01-1

On Board Diagnostic (OBD)

Function

The Multiport Fuel Injection (MFI) system is equipped with an Engine Control Module (ECM) -J220- with On Board Diagnostic (OBD) capability.

When malfunctions occur in sensors or components monitored by OBD, Diagnostic Trouble Codes (DTC) are stored in DTC memory.

Stored DTCs are identified using the VAG 1551 Scan Tool (ST) ⇒ Page 01-15 .

After the necessary repairs are completed, DTC memory must be erased ⇒ Page 01-40 .

OBD II legal regulations require a display (readiness code) that shows inspection readiness for the annual exhaust emissions test. The readiness code shows that every component and/or system that affects exhaust emissions, which can lead to the Malfunction Indicator Lamp (MIL) being switched on, has been operated at least once with positive results.

The readiness code is reset and/or erased and must be regenerated every time DTC memory is erased, the power supply to the ECM -J220- is interrupted (example: when connecting test box

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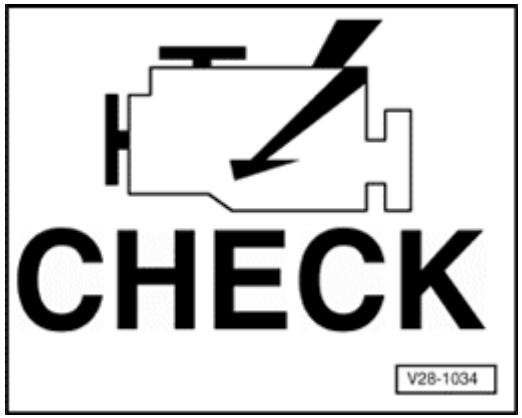
VAG 1598/19), or the battery has been disconnected ⇒ Page 01-62 .

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Malfunction Indicator Lamp (MIL) function, checking

If a malfunction is recognized by the Engine Control Module (ECM), this is indicated by the MIL coming on.



Malfunction Indicator Lamp (MIL)

Note:

When a recognized malfunction switches on the MIL, it will either blink or light continuously. In either case, DTC memory must be checked ⇒ Page 01-15 .

- *If the MIL starts to blink, there is a malfunction that can lead to damage of the Three Way Catalytic Converter (TWC). In this case, driving should only continue using reduced power. The malfunction must be rectified as quickly as possible.*
- *If the MIL lights continuously, there is a malfunction that affects exhaust emissions. In this case, DTC memory must be checked, and the malfunction must be rectified as quickly as possible.*
- *Some malfunctions may occur without causing the MIL to come on. When driveability or performance problems are reported, and there is no indication from the MIL, the operation of the MIL must be checked. In addition, DTC memory must be checked, as there may be malfunctions stored that do not switch the MIL on immediately.*

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Checking function

- Switch ignition on.

  MIL must light up.

- If MIL does not light when ignition is switched on, check wiring to MIL as follows:

Cause:	Remedy:
MIL is not triggered, or does not light, due to faulty wiring or open circuit.	- Switch ignition off. - Connect VAG 1598/22 test box. - Connect jumper wire to bridge test box sockets 2 and 17. - Switch ignition on. • MIL must light up. If MIL does not light: - Switch ignition off. - Check bulb for MIL. If bulb is OK: - Check wiring for open circuit between MIL and Motronic ECM - J220- using applicable wiring diagram.

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	If wiring is OK:
Malfunction: ▶	Motronic ECM -J220- is faulty; replace ⇒ Page 01-57 . - Check and erase Diagnostic Trouble Code (DTC) memory and generate new readiness code.

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If MIL lights up when ignition is switched on, continue checking as follows:

- Start engine and let run at idle.

  MIL must go out after a few seconds.

If MIL does not go out:

- Check Diagnostic Trouble Code (DTC) memory ⇒ Page 01-15 .

If there are no malfunctions stored in DTC memory:

Cause:	Remedy:
MIL is triggered continuously due to short circuit to Ground.	- Switch ignition off. - Connect VAG 1598/22 test box. - Check resistance between test box socket 17 and vehicle Ground, specified value: ∞ Ω (no continuity) If the specified value is not obtained: - Check for short circuit to Ground in wiring from Motronic Engine Control Module (ECM) -J220- to MIL. - Trace malfunction using applicable wiring diagram and repair as necessary.

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	If there is no continuity, and no short circuit to Ground:
Malfunction: ▶	Motronic ECM -J220- is faulty; replace ⇒ Page 01-57 . - Check and erase Diagnostic Trouble Code (DTC) memory and generate new readiness code.

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On Board Diagnostic (OBD) technical data

Memory

- Temporary memory and permanent memory (If the engine control module is disconnected from the Battery Positive Voltage (B+) supply, the readiness code and learning values will be erased. Any malfunctions stored in DTC memory are not erased)

Data output

- Rapid data transfer
- Additional malfunction indication by Malfunction Indicator Lamp (MIL) lighting up

ECM identification

⇒ Page 01-7 ; VAG 1551 Scan Tool (ST), connecting and selecting "Engine Electronics" address word 01

ECM functions

- The Motronic ECM -J220- performs different OBD functions, carried out with the ignition switched on or with the engine running. Following are the conditions required to carry out each of the specific functions.

Address words:

Address word 00: Automatic Test Sequence	r Ignition switched on -or- Engine running at idle
Address word 01: Engine Electronics	r Ignition switched on -or- Engine running at idle
Address word 33: OBD II (generic scan tool)	r Ignition switched on -or- Engine running at idle

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Functions under "Engine Electronics" address word 01:

Function 01: Check Control Module Version	Ignition switched on -or- Engine running at idle
Function 02: Check DTC Memory	Engine running at idle, otherwise crank engine with starter motor for at least 5 sec., then do not switch ignition off

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Function 03: Output Diagnostic Test Mode	Ignition switched on
Function 04: Basic Setting	Engine running at idle
Function 07: Code Control Module	Ignition switched on
Function 08: Read Measuring Value Block	Ignition switched on -or- Engine running at idle -or- Driving

Modes under address word 33:

Mode 1: Transfer diagnostic data	Ignition switched on -or- Engine running at idle
Mode 2: Transfer operating conditions	Ignition switched on -or- Engine running at idle
Mode 3: Check DTC memory	Ignition switched on -or- Engine running at idle
Mode 4: Erase diagnosis information	Ignition switched on -or- Engine running at idle
Mode 5: Output of HO2S signals	Ignition switched on -or- Engine running at idle
Mode 6: Transfer measuring values	Ignition switched on -or- Engine running at idle
Mode 7: Check DTC memory	Ignition switched on -or- Engine running at idle

- Under Address word 33, Mode 1 to Mode 7 can be addressed.
- Under Mode 1 individual measuring values can be displayed. Mode 1 is not recommended for use in an Audi Service department, because these values can be displayed much more precisely using address word 01 and "Basic Setting" function 04 or "Read Measuring Value Block" function 08.
- Mode 2 shows the operating conditions under which the stored malfunctions were recognized.
- With Mode 3, DTC memory is checked-with Mode 4, DTC memory is erased.

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- Mode 5 shows the statistical value of the oxygen sensors as mandated by law. As these values have no direct bearing on oxygen sensor diagnosis, Mode 5 is of no particular value in an Audi Service department.

- Under Mode 6, values can be checked for components and systems that are not continuously monitored.

- *With Mode 7 all malfunctions can be checked, even if they have not switched on the Malfunction Indicator Lamp (MIL) (if the MIL has not been switched on, there is no malfunction recognized under Mode 3)*

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VAG 1551/ VAG 1552 Scan Tool (ST), connecting and selecting "Engine Electronics" address word 01

Required special tools and test equipment

- VAG 1551 Scan Tool (ST) with VAG 1551/3 adapter cable

Note:

VAG 1552 scan tool can be used instead of VAG 1551, however there is no print-out capability.

Requirements

- Fuses for engine electronics OK
- Battery Positive Voltage (B+) OK (at least 11 volts)
- Engine and transmission Ground connections OK

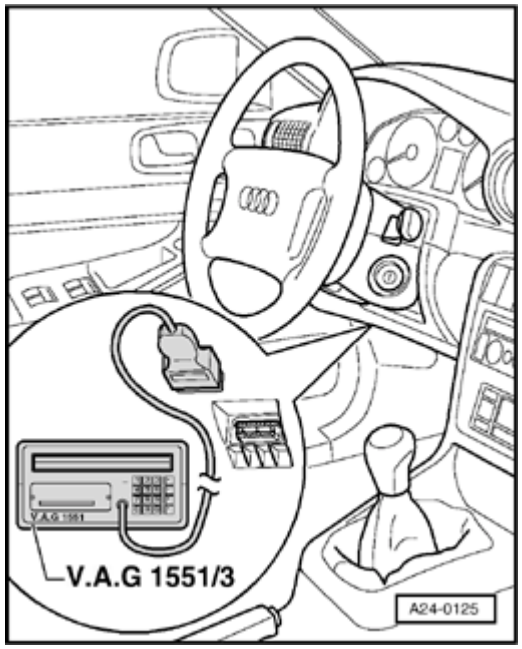
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

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- Fuel pump relay OK

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Connecting

- Locate Data Link Connector (DLC), under driver's knee bar to left side of steering wheel.
- Connect VAG 1551 Scan Tool (ST) with VAG 1551/3 adapter cable to DLC.
- Switch ignition on, or start engine, depending on function to be selected.

Notes:

- *If scan tool displays do not appear as indicated:*

⇒ *Scan tool operating instructions*

- *If "Error in communication link" is displayed, disconnect adapter cable at scan tool, reconnect, and repeat procedure.*
- Operate scan tool and advance through program sequence by following display:
- Press button -1- to select "Rapid data transfer" operating mode 01.
- Press buttons -0- and -1- to insert "Engine Electronics" address word 01, and press -Q- button to confirm input.

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Indicated on display (ECM identification and coding)

8D0 _ _ _ _ _ _ _ _	Engine Control Module (ECM) Part No.
1.8 L	Engine displacement
R4 / 5VT	Engine type:
	In-line (Reihenmotor), 4-Cyl.
	5- Valve, Turbocharged
MOTR	Motronic
HS	Manual transmission
AT	Automatic transmission
D..	ECM software version
Coding	ECM coding:
	See coding table ⇒ page
WSC 12345	Plant number: indicates where the VAG 1551 scan tool was used for the last coding and/or adaptation (as long as factory coding has not been changed, WSC 00000 is displayed)

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Notes:

If the ECM version that corresponds to the vehicle is not displayed, replace ECM ⇒ Page 01-57 . Incorrect ECM coding leads to:

- *Performance problems (e.g. jerky shifting, abrupt load changes, etc.*
- *Increased fuel consumption*
- *Elevated exhaust gas values*
- *Reduction in transmission service life*
- *Malfunctions not present are stored in DTC memory*
- *Necessary functions are not carried out (oxygen sensor control, actuation of EVAP canister system, etc.)*

- Press → button to advance program sequence.

Rapid data transfer HELP **Select function XX**	Indicated on display

- Continue as specified in procedures for specific OBD functions.

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Code Control Module (function 07)

If vehicle coding information is not as specified, or if the ECM has been replaced, the ECM must be coded as follows.

Required special tools and test equipment

- VAG 1551/ VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable

Coding procedure

- Connect VAG 1551/ VAG 1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (ignition switched on) ⇒ Page 01-7 .

Rapid data transfer HELP Select function XX	➢	Indicated on display

- Press buttons -0- and -7- to select "Code Control Module function 07, and press -Q- button to confirm input.

Code Control Module HELP Input code number XXXXX (0-32000)	➢	Indicated on display

- Input applicable code number for vehicle, and press -Q- button to confirm input. ECM coding variations ⇒ Page 01-13 .

Function is unknown or →	➢	If indicated on display:

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cannot be carried out at the moment	Incorrect code number has been entered.

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8D0907557 1,8L R4/5VT MOTR HS D02 →	
Coding 06051	**WSC 00000**

Indicated on display (ECM identification and coding, e.g. 06051)

- Press →button to advance program sequence.

Rapid data transfer	**HELP**
Select function XX	

Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

Note:

The Motronic ECM -J220- only uses the code that has been entered after the ignition has been switched off once. Incorrect coding leads to:

- *Performance problems (e.g. jerky shifting, abrupt load changes, etc.*
- *Increased fuel consumption*
- *Elevated exhaust gas values*
- *False malfunctions stored in DTC memory*
- *Reduction in transmission service life*

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ECM coding variations

Country/Emissions	Drivetrain/Options	Transmission	Vehicle type
00 ---------- =	0 = Front-wheel-drive without traction control (ASR)	0 = 5-speed manual	0 ---------- = ------
01 ---------- =	1 = Front-wheel-drive with traction control (ASR)	1 = ----------	1 = A4
02 ---------- =	2 = All-wheel-drive without traction control (ASR)	2 = ----------	2 ---------- = ------
03 ---------- =	3 = All-wheel-drive with traction control (ASR)	3 = ----------	3 ---------- = ------
04 ---------- =	4 = ----------	4 = ----------	4 ---------- = ------
05 ---------- =	5 = ----------	5 = Automatic trans. 01V	5 ---------- = ------
06 = USA, equipped with EVAP system Leak Detection Pump (LDP)	6 = ----------	6 = ----------	6 ---------- = ------

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Code number stucture (example)					
USA vehicle with Leak Detection Pump (LDP):	0	6			
Front-wheel-drive without traction control (ASR):			0		
Automatic transmission 01V:				5	
Audi A4:					1
Code number:	0	6	0	5	1

Note:

Vehicles with traction control (ASR) can be recognized by the ASR control light in the instrument cluster or by ABS/ASR On Board Diagnostic (OBD).

⇒ *Repair Manual, Brake System On Board Diagnostic (OBD), Repair Group 01*

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Check Diagnostic Trouble Code (DTC) Memory (function 02)

Required special tools and test equipment

- VAG 1551/ VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable

Checking

- Connect VAG 1551/ VAG 1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (engine running at idle) ⇒ Page 01-7 .

Note:

If engine does not start:

- Operate starter to crank engine for approx. 6 seconds, then do not switch ignition off.

- Press PRINT-button to switch scan tool printer on (indicator light in button lights up).

Rapid data transfer **HELP**	
Select function XX	

Indicated on display

- Press buttons -0- and -2- to select "Check DTC Memory" function 02, and press -Q- button to confirm input.

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X DTC recognized	⇐	Indicated on display (number of stored malfunctions, or "No DTC recognized."

Note:

If scan tool displays do not appear as indicated:

⇒ *Scan tool operating instructions*

If one or more malfunctions are stored:

Stored malfunctions are displayed one after another, and are printed out along with applicable DTCs.

Rapid data transfer HELP **Select function XX**	⇐	Indicated on display (after all stored malfunctions)

If no DTCs are recognized:

- Press →button to advance program sequence.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Repair malfunctions according to Diagnostic Trouble Code (DTC) table ⇒ Page 01-17 .
- Erase DTC memory ⇒ Page 01-40 .

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Diagnostic Trouble Code (DTC) table

Notes:

- *The DTC table is organized according to SAE and VAG diagnostic trouble codes.*
- *The "MIL" column labeled specifies the MIL switching condition associated with that DTC.*
- *DTCs that do not switch on the MIL after the malfunction is recognized by the ECM are identified by the MIL switching condition "Off."*
- *DTCs that do switch on the MIL immediately after the malfunction is recognized by the ECM are identified by the MIL switching condition "Immed."*
- *DTCs that are recognized by the ECM and switch on the MIL after two consecutive driving cycles (Dcy) are identified by the MIL switching condition "2 Dcy."*
- *Always correct malfunctions that are designated "immediately" as soon as possible, followed by those malfunctions that are designated "2Dcy."*
- *When all repairs have been completed, erase DTC memory (⇒ Page 01-40) and then generate new readiness code ⇒ Page 01-62*
- *DTCs that are recognized as a result of intermittent malfunctions, or DTCs that are not erased after repairs, are classified as sporadic malfunctions. These are identified by the designation "SP" appearing in the display.*
- *A sporadic malfunction will be erased if it no longer occurs after 50 driving cycles during which the engine reaches*

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operating temperature.

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0102	16486	Mass or Volume Air Flow Circ. Low Input	2 Dcy	- Check Mass Air Flow (MAF) sensor -G70- ⇒ Page 24-57
P0103	16487	Mass or Volume Air Flow Circ. High Input		
P0107	16491	Manifold Abs. Pressure or Bar. Pressure Low Input	2 Dcy	- Check Manifold Absolute Pressure (MAP) sensor -G71- ⇒ Page 24-131
P0108	16492	Manifold Abs. Pressure or Bar. Pressure High Input		
P0112	16496	Intake Air Temp. Circ. Low Input	2 Dcy	- Check Intake Air Temperature (IAT) sensor -G42- ⇒ Page 24-69
P0113	16497	Intake Air Temp. Circ. High Input		
P0116	16500	Engine Coolant Temp. Circ. Range/Performance	2 Dcy	- Check Engine Coolant Temperature (ECT) sensor -G62- ⇒ Page 24-63
P0117	16501	Engine Coolant Temp. Circ.		

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		Low Input		
P0118	16502	Engine Coolant Temp. Circ. High Input		

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0121	16505	Throttle/Pedal Pos. Sensor A Circ. Range/Performance	2 Dcy	- Check Throttle Position (TP) sensor -G69- ⇒ Page 24-99
P0122	16506	Throttle/Pedal Pos. Sensor A Circ. Low Input		
P0123	16507	Throttle/Pedal Pos. Sensor A Circ. High Input		
P0130	16514	O2 Sensor Circ., Bank1-Sensor1 Malfunction	2 Dcy	- Check Heated Oxygen Sensor (HO2S) -G39- and O2S control ⇒ Page 24-17
P0131	16515	O2 Sensor Circ., Bank1-Sensor1 Low Voltage		
P0132	16516	O2 Sensor Circ., Bank1-Sensor1 High Voltage		

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P0133	16517	O2 Sensor Circ., Bank1-Sensor1 Slow Response	2 Dcy	- Check Heated Oxygen Sensor (HO2S) aging ⇒ Page 24-51
P0134	16518	O2 Sensor Circ., Bank1-Sensor1 No Activity Detected	2 Dcy	- Check HO2S -G39- and O2S control ⇒ Page 24-17

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0136	16520	O2 Sensor Circ., Bank1-Sensor2 Malfunction	2 Dcy	- Check Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- ⇒ Page 24-35
P0137	16521	O2 Sensor Circ., Bank1-Sensor2 Low Voltage		
P0138	16522	O2 Sensor Circ., Bank1-Sensor2 High Voltage		
P0140	16524	O2 Sensor Circ., Bank1-Sensor2 No Activity Detected		

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0300	16684	Random/Multiple Cylinder Misfire Detected	2 Dcy / blink	- Fuel level too low, check fuel level and add if necessary - Check misfire detection ⇒ Page 28-12 - Check fuel injectors ⇒ Page 24-87 - Output Diagnostic Test Mode (DTM) ⇒ Page 01-42 - Check engine speed (RPM) sensor -G28- ⇒ Page 24-75
P0301	16685	Cyl. 1 Misfire Detected		
P0302	16686	Cyl. 2 Misfire Detected		
P0303	16687	Cyl. 3 Misfire Detected		
P0304	16688	Cyl. 4 Misfire Detected		
P0321	16705	Ign./Distributor Eng. Speed Inp. Circ.	2 Dcy	- Check engine speed (RPM) sensor -G28-

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		Range/Performance		⇒ Page 24-75
P0322	16706	Ign./Distributor Eng. Speed Inp. Circ. No Signal	Immed.	

