01-1

Motronic, On Board Diagnostic (OBD)

On Board Diagnostic (OBD), technical data

Equipment

- Data is transmitted between the control module and the VAS5051 tester or VAG1551 Scan Tool (ST) via operating mode "Rapid Data Transfer".
- DTC memory is designed for permanent memory and is therefore not dependent on voltage supply.
- Display of stored DTCs occurs after initiation of display mode ⇒ Page 01-15 .
- DTC memory must be erased after malfunction is repaired ⇒ Page 01-15 .

Important:

- Readiness code must be re-generated after every time DTC memory is erased ⇒ Page 01-82 .

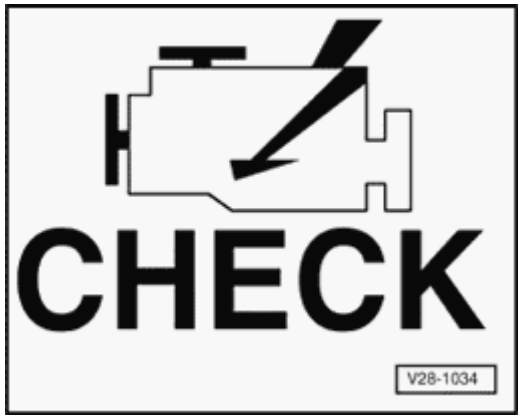
- If the ECM recognizes malfunctions that lead to a degradation of emissions values, it indicates them by lighting the Malfunction Indicator Lamp (exhaust warning lamp -K83-). Clarification of this lamp ⇒ Page 01-3 .

- "E-Gas"-relevant malfunctions are also indicated in the instrument cluster by the warning lamp for Electronic Power Control ("EPC warning lamp").

01-3

Malfunction Indicator Lamp (MIL), significance

If the ECM recognizes malfunctions that lead to a degradation of emissions values, it indicates them by lighting the Malfunction Indicator Lamp for exhaust.



➢ Installation position of exhaust MIL

Note:

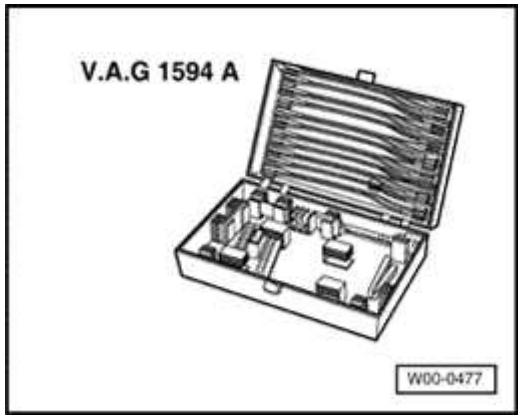
The Malfunction Indicator Lamp (MIL) can blink or remain lit continuously. DTC memory should be checked in both cases ⇒ *Page 01-15* .

- *Blinking: There is a malfunction that causes damage to the catalytic converter in this driving condition (e.g. combustion misfire). In this case, vehicle must only be driven at reduced power!*
- *Continuously lit: There is a malfunction that causes increased emissions. Check DTC memory for Motronic ECM and automatic transmission (if installed).*
- *If there are driveability problems or if there is a customer complaint and the exhaust MIL is not lit, DTC memory must be checked. There may be DTCs stored that do not cause the exhaust MIL to light up immediately, but only if malfunction is recognized again after repeated engine starts.*

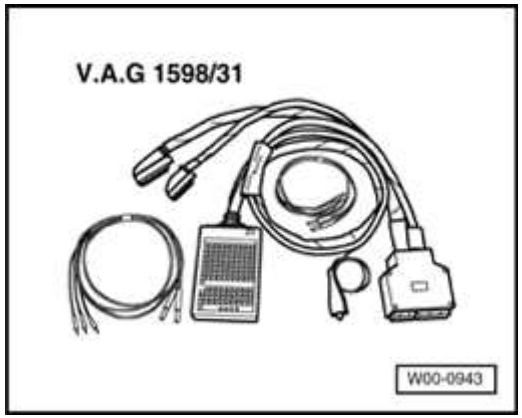
01-4

Malfunction Indicator Lamp (MIL), checking

Special Tools and Equipment



- VAG1594A



- VAG1598/31

Function test of warning lamp

- Switch ignition on.

  - ♦ Warning lamp for On Board Diagnostic (Malfunction Indicator Lamp -MIL-) must light up

A - Warning lamp for On Board Diagnostic (Malfunction Indicator Lamp -MIL-) does not light up

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Bridge sockets 1 and 47 of test box.

- Switch ignition on.

  - ♦ Warning lamp must light up.

If warning lamp does not light up:

- Switch ignition off.

- Remove instrument cluster:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90, Instrument cluster, removing and installing*

01-6

- Check the following wire connection for open circuit and short circuit to B+:

Test box VAG1598/31 Socket	Instrument cluster Terminal
47	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

01-7

B - Warning lamp for On Board Diagnostic (Malfunction Indicator Lamp -MIL-) remains lit constantly

- Check DTC memory of Engine Control Module (ECM) ⇒ Page 01-15 .

If no DTCs are stored:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Remove instrument cluster:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90, Instrument cluster, removing and installing*

- Check the following wire connection for short circuit to Ground (GND):

Test box VAG1598/31 Socket	Instrument cluster Terminal
47	⇒ *Electrical Wiring Diagrams,*

	Troubleshooting & Component Locations binder

- Repair short circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

01-8

Safety precautions

If special testing equipment is required during road test, note the following:

WARNING!

- ***Scan tools and testing devices must always be secured on the rear seat and operated from there by a second person.***

- ***If a scan tool or testing device were to be operated from the passenger seat and there were an accident involving activation of the passenger-side airbag, the person seated there could be seriously injured.***

01-9

VAS 5051 vehicle diagnostic, testing and information system orVAG1551 Scan Tool (ST), connecting and selecting functions

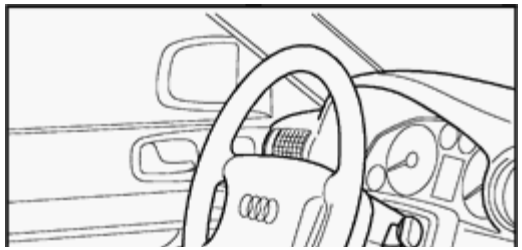
Test requirements:

- Fuses for engine electronics OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Fuel Pump (FP) OK, checking ⇒ Page 24-49 .
- Battery voltage at least 12.7 V
- Ground (GND) connections at engine and transmission OK

Procedure



- Connect VAS5051 tester to vehicle with VAS5051/1 diagnostic wire. Alternately, VAG1551 Scan Tool (ST) can also be attached using VAG1551/3B cable.

Note:

Data Link Connector (DLC) is located in front left knee bolster.

01-10

WARNING!

Observe safety precautions ⇒ ***Page 01-8*** .

Note:

The following description only explains implementation of On Board Diagnostic using VAG1551 Scan tool.

When using the VAS5051 tester, observe the tester's instructions for use

V.A.G - ON BOARD DIAGNOSTIC HELP

1 - Rapid data transfer 1)

2 - Blink code output 1)

Indicated on display:

1) Operating modes 1 and 2 are displayed alternately

Note:

If nothing appears in display:

- Perform troubleshooting procedure after "troubleshooting procedure leak test":

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

Depending on desired function ⇒ Table "Selectable functions", page ⇒ Page 01-14 :

- Switch ignition on.

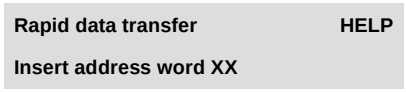
  or

- Start engine.

01-11

- Press -Print- button to turn on Scan Tool (ST) printer. Indicator lamp in button must light up.

- Press button 1 to select "Rapid data transfer" operating mode 1.



➢ When indicated on display:

Note:

The address word 00 initiates the automatic test sequence, i.e. it results in a DTC check on all OBD capable systems in the vehicle via rapid data transfer.

- Press buttons -0- and -1- to select "engine electronics" and press -Q- button to confirm input.



➢ VAG1551 Scan Tool (ST) display indicates control module identification, e.g.:

Note:

Control module identification can be printed by pressing the PRINT key of the VAG1551 scan tool.

01-12

Control module identification (example)

♦ 3B0907551 BA	part number; allocation ⇒ *Parts Catalog*
♦ 2.8 L	Engine displacement
♦ V6/5V	Construction style of engine (V engine, 6 cylinder, 5 valves)
♦ "G" i.e. no indication	Vehicle with or without cruise control system
♦ 0003	Data version (software version) of control module
♦ Coding 07251	Control module coding
♦ WSC 12345	Factory identification of VAG1551, with which the last coding was performed

- Press →button.

Rapid data transfer **HELP**

Select function XX

Indicated on display (function selection):

01-13

Notes:

- *It will be possible to display the control module identification again after pressing buttons -0- and -1- to select "Check Control Module Versions" and confirming with the -Q- button.*

Rapid data transfer **HELP** **Control module does not answer**	➢	- *When indicated on display:*
Rapid data transfer **HELP** **K-wire not switching to Ground**	➢	- Perform troubleshooting procedure after "troubleshooting procedure leak test": ⇒Electrical Wiring Diagrams, Troubleshooting & Component Locations binder
Rapid data transfer **HELP** **K-wire not switching to B+**		
Rapid data transfer **HELP** **Error in communication link**	➢	

01-14

Selectable functions

VAS 5051 vehicle diagnostic, testing and information system or VAG1551 Scan Tool (ST)		Ignition on, engine off	Engine running at idle	Vehicle in drive mode	page
Address words					
01	Engine electronics	Yes	Yes	Yes	⇒ Page 01-9
00	Automatic test sequence	Yes	Yes	Yes	⇒ Page 01-11
Functions					
01	Check Control Module Versions	Yes	Yes	Yes	⇒ Page 01-13
02	Check DTC Memory	No	Yes	Yes	⇒ Page 01-15
03	Output Diagnostic Test Mode (DTM)	Yes	No	No	⇒ Page 01-56
04	Basic Setting	Yes	Yes	Yes	⇒ Page 01-66
05	Erase DTC Memory	Yes	Yes	Yes	⇒ Page 01-15
06	End Output	Yes	Yes	Yes	⇒ Page 01-17
07	Code Control Module	Yes	No	No	⇒ Page 01-71

08	Read Measuring Value Block	Yes	Yes	Yes	⇒ Page 01-74

Check DTC Memory (function 02) and Erase DTC Memory (function 05)

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.

Note:

If engine doesn't start, crank engine using starter for at least 5 seconds. Do not switch ignition off afterward under any circumstance.

Rapid data transfer HELP

Select function XX

When indicated on display:

- Press buttons -0- and -2- to select "Check DTC memory" and press -Q- button to confirm input.

No DTC recognized

When indicated on display:

- Press →button.

or

X DTC recognized

When indicated on display:

When printer is switched on, stored DTCs are shown in sequence and printed.

01-16

- Find printed DTCs in DTC table and repair ⇒ Page 01-18 .

Important note:

- *If there are no DTCs in DTC memory, DTC memory should not be unnecessarily erased or else readiness code will be lost.*
- *If DTC memory was erased, readiness code must be re-generated ⇒ Page 01-82 .*

- Press →button.

Rapid data transfer HELP
Select function XX

When indicated on display:

- Press buttons -0- and -5- to select "Erase DTC memory" and press -Q- button to confirm input.

Note:

Attention!
DTC Memory was not interrogated

When indicated on display:

Procedure was not followed exactly.

- Check DTC memory.

DTC memory will not be erased under the following conditions:

- *Ignition switched off after DTC memory was checked.*

- *A static malfunction was not repaired.*

01-17

Rapid data transfer → **DTC Memory is erased**	When indicated on display: - Press →button. - Check DTC memory again after repair work and erase it if necessary. ***Note:*** *This causes DTCs to be erased that were stored during repair of malfunction, e.g. because harness connectors were disconnected.* - If DTC memory was erased, readiness code must be re-generated ⇒ Page 01-82 . **End Output**
Rapid data transfer HELP **Select function XX**	When indicated on display: - Press buttons -0- and -6- to select "End output" and press -Q- button to confirm input.
Rapid data transfer HELP **Insert address word XX**	When indicated on display: - Switch off ignition and disconnect diagnostic cable.

01-18

Diagnostic Trouble Code (DTC) table

Notes:

- *When malfunctions occur in monitored sensors or components, Diagnostic Trouble Codes (DTCs) are stored in DTC memory with a description of the malfunction type.*
- *"E-Gas"-relevant malfunctions are also indicated in the instrument cluster by the warning lamp for Electronic Power Control ("EPC warning lamp"); Notes for E-gas system ⇒ Page 24-134 .*
- *Malfunctions that worsen emissions are also indicated by an exhaust warning lamp (MIL for output DTM) that is also located in the instrument cluster. There are malfunctions that cause the exhaust warning lamp to light up immediately after recognition. Malfunctions can also occur that do not cause the exhaust MIL to light up immediately, but only if malfunction is recognized again after repeated engine starts.*
- *The DTC table is organized by the 5 digit code at left.*
- *If a stored DTC does not recur within the next 40 warm-up cycles, the DTC will be erased automatically.*
- *Malfunctions that occur only sporadically (temporary malfunctions) are are identified by the letters "SP" (sporadic malfunction) on the VAG1551 scan tool display. The word sporadic means "appearing or occurring at irregular intervals, occasional".*
- *Do not immediately replace components that the VAG1551/VAS5051 suggests are faulty, instead: Check wire connections and harness connectors to these components according to wiring diagram. Also check Ground (GND) connections according to wiring diagram. This is particularly valid when malfunctions are displayed as "sporadically occurring" (SP).*

- *If the connector is disconnected from the ECM or the battery is disconnected, all adaptation values in the control module are erased. DTC memory content will remain intact however. If the engine is started after this, a rough, uneven idle can result. In this case, engine must be allowed to run at idle for a few minutes until adaptation procedure has been completed.*

- *After erasing DTC memory ⇒ Page 01-15 readiness code must be re-generated ⇒ Page 01-82 .*

01-19

DTC		DTC text	Corrective action
SAE	VAG		
P0101	16485	Mass Air Flow (MAF) sensor -G70- Implausible signal[1)]	- Check Mass Air Flow (MAF) sensor ⇒ Page 24-56
P0102	16486	Mass Air Flow (MAF) sensor -G70- Signal too small [1)]	
P0103	16487	Mass Air Flow (MAF) sensor -G70- Signal too large [1)]	
P0112	16496	Intake Air Temperature (IAT) sensor -G42- Signal too small [1)]	- Intake Air Temperature (IAT) sensor, checking ⇒ Page 28-14
P0113	16497	Intake Air Temperature (IAT) sensor -G42- Signal too large [1)]	
P0116	16500	Engine Coolant Temperature (ECT) sensor -G62- Implausible signal[1)]	- Engine Coolant Temperature (ECT) sensor, checking ⇒ Page 28-23
P0117	16501	Engine Coolant Temperature (ECT) sensor -G62- Signal too small [1)]	
P0118	16502	Engine Coolant Temperature (ECT) sensor -G62- Signal too large [1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-20

DTC		DTC text	Corrective action
SAE	VAG		
P0130	16514	Bank 1, sensor 1 Electrical malfunction in circuit [1)]	- Testing Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC) ⇒ Page 24-76
P0131	16515	Bank 1, sensor 1 Voltage too low [1)]	
P0132	16516	Bank 1, sensor 1 Voltage too high [1)]	
P0133	16517	Bank1, Sensor 1 Signal too slow [1)]	
P0134	16518	Bank 1, sensor 1 No activity [1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-21

DTC		DTC text	Corrective action
SAE	VAG		
P0136	16520	Bank1, Sensor 2 Electrical malfunction in circuit [1)]	- Testing Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC) ⇒ Page 24-97
P0137	16521	Bank1, Sensor 2 Voltage too low [1)]	
P0138	16522	Bank1, Sensor 2 Voltage too high [1)]	
P0139	16523	Bank1, Sensor 2 Signal too slow [1)]	
P0140	16524	Bank1, Sensor 2 No activity [1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-22

DTC		DTC text	Corrective action
SAE	VAG		
P0150	16534	Bank 2, sensor 1 Electrical malfunction in circuit [1)]	- Testing Oxygen Sensor (O2S) and oxygen sensor control before Three Way Catalytic Converter (TWC) ⇒ Page 24-76
P0151	16535	Bank 2, sensor 1 Voltage too low [1)]	
P0152	16536	Bank 2, sensor 1 Voltage too high [1)]	
P0153	16537	Bank 2, sensor 1 Signal too slow [1)]	
P0154	16538	Bank 2, sensor 1 No activity [1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-23

DTC		DTC text	Corrective action
SAE	VAG		
P0156	16540	Bank 2, sensor 2 Electrical malfunction in circuit 1)	- Testing Oxygen Sensor (O2S) and oxygen sensor control behind Three Way Catalytic Converter (TWC) ⇒ Page 24-97
P0157	16541	Bank 2, sensor 2 Voltage too low 1)	
P0158	16542	Bank 2, sensor 2 Voltage too high 1)	
P0159	16543	Bank 2, sensor 2 Signal too slow 1)	
P0160	16544	Bank 2, sensor 2 No activity 1)	
P0219	16603	Maximum engine speed exceeded	- Repair mechanical damage

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-24

DTC		DTC text	Corrective action
SAE	VAG		
P0300	16684	Combustion misfire detected 1)	- Check fuel pressure ⇒ Page 24-30 - Test fuel injectors ⇒ Page 24-36
P0301	16685	Cyl. 1 combustion misfire detected 1)	- Check spark plugs and ignition wires with connector
P0302	16686	Cyl. 2 combustion misfire detected 1)	- Check ignition coils ⇒ Page 28-7
P0303	16687	Cyl. 3 combustion misfire detected 1)	- Check ignition coils ⇒ Page 28-10
P0304	16688	Cyl. 4 combustion misfire detected 1)	- Check misfire recognition ⇒ Page 28-52
P0305	16689	Cyl. 5 combustion misfire detected 1)	- Fill fuel tank with fuel
P0306	16690	Cyl. 6 combustion misfire detected 1)	

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-25

DTC		DTC text	Corrective action
SAE	VAG		
P0321	16705	Engine Speed (RPM) sensor -G28- Implausible signal[1)]	- Check sender for fuel gauge ⇒ Page 28-19
P0322	16706	Engine Speed (RPM) sensor -G28- No signal[1)]	
P0327	16711	Knock Sensor (KS) 1 -G61- Signal too small	- Check knock sensor ⇒ Page 28-41
P0328	16712	Knock Sensor (KS) 1 -G61- Signal too large	
P0332	16716	Knock Sensor (KS) 2 -G66- Signal too small	
P0333	16717	Knock Sensor (KS) 2 -G66- Signal too large	
P0341	16725	Camshaft Position (CMP) sensor ⇒ -G40- Implausible signal[1)]	- Check Camshaft Position (CMP) sensor ⇒ Page 28-45
P0346	16730	Camshaft Position (CMP) sensor ⇒ -G163- Implausible signal[1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-26

DTC		DTC text	Corrective action
SAE	VAG		
P0420	16804	Catalytic converter system, bank 1, Not effective enough [1)]	- Generate readiness code ⇒ Page 01-82 . If the same malfunction is indicated again, replace primary catalytic converter, bank 1. ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Exhaust system components, removing and installing
P0421	16805	Primary catalytic converter, bank 1, Not effective enough [1)]	- Generate readiness code ⇒ Page 01-82 . If the same malfunction is indicated again, replace primary catalytic converter, bank 1. ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Exhaust system components, removing and installing

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

Important note:

The primary catalytic converters are located between the oxygen sensors of the appropriate cylinder bank. They are not immediately visible after vehicle is raised; they are the two, slightly smaller catalytic converters located closer to the engine.

01-27

DTC		DTC text	Corrective action
SAE	VAG		
P0430	16814	Catalytic converter system, bank 2, Not effective enough [1)]	- Generate readiness code ⇒ Page 01-82 . If the same malfunction is indicated again, replace primary catalytic converter, bank 2. ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Exhaust system components, removing and installing
P0431	16815	Primary catalytic converter, bank 2, Not effective enough [1)]	- Generate readiness code ⇒ Page 01-82 . If the same malfunction is indicated again, replace primary catalytic converter, bank 2. ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Exhaust system components, removing and installing

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

Important note:

The primary catalytic converters are located between the oxygen sensors of the appropriate cylinder bank. They are not immediately visible after vehicle is raised; they are the two, slightly smaller catalytic converters located closer to the engine.

DTC		DTC text	Corrective action
SAE	VAG		
P0441	16825	Tank ventilation system Throughput faulty 1)	- Check Evaporative Emission (EVAP) Canister Purge Regulator Valve, perform output Diagnostic Test Mode (DTM) ⇒ Page 01-56
P0442	16826	Tank ventilation system Small leak detected 1)	- Checking fuel supply and ventilation systems for leaks ⇒ Repair Manual, Engine Mechanical, Repair Group 20; Evaporative Emissions (EVAP) System Diagnosis using KLI9210 EVAP Tester, test EVAP system.
P0455	16839	Tank ventilation system Large leak detected 1)	
P0456	16840	Tank ventilation system Pinhole leak detected 1)	⇒ Repair Manual, Engine Mechanical, Repair Group 20; EVAP canister system components, servicing; tank leak diagnostic, performing.

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

DTC		DTC text	Corrective action
SAE	VAG		
P0501	16885	Vehicle speed signal Implausible signal[1)]	- Check vehicle speed signal ⇒ Page 24-168
P0506	16890	Idle control Engine speed below specified value [1)]	- Checking throttle valve control module ⇒ Page 24-141
P0507	16891	Idle control Engine speed above specified value [1)]	- Check hose setup (intake manifold change-over valve and Secondary Air Injection -AIR- solenoid valve); check intake system for leaks ⇒ Page 24-64
P0560	16944	Voltage supply Implausible signal	- Check voltage supply for control module ⇒ Page 28-30
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-30

DTC		DTC text	Corrective action
SAE	VAG		
P0571	16955	Brake light switch -F- Implausible signal	- Check brake light switch and brake pedal switch ⇒ Page 24-178
P0601	16985	Control module faulty[1)]	- replacing Engine Control Module (ECM) ⇒ Page 24-21
P0604	16988	Control module faulty[1)]	
P0605	16989	Control module faulty[1)]	
P1102	17510	Bank 1, sensor 1, heating circuit Short circuit to B+[1)]	- Check oxygen sensor heating ⇒ Page 24-116
P1105	17513	Bank 2, sensor 1, heating circuit Short circuit to B+[1)]	
P1107	17515	Bank 2, sensor 1, heating circuit Short circuit to B+[1)]	
P1110	17518	Bank 2, sensor 2, heating circuit Short circuit to B+[1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-31

DTC		DTC text	Corrective action
SAE	VAG		
P1111	17519	Oxygen sensor control, bank 1 System too lean	- Check oxygen sensor control before catalytic converter ⇒ Page 24-76
P1112	17520	Oxygen sensor control, bank 1 System too rich	
P1113	17521	Bank 1, sensor 1 Internal resistance too large 1)	- Next check signal wires for contact resistance => page ⇒ Page 24-90 ; if there are no contact resistances: Replace oxygen sensor
P1114	17522	Bank 2, sensor 1 Internal resistance too large 1)	- Next check signal wires for contact resistance => page ⇒ Page 24-112 ; if there are no contact resistances: Replace oxygen sensor

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-32

DTC		DTC text	Corrective action
SAE	VAG		
P1115	17523	Bank 1, sensor 1, heating circuit Short circuit to Ground (GND)[1)]	- Check oxygen sensor heating ⇒ Page 24-116
P1116	17524	Bank 1, sensor 1, heating circuit Open circuit[1)]	
P1117	17525	Bank 2, sensor 1, heating circuit Short circuit to Ground (GND)[1)]	
P1118	17526	Bank 2, sensor 1, heating circuit Open circuit[1)]	
P1119	17527	Bank 2, sensor 1, heating circuit Short circuit to Ground (GND)[1)]	
P1120	17528	Bank 2, sensor 1, heating circuit Open circuit[1)]	
P1121	17529	Bank 2, sensor 2, heating circuit Short circuit to Ground (GND)[1)]	
P1122	17530	Bank 2, sensor 2, heating circuit	

		Open circuit[1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-33

DTC		DTC text	Corrective action
SAE	VAG		
P1127	17535	Bank 1, mixture adaptation (mult.) System too rich 1)	- Road test vehicle (fuel in oil). - Check fuel system pressure ⇒ Page 24-30
P1128	17536	Bank 1, mixture adaptation (mult.) System too lean 1)	- Check Mass Air Flow (MAF) sensor ⇒ Page 24-56 - Check intake system for proper seal ⇒ Page 24-64
P1129	17537	Bank 2, mixture adaptation (mult.) System too rich 1)	- Check oxygen sensor before catalytic converter ⇒ Page 24-76
P1130	17538	Bank 2, mixture adaptation (mult.) System too lean 1)	- Check oxygen sensor behind catalytic converter ⇒ Page 24-97 - Check fuel injectors ⇒ Page 24-36
P1131	17539	Bank 2, sensor 1 Internal resistance too large 1)	- Next check signal wires for contact resistance => page ⇒ Page 24-91 ; if there are no contact resistances: Replace oxygen sensor

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

Note:

mult. = multiplicative, means that malfunction is valid across entire range of engine speed and engine load.

01-34

DTC		DTC text	Corrective action
SAE	VAG		
P1136	17544	Bank 1, mixture adaptation (add.) System too lean 1)	- Road test vehicle (fuel in oil). - Check fuel system pressure ⇒ Page 24-30 - Check Mass Air Flow (MAF) sensor ⇒ Page 24-56 - Check oxygen sensor before catalytic converter ⇒ Page 24-76 - Check oxygen sensor behind catalytic converter ⇒ Page 24-97 - Check Evaporative Emission (EVAP) Canister Purge Regulator Valve ⇒ Page 24-128
P1137	17545	Bank 1, mixture adaptation (add.) System too rich 1)	
P1138	17546	Bank 2, mixture adaptation (add.) System too lean 1)	
P1139	17547	Bank 2, mixture adaptation (add.) System too rich 1)	
P1140	17548	Bank 2, sensor 2 Internal resistance too large 1)	- Next check signal wires for contact resistance => page ⇒ Page 24-114 ; if there are no contact resistances: Replace oxygen sensor

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

Note:

add = additive, means that malfunction is only valid at closed throttle (idle).

01-35

DTC		DTC text	Corrective action
SAE	VAG		
P1141	17549	Load detection Implausible value	- Check to be sure the correct throttle valve control module is installed (part number) - Check Mass Air Flow (MAF) sensor ⇒ Page 24-56
P1142	17550	Load detection Limit not reached	
P1143	17551	Load detection Limit exceeded	
P1147	17555	Oxygen sensor control, bank 2 System too lean	- Check oxygen sensor adaptation values and regulation ⇒ Page 24-83
P1148	17556	Oxygen sensor control, bank 2 System too rich	

DTC		DTC text	Corrective action
SAE	VAG		
P1149	17557	Oxygen sensor control, bank 1 Unplausible control value	- Check oxygen sensor adaptation values and regulation ⇒ Page 24-83 - Check fuel system pressure ⇒ Page 24-30 - Check intake system for proper seal ⇒ Page 24-64
P1150	17558	Oxygen sensor control, bank 2 Unplausible control value	
P1171	17579	Angle sensor -2- for throttle drive (power accelerator actuation) -G188- Implausible signal[2)3)]	- Check angle sensor -1- for throttle drive ⇒ Page 24-148
P1172	17580	Angle sensor -2- for throttle drive (power accelerator actuation) -G188- Signal too small [2) 3)]	
P1173	17581	Angle sensor -2- for throttle drive (power accelerator actuation) -G188- Signal too large [2) 3)]	

2) For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

3) For these malfunctions, ECM switches on the exhaust warning lamp in instrument cluster immediately after recognizing the malfunction. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-37

DTC		DTC text	Corrective action
SAE	VAG		
P1176	17584	Bank 1, oxygen sensor correction behind catalytic converter Control limit reached [1)]	- Check oxygen sensor aging of oxygen sensor before catalytic converter ⇒ Page 24-93 - Check oxygen sensor and oxygen sensor control behind catalytic converter ⇒ Page 24-97
P1177	17585	Bank 2, oxygen sensor correction behind catalytic converter Control limit reached [1)]	
P1213	17621	Cylinder 1 fuel injector -N30- Short circuit to B+ [1)]	- Check fuel injectors ⇒ Page 24-36
P1214	17622	Cylinder 2 fuel injector -N31- Short circuit to B+ [1)]	
P1215	17623	Cylinder 3 fuel injector -N32- Short circuit to B+ [1)]	
P1216	17624	Cylinder 4 fuel injector -N33- Short circuit to B+ [1)]	
P1217	17625	Cylinder 5 fuel injector -N83- Short circuit to B+ [1)]	
P1218	17626	Cylinder 6 fuel injector -N84- Short circuit to B+ [1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-38

DTC		DTC text	Corrective action
SAE	VAG		
P1225	17633	Cylinder 1 fuel injector -N30- Short circuit to Ground (GND)[1)]	- Check fuel injectors ⇒ Page 24-36
P1226	17634	Cylinder 2 fuel injector -N31- Short circuit to Ground (GND)[1)]	
P1227	17635	Cylinder 3 fuel injector -N32- Short circuit to Ground (GND)[1)]	
P1228	17636	Cylinder 4 fuel injector -N33- Short circuit to Ground (GND)[1)]	
P1229	17637	Cylinder 5 fuel injector -N83- Short circuit to Ground (GND)[1)]	
P1230	17638	Cylinder 6 fuel injector -N84- Short circuit to Ground (GND)[1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-39

DTC		DTC text	Corrective action
SAE	VAG		
P1237	17645	Cylinder 1 fuel injector -N30- Open circuit[1)]	- Check fuel injectors ⇒ Page 24-36
P1238	17646	Cylinder 2 fuel injector -N31- Open circuit[1)]	
P1239	17647	Cylinder 3 fuel injector -N32- Open circuit[1)]	
P1240	17648	Cylinder 4 fuel injector -N33- Open circuit[1)]	
P1241	17649	Cylinder 5 fuel injector -N83- Open circuit[1)]	
P1242	17650	Cylinder 6 fuel injector -N84- Open circuit[1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

DTC		DTC text	Corrective action
SAE	VAG		
P1250	17658	Fuel level too low[4)]	- Fill fuel tank with fuel - Check wire connection between Engine Control Module (ECM) and instrument cluster according to wiring diagram - Check signal from sender for fuel gauge and fuel gauge ⇒ *Repair Manual, Electrical Equipment, Repair Group 01, On Board Diagnostic (OBD) of instrument cluster; Read Measuring Value Block*
P1296	17704	Malfunction in cooling system [1)]	- Check coolant temperature sensor ⇒ Page 28-23 - Check coolant regulator ⇒ Repair Manual, Engine Mechanical, Repair Group 19; Cooling system components, removing and installing

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

[4)] The DTC "Fuel Level Too Low" is stored when there is/was too little fuel in fuel tank. The DTC is stored as a static malfunction and is not switched to sporadic even if fuel tank has been filled with fuel (e.g. by the customer) in the meantime. In this way, it can be determined that subsequent malfunctions were caused by lack of fuel, e.g. combustion misfires or oxygen control related malfunctions.

01-41

DTC		DTC text	Corrective action
SAE	VAG		
P1325	17733	Knock control, cyl. 1 Control limit reached	- Check knock control ⇒ Page 28-33
P1326	17734	Knock control, cyl. 2 Control limit reached	
P1327	17735	Knock control, cyl. 3 Control limit reached	
P1328	17736	Knock control, cyl. 4 Control limit reached	
P1329	17737	Knock control, cyl. 5 Control limit reached	
P1330	17738	Knock control, cyl. 6 Control limit reached	

01-42

DTC		DTC text	Corrective action
SAE	VAG		
P1335	17743	Engine torque monitoring 2 Control limit exceeded [2) 3)]	- Check hose setup - Check Intake Air Temperature (IAT) sensor ⇒ Page 28-14
P1336	17744	Engine torque monitoring Control limit exceeded	- Check Mass Air Flow (MAF) sensor ⇒ Page 24-56 - Check coolant temperature sensor ⇒ Page 28-23
P1337	17745	Bank 1, Camshaft Position (CMP) sensor - G163 Short circuit to Ground (GND)[1)]	- Check Camshaft Position (CMP) sensor ⇒ Page 28-45
P1338	17746	Bank 1, Camshaft Position (CMP) sensor - G163 Open circuit / short circuit to B+[1)]	
P1340	17748	Camshaft Position (CMP) / crankshaft position sensor Incorrect allocation [1)]	- Check phase position of Camshaft Position (CMP) sensor ⇒ Page 28-50
P1347	17755	Bank 2 Camshaft Position (CMP) / crankshaft position sensor Incorrect allocation [1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

2) For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

3) For these malfunctions, the Engine Control Module (ECM) switches on the Malfunction Indicator Lamp (MIL) in the instrument cluster immediately after recognizing the malfunction. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-43

DTC		DTC text	Corrective action
SAE	VAG		
P1386	17794	Control module faulty	- replacing Engine Control Module (ECM) ⇒ Page 24-21
P1387	17795	Control module faulty[1)]	
P1388	17796	Control module faulty[2) 3)]	
P1391	17799	Bank 2, Camshaft Position (CMP) sensor -G40 Short circuit to Ground (GND)[1)]	- Check Camshaft Position (CMP) sensor ⇒ Page 28-45
P1392	17800	Bank 2, Camshaft Position (CMP) sensor -G40 Open circuit / short circuit to B+[1)]	

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

2) For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

3) For these malfunctions, the Engine Control Module (ECM) switches on the Malfunction Indicator Lamp (MIL) in the instrument cluster immediately after recognizing the malfunction. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-44

DTC		DTC text	Corrective action
SAE	VAG		
P1393	17801	Ignition output 1 Electrical malfunction in circuit	- Check activation or wiring connection from Engine Control Module (ECM) to power output stage ⇒ Page 28-12
P1394	17802	Ignition output 2 Electrical malfunction in circuit	
P1395	17803	Ignition output 3 Electrical malfunction in circuit	
P1410	17818	EVAP canister purge regulator valve -N80- Short circuit to B+ 1)	- Check Evaporative Emission (EVAP) Canister Purge Regulator Valve ⇒ Page 24-128
P1411	17819	Bank 2, Secondary Air Injection (AIR) system Throughput too low 1)	- Check fuse for Secondary Air Injection (AIR) pump - Check vacuum hose setup - Check hose setup from pump to combination valve for Secondary Air Injection (AIR) ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

Note for DTC codes 17801, 17802, 17803:

The terms "ignition output 1", "ignition output 2" and "ignition output 3" refer to the outputs on the Engine Control Module (ECM), via which the Engine Control Module (ECM) activates the power output stages at the ignition coil.

01-45

DTC		DTC text	Corrective action
SAE	VAG		
P1414	17822	Bank 2, Secondary Air Injection (AIR) system Leak detected	- Check hose setup from pump to mechanical Secondary Air Injection (AIR) valve, cylinder bank 2 ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system
P1421	17829	Secondary Air Injection (AIR) solenoid valve -N112- Short circuit to Ground (GND)[1)]	- Check Secondary Air Injection (AIR) system ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system
P1422	17830	Secondary Air Injection (AIR) solenoid valve -N112- Short circuit to B+[1)]	
P1423	17831	Bank 1, Secondary Air Injection (AIR) system Throughput too low [1)]	- Check fuse for Secondary Air Injection (AIR) pump - Check vacuum hose setup - Check hose setup from pump to combination valve for Secondary Air Injection (AIR) ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

DTC		DTC text	Corrective action
SAE	VAG		
P1424	17832	Bank 1, Secondary Air Injection (AIR) system Leak detected	- Check hose setup from pump to mechanical Secondary Air Injection (AIR) valve, cylinder bank 1 ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system
P1425	17833	EVAP canister purge regulator valve -N80- Short circuit to Ground (GND)[1)]	- Check Evaporative Emission (EVAP) Canister Purge Regulator Valve ⇒ Page 24-128
P1426	17834	EVAP canister purge regulator valve -N80- Open circuit[1)]	
P1432	17840	Secondary Air Injection (AIR) solenoid valve -N112- Open circuit[1)]	- Check Secondary Air Injection (AIR) system ⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system
P1433	17841	Secondary Air Injection (AIR) pump relay -J299- Open circuit[1)]	
P1434	17842	Secondary Air Injection (AIR) pump relay -J299- Short circuit to B+[1)]	

P1435	17843	Secondary Air Injection (AIR) pump relay -J299- Short circuit to Ground (GND)[1)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-47

DTC		DTC text	Corrective action
SAE	VAG		
P1471	17879	Leak Detection Pump (LDP) tank ventilation system Short circuit to B+[1)]	- Leak Detection Pump (LDP) Checking ⇒ Repair Manual, Engine Mechanical, Repair Group 20; EVAP canister system components, servicing; Leak Detection Pump (LDP) -V144-, checking.
P1472	17880	Leak Detection Pump (LDP) tank ventilation system Short circuit to Ground (GND)[1)]	
P1473	17881	Leak Detection Pump (LDP) tank ventilation system Open circuit[1)]	
P1475	17883	Leak Detection Pump (LDP) tank ventilation system Malfunction / no signal[1)]	- Check pressurized/vacuum lines to Leak Detection Pump (LDP) ⇒ Repair Manual, Engine Mechanical, Repair Group 20; EVAP canister system components, servicing; wiring diagram, EVAP canister system.
P1476	17884	Leak Detection Pump (LDP) tank ventilation system Malfunction/vacuum pressure too low [1)]	- Check electrical wire connections to Leak Detection Pump according to wiring diagram

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-48

DTC		DTC text	Corrective action
SAE	VAG		
P1501	17909	Fuel Pump (FP) relay -J17- Short circuit to Ground (GND)[1)]	- Check Fuel Pump (FP) relay ⇒ Page 24-49
P1502	17910	Fuel Pump (FP) relay -J17- Short circuit to B+[1)]	
P1512	17920	Intake manifold change-over valve -N156- Short circuit to B+[1)]	- Check intake manifold change-over ⇒ Page 24-71
P1515	17923	Intake manifold change-over valve -N156- Short circuit to Ground (GND)[1)]	
P1516	17924	Intake manifold change-over valve -N156- Open circuit[1)]	
P1519	17927	Bank 1, camshaft adjustment Malfunction[1)]	⇒ Repair Manual, Engine Mechanical, Repair Group 15; Camshaft adjustment, checking; Function of camshaft adjustment, checking
P1522	17930	Bank 2, camshaft adjustment Malfunction[1)]	
P1523	17931	Crash signal from airbag control module	⇒ *Repair Manual, Body-On Board Diagnostic (OBD), Repair Group 01; On Board Diagnostic (OBD) of airbag system*

		Implausible signal[4)]	

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

[4)] DTC is stored upon appropriate signal from airbag control module.

DTC		DTC text	Corrective action
SAE	VAG		
P1529	17937	Camshaft adjustment Short circuit to B+[1)]	⇒ Repair Manual, Engine Mechanical, Repair Group 15; Camshaft adjustment, checking; Solenoid valve for camshaft adjustment, checking
P1530	17938	Camshaft adjustment Short circuit to Ground (GND)[1)]	
P1531	17939	Camshaft adjustment Open circuit[1)]	
P1539	17947	Clutch vacuum vent valve switch -F36- Implausible signal[1)]	- Check clutch pedal switch ⇒ Page 24-183
P1541	17908	Fuel Pump (FP) relay -J17- Open circuit[1)]	- Check Fuel Pump (FP) relay ⇒ Page 24-49
P1542	17950	Throttle Actuation Potentiometer -G187 Implausible signal[2)3)]	- Check angle sensor -1- for throttle drive ⇒ Page 24-148
P1543	17951	Throttle Actuation Potentiometer -G187 Signal too small [2) 3)]	

P1544	17952	Throttle Actuation Potentiometer -G187- Signal too large 2) 3)	

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

2) For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

3) For these malfunctions, the ECM switches on the Malfunction Indicator Lamp (MIL) in the instrument cluster immediately after recognizing the malfunction. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-50

DTC		DTC text	Corrective action
SAE	VAG		
P1545	17953	Throttle valve control Malfunction 2) 3)	- Check throttle valve control module ⇒ Page 24-141
P1558	17966	Throttle drive (power accelerator actuation) -G186- Electrical malfunction in circuit 2) 3)	
P1559	17967	Throttle valve control module -J338- Malfunction in basic setting 1) 2)	- Perform adaptation ⇒ Page 24-142
P1564	17972	Throttle valve control module -J338- Voltage too low during basic setting	- Charge battery, repeat basic setting
P1565	17973	Throttle valve control module -J338- Lower impact still not reached 2) 3)	- Check throttle valve control module ⇒ Page 24-141
P1568	17976	Throttle valve control module -J338- Mechanical malfunction 2) 3)	

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

2) For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

3) For these malfunctions, the Engine Control Module (ECM) switches on the Malfunction Indicator Lamp (MIL) in the instrument cluster immediately after recognizing the malfunction. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-51

DTC		DTC text	Corrective action
SAE	VAG		
P1569	17977	Cruise control switch -E45- Implausible signal	⇒ *Repair Manual, Electrical Equipment, Repair Group 01; On Board Diagnostic (OBD) for cruise control system*
P1570	17978	Engine Control Module (ECM) locked	- Adapt electronic immobilizer to Engine Control Module (ECM) ⇒ *Repair Manual, Electrical Equipment, Repair Group 01, On Board Diagnostic (OBD) for immobilizer*
P1579	17987	Throttle valve control module -J338- Adaptation not started	- Perform adaptation of throttle valve control module while maintaining test requirements ⇒ Page 24-142
P1602	18010	Voltage supply, terminal 30 Voltage too low	- Check voltage supply for control module ⇒ Page 28-30

01-52

DTC		DTC text	Corrective action
SAE	VAG		
P1603	18011	Control module faulty[1)]	- Replace Engine Control Module (ECM) ⇒ Page 24-21
P1604	18012	Control module faulty[2) 3)]	
P1606	18014	Rough terrain info/engine torque from ABS control module Electrical malfunction in circuit	- Check wire connection between Engine Control Module (ECM) and ABS control module (powertrain databus) ⇒ Page 24-192 ⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*
P1609	18017	Crash shut-off was triggered (Crash triggered) [5)]	⇒ *Repair Manual, Body-On Board Diagnostic (OBD), Repair Group 01; On Board Diagnostic (OBD) of airbag system* - Erase DTC memory of the Engine Control Module (ECM) after output Diagnostic Test Mode (DTM) of the airbag system ⇒ Page 01-15

[1)] For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

[2)] For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

[3)] For these malfunctions, the Engine Control Module (ECM) switches on the Malfunction Indicator Lamp (MIL) in the instrument cluster immediately after recognizing the malfunction. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

[5)] DTC is stored upon appropriate signal from airbag control module, also during output Diagnostic Test Mode (DTM) of the airbag system.

DTC		DTC text	Corrective action
SAE	VAG		
P1386	17794	Control module faulty	- Replace Engine Control Module (ECM) ⇒ Page 24-21
P1612	18020	Engine Control Module (ECM) incorrectly coded 1)	- Code Engine Control Module (ECM) ⇒ Page 01-71
P1624	18032	Request for warning lamp on active 7)	- Exhaust related malfunction of Transmission Control Module (TCM) - Check DTC memory of Transmission Control Module (TCM) ⇒ Repair Manual, Automatic Transmission On Board Diagnostic (OBD), Repair Group 01; On Board Diagnostic (OBD)
P1626	18034	Powertrain databus Missing message from Transmission Control Module (TCM) 1)	- Check data transfer of Engine Control Module (ECM) and other CAN capable control modules ⇒ Page 24-192

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

7) The Transmission Control Module (TCM) recognized a malfunction that worsens engine emissions. The Transmission Control Module (TCM) sends the DTC to the Engine Control Module (ECM), which then switches on the Malfunction Indicator Lamp (MIL). Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 . The message P1624 is simultaneously stored in the Engine Control Module (ECM) as evidence that the Malfunction Indicator Lamp (MIL) was not switched on due to an engine problem but rather a transmission problem.

01-54

DTC		DTC text	Corrective action
SAE	VAG		
P1630	18038	Throttle Position (TP) sensor -G79- Signal too small 2) 3)	- Throttle Position (TP) sensor, checking ⇒ Page 24-154
P1631	18039	Throttle Position (TP) sensor -G79- Signal too large 2) 3)	
P1633	18041	Sender -2- for accelerator pedal position -G185- Signal too small 2) 3)	
P1634	18042	Sender -2- for accelerator pedal position -G185- Signal too large 2) 3)	
P1639	18047	Throttle Position (TP) sensor -G79- and sender -2- for accelerator pedal position -G185- Implausible signal2)3)	- Throttle Position (TP) sensor, checking ⇒ Page 24-154
P1640	18048	Control module faulty1)	- replacing Engine Control Module (ECM) ⇒ Page 24-21

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

2) For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

3) For these malfunctions, the Engine Control Module (ECM) switches on the Malfunction Indicator Lamp (MIL) in the instrument cluster immediately after recognizing the malfunction. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

01-55

DTC		DTC text	Corrective action
SAE	VAG		
P1648	18056	Powertrain databus faulty	- Check Engine/ABS/Transmission control module ⇒ Page 24-192
P1649	18057	Powertrain databus Missing message from ABS control module	
P1682	18090	Powertrain databus Implausible message from ABS control module	- Check data transfer of Engine Control Module (ECM) and other CAN capable control modules ⇒ Page 24-192
P1853	18261	Powertrain databus Implausible message from ABS control module	- Check data transfer of Engine Control Module (ECM) and other CAN capable control modules ⇒ Page 24-192
P3262	16646	Exhaust bank 1/2 Oxygen sensors behind catalytic converter mixed up	- Check harness connectors

1) For these malfunctions, ECM does not switch on the Malfunction Indicator Lamp (MIL) unless malfunction is recognized again after another engine start. Meaning of Malfunction Indicator Lamp (MIL) ⇒ Page 01-3 .

2) For these malfunctions, ECM switches on the EPC warning lamp in instrument cluster. Significance of EPC warning lamp ⇒ Page 24-136 .

Output Diagnostic Test Mode (DTM) (function 03)

Notes:

- *Output Diagnostic Test Mode (DTM) is only possible with engine idle and ignition switched on.*
- *Output Diagnostic Test Mode (DTM) is aborted if engine is started or an RPM signal is recognized.*
- *In output Diagnostic Test Mode (DTM), individual actuators (with the exception of the fuel injectors) are activated for approximately 1 minute unless the next actuator is selected earlier by pressing the " button.*
- *Actuators are checked either acoustically or by touch.*
- *The electric Fuel Pump (FP) runs during all of output Diagnostic Test Mode (DTM).*
- *Engine must be started before repeating output Diagnostic Test Mode (DTM). (ECM must recognize an engine speed of above 300 RPM).*

01-57

Output Diagnostic Test Mode (DTM) activates the following components in the specified sequence:

Activation sequence	
1	Evaporative Emission (EVAP) canister purge regulator valve -N80-
2	Secondary Air Injection (AIR) solenoid valve -N112-
3	Secondary Air Injection (AIR) pump relay -J299-
4	Intake manifold change-over valve -N156-
5	Camshaft adjustment 1 (Valve 1 for camshaft adjustment -N205- and valve 2 for camshaft adjustment -N208-)
6	Leak Detection Pump (LDP) tank ventilation system
7	Cylinder 1 fuel injector -N30-
8	Cylinder 4 fuel injector -N33-
9	Cylinder 3 fuel injector -N32-
10	Cylinder 6 fuel injector -N84-
11	Cylinder 2 fuel injector -N31-
12	Cylinder 5 fuel injector -N83-

01-58

Test requirement:

- Fuses for engine electronics OK

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.

Rapid data transfer HELP
Select function XX

- When indicated on display:

- Press buttons -0- and -3- to select "output Diagnostic Test Mode" and press -Q- button to confirm input.

Rapid data transfer Q
03-Output Diagnostic Test Mode

- Indicated on display:

Activating the EVAP canister purge regulator valve (tank vent valve)

- Confirm input using the -Q- button.

Note:

The Fuel Pump (FP) relay must trigger, the Fuel Pump (FP) must run, flowing noise at fuel pressure regulator is clearly audible. If Fuel Pump (FP) does not run, check activation ⇒ Page 24-52 .

01-59

Output Diagnostic Test Mode →

EVAP canister purge regulator valve -N80

Indicated on display:

(Indicated on VAG1551: from EVAP canister purge regulator valve -N80-)

This valve is activated for approx. 1 minute (clicks), unless → - button is pressed first to switch to the next actuator.

If valve is not activated (does not click):

- Check Evaporative Emission (EVAP) canister purge regulator valve -N80- ⇒ Page 24-128 .

Activating the Secondary Air Injection (AIR) solenoid valve

- Press →button.

Output Diagnostic Test Mode →

Secondary air injection solenoid valve -N112

Indicated on display:

This valve is activated for approx. 1 minute (clicks), unless → - button is pressed first to switch to the next actuator.

If valve is not activated (does not click):

- Check Secondary Air Injection (AIR) solenoid valve -N112-:

⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system

Activating the Secondary Air Injection (AIR) pump relay

- Press → button.

01-60

Output Diagnostic Test Mode →

Secondary air injection pump relay -J299

Indicated on display:

The Secondary Air Injection (AIR) pump relay -J299- (in 3-socket relay carrier in the E-box, at left in the plenum chamber , position 2) switches the Secondary Air Injection (AIR) pump motor -V101- on for approx. 1 minute in intervals unless the next actuator is selected first by pressing the → button.

If the Secondary Air Injection (AIR) pump motor -V101- does not run in intervals:

- Check Secondary Air Injection (AIR) pump relay -J299-:

⇒ Repair Manual, Engine Mechanical, Repair Group 26; Secondary Air Injection (AIR) system

Activating intake manifold change-over valve

- Press →button.

Output Diagnostic Test Mode →

Intake manifold changeover valve -N156

Indicated on display:

This valve is activated for approx. 1 minute (clicks), unless → - button is pressed first to switch to the next actuator.

If valve is not activated (does not click):

- Check intake manifold change-over valve -N156- ⇒ Page 24-67

01-61

Activating camshaft adjustment valves

- Press →button.

Output Diagnostic Test Mode →

Camshaft adjustment 1

Indicated on display:

Valve -1- for camshaft adjustment -N205- and valve -2- for camshaft adjustment -N208- are activated for approximately 1 minute (they click) unless output Diagnostic Test Mode (DTM) is ended first by pressing the " button

If valves are not activated (do not click).

- Check camshaft adjustment valves:

⇒ Repair Manual, Engine Mechanical, Repair Group 15; Camshaft adjustment, checking; Function of camshaft adjustment, checking

Activating Leak Detection Pump (diagnostic pump for tank ventilation system)

- Press →button.

Output Diagnostic Test Mode →

Leak detection pump Tank vent valve system

Indicated on display:

Th change-over valve in the LDP is activated for approximately 1 minute (clicks), unless → button is pressed first to switch to the next actuator.

01-62

Note:

The click can be heard by listening near the rear left wheelhousing.

If valve is not activated (does not click):

⇒ *Repair Manual, Fuel Supply System, Repair Group 20; components of the EVAP canister system, servicing; Leak Detection Pump (LDP) - V144-, checking.*

Activating fuel injectors

Note:

Fuel injectors are activated according to ignition sequence: Cyl. 1, Cyl. 4, Cyl. 3, Cyl 6 Cyl. 2, Cyl 5.