Note on misfire malfunctions:

For malfunctions that may be caused by low fuel volume (i.e. combustion misfire) a low-fuel malfunction (DTC "P1250") is also stored when there is less than 2 gallons of fuel remaining in the tank.

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0327	16711	Knock Sensor 1 Circ. Low Input	Immed.	- Check knock sensors and knock sensor control ⇒ Page 28-5
P0332	16716	Knock Sensor 2 Circ. Low Input		- Check knock sensors and knock sensor control ⇒ Page 28-5
P0422	16806	Main Catalyst, Bank1 Efficiency Below Threshold	2 Dcy	- Replace Three Way Catalytic Converter (TWC): ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AEB, ATW, Repair Group 26.*
P0441	16825	EVAP Emission Contr. Sys. Incorrect Purge Flow	2 Dcy	- Check Evaporative Emissions (EVAP) canister purge regulator valve ⇒ output Diagnostic Test Mode (DTM), page ⇒ Page 01-42

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0442	16826	EVAP Emission Contr. Sys. (Small Leak) Leak Detected	➢ m.y. 1997: Off	- Check EVAP system ⇒ Page 24-136 - Checking EVAP system for leaks using KLI9210 EVAP tester ⇒ *Repair Manual, Fuel Supply System, Repair Group 20;*
P0455	16839	EVAP Emission Contr. Sys. (Gross Leak) Leak Detected	m.y. 1998 ➢: 2 Dcy	
P0456	16840	EVAP Emission Contr. Sys. (Small Leak) Leak Detected		- Checking EVAP system for leaks using KLI9210 EVAP tester ⇒ *Repair Manual, Fuel Supply System, Repair Group 20;*
P0501	16885	Vehicle Speed Sensor Range/Performance	2 Dcy	- Check vehicle speed signal ⇒ Page 24-149
P0506	16890	Idle Control System RPM Lower Than Expected	2 Dcy	- Check throttle body and throttle valve control module ⇒ Page 24-99
P0507	16891	Idle Control System		

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		RPM Higher Than Expected		

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P0560	16944	System Voltage Malfunction	2 Dcy	- Check Engine Control Module (ECM) power supply ⇒ Page 24-77
P0562	16946	System Voltage Low Voltage		
P0563	16947	System Voltage High Voltage		
P0601	16985	Internal Contr. Module Memory Check Sum Error	2 Dcy	Replace ECM ⇒ Page 01-57
P0604	16988	Internal Contr. Module Random Access Memory (RAM) Error		
P0707	17091	Transm. Range Sensor Circ. Low Input	Off	- Check transmission driving range signal -F125- ⇒ Page 24-153
P0708	17092	Transm. Range Sensor Circ. High Input		
P1102	17510	O2 Sensor Heating Circ., Bank1-Sensor1	2 Dcy	- Check Oxygen Sensor (O2S) heater -Z19- ⇒

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		Short to B+		Page 24-27
P1105	17513	O2 Sensor Heating Circ., Bank1-Sensor2 Short to B+		- Check Oxygen Sensor (O2S) heater -Z29- ⇒ Page 24-43

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1127	17535	Long Term Fuel Trim mult., Bank1 System too Rich [1)]	2 Dcy	- Check Mass Air Flow (MAF) sensor -G70- ⇒ Page 24-57
				- Check HO2S -G39- and O2S control ⇒ Page 24-17
				- Check Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- ⇒ Page 24-35
				- Check fuel pressure regulator and residual fuel pressure ⇒ Page 24-93
				- Check fuel injectors ⇒ Page 24-87 - Output Diagnostic Test Mode (DTM) ⇒ Page 01-42

[1)] The term "mult." = multiplicative; applies to entire engine speed (RPM) and load range.

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1128	17536	Long Term Fuel Trim mult., Bank1 System too Lean [1)]	2 Dcy	- Check HO2S -G39- and O2S control ⇒ Page 24-17
				- Check Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- ⇒ Page 24-35
				- Check fuel pressure regulator and residual fuel pressure ⇒ Page 24-93
				- Check fuel injectors ⇒ Page 24-87 - Output Diagnostic Test Mode (DTM) ⇒ Page 01-42
				- Check EVAP canister purge regulator valve ⇒ output Diagnostic Test Mode (DTM), page ⇒ Page 01-42

[1)] The term "mult." = multiplicative; applies to entire engine speed (RPM) and load range.

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1136	17544	Long Term Fuel Trim Add. Fuel, Bank1 System too Lean [2)]	2 Dcy	- Check intake air system for leaks ("false air") ⇒ Page 24-97
				- Check HO2S -G39- and O2S control ⇒ Page 24-17
				- Check Mass Air Flow (MAF) sensor -G70- ⇒ Page 24-57
				- Check fuel pressure regulator and residual fuel pressure ⇒ Page 24-93
				- Check fuel injectors ⇒ Page 24-87 - Output Diagnostic Test Mode (DTM) ⇒ Page 01-42

[2)] The term "Add." = additive; applies only with engine running at idle speed.

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1137	17545	Long Term Fuel Trim Add. Fuel, Bank1 System too Rich [2]	2 Dcy	- Check HO2S -G39- and O2S control ⇒ Page 24-17
				- Check fuel pressure regulator and residual pressure ⇒ Page 24-93
				- Check exhaust system for leakage: ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AEB, ATW, Repair Group 26.*
P1171	17579	Throttle Actuation Potentiometer Signal 2 Range/Performance [1]	Immed.	- Check throttle actuation potentiometer ⇒ Page 24-107 .

[1] With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-2 .

[2] The term "Add." = additive; applies only with engine running at idle speed.

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1176	17584	O2 Correction Behind Catalyst, B1 Limit Attained	2 Dcy	- Check intake air system for leaks ("false air") ⇒ Page 24-97
				- Check Heated Oxygen Sensor (HO2S) aging ⇒ Page 24-51
				- Check Oxygen Sensor (O2S) heater -Z29- ⇒ Page 24-43
				- Check O2S behind TWC ⇒ Page 24-35
P1196	17604	O2 Sensor Heater Circ., Bank1-Sensor1 Electrical Malfunction	2 Dcy	- Check Oxygen Sensor (O2S) heater -Z19- ⇒ Page 24-27
P1198	17606	O2 Sensor Heater Circ., Bank1-Sensor2 Electrical Malfunction		- Check Oxygen Sensor (O2S) heater -Z29- ⇒ Page 24-43
P1213	17621	Cyl.1-Fuel Inj. Circ. Short to B+	Immed.	- Check fuel injectors ⇒ Page 24-87 - Output Diagnostic Test Mode (DTM) ⇒ Page 01-42
P1214	17622	Cyl.2-Fuel Inj. Circ.		

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		Short to B+		

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1215	17623	Cyl.3-Fuel Inj. Circ. Short to B+	Immed.	- Check fuel injectors ⇒ Page 24-87 - Output Diagnostic Test Mode (DTM) ⇒ Page 01-42
P1216	17624	Cyl.4-Fuel Inj. Circ. Short to B+		
P1225	17633	Cyl.1-Fuel Inj. Circ. Short to Ground		
P1226	17634	Cyl.2-Fuel Inj. Circ. Short to Ground		
P1227	17635	Cyl.3-Fuel Inj. Circ. Short to Ground		
P1228	17636	Cyl.4-Fuel Inj. Circ. Short to Ground		
P1237	17645	Cyl.1-Fuel Inj. Circ. Open Circuit		
P1238	17646	Cyl.2-Fuel Inj. Circ. Open Circuit		

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P1239	17647	Cyl.3-Fuel Inj. Circ. Open Circuit		
P1240	17648	Cyl.4-Fuel Inj. Circ. Open Circuit		

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1250	17658	Fuel Level Too Low	Off	- Fuel volume less than 2 gallons, add fuel. - Check wiring between ECM and instrument cluster ⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations* - Check signal from fuel gauge, and fuel gauge ⇒ *Repair Manual, Electrical Equipment, Repair Group 01*
P1297	17705	Connection charger-throttle valvle Pressure drop		- Check air pressure system using VAG 1687 charge air system tester ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AWM, Repair Group 21; Charge Pressure, Leak test with VAG 1687*

Note on misfire malfunctions:

For malfunctions that may be caused by low fuel volume (i.e. combustion misfire) a low-fuel malfunction (DTC "P1250") is also stored when there is less than 2 gallons of fuel remaining in the tank.

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01-32

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1325	17733	Cyl.1-Knock Contr. Limit Attained	Off	- Check knock sensors and knock sensor control ⇒ Page 28-5
P1326	17734	Cyl.2-Knock Contr. Limit Attained		
P1327	17735	Cyl.3-Knock Contr. Limit Attained		
P1328	17736	Cyl.4-Knock Contr. Limit Attained		
P1337	17745	Camshaft Pos. Sensor, Bank1 Short to Ground	2 Dcy	- Check Camshaft Position (CMP) sensor -G40- ⇒ Page 28-2
P1338	17746	Camshaft Pos. Sensor, Bank1 Open Circ./Short to B+		
P1386	17794	Internal Control Module Knock Control Circ. Error	Off	- Replace ECM ⇒ Page 01-57

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01-33

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1410	17818	Tank Ventilation Valve Circ. Short to B+	2 Dcy	- Check Evaporative Emissions (EVAP) canister purge regulator valve ⇒ output Diagnostic Test Mode (DTM), page ⇒ Page 01-42
P1425	17833	Tank Vent Valve Short to Ground		
P1426	17834	Tank Vent Valve Open		
P1471	17879	EVAP Emission Contr. LDP Circ. Short to B+	➢ m.y. 1997: Off m.y. 1998 ➢: 2 Dcy	- Check EVAP system ⇒ Page 24-136
P1472	17880	EVAP Emission Contr. LDP Circ. Short to Ground		
P1473	17881	EVAP Emission Contr. LDP Circ. Open Circ.		

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P1475	17883	EVAP Emission Contr. LDP Circ. Malfunction/Signal Circ. Open		
P1476	17884	EVAP Emission Contr. LDP Circ. Malfunction/Insufficient Vacuum		
P1477	17885	EVAP Emission Contr. LDP Circ. Malfunction		

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1500	17908	Fuel Pump Relay Circ. Electrical Malfunction	Immed.	- Check fuel pump relay and relay actuation ⇒ Page 24-81
P1501	17909	Fuel Pump Relay Circ. Short to Ground		
P1502	17910	Fuel Pump Relay Circ. Short to B+		
P1505	17913	Closed Throttle Pos. Switch Does Not Close/Open Circ.	2 Dcy	- Check throttle body and throttle valve control module ⇒ Page 24-99
P1506	17914	Closed Throttle Pos. Switch Does Not Open/Short to Ground		
P1543	17951	Throttle Actuation Potentiometer Signal too Low	Immed.	
P1544	17952	Throttle Actuation Potentiometer		

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		Signal too High		
P1545	17953	Throttle Pos. Contr. Malfunction	2 Dcy	

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1546	17954	Boost Pressure Contr. Valve Short to B+	Off	- Check intake air boost (charge pressure) regulation ⇒ Page 24-123
P1547	17955	Boost Pressure Contr. Valve Short to Ground		
P1548	17956	Boost Pressure Contr. Valve Open		

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1555	17963	Charge Pressure Upper Limit Exceeded	Off	- Check intake air boost (charge pressure) ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AEB, ATW, Repair Group 21* - Check intake air boost (charge pressure) regulation ⇒ Page 24-123 - Check air pressure system using VAG 1687 charge air system tester ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AWM, Repair Group 21; Charge Pressure, Leak test with VAG 1687*
P1556	17964	Charge Pressure Negative Deviation		
P1557	17965	Charge Pressure Positive Deviation		
P1558	17966	Throttle Actuator Electrical	2 Dcy	- Check throttle body and throttle valve control module ⇒ Page 24-99

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		Malfunction		

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01-37

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1559	17967	Idle Speed Contr. Throttle Pos. Adaptation Malfunction (Adaptation of throttle valve control module -J338- to Motronic ECM has been interrupted, e.g. the accelerator pedal was depressed or the engine was started during throttle valve control module adjustment)	Off	- Check throttle body and throttle valve control module ⇒ Page 24-99
P1560	17968	Maximum Engine Speed Exceeded	Off	- Carry out engine mechanical repairs as necessary
P1564	17972	Idle Speed Contr. Throttle Pos. Low Voltage During Adaptation (Voltage less than 10 volts during adaptation of throttle valve control module -J338-)	Off	- Check throttle valve control module power supply voltage ⇒ Page 24-101
P1602	18010	Power Supply (B+) Terminal 30 Low Voltage	Off	- Check Engine Control Module (ECM) power supply ⇒ Page 24-77
P1606	18014	Rough Road Spec Engine Torque ABS-ECU Electrical Malfunction	Off	- Check ABS control module signal for rough road recognition ⇒ Page 24-161

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1611	18019	MIL Call-up Circ./Transm. Contr. Module Short to Ground	2 Dcy	- Check wiring between TCM and ECM ⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*
P1612	18020	Electronic Control Module Incorrect Coding	Off	- Code Motronic ECM ⇒ Page 01-11
P1613	18021	MIL Call-up Circ. Open/Short to B+	2 Dcy	- Check DTC memory for Transmission Control Module (TCM) and correct malfunctions ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01* - Check wiring between TCM and ECM ⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

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01-39

Diagnostic Trouble Code (DTC)		Malfunction text	MIL	Corrective action
SAE	VAG			
P1624	18032	MIL Request Sign. active	Immed.	- Check DTC memory for Transmission Control Module (TCM) and correct malfunctions ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01*
P1640	18048	Internal Contr. Module (EEPROM) Error	2 Dcy	- Replace ECM ⇒ Page 01-57

Note for DTC P1624/18032:

If this malfuncti

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Readiness code

Readiness code, checking

Note:

The readiness code will be erased:

- *When Diagnostic Trouble Code (DTC) memory is erased*
- *When the Engine Control Module (ECM) harness connector is disconnected (e.g. to connect VAG 1598/22 test box)*
- *When the battery is disconnected*

Required special tools and test equipment

- VAG 1551 Scan Tool (ST) with adapter cable VAG 1551/3

Checking

- Connect VAG 1551/ VAG 1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ Page 01-7 .

Rapid data transfer HELP	Indicated on display

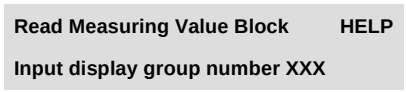
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Select function XX

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

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01-60



Indicated on display

- Press buttons -0-, -8- and -6- to input display group number 86, and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

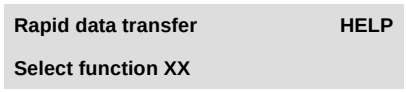
- Check readiness code values in display field 1.

  Specified value: 00000000

Note:

The readiness code is generated as soon as only zeros ("0") are shown in display field 1.

- Press →button to advance program sequence.



Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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If the readiness code was not generated, generate readiness code again ⇒ Page 01-62 .

- Check readiness code ⇒ Page 01-59 . If DTC memory has been erased, or ECM has been disconnected from B+, generate readiness code again ⇒ Page 01-62 .

Explanation of 8-digit readiness code

Readiness code is generated only when all display values = 0								
1	2	3	4	5	6	7	8	Diagnosis
							0	Three Way Catalytic Converter (TWC)
						0		TWC heating (not applicable / always "0")
					0			EVAP system and fuel tank leak detection test
				0				Secondary Air Injection (AIR) system (not applicable / always "0")
			0					Air conditioning system (diagnosis not applicable / always "0")
		0						Oxygen Sensor (O2S) control
	0							Oxygen Sensor (O2S) heating
0								Exhaust Gas Recirculation (EGR) system (not applicable / always "0")

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01-62

Readiness code, generating

Required special tools and test equipment

- VAG 1551 Scan Tool (ST) with adapter cable VAG 1551/3

Test requirements

- No malfunctions stored in DTC memory
- Engine not stopped (ignition not switched off) during the test
- Vehicle not moving
- All electrical consumers switched off (coolant fan must not run during test)

Test sequence

- Connect VAG 1551/ VAG 1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ Page 01-7 .

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01-63

Step 1: Check DTC memory

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -2- to select the "Check DTC Memory" function 02, and press -Q- button to confirm input.

No DTC recognized	Indicated on display

If one or more DTCs are stored:

- Repair cause of malfunction.
- Erase DTC memory.
- Stop engine, start engine again, and road test.
- Check DTC memory again and erase.

If no DTCs were recognized:

- Press →button to advance program sequence.

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01-64

Step 2: Erase DTC memory

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -5- to select the "Erase DTC Memory" function 05, and press -Q- button to confirm input.

Note:

When erasing DTC memory, the readiness code is also erased.

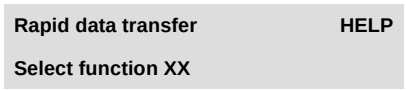
Rapid data transfer → **DTC Memory is erased**	Indicated on display

- Press →button to advance program sequence.

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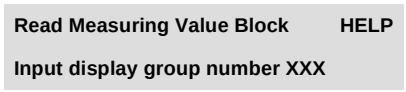
01-65

Step 3: Adaptation of throttle valve control module to ECM



Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



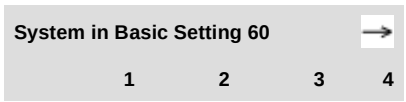
Indicated on display

- Press buttons -0-, -6- and -0- to input display group number 60, and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Press -4- button to select "Basic Setting" function 04 (adaptation of throttle valve control module to ECM)



Indicated on display (1-4 = display fields)

- Check specified values in display fields 3 and 4:

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01-66

	Display fields			
	1	2	3	4
Display group 60: Adaptation of throttle valve control module to Engine Control Module (ECM)				
Display	xxx ∠ °	xxx ∠ °	Idle Part throt. Full throt. Decel Enrich	ADP.runs ADP. OK ADP.ERROR
Indicated	Throttle valve angle	Throttle valve actuator angle	Operational status	Adaptation status
Specified value	---	---	Idle	ADP. OK

If "ADP. ERROR" is indicated in display field 4:

- Check DTC memory ⇒ Page 01-15 .

If the specified value "ADP. OK" is indicated in display field 4:

- Press →button to advance program sequence.

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01-67

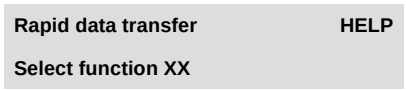
Step 4:

- Start engine and let run at idle.

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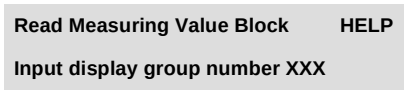
01-68

Step 5: Oxygen Sensor (O2S) control operating condition



Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -3- and -0- to input display group number 30, and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Increase engine speed to 1800-2200 RPM.
- Hold at 1800-2200 RPM until:
  - Specified value of "111" is reached in display field 1
  - Specified value of "110" is reached in display field 2

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01-69

	Display fields			
	1	2	3	4
Display group 30: Oxygen Sensor (O2S) control operating condition				
Display	xxx	xxx		
Indicated	Status of Heated Oxygen Sensor (HO2S), bank 1, before TWC (B1-S1)	Status of Heated Oxygen Sensor (HO2S), bank 1, after TWC (B1-S2)		
Specified value	111	110	---	---
	Evaluation ⇒ Page 01-70	Evaluation ⇒ Page 01-70		

If the specified values are not indicated:

- Check DTC memory ⇒ Page 01-15 .