- Press →button.

Output Diagnostic Test Mode →

Cyl. 1 fuel injector -N30

Indicated on display:

- Press →button.

Output Diagnostic Test Mode →

Cyl. 1 fuel injector -N30

Indicated on display:

Fuel injector must click 5 times after arrow button is pressed.

If injector does not click:

- Check fuel injectors ⇒ Page 24-36 .

01-63

- Press →button.

Output Diagnostic Test Mode →
Cyl. 4 fuel injector -N33

Indicated on display:

- Press →button.

Output Diagnostic Test Mode →
Cyl. 4 fuel injector -N33

Indicated on display:

Fuel injector must click 5 times after arrow button is pressed.

If injector does not click:

- Check fuel injectors ⇒ Page 24-36 .
- Press →button.

Output Diagnostic Test Mode →
Cyl. 3 fuel injector -N32

Indicated on display:

- Press →button.

Output Diagnostic Test Mode →
Cyl. 3 fuel injector -N32

Indicated on display:

Fuel injector must click 5 times after arrow button is pressed.

If injector does not click:

- Check fuel injectors ⇒ Page 24-36 .

01-64

- Press →button.

Output Diagnostic Test Mode →
Cyl. 6 fuel injector -N84

Indicated on display:

- Press →button.

Output Diagnostic Test Mode →
Cyl. 6 fuel injector -N84

Indicated on display:

Fuel injector must click 5 times after arrow button is pressed.

If injector does not click:

- Check fuel injectors ⇒ Page 24-36 .
- Press →button.

Output Diagnostic Test Mode →
Cyl. 2 fuel injector -N31

Indicated on display:

- Press →button.

Output Diagnostic Test Mode →
Cyl. 2 fuel injector -N31

Indicated on display:

Fuel injector must click 5 times after arrow button is pressed.

If injector does not click:

- Check fuel injectors ⇒ Page 24-36 .

01-65

- Press →button.

Output Diagnostic Test Mode →
Cyl. 5 fuel injector -N83

Indicated on display:

- Press →button.

Output Diagnostic Test Mode →
Cyl. 5 fuel injector -N83

Indicated on display:

Fuel injector must click 5 times after arrow button is pressed.

If injector does not click:

- Check fuel injectors ⇒ Page 24-36 .

Output Diagnostic Test Mode →
END

Indicated on display:

- Press →button.

Rapid data transfer HELP
Select function XX

Indicated on display (function selection):

Note:

Before re-initiating output Diagnostic Test Mode (DTM), engine must be started and the ignition must be switched off and on again.

Basic Setting (function 04)

With ignition on and engine at standstill, the following operations can be performed using "function 04", basic setting:

- Adapt throttle valve control module to Engine Control Module (ECM) ⇒ Display group 060 (⇒ Page 24-142)
- Vehicles with automatic transmission: Adaptation of kick down function of accelerator pedal position sensor to ECM ⇒Display group 063 (⇒ Page 24-161)

With ignition on and engine running, the following operations can be performed using basic setting:

- Adaptation of oxygen sensor control ⇒ Page 24-83
- Troubleshooting via targeted activation and deactivation of oxygen sensor control ⇒ Display group 099. For this, observe notes on page ⇒ Page 24-79 .

Test requirements for operations with engine running:

- No DTCs in DTC memory.
- Coolant Temperature at least 80 ° C.
- Electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.

- Check DTC Memory ⇒ Page 01-15 . There must not be any DTCs stored, repair malfunctions if necessary, erase DTC memory, switch engine off and start again, road test vehicle and check DTC memory again as a control measure.

01-68

Depending on desired operation:

- Switch ignition on.

or

- Start engine.

Rapid data transfer	HELP
Select function XX	

➢ When indicated on display:

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.

Initiate basic setting	Q
Input display group number XXX	

➢ When indicated on display:

- Input desired display group number.

Example:

- Press buttons -0-, -0- and -0- to select "display group number 000" and press -Q- button to confirm input.

Note:

After selecting this display group number, the EVAP valve is closed and A/C compressor switched off.

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

➢ Indicated on display:

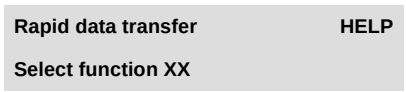
01-69

Notes:

- *For display group number 000, measured values are displayed as a decimal.*
- *Display can be printed out on the paper roll when printer is switched on.*
- *To switch to a different display group, proceed as follows:*

Display group	VAG1551 Scan Tool (ST)	VAS5051 tester
higher	Press button -3-	Press s button.
Lower	Press button -1-	Press t button.

- Let engine run at idle for a few minutes, coolant temperature at least 80 ° C.
- If specified values are obtained in all display fields, press → button.



Indicated on display (function selection):

01-70

Display group 000 (indicated values decimal)		
• Engine running at idle (Coolant Temperature not less than 80 ° C)		
◀ Display fields	Specified value	represents
Adaptation value of mixture preparation, bank 2	77 to 179	-10 to 10 %
Adaptation value of mixture preparation, bank 1	77 to 179	-10 to 10 %
Control value of mixture preparation, bank 2 (road test vehicle if outside of tolerance)	115 to 141	-10 to 10 %
Control value of mixture preparation, bank 1 (road test vehicle if outside of tolerance)	115 to 141	-10 to 10 %
Adaptation value, torque loss at idle:	102 to 169	-5 to 8 %
Idle torque	102 to 154	-5.0 to 5.0 %
Throttle valve angle	0 to 8	0 to 3.0 %
Engine speed (idle speed)		
• Front Wheel Drive Vehicles	72 to 82	720 to 820 RPM
• All-Wheel Drive Vehicles	63 to 73	630 to 730 RPM
Engine load (without consumers)	16 to 34	12 to 26 %
Engine Coolant Temperature (requirement for basic setting)	180 to 205	80 to 105 ° C

Code Control Module (function 07)

If control module does not indicate coding corresponding to vehicle, or if control module has been replaced, code it as follows.

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Ignition must remain switched on for this.

Rapid data transfer	**HELP**
Select function XX	

When indicated on display:

- Press buttons -0- and -7- to select "Code control module" and press -Q- button to confirm input.

Code Control Module	**Q**
Enter code number XXXXX	**(0-32000)**

When indicated on display:

- Input control module coding according to code table ⇒ Page 01-73 .

Clarification of coding

XX		Country/Exhaust
	X	Drive/Additional Functions
		X Transmission

	X	Vehicle model

Coding example	
07251	USA LEV [1] (emissions regulations), All Wheel Drive (AWD) without ESP [2] , 5 speed Automatic transmission, Audi A4

[1] LEV: Abbreviation for Low Emission Vehicle

[2] ESP: Abbreviation for Electronic Stability Program

- Confirm input using the -Q- button.

3B0907551BA 2.8l V6/5V G 0003 →
Coding 07251 WSC 12345

VAG1551 Scan Tool (ST) display indicates control module identification, e.g.:

Note:

Function is unknown or →
cannot be carried out at the moment

When indicated on display:

An unauthorized code number was entered.

- Press →button.

Rapid data transfer HELP
Select function XX

Indicated on display (function selection):

Coding table

Country/Exhaust	07			USA LEV (emissions regulation); Characteristic: Vehicles with Leak Detection Pump (LDP)
Drive/Additional Functions	2			All Wheel Drive (AWD) without Electronic Stability Program (ESP)
	5			Front Wheel Drive (FWD) with Anti-Slip Regulation (ASR)
	7			All Wheel Drive (AWD) with Electronic Stability Program (ESP)
Transmission		0		5 speed manual transmission
		5		Automatic transmission 01V
Vehicle model			1	Audi A4

Notes:

- *Electronic Stability Program is abbreviated as "ESP". Check the ESP switch in the center console to determine whether the vehicle is equipped with ESP.*
- *Anti-Slip Regulation is abbreviated as "ASR".*
- *The abbreviation "LEV" stands for Low Emission Vehicle.*

Read Measuring Value Block (function 08)

Test requirements:

- Coolant Temperature at least 80 ° C.
- Electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- Steering in "straight-ahead" position

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.

Rapid data transfer **HELP**

Select function XX

When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read Measuring Value Block	Q
Input display group number XXX	

When indicated on display:

- Enter desired three digit display group number and confirm by pressing the -Q- button.

Note:

Which display group should be chosen depends on current function and component tests.



➢ Indicated on display for display group 000:



➢ Indicated on display (example) for display group 001:

Notes:

- *Display can be printed out on the paper roll when printer is switched on.*
- *To switch to a different display group, proceed as follows:*

Display group	VAG1551 Scan Tool (ST)	VAS5051 tester
higher	Press button -3-	Press s button.
Lower	Press button -1-	Press t button.

Readiness code

The readiness code appears as an 8-digit display in measuring value block 086, display field 1. Each of the 8 digits is allocated to a specific exhaust related system.

During a test sequence (which must be carried out in its entirity), On Board Diagnostic (OBD) checks the function of each of these systems and then changes the character assigned to it in the 8-digit display from a "1" to a "0".

When the readiness code is generated after a successfully completed test sequence, it reads "0 0 0 0 0 0 0 0" (measuring value block 086, display field 1).

If a single test is completed entirely, but indicated as "not OK", a DTC will be stored in DTC memory. Check DTC Memory ⇒ Page 01-15 .

01-77

Readiness code is returned to "0 1 1 0 1 1 0 1" if:

- DTC memory was erased,
- a new Engine Control Module (ECM) was installed

In this case, readiness code must be re-generated ⇒ Page 01-82 .

Note:

During driving operation in various load conditions, exhaust relevant tests are performed by the control module within a "short trip" and readiness code is generated on its own. In this case, however, concluding control possibilities are not available, meaning that it will not be indicated whether all positions of the readiness code are set to "0".

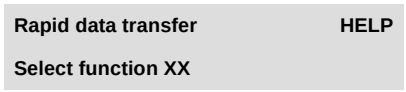
01-78

Readiness code, checking

Test sequence

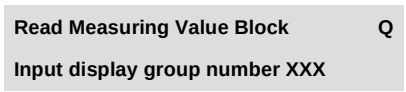
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Ignition must remain switched on for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -8- and -6- to select "display group number 086" and press -Q- button to confirm input.



When indicated on display:

- Check readiness code in display field 1
  - Specification: 0 0 0 0 0 0 0 0

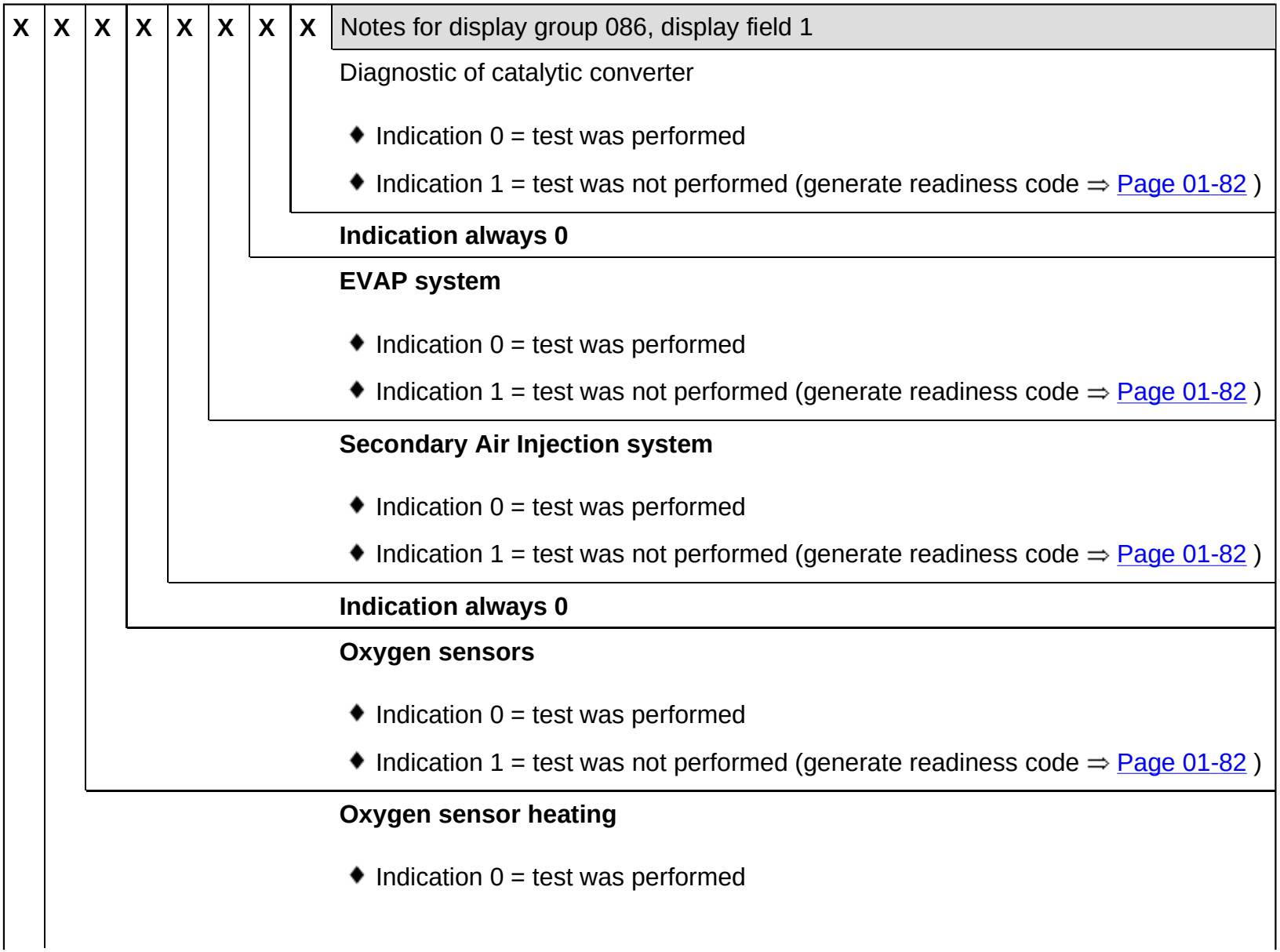
01-79

	Display fields			
	1	2	3	4
Display group 086: Readiness code				
Display	**0 0 0 0 0 0 0 0**	X X X X X X X X	X X X X X X X X	**X X X X X X X X**
Indicated	**Status-digits** **completed tests**	individual tests carried out	individual tests carried out	individual tests carried out
Functional range	**1 = not completed** **0 = completed**	1 = not completed 0 = completed	1 = not completed 0 = completed	1 = not completed 0 = completed
Specified value	**0 0 0 0 0 0 0 0**	X X X X X X X X	X X X X X X X X	X X X X X X X X
Notes	**Meaning of readiness code ⇒ Page 01-80**			

Note for display field 1:

Display field 1 is the most important. This indicates which system was checked via On Board Diagnostic (OBD) since the last time DTC memory was erased or a new control module was implemented. After DTC memory is erased, all testable values are set to 1, after the test is performed, the values are set to 0.

01-80


X X X X X X X X
Notes for display group 086, display field 1
Diagnostic of catalytic converter
♦ Indication 0 = test was performed
♦ Indication 1 = test was not performed (generate readiness code ⇒ Page 01-82)
Indication always 0
EVAP system
♦ Indication 0 = test was performed
♦ Indication 1 = test was not performed (generate readiness code ⇒ Page 01-82)
Secondary Air Injection system
♦ Indication 0 = test was performed
♦ Indication 1 = test was not performed (generate readiness code ⇒ Page 01-82)
Indication always 0
Oxygen sensors
♦ Indication 0 = test was performed
♦ Indication 1 = test was not performed (generate readiness code ⇒ Page 01-82)
Oxygen sensor heating
♦ Indication 0 = test was performed

- Indication 1 = test was not performed (generate readiness code ⇒ Page 01-82)

Indication always 0

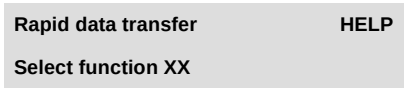
Note:

Readiness code is not generated until all indications in display field 1 show "0"

01-81

Once the specified value "0 0 0 0 0 0 0 0" is reached in display field 1:

- Press →button.



Indicated on display (function selection):

- Check DTC memory as a control measure ⇒ Page 01-15 (no malfunctions may be stored).

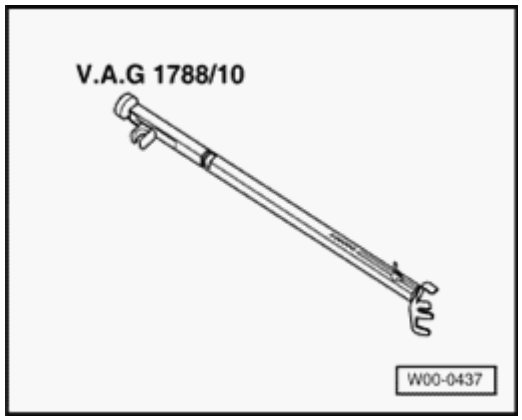
If specified value is not obtained:

- Generate readiness code ⇒ Page 01-82 .

01-82

Readiness code, generating

Special Tools and Equipment



- VAG1788/10 RPM adjuster

Requirements

- Electrical consumers switched off (radiator fan must NOT run during test).
- A/C system switched on.
- Vehicles with automatic transmission Selector lever in P or N.
- Coolant temperature at least 80 ° C ⇒ Display group 4, display field 3. Important: Drive engine warm via road test if possible.

Note:

If, during a work step, the test result is indicated as "OK" immediately after selecting a display group, the test has already been carried out and it is OK to continue on to the next work step.

01-83

Work step 1: Check DTC Memory

Test requirement

- Ignition switched on.

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Rapid data transfer HELP **Select function XX**	When indicated on display:

- Press buttons -0- and -2- to select "Check DTC memory" and press -Q- button to confirm input.

X DTC recognized	Number of stored DTCs or "No DTC recognized" will be indicated on display.

If a DTC is stored:

- Repair malfunction, erase DTC memory. Road test vehicle and then check DTC memory as a control measure.

If no DTCs are stored:

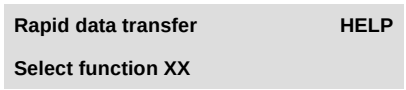
- Press →button.

01-84

Work step 2: Erase DTC Memory

Test requirement

- Engine not running, ignition switched on.

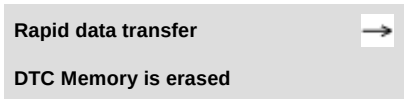


When indicated on display:

- Press buttons -0- and -5- to select "Erase DTC memory" and press -Q- button to confirm input.

Note:

When DTC memory is erased, readiness code is reset and must therefore be re-generated.



When indicated on display:

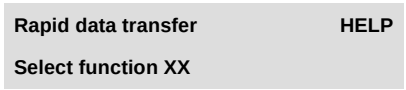
- Press →button.

01-85

Work step 3: Adapt throttle valve control module to Engine Control Module (ECM)

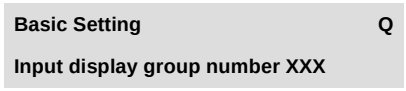
Test requirement

- Engine not running, ignition switched on.



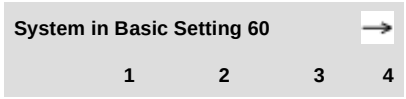
When indicated on display:

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -6- and -0- to select "display group number 060" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4.

01-86

	Display fields			
	1	2	3	4
Display group 060: Adaptation of throttle valve control module				
Display	xx %	xx %	**x**	**---**
Indicated	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Adaptation step counter**	**Adaptation condition**
Functional range	0 to 100 %	0 to 100 %	**0 to 8**	**ADP in progress** **ADP OK** **ADP ERROR**
Specified value	3 to 93 %	97 to 3 %	**8**	**ADP OK**
Notes			**After adaptation, the adaptation step counter reaches the number 8 (it is OK for numbers to be skipped).**	**If "ADP ERROR." is displayed: Check DTC memory ⇒ Page 01-15 .** **If specified value is not obtained: ⇒Note, page ⇒ Page 24-147 .**

Note for display field 3:

Different numbers are shown in display field 3 during adaptation that represent the current adaptation condition. It is not particularly important how the adaptation step counter (display field 3) behaves during adaptation, but rather that display field

4 indicates the specification "ADP OK" after adaptation.

If specified value "ADP OK" is obtained:

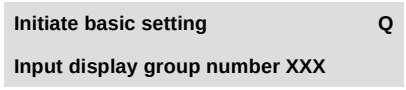
- Press -C- button.

01-87

Work step 4: Kick down function, adapting

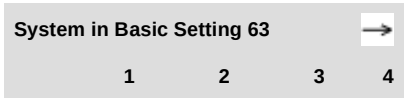
Test requirement

- Engine not running, ignition switched on.



➢ When indicated on display:

- Press buttons -0-, -6- and -3- to select "display group number 063" and press -Q- button to confirm input.



➢ When indicated on display:

Note:

There will be a prompt: "Activate kick-down"

- Depress accelerator pedal completely, past kick down point, and hold down.

Note:

During adaptation of the kick down point, the VAG1551 will display "Kick down ADP in progress". After successful adaptation of the kick down point, the VAG1551 will display "Kick down ADP OK".

- Check specified value in display field 4.

01-88

	Display fields			
	1	2	3	4
Display group 063: Kick down function, adapting				
Display	xx %	xx %	**Kick down**	**---**
Indicated	Sensor 1 for Pedal position	Sensor 2 for Pedal position	**Kick down**	**Adaptation condition**
Functional range	0 to 100 %	0 to 50 %	**Kick down**	**operate** **ADP in progress** **ADP OK** **ADP ERROR**
Specified value	12 to 97 %	4 to 49 %	**Kick down**	**ADP OK**
Notes				**If "ADP ERROR." is displayed: Check DTC memory ⇒ Page 01-15 .**

Note for display field 4:

"ERROR" can be indicated, for example, if the accelerator pedal is not immediately pressed in response to a request by the tester or if the accelerator pedal is released while adaptation is running despite the fact that adaptation is not yet complete.

In both cases, "Basic Setting" must be exited and the adaptation must be performed again.

If specified value "ADP OK" is obtained:

- Press -C- button.

01-89

Work step 5: Check operating condition of oxygen sensor control

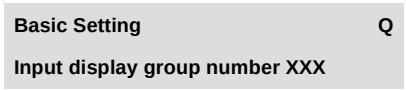
- Start engine (for a vehicle with manual transmission: engage clutch).

Note:

After starting engine, it may be necessary to select the Engine Control Module (ECM) again using "address word" 01 and the function "Initiate basic setting" using "04".

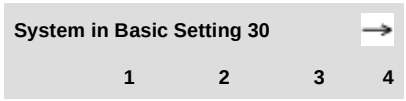
- Install VAG1788/10 RPM adjuster on the accelerator pedal and raise the engine speed.

  - Specification: 2200 RPM



When indicated on display:

- Press buttons -0-, -3- and -0- to select "display group number 030" and press -Q- button to confirm input.



When indicated on display:

- Check oxygen sensor status in display fields 1 to 4.

Note:

A few minutes may pass until a diagnostic result is reached.

01-90

	Display fields			
	1	2	3	4
Display group 030: Oxygen sensor status with engine at idle				
Display	**X X X**	**X X X**	**X X X**	**X X X**
Indicated	**Oxygen sensor status, bank 1, sensor 1**	**Oxygen sensor status, bank 2, sensor 1**	**Oxygen sensor status, bank 2, sensor 1**	**Oxygen sensor status, bank 2, sensor 2**
Functional range	**0 = off** **1 = on**	**0 = off** **1 = on**	**0 = off** **1 = on**	**0 = off** **1 = on**
Specified value	**1 1 1**	**1 1 0**	**1 1 1**	**1 1 0**

Significance of 3 digit indications in display group 030

X	X	X	**Display fields 1 to 4**
		X	Oxygen sensor control 0= not active 1 = active
	X		Operational readiness of oxygen sensor 0= not active 1 = active
X			Condition of oxygen sensor heating

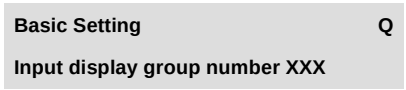
			0= not active 1 = active

01-91

Work step 6: Diagnostic of oxygen sensor aging before catalytic converter

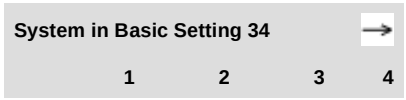
Test requirement

- Engine continues to run at 2200 RPM.



➢ When indicated on display:

- Press buttons -0-, -3- and -4- to select "display group number 034" and press -Q- button to confirm input.



➢ When indicated on display:

- Check specified value in display field 4 after indication "Test ON" appears:

Note:

A few minutes may pass until a diagnostic result is reached.

01-92

	Display fields			
	1	2	3	4
Display group 034: Oxygen sensor aging diagnostic, oxygen sensor before catalytic converter (bank 1)				
Display	xxxx/min	xxx °C	x.x s	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	Period duration Oxygen sensor before Catalytic converter	Diagnostic condition
Functional range	630 to 6800 RPM	70 to 850 °C	0 to 3.0 s	Test OFF Test ON B1-S2 OK B1-S2 not OK
Specified value	2200 RPM	above 380 °C	0.1 to 1.8 s	B1-S2 OK
Notes				**If "B1-S1 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15**

If specified value "B1-S1 OK" is obtained:

- Press -C- button.

Basic Setting Q

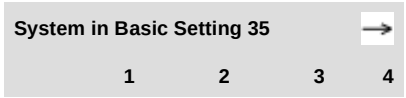
Input display group number XXX

When indicated on display:

- Press buttons -0-, -3- and -5- to select "display group number 035" and press -Q- button to confirm input.

01-93

If specified value "B2-S1 OK" is obtained:



When indicated on display:

- Check specified value in display field 4.

	Display fields			
	1	2	3	4
Display group 035: Oxygen sensor aging diagnostic, oxygen sensor before catalytic converter (bank 2)				
Display	xxxx/min	xxx °C	x.x s	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	Period duration Oxygen sensor before Catalytic converter	Diagnostic condition
Functional range	630 to 6800 RPM	70 to 850 °C	0 to 3.0 s	Test OFF Test ON B2-S2 OK B2-S2 not OK
Specified value	2200 RPM	above 380 °C	0.1 to 1.8 s	B2-S2 OK
Notes				**If "B2-S1 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15**

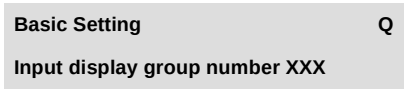
- Press -C- button.

01-94

Work step 7: Diagnostic of operational readiness of oxygen sensors behind catalytic converter

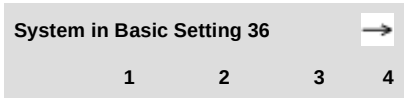
Test requirement

- Engine continues to run at 2200 RPM.



When indicated on display:

- Press buttons -0-, -3- and -6- to select "display group number 036" and press -Q- button to confirm input.



When indicated on display:

- Check specified values in display fields 2 and 4.

01-95

	Display fields			
	1	2	3	4
Display group 036: Operational readiness of the oxygen sensor behind catalytic converter (bank 1 and bank 2)				
Display	x.xxx V	**---**	x.xxx V	**---**
Indicated	Voltage of oxygen sensors behind catalytic converter, bank 1	**Diagnostic condition**	Voltage of oxygen sensors behind catalytic converter, bank 2	**Diagnostic condition**
Functional range	0.100 to 1.000 V	**Test OFF** **Test ON** **B1-S2 OK** **B1-S2 not OK**	0.100 to 1.000 V	**Test OFF** **Test ON** **B2-S2 OK** **B2-S2 not OK**
Specified value	smaller than 0.4 V or larger than 0.5 V	**B1-S2 OK**	smaller than 0.4 V or larger than 0.5 V	**B2-S2 OK**
Notes		**If "B1-S2 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory** ⇒ **Page 01-15**		**If "B2-S2 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory** ⇒ **Page 01-15**

If specified value "B1-S1 OK" is obtained:

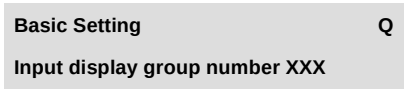
- Press -C- button.

01-96

Work step 8: Diagnostic of oxygen sensor control system

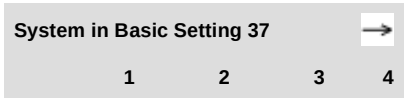
Test requirement

- Engine continues to run at 2200 RPM.



When indicated on display:

- Press buttons -0-, -3- and -7- to select "display group number 037" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4.

01-97

	Display fields			
	1	2	3	4
Display group 037: Diagnostic of oxygen sensor control system (Bank 1)				
Display	xxx %	x.xxx volts	xxx ms	**---**
Indicated	Load	Voltage of oxygen sensors behind catalytic converter, bank 1	Oxygen sensor correction value between sensor 1 and sensor 2 (bank 1)	Diagnostic condition
Functional range	12 to 100 %	0.100 to 1.000 V	-800 to 800 ms	**Test OFF** **Test ON** **System OK** **System not OK**
Specified value	12 to 26 %	0.100 to 1.000 V	-800 to 800 ms	System OK
Notes				**If "System not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory** ⇒ **Page 01-15**

If specified value "Syst. OK" is obtained:

- Press -C- button.

Basic Setting **Q**

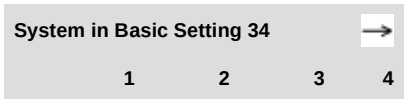
When indicated on display:

Input display group number XXX

- Press buttons -0-, -3- and -8- to select "display group number 038" and press -Q- button to confirm input.

01-98

If specified value "Syst. OK" is obtained:



When indicated on display:

- Check specified value in display field 4.

	Display fields			
	1	2	3	4
Display group 038: Diagnostic of oxygen sensor control system (Bank 2)				
Display	xxx %	x.xxx volts	xxx ms	**---**
Indicated	Load	Voltage of oxygen sensors behind catalytic converter, bank 2	Oxygen sensor correction value between sensor 2 and sensor 2 (bank 1)	Diagnostic condition
Functional range	12 to 100 %	0.100 to 1.000 V	-800 to 800 ms	**Test OFF** **Test ON** **System OK** **System not OK**
Specified value	12 to 26 %	0.100 to 1.000 V	-800 to 800 ms	System OK
Notes				**If "System not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory** ⇒ **Page 01-15**

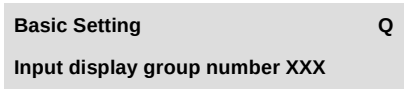
- Press -C- button.

01-99

Work step 9: Diagnostic of oxygen sensor aging behind catalytic converter

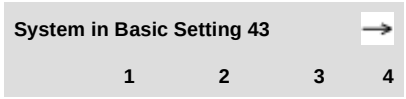
Test requirement

- Engine continues to run at 2200 RPM.



➢ When indicated on display:

- Press buttons -0-, -4- and -3- to select "display group number 043" and press -Q- button to confirm input.



➢ When indicated on display:

- Check specified value in display field 4.

01-100

	Display fields			
	1	2	3	4
Display group 043: Oxygen sensor aging diagnostic, oxygen sensor behind catalytic converter (bank 1)				
Display	xxxx/min	xxx °C	x.x s	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	Voltage of oxygen sensors behind catalytic converter, bank 1	Diagnostic condition
Functional range	630 to 6800 RPM	70 to 850 °C	0.100 to 1.000 V	Test OFF Test ON B1-S2 OK B1-S2 not OK
Specified value	2200 RPM	above 380 °C	0.100 to 1.000 V	B1-S2 OK
Notes				**If "B1-S2 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory** ⇒ **Page 01-15**

If specified value "B1-S1 OK" is obtained:

- Press -C- button.

Basic Setting **Q**

Input display group number XXX

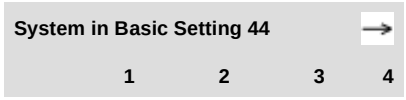
When indicated on display:

- Press buttons -0-, -4- and -4- to select "display group number 044"

and press -Q- button to confirm input.

01-101

If specified value B2-S2 OK" is obtained:



When indicated on display:

- Check specified value in display field 4.

	Display fields			
	1	2	3	4
Display group 044: Oxygen sensor aging diagnostic, oxygen sensor behind catalytic converter (bank 2)				
Display	xxxx/min	xxx °C	x.x s	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	Voltage of oxygen sensors behind catalytic converter, bank 2	Diagnostic condition
Functional range	630 to 6800 RPM	70 to 850 °C	0.100 to 1.000 V	Test OFF Test ON B2-S2 OK B2-S2 not OK
Specified value	2200 RPM	above 380 °C	0.100 to 1.000 V	B2-S2 OK
Notes				**If "B2-S2 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory** ⇒ **Page 01-15**

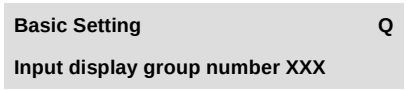
- Press -C- button.

01-102

Work step 10: Diagnostic of catalytic converter

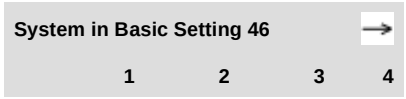
Test requirement

- Engine continues to run at 2200 RPM.



When indicated on display:

- Press buttons -0-, -4- and -5- to select "display group number 046" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4.

Note:

Catalytic converter diagnostic lasts approx. 60 seconds.

01-103

	Display fields			
	1	2	3	4
Display group 046: Diagnostic of catalytic converter (bank 1)				
Display	xxxx/min	xxx °C	x.x s	---
Indicated	Engine speed (RPM)	Exhaust temperature	Catalytic converter - conversion	Diagnostic condition
Functional range	630 to 6800 RPM	70 to 850 °C	0.00 to 0.99	Test OFF Test ON Cat B1 OK Cat B1 not OK
Specified value	2200 RPM	above 420 °C	0.00 to 0.52 1) 0.00 to 0.47 2)	Cat B1 OK
Notes				**If "Cat B1 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15 . If no DTCs are stored, replace catalytic converter.**

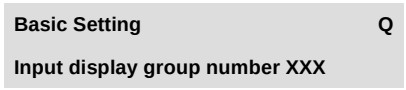
1) Manual transmission

2) Automatic transmission

01-104

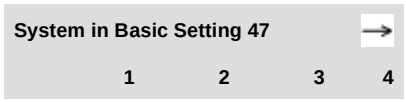
If specified value "Cat B1 OK" is obtained:

- Press -C- button.



When indicated on display:

- Press buttons -0-, -4- and -7- to select "display group number 047" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4.

01-105

	Display fields			
	1	2	3	4
Display group 047: Diagnostic of catalytic converter (bank 2)				
Display	xxxx/min	xxx °C	x.x s	---
Indicated	Engine speed (RPM)	Exhaust temperature	Catalytic converter - conversion	Diagnostic condition
Functional range	630 to 6800 RPM	70 to 850 °C	0.00 to 0.99	Test OFF Test ON Cat B2 OK Cat B2 not OK
Specified value	2200 RPM	above 420 °C	0.00 to 0.52 1) 0.00 to 0.47 2)	Cat B2 OK
Notes				**If "Cat B2 not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15 . If no DTCs are stored, replace catalytic converter.**

1) Manual transmission

2) Automatic transmission

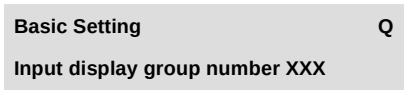
If specified value "Cat B2 OK" is obtained:

- Press -C- button.

01-106

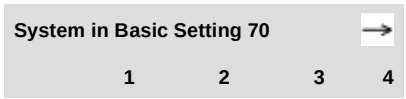
Work step 11: Diagnostic of tank ventilation valve

- Remove the VAG1788/10 RPM adjuster and leave engine running at idle.



When indicated on display:

- Press buttons -0-, -7- and -0- to select "display group number 070" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4.

Note:

If test is not initiated or if indication switches from "Test ON" to "Test OFF", depress accelerator pedal briefly, test will be repeated.

01-107

	Display fields			
	1	2	3	4
Display group 070: Diagnostic of tank ventilation valve				
Display	xx %	xx.x %	g/s	**---**
Indicated	Degree tank ventilation valve is opened	Oxygen sensor control deviation	Deviation of Idle control	**Diagnostic condition**
Functional range	0 to 99 %	-25.0 to 25.0 %		**Test OFF** **Test ON** **TVV OK** **TVV not OK** **Aborted**
Specified value	0 to 99 %	-7.0 to 7.0 %	**x.xx g/s** 1)	**TVV OK**
Notes				**If "TVV not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15 . Check Evaporative Emission (EVAP) canister purge regulator valve -N80- ⇒ Page 24-128**

1) An indication is only displayed if diagnostic result falls within a specified range due to deviation of idle control and not due to deviation of an oxygen sensor (e.g. sensor 1 from EVAP canister). Otherwise, display field 3 remains empty.

If specified value "TVV OK" is obtained:

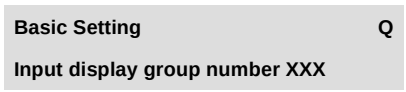
- Press → button.

01-108

Work step 12: Diagnostic of tank seal

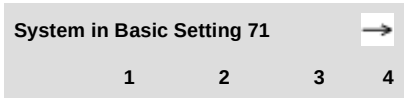
Test requirements

- Engine running at idle:
- Intake Air Temperature (IAT) less than 95 ° C ⇒ display group 004, display field 4.
- Coolant temperature at least 80 ° C ⇒ Display group 4, display field 3
- Fuel filler cap opened briefly (to reduce pressure).



When indicated on display:

- Press buttons -0-, -7- and -1- to select "display group number 071" and press -Q- button to confirm input.



When indicated on display:

Notes:

- *Test lasts approx. 90 seconds.*
- *When the diagnostic of tank seal is performed several times in a row, the fuel filler cap must be opened briefly before each test to release pressure.*

01-109

- Check specified value in display field 4 after indication "Test ON" appears:

	Display fields			
	1	2	3	4
Display group 071: Diagnostic of tank seal				
Display	---	---	---	**---**
Indicated	Condition Reed-Terminal	DTC message	System condition	**Diagnostic condition**
Functional range	Reed open Reed closed	Small leak Large leak System not OK Aborted	System test Measurement END Measurement	**Test OFF** **Test ON** **System OK** **System not OK** **Aborted**
Specified value	Reed open	---	END Measurement	**System OK**
Notes				**If "System not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15**

If specified value "Syst. OK" is obtained:

- Press -C- button.

01-110

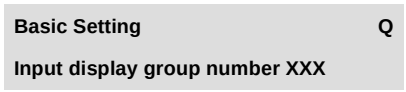
Work step 13: Diagnostic of Secondary Air Injection (AIR) system

Test requirement

- Engine running at idle:

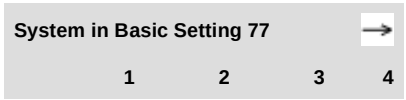
Note:

During diagnostic of the Secondary Air Injection (AIR) system, the Secondary Air Injection (AIR) pump will run for several seconds.



When indicated on display:

- Press buttons -0-, -7- and -7- to select "display group number 077" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4 after indication "Test ON" appears:

Note:

Secondary Air Injection (AIR) system test lasts approx. 60 seconds.

01-111

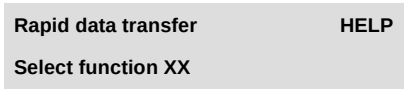
	Display fields			
	1	2	3	4
Display group 077: Secondary Air Injection (AIR) system diagnostic				
Display	xxxx/min	xx.x g/s	%	**---**
Indicated	Engine speed (RPM)	Air mass	Relative air mass Secondary air system	**Diagnostic condition**
Functional range	670 to 6800 RPM			**Test OFF** **Test ON** **System OK** **System not OK**
Specified value	720 to 820 RPM 1) 630 to 730 RPM 2)	0 to 5	-80 to 20	System OK
Notes				**If "System not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15**

1) Front Wheel Drive Vehicles

2) All-Wheel Drive Vehicles

If specified value "Syst. OK" is obtained:

- Press → button.



Indicated on display (function selection):

01-112

Work step 14: Readiness code, reading

- Read readiness code ⇒ Page 01-78 .

24-1

Motronic injection system, servicing

Safety precautions

If special testing equipment is required during road test, note the following:

WARNING!

- ***Scan tools and testing devices must always be secured on the rear seat and operated from there by a second person.***

- ***If a scan tool or testing device were to be operated from the passenger seat and there were an accident involving activation of the passenger-side airbag, the person seated there could be seriously injured.***

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- Only disconnect and reconnect wires for injection and ignition system, including test leads, when ignition is turned off.

- If engine is to be cranked at starting RPM without starting (e.g. for compression testing),

disconnect connector from ignition coils and from fuel injectors.

24-2

- It is possible that the control module will recognize a malfunction and store a DTC during some tests. After completing all tests and repairs, DTC memory should therefore be checked and erased if necessary. Readiness code must be generated after DTC memory is erased ⇒ Page 01-82 .

- Always switch ignition off before cleaning engine.

- The battery should only be disconnected and reconnected when the ignition is turned off, since otherwise the Engine Control Module (ECM) can be damaged.

WARNING!

Fuel system is under pressure! Place a cloth around the connection point before opening system. Then release pressure by carefully loosening connection point.

24-3

Rules of cleanliness

When working on the fuel supply or fuel injection systems, the following "6 rules of cleanliness" should be carefully observed:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place parts that have been removed on a clean surface and cover. Use lint-free cloths only!
- Carefully cover opened components or seal them if repairs are not carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (in tool boxes etc.)
- When the system is open: Do not work with compressed air if it can be avoided. Do not move vehicle unless absolutely necessary.
- Disconnected electrical harness connectors: Protect from dirt and moisture. Be sure harness connector is dry before connecting.

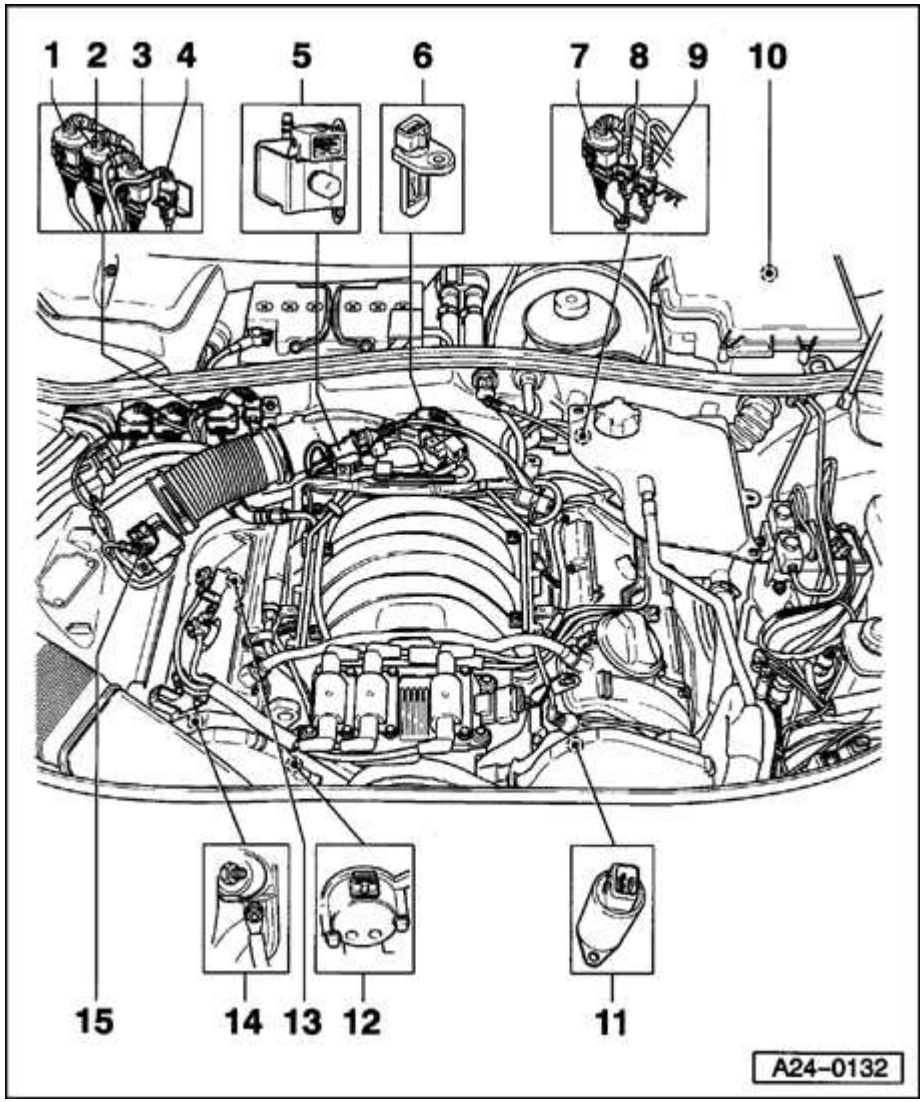
24-4

Technical data

Engine identification		ATQ (2.8 L / 5V/ 147 kW-engine)
Idle speed Engine speed cannot be adjusted, it is regulated by idle stabilization		720 to 820 RPM (front wheel drive) 630 to 730 RPM (all wheel drive)
Engine speed (RPM) limitation via fuel injector shut-off		about 6800 RPM
Fuel pressure at idle speed	Vacuum hose connected	3.2 to 3.8 bar
	Vacuum hose disconnected	3.8 to 4.2 bar
Residual pressure after 10 min.	cold engine	about 2.2 bar positive pressure
	warm engine	about 3.0 bar positive pressure
Fuel injectors	Injection stream	Dual-hole nozzle / same for all injectors
	Injection quantity (30 s)	90 to 125 ml.
	Resistance (room temperature) [1)]	13.5 to 15.5 Ω

1) With an engine at normal operating temperature, the resistance of the fuel injectors increases by approx. 4 to 6 Ω

24-5



Component locations, overview

Notes:

- *Other component Locations ⇒ Fig. ⇒ 7 , page ⇒ Page 24-11 up to Fig. ⇒ 12 , page ⇒ Page 24-13 .*
- *Component Locations without illustration:*

A - Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- with Oxygen Sensor (O2S) Heater 1 -Z29-

- Bank 2, sensor 1
- Accessible from below after vehicle has been lifted

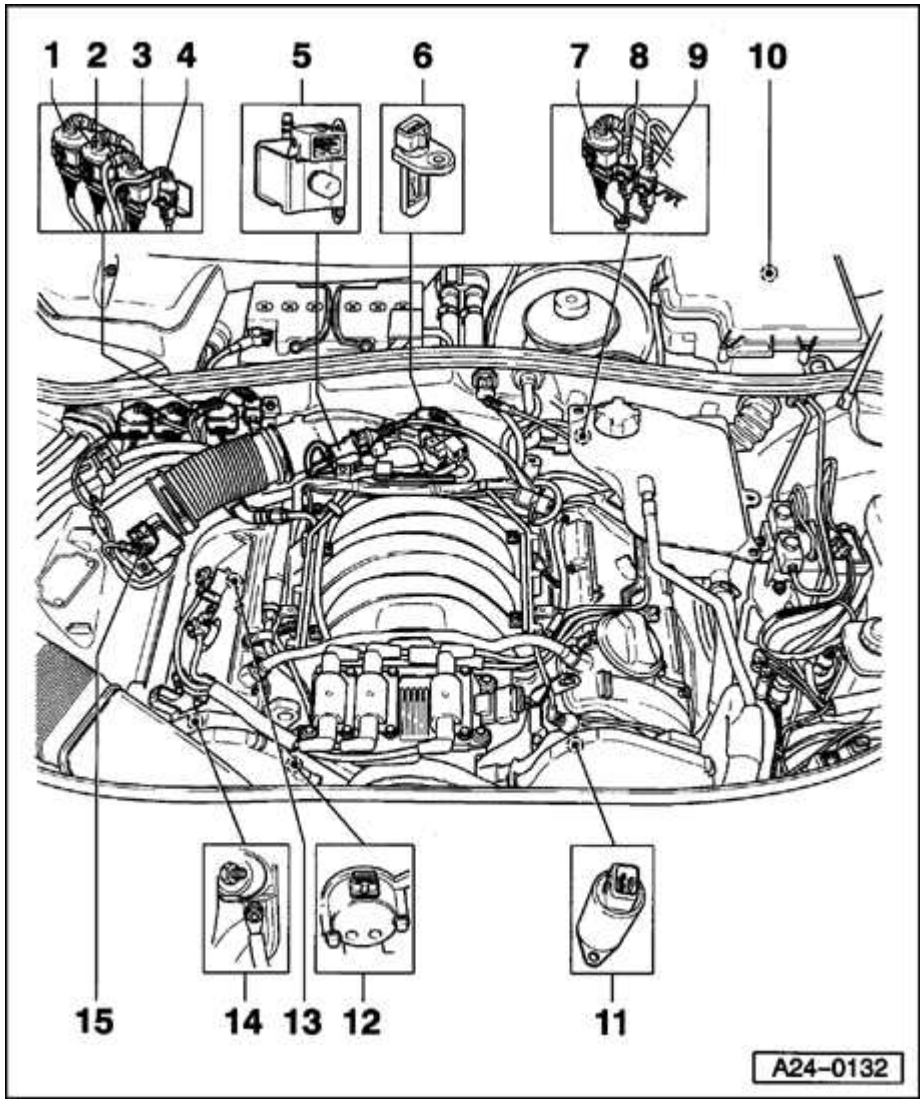
B - Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131- with Oxygen Sensor (O2S) Heater 2 -Z30-

- Bank 2, sensor 2
- Accessible from below after vehicle has been lifted

C - Leak Detection Pump (LDP) -V144-

- Below the rear left wheelhousing liner

24-6



1 - 4-pin harness connector

- for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- and Oxygen Sensor (O2S) Heater 1 -Z29- (bank 1 sensor 2)
- green

2 - 4-pin harness connector

- for Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- and Oxygen Sensor (O2S) Heater 2 -Z30- (bank 2 sensor 2)
- brown