If the specified values are indicated in display fields 1 and 2:

- Continue to hold engine speed at 1800-2200 RPM.

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01-70

Explanation of 3-digit value in display fields 1 and 2

When display = 1			
1	2	3	
		1	Oxygen Sensor (O2S) control active
	1		Heated Oxygen Sensor (HO2S) operational
1			Oxygen Sensor (O2S) heater ON

Note:

O2S control for bank 1 Oxygen Sensor (O2S) after Three Way Catalytic Converter (TWC), B1-S2), is not active at idle.

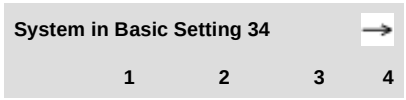
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01-71

Step 6: Oxygen sensor aging (time period)

- Press -4- button to select "Basic Setting" function 04.

- Press -3- button four times to advance to display group number 34.



Indicated on display (1-4 = display fields)

- Hold engine speed at 1800-2200 RPM until display changes from "Test OFF" to "Test ON" in display field 4.
- Continue to hold at 1800-2200 RPM until specified value "B1-S1. OK" is indicated in display field 4.

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01-72

	Display fields			
	1	2	3	4
Display group 34: Oxygen sensor aging (time period of oxygen sensor)				
Display	xxxx RPM	xx.xx ms	xx.xx s	Test OFF/Test ON B1-S1 OK/B1-S1 n. OK
Indicated	Engine speed (increments of 40 RPM)	Engine load	Time period of Heated Oxygen Sensor (O2S) before TWC	Diagnostic status Diagnostic result
Range	0-6800 RPM	0.00-8.50 ms	0.00-5.00 s	---
Specified value	1800-2200 RPM	0.80-2.00 ms	0.00-3.30 s	B1-S1 OK

If "B1-S1 n. OK" is indicated in display field 4:

- Check DTC memory ⇒ Page 01-15 .

If the specified value "B1-S1 OK" is indicated in display field 4:

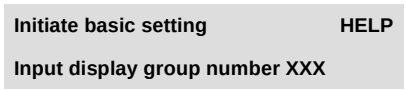
- Continue to hold engine speed at 1800-2200 RPM.

- Press -C- button.

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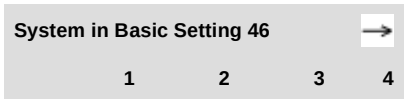
01-73

Step 7: Three Way Catalytic Converter (TWC) diagnosis



Indicated on display

- Press buttons -0-, -4- and -6- to input display group number 46, and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Hold engine speed at 1800-2200 RPM until display changes from "Test OFF" to "Test ON" in display field 4.
- Continue to hold at 1800-2200 RPM until specified value "Cat B1 OK" is indicated in display field 4.

Note:

The test time for TWC diagnosis is approx. 60 seconds.

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	Display fields			
	1	2	3	4
Display group 46: Three Way Catalytic Converter (TWC) diagnosis				
Display	x.xx	x	xx.x s	Test OFF/Test ON Cat B1 OK Cat B1 n. OK
Indicated	Amplitude ratio	Exceeded diagnosis range	Test time of TWC diagnosis	Diagnostic status Diagnostic result
Range	0.00-1.00	0-9	00.0-60.0	---
Specified value	0.00-0.10	0-2	60.0 s	Cat B1 OK

If "Cat B1 n. OK" is indicated in display field 4:

- Check DTC memory ⇒ Page 01-15 .

If specified value "Cat B1 OK" is indicated in display field 4:

- Press -C- button.

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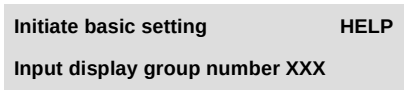
01-75

Step 8: Evaporative Emissions (EVAP) system and fuel tank leak detection

Note:

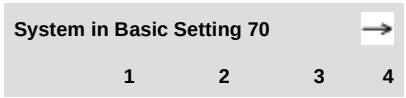
During this diagnosis there should be no engine load, otherwise the diagnosis is interrupted and can only be restarted after a period of acceleration.

- Start engine and let run at idle.



➢ Indicated on display

- Press buttons -0-, -7- and -0- to input display group number 70, and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

If the diagnosis is initiated by the ECM, the display changes from "Test OFF" to "Test ON" in display field 4.

- Let engine continue to run at idle until the specified value "EVAP OK" is indicated in display field 4.

Note:

If the display changes from "Test ON" to "Test OFF" during the diagnosis, briefly accelerate the engine to reset and repeat the test.

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01-76

	Display fields			
	1	2	3	4
Display group 70: Evaporative Emissions (EVAP) canister purge regulator valve				
Display	xxx%	xx.x %	xx.xx g/s	Test OFF/Test ON EVAP OK EVAP n. OK
Indicated	Opening of EVAP canister purge regulator valve during diagnosis	Oxygen sensor control deviation during diagnosis	Oxygen sensor control deviation during diagnosis	Diagnostic status Diagnostic result
Range	0-100 %	-25.0 to 25.0 %	-2.70 to 4.16 g/s	---
Specified value	0-100 %	- 5.4 to 9.4 %	0.00 to 0.33 g/s	EVAP OK

If "EVAP n. OK" is indicated in display field 4:

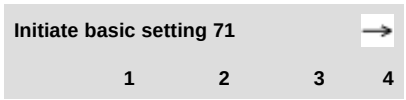
- Check DTC memory ⇒ Page 01-15 .

If the specified value "EVAP OK" is indicated in display field 4:

- Press -3- button to input display group number 71.

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01-77



Indicated on display (1-4 = display fields)

- Start engine and let run at idle.

If the diagnosis is initiated by the ECM, the display changes from "Test OFF" to "Test ON" in display field 4.

- Let engine continue to run at idle until the specified value "Syst. OK" is indicated in display field 4.

	Display fields			
	1	2	3	4
Display group 71: Fuel tank leak detection				
Display	Reed op. Reed cl.	Small leak/large leak determination	Syst.Test Measurement Measurement end	Test OFF/Test ON Syst. OK Syst. n.OK
Indicated	Status: Reed contact	Error message	System status	Diagnostic status Diagnostic result
Range	---	---	---	---
Specified value	Reed op.	---	Measurement end	Syst. OK

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01-78

Note:

If display field 4 changes from "Test ON" to "Test OFF" and "Abort" appears in display field 2, repeat the diagnosis of fuel tank leak detection. Repeating the diagnosis can take up to approx. 60 seconds until the display changes from "Test OFF" to "Test ON"in display field 4.

Diagnosis conditions for fuel tank leak detection:

- *Intake Air Temperature (IAT) must be less than 90° C (194° F) ⇒Display group 4, display field 4*
- *Engine Coolant Temperature (ECT) must be less than 95° C (203° F) ⇒ Display group 4, display field 3*
- *Throttle valve angle must be smaller than 10 ∠ ° ⇒ Display group 3, display field 3*

If "SYST. n. OK" is indicated in display field 4:

- Check DTC memory ⇒ Page 01-15 .

If the specified value "SYST. OK" is indicated in display field 4:

- Press →button to advance program

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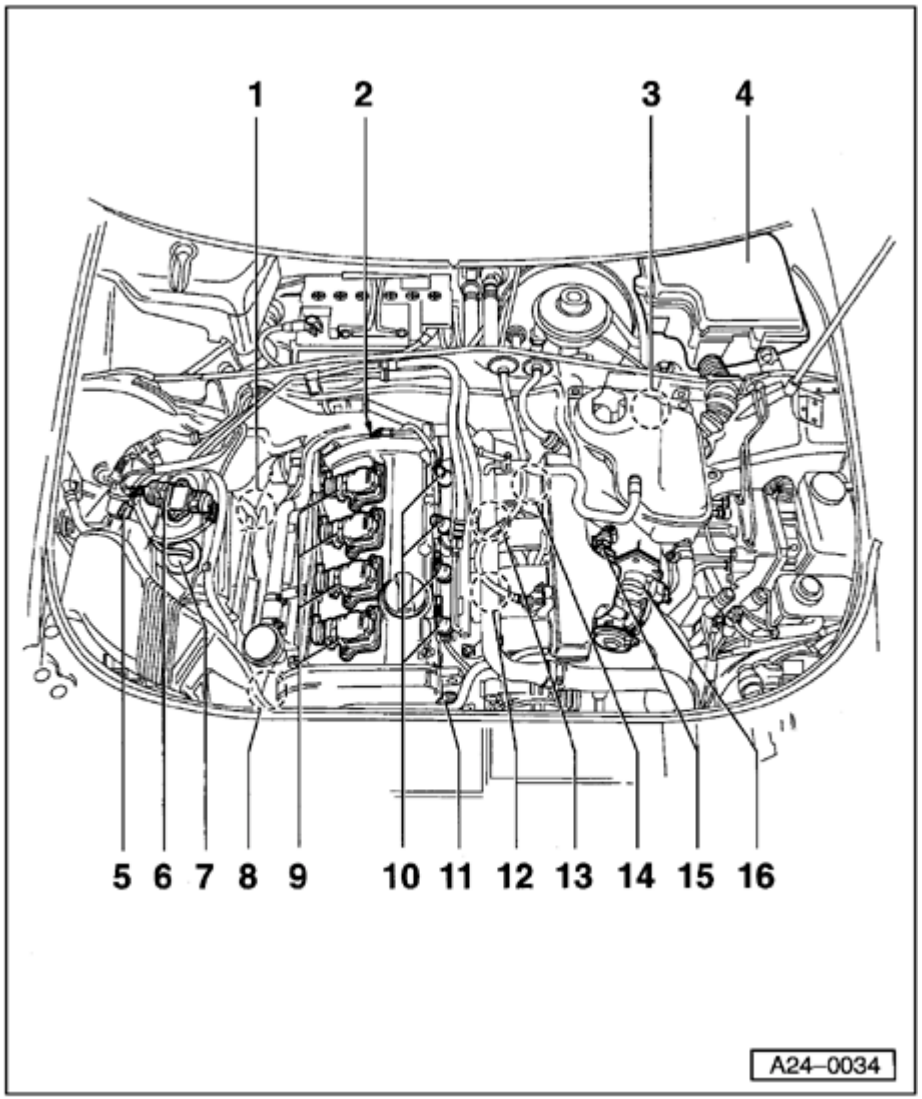
sequence.

Step 9: Check readiness code

- Check readiness code ⇒ Page 01-59 .

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24-1



Motronic Multiport Fuel Injection (MFI) and ignition system

Component locations, overview

---- **Data Link Connector (DLC)**

- Located under knee bar, left side of steering wheel

---- **Fuel pump relay**

- Position 6 on relay panel in driver's side footwell

---- **Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- with Oxygen Sensor (O2S) heater -Z29-**

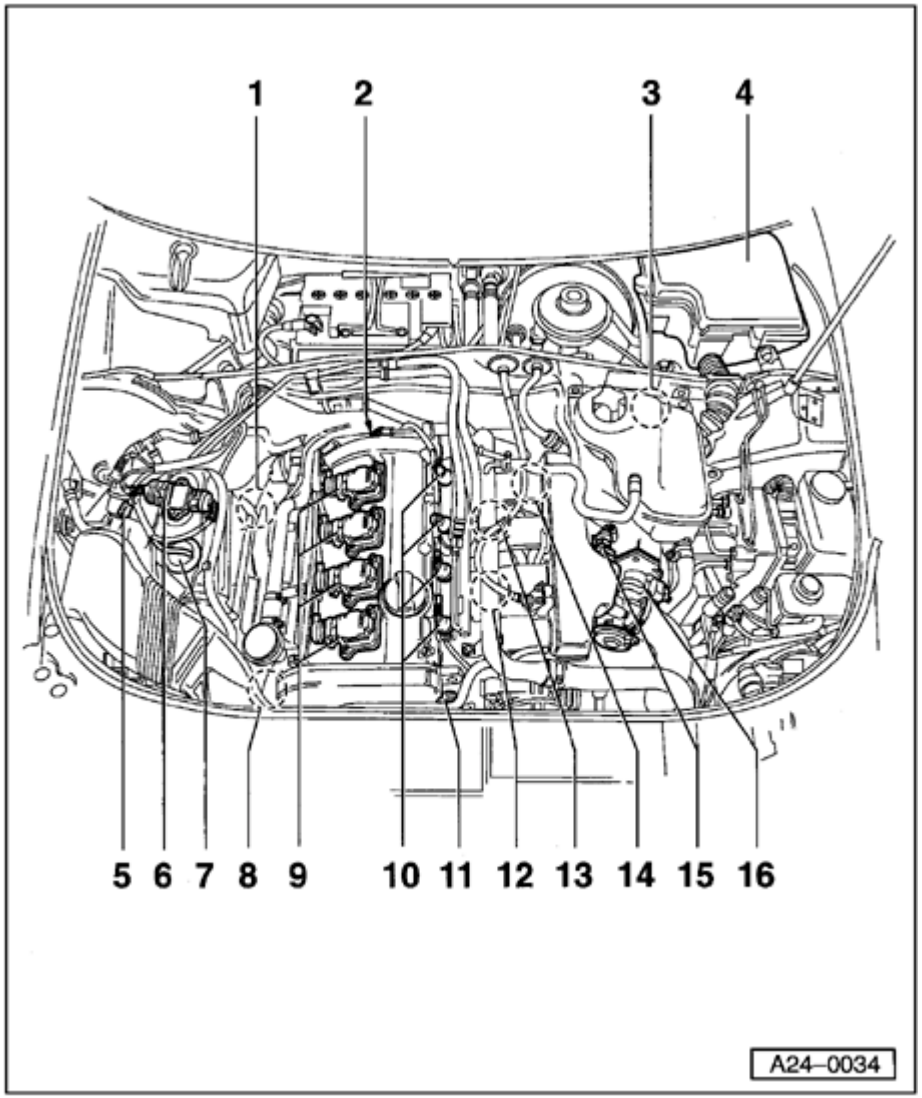
- In exhaust system behind TWC

---- **EVAP system Leak Detection Pump (LDP) -V144-**

- In left-rear wheelhousing behind splash shield

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24-2



1 - Heated Oxygen Sensor (HO2S) -G39- with Oxygen Sensor (O2S) heater -Z19-

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

- 4-pin connector

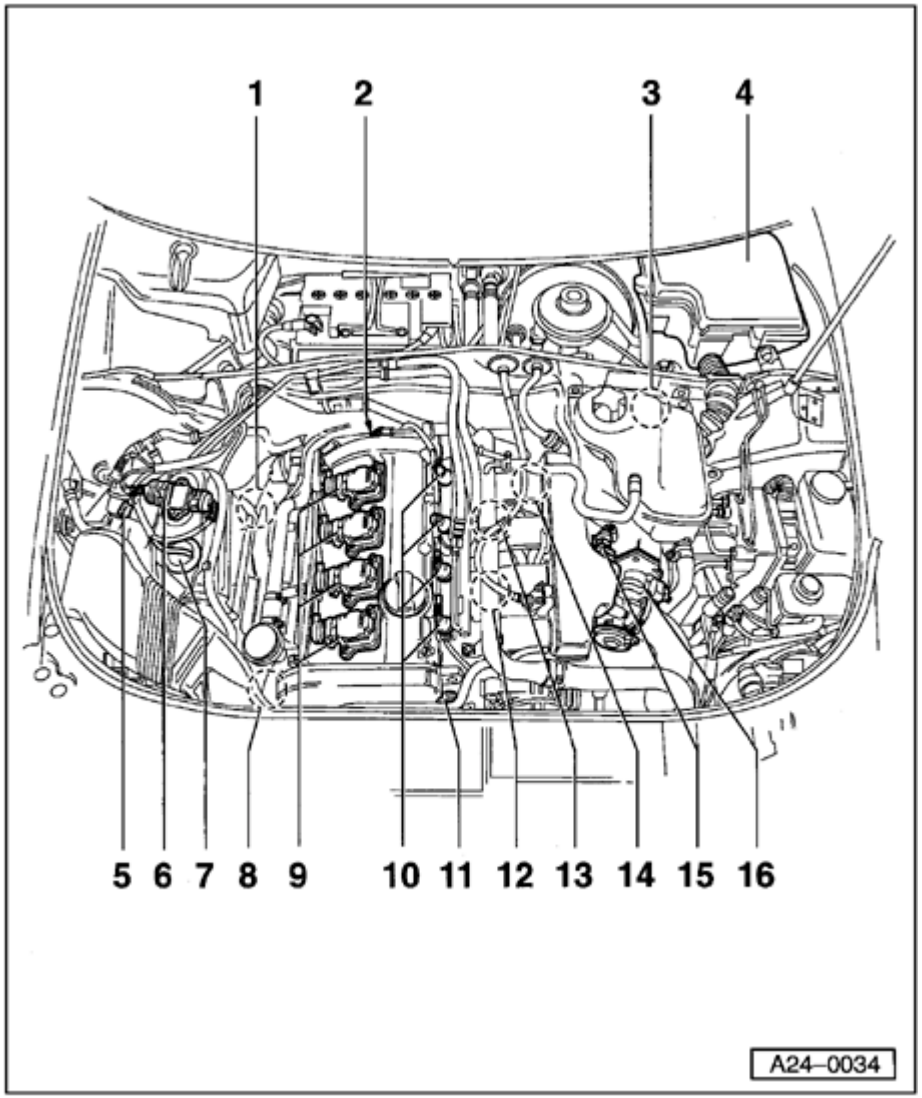
3 - Harness connector for:

- Heated Oxygen Sensor (HO2S) -G39- and Oxygen Sensor (O2S) heater -Z19- (4-pin, brown)
- Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- with Oxygen Sensor (O2S) heater -Z29- (4-pin, black)
- Engine speed (RPM) sensor -G28- (3-pin, gray)
- Knock sensor (KS) 1 -G61 (3-pin, green)
- Knock sensor (KS) 2 -G66- (3-pin, blue)

4 - Electronics box (E-box) with:

- Motronic Engine Control Module (ECM) -J220-
- Barometric Pressure (BARO) sensor -F96-

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5 - EVAP canister purge regulator valve -N80-

6 - Power output stage -N122-

- 5-pin connector: signal wiring from ECM
- 4-pin connector: coil primary circuit connections