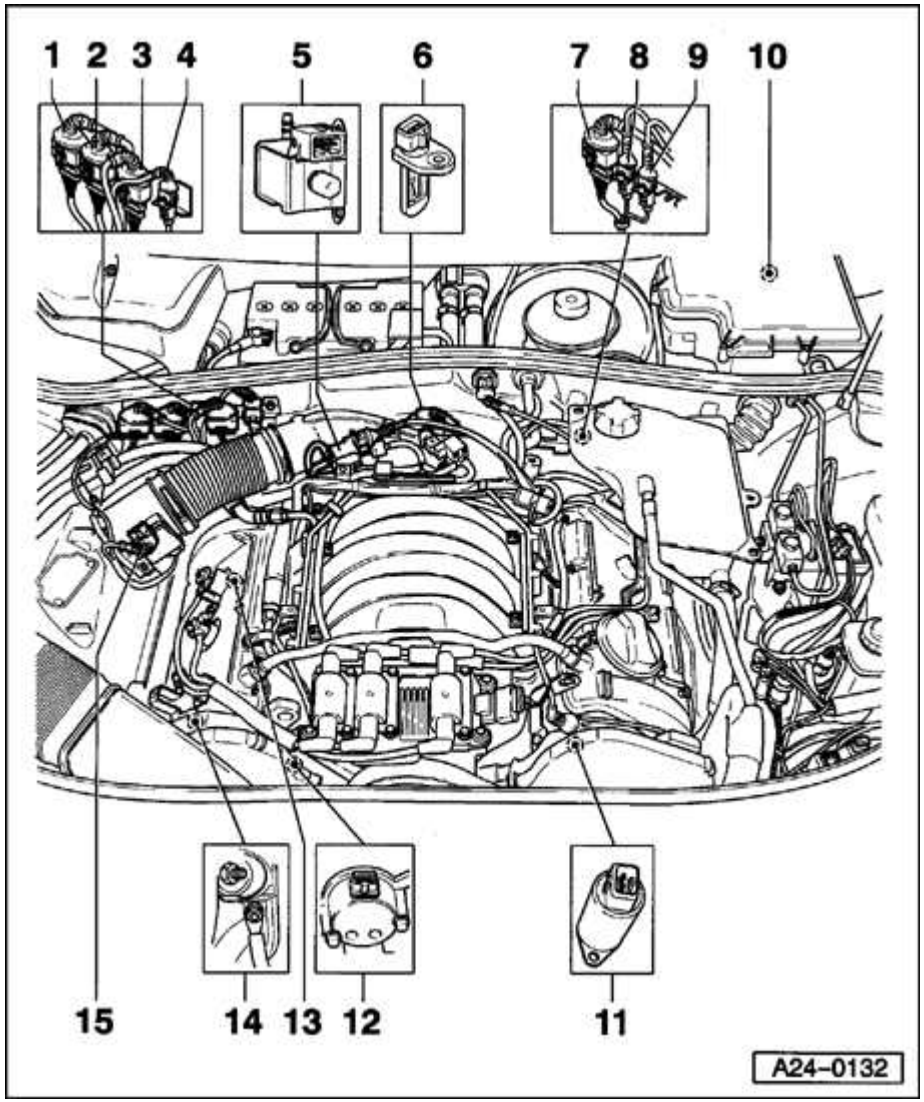
3 - 4-pin harness connector

- for Heated Oxygen Sensor (HO2S) -G39- before catalytic converter and Oxygen Sensor (O2S) Heater -Z19- (bank 1 sensor 1)
- Black

4 - 3-pin harness connector

- for Knock Sensor (KS) 1 -G61-
- blue

24-7



5 - Secondary Air Injection (AIR) solenoid valve -N112-

6 - Intake Air Temperature (IAT) sensor -G42-

7 - 4-pin harness connector

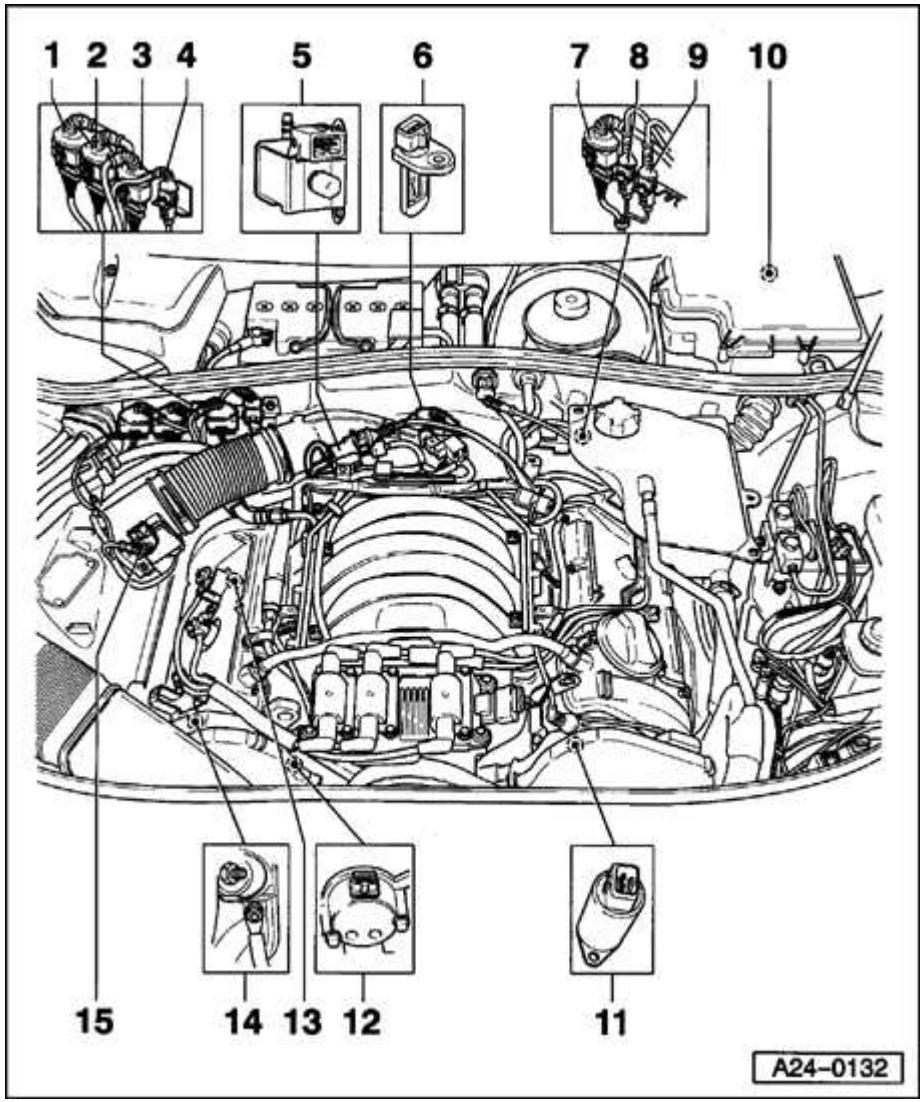
- for Heated Oxygen Sensor (HO2S) 2 -G108- before catalytic converter and Oxygen Sensor (O2S) 2 Heater -Z28- (bank 2 sensor 1)
- Black

8 - 3-pin harness connector

- for engine speed (RPM) sensor -G28-
- gray

9 - 3-pin harness connector

- for Knock Sensor (KS) 2 -G66-
- blue



10 - E-box in plenum chamber

- Motronic Engine Control Module (ECM) -J220-
- Secondary Air Injection (AIR) Pump Relay -J299- ⇒ Fig. ⇒ 10 , page ⇒ Page 24-12

11 - Valve -2- for camshaft adjustment -N208-

12 - Camshaft Position (CMP) sensor 2 -G163-

- Bank 1

13 - Heated Oxygen Sensor (HO2S) -G39- before catalytic converter with Oxygen Sensor (O2S) Heater -Z19-

- Bank 1, sensor 1

14 - Ground connection

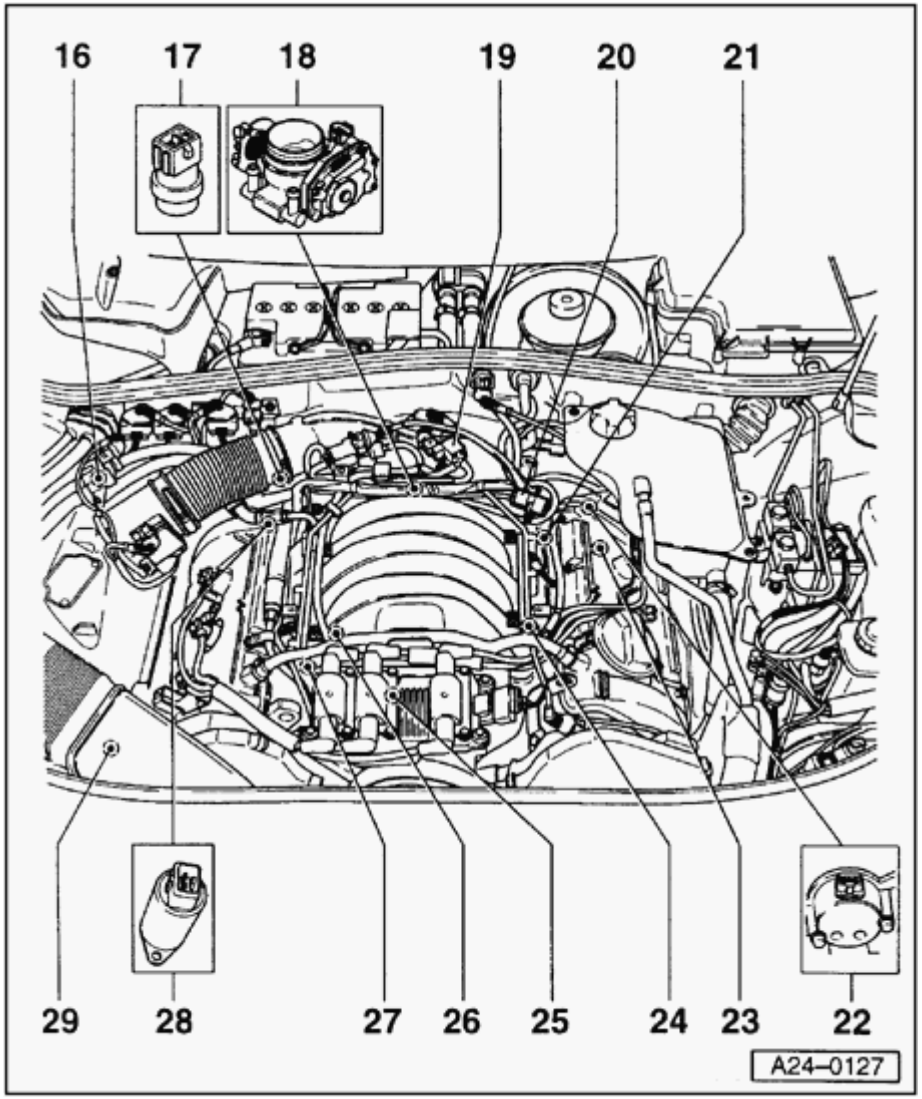
- on the engine bracket, right side

15 - Mass Air Flow (MAF) sensor -G70-

- Checking ⇒ Page 24-56

16 - Evaporative Emission (EVAP) canister purge regulator valve -N80-

24-9



17 - Engine Coolant Temperature (ECT) sensor -G62-

- for Engine Control Module (ECM)
- At coolant line behind cylinder head engine bank 1
- with Engine Coolant Temperature (ECT) Sensor -G2-
- Checking ⇒ Page 28-23
- If necessary, release pressure in cooling system before removing

18 - Throttle valve control module -J338-

- With throttle drive (power accelerator actuation) -G186-, angle sensor -1- for throttle drive (power accelerator actuation) -G187-, and angle sensor -2- for throttle drive (power accelerator actuation) -G188-

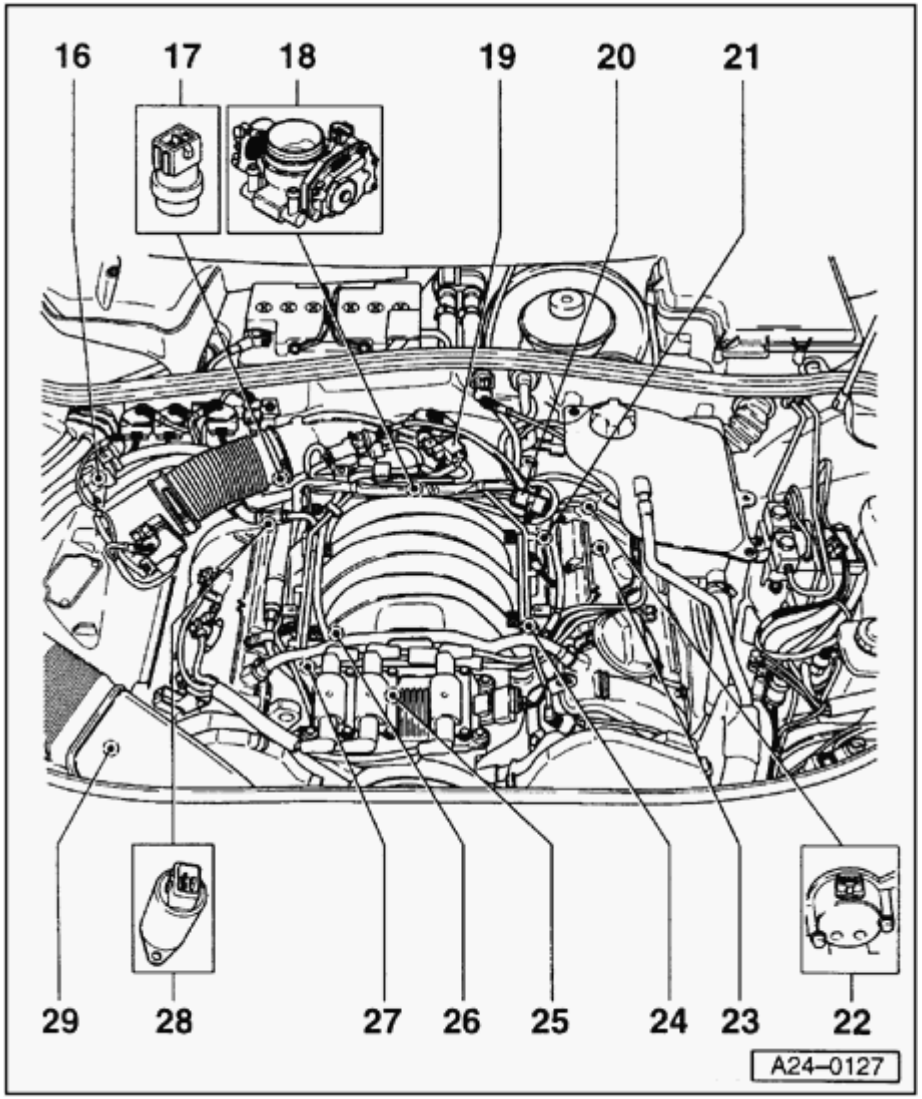
19 - Intake Manifold Change-Over Valve -N156-

20 - Fuel pressure regulator

21 - Engine Speed (RPM) sensor -G28-

- in transmission housing via ring gear
- Checking ⇒ Page 28-19

24-10



22 - Camshaft Position (CMP) sensor 2 -G40-

- Bank 2

23 - Heated Oxygen Sensor (HO2S) 2 -G108- before catalytic converter with Oxygen Sensor (O2S) 2 Heater -Z28-

- Bank 2, sensor 1

24 - Knock Sensor (KS) 2 -G66-

25 - Ignition coils (-N-, -N128-, -N158-)

- with power output stage -N122-

26 - Knock Sensor (KS) 1 -G61-

27 - Fuel injectors -N30- through -N33- ,Cylinder 5/6 Fuel Injector -N83-, -N84-

28 - Valve -1- for camshaft adjustment -N205-

29 - Secondary Air Injection (AIR) pump motor-V101-

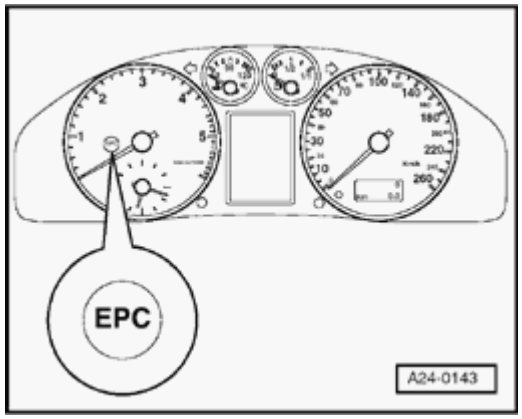


Fig. 7 Component location, fault light for power accelerator activation -K132-

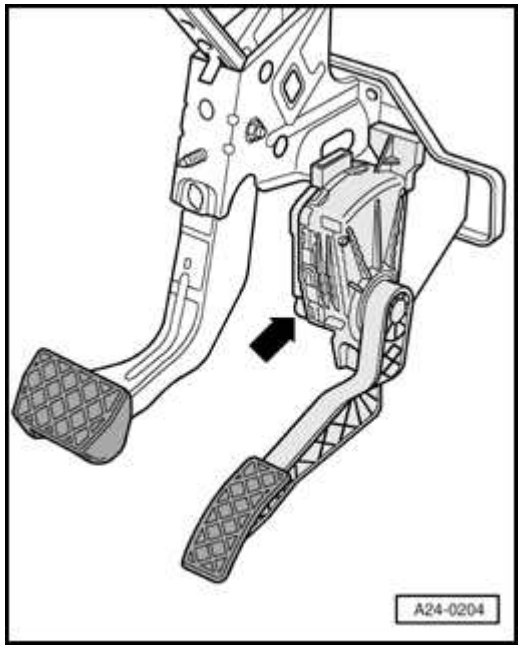


Fig. 8 Installation position, Throttle Position (TP) sensor -G79- and sender 2 for accelerator pedal position -G185-

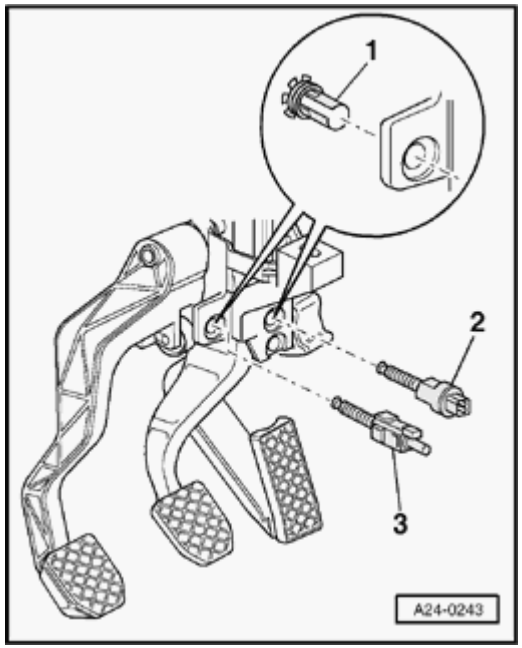


Fig. 9 Component location Brake Light Switch -F- and Brake Vacuum Vent Valve Switch For Cruise Control/Diesel Fuel Injection, Clutch Vacuum Vent Valve Switch -F36-

1 - Clip

2 - Brake Light Switch -F-, Brake Vacuum Vent Valve Switch For Cruise Control/Diesel Fuel Injection -F47-

3 - Clutch vacuum vent valve switch -F36-

Note:

In order to assure sufficiently secure fitting, switches must not be installed more than once.

Adjusting switch:

⇒ *Repair Manual, Brake System, ABS, ABS/EDL, Repair Group 46*

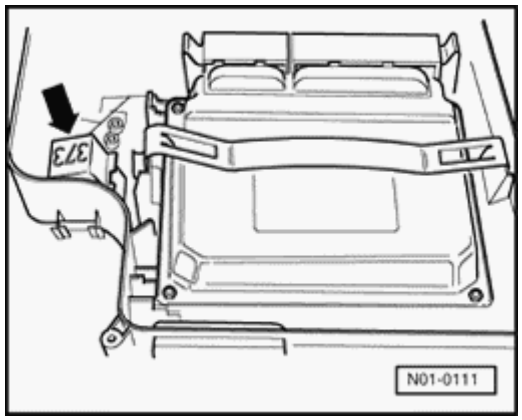


Fig. 10 Component location for Secondary Air Injection (AIR) Pump Relay -J299-

Secondary Air Injection (AIR) Pump Relay -J299- (arrow) in 3-pin relay carrier in E-box, plenum chamber.

24-13

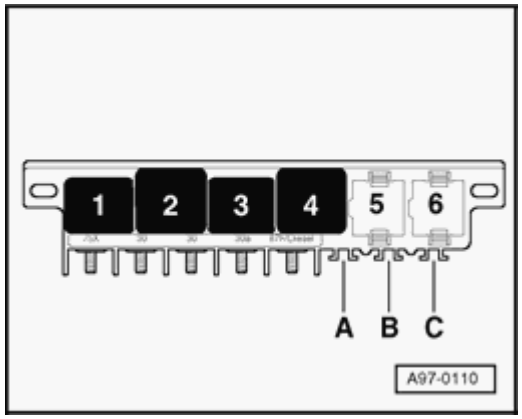


Fig. 11 Component locations Fuel Pump (FP) Relay -J17-

Fuel Pump (FP) Relay -J17- is located at position 4 of central electrics in driver's footwell, left.

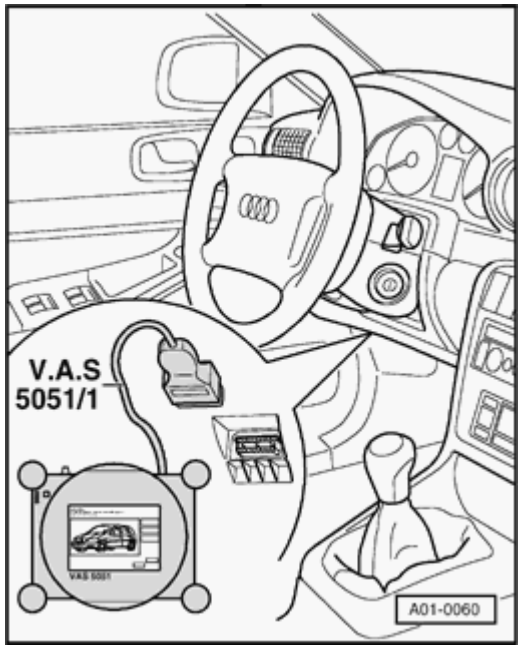
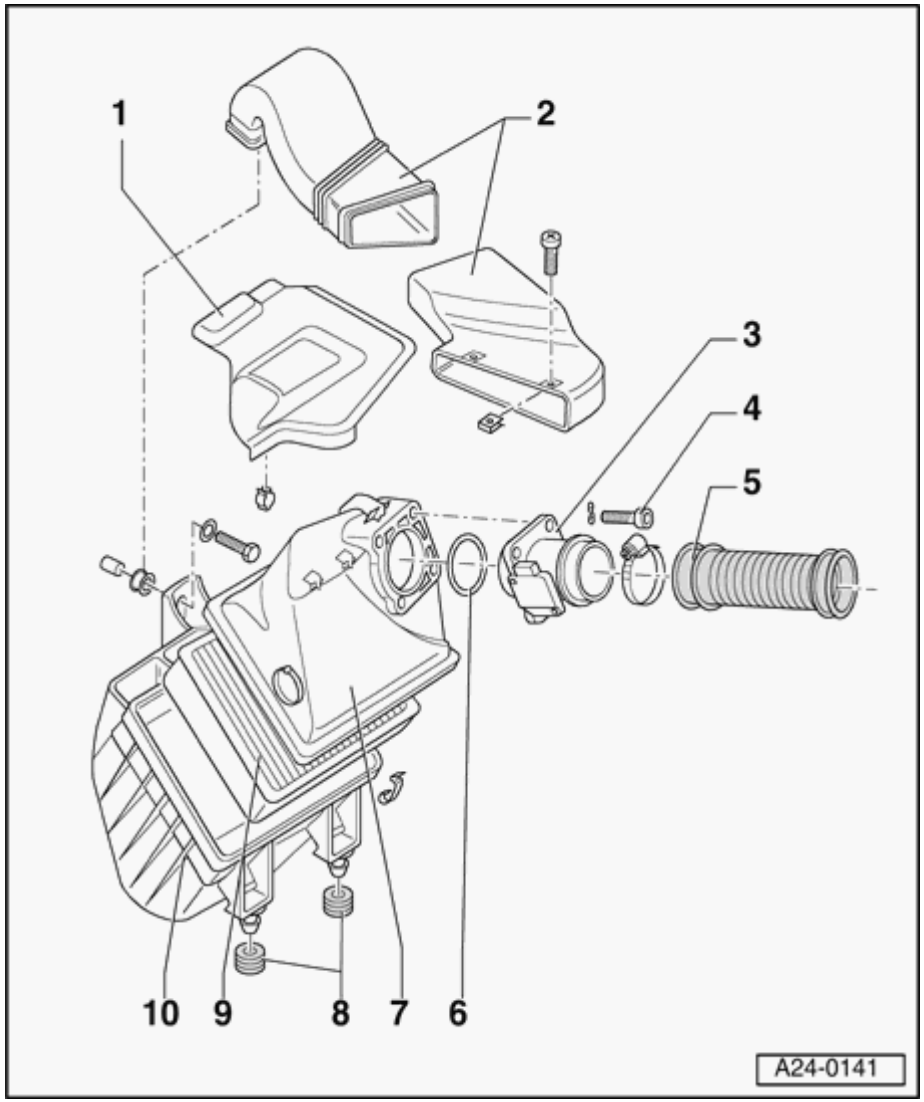


Fig. 12 Component location of Data Link Connector (DLC)

Data Link Connector (DLC) in knee bolster on driver's side.

24-14



Air filter, disassembling and assembling

1 - Cover

2 - Air duct

- to metering unit

3 - Mass Air Flow (MAF) sensor -G70-

4 - 10 Nm

5 - Connection hose

6 - Seal

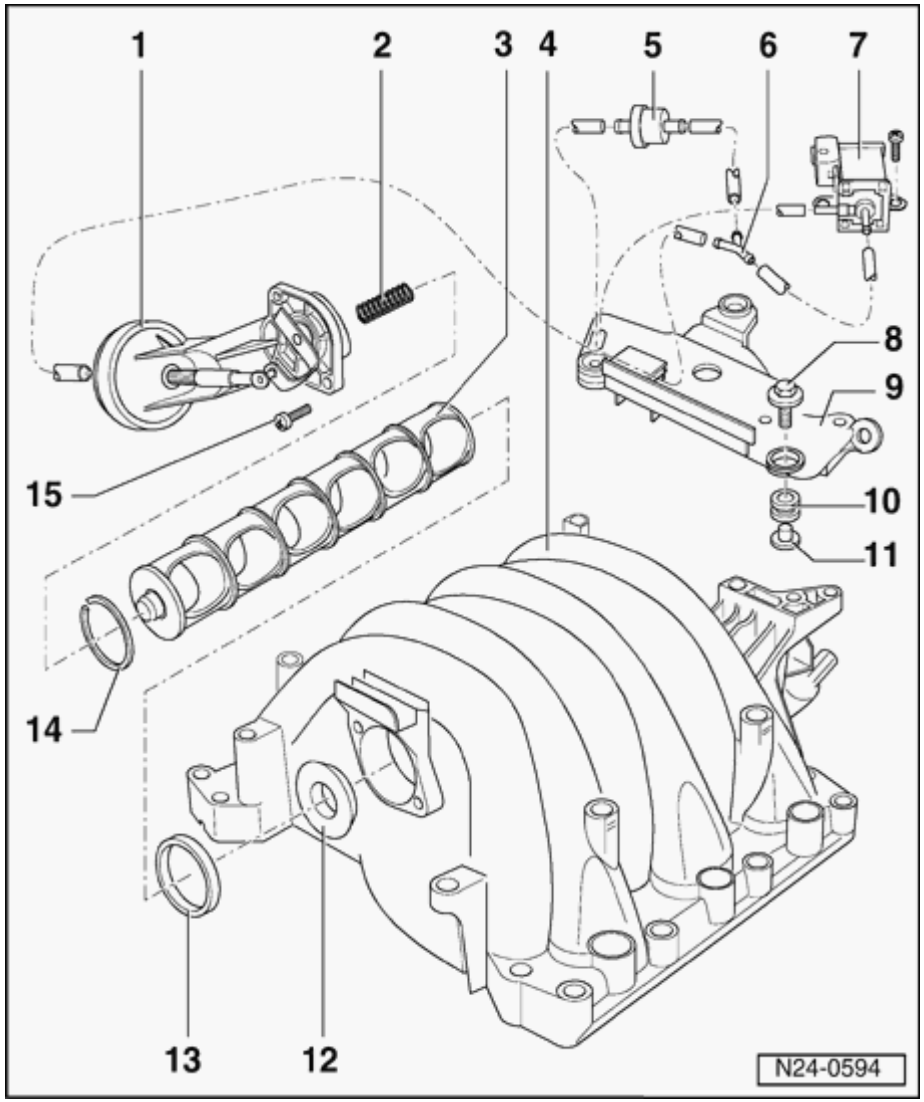
7 - Air filter, upper portion

8 - Rubber grommet

9 - Filter element

10 - Air filter, lower portion

24-15



Intake manifold change-over components, removing and installing

1 - Vacuum setting element

2 - Compression spring

3 - Rotary change-over valve

4 - Intake Manifold

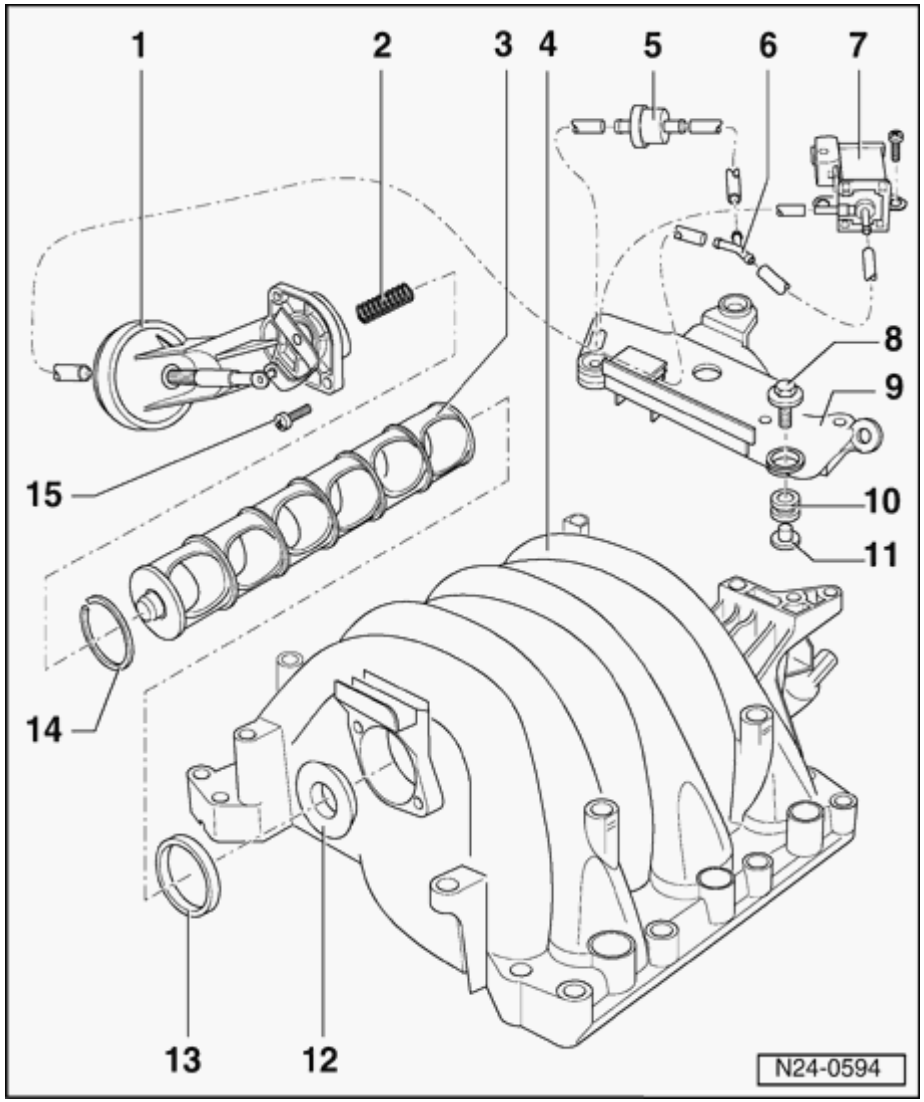
5 - Check-valve

- Installed position: blue side toward Y-piece

6 - Y-piece

7 - Intake manifold change-over valve -N156-

24-16



8 - 10 Nm

9 - Securing plate

10 - Rubber grommet

11 - Spacer sleeve

12 - Washer

- conical side toward intake manifold

13 - Seal

- Replace if damaged

14 - Seal

- for rotary change-over valve
- Replace if damaged

15 - 6 Nm

24-17

Wire and component test using VAG1598/31 test box

Notes:

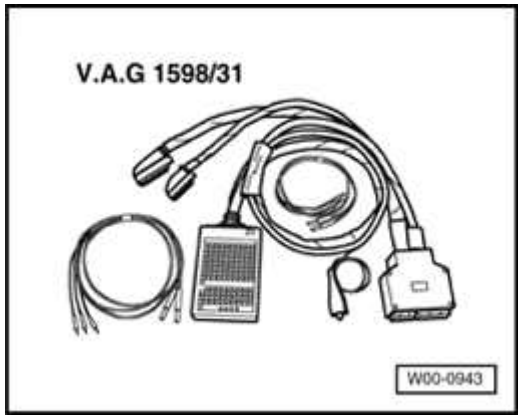
- *VAG1598/31 test box is designed so that it can be simultaneously connected to the wiring harness at the Engine Control Module (ECM) and also to the ECM itself.*
- *This is advantageous because electronic engine control remains fully functional (e.g. measurement of signals with engine running) when the test box is attached.*
- *Relevant test procedures note whether Engine Control Module (ECM) should also be connected to the test box or not.*
- *Always use VAG1594A connector test kit to attach measurement devices (e.g. VAG1527B voltage tester, VAG1526 multimeter etc.).*

CAUTION!

To reduce the risk of damaging electronic components, set the tester to the approprate test range and observe test requirements before connecting test leads.

24-18

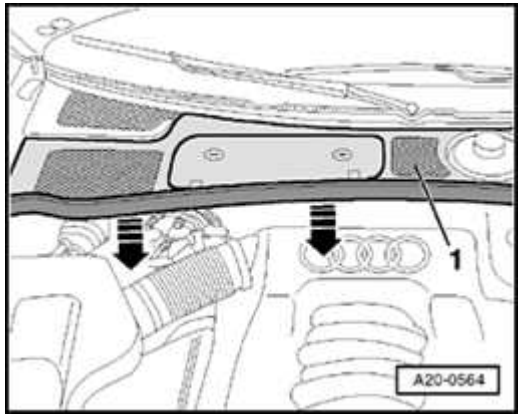
Special Tools and Equipment



- VAG1598/31

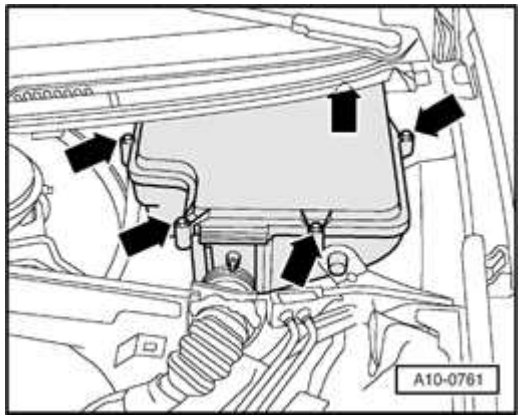
Procedure

- Switch ignition off.

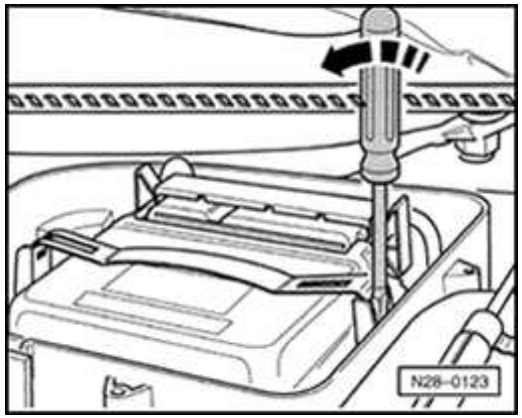


- Pull off rubber seal of plenum chamber cover in direction of arrow.
- Remove cover -1- toward front.

24-19



- Remove Heater Core E-box cover -arrows-.

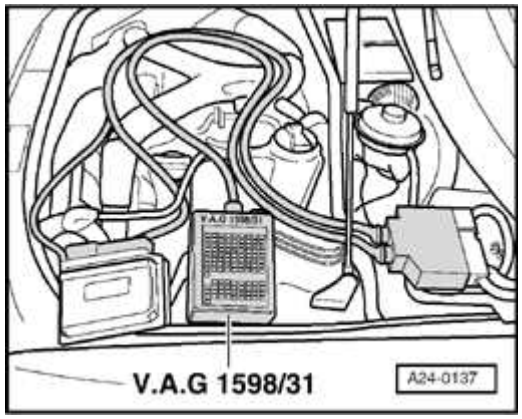


- Using a screwdriver, carefully pry off retaining bracket (arrow).
- Disengage locking lugs and remove control module connector.

Note:

Adaptation values are erased when connector is disconnected from the Engine Control Module (ECM), DTC memory content remains intact.

24-20



- Connect VAG1598/31 test box to connector of wiring harness. Ground (GND) clip at test box (not visible in illustration) must be connected to Ground (GND). Relevant test procedures note whether Engine Control Module (ECM) should also be connected to the test box.
- Perform test as described in relevant repair sequence.

Important note:

After re-connecting the Engine Control Module (ECM), the following work steps must be performed:

- Check DTC memory and erase it if necessary ⇒ *Page 01-15* .

- Perform adaptation of the Throttle Valve Control Module -J338- ⇒ *Page 24-142* .

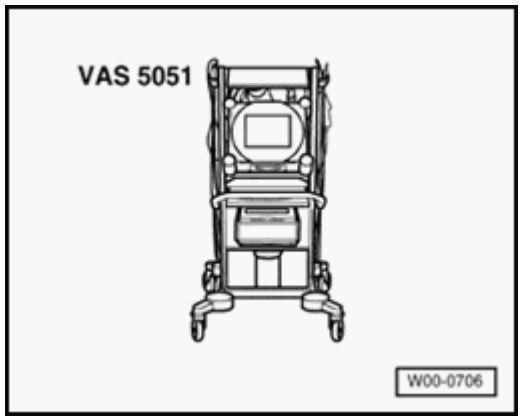
Note:

In the first adaptation phase during engine basic setting, it is possible that idle will be rough and vehicle may shake lightly in drive mode.

24-21

Engine Control Module (ECM), replacing

Special Tools and Equipment



- VAS5051 with VAG5051/1

  or

- VAG1551 with VAG1551/3B

Removing

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.

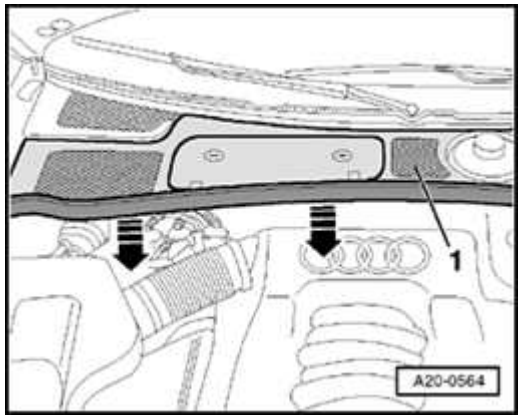
3B0907551BA 2.8l V6/5V G 0003 →

Coding 07252 WSC 12345

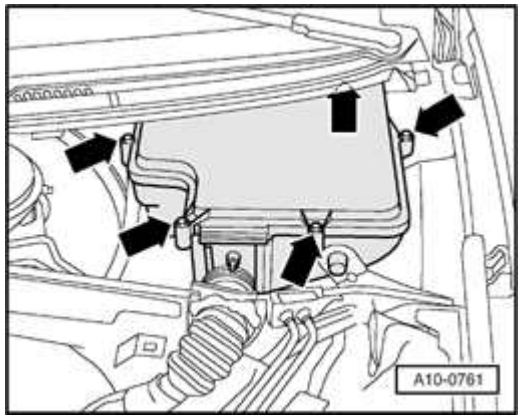
VAG1551 Scan Tool (ST) display indicates control module identification, e.g.:

- First, always allow display of control module identification and print it out ⇒ Page 01-11 .
- Compare coding with coding versions ⇒ Page 01-73 .
- Switch ignition off.

24-22

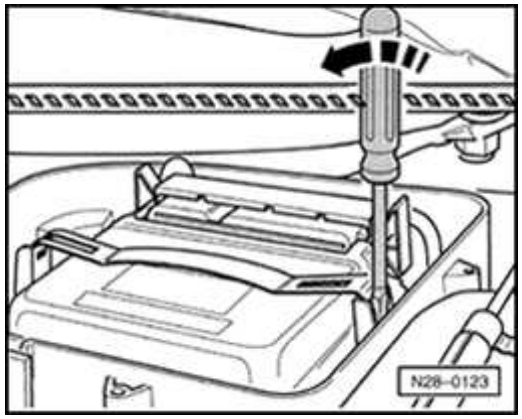


- Pull off rubber seal of plenum chamber cover in direction of arrow.
- Remove cover -1- toward front.



- Remove Heater Core E-box cover -arrows-.

24-23



- Using a screwdriver, carefully pry off retaining bracket (arrow).
- Disengage locking lugs and remove control module connector.
- Remove Engine Control Module (ECM).

Installing

Installation is reverse of removal, noting the following:

Important note:

After installing new Engine Control Module (ECM), the following work steps must be performed:

- Check DTC memory and erase it if necessary ⇒ *Page 01-15* .

- Perform adaptation of the Throttle Valve Control Module -J338- ⇒ *Page 24-142* .

24-24

- Observe notes for coding new Engine Control Module (ECM) ⇒ Page 01-71 .

- For vehicles with cruise control (discernable at steering column), switch this free in ECM:

⇒ Repair Manual, Electrical Equipment, Repair Group 01; On Board Diagnostic (OBD) of cruise control system; Cruise control system, checking

- Adapt immobilizer to Engine Control Module (ECM):

⇒ Repair Manual, Electrical Equipment, Repair Group 01; On Board Diagnostic (OBD) of immobilizer after replacing Engine Control Module (ECM)

- For vehicles with automatic transmission, the kick down function must be learned ⇒ Page 24-161 .

- Generate readiness code ⇒ Page 01-82 .

Note:

In the first adaptation phase during engine basic setting, it is possible that idle will be rough and vehicle may shake lightly in drive mode.

24-25

Idle speed (RPM), checking

Special Tools and Equipment



- VAS5051 with VAG5051/1

or

- VAG1551 with VAG1551/3B

Test requirements:

- Exhaust system free of leaks.
- Coolant Temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- No pressure gauge connected.
- Vehicles with automatic transmission Selector lever in P or N.

24-26

Notes:

- *Idle speed cannot be adjusted.*
- *Idle speed is checked during basic setting of the engine.*
- *During basic setting, the Evaporative Emission (EVAP) canister purge regulator valve (EVAP valve -N80-) is closed and the A/C compressor is switched off*

Test sequence

- Check DTC Memory ⇒ Page 01-15 . There must not be any DTCs stored, repair malfunctions if necessary, erase DTC memory, switch engine off and start again, road test vehicle and check DTC memory again as a control measure.

- Let engine continue to run at idle.

CAUTION!

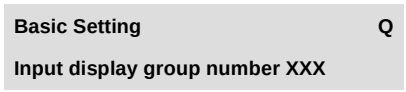
The electric cooling fan must not run.

Rapid data transfer	**HELP**
Select function XX	

When indicated on display:

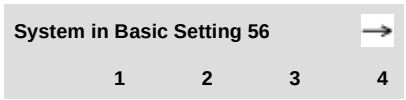
- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.

24-27



➢ When indicated on display:

- Press buttons -0-, -5- and -6- to select "display group number 056" and press -Q- button to confirm input.



➢ When indicated on display:

- Check whether the engine speed in display field 1 (actual engine speed) is within tolerated range.

	Display fields			
	1	2	3	4
Display group 056: Idle stabilization with engine at idle and operating temperature				
Display	**xxx /min**	**xxx /min**	x.x %	X X X X X
Indicated	**Engine speed (actual)**	**Engine speed (specified)**	Idle control Torque change	Operating conditions
Specified value	**720 to 820 RPM** [1)] **630 to 730 RPM** [2)]	**770 RPM** [1)] **680 RPM** [2)]	-5 to 5 %	0 0 0 0 0
Notes	**If specified value is not obtained** ⇒ **Page 24-29**			Significance of numbers ⇒ Page 24-29

1) Front Wheel Drive Vehicles

2) All-Wheel Drive Vehicles

24-28

Notes:

- *Engine speed in display field 1 (actual engine speed) is the current engine speed.*
- *Engine speed in display field 2 (specified engine speed) is a theoretical engine speed calculated by the ECM.*
- *At idle, the ECM always attempts to adapt the engine speed (actual) to the specified engine speed (specified).*
- *This means that the engine speed (actual) must always approximately match the engine speed (specified) at idle.*
- *Display fields 3 and 4 provide information, but are not relevant for checking idle speed.*

If specified value is obtained:

- Press →button.

Rapid data transfer **HELP**	
Select function XX	

Indicated on display (function selection):

If specified value is not obtained:

- Check DTC memory again ⇒ Page 01-15 .

- If DTC memory was erased, readiness code must be re-generated ⇒ Page 01-82 .

24-29

If idle speed is too high or low and there are no DTCs in DTC memory, the following tests (marked with dots) must be performed:

- False air in intake air system, checking ⇒ Page 24-64 .
- Throttle valve control module, checking ⇒ Page 24-141 .
- Evaporative Emission (EVAP) canister purge regulator valve always open, checking ⇒ Page 24-128 .
- Perform adaptation of throttle valve control module ⇒ Page 24-142 .

Significance of 5 digit indication of display group 056

x	x	x	x	x	Display field 4
				0	A/C compressor 0 = A/C compressor off 1 = A/C compressor on
			0		Driving mode selected 0 = selector lever in P or N

					1 = selector lever in 2/3/4/D/R
		0			A/C readiness maximum heating/cooling power
	0				Indication always 0
0					Indication always 0

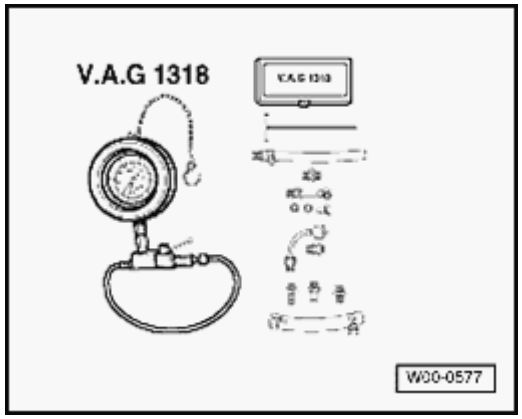
24-30

Fuel pressure regulator and residual pressure, checking

Note:

Fuel pressure regulator regulates fuel pressure according to intake manifold pressure. This ensures that the pressure drop at the fuel injectors remains the same for each speed and load range of the engine.

Special Tools and Equipment



- VAG 1318 with VAG 1318/7 adapter, VAG 1318/8 pressure hose with connectors and VAG 1318/15 adapter

Test requirements:

- Fuel Pump (FP) OK, checking ⇒ Page 24-49 .
- Fuel Pump (FP) OK, checking:

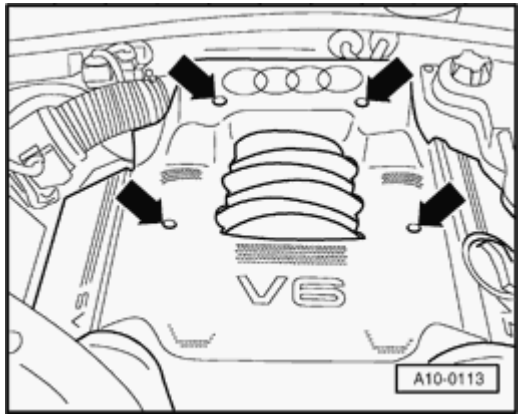
⇒ *Repair Manual, Fuel Supply System, Repair Group 20; Fuel supply Front Wheel Drive or fuel supply - All Wheel Drive*

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

24-31

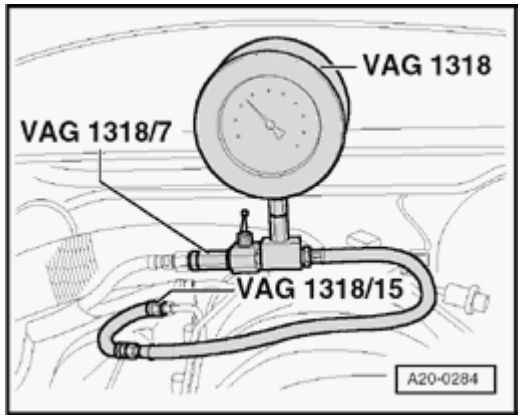
WARNING!

Fuel system is under pressure! Place a cloth around the connection point before opening system. Then release pressure by carefully loosening connection point.



- Remove engine cover (arrows).

Checking system pressure



- Connect VAG1318 pressure gauge using adapters VAG1318/7, /1318/8 pressure hose with connectors and 1318/15 adapter in supply line.
- Disconnect vacuum hose from pressure regulator to intake manifold at pressure regulator and seal line.

Note:

If fuel should escape at the vacuum connection of the pressure regulator during the following pressure test, replace pressure regulator.

- Start engine and let run at idle.

24-32

- Measure fuel pressure.

  - Specification: 3.8 to 4.2 bar

- If the specified value is not reached, replace pressure regulator on a trial basis and repeat pressure test.

- If the specified value is not reached again, check Fuel Pump (FP) or supply line for damage (e.g. pinched areas) and replace if necessary.

- If the specified value is exceeded, check return line for damage (e.g. pinched areas) and replace if necessary.

Note:

During the following test, the engine must not run for an unnecessarily long period of time with the vacuum hose removed. Otherwise, the higher fuel pressure can cause enrichment of the fuel to air ratio, which under some circumstances can cause the oxygen sensor control limits to be exceeded, causing a DTC to be stored.

- Start engine and let run at idle.

- Switch of electrical consumers (A/C system

etc.).

- Connect vacuum hose at pressure regulator while observing pressure drop at pressure gauge.

24-33

- Fuel pressure must drop by approx. 0.5 bar when connecting the vacuum hose.

  If the pressure change does not occur, the following tests must be performed:

  - Check vacuum hose for tears and damage.
  - Check vacuum hose at intake manifold for throughput by disconnecting from pressure regulator and blowing into it.

- If no leaks can be detected and if the vacuum hose has throughput, replace the pressure regulator.

Checking residual pressure

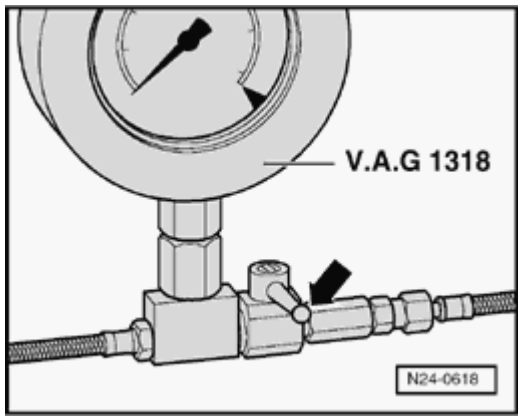
- Residual pressure 10 minutes after switching engine off (minimum pressure).

  - Specified value with a cold engine: approx. 2.2 bar
  - Specified value with the engine at operating temperature: approx. 3.0 bar

Note:

Pressure increase for an engine at operating temperature limited by the fuel expansion is normal.

24-34



- Start engine and let run at idle.

- Wait until pressure has dropped, and then switch off ignition. Simultaneously close shut-off valve of VAG1318 pressure gauge (lever perpendicular to direction of flow -arrow-).

The following malfunction are possible if the pressure does not drop:

- There is a leak in the threaded connection between the pressure gauge and the fuel supply line
- There is a leak at the supply line at fuel tank.
- There is a leak in the check valve in the Fuel Pump (FP).