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

- In upper air cleaner housing

8 - Wastegate bypass regulator valve -N75-

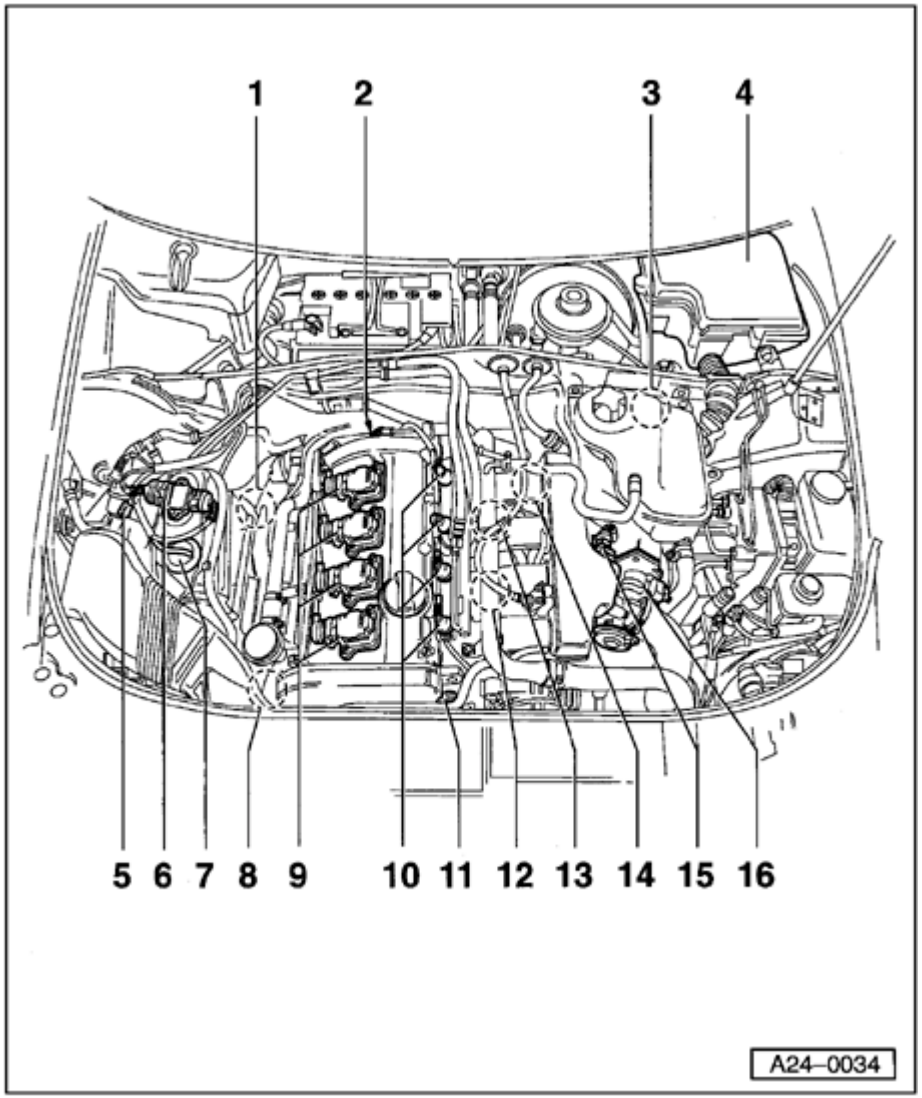
9 - Ignition coils

- Cylinder 1: -N-
- Cylinder 2: -N128-
- Cylinder 3: -N158-
- Cylinder 4: -N163-

10 - Fuel injectors

- Cylinder 1: -N30-
- Cylinder 2: -N31-
- Cylinder 3: -N32-
- Cylinder 4: -N33-

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11 - Camshaft Position (CMP) sensor -G40-

12 - Knock Sensor (KS) 1 -G61-

13 - Knock Sensor (KS) 2 -G66-

14 - Engine speed (RPM) sensor -G28-

(behind oil filter housing on engine cylinder block)

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

16 - Throttle valve control module -J338-

Including:

- Throttle drive -G186-
- Angle sensor 1 for throttle drive -G187-
- Throttle Position (TP) sensor -G69-
- Closed Throttle Position (CTP) switch -F60-

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24-5

Safety precautions

WARNING!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything nearby that could ignite fuel. The fuel system is under pressure. Before opening, cover connections with a rag, and open carefully to release pressure. Be alert when working on or near the engine and ignition wires. High secondary ignition voltage can cause serious personal injury and damage vehicle components.

- ***DO NOT touch or disconnect ignition system wires when the engine is running or being cranked at starting RPM.***
- ***DO NOT operate starter if fuel injectors are removed.***

Be sure the ignition is switched OFF, when:

- ***Disconnecting or connecting the battery, ignition wires, or test equipment leads***
- ***Disconnecting fuel injection system wiring***
- ***Washing the engine or engine compartment.***

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BEFORE cranking engine at starting RPM (e.g. for compression testing) disable ignition and fuel injection systems:

- ***Disconnect both ignition coil power output stages, and both Motronic fuses at the E-box in the plenum.***
- ***Disconnect harness connectors from all fuel injectors.***
- ***Afterward, erase DTC memory.***

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24-6

CAUTION!

BEFORE disconnecting the battery:

- ***Stop the engine.***
- ***Be sure the ignition is switched OFF (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***
- ***Be sure of the proper radio code (for vehicles equipped with coded anti-theft radio).***

Be sure the battery negative (-) cable is disconnected, when:

- ***Working on the electrical system***
- ***Resistance (spot) welding or electric arc welding anywhere on the vehicle.***

When connecting and disconnecting electrical test equipment (LED voltage tester, multimeter, etc.):

- ***Be sure the ignition is switched OFF.***
- ***Use correct adapters from the VW 1594***

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connector test kit.

For any work affecting the Engine Control Module (ECM):

- ***BEFORE disconnecting the ECM harness connector, switch the ignition OFF and WAIT at least 20 seconds. Failure to do so may damage the ECM.***

- ***DO NOT connect any outside voltage source to stimulate an output signal at the ECM.***

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Rules of cleanliness

CAUTION!

Whenever carrying out work on the fuel supply and fuel injection systems, carefully observe the following five rules of cleanliness.

1. Thoroughly clean fuel system line and hose connections and the surrounding area before disconnecting.

2. Place removed components on a clean surface and cover. Use plastic sheeting or paper. Do not use fluffy rags that could leave lint!

3. Carefully cover over or seal any components that have been opened if repairs are not carried out immediately.

4. Install only clean parts:

- Do not remove replacement parts from the packaging until immediately before they are to be installed.

- Do not use parts that have been stored without packaging (e.g. in toolboxes, etc.).

5. When the fuel system is opened:

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- Avoid working with compressed air whenever possible.
- Avoid moving the vehicle if possible.

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24-8

Technical data

Engine code		AEB	
Engine idle speed: not adjustable, maintained by Idle Air Control (IAC)		820-900 RPM	
Engine speed (RPM) upper limit: actuated by switching off fuel injectors		approx. 6500 RPM	
Fuel system pressure at idle	Vacuum hose for pressure regulator connected:	approx. 3.5 bar (50 psi)	
	Vacuum hose for pressure regulator disconnected:	approx. 4.0 bar (58 psi)	
Residual fuel pressure after 10 minutes		at least 2.5 bar	
Fuel injectors	Spray pattern:	approx. the same for all fuel injectors	
	Resistance [1]:	11-13 ohm	

[1] Engine at room temperature; with the engine at normal operating temperature the resistance increases by approx. 4-6 ohms.

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24-9

Fuel injection system, servicing

Servicing ignition system:

⇒ *Repair Group 28*

Notes:

- *Fuel hoses in the engine compartment must be secured with spring-type clamps. Screw-type clamps or equivalent must not be used.*
- *The Engine Control Module (ECM) has On Board Diagnostic (OBD) capability, and is equipped with Diagnostic Trouble Code (DTC) memory. Before repairing or adjusting any components or systems, first check DTC memory. Also check all vacuum connections for leaks ("false air").*
- *For proper operation of electrical and electronic components, a Battery Positive Voltage (B+) supply of at least 11.5 volts is required.*
- *Do not use any gasket sealers or other automotive chemical compounds that contain silicone. Traces of silicone drawn into the engine pass unburned into the exhaust and can damage the oxygen sensors.*

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- *Do not use any electrical contact sprays or equivalent near oxygen sensor connections. Proper oxygen sensor function requires reference to outside air via the cable. If any contact spray reaches the oxygen sensor, it can cause damage or improper function.*

- *During some tests, malfunctions are recognized by the ECM and stored in DTC memory. For this reason, always check DTC memory after all tests and repairs, and erase DTC memory as necessary.*

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24-10

Safety precautions ⇒ Page 24-5

Rules of cleanliness ⇒ Page 24-7

Technical data ⇒ Page 24-8

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24-11

Idle speed, checking

Notes:

- *Idle speed, ignition timing and CO-content cannot be adjusted.*
- *Idle speed is maintained by the Throttle valve control module.*
- *CO-content is maintained and adjusted by Oxygen Sensor (O2S) control. Malfunctions in O2S control are recognized by On Board Diagnostic (OBD) and stored in DTC memory.*

Required special tools and test equipment

- VAG 1551 Scan Tool (ST) with VAG 1551/3 adapter cable

Test conditions

- No malfunctions stored in DTC memory ⇒ Page 01-15
- Engine Coolant Temperature (ECT) at least 85 ° C (185 ° F)

  All electrical consumers switched off

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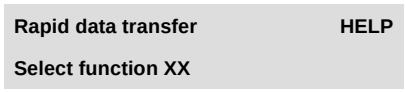
- (radiator coolant fan must not run during test)
- A/C switched off
- Exhaust system free of leaks
- Automatic transmission selector lever in "P" or "N" position

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24-12

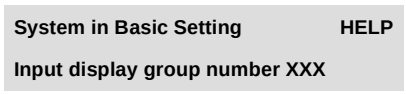
Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .



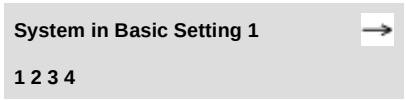
Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04, and press -Q- button to confirm input.



Indicated on display

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



Indicated on display (1-4 = display fields)

Note:

After selecting function 04, the ECM initiates the following:

- *EVAP canister purge regulator valve is closed*
- *A/C compressor is switched off*

Continue with the test only when the operating conditions in display field 4 are satisfied.

- Briefly raise engine speed (acceleration burst) and let engine run at idle

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for another 2 minutes.

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24-13

- Compare display with specified values (display fields 1-4):

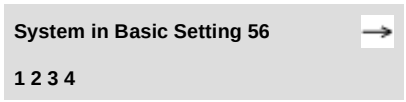
	Display fields			
	1	2	3	4
Display group 1: Engine idle speed				
Display	xxxx RPM	xxx.x °C	xx.x%	xxxxxx
Indicates	Idle speed	Engine Coolant Temperature (ECT)	Oxygen sensor control	Adjustment conditions
Range	0-6800 RPM (in 40 RPM steps)	---	-25.0 to 25.0 %	---
Specified value	760-960 RPM	80.0°-105.0° C	In the range from -10.0 to 10.0 %, the value must change by at least 2 %	111111
	If not as specified ⇒ Page 24-99 , Throttle valve control module, checking	---	If not as specified ⇒ Page 24-99 , Throttle valve control module, checking	Explanation ⇒ Page 24-15

If displayed values are OK (as specified):

- Press -C- button.

- Press buttons -0-, -5- and -6- to input display group number 56, and press -Q- button to confirm input.

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< Indicated on display (1-4 = display fields)

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24-14

- Compare display with specified values (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 56: Engine idle speed				
Display	xxxx RPM	xxxx RPM	x.xx g/s	xxxx
Indicates	Engine speed (actual)	Engine speed (specified)	Mass air flow (idle speed control)	Operating conditions
Range	0-2550 RPM (steps of 10 RPM)	---	-2.80 to 4.17 g/s	---
Specified value	820-900 RPM	860 RPM	-1.11 to 1.11 g/s	0000
	If not as specified ⇒ Page 24-99 , Throttle valve control module, checking	---	If not as specified ⇒ Page 24-99 , Throttle valve control module, checking	Explanation ⇒ Page 24-16

- Press →button to advance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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- Road test vehicle, then repeat test.

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-15

Evaluation of 6-digit display:

- "1" = Adjustment conditions fulfilled
- "0" = Adjustment conditions not fulfilled
- If adjustment conditions have been fulfilled (indicated in display field 4), a series of 6 numerals ("1") will be displayed. If one of the digits in the 6-digit display is "0," the adjustment condition has not been fulfilled. Repair the cause of the unfulfilled condition, and repeat the test.

Explanation (display = 1)						
x	x	x	x	x	x	Adjusting conditions (display group 1)
					1	Engine Coolant Temperature (ECT) above 80° C
				1		Engine speed less than 2000 RPM
			1			Throttle valve closed
		1				Oxygen sensor control active
	1					Closed Throttle Position (CTP) switch closed
1						A/C compressor off

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24-16

Evaluation of 4-digit display:

Explanation (display = 0)				
x	x	x	x	(Display group 56)
			0	A/C compressor off ("0" = off; "1" = on)
		0		Transmission selector lever in "P" or "N" position ("0" = "P" or "N" position; "1" = 2/3/4/R/D)
	0			Not used ("0" is always displayed)
0				Not used ("0" is always displayed)

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24-17

Heated Oxygen Sensor (HO2S) and oxygen sensor control (before TWC), checking

Notes:

- *Connector for Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC): 4-pin, brown*

- *Component location* ⇒ *Page 24-1*

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Test conditions

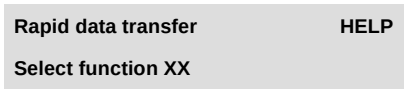
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- Engine Coolant Temperature (ECT) at least 85° C (185° F)

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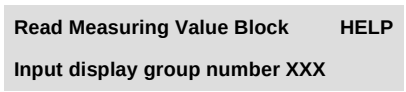
Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .



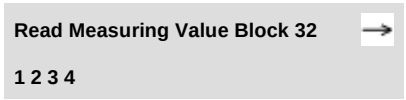
➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



➢ Indicated on display

- Press buttons -0-, -3- and -2- to input display group number 32, and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

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24-19

- Check oxygen sensor control learning values (display fields 1 and 2):

	Display fields			
	1	2	3	4
Display group 32: Oxygen sensor control learning values				
Display	xx.x %	xx.x %		
Indicates	Oxygen sensor control learning value at idle (additive) (before TWC)	Oxygen sensor control learning value at partial load (multiplicative) (before TWC)		
Range	-26.0 to 26.0 %	-25.0 to 25.0 %		
Specified value	-8.0 to 8.0 % (can vary slightly)	-8.0 to 8.0 % (can vary slightly)		
	If not as specified ⇒ Page 24-22 , Evaluation of display group 32			

If displayed values are OK (as specified):

- Press -C- button.

- Press buttons -0-, -3- and -3- to input display group number 33, and press -Q- button to confirm input.

Read Measuring Value Block 33 →

< Indicated on display (1-4 = display fields)

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1 2 3 4

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24-20

- Check oxygen sensor control (display fields 1 and 2):

	Display fields			
	1	2	3	4
Display group 33: Oxygen sensor control				
Display	xx.x %	x.xxx V		
Indicates	Oxygen sensor control (before TWC)	Oxygen sensor voltage (before TWC)		
Range	-25.0 to 25.0 %	0.000-1.000 V		
Specified value	Within the range from -10.0 to 10.0 % the value must change by at least 2 %	Within the range from 0.000 to 1.000 V the value must fluctuate at least 30 times per minute, and change by at least 0.3 volts		
	If not as specified ⇒ Page 24-21 , Continuation	If not as specified ⇒ Page 24-23 , Evaluation of display group 33		

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24-21

Continuation

If the value in display field 1 is NOT OK, or if the value does not fluctuate by at least 2 %:

- Road test to condition oxygen sensor (eliminate possible contamination) and repeat test.

If the value in display field 1 is still NOT OK, or if it still does not fluctuate by at least 2 %:

- Check Oxygen Sensor (O2S) heater ⇒ Page 24-27 .

If the value in display field 1 remains constant:

- Check oxygen sensor voltage (display field 2).

- Press →button to advance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

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Evaluation of display group 32

Display group: 32 Display fields: 1 + 2	Possible cause	Corrective action
O2S control learning value: -26.0 to -8.0 %	♦ Engine oil dilution (when partial load learning value is normal, ⇒ display field 2)	- Change engine oil, or carry out extensive road test and check again.
	♦ Fuel pressure too high	- Check fuel pressure regulator ⇒ Page 24-93
	♦ Fuel injector leaking	- Check fuel injectors ⇒ Page 24-87
	♦ Oxygen Sensor (O2S) heater malfunction	- Check O2S heater ⇒ Page 24-27
O2S control learning value: 8.0-26.0 %	♦ Intake air leaks ("false air") or exhaust manifold leaks (when partial load learning value is normal, ⇒ display field 2)	- Check intake air system for leaks ⇒ Page 24-97 - Check exhaust system for leaks: ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AEB, ATW, Repair Group 26*
	♦ Fuel pressure too low	- Check fuel pressure regulator ⇒ Page 24-93
	♦ Oxygen Sensor (O2S) heater malfunction	- Check O2S heater ⇒ Page 24-27

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	♦ Fuel injector does not open, or partially opens	- Check fuel injectors ⇒ Page 24-87
O2S control learning value: constant 0.0 %	♦ Oxygen sensor control learning not active	- Check Mass Air Flow (MAF) sensor -G70- ⇒ Page 24-57

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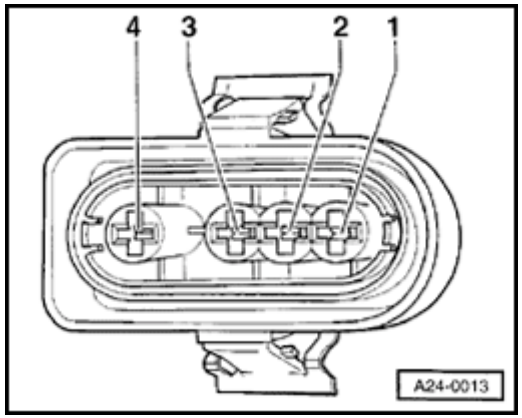
24-23

Evaluation of display group 33

Display group: 33 Display field: 2	Possible cause	Corrective action
approx. 0.435 V	♦ Open circuit in wiring between HO2S connector terminal 4 and ECM	- Check reference voltage ⇒ Page 24-24 .
approx. 0.435 V	♦ Open circuit in wiring between HO2S connector terminal 3 and ECM	
approx. 1.085 V	♦ Short circuit to positive (B+) between HO2S connector terminal 4 and ECM	- Check HO2S wiring ⇒ Page 24-25 .
approx. 0.000 V	♦ Short circuit to Ground between HO2S connector terminal 4 and ECM	

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24-24



Checking HO2S reference voltage

- Disconnect 4-pin connector -1- (brown) for HO2S -G39-.

- Connect multimeter US 1119 (Fluke 83 or equivalent) between harness connector terminals 3 and 4 (to ECM), using adapter cables from VW 1594 connector test kit.
- Start engine and measure voltage.

  Specified value: 0.40-0.50 volts
- Switch ignition off.

If voltage is NOT OK:

- Check HO2S wiring ⇒ Page 24-25

If voltage is OK:

- Replace Heated Oxygen Sensor (HO2S) -G39-.

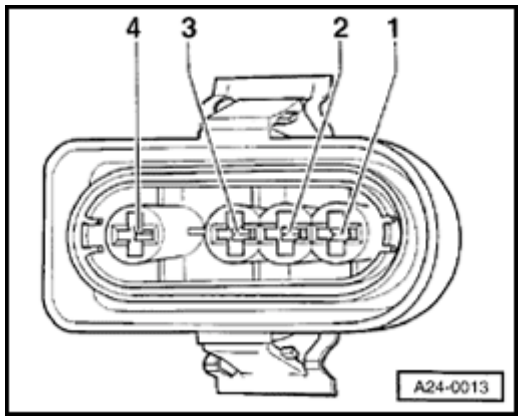
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24-25

Checking HO2S wiring

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Disconnect 4-pin connector (brown) for HO2S - G39-.