⇒ *Repair Manual, Fuel Supply System, Repair Group 20; Fuel supply - Front Wheel Drive or fuel supply - All Wheel Drive*

Note:

Pressure gauge displays the pressure behind the stopcock "intake manifold side" after the stopcock is closed (in direction of fuel injector, fuel pressure regulator). If the pressure drops in front of the stopcock (in direction of fuel tank), the device cannot detect it. For this reason, the center of this page states "If the pressure does not drop...".

24-35

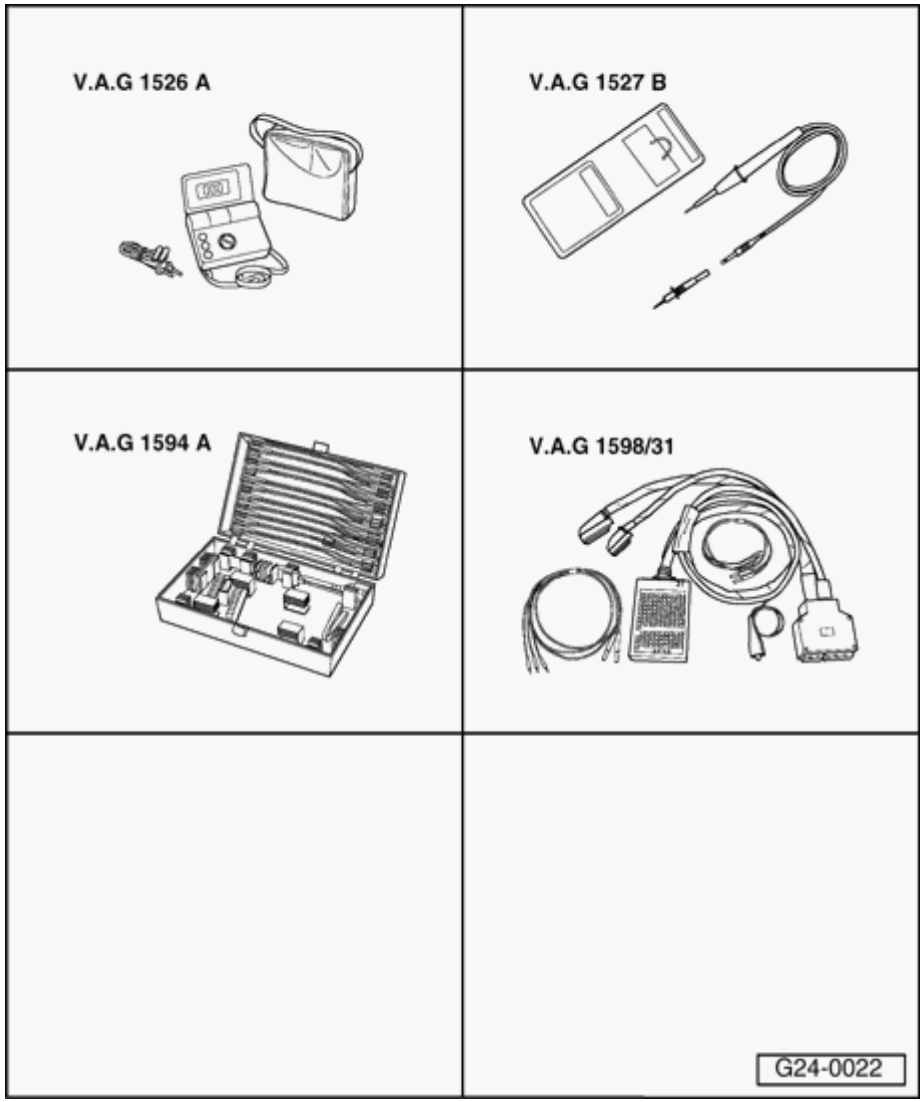
The following malfunctions are possible if the pressure drops again:

- Fuel pressure regulator faulty
- Fuel injectors not properly sealed
- Threaded connections of pressure gauge behind stopcock is not properly sealed.

Note:

Close stopcock for removing the pressure gauge, loosen threaded connection at VAG1318/15 adapter and let excess fuel escape into catch reservoir by opening stopcock.

24-36



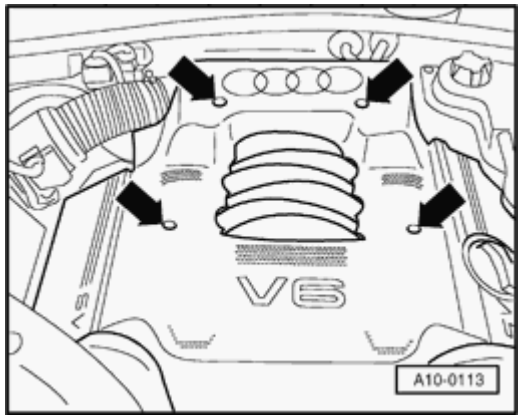
Fuel injectors, checking

Special Tools and Equipment

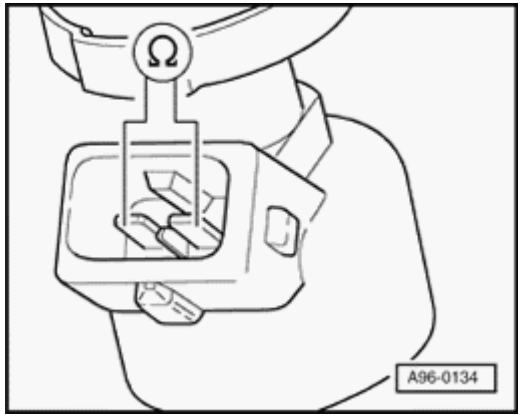
- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31

24-37

Checking internal resistance



- Remove engine cover (arrows).
- Disconnect harness connector at the fuel injector to be tested.



- Connect multimeter at valve for resistance measurement.
  - Specification: 13.5 to 15.5 Ω

With an engine at operating temperature, the resistance increases by approx. 4 to 6 Ω.

If specified value is not obtained:

- Replace fuel injector ⇒ Page 24-43 .

24-38

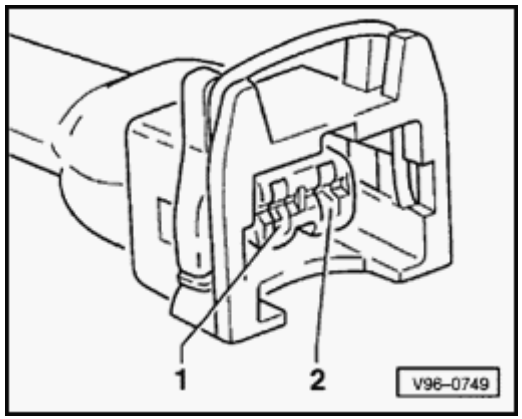
Checking voltage supply

Test requirements:

- Fuel Pump (FP) OK, checking ⇒ Page 24-49 .
- Fuse for fuel injectors OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Disconnect harness connector at the fuel injector to be tested.



- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

- Switch ignition on.
  - ♦ LED must light up.

If LED does not light up:

- Check wire connection between terminal 1 and fuse for injector valves for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

24-39

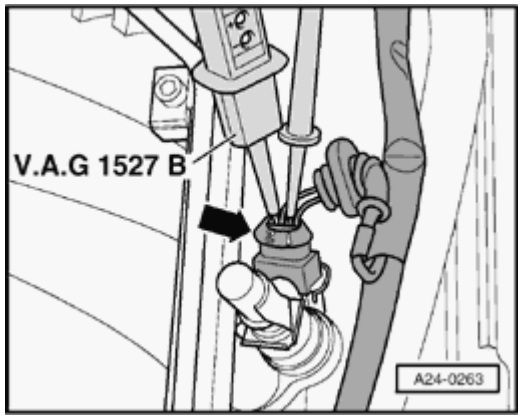
- Repair open circuit if necessary.

If LED lights up:

Checking activation

Test requirement:

- Internal resistance of valve OK

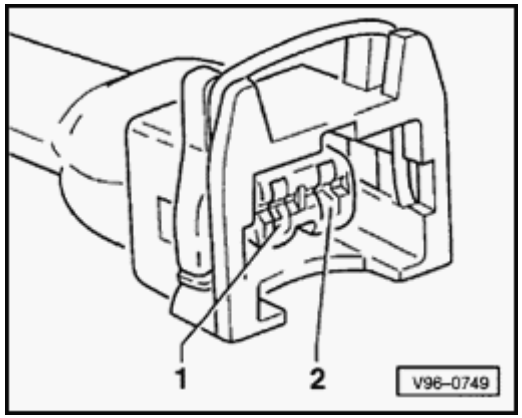


- Slide back rubber grommet of fuel injector connector (arrow), but leave connector connected.
- Connect VAG1527B voltage tester between sockets 2 (signal) and 1 (B+).
- Operate starter briefly (engine can also start).
  - ♦ LED must blink.

Note:

Voltage testers do not go out completely during low current pick-up between activations by the ECM, but rather continue to glow a little and then get slightly brighter during activation.

24-40



If LED does not blink:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

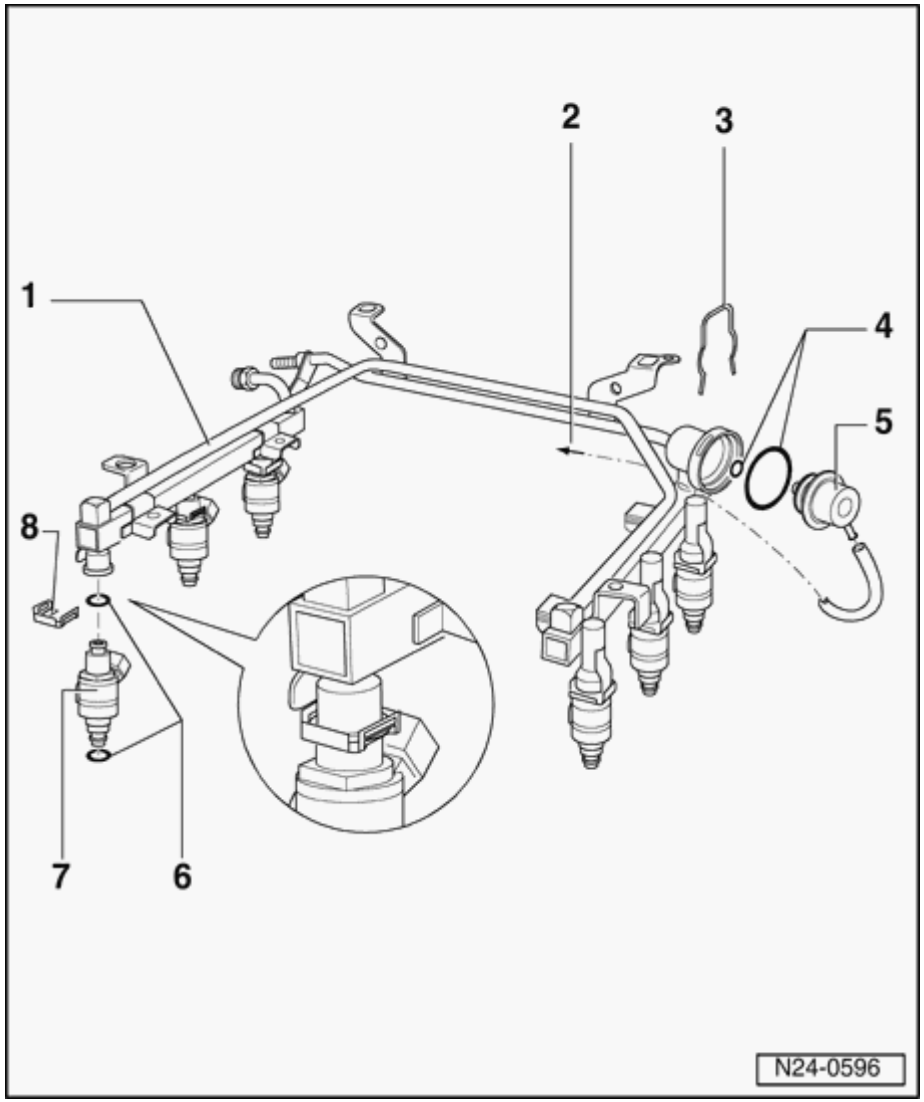
Cylinder	Fuel injector harness connector Terminal	VAG1598/31 test box Socket
1	2	96
2	2	112
3	2	88
4	2	97
5	2	113
6	2	89

- Repair open circuit or short circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

24-41



Fuel rail with fuel injectors, disassembling and assembling

1 - Fuel distributor

2 - to T-piece

3 - Retaining clip

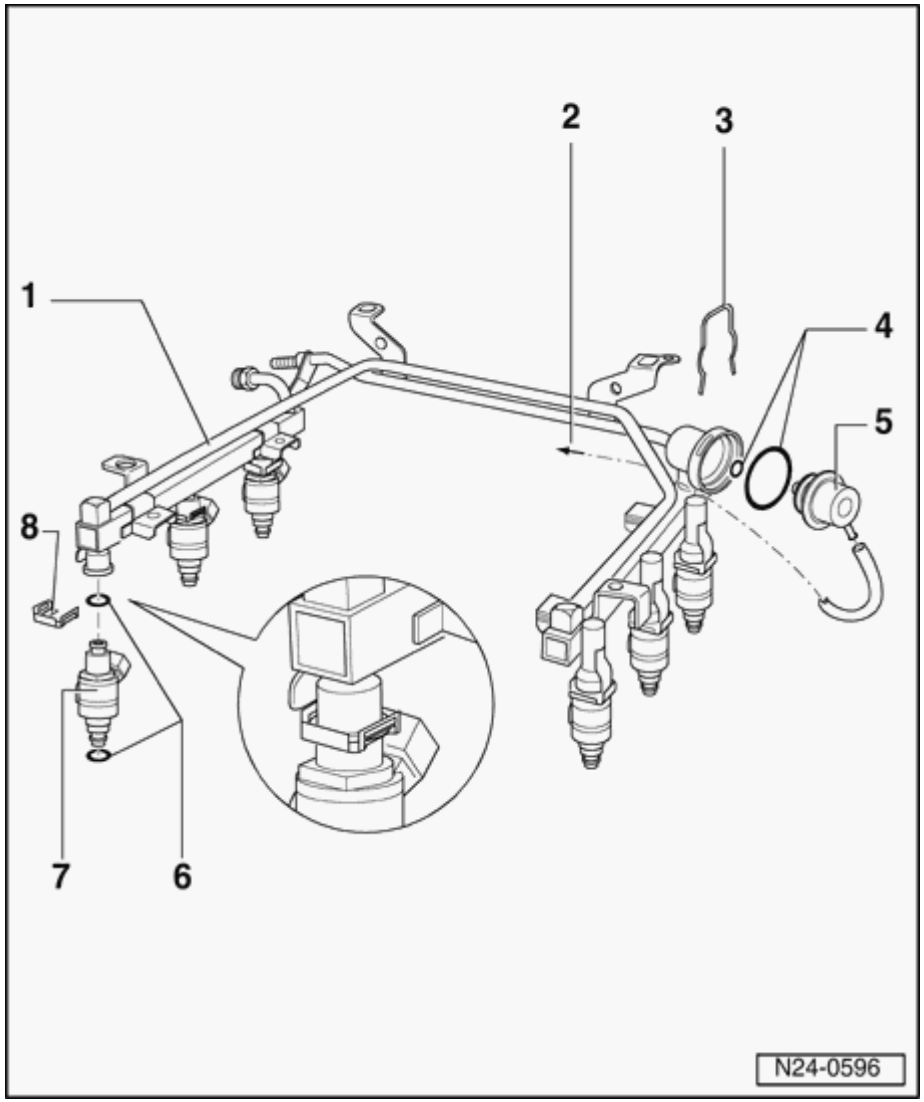
- Check for secure fitting

4 - O-ring

- Removing and installing ⇒ Page 24-43
- Always replace
- Coat with clean engine oil

5 - Fuel pressure regulator

24-42



6 - O-ring

- Removing and installing ⇒ Page 24-43
- Always replace
- Coat with clean engine oil

7 - Fuel injectors -N30- through -N33- ,Cylinder 5/6 Fuel Injector -N83-, -N84-

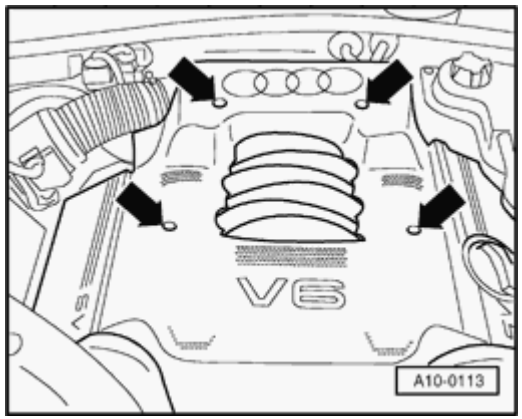
- Removing and installing ⇒ Page 24-43

8 - Retaining clip

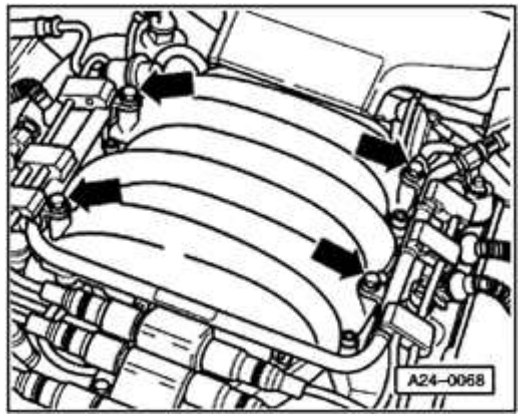
- Make sure clip is correctly seated on fuel injector and fuel rail

24-43

Fuel injectors, removing and installing



- Remove engine cover (arrows).
- Remove intake air hose between Mass Air Flow (MAF) sensor and intake air elbow.
- Remove all harness connectors to injectors.
- Disconnect vacuum hose from fuel pressure regulator.
- Expose wires at fuel distributor.



- Unscrew fuel distributor from intake manifold (arrows) .
- Remove fuel distributor with injectors from intake manifold simultaneously upward and set aside in rear of engine compartment on a clean cloth.

WARNING!

Fuel system is under pressure! Place a cloth around the connection point before opening system. Then release pressure by carefully loosening connection point.

24-44

- Disengage retaining clip and remove fuel injector.

Note:

Fuel lines must be disconnected before replacing fuel distributor.

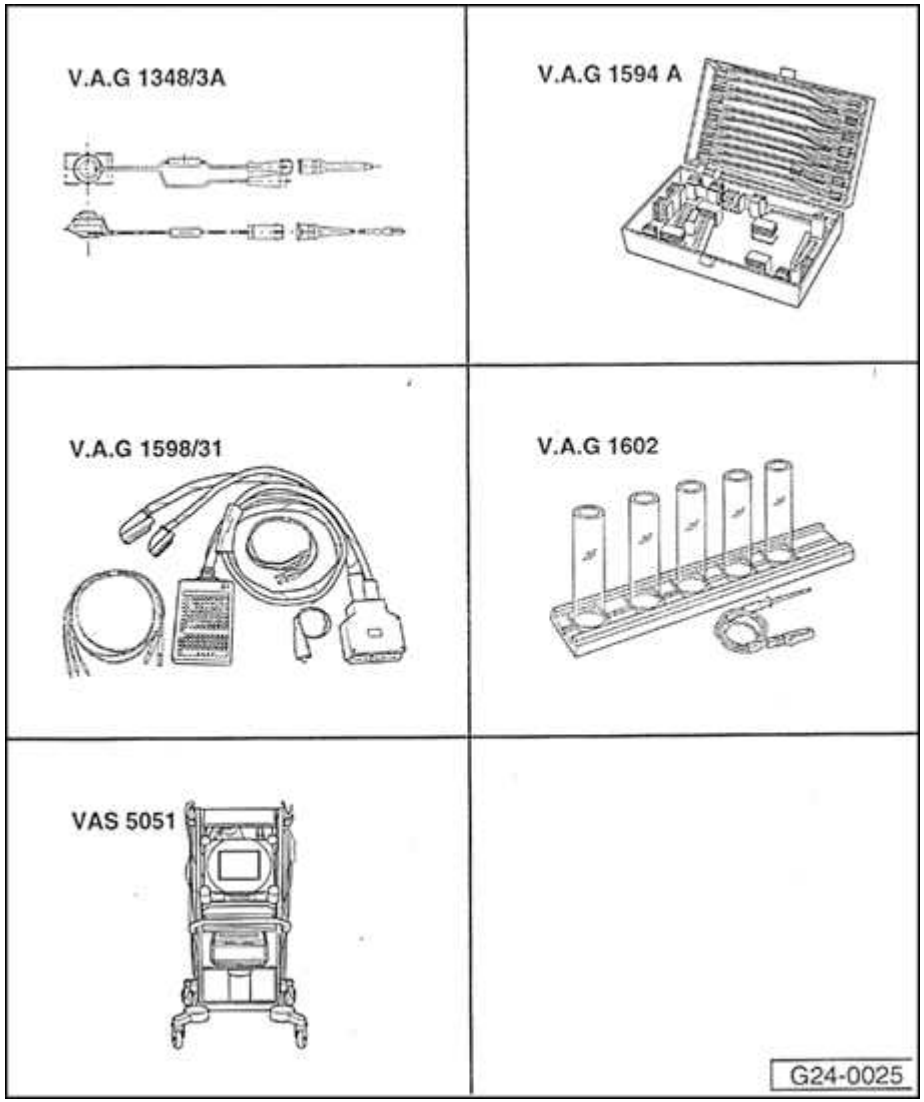
Installation is reverse of removal, noting the following:

- Remove O-rings at all opened connections. (Never remove plastic cap from valve head to replace front O-ring - pry O-ring off over plastic cap).
- Lightly lubricate O-rings with clean engine oil.
- Make sure fuel injectors are in place and seated correctly
- Check clip for unobstructed fitting.
- Place fuel rail with secured fuel injectors onto intake manifold, and apply uniform pressure to press it in.

Tightening torque

Component	Nm
Fuel distributor at intake manifold	10

24-45



Injection quantity, proper seal and spray pattern of fuel injectors, checking

Special Tools and Equipment

- VAG1348/3A with VAG1348/3-2
- VAG1594A
- VAG1598/31
- VAG1602
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

24-46

Test requirement:

- Fuel pressure OK, checking ⇒ Page 24-30 .

Test sequence

- Remove fuel distributor including fuel injectors from intake manifold ⇒ Page 24-43 . Fuel lines remain connected.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Bridge terminals 1 and 65 at test box using adapter cables from VAG1594A connector test kit (this step supplies Ground -GND- to one side of relay coil for Fuel Pump -FP- relay).

Note:

Fuel Pump (FP) relay is supplied with B+ via the central electric (terminal 30). Fuel Pump (FP) relay receives minus via the cable bridge in test box. The Fuel Pump (FP) is now running constantly.

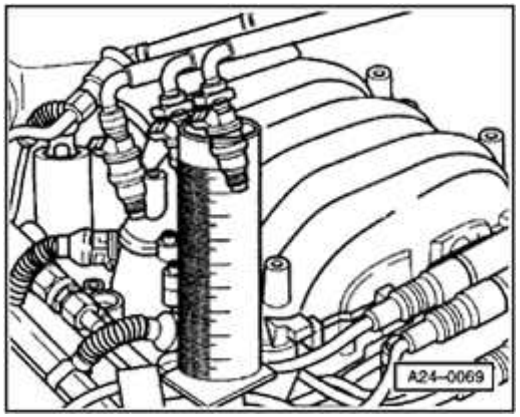
24-47

Checking Proper Seal

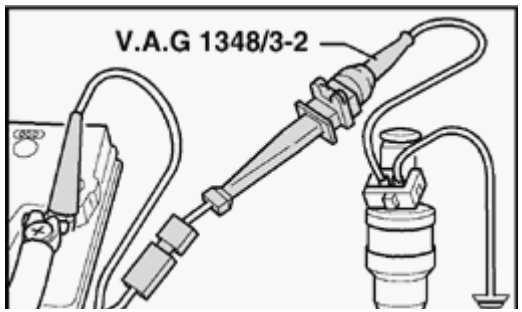
- Check proper seal of fuel injectors (visual inspection). With Fuel Pump (FP) running, only 1 to 2 drops per minute may drip out per injector.

- If fuel loss is greater, stop Fuel Pump (FP) from running (disconnect cable bridge) and replace faulty fuel injector ⇒ Page 24-43 .

Checking Injection Quantity



- Insert fuel injector to be tested in a measuring glass from VAG1602 injection quantity test device.



- Connect one terminal of fuel injector to engine Ground (GND) using an adapter cable and an alligator clip from VAG1594A connector test kit.
- Connect the second terminal of fuel injector to B+ using VAG1348/3A remote control, VAG1348/3-2 adapter cable and assisting cable.

24-48

- Bridge terminals 1 and 65 at test box using wires from VAG1594A adapter test kit.

  - Fuel Pump (FP) must run.

- Operate VAG1348/3A remote control for 30 seconds.

- After all three fuel injectors of one cylinder row have been activated, place measuring glasses on an even surface.

  - Specified value for each fuel injector: 90 to 125 ml.

- If measured value of one or more fuel injectors is outside of specified range, switch Fuel Pump (FP) off (disconnect cable bridge) and replace faulty fuel injector ⇒ Page 24-43 .

- Repeat test at fuel injectors of second cylinder row.

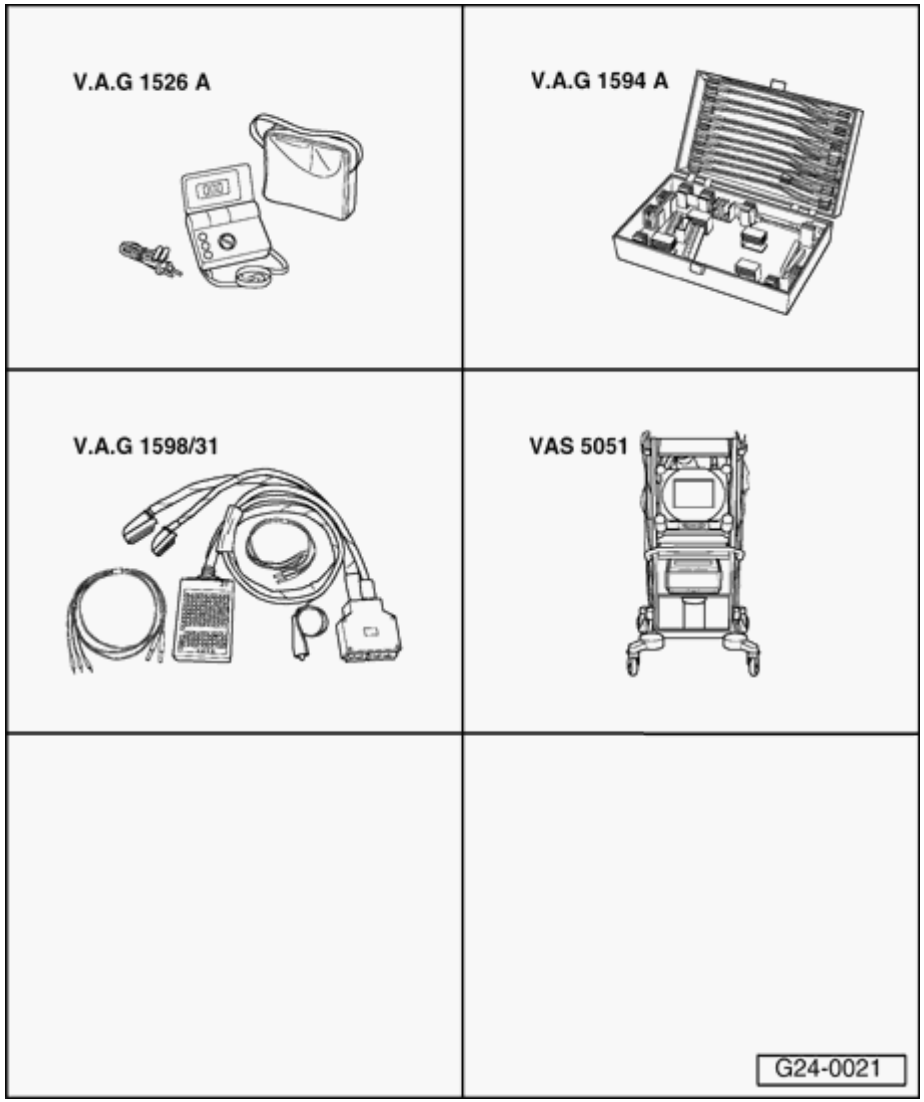
- If the measured values of all fuel injectors are outside the specified range, check fuel pressure ⇒ Page 24-30 .

Note:

Also check spray pattern when checking injection quantity. Spray pattern must be the same for all injectors

- Install fuel injectors together with fuel distributor ⇒ Page 24-44 .

24-49



Fuel Pump (FP) relay -J17- and activation, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

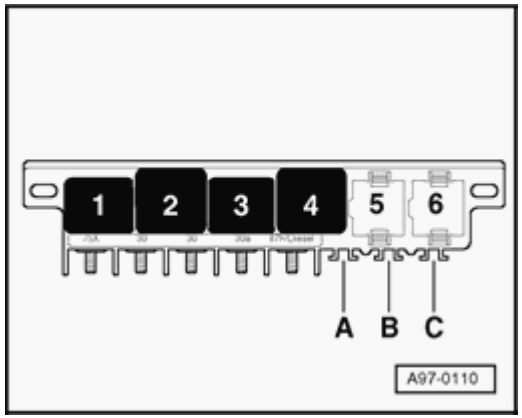
- VAG1551 with VAG1551/3B

24-50

Voltage is supplied to the Fuel Pump (FP) and several components of the injection system via the Fuel Pump (FP) relay -J17-.

Engine must be turning for Fuel Pump (FP) relay -J17- to close. This means that the relay does not receive Ground (GND) (via ECM) until the ECM recognizes RPM signals.

Note:



➢ *Fuel Pump (FP) relay is located at position 4 of central electrics in driver's footwell, left.*

Test requirement:

- Battery voltage at least 12.7 V

24-51

Function test of Fuel Pump (FP) relay

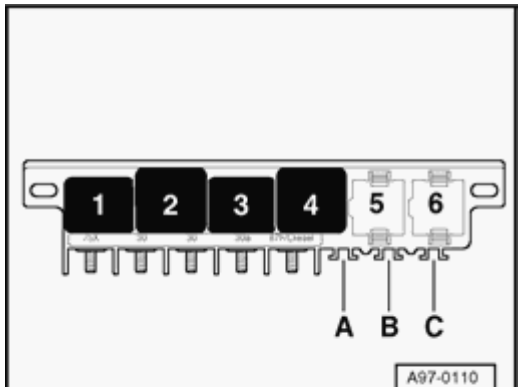
- Remove driver-side storage compartment.

⇒ *Repair Manual, Body-Interior, Repair Group 68; Instrument Panel; Removing Driver-Side Storage Compartment*

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.

- Initiate output Diagnostic Test Mode ⇒ Page 01-56 and activate Evaporative Emission (EVAP) canister purge regulator valve -N80-.



- ♦ Fuel Pump (FP) relay (at position 4 of central electrics in driver's footwell, left) must trigger and Fuel Pump (FP) must run.

A - If relay does not trigger:

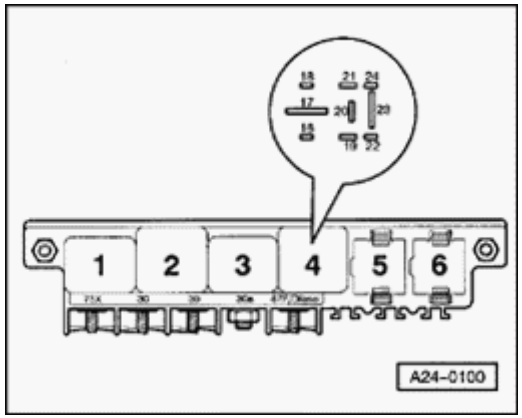
- Check voltage supply of Fuel Pump (FP) relay ⇒ Page 24-52 .
- Checking activation of Fuel Pump (FP) relay ⇒ Page 24-52 .

B - If relay triggers, but Fuel Pump (FP) does not run:

- Check voltage supply for Fuel Pump (FP) and components (via Fuel Pump -FP- relay) ⇒ Page 24-54 .

Check voltage supply of Fuel Pump (FP) relay

- Remove Fuel Pump (FP) relay.



- Connect multimeter to terminal 17 of relay socket and Ground (GND) for voltage measurement.
  - ♦ Specification: approx. battery voltage

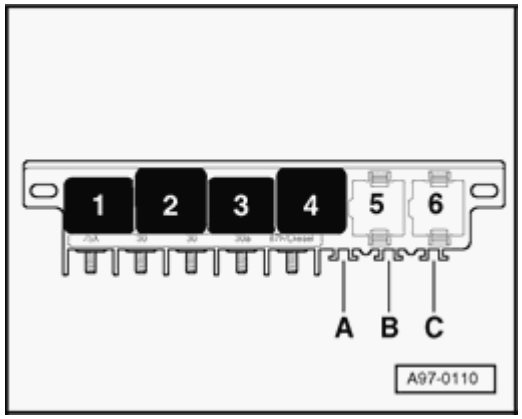
If specified value is not obtained:

- Replace central electrics.

Checking activation of Fuel Pump (FP) relay

- Switch ignition off.
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .
- Bridge terminals 1 and 65 at test box using wires from VAG1594A adapter test kit.

24-53



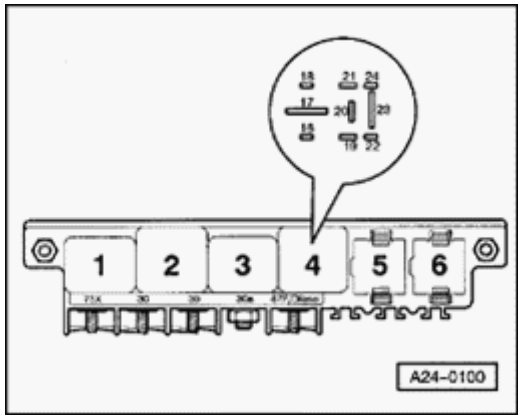
- ♦ Fuel Pump (FP) relay (at position 4 of central electrics in driver's footwell, left) must trigger.

If relay triggers now, but didn't during output DTM:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

If relay does not trigger:

- Remove cable bridge.
- Remove Fuel Pump (FP) relay.

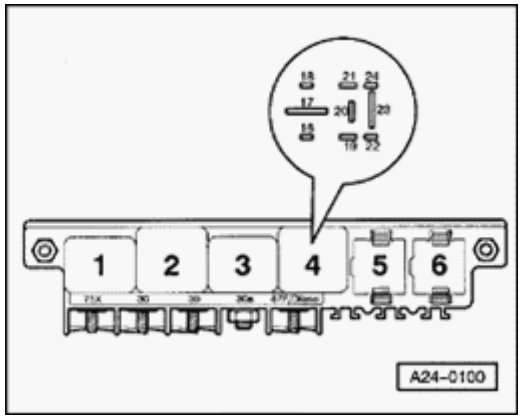


- Connect multimeter to terminal 19 of relay socket and Ground (GND) for voltage measurement.
  - ♦ Specification: approx. battery voltage

If specified value is not obtained:

- Check wire connections.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*



If specified value is obtained:

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Central electric in driver-side footwell, left, position 4 Terminal	VAG1598/31 test box Socket
16	65

- Repair open circuit or short circuit if necessary.

If no malfunctions are detected:

- Replace Fuel Pump (FP) relay -J17-.
- Re-connect Engine Control Module (ECM).

Check voltage supply for Fuel Pump (FP) and components



- Remove fuses S228, S229, and S234 (positions 28, 29, and S234) from fuse holder.
- Initiate output Diagnostic Test Mode ⇒ Page 01-56 and activate Evaporative Emission (EVAP) canister purge regulator valve -N80-.

24-55

- Connect multimeter for voltage measurement to Ground (GND) and to one terminal of the following fuses in the fuse holder.

Fuse	Specified value at one of the terminals
S228	approx. battery voltage
S229	approx. battery voltage
S234	approx. battery voltage

If specified values are not obtained:

- Repeat test at another terminal of fuse socket.

If specified values are not obtained again:

- Check wire connections.

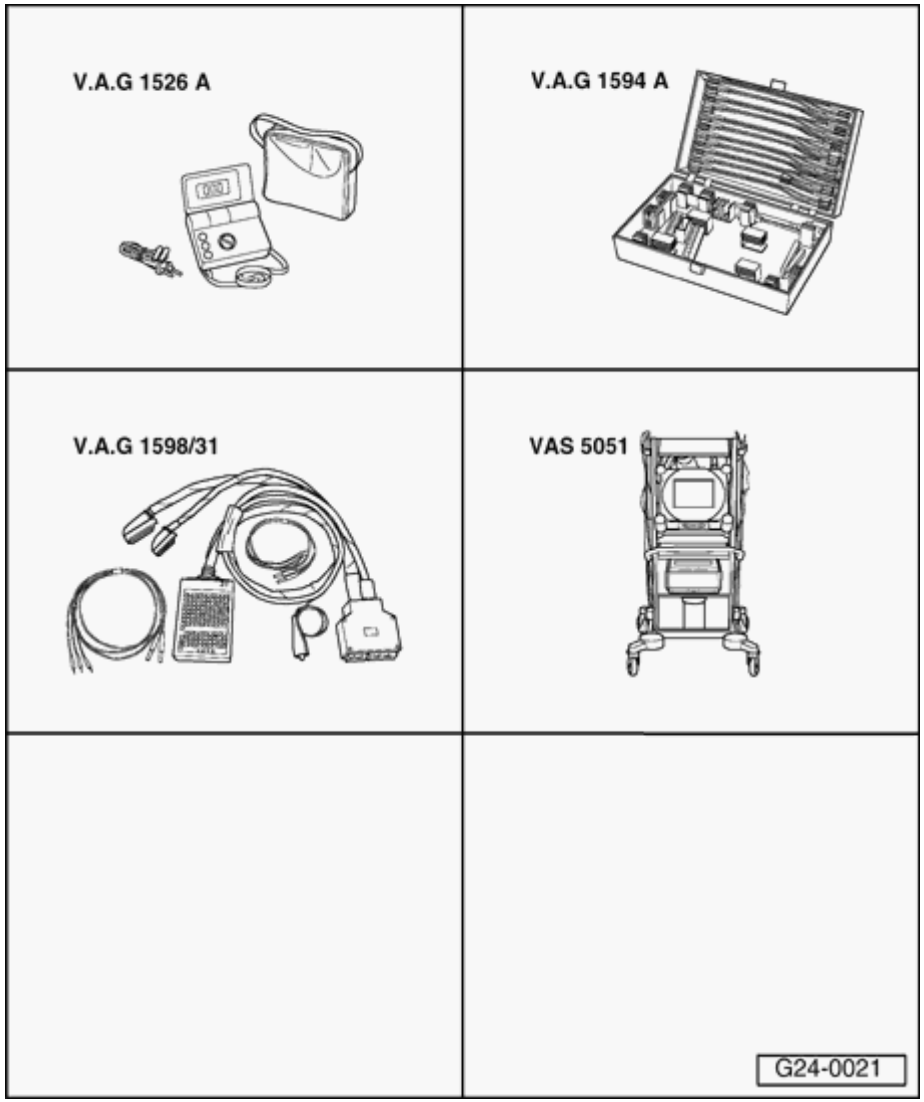
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If no malfunctions are detected:

- Replace Fuel Pump (FP) relay -J17-.

- Re-insert the fuses.

24-56



Mass Air Flow (MAF) sensor -G70-, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

24-57

Test requirements:

- Coolant Temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- Fuse for Mass Air Flow (MAF) sensor OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

Checking function

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.

Rapid data transfer	**HELP**
Select function XX	

When indicated on display:

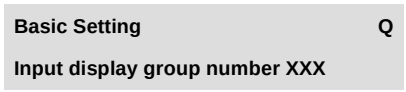
-
  Press buttons -0- and -4- to select "Initiate basic setting" and press -Q-

button to confirm input.

Note:

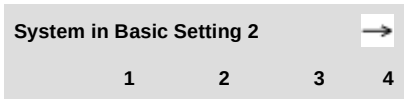
During basic setting, the Evaporative Emission (EVAP) canister purge regulator valve (EVAP valve -N80-) is closed and the A/C compressor is switched off

24-58



When indicated on display:

- Press buttons -0-, -0- and -2- to select "display group number 002" and press -Q- button to confirm input.



When indicated on display:

- Check specified values for load detection in display fields 3 and 4.

	Display fields			
	1	2	3	4
Display group 002: Air mass taken in with engine at idle and operating temperature				
Display	xxx /min	xx.x %	**x.x ms**	**xxx.x g/s**
Indicated	Engine speed (RPM)	Load	**mean injection time**	**Air mass**
Functional range	630 to 6800 RPM	12 to 100 %	**1.0 to 20.0 ms**	**1.0 to 150 g/s**
Specified value	720 to 820 RPM[1)] 630 to 730 RPM[2)]	12.0 to 26.0 %	**1.0 to 4.0 ms**	**1.0 to 5.0 g/s**
Notes	---	---	**If specified value is not obtained: Evaluation display field 3 ⇒ Page 24-59**	**If specified value is not obtained: Evaluation display field 4 ⇒ Page 24-60**

1) Front Wheel Drive Vehicles

2) All-Wheel Drive Vehicles

24-59

If specified values are obtained:

- Press →button.

Rapid data transfer HELP	
Select function XX	

Indicated on display (function selection):

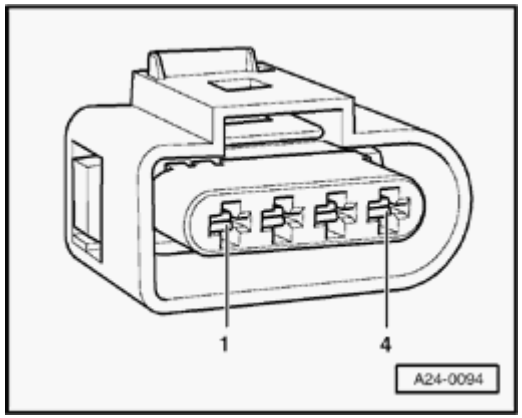
Evaluation display group 002

Display field: 3	Possible cause	Corrective action
less than 1.0 ms	♦ Smaller values are only possible when driving in deceleration mode	
larger than 4.0 ms	♦ Engine under load due to power accessories.	- Reduce load (A/C system/power steering/generator)
	♦ Poor idle (does not run on all cylinders)	- Check spark plugs. - Check fuel injectors ⇒ Page 24-36
	♦ Throttle valve control module - J338- faulty	- Check throttle valve control module ⇒ Page 24-141

Evaluation display group 002

Display field: 4	Possible cause	Corrective action
smaller than 1.0 g/s	♦ large false air mass between intake manifold and Mass Air Flow (MAF) sensor ♦ Voltage supply of Mass Air Flow (MAF) sensor or wire connections to Engine Control Module (ECM)	- Check intake system for leaks (false air) ⇒ Page 24-64 - Check voltage supply ⇒ Page 24-61
larger than 5.0 g/s	♦ Engine under load due to power accessories.	- Reduce load (A/C system/power steering/generator)
	♦ Voltage supply of Mass Air Flow (MAF) sensor or wire connections to Engine Control Module (ECM)	- Check voltage supply ⇒ Page 24-61

24-61



Voltage supply for Mass Air Flow (MAF) sensor, checking

- Disconnect connector from Mass Air Flow (MAF) sensor.

- Connect multimeter for voltage measurement as follows.

Harness connector Terminal	Measure to
3	Engine Ground (GND)

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

Note:

Voltage is supplied to Mass Air Flow (MAF) sensor from Fuel Pump (FP) relay.

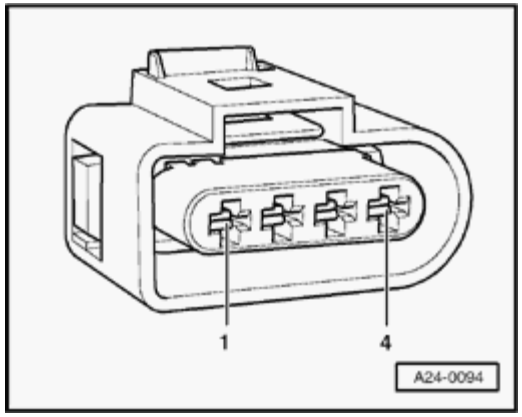
If specified value is not obtained:

- Check wire connection from terminal 3 of connector to Fuel Pump (FP) relay via fuse for open circuit and short circuit to Ground (GND):

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

24-62

- Repair open circuit or short circuit if necessary.



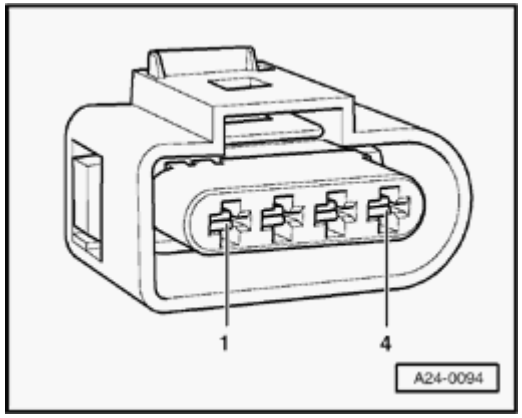
- Connect multimeter to terminal 2 and terminal 3 of connector for voltage measurement.
- Operate starter briefly.
  - Specification: approx. battery voltage

Note:

Ground (GND) from the ECM is present at terminal 2 of connector.

If specified value is not obtained:

- Check wire connections ⇒ Page 24-63 .



- Connect multimeter to terminal 1 and terminal 2 of connector for voltage measurement.
- Switch ignition on.
  - Specification: about 5 V

If specified value is not obtained:

- Check wire connections ⇒ Page 24-63 .

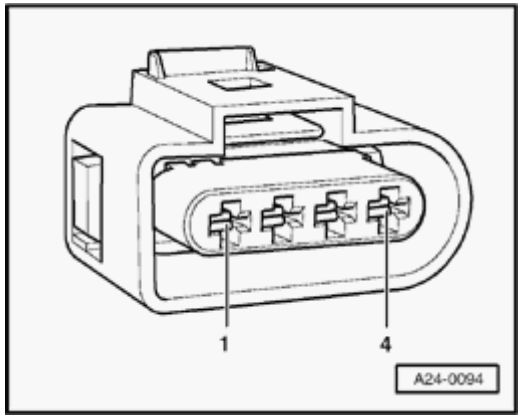
24-63

Check wire connections for Mass Air Flow (MAF) sensor

Note:

Signal wire is also checked during wire test.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
1	53
2	27
4	29

- Repair open circuit or short circuit if necessary.
- Also check all wires for short circuit to each other.

If wire connection is OK:

- Replace Mass Air Flow (MAF) sensor -G70-.

24-64

Intake air system, checking for leaks (unmetered air)

Special tools and equipment



- VAS5051 with VAG5051/1

  or

- VAG1551 with VAG1551/3B
- Engine leak detection spray G 001 800 A1

Notes:

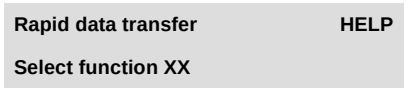
- *The negative pressure in the intake system sucks in the leak detection spray with the unmetered air. Leak detection spray decreases ignition quality and performance of the fuel mixture. This causes a reduction in engine speed and a sharp increase of CO content.*
- *It is absolutely necessary to follow the safety precautions listed on the can.*

24-65

Test sequence

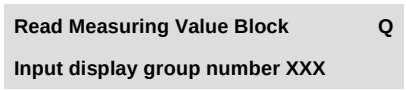
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -0- and -1- to select "display group number 001" and press -Q- button to confirm input.



Indicated on display: (1 thru 4 = display fields)

- Make note of engine speed in display field 1.
- Spray intake system parts with engine leak detection spray in a systematic manner.

24-66

If engine speed does not change:

- Press →button.

Rapid data transfer **HELP**

Select function XX

Indicated on display (function selection):

If engine speed decreases:

- Press →button.
- Press buttons -0- and -6- to select "End output" and press -Q- button to confirm input.
- Switch ignition off.
- Check sprayed part of intake system for leaks, and eliminate the error.

Intake manifold change-over

This test should only be performed if there is a performance deficiency.

The intake manifold switches from the long intake path to the short one at approx. 4700 RPM.

Intake manifold change-over function, checking

- Increase engine RPM significantly above 4700 RPM. This process should actuate the vacuum diaphragm for the intake manifold change-over. (Component location: on intake manifold front left, beneath ignition coils).

If the change-over does not occur, the following tests must be performed.

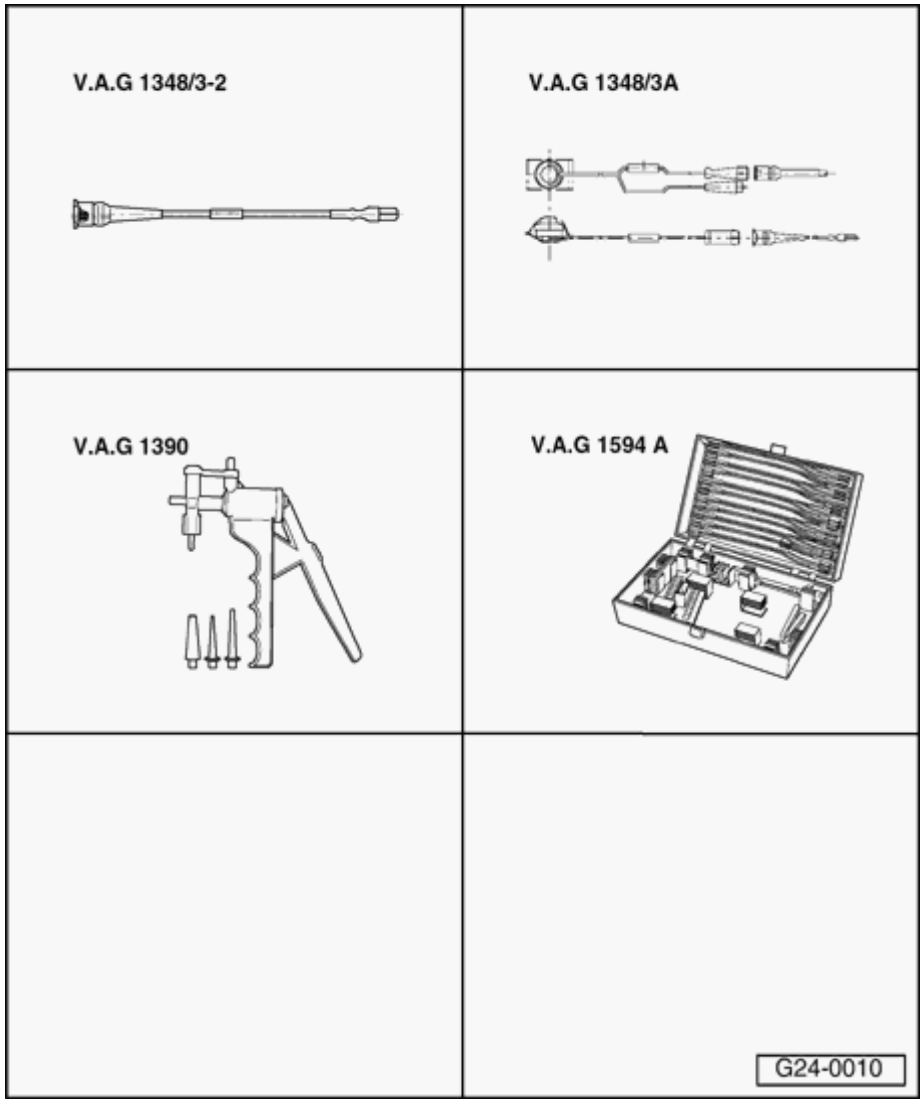
- Check Intake Manifold Change-Over Valve - N156- ⇒ Page 01-56 ,if necessary, check activation valve ⇒ Page 24-71 or page ⇒ Page 24-74).

- Check vacuum system for proper seal ⇒ Page 24-68 .

- Check vacuum lines for proper connection, sealing and continuity.

- Check whether the change-over mechanism moves easily (operate change-over linkage by hand).

24-68



Vacuum system, checking for proper seal

Special Tools and Equipment

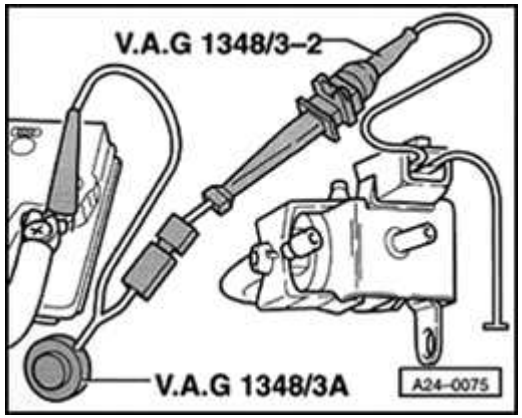
- VAG1348/3-2
- VAG1348/3A
- VAG1390
- VAG1594A

24-69

- Let vehicle run at idle for 2 to 3 minutes (vacuum build-up).

- Switch ignition off.

- Disconnect connector from Intake Manifold Change-Over Valve -N156-.



- Connect one terminal of solenoid valve to engine Ground (GND) using an adapter cable and an alligator clip from VAG1594A connector test kit.
- Connect the second terminal of solenoid valve to B+ using VAG1348/3A remote control, VAG1348/3-2 adapter cable and assisting cable.
- Operate VAG1348/3A remote control for approx. 2 to 3 minutes, vacuum diaphragm must remain activated during this time.

If the vacuum diaphragm moves back, check vacuum reservoir as follows:

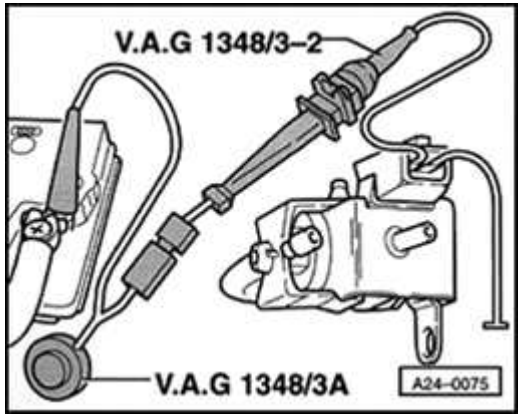
- Disconnect vacuum hoses from vacuum reservoir for intake manifold change-over.
- Connect VAG1390 hand vacuum pump to vacuum reservoir.
- Operate hand vacuum pump and observe change-over procedure.

24-70

- Check vacuum reservoir for proper seal. (Vacuum reservoir must not return to rest position, as long as the hand vacuum pump is not vented.)

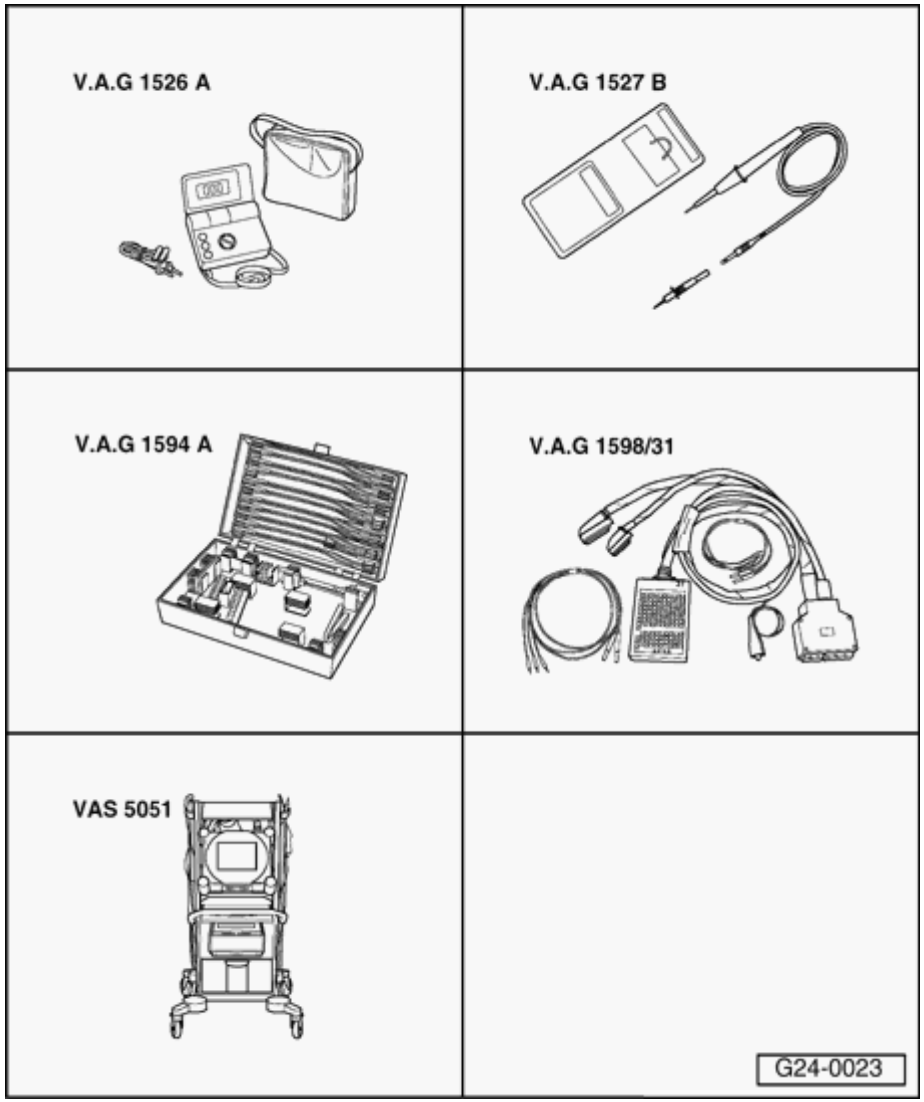
- Replace vacuum reservoir if necessary.

- If the vacuum diaphragm does not activate, check Intake Manifold Change-Over Valve - N156- for continuity as follows:



- Connect one terminal of Intake Manifold Change-Over Valve -N156- to engine Ground (GND) using an adapter cable and an alligator clip from VAG1594A connector test kit.
- Connect the second terminal of Intake Manifold Change-Over Valve - N156- to B+ using VAG1348/3A remote control, VAG1348/3-2 adapter cable and assisting cable.
- Operate VAG1348/3A remote control.
- Check valve for throughput (disconnect vacuum hose and blow through).
- If necessary, replace intake manifold change-over valve.
- Check vacuum system for leaks if no malfunctions were detected for all previous tests.

24-71



Intake manifold change-over valve -N156-, checking

Special Tools and Equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

Component location ⇒ Overview of component locations, page ⇒ Page 24-5

Test requirement:

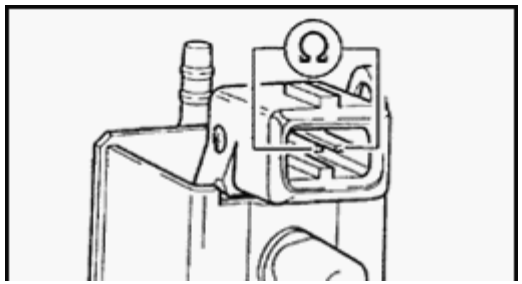
- Output Diagnostic Test Mode (DTM) performed
- Fuse for intake manifold change-over valve is OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

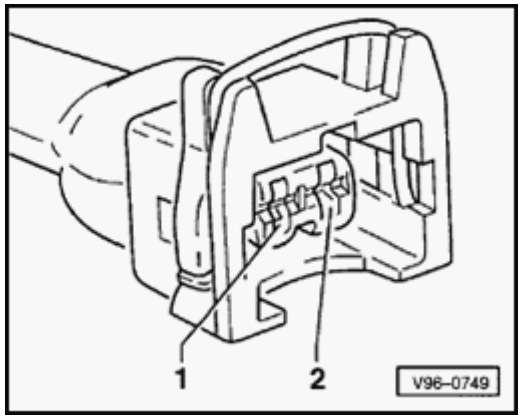
- Fuel Pump (FP) OK, checking ⇒ Page 24-49 .

Checking internal resistance

- Disconnect connector from Intake Manifold Change-Over Valve -N156-.



- Connect multimeter at valve for resistance measurement.
  - ♦ Specification: 25 to 35 Ω
- Replace Intake Manifold Change-Over Valve -N156- if specified value is not obtained.



Checking voltage supply

- Disconnect connector from Intake Manifold Change-Over Valve -N156-.

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

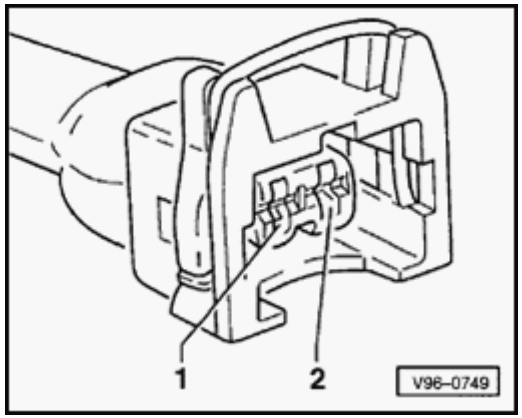
- Operate starter briefly.
  - ♦ LED must light up.

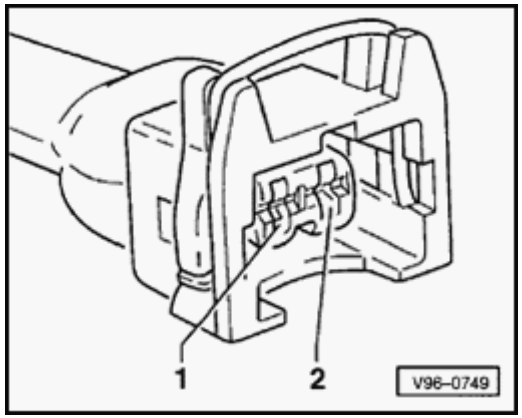
If LED does not light up:

- Check wire connection from terminal 1 to Fuel Pump (FP) relay via fuse for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

24-74





Checking activation

- Connect VAG1527B voltage tester between terminals 1 and 2
- Initiate output Diagnostic Test Mode ⇒ Page 01-56 and activate the intake manifold change-over valve.
  - ♦ LED must blink.

If LED does not blink or if it remains constantly lit:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
2	104

- Repair open circuit or short circuit if necessary.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If wire connection is OK:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

Oxygen sensor control, checking

Oxygen sensor control, function

Notes:

The oxygen sensors compare the oxygen content of the air with residual oxygen content in exhaust and deliver a voltage signal to the control module.

The voltage signal "mixture rich (too little residual oxygen)" is approx. 0.7 to 1.0 V.

The voltage signal "mixture lean (a lot of residual oxygen)" is approx. +0.0 to 0.3 V.

At the transition from "rich" to "lean" and vice-versa (λ = 1.0) voltage will jump from 0.7 to 1.0 V to 0.0 to +0.3 V (or viceversa).

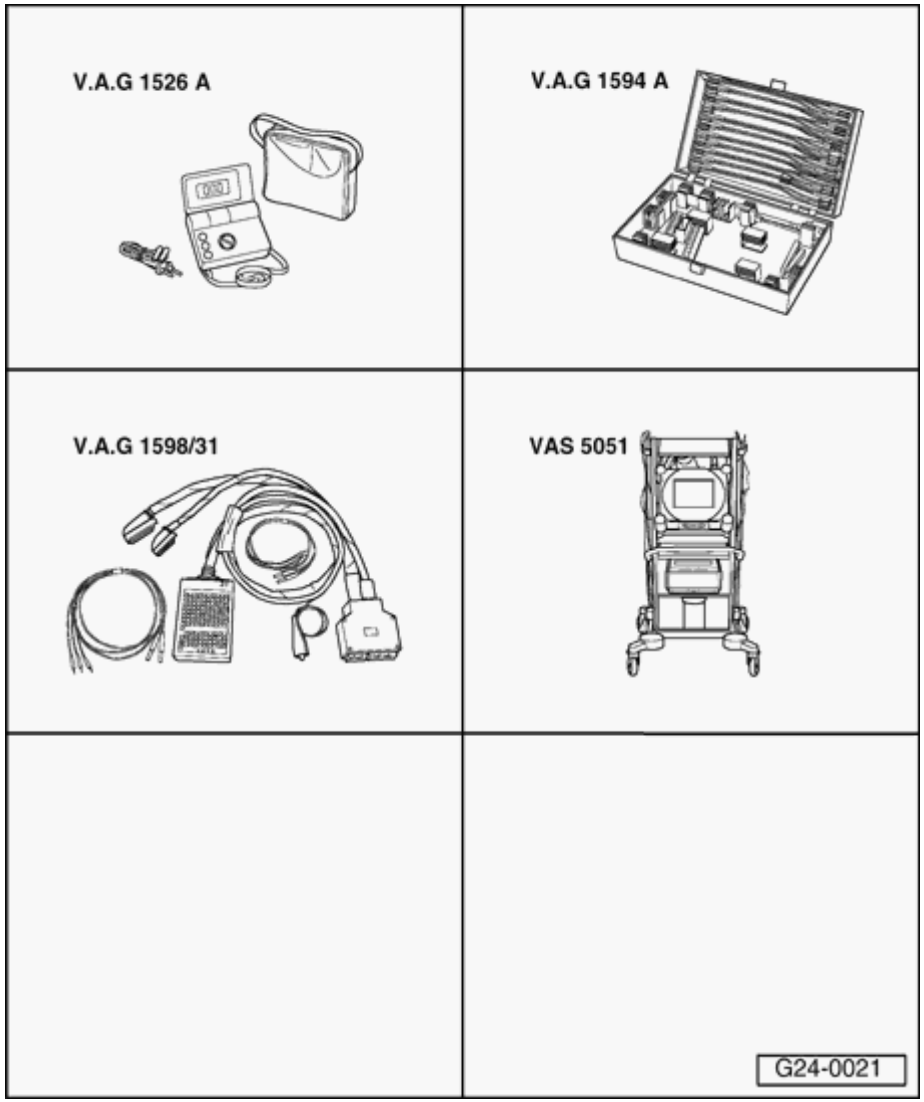
Due to the steep voltage jump, oxygen sensor control cannot maintain the ideal mixture of λ = 1.0 as constant. Oxygen sensor control constantly fluctuates back and forth between the conditions "slightly too lean" and "slightly too rich".

24-77

If voltage change does not occur or occurs only slowly, the following malfunctions could be present:

- *Slits or holes in sensor head clogged.*
- *Sensors suffered thermal overload.*
- *Transition resistance in signal wire or Ground (GND) wire.*
- *Sensor too cold, sensor heating not functioning.*
- *Sensor damaged by contact spray or similar substance (contact spray is drawn through the fine hollow interiors by thermal fluctuations and capillary action into the electrical wiring in sensor).*
- *Sensor damaged by silicon vapors (the use of sealants containing silicon leads to trace elements of silicon being taken in by the engine. These silicon elements are not combusted and damage the oxygen sensor).*

24-78



Oxygen sensors and oxygen sensor control before catalytic converter, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

24-79

Notes:

- *For the defined troubleshooting procedure, it is possible, to switch oxygen sensor control off by selecting display group 099 under "basic setting" and switch it on again under "read measuring value block".*
- *After selecting display group 099 (either in "basic setting" or "read measuring value block"), it is possible to switch back and forth between "basic setting" (function 04) and "read measuring value block" (function 08) by pressing buttons 4 or 8 on the VAG1551.*
- *Once function 04 "basic setting" is exited, oxygen sensor control is automatically switched on again.*

Test requirements:

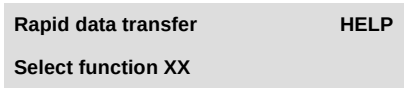
- Road test performed and DTC memory erased.
- Coolant temperature at least 80 °C ⇒ Display group 4, display field 3

24-80

Function test

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.

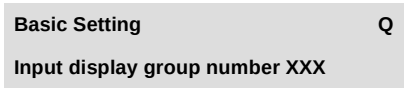


When indicated on display:

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.

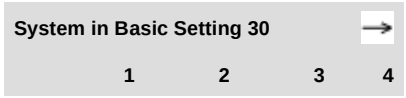
Note:

During basic setting, the Evaporative Emission (EVAP) canister purge regulator valve (EVAP valve -N80-) is closed and the A/C compressor is switched off



When indicated on display:

- Press buttons -0-, -3- and -0- to select "display group number 030" and press -Q- button to confirm input.



When indicated on display:

- Check oxygen sensor status in display fields 1 and 3.

Note:

"Oxygen sensor status" indicates status of oxygen sensor control and oxygen sensors.

24-81

	Display fields			
	1	2	3	4
Display group 030: Oxygen sensor status with engine at idle				
Display	**X X X**	X X X	**X X X**	X X X
Indicated	**Oxygen sensor status, bank 1, sensor 1**	Oxygen sensor status, bank 2, sensor 1	**Oxygen sensor status, bank 2, sensor 1**	Oxygen sensor status, bank 2, sensor 2
Functional range	**0 = off** **1 = on**	0 = off 1 = on	**0 = off** **1 = on**	0 = off 1 = on
Specified value	**1 1 1**	1 1 0	**1 1 1**	1 1 0
Notes	**Meaning of display ⇒ Page 01-90** **If specified value is not obtained ⇒ Page 24-89** **If specified value is obtained but there is a malfunction stored in DTC memory ⇒Check oxygen sensor adaptation values and control, page ⇒ Page 24-83**			

24-82

Significance of 3 digit indication of display group 030

X	X	X	**Display fields 1 to 4**
		X	Oxygen sensor control 0= not active 1 = active
	X		Operational readiness of oxygen sensor 0= not active 1 = active
X			Condition of oxygen sensor heating 0= not active 1 = active

Notes:

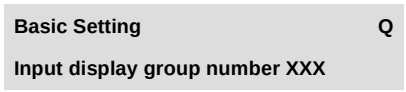
- *The oxygen sensor control of the oxygen sensors behind catalytic converter (B1-S2 and B2-S2) are not active at certain operation points without engine load, that means that the third position of the oxygen sensor controls behind catalytic converter can fluctuate between 0 and 1.*

- *The first position of the 3 digit indication (heating) fluctuates between 0 and 1 at certain operation points.*

24-83

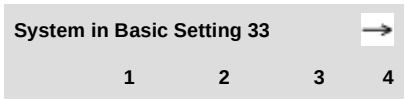
Checking oxygen sensor adaptation values and control

- Press -C- button.



When indicated on display:

- Press buttons -0-, -3- and -3- to select "display group number 033" and press -Q- button to confirm input.



When indicated on display:

- Check oxygen sensor control in display fields 1 and 3.

24-84

	1	2	3	4
Display group 033: Oxygen sensor control before catalytic converter				
Display	**xx.x %**	x.xxx volts	**xx.x %**	x.xxx V
Indicated	**Oxygen sensor control Bank1**	Oxygen sensor voltage bank 1	**Oxygen sensor control Bank2**	Oxygen sensor voltage bank 2
Functional range	**-25.0 to 25.0 %**	0.100 to 1.000 V	**-25.0 to 25.0 %**	0.100 to 1.000 V
Specified value	**Value must fluctuate by at least 2 % in the range 10.0 to 10.0 %**	Value must fluctuate approx. 0.3 V in the range 0.100 to 1.000 volts	**Value must fluctuate by at least 2 % in the range 10.0 to 10.0 %**	Value must fluctuate approx. 0.3 V in the range 0.100 to 1.000 volts
Notes	**If specified value is not obtained ⇒ Page 24-85**		**If specified value is not obtained ⇒ Page 24-85**	

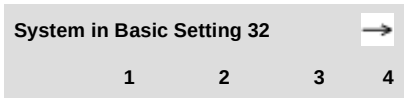
Evaluation display group 033

Display field: 1 / 3	Possible cause	Corrective action
Values in range: -10.0 to -25.0 % or Values in range: 10.0 to 25.0 % or Value does not fluctuate by at least 2 %	♦ Oxygen sensor heating faulty	- Check oxygen sensor heating ⇒ Page 24-116
	♦ Open circuit in wires between oxygen sensor and control module	- Check primary voltage ⇒ Page 24-89
	♦ Short circuit to Ground (GND) or B+ between oxygen sensor and control module	- Check oxygen sensor wires bank 1 ⇒ Page 24-90 - Check oxygen sensor wires bank 2 ⇒ Page 24-91
	♦ False air in intake area	- Check intake system for leaks and repair false air ⇒ Page 24-64
	♦ Fuel pressure too low or too high	- Check fuel pressure regulator ⇒ Page 24-30
	♦ Fuel return line is kinked or clogged	- Check fuel return line.

24-86

- Press -C- button.

- Press buttons -0-, -3- and -2- to select "display group number 032" and press -Q- button to confirm input.



When indicated on display:

- Check oxygen sensor control in display fields 1 to 4:

	Display fields			
	1	2	3	4
Display group 032: Oxygen sensor adaptation values before catalytic converter				
Display	**xx.x %**	**xx.x %**	**xx.x %**	**xx.x %**
Indicated	**Oxygen sensor adaptation value Bank 1 at idle (additive)**	**Oxygen sensor adaptation value bank 1 at partial throttle (multiple)**	**Oxygen sensor adaptation value Bank 2 at idle (additive)**	Oxygen sensor adaptation value bank 2 at partial throttle (multiple)
Functional range	**-25.0 to 25.0 %**	**-25.0 to 25.0 %**	**-25.0 to 25.0 %**	**-25.0 to 25.0 %**
Specified value	**-10.0 to 10.0 %** **can fluctuate slightly**	**-10.0 to 10.0 %** **can fluctuate slightly**	**-10.0 to 10.0 %** **can fluctuate slightly**	**-10.0 to 10.0 %** **can fluctuate slightly**
Notes	**If specified value is not obtained ⇒ Page 24-87**			

Evaluation display group 032

Display field: 1 / 3 or 2 / 4	Possible cause	Corrective action
Oxygen sensor adaptation value in range: -10.0 to .-25.0 %	♦ Oil thinning	- Oil change or perform swift country road test
	♦ High oil consumption	
	♦ Mass Air Flow (MAF) sensor faulty	- Mass Air Flow (MAF) sensor, checking ⇒ Page 24-56
	♦ Evaporative Emission (EVAP) canister purge regulator valve remains stuck in open position	- Check Evaporative Emission (EVAP) Canister Purge Regulator Valve ⇒ Page 24-128
	♦ Fuel pressure too high	- Check fuel pressure regulator ⇒ Page 24-30
	♦ Fuel return line is kinked or clogged.	- Check fuel return line.
	♦ Fuel injector does not close	- Check fuel injectors ⇒ Page 24-36

24-88

Evaluation display group 032

Display field: 1 / 3 or 2 / 4	Possible cause	Corrective action
Oxygen sensor adaptation value in range: 10.0 to 25.0 %	♦ False air in intake area	- Check intake system for leaks and repair false air. ⇒ Page 24-64 .
	♦ Fuel pressure too low	- Check fuel pressure regulator ⇒ Page 24-30
	♦ Mass Air Flow (MAF) sensor faulty	- Mass Air Flow (MAF) sensor, checking ⇒ Page 24-56
	♦ Oxygen sensor heating faulty ♦ Oxygen sensor faulty	- Check oxygen sensor heating ⇒ Page 24-116
	♦ Fuel injector does not open or opens only partially	- Check fuel injectors ⇒ Page 24-36
	♦ Evaporative Emission (EVAP) Canister Purge Regulator Valve sticks	- Check Evaporative Emission (EVAP) Canister Purge Regulator Valve ⇒ Page 24-128
	♦ Ignition coil or spark plug faulty	- Check ignition coils ⇒ Page 28-7

24-89

Checking primary voltage

Component location of harness connectors ⇒ Overview of component locations, page ⇒ Page 24-5

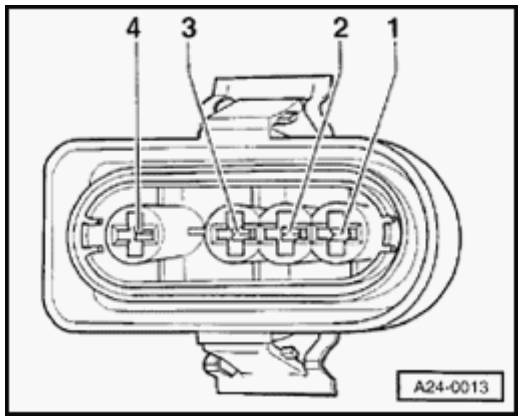
Note:

Coolant reservoir screws must be removed and coolant reservoir must be placed to side in order to access this harness connector. The coolant hoses can remain connected.

Test requirement:

- Fuse for oxygen sensor are OK

- Disconnect 4-pin harness connector leading to respective oxygen sensor.



- Connect multimeter between terminal 3 and 4 for voltage measurement.
- Switch ignition on.
  - Specification: 0.400 to 0.500 V
- Switch ignition off.

If specified value is not obtained:

- Check oxygen sensor wires ⇒ Bank 1, page ⇒ Page 24-90 or ⇒ Bank

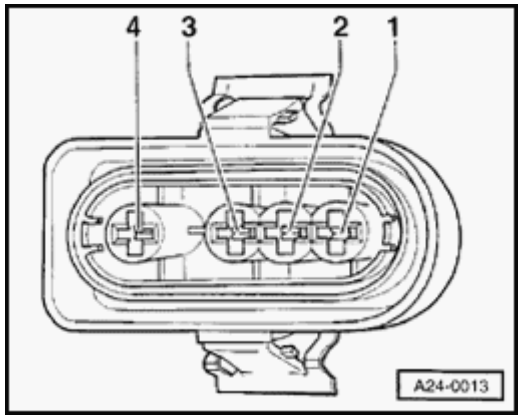
2, page ⇒ Page 24-91 .

Check oxygen sensor wires bank 1 for Heated Oxygen Sensor (HO2S) 2 -G39-.

Component location of harness connectors ⇒ Overview of component locations, page ⇒ Page 24-5

- Disconnect black 4-pin harness connector to bank 1 Heated Oxygen Sensor (HO2S) -G39-.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connections for open circuit.

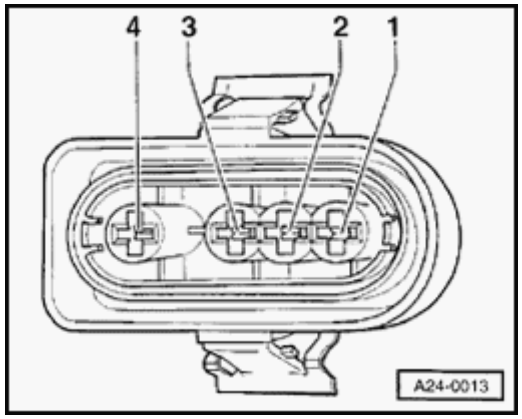
Harness connector Terminal	VAG1598/31 test box Socket
3	51
4	70

- Repair open circuit if necessary.

- Check wires to each other for short circuit.

Harness connector Terminal	VAG1598/31 test box Socket
4	51

24-91



- Check shielded wire for short circuit to sensor wires.

Harness connector Terminal	VAG1598/31 test box Socket
3	32
4	32

If no malfunctions are found in wires:

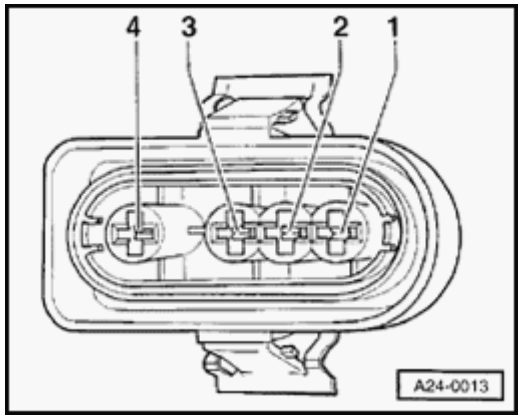
- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

Check oxygen sensor wires bank 2 for Heated Oxygen Sensor (HO2S) 2 -G108-.

Component location of harness connectors ⇒ Overview of component locations, page ⇒ Page 24-5

- Disconnect black 4-pin harness connector to bank 2 Heated Oxygen Sensor (HO2S) 2 -G108-.
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

24-92



- Check the following wire connections for open circuit.

Harness connector Terminal	VAG1598/31 test box Socket
3	12
4	13

- Repair open circuit if necessary.
- Check wires to each other for short circuit.

Harness connector Terminal	VAG1598/31 test box Socket
4	12

- Check shielded wire for short circuit to sensor wires.

Harness connector Terminal	VAG1598/31 test box Socket
3	32
4	32

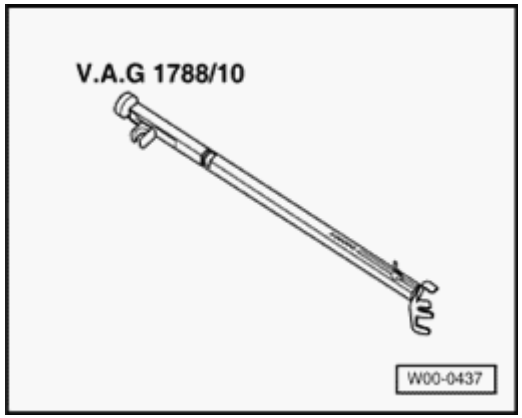
If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

24-93

Oxygen sensor aging (oxygen sensor before catalytic converter), checking

Special Tools and Equipment



- VAG1788/10 RPM adjuster



- VAS5051 with VAG5051/1

  or

- VAG1551 with VAG1551/3B

Test requirement:

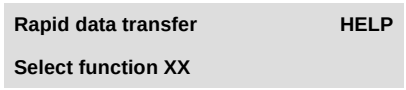
- Coolant temperature at least 80 °C ⇒ Display group 4, display field 3

24-94

Test sequence

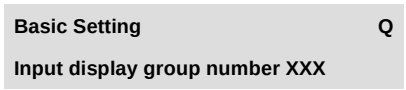
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.



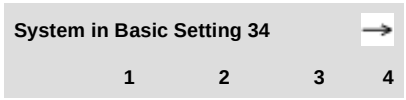
When indicated on display:

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -3- and -4- to select "display group number 034" and press -Q- button to confirm input.



When indicated on display:

- Use VAG1788/10 RPM adjuster to adjust engine speed to between 1000 and 2400 RPM.
- Check specified value in display field 4 after indication "Test ON" appears:

Note:

This process can take a few minutes.

24-95

	Display fields			
	1	2	3	4
Display group 034: Oxygen sensor aging diagnostic, oxygen sensor before catalytic converter (bank 1)				
Display	xxxx/min	xxx °C	**x.x s**	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	**Period duration Oxygen sensor before Catalytic converter**	Diagnostic condition
Functional range	630 to 6800	70 to 850 °C	**0 to 3.0 s**	**Test OFF** **Test ON** **B1-S2 OK** **B1-S2 not OK**
Specified value	1000 to 2400 RPM	above 380 °C	**0.1 to 1.8 s**	B1-S2 OK
Notes			**If the specified value is not reached, replace oxygen sensor 1 before catalytic converter (bank 1)**	

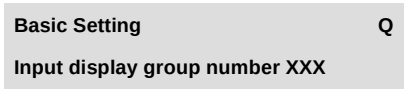
Note for display field 2:

Calculated value from engine speed and engine load.

Note for display fields 3 and 4:

Period duration is the time between two oxygen sensor voltage jumps (e.g. rich - lean - rich) and is therefore a measurement of the aging condition of the oxygen sensor. If the specified time is exceeded, display field 4 will indicate = B1-S1 not OK.

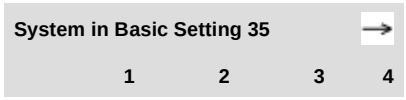
- Press -C- button.



When indicated on display:

24-96

- Press buttons -0-, -3- and -5- to select "display group number 035" and press -Q- button to confirm input.



➢ When indicated on display:

- Check specified value in display field 4.

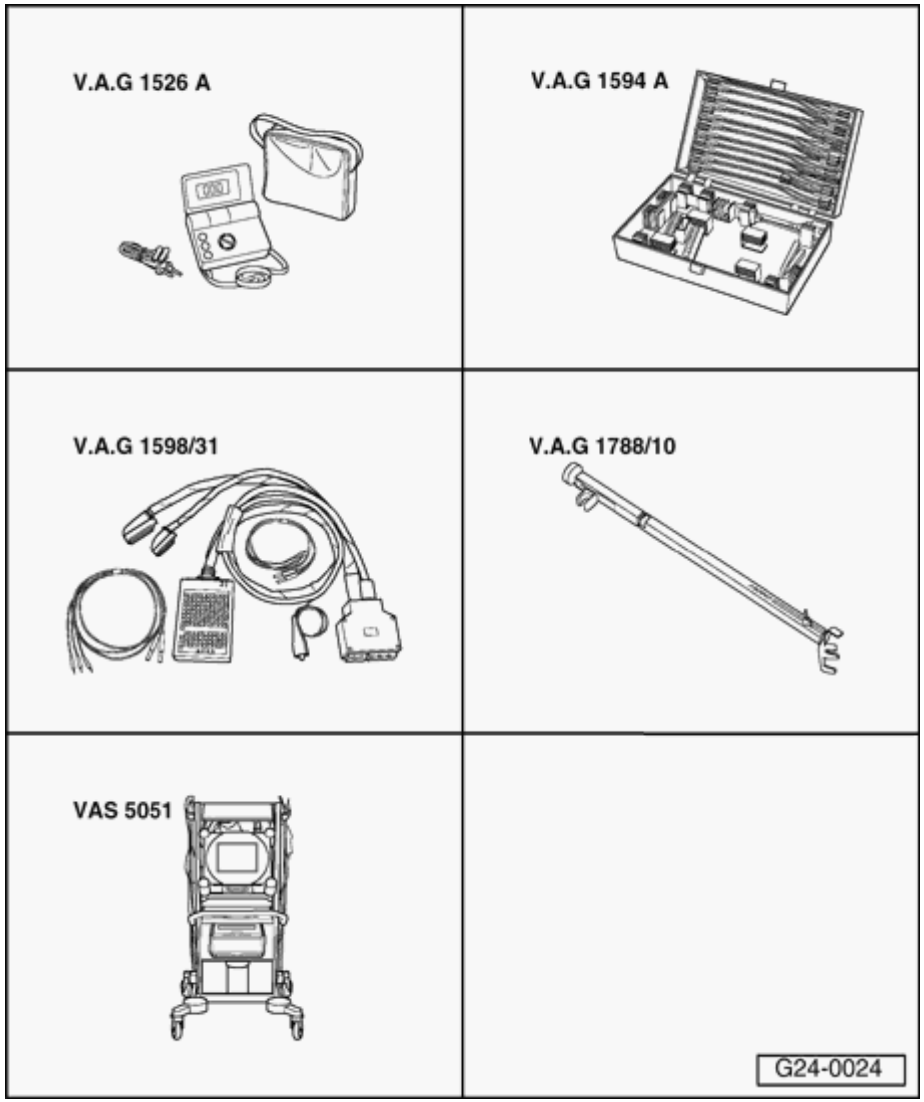
Note:

The test in display group 035 is activated simultaneously with the test in display group 034 Therefore the test result is indicated immediately after display group 035 is selected.

	Display fields			
	1	2	3	4
Display group 035: Oxygen sensor aging diagnostic, oxygen sensor before catalytic converter (bank 2)				
Display	xxxx/min	xxx °C	**x.x s**	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	**Period duration Oxygen sensor before Catalytic converter**	Diagnostic condition
Functional range	630 to 6800	70 to 850 °C	**0 to 3.0 s**	**B1-S2 OK** **B1-S2 not OK**
Specified value	1000 to 2400 RPM	above 380 °C	**0.1 to 1.8 s**	B1-S2 OK
Notes			**If the specified value is not reached, replace oxygen sensor 2**	

			before catalytic converter (bank 1)

24-97



Oxygen sensor and oxygen sensor control behind catalytic converter, checking

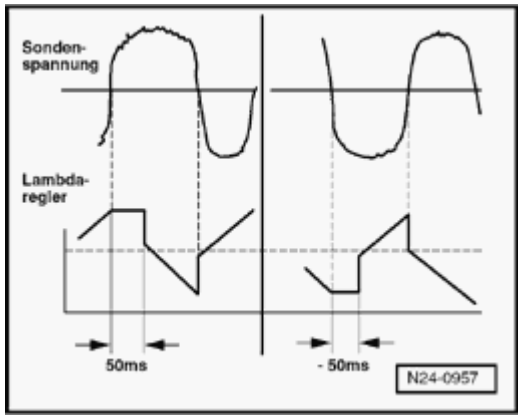
Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAG1788/10 RPM adjuster
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

24-98



Notes:

- *The oxygen sensor control behind catalytic converter overrules the oxygen sensor control before catalytic converter. It serves as a corrective control.*

- *It corrects slight changes in the mixture (i.e. enrichment) via the oxygen sensor before catalytic converter by holding oxygen sensor control before catalytic converter at its higher or lower point for a specific time (dwell time). If this time is in the positive range (i.e. 50 ms), mixture is shifted in the -enrich- direction. If it is in the negative range (i.e.--50 ms), mixture is shifted in the -lean- direction.*

Test requirements:

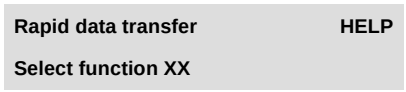
- Road test performed and DTC memory erased.
- Coolant temperature at least 80 ° C ⇒ Display group 4, display field 3

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.

24-99

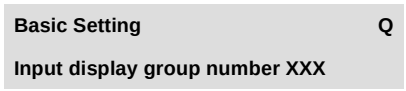


When indicated on display:

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.

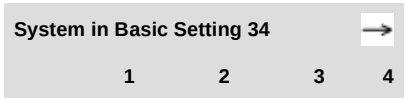
Note:

During basic setting, the Evaporative Emission (EVAP) canister purge regulator valve (EVAP valve -N80-) is closed and the A/C compressor is switched off



When indicated on display:

- Press buttons -0-, -3- and -4- to select "display group number 034" and press -Q- button to confirm input.



When indicated on display:

- Use VAG1788/10 RPM adjuster to adjust engine speed to between 2800 and 3200 RPM.
- Continue test as soon as display field 2 indicates an exhaust temperature of more than 380 ° C

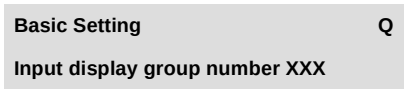
Note:

This process can take a few minutes.

24-100

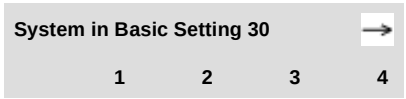
- Press -C- button.

- Let engine continue to idle



When indicated on display:

- Press buttons -0-, -3- and -0- to select "display group number 030" and press -Q- button to confirm input.



When indicated on display:

- Check oxygen sensor status for oxygen sensor behind catalytic converter in display fields 2 and 4.

Note:

"Oxygen sensor status" indicates status of oxygen sensor control and oxygen sensors.

24-101

	Display fields			
	1	2	3	4
Display group 030: Oxygen sensor status with engine at idle				
Display	X X X	**X X X**	X X X	**X X X**
Indicated	Oxygen sensor status, bank 1, sensor 1	**Oxygen sensor status Bank 2, sensor 1**	Oxygen sensor status, bank 2, sensor 1	**Oxygen sensor status Bank 2, sensor 2**
Functional range	0 = off 1 = on	**0 = off** **1 = on**	0 = off 1 = on	**0 = off** **1 = on**
Specified value	1 1 1	**1 1 0**	1 1 1	**1 1 0**
Notes	**Meaning of display ⇒ Page 24-102** **If specified value is not obtained ⇒ Page 24-111** **If specified value is obtained but there is a malfunction stored in DTC memory ⇒Check oxygen sensor control, page ⇒ Page 24-105**			

Notes:

- *Oxygen sensor control of oxygen sensor behind catalytic converter (bank 1 sensor 2 and bank 2 sensor 2) are not active without engine load, meaning that the display is 0.*

- *The first position of the 3 digit indication (heating) fluctuates between 0 and 1.*

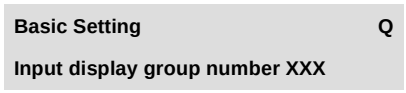
- *The third position of the 3 digit indication (oxygen sensor control) fluctuates between 0 and 1.*

24-102

Significance of 3 digit indication of display group 030

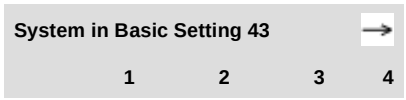
X	X	X	**Display fields 1 to 4**
		X	Oxygen sensor control 0= not active 1 = active
	X		Operational readiness of oxygen sensor 0= not active 1 = active
X			Condition of oxygen sensor heating 0= not active 1 = active

- Press -C- button.



When indicated on display:

- Press buttons -0-, -4- and -3- to select "display group number 043" and press -Q- button to confirm input.



When indicated on display:

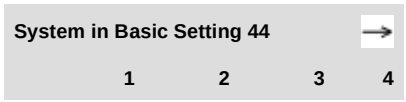
- Check specified value in display field 4 after indication "Test ON" appears:

24-103

	Display fields			
	1	2	3	4
Display group 043: Oxygen sensor aging, oxygen sensor behind catalytic converter (bank 1)				
Display	xxxx/min	xxx ° C	x.xxx V	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	Voltage of oxygen sensor behind catalytic converter, bank 1	Diagnostic condition
Functional range	630 to 6800 RPM	70 to 850 ° C	0.100 to 1.000 volts	Test OFF Test ON B1-S2 OK B1-S2 not OK
Specified value	1800 to 2400 RPM	above 380 ° C	0.100 to 1.000 volts	B1-S2 OK
Notes				**If specified value is not obtained ⇒Check oxygen sensor heater ⇒ Page 24-116**

If specified value B1-S2 OK" is obtained:

- Press -C- button.
- Press buttons -0-, -4- and -4- to select "display group number 044" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4 after indication "Test ON" appears:

24-104

	Display fields			
	1	2	3	4
Display group 044: Oxygen sensor aging, oxygen sensor behind catalytic converter (bank 2)				
Display	xxxx/min	xxx ° C	x.xxx V	**---**
Indicated	Engine speed (RPM)	Exhaust temperature	Voltage of oxygen sensor behind catalytic converter, bank 2	Diagnostic condition
Functional range	670 to 6800 RPM	70 to 850 ° C	0.100 to 1.000 volts	Test OFF Test ON B2-S2 OK B2-S2 not OK
Specified value	1800 to 2400 RPM	above 380 ° C	0.100 to 1.000 volts	B2-S2 OK
Notes				**If specified value is not obtained ⇒Check oxygen sensor heater ⇒ Page 24-116**

If specified value B2-S2 OK" is obtained:

- Press -C- button.

24-105

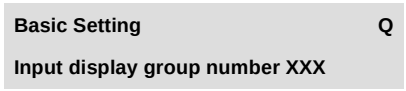
Checking oxygen sensor control behind catalytic converter

- Perform a test drive of approx. 10 minutes.

WARNING!

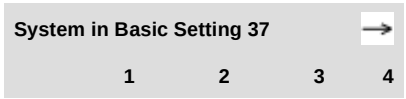
Observe safety precautions to reduce the risk of accidents during road test ⇒ ***Page 24-1*** .

- Let engine continue to run at idle.



When indicated on display:

- Press buttons -0-, -3- and -7- to select "display group number 037" and press -Q- button to confirm input.



When indicated on display:

- Check oxygen sensor voltage in display field 2.
- Check dwell time between oxygen sensor 1 before catalytic converter and oxygen sensor 2 behind catalytic converter in display field 3 and diagnostic result in display field 4.

24-106

	Display fields			
	1	2	3	4
Display group 037: Diagnostic, oxygen sensor control system (bank 1)				
Display	xxx %	x.xxx volts	**xxx ms**	**---**
Indicated	Engine load	Oxygen sensor voltage behind catalytic converter, bank 1	**Oxygen sensor correction value between oxygen sensor 1 and oxygen sensor 2, bank 1**	Diagnostic condition
Functional range	12.0 to 100.0 %	0.100 to 1.000 V	**-800 to 800 ms**	**Test OFF** **Test ON** **System OK** **System not OK**
Specified value	12.0 to 26.0 %	0.100 to 1.000 V	**-800 to 800 ms**	System OK
Notes		If specified value is not obtained: Evaluation display field 2 ⇒ Page 24-109	**If specified value is not obtained ⇒ Page 24-110**	**If "System not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15** **or continuation ⇒ Page 24-110**

Note for display field 3:

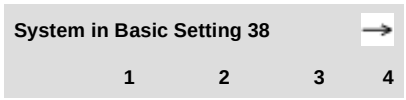
The oxygen sensor control behind catalytic converter overrules the oxygen sensor control before catalytic converter. It corrects slight changes in the mixture (i.e. toward rich or lean) due to the oxygen sensor before catalytic converter by holding oxygen sensor control before catalytic converter at its higher or lower point for a specific time (dwell time). If this time is in the positive range (i.e. 50 ms), mixture is shifted in the -enrich- direction. If this time is in the negative range (i.e. -50 ms), mixture

is shifted in the -lean- direction.

24-107

- Press -C- button.

- Press buttons -0-, -3- and -8- to select "display group number 038" and press -Q- button to confirm input.



When indicated on display:

- Check specified value in display field 4.

Note:

The test in display group 038 is activated simultaneously with the test in display group 037 Therefore the test result is indicated immediately after display group 038 is selected.

24-108

	Display fields			
	1	2	3	4
Display group 038: Diagnostic of oxygen sensor control system (Bank 2)				
Display	xxx %	x.xxx V	xxx ms	**---**
Indicated	Engine load	Oxygen sensor voltage behind catalytic converter, bank 2	Oxygen sensor correction value between oxygen sensor 2 and oxygen sensor 2, bank 1	Diagnostic condition
Functional range	12.0 to 100.0 %	0.100 to 1.000 V	-800 to 800 ms	**System OK** **System not OK**
Specified value	12.0 to 26.0 %	0.100 to 1.000 V	-800 to 800 ms	System OK
Notes		If specified value is not obtained: Evaluation display field 2 ⇒ Page 24-109	If specified value is not obtained ⇒ Page 24-110	**If "SYST not OK" is displayed: Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15** **or continuation ⇒ Page 24-110**

Note for display field 3:

The oxygen sensor control behind catalytic converter overrules the oxygen sensor control before catalytic converter. It corrects slight changes in the mixture (i.e. toward rich or lean) due to the oxygen sensor before catalytic converter by holding oxygen sensor control before catalytic converter at its higher or lower point for a specific time (dwell time). If this time is in the positive range (i.e. 50 ms), mixture is shifted in the -enrich- direction. If this time is in the negative range (i.e. -50 ms), mixture is shifted in the -lean- direction.

24-109

Evaluation of display group 037 and 038

Display field: 2	Possible cause	Corrective action
constant about 0.450 V	♦ Open circuit in wire 4 between oxygen sensor and control module	- Check primary voltage ⇒ Page 24-111
	♦ Open circuit in wire 3 between oxygen sensor and control module	
larger than 1.000 V	♦ Short circuit to B+ in wire 4 between oxygen sensor and control module	- Check oxygen sensor wiring and oxygen sensor behind catalytic converter ⇒ Page 24-112
smaller than 0.150 V	♦ Short circuit to Ground (GND) in wire 4 between oxygen sensor and control module	

24-110

If specified value in display group 037 and 038 display field 3 or 4 is not obtained:

- Search for leaking air at exhaust system or catalytic converter (check screw clamps and exhaust system for damage).

- Check if possibly the oxygen sensors behind catalytic converter of cylinder bank 1 and 2 have been switched, in case of extremely different values (e.g. +500 ms, - 500 ms) of display fields 3 (oxygen sensor correction value) in the measuring value blocks 037 and 038.

If none of the listed causes applies:

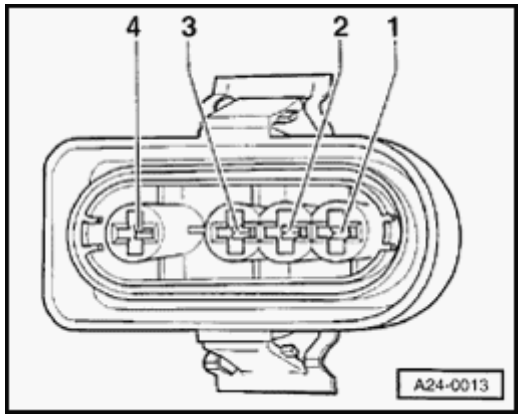
- Replace respective oxygen sensor -before- catalytic converter

24-111

Checking primary voltage

Component location of harness connectors ⇒ Overview of component locations - page ⇒ Page 24-5

- Disconnect 4-pin harness connector leading to respective oxygen sensor.



- Connect multimeter between terminal 3 and 4 for voltage measurement.
- Switch ignition on.
  - ♦ Specification: 0.400 to 0.500 V
- Switch ignition off.

If specified value is not obtained:

- Check oxygen sensor wires ⇒ Bank 1 page ⇒ Page 24-112 or bank 2 page ⇒ Page 24-114 .

If specified value is obtained:

- Replace appropriate oxygen sensor behind catalytic converter.

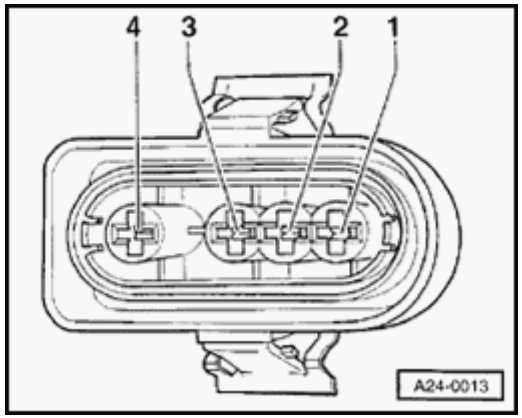
24-112

Testing Oxygen Sensor Wires

Component location of harness connectors ⇒ Overview of component locations, page ⇒ Page 24-5

- Disconnect green 4-pin harness connector 1 to Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130-.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



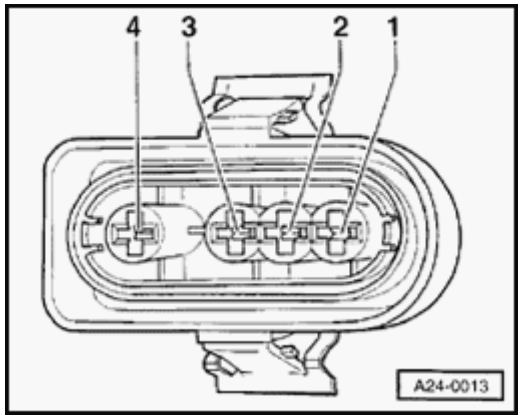
- Check the following wire connections for open circuit.