- Check wiring for open circuit between ECM/test box and 4-pin HO2S harness connector (to ECM).
  - Connector terminal 3 to ECM/test box socket 25
  - Connector terminal 4 to ECM/test box socket 26
  - Specified value: max. 1.5 Ω
- Check wiring for short circuits between terminals of 4-pin connector, and between connector and ECM/test box.
  - Connector terminal 4 to ECM/test box socket 25
  - Specified value: ∞ Ω
- Check wiring for short circuits to wiring harness shielding.
  - Connector terminal 3 to ECM/test box socket 2
  - Connector terminal 4 to ECM/test box socket 2
  - Specified value: ∞ Ω

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24-26

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-27

Oxygen Sensor (O2S) heater (before TWC), checking

Notes:

- *Harness connector for Oxygen Sensor (O2S) heater: 4-pin, brown*
- *Component locations* ⇒ *Page 24-1* .

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Test requirements

- Fuse for Oxygen Sensor (O2S) heater OK

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- Engine Coolant Temperature (ECT) at least 85° C (185° F)

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24-28

Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -4- and -1- to input display group number 41, and press -Q- button to confirm input.

Read Measuring Value Block 41 →

1 2 3 4

Indicated on display (1-4 = display fields)

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24-29

- Compare display and specified values (display fields 1 and 2):

	Display fields			
	1	2	3	4
Display group 41: Oxygen Sensor (O2S) heating				
Display	xx.x Ω	Htg.bC.ON/Htg.bC.OFF	xx.x Ω	Htg.aC.ON/Htg.aC.OFF
Indicates	Resistance of oxygen sensor heater (before TWC)	O2S heater on or O2S heater off (before TWC)	Resistance of oxygen sensor heater (after TWC)	O2S heater on or O2S heater off (after TWC)
Range	0.0-65.0 Ω	---	---	---
Specified value	4.9-19.9 Ω	Htg.bC.ON	---	---
	If not as specified ⇒ Page 24-30 , Continuation		---	---

If displayed values are OK (as specified):

- Press →button to advance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm

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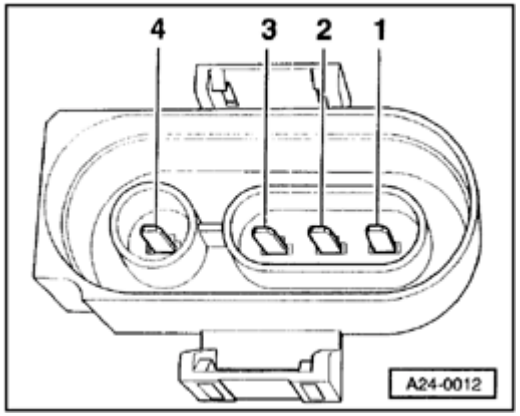
input.

- Switch ignition off.

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24-30

Continuation



- Disconnect 4-pin connector -1- (brown) for Heated Oxygen Sensor (HO2S) -G39-.

- Connect multimeter US 1119 (Fluke 83 or equivalent) between HO2S connector terminals 1 and 2, using VW 1594 connector test kit.
- Measure resistance.

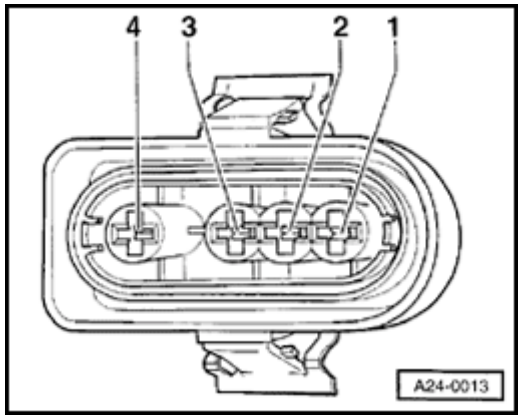
  Specified value: 0.0-19.9 Ω

If resistance is NOT OK:

- Replace Heated Oxygen Sensor (HO2S) -G39-.

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24-31



If resistance is OK:

- Switch multimeter to 20 VDC measuring range.

- Connect multimeter between harness connector terminals 1 and 2 (to ECM), using VW 1594 connector test kit.
- Measure voltage supply and check display in display group 41, display field 2.

If display = Htg.bC.ON:

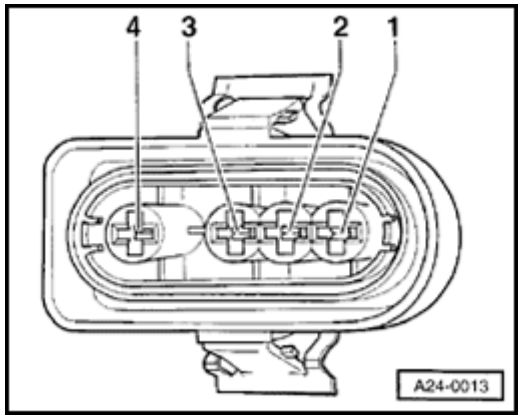
- Specified value: 11.0-14.5 volts

If display switches between "Htg.bC.ON" and "Htg.bC.OFF:"

- Specified value: 0.0-12.0 volts (oscillating)

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24-32



If there is no voltage:

- Connect multimeter between harness connector terminal 1 (to ECM) and vehicle Ground, using VW 1594 connector test kit.

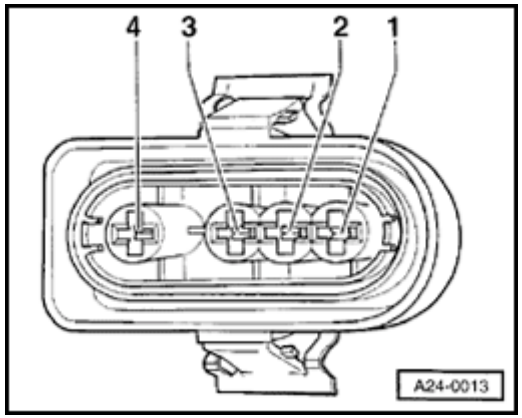
  Specified value: 11.0-14.5 volts

If there is still no voltage:

- Check wiring between terminal 1 and relay panel using appropriate wiring diagram.

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24-33



If there is voltage:

- Connect multimeter between harness connector terminal 2 (to ECM) and Battery Positive Voltage (B+), using VW 1594 connector test kit.
- Measure voltage supply and check display in display group 41, display field 2.

If display = Htg.bC.ON:

- Specified value: 11.0-14.5 volts

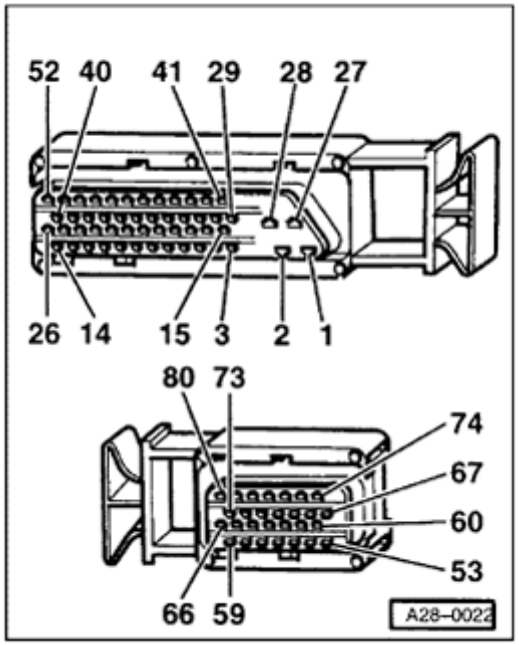
If display switches between "Htg.bC.ON" and "Htg.bC.OFF:"

- Specified value: 0.0-12.0 volts (oscillating)

- Switch ignition off.

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24-34



If there is no voltage:

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Check wiring for open circuit between ECM/test box and 4-pin HO2S harness connector (to ECM).
  - Connector terminal 2 to ECM/test box socket 27
  - Specified value: max. 1.5 Ω

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ Page 01-57
- Initiate adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-35

Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) and oxygen sensor control, checking

Notes:

- *Harness connector for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC): 4-pin, black*

- *Component locations* ⇒ *Page 24-1*

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Test requirements

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- Engine Coolant Temperature (ECT) at least 85° C (185° F)

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24-36

Function test

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	Indicated on display

- Press buttons -0-, -3- and -6- to input display group number 36, and press -Q- button to confirm input.

Read Measuring Value Block 36 → **1 2 3 4**	Indicated on display (1-4 = display fields)

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24-37

- Compare display and specified values (display fields 1 and 2):

	Display fields			
	1	2	3	4
Display group 36: Heated Oxygen Sensor (HO2S) behind Three Way Catalytic Converter (TWC)				
Display	x.xxx V	B1-S2 ON B1-S2 OFF		
Indicates	Voltage supply to HO2S behind TWC	HO2S behind TWC ON/OFF		
Range	0.000-1.000 V	---		
Specified value	0.000-1.000 V (can oscillate slightly)	B1-S2 ON		
	If not as specified ⇒ Page 24-38 , Continuation			

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Continuation

If displayed values are NOT OK (not as specified):

- Road test to condition oxygen sensor (eliminate possible contamination) and repeat test.

If the values in display fields 1 and 2 are still NOT OK:

- Check Oxygen Sensor (O2S) heater ⇒ Page 24-43 .

- Briefly accelerate engine over 3000 RPM.

If the value in display field 1 remains constant:

page ⇒ Page 24-39 , Evaluation of display group 36.

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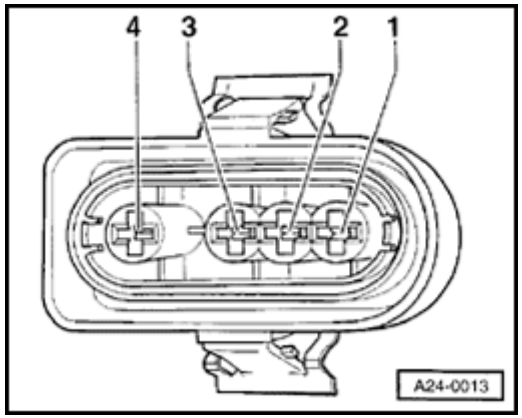
24-39

Evaluation of display group 36

Display group: 36 Display field: 1	Possible causes	Corrective action
approx. 0.435 V	♦ Open circuit in wiring -4- between oxygen sensor and ECM	- Check basic voltage ⇒ Page 24-40
approx. 0.440 V	♦ Open circuit in wiring -4- between oxygen sensor and ECM	
approx. 1.085 V	♦ Short circuit to B+ in wiring -4- between oxygen sensor and ECM	- Check wiring for oxygen sensor ⇒ Page 24-41
approx. 0.000 V	♦ Short circuit to Ground in wiring -4- between oxygen sensor and ECM	

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24-40



Checking HO2S reference voltage

- Disconnect 4-pin connector (black) for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G108-.

- Connect multimeter US 1119 (Fluke 83 or equivalent) between harness connector terminals 3 and 4 (to ECM), using adapter cables from VW 1594 connector test kit.
- Start engine and measure voltage.

  Specified value: 0.40 to 0.50 volts
- Switch ignition off.

If voltage is NOT OK:

- Check HO2S wiring ⇒ Page 24-41

If voltage is OK:

- Replace HO2S behind TWC -G108-.

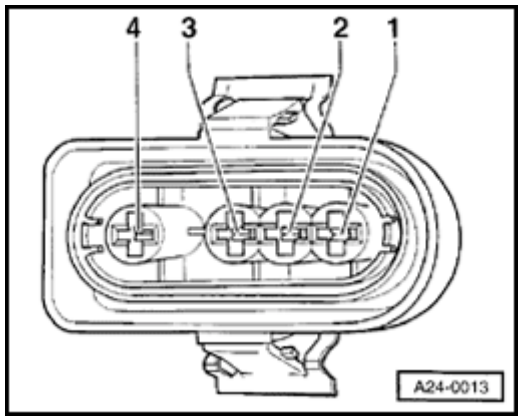
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24-41

Checking HO2S wiring

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Disconnect 4-pin connector (black) for Heated Oxygen Sensor (HO2S) behind Three Way Catalytic Converter (TWC) -G108-.



- Check wiring for open circuit between ECM/test box and 4-pin HO2S harness connector (to ECM).
  - Connector terminal 3 to ECM/test box socket 51
  - Connector terminal 4 to ECM/test box socket 52
  - Specified value: max. 1.5 Ω
- Check wiring for short circuits between terminals of 4-pin connector, between connector, ECM/test box, and shielding for wiring harness.
  - Connector terminal 4 to ECM/test box socket 51
  - Connector terminal 3 to ECM/test box socket 2
  - Connector terminal 4 to ECM/test box socket 2
  - Specified value: ∞ Ω

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24-42

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-43

Oxygen Sensor (O2S) heater (behind TWC), checking

Notes:

- *Harness connector for Oxygen Sensor (O2S) heater: 4-pin, black*
- *Component locations* ⇒ *Page 24-1*

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Test requirements

- Fuse for Oxygen Sensor (O2S) heater OK

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- Engine Coolant Temperature (ECT) at least 85° C (185° F)

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24-44

Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block **HELP**

Input display group number XXX

➢ Indicated on display

- Press buttons -0-, -4- and -1- to input display group number 41, and press -Q- button to confirm input.

Read Measuring Value Block 41 →

1 2 3 4

➢ Indicated on display (1-4 = display fields)

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24-45

- Compare display and specified values (display fields 3 and 4):

	Display fields			
	1	2	3	4
Display group 41: Oxygen Sensor (O2S) heater, before and after Three Way Catalytic Converter (TWC)				
Display	xx.x Ω	Htg.bC.ON/Htg.bC.OFF	xx.x Ω	Htg.aC.ON/Htg.aC.OFF
Indicates	Resistance of Oxygen Sensor (O2S) heater before TWC	O2S heater on or O2S heater off (before TWC)	Resistance of oxygen sensor (O2S) heater (after TWC)	O2S heater on or O2S heater off (after TWC)
Range	---	---	0.0-65.0 Ω	---
Specified value	---	---	4.9-19.9 Ω	Htg.aC.ON
	---	---	If not as specified ⇒ Page 24-46 , Continuation	---

If displayed values are OK (as specified):

- Press →button to advance program sequence.

- Press buttons -0- and -6- to select "End Output"

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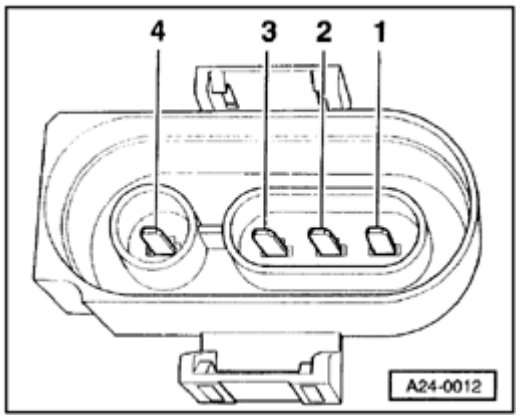
function 06, and press -Q- button to confirm input.

- Switch ignition off.

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24-46

Continuation



- Disconnect 4-pin connector (black) for Oxygen Sensor (O2S) 2 -G108- behind Three Way Catalytic Converter (TWC).

- Connect multimeter US 1119 (Fluke 83 or equivalent) between HO2S connector terminals 1 and 2, using VW 1594 connector test kit.
- Measure resistance.

  Specified value: 0.00-19.9 Ω

If resistance is NOT OK:

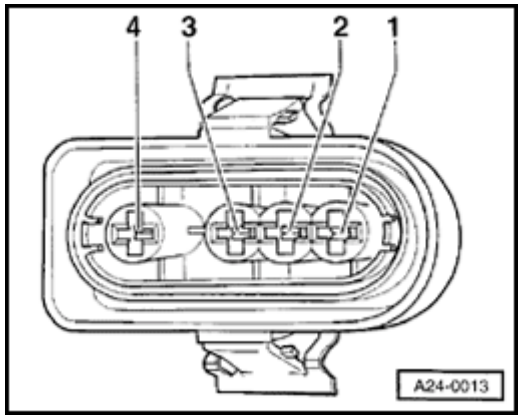
- Replace Heated Oxygen Sensor (HO2S) behind TWC -G108-.

If resistance is OK:

- Switch multimeter to 20 VDC measuring range.

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24-47



- Connect multimeter between harness connector terminals 1 and 2 (to ECM), using VW 1594 connector test kit.
- Measure voltage supply and check display in display group 41, display field 4.

If display = Htg.aC.ON:

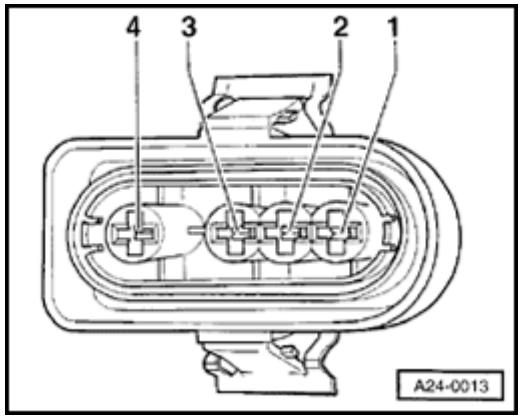
- Specified value: 11.0-14.5 volts

If display is switching between "Htg.aC.ON" and "Htg.aC.OFF"

- Specified value: 0.0-12.0 volts (oscillating)

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24-48



If there is no voltage:

- Connect multimeter between harness connector terminal 1 (to ECM) and vehicle Ground, using VW 1594 connector test kit.

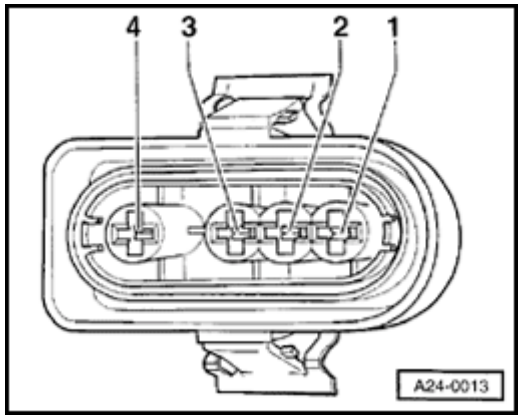
  Specified value: 11.0-14.5 volts

If there is still no voltage:

- Check wiring between terminal 1 and relay panel using appropriate wiring diagram.

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24-49



If there is voltage:

- Connect multimeter between harness connector terminal 2 (to ECM) and Battery Positive Voltage (B+), using VW 1594 connector test kit.
- Measure voltage supply and check display in display group 41, display field 4.