Harness connector Terminal	VAG1598/31 test box Socket
3	68
4	69

- Repair open circuit if necessary.
- Check wires to each other for short circuit.

Harness connector Terminal	VAG1598/31 test box Socket
4	68

24-113



- Check shielded wire for short circuit to sensor wires.

Harness connector Terminal	VAG1598/31 test box Socket
3	32
4	32

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

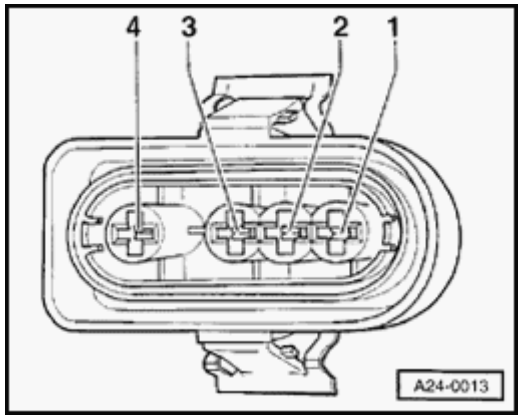
24-114

Check oxygen sensor wires for Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131-.

Component location of harness connectors ⇒ Overview of component locations, page ⇒ Page 24-5

- Disconnect brown 4-pin harness connector 2 to Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131-.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connections for open circuit.

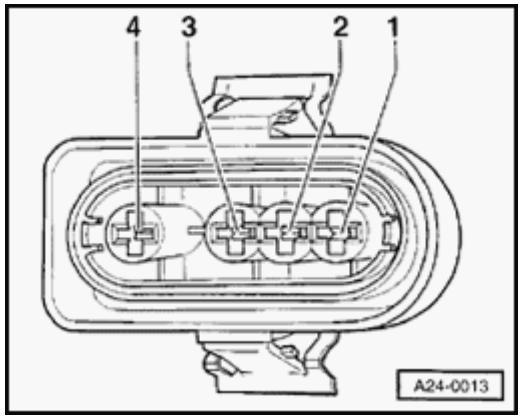
Harness connector Terminal	VAG1598/31 test box Socket
3	10
4	11

- Repair open circuit if necessary.
- Check wires to each other for short circuit.

Harness connector Terminal	VAG1598/31 test box Socket


4
10

24-115



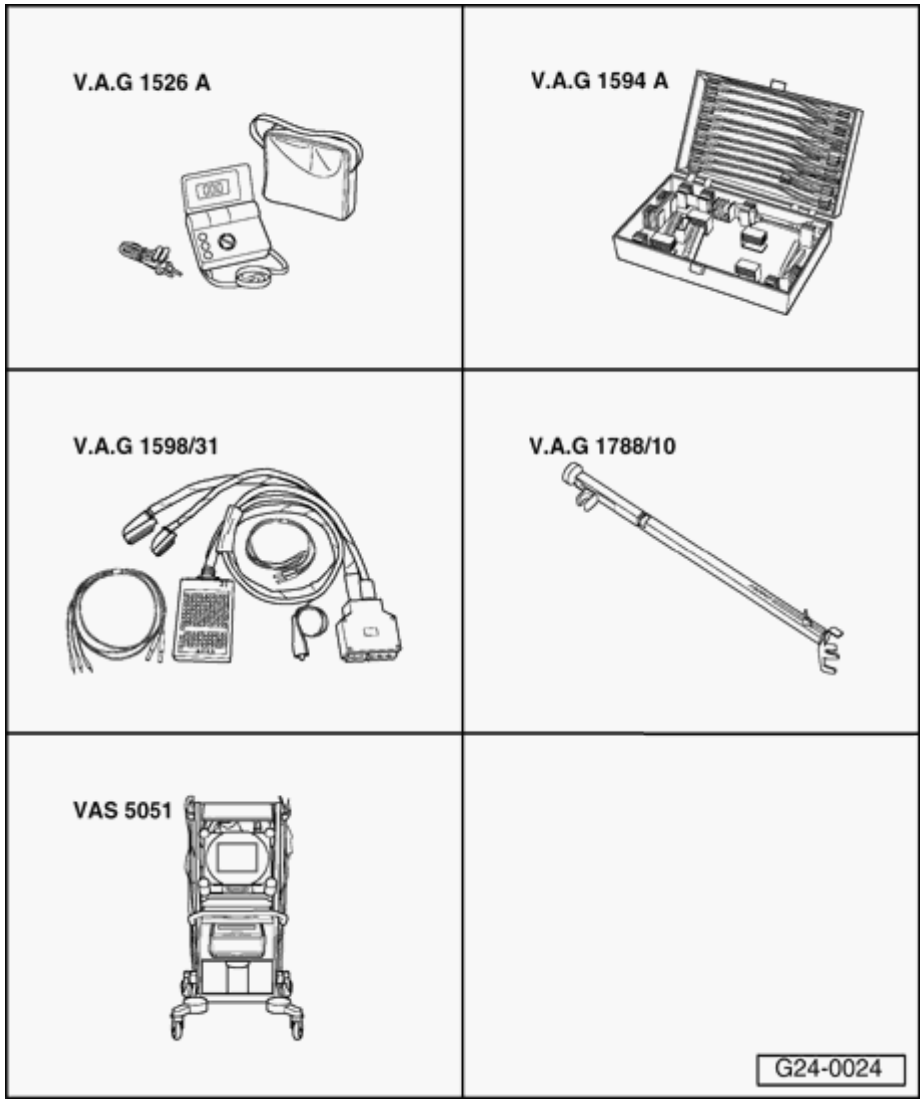
- Check shielded wire for short circuit to sensor wires.

Harness connector Terminal	VAG1598/31 test box Socket
3	32
4	32

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

24-116



Oxygen sensor heating for oxygen sensors before and behind catalytic converter, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAG1788/10 RPM adjuster
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

24-117

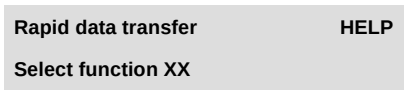
Note:

The heating circuit of the oxygen sensor is monitored by On Board Diagnostic (OBD),

Check DTC memory ⇒ *Page 01-15* .

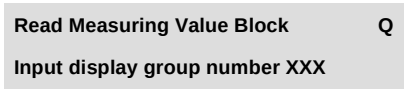
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -4- and -1- to select "display group number 041" and press -Q- button to confirm input.



When indicated on display:

- Check specified values in display fields 1 and 3.

Note:

Increasing engine speed accelerates the obtaining of specified values.

24-118

	Display fields			
	1	2	3	4
Display group 041: Oxygen sensor heating (bank 1) at idle				
Display	**xxx kOhm**	---	**xxx kOhm**	---
Indicated	**Bank 1, sensor 1**	Condition of heating	**Bank 2, sensor 1**	Condition of heating
Functional range		Htng. bef. cat. ON Htng. bef. cat. OFF		Htng. beh. cat. ON Htng. beh. cat. OFF
Specified value	**0 to 0.9 kOhm**	Htng. bef. cat. ON/OFF	**0 to 0.9 kOhm**	Htng. beh. cat. ON/OFF

Important notes to display fields 1, 2, 3 and 4:

- *If oxygen sensors have not yet reached their operating temperature, there will be no indication in display fields 1 and 3, i.e. they will both be empty. (increase engine speed to obtain specified values).*
- *After reaching operating temperature of the two oxygen sensors, a resistance of less than 0.9 kOhm must be indicated in display fields 1 and 3.*
- *Do not continue test until a resistance of less than 0.9 kOhm is indicated in display fields 1 and 3.*
- *At certain points of operation, the ECM "pulses" oxygen sensor heating. This means that oxygen sensor heating is switched on and off at these points. It is entirely possible that the specified value "Htng. bef. Cat. OFF" or "Htng. beh. Cat. OFF" will appear in display fields 2 and 4*

- Press -C- button.

Read Measuring Value Block **Q**

Input display group number XXX

When indicated on display:

- Press buttons -0-, -4- and -2- to select "display group number 042" and press -Q- button to confirm input.

24-119



When indicated on display:

- Check specified values in display fields 1 and 3.

	Display fields			
	1	2	3	4
Display group 042: Oxygen sensor heating (bank 2) at idle				
Display	**xxx kOhm**	---	**xxx kOhm**	---
Indicated	**Bank 2, sensor 1**	Condition of heating	**Bank 2, sensor 2**	Condition of heating
Functional range		Htng. bef. cat. ON Htng. bef. cat. OFF		Htng. beh. cat. ON Htng. beh. cat. OFF
Specified value	**0 to 0.9 kOhm**	Htng. bef. cat. ON/OFF	**0 to 0.9 kOhm**	Htng. beh. cat. ON/OFF

Important notes to display fields 1, 2, 3 and 4:

- *If oxygen sensors have not yet reached their operating temperature, there will be no indication in display fields 1 and 3, i.e. they will both be empty. (increase engine speed to obtain specified values).*
- *After reaching operating temperature of the two oxygen sensors, a resistance of less than 0.9 kOhm must be indicated in display fields 1 and 3.*
- *Do not continue test until a resistance of less than 0.9 kOhm is indicated in display fields 1 and 3.*
- *At certain points of operation, the ECM "pulses" oxygen sensor heating. This means that oxygen sensor heating is switched on and off at these points. It is entirely possible that the specified value "Htng. bef. Cat. OFF" or "Htng. beh. Cat.*

OFF" will appear in display fields 2 and 4

24-120

If specified value is not obtained:

- Check voltage supply of oxygen sensor heating ⇒ Page 24-121 .

- Check oxygen sensor signal wire and activation ⇒ Page 24-112 or ⇒ Page 24-114 .

24-121

Checking voltage supply for oxygen sensor heating

Test requirement:

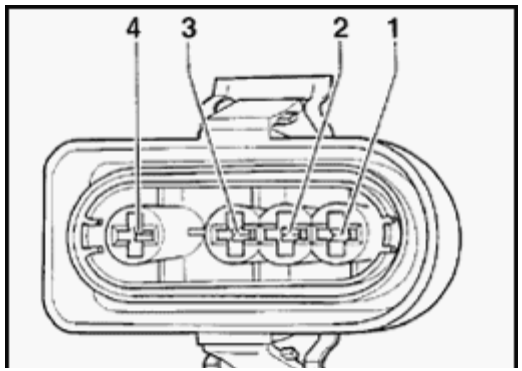
- Fuse for oxygen sensor heating OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Fuel Pump (FP) OK, checking ⇒ Page 24-49 .

Component location of harness connectors ⇒ Overview of component locations, page ⇒ Page 24-5

- Disconnect 4-pin harness connector leading to respective oxygen sensor.



- Connect multimeter between terminal 1 and 2 for voltage measurement.

24-122

- Start engine.

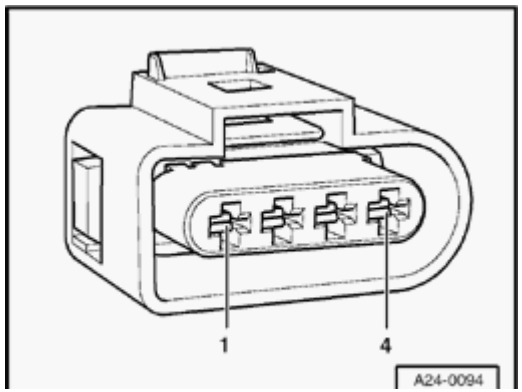
  - Specification: approx. battery voltage, possibly fluctuating

Notes:

- *At certain operating points, the ECM "pulses" the Ground (GND) for oxygen sensor heating. This means that the Ground (GND) is constantly switched on and off at these points. It is therefore possible that the voltage displayed on the tester will fluctuate.*

- *It is possible to observe the ECM switching oxygen sensor heating on and off within the function "read measuring value block", display group numbers 041 and 042.*

If there is no voltage:



- Connect multimeter for voltage measurement as follows:

Harness connector **Terminal**	**Measure to**
1 (B+)	Vehicle Ground (GND)

- Operate starter briefly.

- Specification: approx. battery voltage

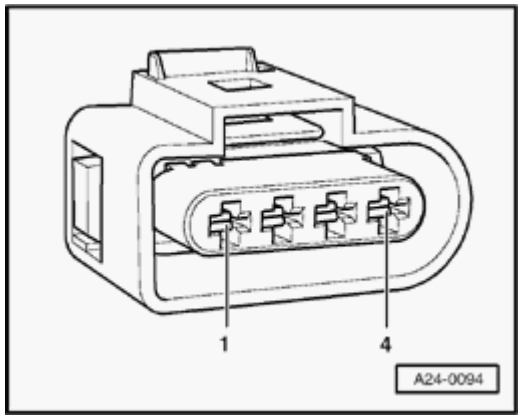
24-123

If there is no voltage again:

- Check wire connection from terminal 1 to Fuel Pump (FP) relay via fuse for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If voltage supply is OK:



- Connect multimeter for voltage measurement as follows:

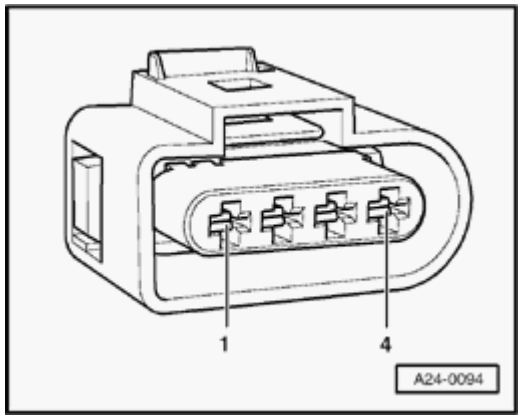
Harness connector **Terminal**	**Measure to**
2 (Ground -GND- activation of Engine Control Module - ECM-)	B+

- Start engine.
  - ♦ Specification: approx. battery voltage, possibly fluctuating
- Switch ignition off.

If there is no voltage:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

24-124



- Check the following wire connection for open circuit:

- Oxygen Sensor (O2S) heater -Z19- bank 1 before catalytic converter:

Harness connector Terminal	VAG1598/31 test box Socket
2	5

- Oxygen Sensor (O2S) heater -Z28- bank 2 before catalytic converter:

Harness connector Terminal	VAG1598/31 test box Socket
2	4

- Oxygen Sensor (O2S) heater -Z29- bank 1 behind catalytic converter:

Harness connector Terminal	VAG1598/31 test box Socket
2	63

- Oxygen Sensor (O2S) heater -Z30- bank 2 behind catalytic converter:

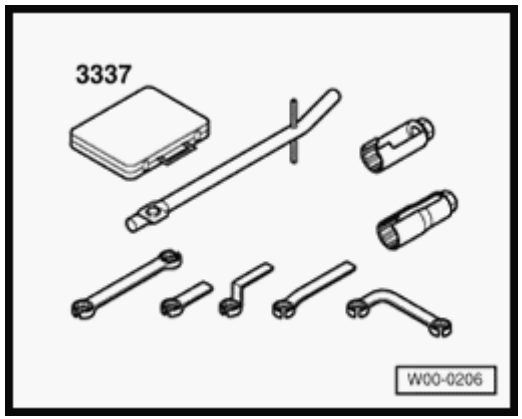
Harness connector Terminal	VAG1598/31 test box Socket
2	6

24-125

If no malfunctions are found in wires:

- Replace appropriate Oxygen Sensor (O2S).
- Read readiness code ⇒ Page 01-78 . If DTC memory was erased, readiness code must be re-generated ⇒ Page 01-82 .

24-126



Oxygen sensor, removing and installing

Special tools and equipment

- 3337 wrench, 7-piece set
- Locking compound G 052 112 A3

Removing

Component location of harness connectors ⇒ Overview of component locations, page ⇒ Page 24-5

- Disconnect 4-pin harness connector leading to respective oxygen sensor.
- Open cable ties.
- Unscrew oxygen sensor using special tool 3337.

24-127

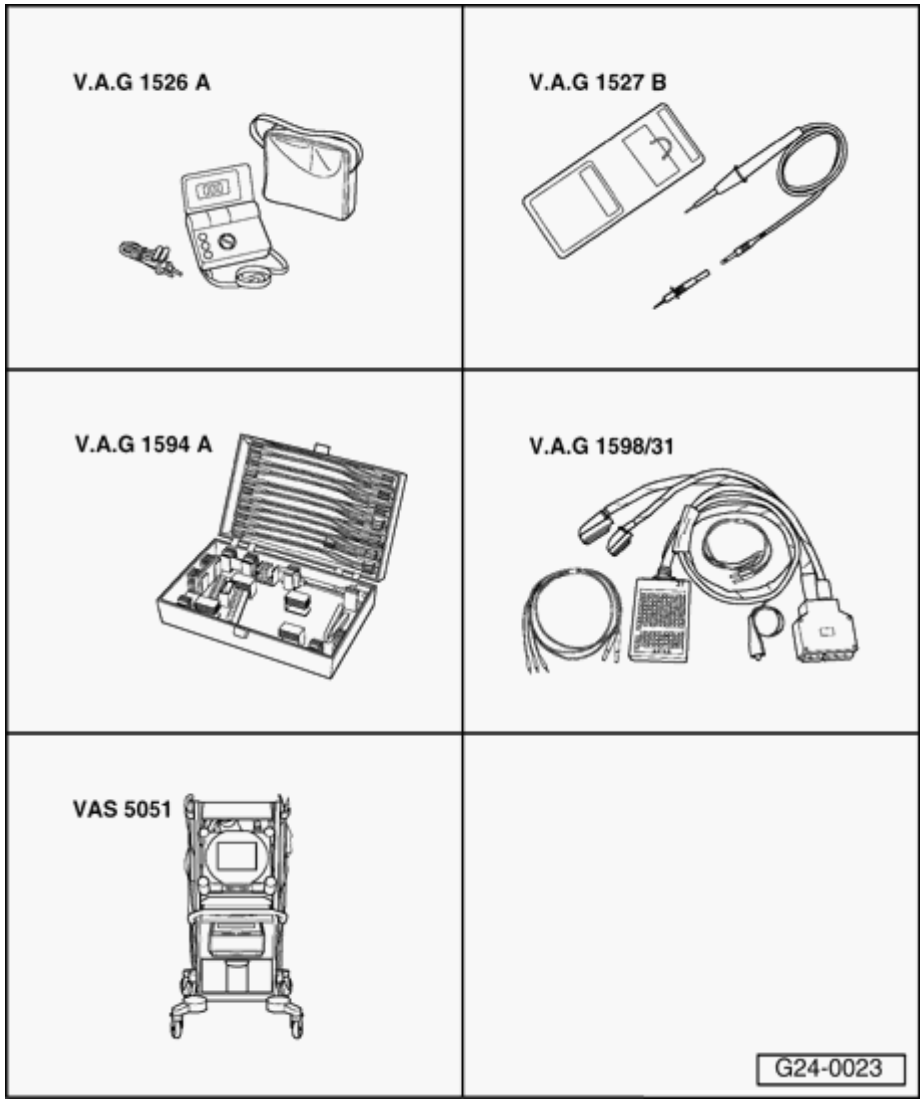
Installing

Note the following when installing:

Notes:

- *Oxygen sensor threads are coated with an assembly paste. This paste must not contact sensor openings.*
- *Cable ties must always be installed again in exactly the same place to prevent the sensor wire from contacting the exhaust pipe.*
- *Tightening torque: 55 Nm*

24-128



Tank ventilation, checking

Evaporative Emission (EVAP) canister purge regulator valve -N80-, checking

Special Tools and Equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

Note:

The Evaporative Emission (EVAP) canister purge regulator valve is also called the Tank Ventilation Valve (TVV) and is sometimes referred to as the EVAP valve.

Checking for proper seal

Solenoid valve is closed when no voltage is present.

- Disconnect hoses from EVAP valve; harness connector remains connected.

- Attach assisting hose to one connection of EVAP valve.

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.

- Initiate output DTM and activate Evaporative Emission (EVAP) canister purge regulator valve -N80- ⇒ Page 01-56 .

Output Diagnostic Test Mode →

➢ Indicated on display:

EVAP canister purge regulator valve -N80

Valve must click...

...and must open and close (can be tested by blowing into assisting hose).

If valve does not click:

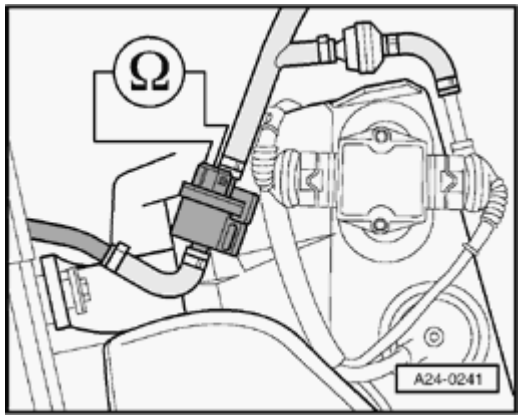
- Check internal resistance of EVAP valve.

If valve does not open and close properly:

- Replace Evaporative Emission (EVAP) canister purge regulator valve -N80-.

Checking internal resistance

- Disconnect connector at EVAP valve.



- Connect multimeter at valve for resistance measurement.
  - Specification: 22 to 30 Ω

If specified value is not obtained:

- Replace Evaporative Emission (EVAP) canister purge regulator valve -N80-.

If specified value is obtained:

- Check voltage supply ⇒ Page 24-131 .

24-131

Checking voltage supply

Test requirements:

- Fuse for the EVAP valve OK.

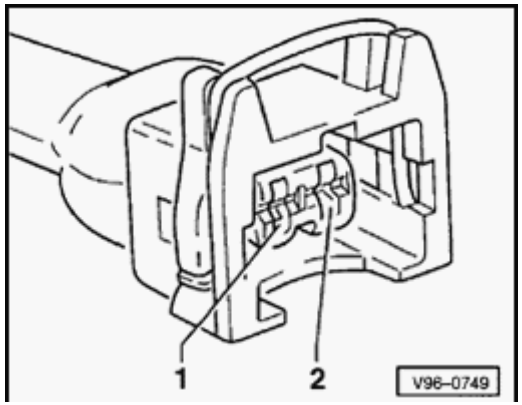
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Fuel Pump (FP) OK, checking ⇒ Page 24-49 .

Note:

Voltage is supplied to the EVAP valve via the Fuel Pump (FP) relay.

- Disconnect connector at EVAP valve.



- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly (engine can also start).
  - ♦ LED must light up.

If LED does not light up:

- Check wire connection from terminal 1 to Fuel Pump (FP) relay via fuse for open circuit.

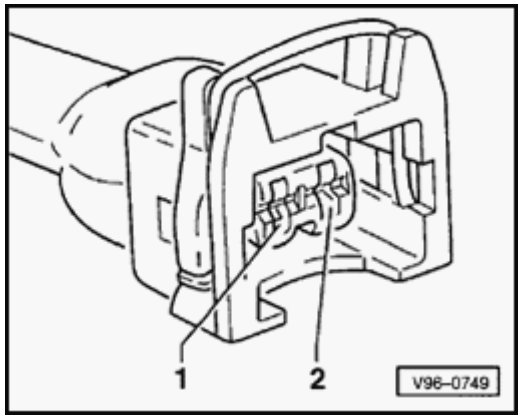
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit if necessary.

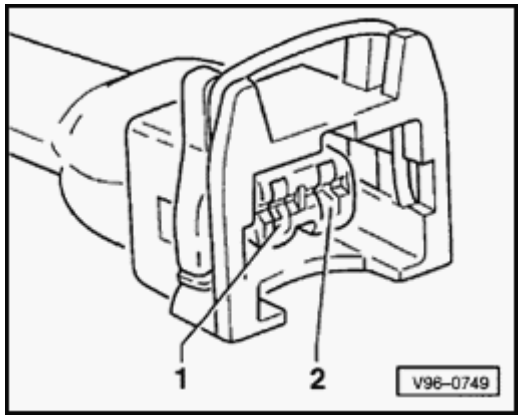
If LED lights up:

- Checking activation.

Checking activation



- Connect VAG1527B voltage tester to connector terminals 1 (B+) and 2.
- Initiate output DTM and activate Evaporative Emission (EVAP) canister purge regulator valve -N80- ⇒ Page 01-56 .
  - ♦ LED must blink.



If LED does not blink or if it remains constantly lit:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
2	64

- Repair open circuit or short circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

Electronic engine power control (E-Gas), checking

E-Gas system, function

For E-Gas, the throttle valve is not operated by a cable from the accelerator pedal. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is communicated to the Engine Control Module (ECM) via two sensors for accelerator pedal position (variable resistances; stored in one housing) that are connected with the accelerator pedal.

The accelerator pedal position (driver's intention) is a main input unit for the ECM.

Operation of the throttle valve occurs via an electric motor (throttle valve actuator) in the throttle valve control module. This is true across the entire engine speed and engine load spectrum.

The throttle valve is operated by the throttle valve actuator according to the instructions of the ECM.

With ignition switched on and engine off, the ECM activates the throttle valve actuator precisely according to the sensor for accelerator

pedal position. This means, if the accelerator pedal is depressed half way, the throttle valve actuator opens the throttle valve to the same degree; i.e. throttle valve would be opened half way.

24-135

With engine running (under load), the ECM can open or close the throttle valve independently of the sensor for accelerator pedal position.

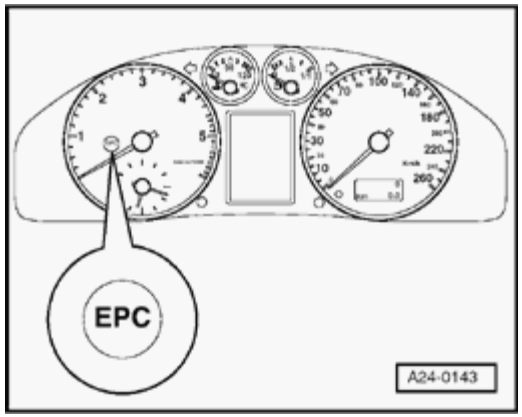
This means, for example, that the throttle valve could be fully opened even though the accelerator pedal has only been depressed half way. This has the advantage of preventing torque losses at the throttle valve.

In addition to this, it results in significantly better values relative to emissions and consumption under certain load conditions.

It would be incorrect to think that "E-Gas" consists of only one or two component. E-Gas is much more of a system containing all components that contribute to recognizing, controlling and monitoring the position of the throttle valve, e.g. sensor for accelerator pedal position, throttle valve control module, EPC warning lamp, Engine Control Module (ECM).

Electronic Power Control (EPC) warning lamp -K132- in instrument cluster, significance

"EPC" is an abbreviation and stands for Electronic Power Control (E-gas).



Installation location of EPC warning lamp

Engine Control Module (ECM) checks all components that are important for function of the E-Gas system after ignition is switched on.

The Engine Control Module (ECM) switches on the EPC warning lamp after ignition is switched on. Shortly after engine is started, the EPC warning lamp will go out. This requires, first of all, that the Engine Control Module (ECM) does not detect a malfunction in the E-gas system and, secondly, that activation of the lamp by the Engine Control Module (ECM) is OK.

If malfunctions are recognized in the E-Gas system during operation of the engine, the ECM switches on the EPC warning lamp in instrument cluster. (These malfunctions are listed in the DTC table). An entry is made in DTC memory at the same time.

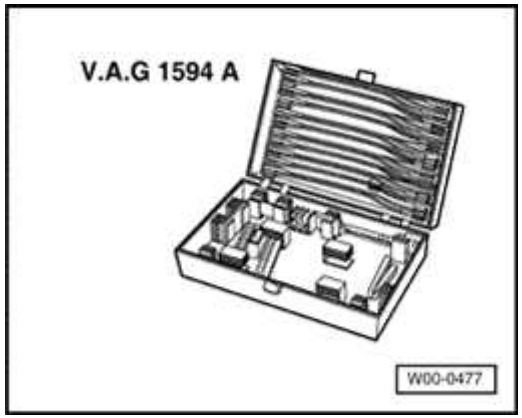
24-137

Electronic Power Control (EPC) warning lamp -K132-, checking

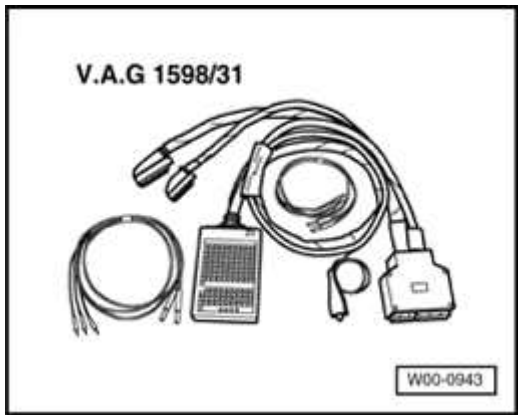
Note:

The fault light for power accelerator activation - K132- is also called the EPC warning lamp.

Special Tools and Equipment



- VAG1594A



- VAG1598/31

24-138

Function test of warning lamp

- Switch ignition on.

  - Engine Control Module (ECM) switches EPC lamp on.

- Start engine.

  - Shortly after engine is started, the EPC warning lamp will go out if there are not malfunctions stored in DTC memory that relate to the E-gas system

A- Fault light for power accelerator activation -K132- does not light up

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Bridge sockets 1 and 48 of test box.

- Switch ignition on.

  - Warning lamp must light up.

If warning lamp does not light up:

- Switch ignition off.

- Remove instrument cluster:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90, Instrument cluster, removing and installing*

- Check the following wire connection for open circuit and short circuit to B+:

Test box VAG1598/31 Socket	Instrument cluster Terminal
48	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

B- Fault light for power accelerator activation -K132- lights up constantly

- Check DTC memory of Engine Control Module (ECM).

If no DTCs are stored:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Remove instrument cluster:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90, Instrument cluster, removing and installing*

- Check the following wire connection for short circuit to Ground (GND):

Test box VAG1598/31 Socket	Instrument cluster Terminal
48	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component*

	Locations binder

- Repair short circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

24-141

Throttle valve control module -J338-, checking

The following components are located in the housing for the throttle valve control module:

- Throttle drive (power accelerator actuation) -G186-. (This is an electric motor that is activated by the ECM. This electric motor opens the throttle valve against spring pressure.)
- Angle sensor -1- for throttle drive (power accelerator actuation) -G187-
- Angle sensor -2- for throttle drive (power accelerator actuation) -G188-

Notes:

- *The housing for the throttle valve control module must not be opened.*
- *The angle sensors are designed as potentiometers (variable resistances). They communicate the position of the throttle valve to the Engine Control Module (ECM) fully independent of each other.*
- *The potentiometers cannot be mechanically*

adjusted. Adjustment is performed in basic setting (function 04) using the VAS5051 tester or the VAG1551 Scan Tool (ST).

24-142

Throttle valve control module, adapting

The adaptation teaches the Engine Control Module (ECM) various positions of the throttle valve when the ignition is on and the engine is stopped. These positions are stored in the control module The return communication regarding the position of the throttle valve occurs via the two angle sensors for throttle drive.

An adaptation must always be performed when the throttle valve control module -J338- or the Engine Control Module (ECM) are removed and installed (or replaced) or if voltage supply to the Engine Control Module (ECM) is interrupted.

The learning process (adaptation) occurs:

- automatically if the ignition is switched on for at least 10 seconds without operating starter and accelerator pedal and the Engine Control Module (ECM) recognizes "adaptation required". (There will be no notification of whether adaptation was successful or not however). Adaptation required is recognized if stored voltage values from the angle sensors do not match actual measured voltage values within a certain tolerance range.

- via initiation of basic setting (function 04) display group 060 with ignition on.

24-143



Note:

Engine will not start during automatic adaptation.

Special Tools and Equipment

- VAS5051 with VAG5051/1

or

- VAG1551 with VAG1551/3B

Requirements

- No DTCs in DTC memory, check DTC memory ⇒ Page 01-15 .
- Engine not running, ignition switched on.
- Accelerator pedal not depressed.
- Coolant temperature 10 to 95 °C.
- Intake air temperature 10 to 90 °C.
- Supply voltage for ECM larger than 12.7 V; checking ⇒ Page 28-30 .

Procedure

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Ignition must remain switched on for this.

Rapid data transfer **HELP**
Select function XX

When indicated on display:

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.

Basic Setting **Q**
Input display group number XXX

When indicated on display:

- Press buttons -0-, -6- and -0- to select "display group number 060" and press -Q- button to confirm input.

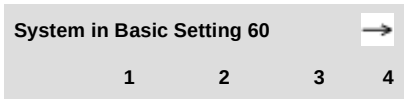
After pressing Q-button, throttle valve actuator will be switched on without current.

In this condition, the throttle valve will be drawn into an emergency position by a mechanical spring, which is located in the throttle valve control module. The values supplied by the two angle sensors in this emergency position are stored by the Engine Control Module (ECM).

Next, the throttle valve is opened by a certain value. If this value is reached, the throttle valve actuator is once again de-energized. Now, the mechanical spring must close the throttle valve to the previously learned emergency position within a specified time (spring test).

Then, the throttle valve is closed by the throttle valve actuator; the values supplied by the angle sensors in the throttle valve control unit are stored by the Engine Control Module (ECM).

If Engine Control Module (ECM) should de-energize throttle valve actuator during driving operation, this is expressed by an increased, surging idle speed (RPM). The engine accepts gas only after great delay.



When indicated on display:

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

	Display fields			
	1	2	3	4
Display group 060: Adaptation of throttle valve control module				
Display	xx %	xx %	**x**	**---**
Indicated	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Adaptation step counter**	**Adaptation condition**
Functional range	0 to 100%	0 to 100 %	**0 to 8**	**ADP in progress** **ADP OK** **ADP ERROR**
Specified value	3 to 93 %	97 to 3 %	**8**	**ADP OK**
Notes			**After adaptation, the adaptation step counter reaches the number 8 (it is OK for numbers to be skipped).**	**If "ADP ERROR." is displayed: Check DTC memory ⇒ Page 01-15 .** **If specified value is not obtained: ⇒Note, page ⇒ Page 24-147 .**

Note for display field 3:

Different numbers are shown in display field 3 during adaptation that represent the current adaptation condition. It is not particularly important how the adaptation step counter (display field 3) behaves during adaptation, but rather that display field

4 indicates the specification "ADP OK" after adaptation.

24-147

Note:

The control module can abort adaptation for the following reasons:

- *Throttle valve cannot be closed completely (e.g. contamination)*
- *Battery voltage is too low.*
- *Throttle valve control module or wire connection is faulty.*
- *Engine is started during adaptation or accelerator pedal is operated.*
- *Tension of throttle valve housing (check bolts)*

After termination, tester displays "Function is unknown or cannot be performed at the moment". The next time the ignition is switched on (several seconds), adaptation will be automatically repeated.

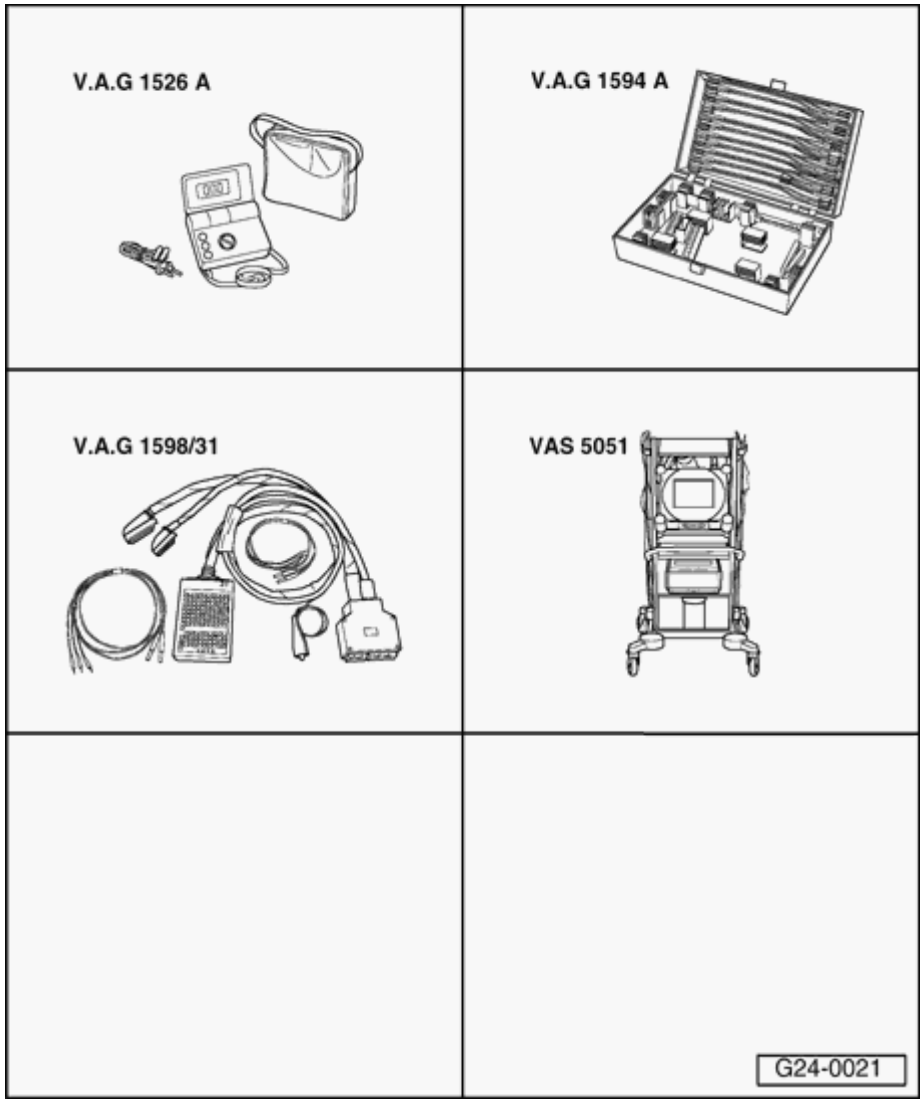
- End basic adjustment of the engine by pressing the→ key.

Rapid data transfer **HELP**

Indicated on display (function selection):

Select function XX

24-148



Angle sensor -1- for throttle drive, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

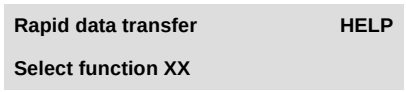
24-149

Angle sensor 1 for throttle drive (power accelerator actuation) -G187- and angle sensor 1 for throttle drive (power accelerator actuation) -G188- inform the Engine Control Module (ECM) about the position of the throttle valve. Both angle sensors are located in the throttle valve control module.

Test sequence

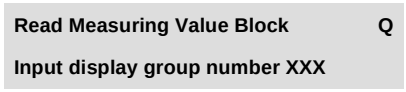
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.



- When indicated on display:

  - Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



- When indicated on display:

  - Press buttons -0-, -6- and -2- to select "display group number 062" and press -Q- button to confirm input.



- Indicated on display:

  - Check specified values for E-gas potentiometer voltages in display fields 1 and 2.

24-150

	Display fields			
	1	2	3	4
Display group 062: E-Gas potentiometer voltages				
Display	**xx %**	**xx %**	xx %	xx %
Indicated	**Throttle valve angle (angle sensor 1)**	**Throttle valve angle (angle sensor 2)**	Sensor for Pedal position	Sensor 2 for Pedal position
Specified value	**3 to 93 % (Idle value: 8 to 18 %)**	**97 to 3 % (Idle value: 80 to 90 %)**	12 to 97 %	4 to 49 %
Specified value	**3 to 93 %**	**97 to 3 %**	12 to 97 %	4 to 49 %

Note:

Engine Control Module (ECM) calculates the voltage values of the angle sensors in percent relative to 5 volts and displays these percentage values. (5 volts supply voltage represents 100 %).

- Observe display field 1 and 2.

- Slowly depress accelerator pedal completely.

Percent indication in display field 1 must rise uniformly. The tolerance range of 3 to 93% will

not be used completely during this.

Percent indication in display field 2 must decrease uniformly. The tolerance range of 97 to 3% will not be used completely during this.

24-151

Notes:

- *The reason why the value indicated in display field 1 climbs, while the value indicated in display field 2 decreases, has to do with the fact that the potentiometers (angle sensors) in the throttle valve control unit run in opposite directions.*

- *This means that the voltage tap of angle sensor 1 runs from 0 to 5 volts. (The more the throttle valve is opened, the larger the voltage; percent indication climbs).*

- *The voltage tap of angle sensor 2 runs from 5 to 0 volts. (The more the throttle valve is opened, the lower the voltage; the percentage decreases).*

If indications do not resemble description:

- Check voltage supply and wire connections of throttle valve control module ⇒ Page 24-152 . Pay particular attention to harness connectors that could be loose or corroded.

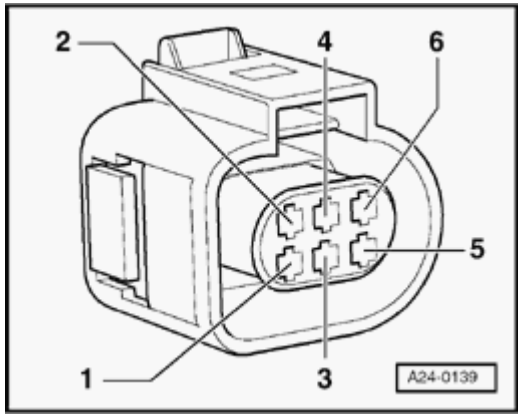
- Check accelerator pedal position sensor ⇒ Page 24-154 .

24-152

Check voltage supply throttle valve control module

- Pull connector (2) off throttle valve control module.

- Switch ignition on.

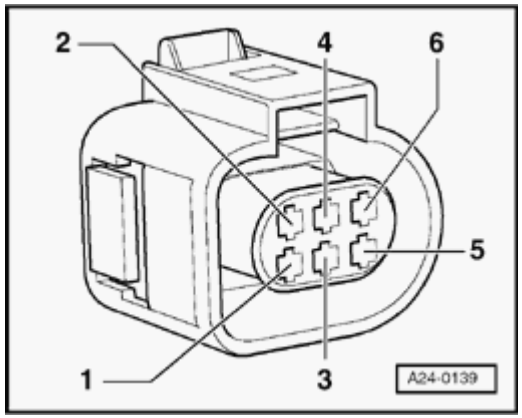


- Connect multimeter to the following connector terminals for voltage measurement:

Harness connector Terminal	Specified value
2 + Ground (GND)	about 5 V
2 + 6	about 5 V

If specified values are not obtained:

Check wire connections from Engine Control Module (ECM) to throttle valve control module ⇒ Page 24-153 .



Checking wire connections

- Pull connector (2) off throttle valve control module.
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .
- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

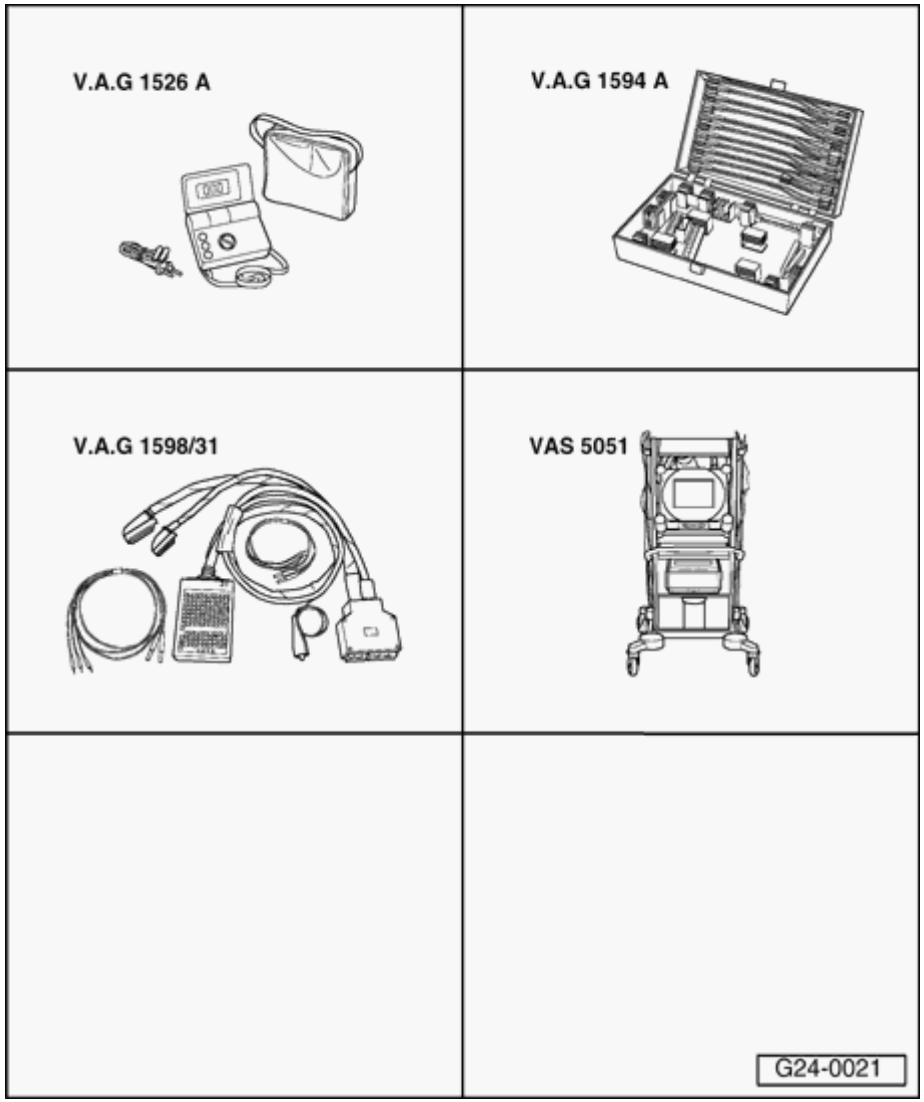
Harness connector Terminal	VAG1598/31 test box Socket
1	92
2	83
3	117
4	84
5	118
6	91

- Repair open circuit or short circuit if necessary.

If no malfunctions are found in wires:

- Replace throttle valve control module.

24-154



Throttle Position (TP) sensor, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

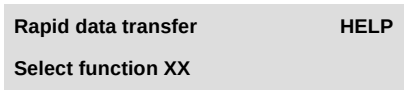
24-155

Both the Throttle Position (TP) sensor -G79- and the Sender -2- for accelerator pedal position -G185- are located at the accelerator pedal and communicate the driver's intentions to the ECM completely independently of each other. Both sensors are stored in one housing.

Test sequence

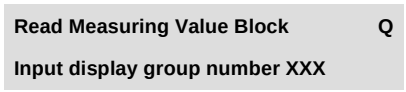
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.



➢ When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



➢ When indicated on display:

- Press buttons -0-, -6- and -2- to select "display group number 062" and press -Q- button to confirm input.



➢ Indicated on display:

- Check specified values for E-gas potentiometer voltages in display fields 3 and 4.

24-156

	Display fields			
	1	2	3	4
Display group 062: E-Gas potentiometer voltages				
Display	xx %	xx %	**xx %**	**xx %**
Indicated	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Sensor for Pedal position**	**Sensor 2 for Pedal position**
Functional range	0 to 100 %	0 to 100 %	**0 to 100 %**	**0 to 50 %**
Specified value	3 to 93 %	97 to 3 %	**12 to 97 % (Idle value: 8 to 18 %)**	**4 to 49 % (Idle value: 3 to 13 %)**

Note:

Engine Control Module (ECM) calculates the voltage values of the angle sensors in percent relative to 5 volts and displays these percentage values. (5 volts supply voltage represents 100 %).

- Observe display field 3 and 4.

- Slowly depress accelerator pedal completely.

Percent indication in display field 3 must rise uniformly. The tolerance range 12 to 97% is not used completely during this.

Percent indication in display field 4 must also rise uniformly. In the process, the tolerance range of 4 to 49% is not completely utilized.

24-157

Note:

The indicated value in display field 3 must always be about twice as large as the value in display field 4.

If indications do not resemble description:

- Check voltage supply and wire connections of sensor for accelerator pedal position ⇒ Page 24-158 .

24-158

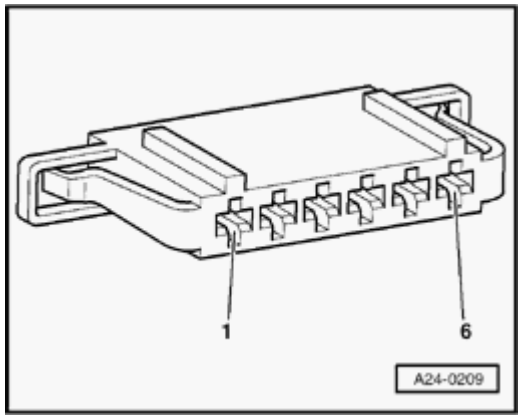
Checking voltage supply of Throttle Position (TP) sensor

- Remove driver-side storage compartment.

⇒ *Repair Manual, Body-Interior, Repair Group 68; Instrument Panel; Removing Driver-Side Storage Compartment*

- Disconnect harness connector for accelerator pedal position sensor.

- Switch ignition on.



- Connect multimeter for voltage measurement as follows:

Harness connector Terminal	Specified value
1 + Ground (GND)	about 5 V
1 + 5	about 5 V
2 + Ground (GND)	about 5 V
2 + 3	about 5 V

If specified values are obtained:

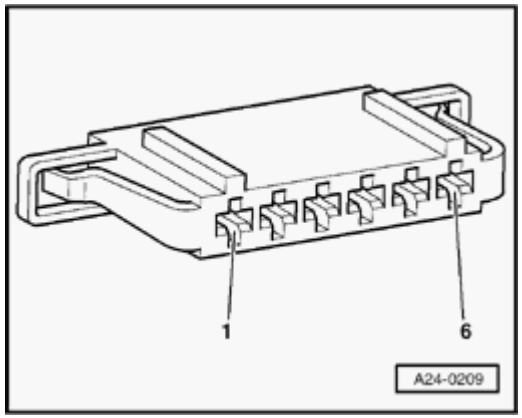
- Also check signal wires.

If specified values are not obtained:

- Check wire connections from Engine Control Module (ECM) to sensors for accelerator pedal position.

Checking wire connections

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
1	72
2	73
3	36
4	35
5	33
6	34

- Repair open circuit or short circuit if necessary.

24-160

If no malfunctions are found in wires:

- Replace accelerator pedal position sensor.

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

Note:

For vehicles with automatic transmission, the kick down function must be learned ⇒ *Page 24-161* .

24-161

Kick down function, adapting

If the sensor for accelerator pedal position or the Engine Control Module (ECM) is replaced on a vehicle with automatic/variable transmission, the kick down function must be learned by the ECM.

Special Tools and Equipment



- VAS5051 with VAG5051/1

  or

- VAG1551 with VAG1551/3B

Requirements

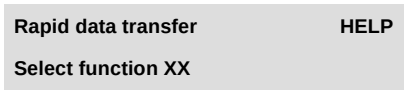
- No DTCs in DTC memory, check DTC memory ⇒ Page 01-15 .
- Engine not running, ignition switched on.

Procedure

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

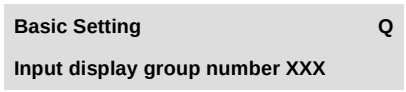
  Ignition must remain switched on for this.

24-162



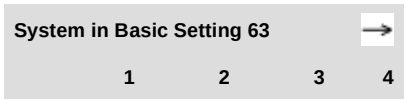
When indicated on display:

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -6- and -3- to select "display group number 063" and press -Q- button to confirm input.



When indicated on display:

Note:

There will be a prompt: "Activate kick-down"

- Depress accelerator pedal completely, past kick down point, and hold down.