If display = Htg.aC.ON:

- Specified value: 11.0-14.5 volts

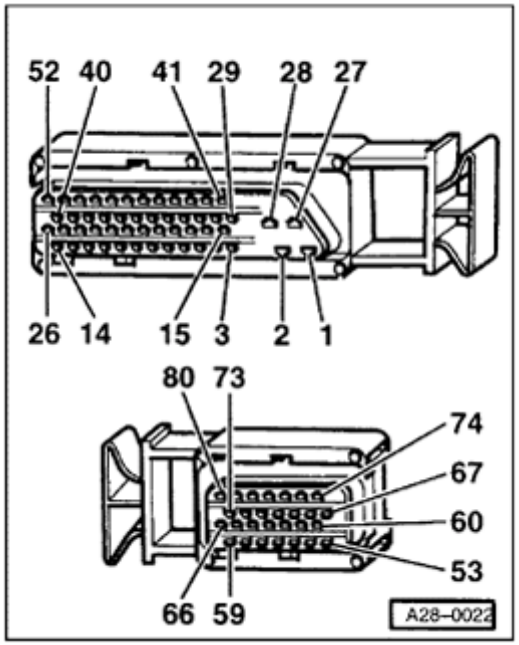
If display switches between "Htg.aC.ON" and "Htg.aC.OFF:"

- Specified value: 0.0-12.0 volts (oscillating)

- Switch ignition off.

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24-50



If there is no voltage:

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Check wiring for open circuit between ECM/test box and 4-pin HO2S harness connector (to ECM).
  - Connector terminal 2 to ECM/test box socket 28
  - Specified value: max. 1.5 Ω

If wiring is OK:

- Replace ECM -J220- ⇒ Page 01-57
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-51

Oxygen Sensor (O2S) aging, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable

Test requirements

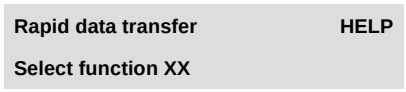
- Engine Coolant Temperature (ECT) at least 85 ° C (185 ° F)

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24-52

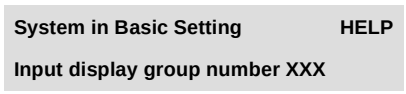
Function test

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .



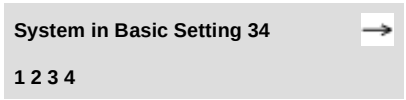
Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -3- and -4- to input display group number 34, and press -Q- button to confirm input.



Indicated on display (1-4 = display fields)

- Increase engine speed to 1800-2200 RPM and compare display with specified values for oxygen sensor aging (display fields 1-4).

Note:

To be sure that the temperature is within the specified range, the specified RPM has to be maintained for at least 1 minute. Observe status of oxygen sensor control in display field 4.

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24-53

	Display fields			
	1	2	3	4
Display group 34: Oxygen sensor aging (time period check of oxygen sensor)				
Display	xxxx RPM	xx.xx ms	xx.xx s	Test OFF/Test ON B1-S1 OK/B1-S1 n.OK
Indicates	Engine speed (in 40 RPM steps)	Engine load	Time period oxygen sensor	Diagnostic status Diagnostic result
Range	0-6800 RPM	0.00-8.50 ms	0.00-5.00 s	---
Specified value	1800-2200 RPM	0.8-2.0 ms	0.00-3.30 s	B1-S1 OK
	---	---	If not as specified ⇒ Page 24-54 , Continuation	

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24-54

Continuation

If displayed value is NOT OK (not as specified):

- Road test to condition oxygen sensor (eliminate possible contamination) and repeat test.

If displayed value is still NOT OK:

- Replace HO2S -G39-.

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-55

Engine operating conditions (engine electronics), checking

Note:

This test checks whether the Motronic Engine Control Module (ECM) -J220- recognizes the engine operating conditions.

Required special tools and test equipment

- VAG 1551 or VAG 1552 scan tool with VAG 1551/3 adapter

Test requirements

- Engine oil temperature at least 80 °C (176 °F)

Checking

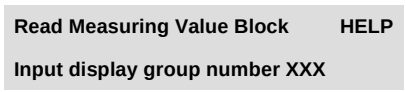
- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer **HELP**	
Select function XX	

Indicated on display

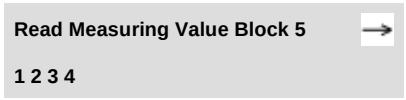
- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

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➢ Indicated on display

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



➢ Indicated on display (1-4 = display fields)

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24-56

- Check engine operating conditions (display field 4):

	Display fields			
	1	2	3	4
Display group 5: Engine electronics-operating conditions				
Display	xxx RPM	xx.xx ms	xxx km/h	Idle Part throt Full throt [1)] Decel Enrich
Indicates	Engine speed (in 40 RPM steps)	Engine load	Vehicle speed	Operational condition
Range	0-6800 RPM	0.00-8.50 ms	---	---
Specified value	760-960 RPM	0.50-1.50 ms	0 km/h	Idle: "Idle" Throttle slightly open: "Part throt" Throttle quickly closed: "Decel" Quick acceleration over 3000 RPM: "Enrich"

1) Possible only while driving

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If displayed values are NOT OK (not as specified):

- Check free movement of accelerator pedal and cable.

- Check throttle valve control module ⇒ Page 24-99 .

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24-57

Mass Air Flow (MAF) sensor, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Test requirements

- All electrical consumers switched off (coolant fan must not run during test).
- A/C must be switched off
- Fuse for MAF sensor OK

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24-58

Test sequence

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer HELP **Select function XX**	⮜	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	⮜	Indicated on display

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

Read Measuring Value Block 2 → **1 2 3 4**	⮜	Indicated on display (1-4 = display fields)

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24-59

- Compare display with specified values for engine load (display fields 2 and 4):

	Display fields			
	1	2	3	4
Display group 2: Load measurement				
Display	xxx RPM	xx.xx ms	xx.xx ms	xx.x g/s
Indicates	Engine speed (in 40 RPM steps)	Engine load	Injection time	Mass air flow
Range	0-6800 RPM	0.00-8.50 ms	0.00-25.00 ms	
Specified value	760-960 RPM	0.50-1.50 ms	1.00-3.00 ms	1.8-4.0 g/s
	2520 RPM	0.80-2.00 ms	1.50-4.00 ms	7.5-12.0 g/s
	---	If not as specified ⇒ Page 24-60 , Evaluation of display group 2	---	If not as specified ⇒ Page 24-60 , Evaluation of display group 2

If displayed values are OK (as specified):

- Press →button to advance program sequence.

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- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

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24-60

Evaluation of display group 2

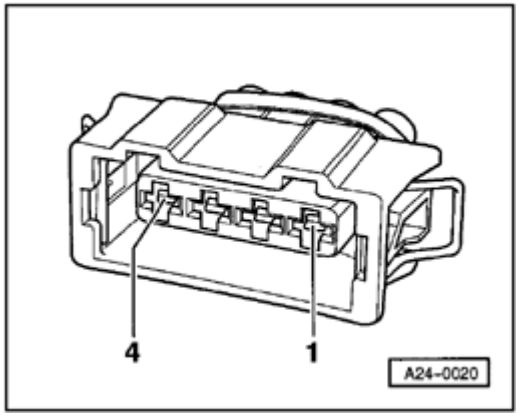
Display group: 2 Display field: 2	Possible cause	Corrective action
less than 0.50 ms	♦ Smaller values can only occur while driving during deceleration	
more than 1.50 ms	♦ Shift into drive range (auto. transmission) ♦ Engine is affected by additional consumers	- Move shift lever to P or N - Illuminate load (A/C, power steering, generator)
	♦ Poor idle (does not run on all cylinders)	- Check spark plugs - Check fuel injectors ⇒ Page 24-87
	♦ Throttle valve control module -J338 faulty	- Check throttle valve control module ⇒ Page 24-99
Display field: 4	**Possible cause**	**Corrective action**
less than 1.8 g/s	♦ Large amount of false air between intake air duct and Mass Air Flow (MAF) sensor	- Check intake air system for leaks (false air) ⇒ Page 24-97
larger than 4.0 g/s	♦ Shift lever in drive range (auto. transmission) ♦ Engine affected by additional consumers	- Move shift lever to P or N - Eliminate load (A/C, power steering, generator)

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	♦ Open circuits in wiring 3 or 4 between MAF sensor and ECM	- Check voltage supply ⇒ Page 24-61
	♦ Open circuit in wiring 1 or 2 between MAF sensor and ECM	- Check wiring ⇒ Page 24-61

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24-61



Checking voltage supply

- Disconnect 4-pin harness connector from Mass Air Flow sensor (MAF).
- Connect multimeter US 1119 (Fluke 83 or equivalent) between harness connector terminals 1 and 3 (to ECM), using adapter cables from VW 1594 connector test kit.

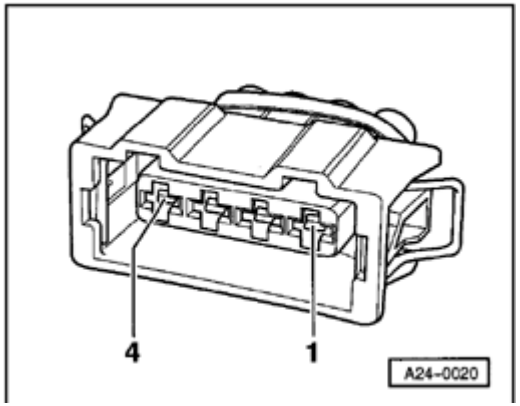
  Specified value: 9.0-14.5 volts

If there is no voltage:

- Switch ignition off.
- Check wiring using applicable wiring diagram.

Checking wiring

- Switch ignition off.
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuits between ECM/test box and 4-pin MAF sensor harness connector.
  - Connector terminal 2 to ECM/test box socket 12
  - Connector terminal 4 to ECM/test box socket 13
  - Specified value: max. 1.5 Ω

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24-62

- Check wiring for short circuits between terminals of 4-pin connector, and between connector and ECM/test box.
  - Connector terminal 4 to ECM/test box socket 12
  - Specified value: ∞ Ω
- Switch multimeter to 20 VDC measuring range.
- Check wiring at 4-pin connector for short circuit to B+ (battery positive voltage), according to applicable wiring diagram.
  - Connector terminal 2 to vehicle Ground
  - Connector terminal 4 to vehicle Ground
  - Specified value: 0 volts

If wiring is OK:

- Replace Mass Air Flow sensor (MAF) -G70-.
- Check readiness code ⇒ Page 01-59 . If

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Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-63

Engine Coolant Temperature (ECT) sensor, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Test requirements

- Engine cold

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Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ Page 01-7 .

Rapid data transfer HELP **Select function XX**	➢	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	➢	Indicated on display

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

Read Measuring Value Block 1 → **1 2 3 4**	➢	Indicated on display (1-4 = display fields)

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24-65

- Compare display with specified value for engine coolant temperature sensor (display field 2):

	Display fields			
	1	2	3	4
Display group 1: Basic function, engine idle speed				
Display	xxxx RPM	xxx.x °C	xx.x%	XXXXXX
Indicates	Engine speed (in 40 RPM steps)	Engine coolant temperature	Oxygen sensor control	Adjustment conditions
Range	0-6800 RPM	-46.5° to 141.0°C	-25.0 to 25.0 %	---
Specified value	0 RPM	approx. ambient temperature[1)]	Between -10.0 and 10.0%, value must fluctuate by at least 2 %	---
	---	If not as specified ⇒ Page 24-66 , Evaluation of display group 1	---	---

1) If indicated temperature deviates significantly from the ambient temperature, check ECT sensor wiring for resistance or open circuits.

- Start engine and let run at idle.

- Temperature value must increase evenly

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Notes:

- *Temperature is displayed in increments of 1.5 ° C.*
- *If engine performance problems occur within certain temperature ranges, and if the temperature values do not increase without interruption, the temperature signal is intermittently interrupted and the sensor must be replaced.*

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24-66

If NOT:

- Replace Engine Coolant Temperature (ECT) sensor -G62-.
- Press →button to advance program sequence.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Switch ignition off.

Evaluation of display group 1

Display group: 1 Display field: 2	Possible cause	Corrective action
approx. -46.5 ° C	♦ Open circuit or short circuit in wiring to B+	- Check wiring ⇒ Page 24-66
approx. 141.0 ° C	♦ Short circuit to Ground	

Checking wiring

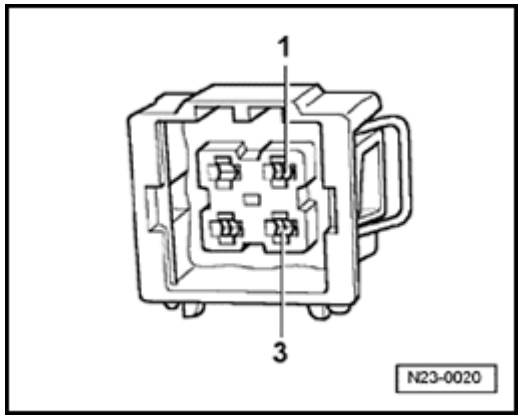
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

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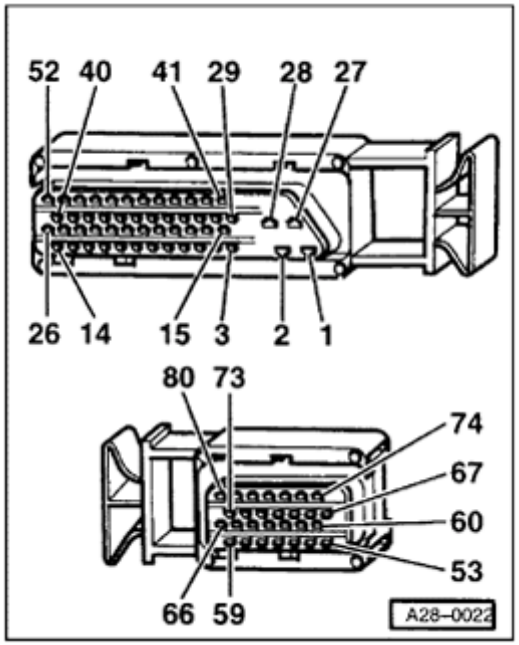
- Disconnect 4-pin connector from ECT sensor - G62-.

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24-67



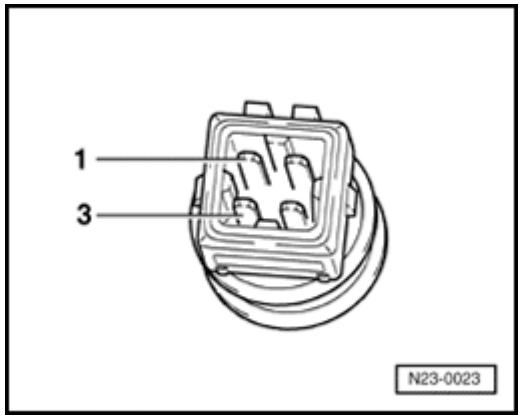
- Check wiring resistance for open circuit between ECM/test box and 4-pin ECT sensor connector.
  - Connector terminal 1 to ECM/test box socket 53
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω



- Check wiring for short circuit between ECM/test box and 4-pin harness connector according to wiring diagram.
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 1 to ECM/test box socket 67
  - Connector terminal 1 to terminal 3
  - Connector terminal 3 to vehicle Ground
  - Specified value: ∞ Ω
- Check wiring between ECM and 4-pin harness connector for short circuit to battery B+. Specified value: 0 volts
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 3 to vehicle Ground

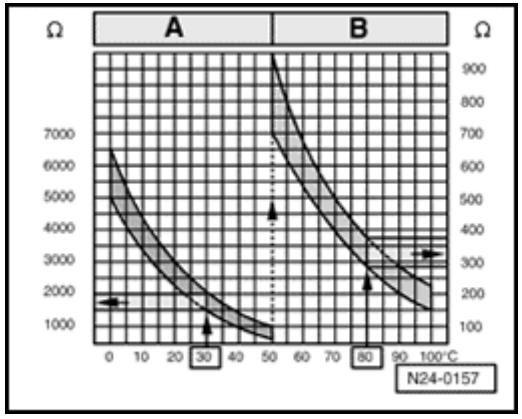
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24-68



If wiring is OK:

- Check ECT sensor resistance across terminal 1 (signal) and terminal 3 (ground).
- Check measured resistance value for appropriate temperature range using graph below (N24-0157).
  - Range A: 0 to 50 ° C
  - Range B: 50 to 100 ° C



Examples:

- At 30 ° C, ECT sensor resistance should be 1500-2000 Ω
- At 80 ° C, ECT sensor resistance should be 275-375 Ω

If resistance is NOT OK:

- Replace Engine Coolant Temperature (ECT) sensor -G62-.
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-69

Intake Air Temperature (IAT) sensor, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram
- Chilling spray (commercially available)

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24-70

Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ Page 01-7 .

Rapid data transfer HELP **Select function XX**	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	Indicated on display

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

Read Measuring Value Block 4 → **1 2 3 4**	Indicated on display (1-4 = display fields)

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24-71

- Compare displayed value with specified value for intake air temperature (display field 4):

	Display fields			
	1	2	3	4
Display group 4: Engine basic settings				
Display	xxx RPM	xx.xxx V	xxx.x °C	xxx.x °C
Indicates	Engine speed (in 40 RPM steps)	Battery Positive Voltage (B+)	Engine coolant temperature	Intake air temperature
Range	0-6800 RPM	0.000-16.500 V	-46.5 to 141.0	-46.5 to 141.0
Specified value	0 RPM	10.000-14.500 V	---	approx. ambient temperature[1)]
	---	---	---	Continuation ⇒ Page 24-72 , Evaluation of display group 4

[1)] If temperature displayed deviates significantly from ambient temperature, check sensor wiring for contact resistance or open circuit.

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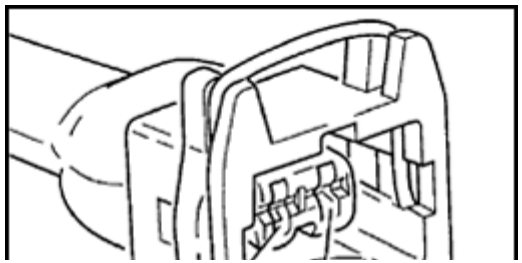
24-72

Evaluation of display group 4

Display group: 4 Display field: 4	Possible cause	Corrective action
-46.5 ° C	♦ Open or short circuit in wiring to B+	⇒ Page 24-72 , check wiring
141.0 ° C	♦ Short circuit to ground	
approx. ambient temperature	♦ Signal intermittently interrupted	- Check IAT sensor ⇒Continuation of test, page ⇒ Page 24-74

Wiring, checking:

- Switch ignition off.
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .
- Disconnect 2-pin connector from Intake Air Temperature (IAT) sensor -G42-.



- Check wiring for open circuit between ECM/test box and 2-pin IAT harness connector (to ECM).
  - ♦ Connector terminal 1 to ECM/test box socket 54
  - ♦ Connector terminal 2 to ECM/test box socket 67

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- Specified value: max. 1.5 Ω

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24-73

- Check wiring for short circuit between ECM/test box and 2-pin harness connector according to wiring diagram.
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 1 to ECM/test box socket 67
  - Connector terminal 1 to terminal 2
  - Connector terminal 2 to vehicle Ground
  - Specified value: ∞ Ω
- Check wiring between ECM and 2-pin harness connector for short circuit to battery B+.
  - Connector terminal 1 to vehicle Ground
  - Connector terminal 2 to vehicle Ground
  - Specified value: 0 volts



- Check resistance across terminals of IAT sensor -G42-.

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Specified value: approx. 1.6-2.8 kΩ

If resistance is NOT OK:

- Replace intake air temperature sensor -G42-.

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24-74

Continuation of test

(when IAT sensor indicates approx. ambient temperature)

- Without disconnecting harness connector, remove IAT sensor -G42-.

- Monitor intake air temperature value in display field 4.

- Spray sensor with commercially available chilling spray and check temperature value in display field 4.

  - Temperature value must decrease

If NOT:

- Replace intake air temperature sensor -G42-.

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-75

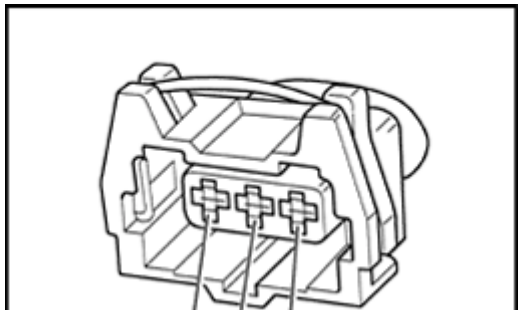
Engine Speed (RPM) sensor, checking

Required special tools and test equipment

- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Checking

- Disconnect 3-pin harness connector from engine speed sensor ⇒ Page 24-1 , Component locations
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit between ECM/test box and 3-pin harness connector.
  - Connector terminal 1 to ECM/test box socket 56
  - Connector terminal 2 to ECM/test box socket 63
  - Connector terminal 3 to ECM/test box socket 2

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- Specified value: max. 1.5 Ω

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24-76

- Check wiring for short circuit between ECM/test box and 4-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 2
  - Connector terminal 1 to ECM/test box socket 63
  - Connector terminal 2 to ECM/test box socket 56
  - Specified value: $\infty\ \Omega$

If wiring is OK:

- Replace engine speed (RPM) sensor -G28-.
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-77

Voltage supply to Engine Control Module (ECM)

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagram

Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on) ⇒ Page 01-7 .

Rapid data transfer **HELP**	
Select function XX	

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

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Read Measuring Value Block HELP

Input display group number XXX

➢ Indicated on display

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

Read Measuring Value Block 4 →

1 2 3 4

➢ Indicated on display (1-4 = display fields)

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24-78

- Check battery positive voltage (B+) in display field 2.

	Display fields			
	1	2	3	4
Display group 4: Basic engine setting				
Display	xxx RPM	xx.xxx V	xxx.x °C	xxx.x 5C
Indicates	Engine speed (in 40 RPM steps)	Battery Positive Voltage (B+)	Engine coolant temperature	Intake air temperature
Range	0-6800 RPM	0.000-16.500 V	-46.5 to 141.0	-46.5 to 141.0
Specified value	0 RPM	10.000-14.500 V	---	---
	---	If not as specified ⇒ Page 24-79 , Evaluation of display group 4	---	---

If displayed value is OK (as specified):

- Press →button to advance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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24-79

Evaluation of display group 4

Display group: 4 Display field: 2	Possible cause	Corrective action
No VAG 1551 display	♦ Fuse for ECM faulty	- Replace fuse
	♦ Open circuit in wiring	- Voltage supply at terminal 15 ⇒ Page 24-80 - Voltage supply at terminal 30 ⇒ Page 24-79
Displayed value changes between 10.0-14.5 V	♦ Intermittent connection	
0.0-10.0 V	♦ Battery discharged/faulty ♦ Voltage regulator faulty	- Check battery - Check generator - Check voltage regulator
14.5-16.5 V	♦ Generator faulty ♦ Voltage regulator faulty	- Check generator - Check voltage regulator

Checking voltage supply at terminal 30

- Switch ignition off.

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

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- Connect multimeter US 1119 (Fluke 83 or equivalent) between ECM/test box sockets 2 (Ground) and 3 (B+), using adapter cables from VW 1594 connector test kit.

  Specified value: 10-14.5 volts

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If voltage is NOT OK:

- Check wiring according to applicable wiring diagram.

Checking voltage supply at terminal 15

- Switch ignition off.

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Connect multimeter between ECM/test box sockets 1 (B+) and 2 (Ground), using adapter cables from VW 1594 connector test kit.

- Switch ignition on, and check voltage.

  Specified value: 10-14.5 volts

If voltage is NOT OK:

- Check wiring according to applicable wiring diagram.

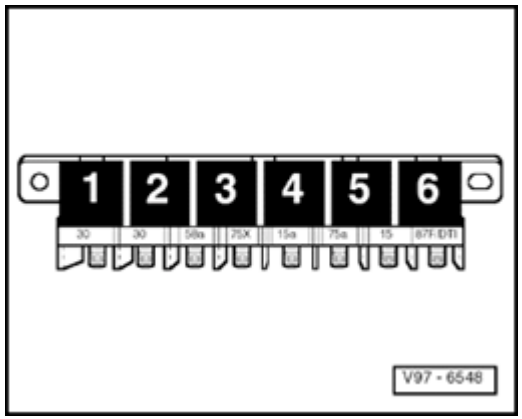
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected,

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generate new readiness code ⇒ Page 01-62 .

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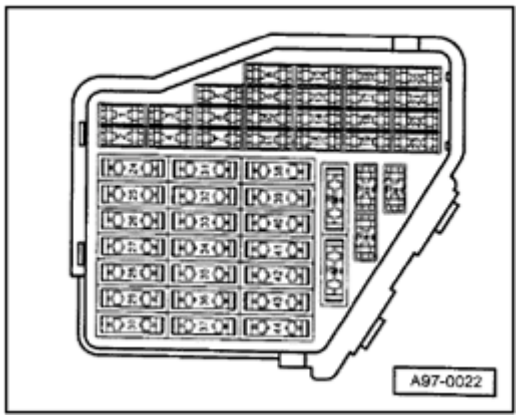
Fuel pump relay and connections, checking



➢ The fuel pump relay is located at relay position 4 on the relay panel on the left side under the instrument panel.

Checking function of fuel pump relay -J17-

- Remove storage shelf in left-front footwell.



➢
- Remove fuses 28, 29 and 34 from fuse panel.
- Connect VAG 1527B LED voltage tester between Ground and one of the two terminals for fuse 28.
- Briefly crank starter.
  - ♦ LED test light must light up.
  - ♦ Fuel pump relay must be actuated (sound and vibration)

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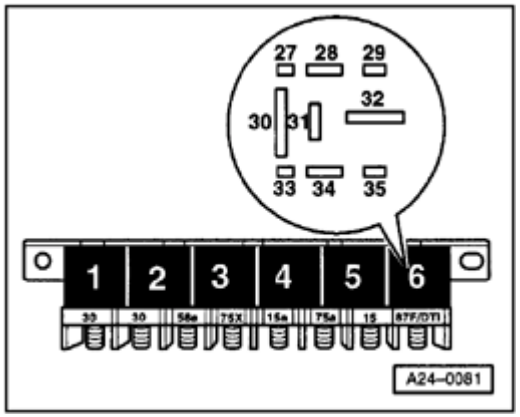
24-82

If the fuel pump does not respond:

- Check power supply wiring ⇒ Page 24-84 .

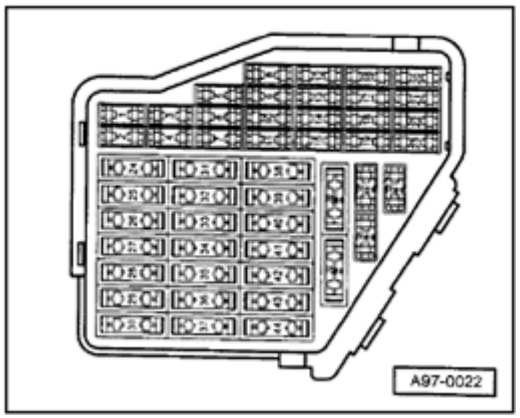
If the LED test light does not light up:

- Repeat test at other terminal of fuse 28.



➢ If the LED light still does not light up:

- Check wiring for open or short circuits between fuse 28 and terminal 30 at relay position 6, using the applicable wiring diagram. Repair wiring as necessary.



➢

- Connect VAG 1527B LED voltage tester between Ground and one of the two terminals for fuse 29.

Note:

This step lets the fuel pump run without the engine running. The closed throttle position switch must be closed during the test, or the selected fuel injector will discharge fuel when it is actuated 5 times.

- Initiate output Diagnostic Test Mode (DTM) and advance to test of

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cylinder 1 fuel injector -N30- ⇒ Page 01-42 .

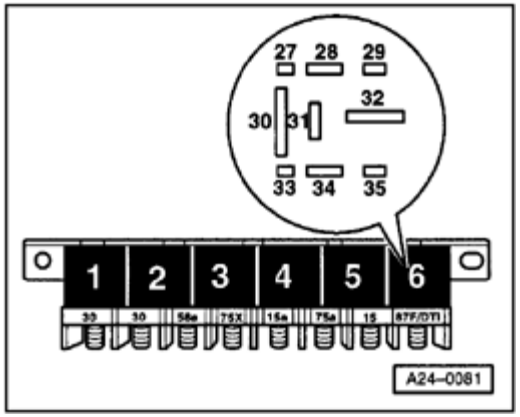
- LED test light must light up
- Fuel pump relay must be activated
- Fuel pump must run

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24-83

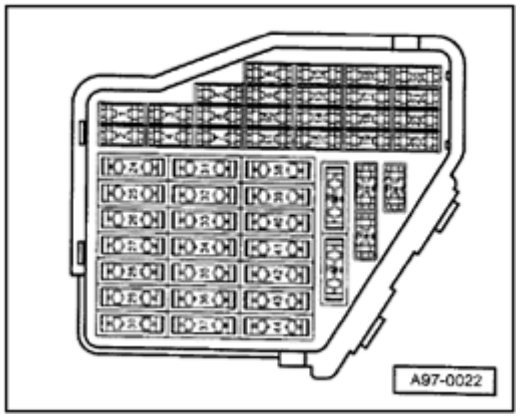
If the LED test light does not light up:

- Repeat test at other terminal of fuse 29.



➢ If the LED test light does not light up:

- Check wiring for open circuit between fuse 29 and terminal 30 at relay position 6, using the applicable wiring diagram. Repair wiring as necessary.



➢

- Connect VAG1527 LED voltage tester between Ground and one of the two terminals of fuse 34.

Note:

This step lets the fuel pump run without the engine running. The closed throttle position switch must be closed during the test, or the selected fuel injector will discharge fuel when it is actuated 5 times.

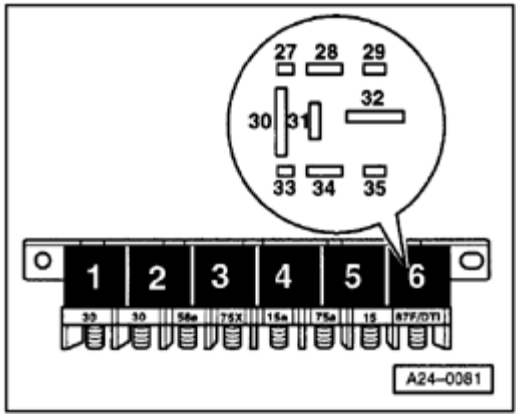
- Initiate output Diagnostic Test Mode (DTM) and advance to test of cylinder 1 fuel injector -N30- ⇒ Page 01-42 .
  - ♦ LED test light must light up
  - ♦ Fuel pump relay must be activated

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- Fuel pump must run

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24-84



If the LED test light does not light up:

- Repeat test at other terminal of fuse 34.

If the LED test light does not light up:

- Check wiring for open circuit between fuse 34 and terminal 31 at relay position 6, using the applicable wiring diagram. Repair wiring as necessary.

Checking fuel pump relay voltage supply

- Remove fuel pump relay -J17- from relay panel position 6.
- Switch ignition on.
- Connect multimeter US 1119 (Fluke 83 or similar) and check for voltage at relay socket:
  - Terminals 28 (B+) and 34
  - Terminals 32 (B+) and 34
  - Specified values: approx. Battery Positive Voltage (B+)

If voltage is NOT OK:

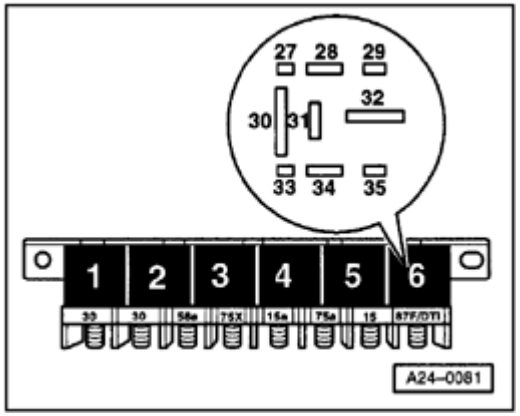
- Repair wiring according to applicable wiring diagram.

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Checking fuel pump relay signal

- Fuel pump relay -J17- removed
- Fuses 28, 29 and 34 removed from fuse panel

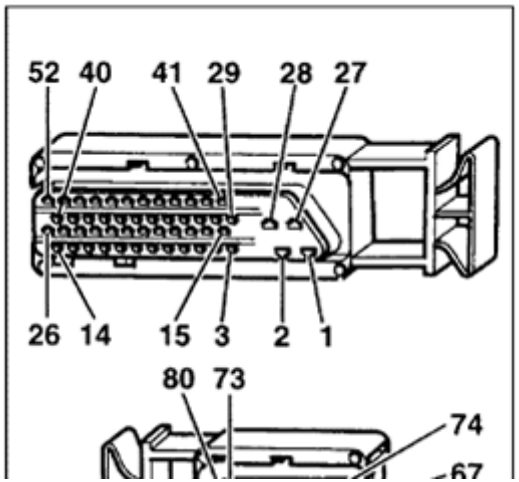


- Connect VAG 1527B LED voltage tester between relay socket terminals 28 (B+) and 29.

  LED test light must light up (dimly).

- Briefly crank starter; LED test light must continue to light up (dimly).

If the LED test light does not light up while cranking the starter, check wiring as follows.



- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 . (Numbers marked on ECM connector match those on test box).
- Connect multimeter US 1119 (Fluke 83 or equivalent) to check for open circuit between relay socket terminal 29 and test box socket 4.

  Specified value: max. 1 Ω

If resistance is NOT OK:

- Repair wiring using applicable wiring diagram.

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

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24-86

If the wiring is OK, but the LED test light does not light up:

- Replace Engine Control Module (ECM) ⇒ Page 01-57 .

If the wiring is OK, and the signal to the fuel pump relay is OK:

- Replace fuel pump relay -J17-.

- Reinstall fuses.

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24-87

Fuel injector actuation, checking

Triggering fuel injectors via output Diagnostic Test Mode (DTM) ⇒ Page 01-42

Required special tools and test equipment

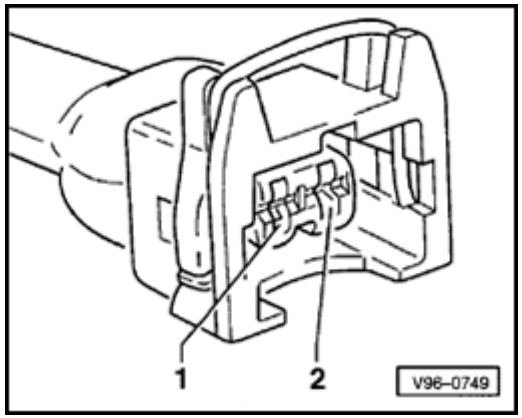
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VAG 1527B LED voltage tester
- VW 1594 connector test kit
- Wiring diagram

Test requirements

- Fuse for fuel injectors OK
- Engine speed (RPM) sensor OK
- Fuel pump relay OK

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Checking

- Disconnect harness connector from cylinder 1 fuel injector.
- Connect VAG 1527B LED voltage tester between connector terminals (to ECM), using adapters from VW 1594 connector test kit.
- Disconnect harness connectors from fuel injectors for cylinders 2, 3 and 4.
- Crank starter briefly to check voltage supply for cylinder 1 fuel injector.

  LED must flicker.
- Repeat test for fuel injectors for cylinders 2, 3 and 4.

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24-89

If LED does not flicker:

- Switch ignition off.
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .
- Check wiring for open circuits between ECM/test box and fuel injector harness connectors:
  - Cyl. 1 fuel injector terminal 2 to ECM/test box socket 73
  - Cyl. 2 fuel injector terminal 2 to ECM/test box socket 80
  - Cyl. 3 fuel injector terminal 2 to ECM/test box socket 58
  - Cyl. 4 fuel injector terminal 2 to ECM/test box socket 65
  - Specified value: max. 1.5 Ω
- Check wiring for open circuit between fuel injector connector terminal 1 and relay panel, according to wiring diagram.

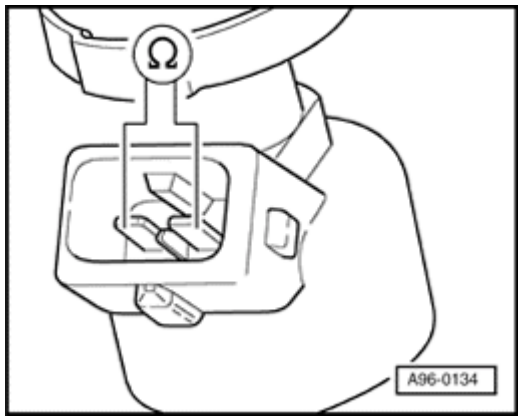
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Specified value: max. 15 Ω

- Check wiring for short circuits between wires and connector terminals.

Specified value: ∞ Ω

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Fuel injector resistance, checking

- Check resistance of individual fuel injectors.

  Specified value: 11-13 Ω

Note:

With engine at operating temperature, resistance increases by approx. 4-6 Ω

If resistance is NOT OK:

- Replace affected fuel injector.

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24-91

Fuel injectors, checking for leakage

WARNING!

The fuel system is under pressure! Before loosening hoses or opening the test connection, cover the connection with a rag. Only then, open carefully to slowly release pressure.

Required special tools and test equipment

- VW 1594 connector test kit
- VAG 1630 digital potentiometer
- VAG 1602 fuel analyzer

Checking

- Disconnect harness connector for Camshaft Position (CMP) sensor -G40-.
- Disconnect vacuum hose from fuel pressure regulator.
- Remove fuel rail together with fuel injectors.

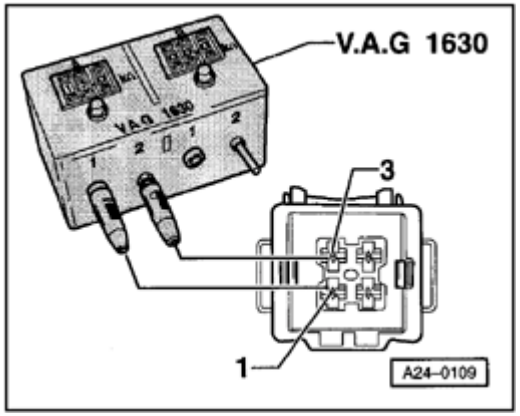


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- Insert fuel injectors in VAG 1602 fuel analyzer.

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24-92



- Disconnect harness connector for Engine Coolant Temperature (ECT) sensor -G62-.
- Adjust VAG 1630 digital potentiometer to 15 kΩ setting.
- Connect to ECT sensor harness connector terminals 1 and 3, using adapter cables from VW 1594 connector test kit.
- With the aid of a helper, briefly crank starter.