Note:

During adaptation of the kick down point, the VAG1551 will display "Kick down ADP in progress". After successful adaptation of the kick down point, the VAG1551 will display "Kick down ADP OK".

- Check specified value in display field 4.

24-163

	Display fields			
	1	2	3	4
Display group 063: Kick down function, adapting				
Display	xx %	xx %	**Kick down**	**---**
Indicated	Sensor 1 for Pedal position	Sensor 2 for Pedal position	**Kick down**	**Adaptation condition**
Functional range	0 to 100 %	0 to 50 %	**Kick down**	**operate** **ADP in progress** **ADP OK** **ADP ERROR**
Specified value	12 to 97 %	4 to 49 %	**Kick down**	**ADP OK**
Notes				**If "ADP ERROR." is displayed: Check DTC memory ⇒ Page 01-15 .**

Notes:

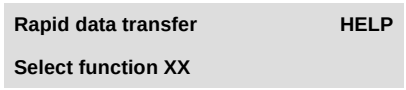
- *The abbreviation "ADP" in display field 4 stands for Adaptation.*
- *"ERROR" can be indicated, for example, if the accelerator pedal is not immediately pressed in response to a request by the tester or if the accelerator pedal is released while adaptation is running despite the fact that adaptation is not yet*

complete.In both cases, "Basic Setting" must be exited and the adaptation must be performed again ⇒ Page 24-161 .

24-164

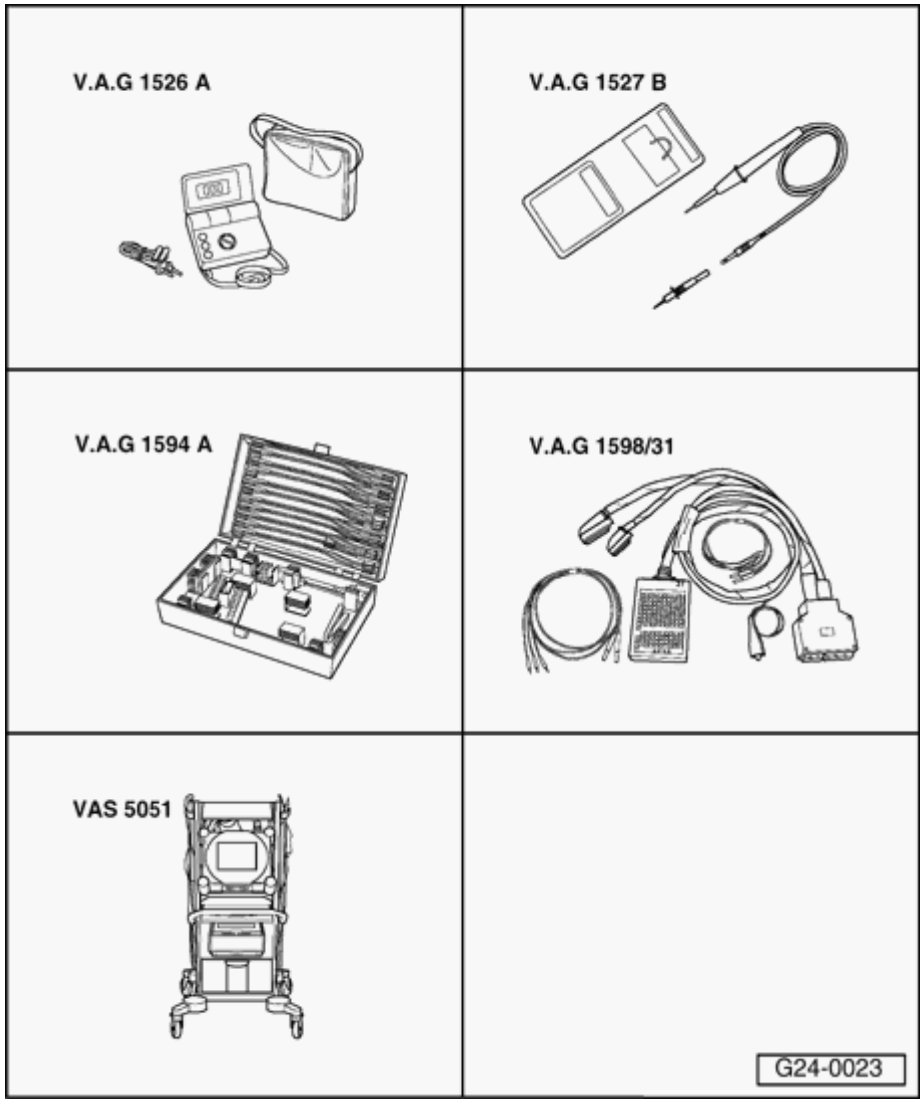
If specified value "ADP OK" is obtained:

- Press →button.



Indicated on display (function selection):

24-165



Additional signals, testing

Special Tools and Equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

Engine speed signal, checking

Note:

The engine speed signal is output at terminal 37 of the Engine Control Module (ECM). The signal is used, among other things, for RPM display in the instrument cluster.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Test box VAG1598/31 Socket	Instrument cluster Terminal
37	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

24-167

Consumption signal for on board computer, checking

Notes:

- *The consumption signal is calculated by the ECM from the injection time and directed to the on board computer via terminal 81 of the ECM.*

- *Consumption signal, checking*

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

24-168

Vehicle speed signal, checking

Notes:

- *The vehicle speed signal is generated by the Vehicle Speed Sensor (VSS) -G68- (at transmission) and processed in the instrument cluster.*

- *The processed signal enters at terminal 54 of the ECM and is used for idle stabilization and tip-in shock reduction during shifting.*

Test requirement:

- Function and display of speedometer OK.
  Troubleshooting:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

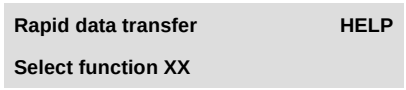
Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.

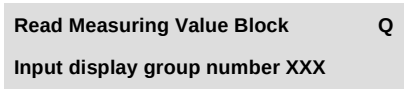
WARNING!

Observe safety precautions to reduce the risk of accidents during road test ⇒ Page 24-1 .



➢ When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



➢ When indicated on display:

- Press buttons -0-, -0- and -5- to select "display group number 005" and press -Q- button to confirm input.



➢ Indicated on display:

- Determining via road test whether vehicle speed is displayed in display field 3.
- If vehicle speed is not display, lift vehicle -if possible using a vehicle lift- until front left wheel is free.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Connect VAG1527B voltage tester to sockets 3 (B+) and 54 (VSS) of VAG1598/31 test box.

- Switch ignition on and turn front left wheel by hand.

  - LED must blink (very brief blink signal).

If LED does not blink:

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Test box VAG1598/31 Socket	Instrument cluster Terminal
54	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

24-171

Wire for fuel level signal, checking

Notes:

- *The Engine Control Module (ECM) receives the fuel level signal from the instrument cluster.*
- *The processed signal enters at terminal 30 of the ECM and is used to determine the cause of certain recognized malfunctions (e.g. combustion misfires).*

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Test box VAG1598/31 Socket	Instrument cluster Terminal
30	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

24-172

A/C compressor shut-off, checking

Notes:

- *The A/C compressor signal communicates to the ECM that the compressor will be switched on in 140 ms.*
- *The ECM can switch off the A/C compressor via the same wire connection.*
- *Engine Control Module (ECM) switches off A/C compressor:*
  - *during hard acceleration (Wide Open Throttle 1st gear)*
  - *in emergency mode (emergency operation)*
  - *after initiating basic setting (function 04)*

Test requirements:

- A/C system OK
- No DTCs in DTC memory of Engine Control Module (ECM).

- Vehicle at room temperature (warmer than +15 °C).

24-173

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.

Rapid data transfer **HELP**
Select function XX

When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read Measuring Value Block **Q**
Input display group number XXX

When indicated on display:

- Press buttons -0-, -5- and -0- to select "display group number 050" and press -Q- button to confirm input.

Read Measuring Value Block 50			→
1	**2**	**3**	**4**

Indicated on display: (1 thru 4 = display fields)

- Switch A/C system off.
  - ♦ Specified value in display field 4: Compr. OFF
- Switch A/C system on using "Auto" button and adjust A/C system to maximum cooling or heating power. Compressor must run.
  - ♦ Specified value in display field 4: Compr. ON

- Depress gas pedal completely (swiftly) and then release it (brief acceleration).

  - Specified value in display field 4: Indication jumps for a few seconds from "Compr. ON" to "Compr. OFF" (compressor is switched off when vehicle accelerates).

If indications do not resemble description:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Test box VAG1598/31 Socket	A/C control head -E87- Terminal
41	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

- If there are no malfunctions in the wiring, check function of A/C system.

⇒ *Repair Manual, Heating & Air Conditioning, Repair Group 01*

24-175

A/C system signal, checking

The A/C system signal notifies the Engine Control Module (ECM), that the A/C system requires a higher idle speed to achieve the desired interior temperature (regardless of whether heating or cooling is required).

The increase in idle speed based on presence of the A/C system signal is control module dependent and occurs only in vehicles with All Wheel Drive (AWD) and manual transmission.

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.

Rapid data transfer	**HELP**
Select function XX	

When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

24-176

If specified values are not obtained:

Read Measuring Value Block Q

Input display group number XXX

When indicated on display:

- Press buttons -0-, -5- and -6- to select "display group number 056" and press -Q- button to confirm input.
- Switch on A/C system, press "Auto" button and select the lowest temperature.
- Check indications in display field 3 and 4.

	Display fields			
	1	2	3	4
Display group 056: Idle stabilization with engine at idle and operating temperature				
Display	xxx /min	xxx /min	**---**	**---**
Indicated	Engine speed (actual)	Engine speed (specified)	**A/C readiness**	**A/C compressor**
Functional range			**A/C - LOW** **A/C - HIGH**	**Compr. OFF** **Compr. ON**
Specified value	720 to 820 RPM [1)] 630 to 730 RPM [2)]	760 RPM [1)] 680 RPM [2)]	**A/C - HIGH**	**Compr. ON**

[1)] Front Wheel Drive Vehicles

[2)] All-Wheel Drive Vehicles

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

24-177

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Test box VAG1598/31 Socket	A/C control head -E87- Terminal
40	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

- If there are no malfunctions in the wiring, check function of A/C system.

⇒ *Repair Manual, Heating & Air Conditioning, Repair Group 01*

24-178

Brake light switch and brake pedal switch, checking

Note:

For safety reasons, the instruction from the accelerator pedal sensor (potentiometer) to the ECM to open the throttle valve is suppressed when brake is being operated. This requires the brake light switch signal and also the brake pedal switch signal in the control module.

If brake pedal is operated with accelerator pedal constantly depressed, engine is immediately regulated down to idle speed. A faulty switch can lead to undesired regulation.

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

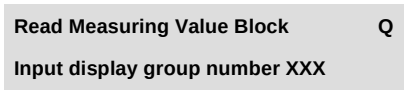
  Ignition must remain switched on for this.

Rapid data transfer **HELP**	
Select function XX	

When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

24-179



- When indicated on display:

  - Press buttons -0-, -6- and -6- to select "display group number 066" and press -Q- button to confirm input.



- Indicated on display:

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

	Display fields			
	1	2	3	4
Display group 066: Signals to Engine Control Module (ECM)				
Display	xxx km/h	**XXXX**	xxx km/h	XXXX
Indicated	ACTUAL speed	**Switch positions**	SPECIFIED speed	Switch positions
Functional range		**XX00** **XX11**		
Specified value		**XX00** **(with brake pedal not operated)**		
		XX11 **(with brake pedal operated)**		
Notes		**Value:** **X = no significance.**		

		Switch points slightly offset		

24-180

If indications do not resemble description:

Check switch

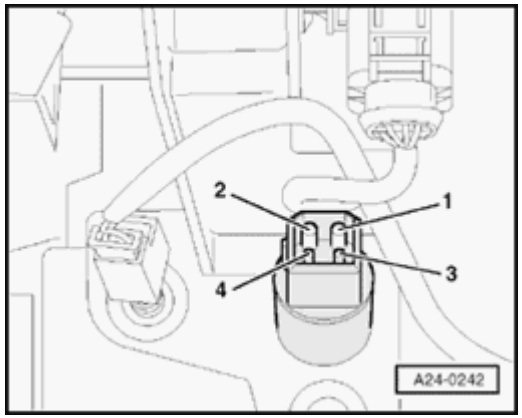
- Remove driver-side storage compartment.

⇒ *Repair Manual, Body-Interior, Repair Group 68; Instrument Panel; Removing Driver-Side Storage Compartment*

- Disconnect harness connector at brake light switch and brake pedal switch.

Note:

Connector sockets are marked on the back side of the connector.



- Connect multimeter between terminal 1 and 2 for resistance measurement.
  - Specification: ∞ Ω (no continuity)
- Depress accelerator pedal.
  - Specification: approx. 0 Ω
- Connect multimeter between terminal 3 and 4 for resistance measurement.
  - Specification: approx. 0 Ω

- Depress accelerator pedal.
  - Specification: ∞ Ω (no continuity)

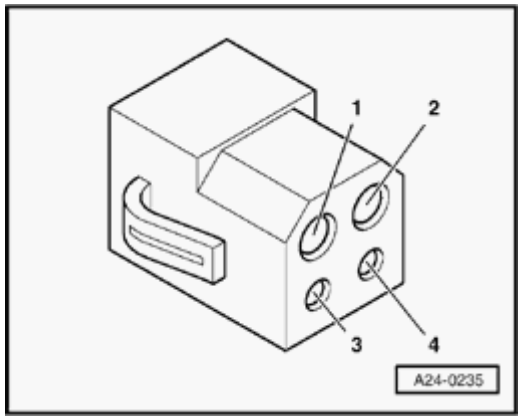
24-181

If specified values are not obtained:

- Check adjustment of switch or
- Replace brake light switch / brake pedal switch.

If specified values are obtained:

Checking voltage supply



- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Chassis Ground (GND)

♦ LED must light up.

- Switch ignition on.

Harness connector Terminal	Measure to
3	Chassis Ground (GND)

♦ LED must light up.

If LED does not light up:

- Check wire connection from terminal 1 or 3 of connector for open circuit and short circuit to Ground (GND):

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit or short circuit if necessary.

If LED lights up:

Checking activation

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
2	56
4	55

- Repair open circuit or short circuit if necessary.

24-183

Clutch vacuum vent valve switch -F36-, checking

Note:

This signal helps prevent excessive RPM oscillations and tip-in shocks when clutch is disengaged and is required for the cruise control system.

Test sequence

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.

Rapid data transfer HELP **Select function XX**	When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read Measuring Value Block Q **Input display group number XXX**	When indicated on display:

- Press buttons -0-, -6- and -6- to select "display group number 066" and press -Q- button to confirm input.

Read Measuring Value Block 66 →	Indicated on display:

1	2	3	4

- Check Clutch Pedal Position (CPP) switch in display field 2.

24-184

	Display fields			
	1	2	3	4
Display group 066: Signals to Engine Control Module (ECM)				
Display	xxx km/h	**XXXX**	xxx km/h	XXXX
Indicated	ACTUAL speed	**Switch positions**	SPECIFIED speed	Switch positions
Functional range		**X0XX** **X1XX**		
Specified value		**X0XX** **(at clutch pedal not operated)**		
		X1XX **(at clutch pedal operated)**		
Notes		**Value:** **X = no significance**		

24-185

If indications do not resemble description:

Check switch

- Remove driver-side storage compartment.

⇒ *Repair Manual, Body-Interior, Repair Group 68; Instrument Panel; Removing Driver-Side Storage Compartment*

- Disconnect harness connector at Clutch Pedal Position (CPP) switch.

Note:

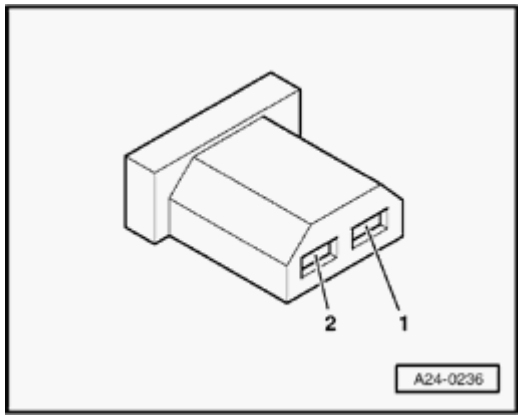
Connector sockets are marked on the back side of the connector.

- Connect multimeter between terminal 1 and 2 for resistance measurement.
  - Specification: approx. 0 Ω
- Depress clutch pedal.
  - Specification: ∞ Ω (no continuity)

If specified value is not obtained:

- Check adjustment of switch or
- Replace Clutch Pedal Position (CPP) switch.

24-186



If specified value is obtained:

Checking voltage supply

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Chassis Ground (GND)

- Switch ignition on.
  - ♦ LED must light up.

If LED does not light up:

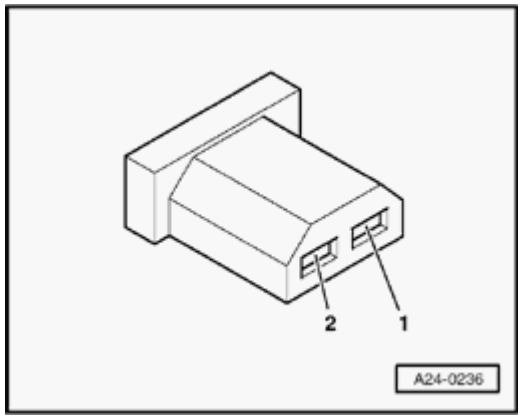
- Check wire connection from terminal 1 of connector to fuse for open circuit and short circuit to Ground (GND):

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If LED lights up:

Checking activation

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
2	39

- Repair open circuit or short circuit if necessary.

Wire for crash signal, checking

The Engine Control Module (ECM) receives the crash signal ("Crash shut-off was triggered") from the airbag control module.

When the airbag control module sends the crash signal to the ECM (during an accident or when output DTM is being performed for the airbag system), the ECM switches the Fuel Pump (FP) off. This means that the engine will stop running but can be started again afterward (e.g. to remove vehicle from danger).

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Test box VAG1598/31 Socket	Control module for Airbag -J234- Terminal
67	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

24-189

- Repair open circuit or short circuit if necessary.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If no malfunctions are found in wire:

- Check DTC memory of control module for airbag:

⇒ *Repair Manual, Body-On Board Diagnostic (OBD), Repair Group 01; On Board Diagnostic (OBD) of airbag system BAE (basic trigger unit) with side airbag; DTC memory, checking*

24-190

Rough terrain signal from ABS/EDL control module, checking

Notes:

- *When the ABS/EDL control module recognizes that a wheel is spinning, the ABS/EDL control module generates the rough terrain signal. When the Engine Control Module (ECM) recognizes the rough terrain signal, combustion misfire recognition is switched off in the Engine Control Module (ECM).*

- *Only check the rough terrain signal if the malfunction "18014 (P1606) rough terrain info/engine torque from ABS cont. mod. Electrical malfunction in circuit" is stored DTC memory.It is possible that the malfunction "Combustion misfire" is also stored in DTC memory as a side effect and it can be disregarded.*

- *The wire connection and rough terrain signal are monitored by the Engine Control Module (ECM).*

24-191

Test requirement:

- Control module coding OK ⇒ Page 01-71 .

Test sequence

- Switch ignition off.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Check the following wire connection for open circuit and short circuit to Ground (GND) and B+:

Test box VAG1598/31 Socket	ABS control module (w/EDL) -J104- Terminal
74	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

If no malfunctions are found in wire:

- Replace ABS control module.

If the malfunction is indicated again after

replacing the ABS control module:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

24-192

Data transfer between Engine Control Module (ECM) and CAN capable control modules, checking

Notes:

- *Data exchange between individual control modules occurs via a bus system.*
- *The term "CAN-bus" refers to a system that transports and distributes data.*
- *The wire connections between the control modules, via which data is transferred, are referred to as data wires.*
- *Data is transferred to the connected control modules serially (one after the other) via these data wires (i.e. engine speed, accelerator position).*

Checking bus system

The DTC table suggested checking the data exchange between the Engine Control Module (ECM) and CAN capable control modules.

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-

9 .

Ignition must remain switched on for this.

24-193

Rapid data transfer	**HELP**
Select function XX	

When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read Measuring Value Block	**Q**
Input display group number XXX	

When indicated on display:

- Press buttons -1-, -2- and -5- to select "display group number 125" and press -Q- button to confirm input.
- Check indications in display fields 1 through 4.

  CAN capable control modules connected to the Engine Control Module (ECM) are indicated:

  - No indication: Control module not CAN capable
  - Indication 1: CAN capable control module is connected to databus
  - Indication 0: CAN capable control module is not connected to databus

Note:

Measuring value blocks 125 and 126 indicate the components that are part of the powertrain data bus.

- Press →button.

24-194

Rapid data transfer HELP **Select function XX**	When indicated on display: - Press buttons -0- and -6- to select "End output" and press -Q- button to confirm input.
Rapid data transfer HELP **Insert address word XX**	When indicated on display: - Press button 0- twice to select "Automatic test sequence", address word 00. Press -Q- button to confirm input. ♦ DTC memory of all OBD capable systems in the vehicle will be checked. When a control module responds with its identification, the display indicates the number of stored errors or indicates "no malfunctions recognized". DTCs stored in the system are indicated in sequence and printed out. Then the VAG1551 scan tool sends the next address word.
V.A.G - ON BOARD DIAGNOSTIC HELP **1 - Rapid data transfer*** **2 - Blink code output***	The automatic test sequence is over when the following indication appears on the display: If a malfunction related to the"powertrain databus" or the "CAN-bus" is indicated: - Check whether the Engine Control Module (ECM) and other CAN capable control modules installed are appropriate for this vehicle (part no. and coding).

24-195

If the correct control modules are installed:

- Check to be sure the multi-pin connectors of the control modules are securely connected.

If multi-pin connectors are properly secured:

- Check CAN bus system

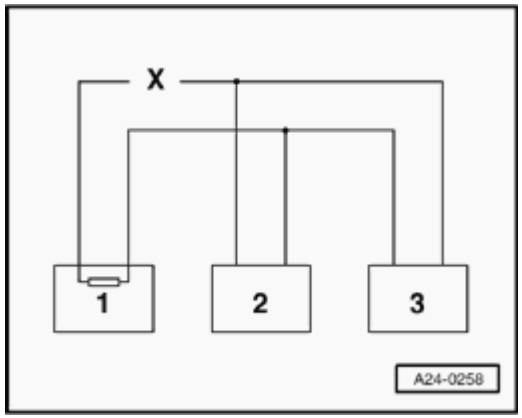
Checking a "two-line bus system"

Three or more control modules are communicating across a "two-line bus system".

- Analyze the DTCs stored in the memories of the control modules.

Note:

This analysis will help you locate the cause of the line malfunction.



Example 1:

From the DTCs stored in the memories, you have determined that control module 1 is not communicating with control modules 2 and 3.

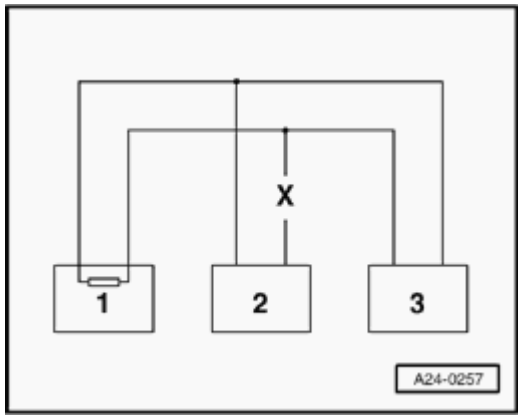
Control module	DTCs stored in DTC memories:
1	♦ Missing signal from control module 2 ♦ Missing signal from control module 3
2	♦ Missing signal from control module 1
3	♦ Missing signal from control module 1

- Switch ignition off.
- Disconnect the control modules connected across the bus wires and check the bus wires for an open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Replace control module 1 if no malfunctions can be found in the bus wires.

24-197



Example 2:

From the DTCs stored in the memories, you have determined that control module 2 is not communicating with control modules 1 and 3.

Control module	DTCs stored in DTC memories:
1	♦ Missing signal from control module 2
2	♦ Missing signal from control module 1 ♦ Missing signal from control module 3
3	♦ Missing signal from control module 2

- Switch ignition off.
- Disconnect the control modules connected across the bus wires and check the bus wires for an open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Replace control module 2 if no malfunctions can be found in the bus wires.

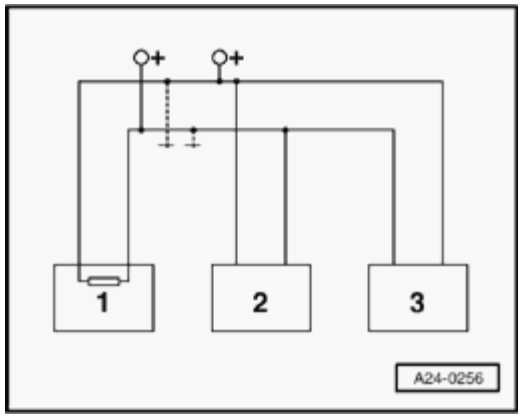
24-198

Example 3:

Using the DTCs stored in the memories, you have determined that none of the control modules are sending or receiving signals.

Control module	DTCs stored in DTC memories:
1	♦ Powertrain databus faulty
2	♦ Powertrain databus faulty
3	♦ Powertrain databus faulty

- Switch ignition off.



- Disconnect the control modules connected across the bus wires and check bus wires for a short circuit to B+ and Ground (GND).

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

24-199

If you cannot determine a cause for the DTC "Powertrain databus malfunction, check whether the DTC is caused by one of the control modules.

All control modules that use the CAN-bus are still disconnected. Ignition is switched off.

- Connect one of the control modules.
- Connect VAG 1551 scan tool. Switch ignition on, and erase the DTC memory of the control module you just connected. End scan tool output using the "End Output" function 06.
- Switch ignition off and then on.
- Leave ignition on for 10 seconds. Then, read the DTC memory of the control module you just connected.
- If the DTC "Powertrain databus malfunction" is displayed, replace the control module you just connected.
- If the DTC "Powertrain databus malfunction" is not displayed, connect the next control module and repeat the procedure.

28-1

Ignition system, checking

General notes on ignition system

- *The battery should only be disconnected and reconnected when the ignition is turned off, since otherwise the Engine Control Module (ECM) can be damaged.*
- *The Engine Control Module (ECM) is equipped with an On Board Diagnostic (OBD)*
- *For the electric components to work properly, a voltage of at least 12.7 V is required.*
- *It is possible that the control module will recognize a malfunction and store a DTC during some tests. After completing all tests and repairs, DTC memory should therefore be checked and erased if necessary.*
- *If the engine only starts briefly and then turns off again after troubleshooting, repair or checking of the components, it may be that the immobilizer is blocking the Engine Control Module (ECM). DTC memory must then be checked and if necessary, control module must be adapted.*

Safety precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- Do not touch or pull off ignition wires when engine is running or turning at starting RPM.
- Always switch ignition off before disconnecting or reconnecting wires for the injection and ignition system, including high voltage wiring and test leads.
- If engine is to be cranked at starting RPM without starting (e.g. for compression testing), disconnect connector from ignition coils and from fuel injectors.
- It is possible that the control module will recognize a malfunction and store a DTC during some tests. After completing all tests and repairs, DTC memory should therefore be checked and erased if necessary. Readiness code must be generated after DTC memory is erased ⇒ Page 01-82 .
- Always switch ignition off before cleaning engine.

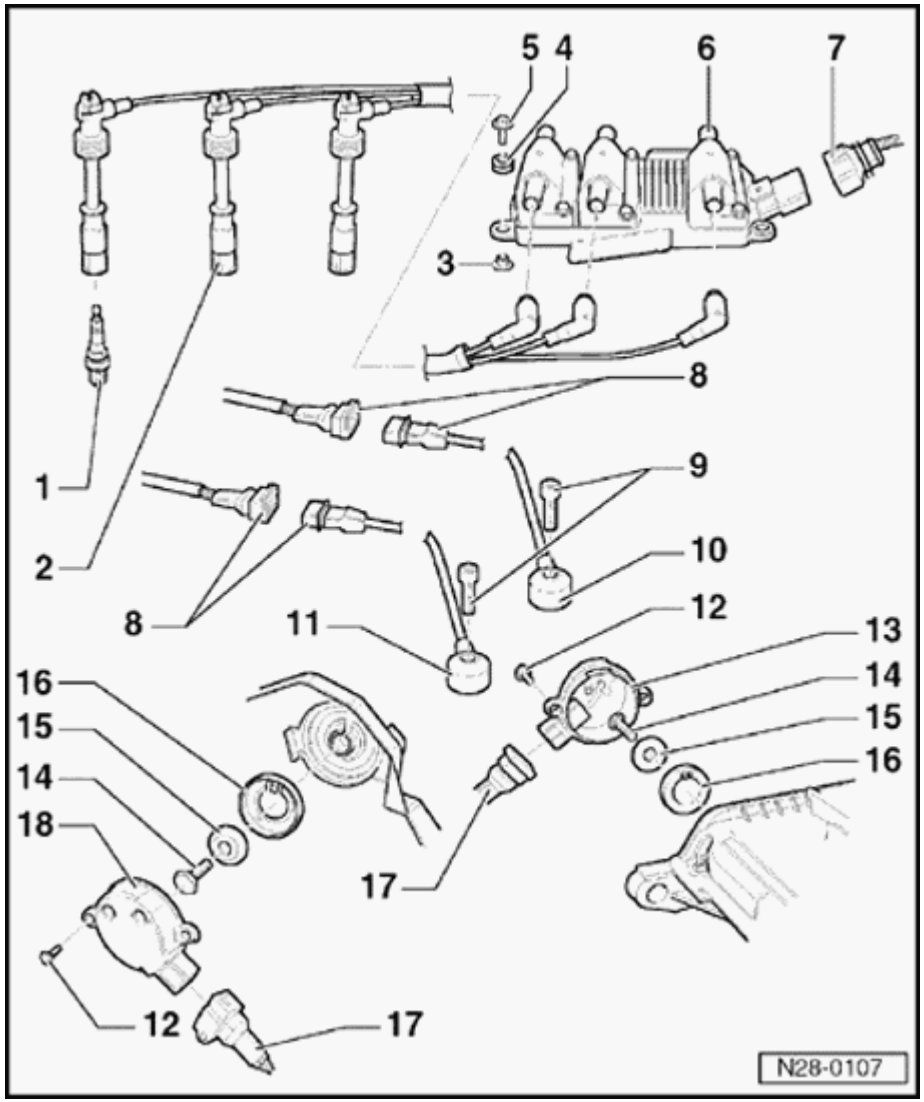
- The battery should only be disconnected and reconnected when the ignition is turned off, since otherwise the Engine Control Module (ECM) can be damaged.

28-3

Technical data, ignition

Engine identification	ATQ (2.8 L / 5V/ 147 kW-engine)
Idle speed Engine speed cannot be adjusted, it is regulated by idle stabilization	720 to 820 RPM (front wheel drive) 630 to 730 RPM (all wheel drive)
Engine speed (RPM) limitation via fuel injector shut-off	 about 6800 RPM
Ignition timing is determined in the control module It is not possible to adjust the ignition timing	
Ignition system	Dual-spark ignition system with three ignition coils
Spark plugs	Tightening torque 30 Nm.
Firing sequence	1-4-3-6-2-5

28-4



Ignition system components, removing and installing

1 - Spark plug, 30 Nm

- Remove and install with 3122 B

2 - Spark plug connectors with ignition wires

3 - Spacer sleeve

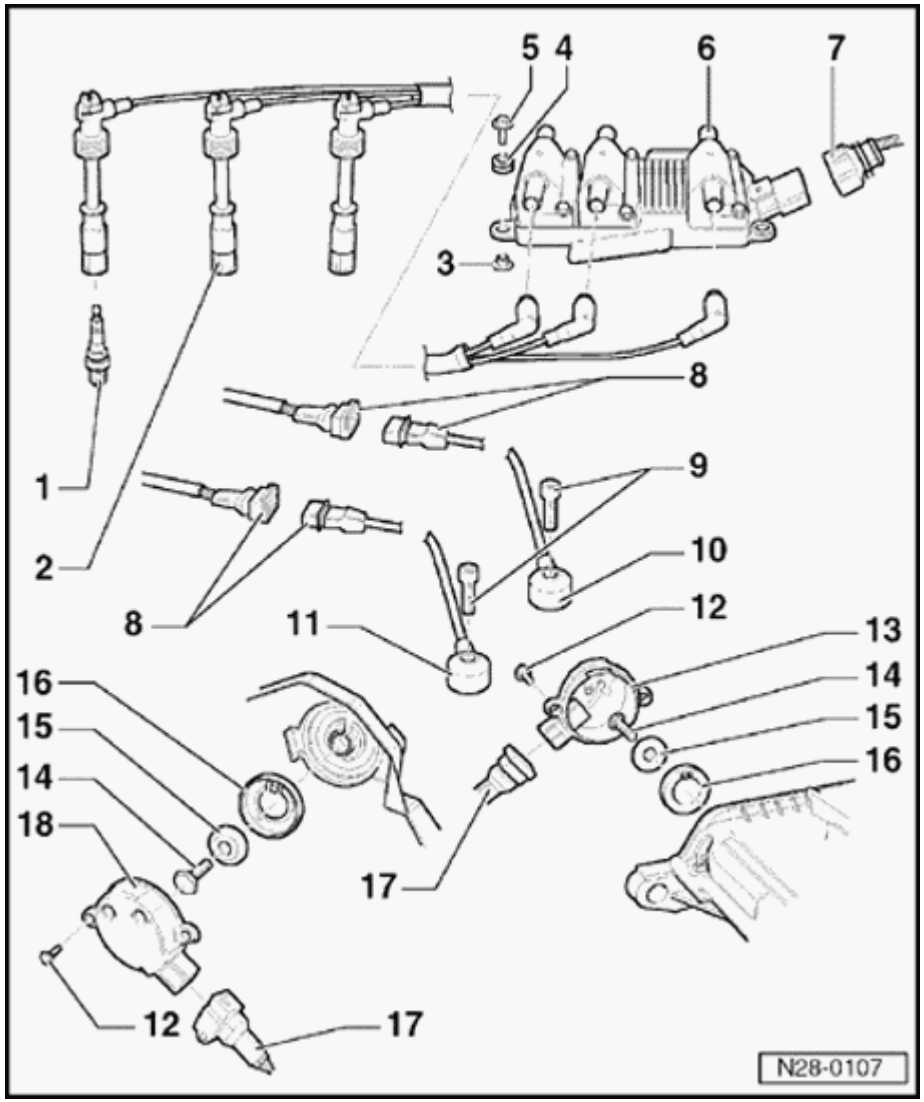
4 - Rubber grommet

5 - 10 Nm

6 - Ignition coils (-N-, -N128-, -N158-)

- With power output stage -N122-
- With marking for ignition wires, do not interchange

28-5



7 - 5-pin harness connector

- Black

8 - 3-pin harness connector

- Terminals are gold-plated

9 - 20 Nm

- Tightening torque affects function of Knock Sensor (KS)

10 - Knock Sensor (KS) 2 -G66-

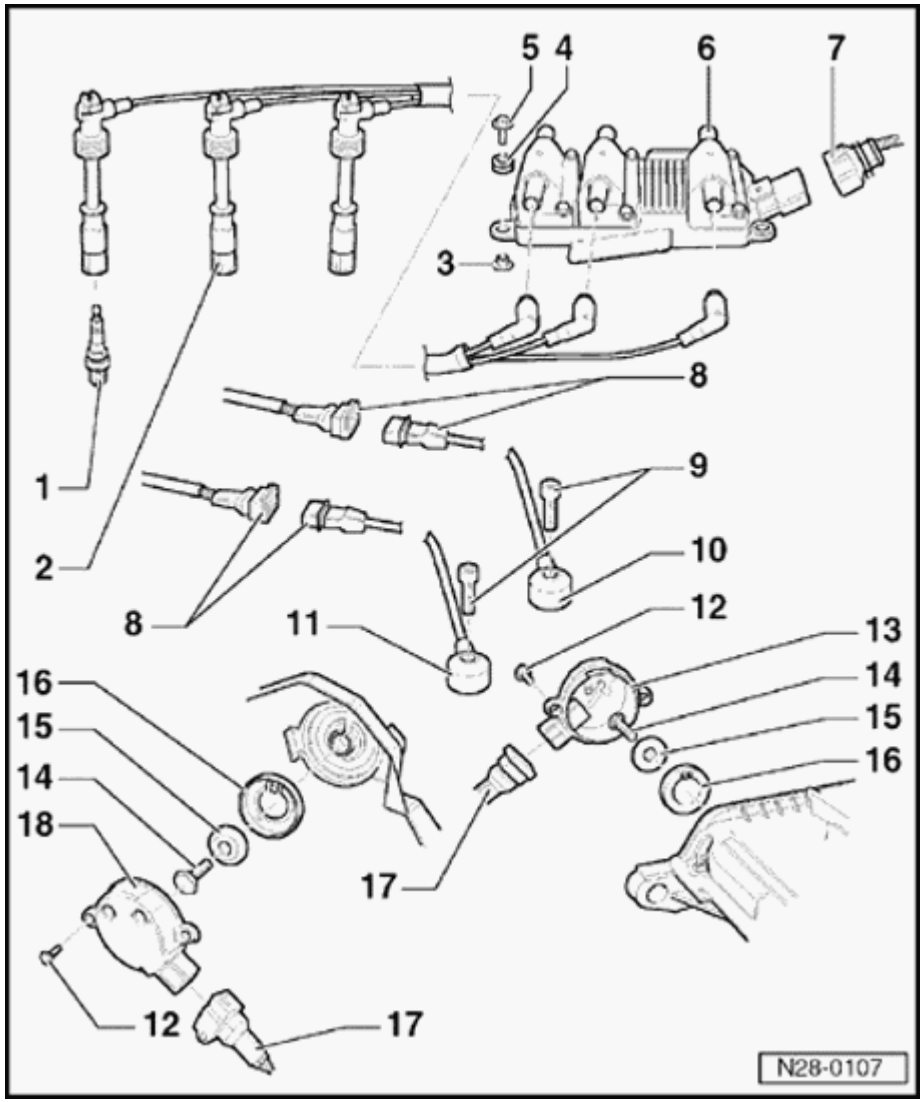
- Bank 2
- Terminals of sensor and connector are gold-plated

11 - Knock Sensor (KS) 1 -G61-

- Bank 1
- Terminals of sensor and connector are gold-plated

12 - 10 Nm

28-6



13 - Camshaft Position (CMP) sensor 2 -G40-

- Bank 2

14 - 25 Nm

15 - Washer

- Conical

16 - Face plate

- for Camshaft Position (CMP) sensor
- note position when installing

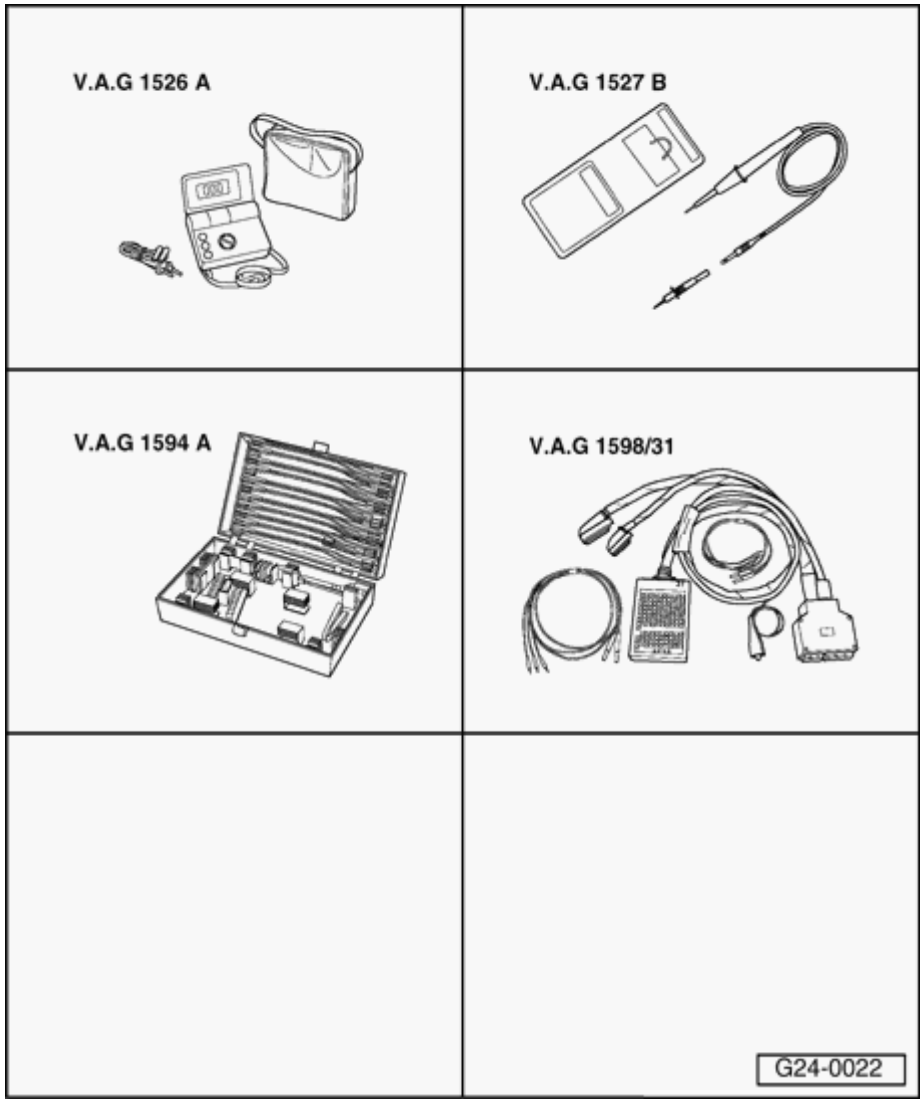
17 - 3-pin harness connector

- Black
- for Camshaft Position (CMP) sensor -G40- or -G163-

18 - Camshaft Position (CMP) sensor 2 -G163-

- Bank 1

28-7



Ignition coils, checking

Special Tools and Equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31

28-8

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

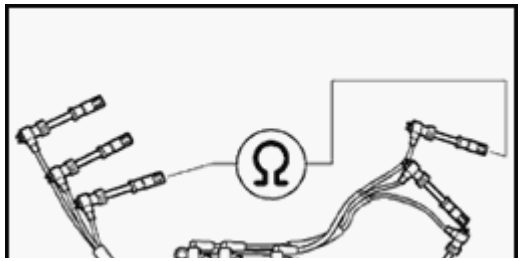
Notes:

- *Ignition coils and power output stage are a common part.*
- *Primary resistance of ignition coils cannot be measured.*
- *Secondary resistance must first be measured with the ignition wires connected to the ignition coils via the spark plug connectors of the corresponding cylinder (This measurement will include measurement of the shielded resistances of the ignition wires).*

- Disconnect 5-pin connector from ignition coils.

Check ignition coils (-N-, -N128- and -N158-)

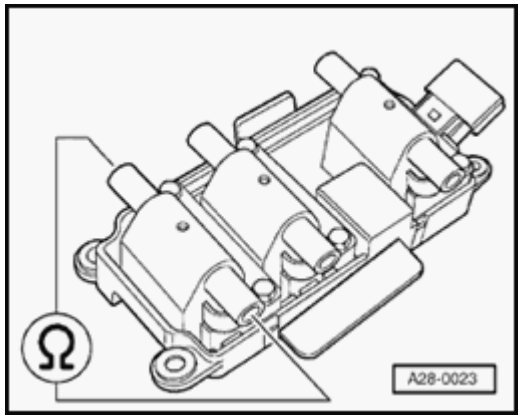
- Pull the ignition wires from the spark plugs.



- In order to perform a resistance measurement, connect multimeter between both spark plug connectors of the respective ignition circuit to be checked.
  - Specification: each 16 to 27 kΩ

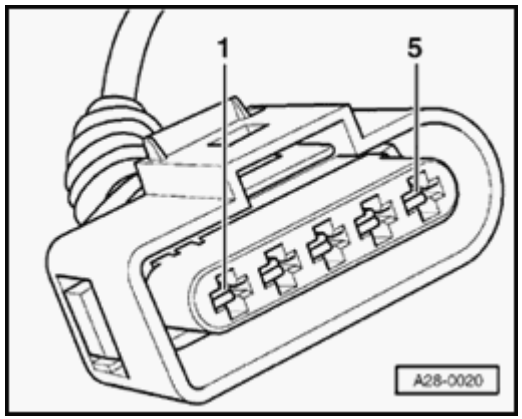
- If the specified values are not reached, disconnect ignition wires from ignition coils and perform a separate resistance measurement at the ignition wires and at the ignition coils.

28-9



- In order to perform a resistance measurement, connect multimeter between both ignition wire connectors connectors of the ignition coil to be checked.
  - Specification: 8 to 14 kΩ
- In order to perform a resistance measurement, connect multimeter between both ignition wire connectors connectors of the ignition wire to be checked.
  - Specification: 3 to 7 kΩ
- Replace faulty components if the specified values are not reached again.

28-10



Checking Ground (GND) supply of power output stage

- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
2	B+

♦ LED must light up.

If LED does not light up:

- Check the wire connection for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit if necessary.

28-11

Checking voltage supply to ignition coils

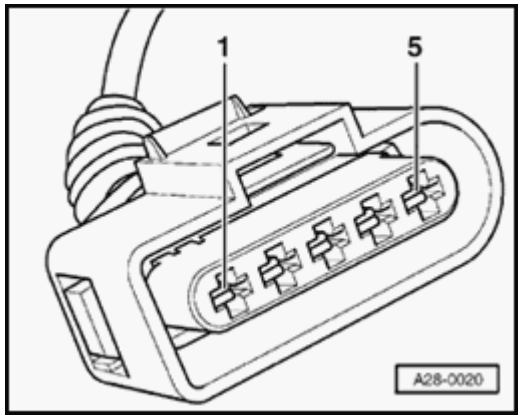
Note:

Voltage is supplied to ignition coils via Fuel Pump (FP) relay.

Test requirement:

- Fuse for ignition coils OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*



- Connect VAG1527B voltage tester as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

- Operate starter.
  - ♦ LED must light up.

If LED does not light up:

- Check the wire connection for open circuit:

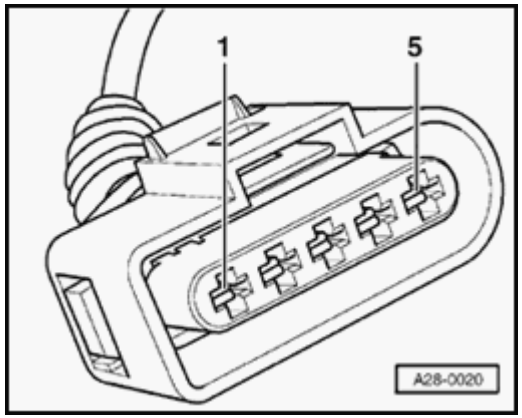
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Repair open circuit if necessary.

28-12

Checking activation

- Disconnect connectors from all six fuel injectors. (afterward check DTC memory)



- Connect VAG1527B voltage tester as follows:

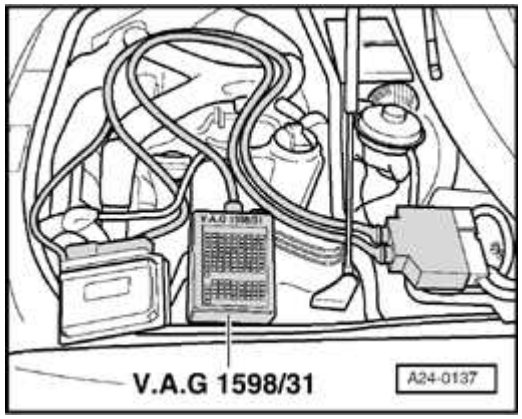
Harness connector Terminal	Measure to
3	Engine Ground (GND)
4	Engine Ground (GND)
5	Engine Ground (GND)

- Operate starter for a few seconds.
  - ♦ LED must blink (brief blink signal).

If specified values are not obtained:

- Switch ignition off.
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

28-13



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

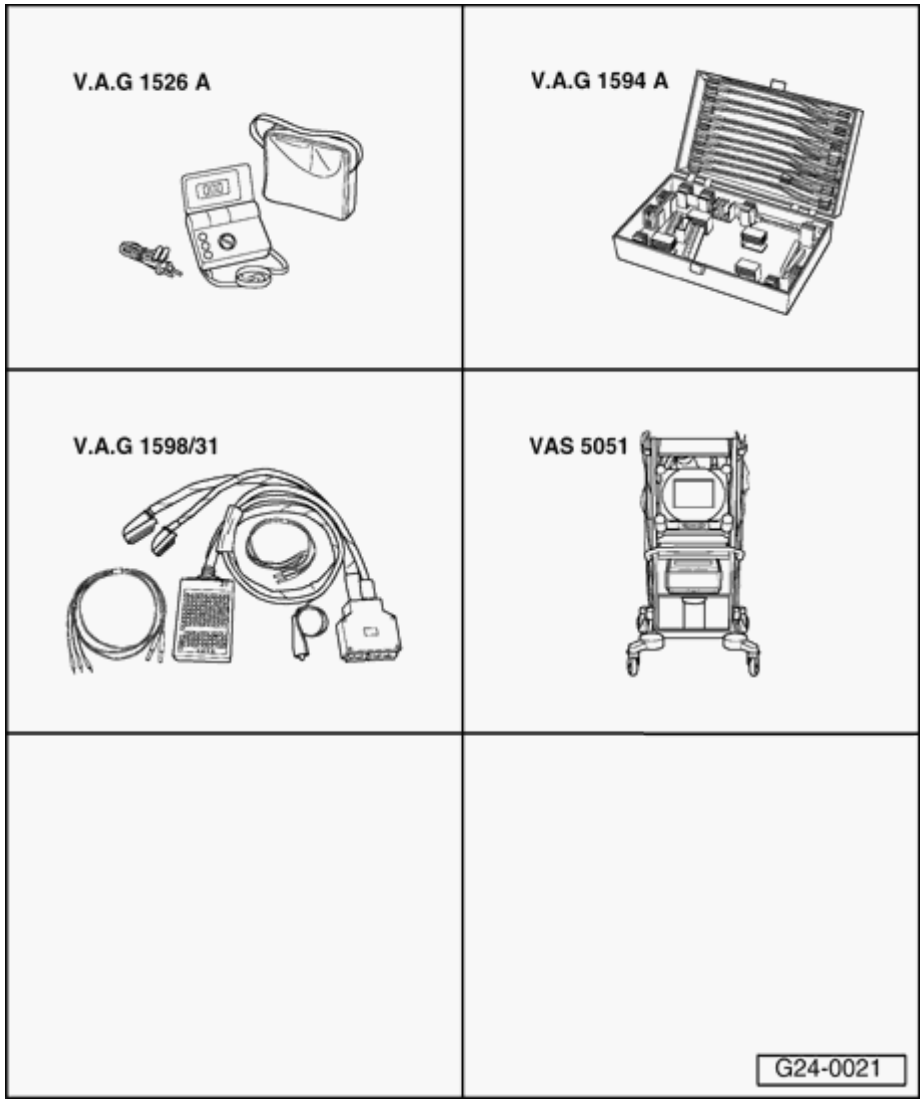
Harness connector Terminal	VAG1598/31 test box Socket
3	102
4	103
5	94

- Repair open circuit or short circuit if necessary.

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

28-14



Intake Air Temperature (IAT) sensor -G42-, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

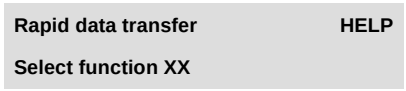
28-15

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

Test sequence

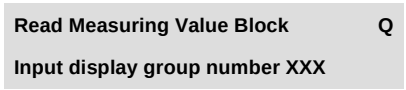
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Ignition must remain switched on for this.



➢ When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



➢ When indicated on display:

- Press buttons -0-, -0- and -4- to select "display group number 004" and press -Q- button to confirm input.



➢ Indicated on display:

- Check specified value for Intake Air Temperature (IAT) sensor in display field 4:

28-16

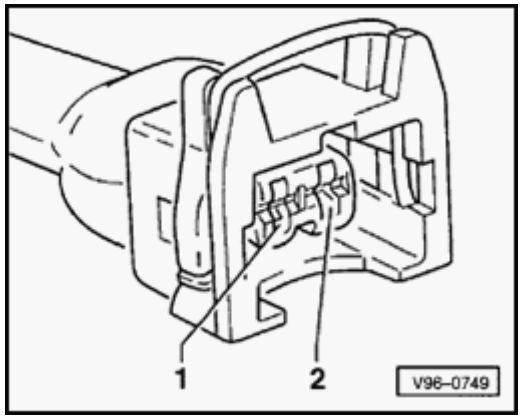
	Display fields			
	1	2	3	4
Display group 004: Intake Air Temperature (IAT), engine at idle				
Display	xxxx/min	xx.xxx volts	xxx.x °C	**xxx.x °C**
Indicated	Engine speed (RPM)	Battery voltage	Coolant temperature	**Intake Air Temperature (IAT)**
Functional range	630 to 6800 RPM	10.000 to 15.000 V	-48.0 to 143.0 °C	**-48.0 to 143.0 °C**
Specified value	xxxx/min	12.000 to 15.000 V	80.0 to 110.0 °C	**From ambient temperature up to 120 °C** [1)]

1) Approximate values: While driving, up to 24 °C above ambient temperature. If heated while standing, up to 120 °C is possible.

28-17

Checking wire connections

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
1	85
2	108

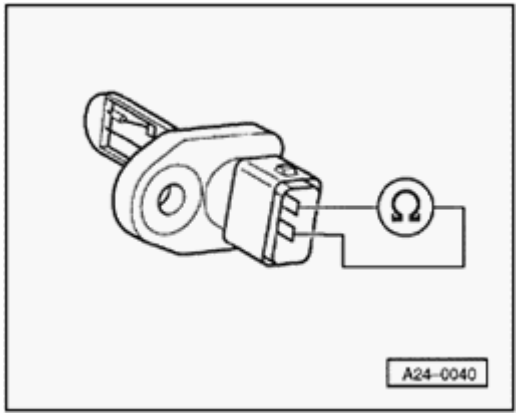
- Check both wires to each other for short circuit.
- Repair open circuit or short circuit if necessary.

28-18

If no malfunctions are found in wire:

Check sensor:

- Disconnect connector from Intake Air Temperature (IAT) sensor.



- Connect multimeter at sensor for resistance measurement.

Specified values

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

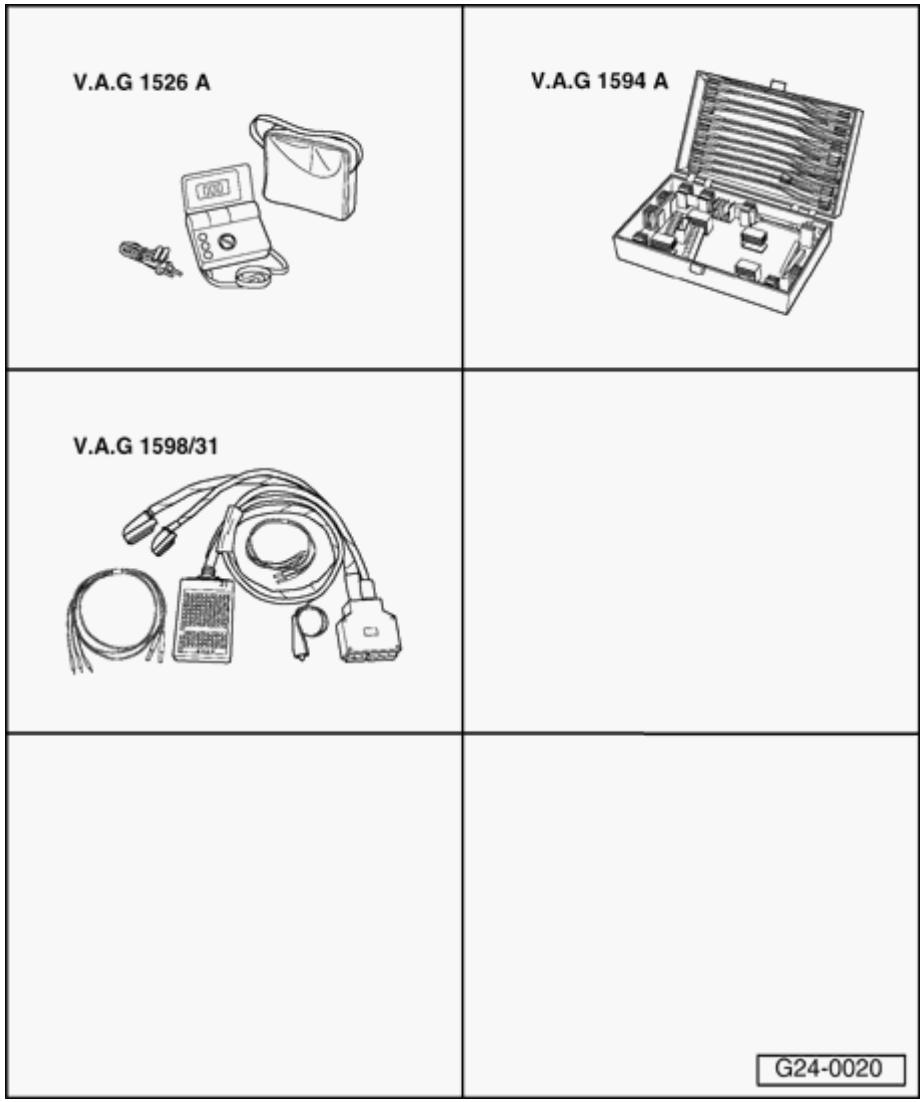
Example:

If air temperature is in a range from 0 °C to 20 °C, the resistance value must be between 5 kΩ and 2.4 kΩ

If specified value is not obtained:

- Replace Intake Air Temperature (IAT) sensor.

28-19



Engine speed (RPM) sensor -G28-, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31

28-20

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

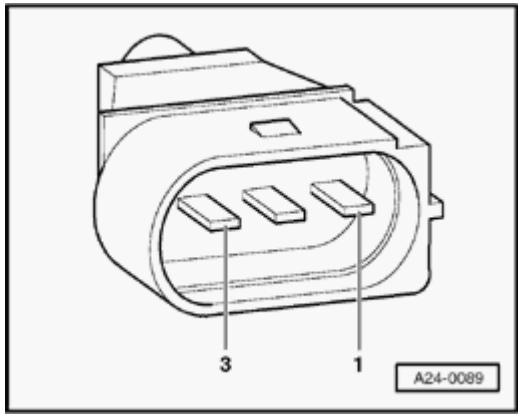
Note:

The engine speed (RPM) sensor detects RPM and reference marks. The engine cannot be started without a signal from the engine speed (RPM) sensor -G28-. If the engine speed (RPM) sensor -G28- signal fails while the engine is running, the engine will stop immediately.

Test sequence

- Before performing test, check sensor for proper installation and proper fitting.

- Disconnect harness connector for the engine speed (RPM) sensor (identification: gray harness connector).



- Connect multimeter between terminal 2 and 3 for resistance measurement.

  - Specification: 730 to 1000 Ω

Note:

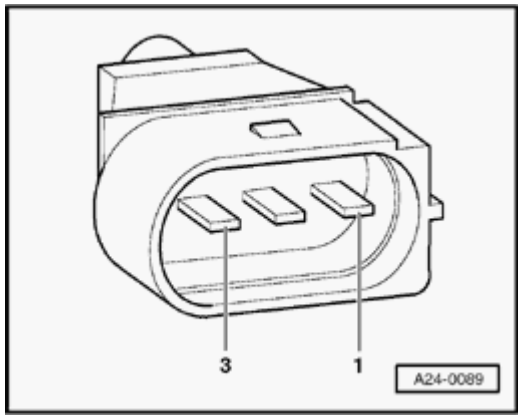
Resistance value of the engine speed (RPM) sensor is based on a temperature of 20 °C. Resistance increases as temperature increases.

28-21

If specified value is not obtained:

- Replace engine speed (RPM) sensor.

If specified value is obtained:



- Connect multimeter to terminals 2 and 1 (shielding) and to terminals 3 and 1 (shielding) for resistance measurement.
  - Specification: each ∞ Ω (no continuity)

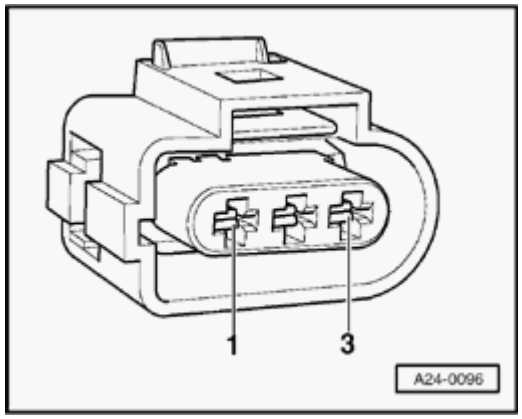
If specified value is not obtained:

- Replace engine speed (RPM) sensor.

If specified value is obtained:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

28-22



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

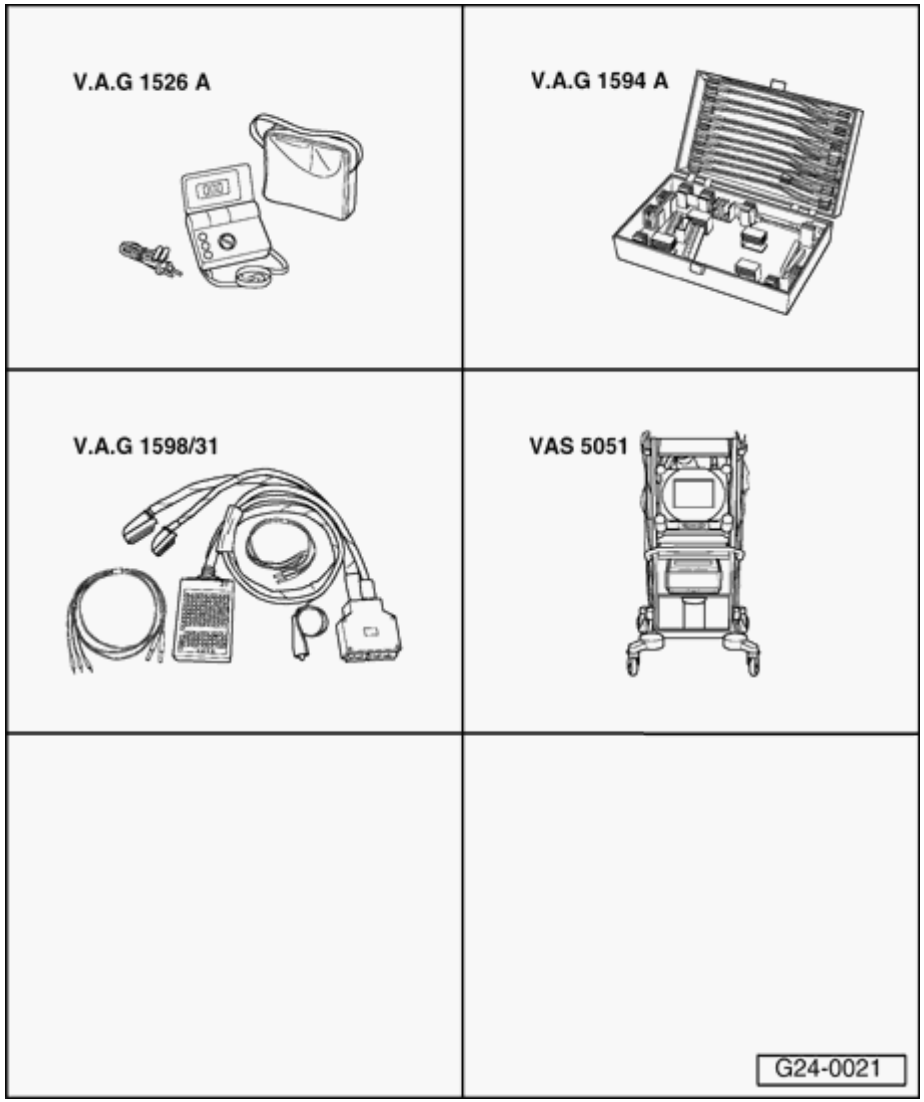
Harness connector Terminal	VAG1598/31 test box Socket
1 (shielding)	108
2 (Ground -GND-)	90
3 (signal)	82

- Repair open circuit or short circuit if necessary.

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

28-23



Engine Coolant Temperature (ECT) sensor -G62-, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31
- VAS5051 with VAG5051/1

- or

- VAG1551 with VAG1551/3B

28-24

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

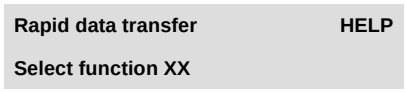
Test requirement:

- Engine cold

Test sequence

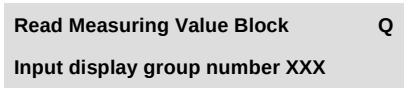
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -0- and -4- to select "display group number 004" and press -Q- button to confirm input.



Indicated on display:

- Check indication in display field 3.

28-25

	Display fields			
	1	2	3	4
Display group 004: Coolant temperature, engine at idle				
Display	xxxx/min	xx.xxx V	**xxx.x °C**	xxx.x °C
Indicated	Engine speed (RPM)	Battery voltage	**Coolant temperature**	Intake Air Temperature (IAT)
Functional range	630 to 6800 RPM	10.000 to 15.000 V	**-48.0 to 143.0 °C**	-48.0 to 143.0 °C
Specified value	xxxx/min	12.000 to 15.000 V	**Temperature value must rise evenly**	From ambient temperature up to 120 °C

If display field 3 does not have a realistic indication:

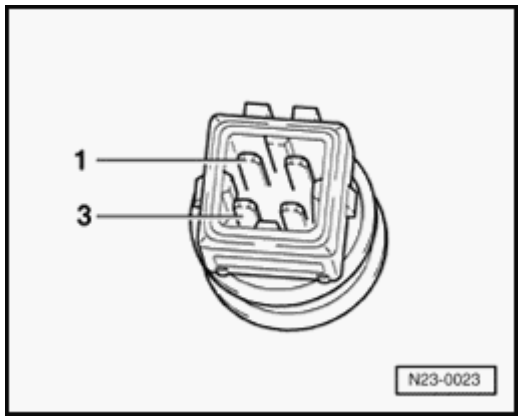
Note:

Intake air hose between Mass Air Flow (MAF) sensor and intake air elbow must be removed in order to be able to reach the coolant temperature sensor.

- Disconnect connector at coolant temperature sensor.

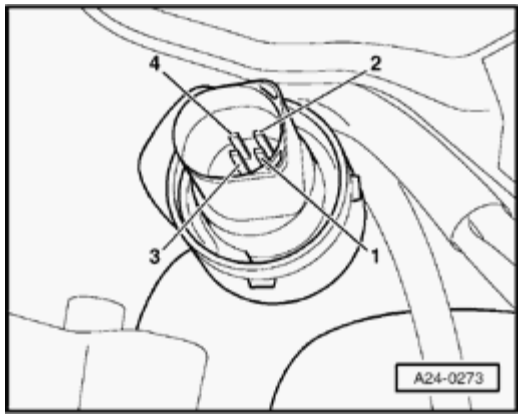
28-26

Coolant temperature sensor with square connector:



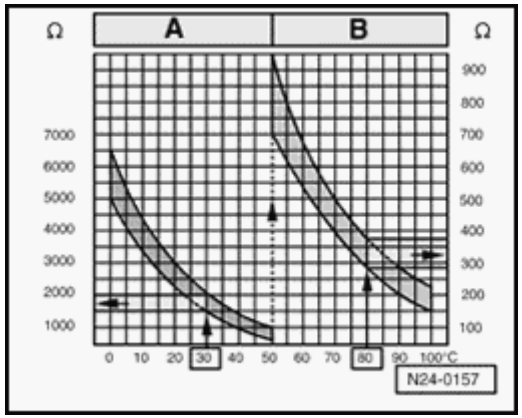
- Connect multimeter between terminal 1 and 3 of connector for resistance measurement.

Coolant temperature sensor with oval connector:



- Connect multimeter between terminal 3 and 4 of connector for resistance measurement.

28-27



All models

Range A shows the resistance values for the temperature range from 0-50 °C, and range B shows the values for the temperature range from 50-100 °C.

Read-out examples:

- 30 °C corresponds to a resistance of 1500 to 2000 Ω
- 80 °C corresponds to a resistance of 275 to 375 Ω

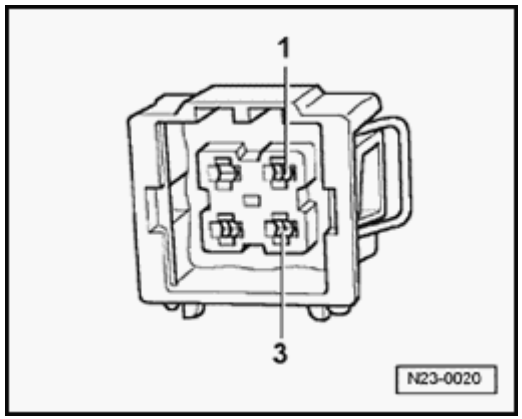
If specified value is not obtained:

- Replace coolant temperature sensor.

If specified value is obtained:

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

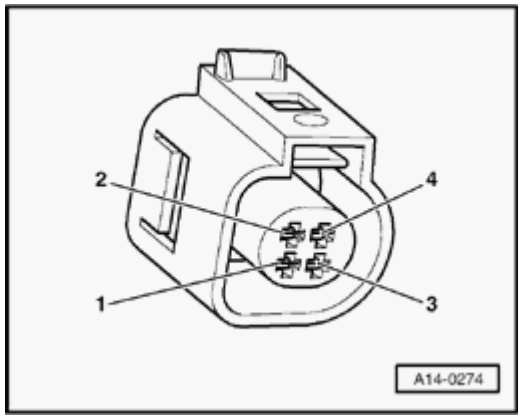
28-28



Coolant temperature sensor with square connector:

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
1 (signal)	93
3	108



Coolant temperature sensor with oval connector:

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector Terminal	VAG1598/31 test box Socket
3	108
4 (signal)	93

28-29

All models

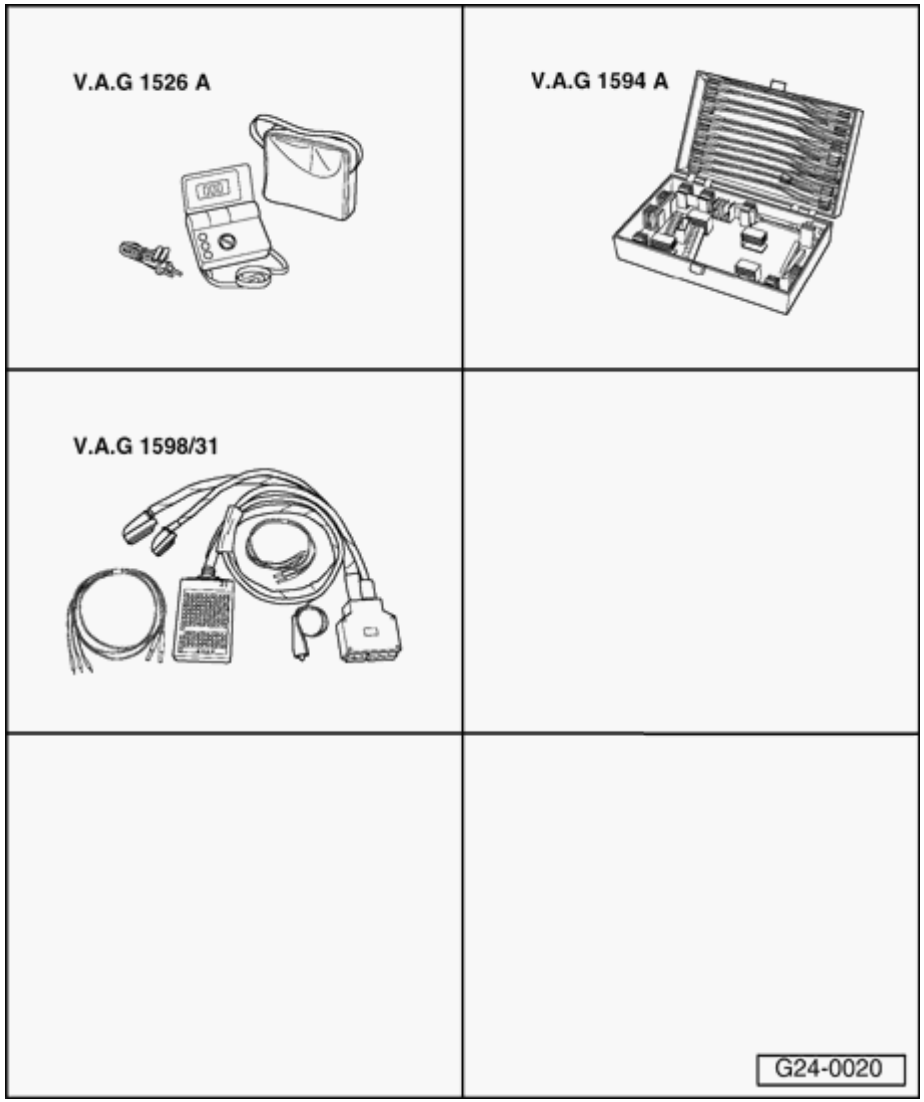
- Check both wires to each other for short circuit.

- Repair open circuit or short circuit if necessary.

If no malfunctions are found in wires:

- Replace Engine Control Module (ECM) ⇒ Page 24-21 .

28-30



Voltage supply for control module, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31

28-31

Test requirements:

- Fuse for Engine Control Module (ECM) OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

- Battery voltage at least 12.7 V

- Generator OK

Test sequence

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .

- Switch ignition on.

Note:

- *The plus voltage supply for the Engine Control Module (ECM) travels via connector terminal 3 (terminal 15) and connector terminal 62 (terminal 30).*

- *Ground (GND) supply of the Engine Control*

Module (ECM) travels via connector terminal 1 and terminal 2.

28-32

- Connect multimeter for voltage measurement as follows:

VAG1598/31 test box Socket	Measure to
1	B+
2	B+
62	Engine Ground (GND)

- Specification: approx. battery voltage

- Connect multimeter for voltage measurement as follows:

VAG1598/31 test box Socket	Measure to
3	Engine Ground (GND)

- Switch ignition on.

- Specification: approx. battery voltage

If specified values are not obtained:

- Check wire connections.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations binder*

28-33

Knock recognition control stop, checking

The following tests must be performed when a DTC is stored that relates to "knock recognition control limit reached".

	Possible cause	Corrective action
DTC for all cylinders or DTC for all cylinders in one row	♦ Poor fuel quality	- Change fuel quality (see operating instructions)
	♦ Knock sensor tightened to incorrect torque	- Loosen knock sensors and tighten to 20 Nm
	♦ Knock sensor faulty	- Check knock sensors ⇒ Page 28-41
	♦ Corrosion at harness connector	
	♦ Engine accessories loose	- Secure engine accessories
DTC for one Cylinder	♦ Engine damage	- Check compression pressure
	♦ Engine accessories loose	- Secure engine accessories

- Also check ignition angle retardation of the individual cylinders ⇒ Page 28-34 .

28-34

Check ignition angle retardation of the individual cylinders

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.

Rapid data transfer HELP
Select function XX

When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read Measuring Value Block Q
Input display group number XXX

When indicated on display:

- Press buttons -0-, -2- and -0- to select "display group number 020" and press -Q- button to confirm input.

Read Measuring Value Block 20 →
1 2 3 4

When indicated on display:

- Check indication in all display fields.

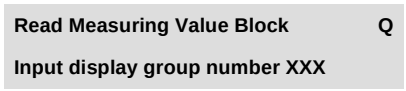
28-35

	Display fields			
	1	2	3	4
Display group 020: Ignition -knock control in driving operation				
Display	**xx.x ° KW**	**xx.x ° KW**	**xx.x ° KW**	**xx.x ° KW**
Indicated	**Ignition angle retardation cylinder 1 via knock control Knock sensor control**	**Ignition angle retardation cylinder 2 via knock control Knock sensor control**	**Ignition angle retardation cylinder 3 via knock control Knock sensor control**	**Ignition angle retardation cylinder 4 via knock control Knock sensor control**
Specified value	**0 to 12 ° KW**	**0 to 12 ° KW**	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes	Evaluation ⇒ Page 28-40			

Note:

The number values indicated in display fields 1 to 4 represent actual ignition angle retardation via knock control of the individual cylinders. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -1- to select "display group number 021" and press -Q- button to confirm input.



When indicated on display:

- Check indication in display field 1 and 2.

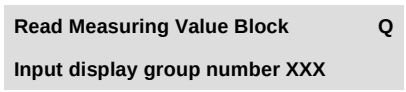
28-36

	Display fields			
	1	2	3	4
Display group 021: Ignition -knock control in driving operation				
Display	**xx.x ° KW**	**xx.x ° KW**		
Indicated	**Ignition angle retardation cylinder 5 via knock control Knock sensor control**	**Ignition angle retardation cylinder 6 via knock control Knock sensor control**		
Specified value	**0 to 12 ° KW**	**0 to 12 ° KW**		
Notes	Evaluation ⇒ Page 28-40			

Note:

The number values indicated in display fields 1 and 2 represent actual ignition angle retardation via knock control of the individual cylinders. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -2- to select "display group number 022" and press -Q- button to confirm input.



When indicated on display:

- Check indications in display field 3 and 4.

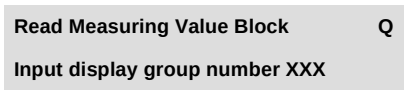
28-37

	Display fields			
	1	2	3	4
Display group 022: Ignition -knock control in driving operation				
Display	xxxx/min	xxx.x %	**xx.x ° KW**	**xx.x ° KW**
Indicated	Engine speed (RPM)	Engine load	**Ignition angle retardation cylinder 1 via knock control Knock sensor control**	**Ignition angle retardation cylinder 2 via knock control Knock sensor control**
Specified value	xxxx/min	12 to 100 %	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes			Evaluation ⇒ Page 28-40	

Note:

The number values indicated in display fields 3 and 4 represent actual ignition angle retardation via knock control of cylinders 1 and 2. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -3- to select "display group number 023" and press -Q- button to confirm input.



When indicated on display:

- Check indications in display field 3 and 4.

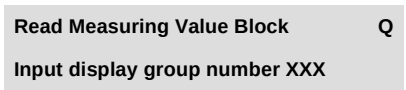
28-38

	Display fields			
	1	2	3	4
Display group 023: Ignition -knock control in driving operation				
Display	xxxx/min	xxx.x %	**xx.x ° KW**	**xx.x ° KW**
Indicated	Engine speed (RPM)	Engine load	**Ignition angle retardation cylinder 3 via knock control Knock sensor control**	**Ignition angle retardation cylinder 4 via knock control Knock sensor control**
Specified value	xxxx/min	12 to 100 %	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes			Evaluation ⇒ Page 28-40	

Note:

The number values indicated in display fields 3 and 4 represent actual ignition angle retardation via knock control of cylinders 3 and 4. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

- Press -C- button.



When indicated on display:

- Press buttons -0-, -2- and -4- to select "display group number 024" and press -Q- button to confirm input.



When indicated on display:

- Check indications in display field 3 and 4.

28-39

	Display fields			
	1	2	3	4
Display group 024: Ignition -knock control in driving operation				
Display	xxxx/min	xxx.x %	**xx.x ° KW**	**xx.x ° KW**
Indicated	Engine speed (RPM)	Engine load	**Ignition angle retardation cylinder 5 via knock control Knock sensor control**	**Ignition angle retardation cylinder 6 via knock control Knock sensor control**
Specified value	xxxx/min	12 to 100 %	**0 to 12 ° KW**	**0 to 12 ° KW**
Notes			Evaluation ⇒ Page 28-40	

Note:

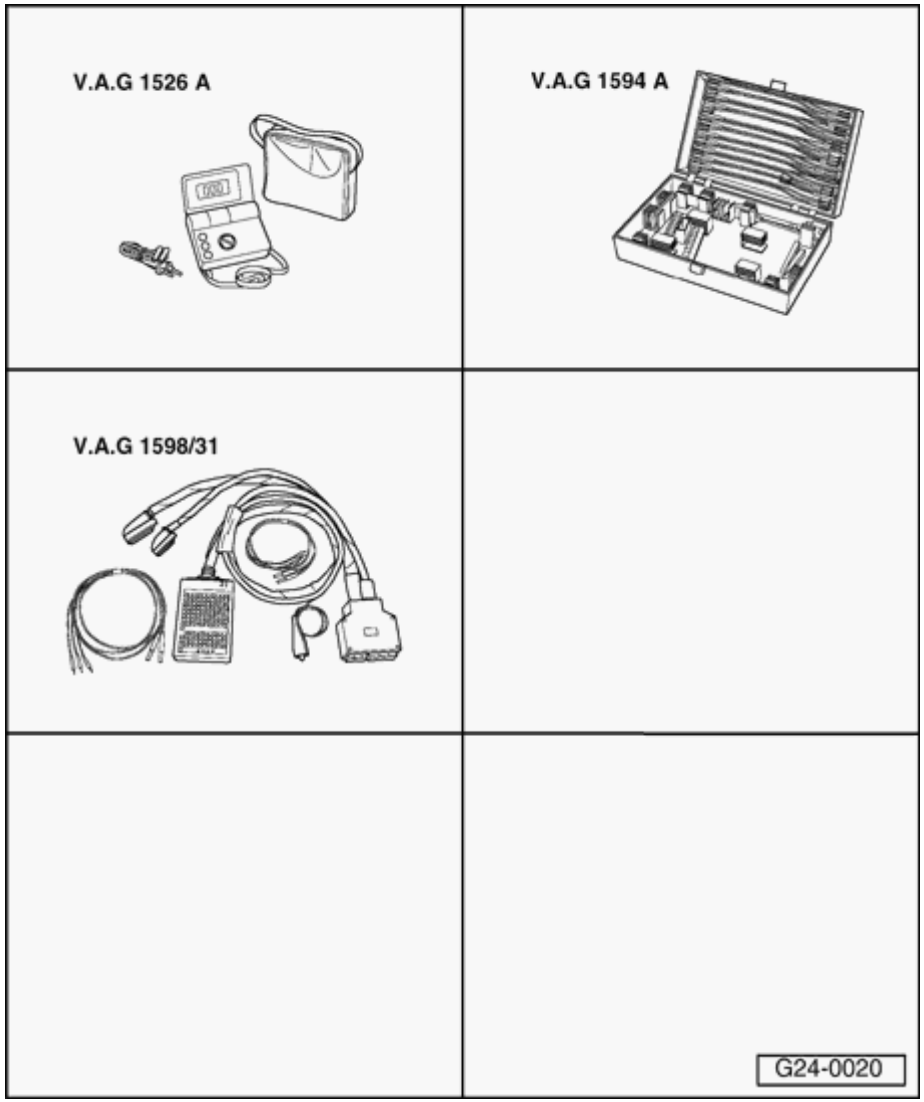
The number values indicated in display fields 3 and 4 represent actual ignition angle retardation via knock control of cylinders 5 and 6. Ignition angle retardation occurs in ° KW (crankshaft degrees) toward retardation.

28-40

Evaluation display groups 020/021/022/023/024 - ignition angle retardation

Indicated on display	Possible cause	Corrective action
All cylinders more than 12 ° KW	♦ Knock sensor faulty	- Check knock sensor ⇒ Page 28-41
	♦ Harness connector corroded	
	♦ Knock sensor incorrect tightening torque	- Loosen knock sensors and tighten to 20 Nm
	♦ Engine accessories loose	- Secure engine accessories
	♦ Poor fuel quality	- Change fuel quality (see operating instructions)
One cylinder deviates significantly from the others	♦ Harness connector corroded	- Check knock sensor ⇒ Page 28-41
	♦ Engine damage	- Check compression pressure: ⇒ Repair Manual, Engine Mechanical, Repair Group 15
	♦ Engine accessories loose	- Secure engine accessories

28-41



Knock sensors, checking

Special Tools and Equipment

- VAG1526A
- VAG1594A
- VAG1598/31

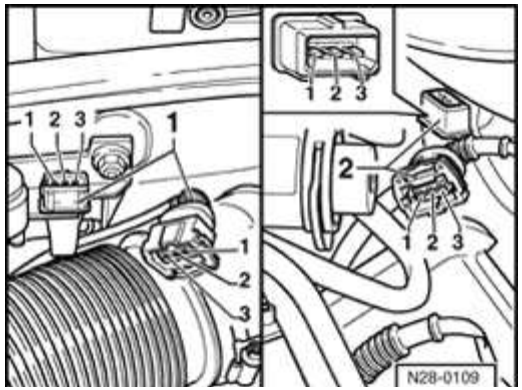
28-42

Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

Notes:

- *Knock Sensor (KS) 1 -G61- and Knock Sensor (KS) 2 -G66- themselves cannot be electrically tested.*
- *Use only gold-plated terminals when servicing harness connector for knock sensors.*
- *For the knock sensors to function properly, it is important that tightening torque be exactly 20 Nm.*
- *Check harness connector from knock sensor to wiring harness for corrosion.*

Check knock sensors

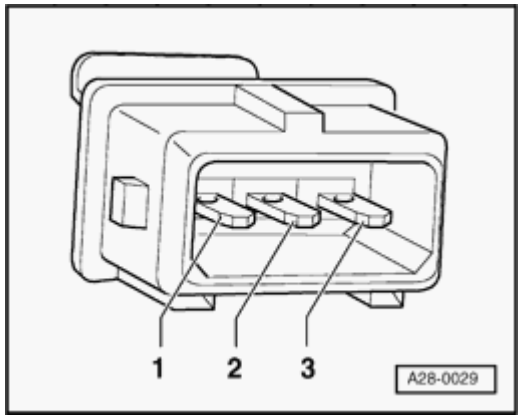


- Disconnect the harness connector of the relevant knock sensor in engine compartment.

Note:

Coolant reservoir screws must be removed and coolant reservoir must be placed to side in order to access harness connector for knock sensor for bank 2. The coolant hoses can remain connected.

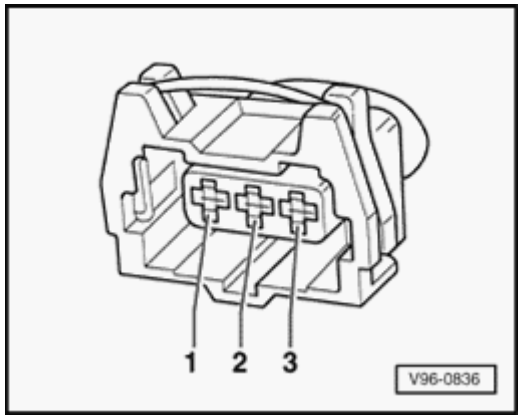
28-43



- Check all three terminals at knock sensor connector for short circuit to each other (terminal 1+2, 1+3, 2+3).
  - Specification: ∞ Ω (no continuity) - the wires must not have any connection to each other.
- If there is no connection , replace knock sensor.
- If no short circuit is detected, check knock sensor wires:

Check wires from knock sensors to Engine Control Module (ECM).

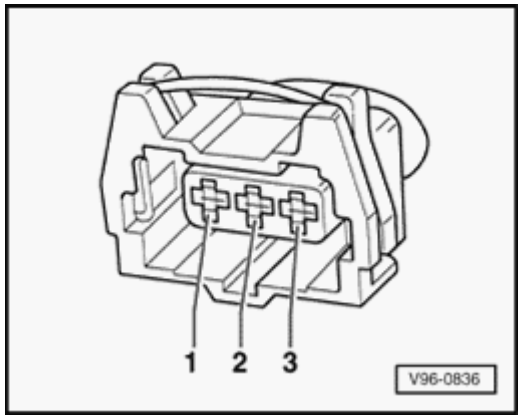
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .
- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:



Knock Sensor (KS) 1 -G61-

Harness connector Terminal	VAG1598/31 test box Socket
1 (signal)	106
2 (Ground -GND-)	99
3 (shielding)	108

28-44

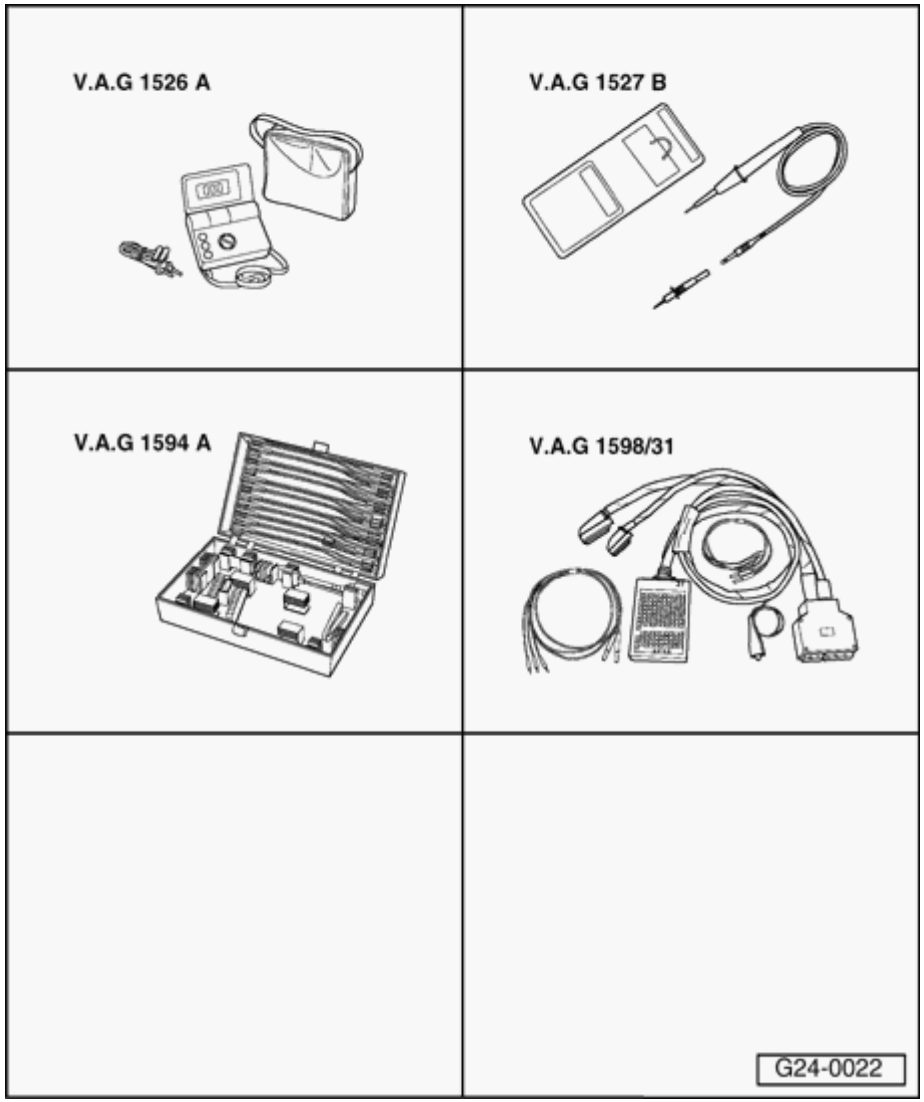


Knock Sensor (KS) 2 -G66-

Harness connector Terminal	VAG1598/31 test box Socket
1 (signal)	107
2 (Ground -GND-)	99
3 (shielding)	108

- Repair open circuit or short circuit if necessary.

28-45



Camshaft Position (CMP) sensor, checking

Special Tools and Equipment

- VAG1526A
- VAG1527B
- VAG1594A
- VAG1598/31

28-46

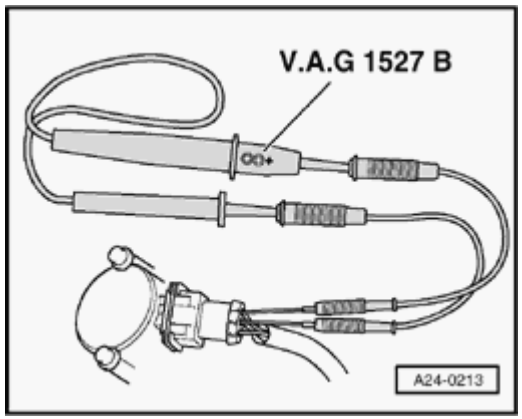
Component location ⇒ Overview of Component Locations, page ⇒ Page 24-5

Notes:

- *Camshaft Position (CMP) Sensor -G40- is located at rear of left cylinder block (bank 2).*
- *Camshaft Position (CMP) Sensor 2 -G163- is located at front of right cylinder block (bank 1).*

Checking activation

- Slide back rubber grommet at connector of the respective Camshaft Position (CMP) Sensor (connector remains connected to Camshaft Position (CMP) Sensor).



- Connect VAG1527B voltage tester between sockets 2 (CMP sensor signal) and 1 (B+).

Note:

Connector socket numbers are shown on the rear side of the connector.

- Operate starter for a few seconds.
  - LED must blink briefly at every second engine rotation.

28-47

Note:

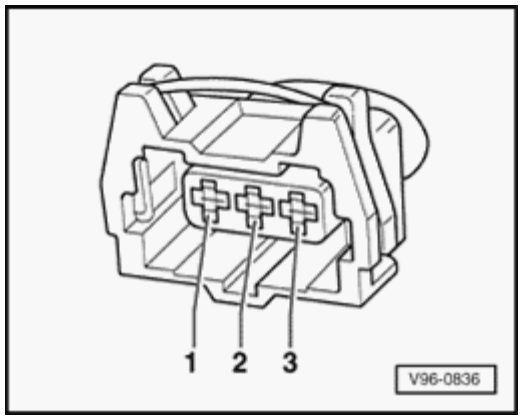
Voltage testers do not go out completely during low current pick-up between activations by the ECM, but rather continue to glow a little and then get significantly brighter during activation.

If LED does not blink:

Checking voltage supply

- Disconnect connector at respective Camshaft Position (CMP) sensor.

- Switch ignition on.

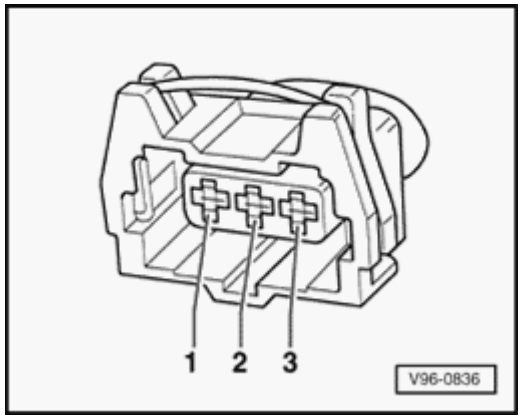


- Connect multimeter for voltage measurement as follows:

Harness connector Terminal	Measure to
1	Engine Ground (GND)

♦ Specification: about 5 V

28-48



Checking signal wire

- Connect multimeter for voltage measurement as follows:

Harness connector Terminal	Measure to
2	Engine Ground (GND)

♦ Specification: approx. battery voltage

Checking Ground (GND) wire

- Connect multimeter for voltage measurement as follows:

Harness connector Terminal	Measure to
3	B+

♦ Specification: approx. battery voltage

- Repair open circuit or short circuit if necessary.

If all specified values are being reached and the LED does not blink (measured between terminal 1 and 2 with starter and connector connected):

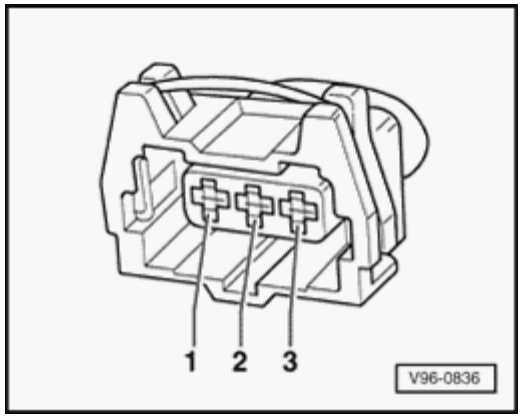
- Replace respective Camshaft Position (CMP) sensor.

28-49

If specified values are not obtained:

Checking wire connections between Camshaft Position (CMP) sensor and Engine Control Module (ECM)

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-17 .



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Camshaft Position (CMP) Sensor 2 -G40- (bank 2)

Harness connector Terminal	VAG1598/31 test box Socket
1 (B+)	98
2 (signal)	86
3 (Ground -GND-)	108

Camshaft Position (CMP) Sensor 2 -G163- (bank 1)

Harness connector Terminal	VAG1598/31 test box Socket
1 (B+)	98

2 (signal)	87
3 (Ground -GND-)	108

28-50

- Repair open circuit or short circuit if necessary.

- If, after erasing DTC memory for the sake of the test, a DTC relating to the Camshaft Position (CMP) sensor (hall sensor) is indicated again, even though all previous tests were OK, the following malfunction is possible:

  - Shutter wheel for Camshaft Position (CMP) sensor is not aligned properly.

Check phase position of Camshaft Position (CMP) sensor

- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

  Engine must run at idle for this.

Rapid data transfer **HELP**

Select function XX

➢ When indicated on display:

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read Measuring Value Block **Q**

Input display group number XXX

➢ When indicated on display:

- Press buttons -0-, -9- and -3- to select "display group number 093" and press -Q- button to confirm input.



When indicated on display:

- Check specified values of Camshaft Position (CMP) sensor

28-51

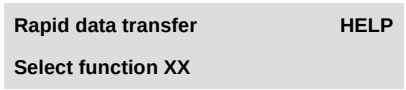
	Display fields			
	1	2	3	4
Display group 093: Phase position of Camshaft Position (CMP) sensor bank 1 and bank 2 with engine at idle.				
Display	xxx /min	xx %	**° KW**	**° KW**
Indicated	Engine speed	Engine load	**Phase position Bank 1**	**Phase position Bank 2**
Functional range	630 to 6800 RPM	12 to 100 %	**-20 to 15 ° KW**	**-20 to 15 ° KW**
Specified value	720 to 820 RPM 1) 630 to 730 RPM 2)	12 to 26 %	**-20 to 15 ° KW**	**-20 to 15 ° KW**
Notes			**If specified values are not reached, unscrew Camshaft Position (CMP) sensor and check whether shutter wheel is mounted properly at camshaft (if mounted improperly, locking lug will get squished when mounting bolt is tightened).** - Also check engine timing ⇒ Repair Manual, Engine, Mechanical, Repair Group 13, removing and installing toothed belt	

1) Front Wheel Drive Vehicles

2) All-Wheel Drive Vehicles

If specified values are obtained:

- Press → button.



Indicated on display (function selection):

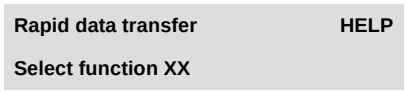
28-52

Misfire recognition, checking

Test sequence

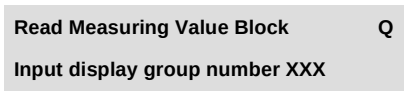
- Connect VAS5051 tester or VAG1551 scan tool and select the control module for engine electronics using "address word" 01 ⇒ Page 01-9 .

Engine must run at idle for this.



When indicated on display:

- Press buttons -0- and -8- to select "Read measuring value block" function 08. Press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -1- and -4- to select "display group number 014" and press -Q- button to confirm input.



When indicated on display:

- Check misfire recognition in display fields 3 and 4.

28-53

	Display fields			
	1	2	3	4
Display group 014: Misfire recognition				
Display	xxxx/min	xxx %	**xxx**	**---**
Indicated	Engine speed (RPM)	Load	**Number of combustion misfires**	**Misfire recognition**
Functional range	670 to 6800 RPM	12 to 100 %		**activated** **locked**
Specified value	720 to 820 RPM [1)] 630 to 730 RPM [2)]	12 to 26 %	**0 to 12**	**activated**
Notes			**If the specified value is exceeded: Check combustion misfires of the individual cylinders ⇒ Page 28-54**	

1) Front Wheel Drive Vehicles

2) All-Wheel Drive Vehicles

If specified value is obtained:

- Press →button.

Rapid data transfer HELP

< Indicated on display (function selection):

Select function XX

28-54

Check misfire recognition of the individual cylinders.

- Press -C- button.

Read Measuring Value Block Q

Input display group number XXX

When indicated on display:

- Press buttons -0-, -1- and -5- to select "display group number 015" and press -Q- button to confirm input.

Read Measuring Value Block 15 →

1 2 3 4

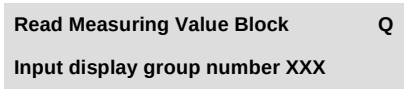
When indicated on display:

- Check misfire recognition in display fields 1 to 4.

	Display fields			
	1	2	3	4
Display group 015: Misfire recognition of cylinders 1, 2 and 3				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicated	**Number of combustion misfires, cylinder 1**	**Number of combustion misfires, cylinder 2**	**Number of combustion misfires, cylinder 3**	**Misfire recognition**
Functional range				**activated** **locked**
Specified value	**0 to 15**	**0 to 15**	**0 to 15**	**activated**
Notes	**If the specified value is exceeded: Evaluation ⇒ Page 28-56**			**---**

28-55

- Press -C- button.



When indicated on display:

- Press buttons -0-, -1- and -4- to select "display group number 014" and press -Q- button to confirm input.



When indicated on display:

- Check misfire recognition in display fields 1 to 4.

	Display fields			
	1	2	3	4
Display group 016: Misfire recognition of cylinders 4, 5 and 6				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicated	**Number of combustion misfires, cylinder 4**	**Number of combustion misfires, cylinder 5**	**Number of combustion misfires, cylinder 6**	**Misfire recognition**
Functional range				**activated** **locked**
Specified value	**0 to 15**	**0 to 15**	**0 to 15**	**activated**
Notes	**If the specified value is exceeded: Evaluation ⇒ Page 28-56**			**---**

28-56

Evaluation display group 014, display field 3 and display group 015 and 016, display fields 1, 2 and 3

Indicated on display	Possible cause	Corrective action
greater than 15	♦ spark plug defective ♦ spark plug connector defective ♦ Ignition coil or power output stage faulty	- Check spark plugs and ignition wires with connectors. - Check ignition coils and power output stages ⇒ Page 28-7
	♦ Fuel injector faulty	- Check fuel injectors ⇒ Page 24-36
	♦ Poor compression of one or more cylinders	- Check compression pressure: ⇒ Repair Manual, Engine Mechanical, Repair Group 15