  Fuel injectors must spray according to the firing order.
- Switch ignition off, and check for leaks at fuel injectors.

  Fuel injectors may not drip more than 2 drops per minute.

Note:

When reinstalling the fuel injectors be careful not to damage the O-rings.

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24-93

Fuel pressure regulator and residual pressure, checking

The fuel pressure regulator controls the fuel pressure depending on intake manifold pressure.

Required special tools and test equipment

- Pressure tester VAG 1318
- Adapter 1318/11
- Adapter 1318/12
- Adapter 1318/13

Test requirements

- Fuel pump delivery rate must be OK; checking:

⇒ *Repair Manual, Fuel Supply System, Repair Group 20.*

Checking

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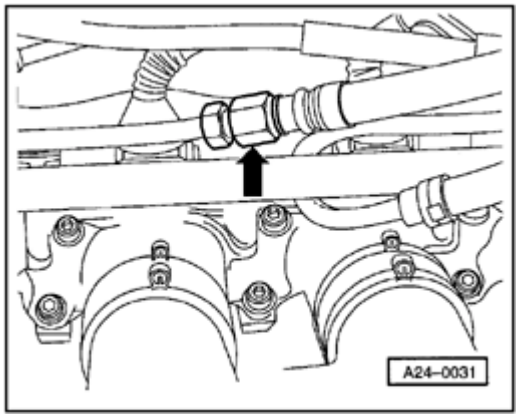
WARNING!

The fuel system is under pressure! Before loosening hoses or opening the test connection, cover the connection with a rag. Only then, open carefully to slowly release pressure.

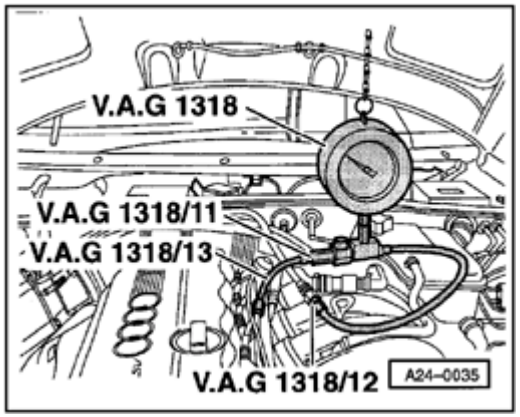
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24-94

- Open fuel filler cap briefly (release pressure).



- Cover the fuel supply line connection (arrow) to protect against fuel spray.
- Slowly open connection and catch leaking fuel.



- Connect pressure tester VAG 1318 to fuel rail using adapters VAG 1318/11, VAG 1318/12 and VAG 1318/13.

Note:

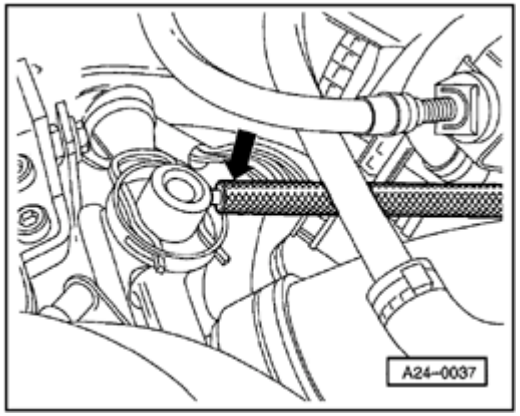
The valve on the pressure tester must be open (lever pointing in direction of flow).

- Start engine and let run at idle.
- Measure fuel pressure.

  Specified value: approx. 3.5 bar (50 psi)

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24-95



- Disconnect vacuum hose (arrow) for fuel pressure regulator.

  Fuel pressure must increase to approximately 4.0 bar (58 psi)

- Reconnect vacuum hose.
- Switch ignition off.
- Check for residual fuel pressure by monitoring decrease in pressure on gauge. Specified value:

  After 10 minutes: at least 2.5 bar (36 psi)

If residual pressure drops below 2.5 bar (36 psi):

- Start engine and let run at idle.
- After pressure has built up, at the same time:
  - Switch ignition off.
  - Close valve on pressure tester VAG 1318-lever in OFF position (arrow).
- Monitor decrease in pressure on gauge.

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24-96

If residual pressure still drops below 2.5 bar (36 psi), possible malfunctions are:

- Leaking connection between pressure tester and fuel line
- Leaking connection between fuel supply line and fuel rail
- Faulty check valve in fuel pump; removing and installing:

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

If residual pressure no longer drops below 2.5 bar (36 psi), the possible malfunctions are:

- Leaking fuel pressure tester connections after shut-off valve.
- Faulty fuel pressure regulator
- Leaking fuel injectors

Note:

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When disconnecting the pressure tester, close the shut-off valve, disconnect adapter VAG 1328/12, then catch excess fuel in a container by opening the shut-off valve.

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24-97

Intake air system, checking for leaks (false air)

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- Engine leak detector spray G 001 800 A1

Notes:

- *If there are leaks, intake manifold vacuum will draw in the leak detector spray with outside air. The spray reduces the ability of the fuel/air mixture to ignite, which causes a drop in engine speed and a significant increase in CO-content.*
- *Observe the safety precautions listed on the container.*

Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer HELP	<	Indicated on display

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Select function XX

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP

Input display group number XXX

➢ Indicated on display

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

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24-98

Read Measuring Value Block 1 →

1 2 3 4

< Indicated on display (1-4 = display fields)

- Monitor oxygen sensor control in display field 3.

	Display fields			
	1	2	3	4
Display group 1: Idle test				
Display	xxxx RPM	xxx.x °C	xx.x%	xxxxxx
Indicates	Engine speed (in 40 RPM steps)	Engine temperature	Oxygen sensor control	Adjustment conditions
Range	0-6800 RPM	---	-25.0 to 25.0 %	---
Specified value	760-960 RPM	---	In the range of -10.0 to 10.0% the value must fluctuate by at least 2%	---

- Systematically spray parts of intake air system with engine leak detector spray.

If engine speed drops, or the value displayed for oxygen sensor control changes:

- Check for leaks in area of intake air system most recently sprayed, and eliminate leaks.

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Throttle valve control module, checking

Note:

If the throttle valve control module -J338- is removed and installed, or replaced, adaptation of the throttle valve control module to the Motronic ECM is required ⇒ *Page 24-119* .

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagrams

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Function

Idle speed stabilization is integrated in the throttle valve control module -J338-. In the housing opposite the throttle valve are Throttle Position (TP) sensor -G69-, Closed Throttle Position (CTP) switch -F60-, throttle drive -G186- and angle sensor -1- for throttle drive -G187-.

The housing should not be opened.

The individual components cannot be replaced or mechanically adjusted. All adjustments are accomplished by the VAG 1551 Scan Tool (ST) using the "Basic Setting" function 04.

If the complete throttle valve control module is without power (i.e. disconnected), the throttle valve assumes a mechanical closed throttle position that results in an increased idle speed of 1200-1300 RPM (with engine at operating temperature).

If only the Throttle Position (TP) actuator -V60- is without power, the throttle valve also assumes a mechanical closed throttle position (limp-home position), but because the signal from the CTP switch -F60- can still be recognized, a nearly "normal" idle speed of approx. 900 RPM is maintained with a corresponding reduction of the ignition timing advance.

If the Engine Control Module (ECM) recognizes a

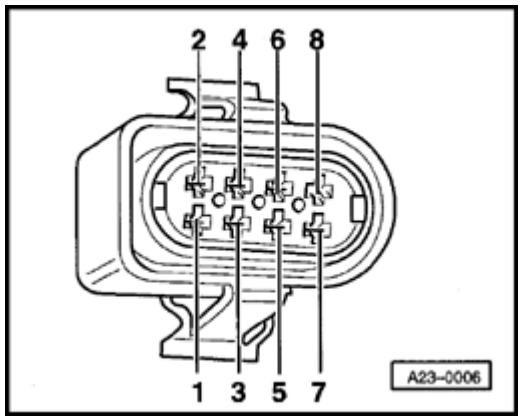
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malfunction in the angle sensor -1- for throttle drive -G187-, it switches the power off for throttle drive -G186-,and the throttle valve again assumes the mechanical closed throttle position (limp-home position).

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24-101

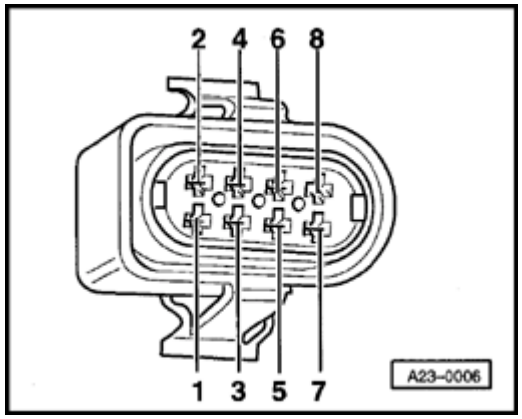
Throttle valve control module power supply, checking



- Disconnect 8-pin harness connector from throttle valve control module -J338-.
- Connect multimeter US 1119 (Fluke 83 or equivalent) between harness connector terminals using adapter cables from VW 1594 connector test kit.
- Switch ignition on, and check voltage. Specified values:
  - Connector terminals 3 and 7 (Ground): 9.0-14.5 volts
  - Connector terminals 4 and 7 (Ground): 4.0-6.0 volts
- Switch ignition off.

If voltage is NOT OK:

- Connect VAG 1598/22 test box ⇒ Page 01-56 .



- Check wiring for open circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 3 to ECM/test box socket 69
  - Connector terminal 4 to ECM/test box socket 62
  - Connector terminal 7 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω

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- Check wiring for short circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 7 to ECM/test box socket 69
  - Connector terminal 7 to ECM/test box socket 62
  - Connector terminal 4 to ECM/test box socket 67
  - Specified value: ∞ Ω
- Reconnect throttle valve control module harness connector.

If wiring is OK:

- Replace Motronic Engine Control Module (ECM) -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected,

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generate new readiness code ⇒ Page 01-62 .

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Closed Throttle Position (CTP) switch, checking

Note:

The Closed Throttle Position (CTP) switch -F60- is inside the throttle valve control module -J338-.

Test conditions

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK

- Power supply for throttle valve control module OK; checking ⇒ Page 24-101

Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

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Rapid data transfer HELP
Select function XX

➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP
Input display group number XXX

➢ Indicated on display

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24-104

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

Read Measuring Value Block 5 →

1 2 3 4

< Indicated on display (1-4 = display fields)

- Check Closed Throttle Position (CTP) switch (display field 4):

	Display fields			
	1	2	3	4
Display group 5: Engine electronics				
Display	xxx RPM	xx.xx ms	xxx km/h	Idle Part throt Full throt Decel Enrich
Indicates	Engine speed (in 40 RPM steps)	Engine Load	Vehicle speed	Operational condition
Range	0-6800 RPM	0.00-8.50 ms	---	---
Specified value	760-960 RPM	0.50-1.50 ms	0 km/h	Throttle closed: "Idle" Throttle slightly open: "Part throt"

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	---	---	---	If display is NOT OK ⇒ Page 24-105 , Continuation

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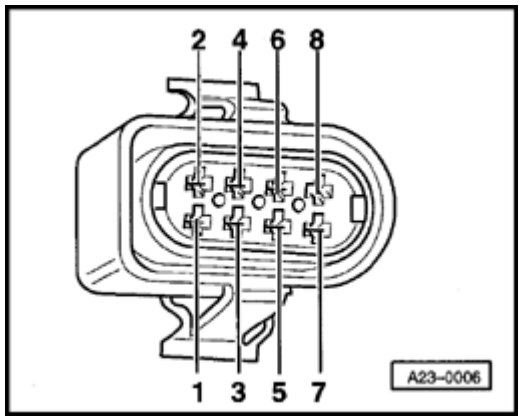
24-105

Continuation

- Switch ignition off.
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .
- Connect multimeter US1119 (Fluke 83 or similar) and check resistance between test box sockets 67and 69.

  Specified value: max. 5.0 Ω
- Open throttle slowly. Specified value: ∞ Ω

If resistance is NOT OK:



- Disconnect 8-pin harness connector for throttle valve control module -J338-.
- Check wiring for open circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 3 to ECM/test box socket 69
  - Connector terminal 7 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω
- Check wiring for short circuit between ECM/test box and 8-pin harness connector.

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- Connector terminal 7 to ECM/test box socket 69
- Specified value: ∞ Ω

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24-106

- Reconnect throttle valve control module harness connector.

If wiring is OK:

- Replace throttle valve control module -J338-.

- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-107

Throttle drive and angle sensor for throttle drive, checking

Note:

Throttle drive -G186- and angle sensor -1- for throttle drive -G187- are located in the throttle valve control module -J338-.

Test conditions

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

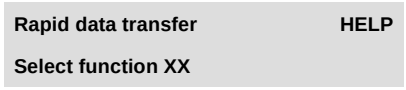
⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK
- Power supply for throttle valve control module OK; checking ⇒ Page 24-101
- Engine coolant temperature at least 80 °C (176 °F)
- Automatic transmission selector lever in "P" or "N"

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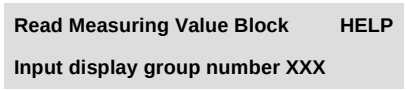
Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .



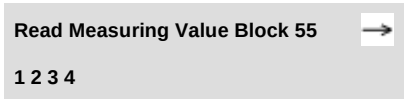
➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



➢ Indicated on display

- Press buttons -0-, -5- and -5- to input display group number 55, and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

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24-109

- Compare display with specified values for idle air control (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 55: Idle control				
Display	xxx RPM	x.xx g/s	x.xx g/s	xxxx
Indicates	Engine speed RPM (in steps of 10 RPM)	Regulating value-idle mass air flow (idle air control)	Learning value-idle mass air flow	Operating conditions
Range	0-2550 RPM	-2.80 to 4.17 g/s	-1.94 to 2.22 g/s	---
Specified value	820-900 RPM	-1.11 to 1.11 g/s	-1.11 to 1.11 g/s	0000
	If engine speed is NOT OK ⇒ Page 24-111 , Continuation	If display is NOT OK ⇒ Page 24-110 , Evaluating display group 55		Explanation ⇒ Page 24-110

If displayed values are OK:

- Press →button to advance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

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Evaluating display group 55

Display group: 55 Display fields: 2 + 3	Possible cause	Corrective action
above 1.11 g/s	♦ Increased load because of switched-on consumers ♦ Throttle valve mechanism sticking ♦ Air passage in area of throttle valve contaminated	- Switch off electrical consumers - Visually check, repair if necessary
below -1.11 g/s	♦ Intake air leak (false air) behind throttle valve	- Check intake air system for leaks (false air) ⇒ Page 24-97 - Check exhaust system: ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AEB, ATW, Repair Group 26*

Explanation of the 4-digit display

Explanation when display field is = 0				
x	x	x	x	(Display group 55)
			0	A/C compressor off (0 = A/C compressor off /1 = A/C compressor on)
		0		Shift lever in P or N (0 = Shift lever in P or N/ 1 = Shift lever in 2/3/4/R/D)
	0			Always "0"

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0				Always "0"

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24-111

Continuation

- Switch ignition off.

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

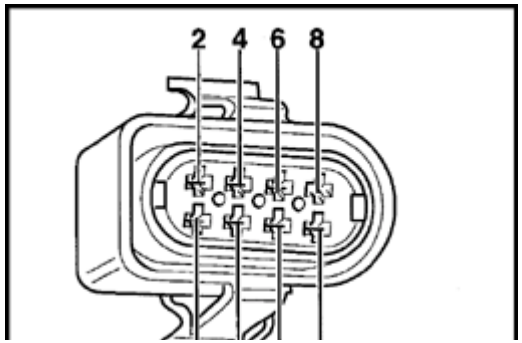
- Switch ignition on.

- With throttle valve in closed throttle position, connect multimeter US 1119 (Fluke 83 or equivalent), and check resistance between ECM/test box sockets 59 and 66.

  Specified value: 3-200 Ω

If resistance is NOT OK:

- Disconnect 8-pin harness connector from throttle valve control module -J338-.



- Check wiring for open circuit between ECM/test box and 8-pin throttle valve control module harness connector.
  - Connector terminal 1 to ECM/test box socket 66
  - Connector terminal 2 to ECM/test box socket 59
  - Connector terminal 7 to ECM/test box socket 67

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- Connector terminal 8 to ECM/test box socket 74
- Specified value: max. 1.5 Ω

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24-112

- Check wiring of 8-pin connector for short circuit between wires, according to wiring diagram.

  - Connector terminal 1 to ECM/test box socket 59
  - Connector terminal 1 to ECM/test box socket 74
  - Connector terminal 1 to ECM/test box socket 67
  - Connector terminal 2 to ECM/test box socket 67
  - Connector terminal 2 to ECM/test box socket 74
  - Connector terminal 7 to ECM/test box socket 74
  - Specified value: $\infty\ \Omega$

If wiring is OK:

- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .

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- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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24-113

Throttle Position (TP) sensor, checking

Note:

Throttle Position (TP) sensor -G69- is located inside the throttle valve control module -J338-.

Test conditions

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK

- Power supply for throttle valve control module OK; checking ⇒ Page 24-101

Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched; engine not running) ⇒ Page 01-7 .

Rapid data transfer HELP	⮜	Indicated on display

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Select function XX

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP

Input display group number XXX

➢ Indicated on display

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24-114

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

Read Measuring Value Block 3 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Compare display with specified values for throttle angle, (display field 3):

	Display fields			
	1	2	3	4
Display group 3: Load measurement				
Display	xxx RPM	xx.x g/s	xxx ∠°	xx.x °BTDC
Indicates	Engine speed (in 40 RPM steps)	Mass air flow	Throttle angle	Ignition timing
Range	0-6800 RPM	---	0-90 ∠°	0.0°-50.0 °BTDC
Specified value	0 RPM	---	0-5 ∠°	0.0°
	---	---	If not as specified ⇒ Page 24-115 , Evaluating display group 3	---

- Open throttle valve slowly while monitoring degree (°) value in display field 3.

  Value must increase uniformly over the entire range.

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- Press →button to advance program sequence.

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- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

Note:

The values displayed in display field 3 depend on the calibration of the Throttle Position (TP) sensor and do not correspond with the actual throttle valve opening in degrees. The maximum displayed value is 90.0 ∠°.

If the throttle angle value does not increase uniformly:

- Replace throttle valve control module -J338-.

- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

Evaluating display group 3

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Display group: 3 Display field: 3	Possible cause	Corrective action
0.0 ∠ °	♦ Open circuit in wiring	- Check wiring ⇒ Page 24-116
99.0 ∠ °	♦ Short circuit to ground (GND)	

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Checking wiring

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Connect multimeter US 1119 (Fluke 83 or equivalent), using adapter cables from VW 1594 connector test kit.

- Measure resistance to check for short circuit between test box sockets 2 (Ground) and 75 (signal wire).

  - Test box sockets 2 and 75

  - Specified value: ∞ Ω

- Switch multimeter to voltage (20 VDC) measuring range.

- Switch ignition on.

- Check wiring for short circuit to B+.

  Note voltage reading if applicable (if not 0 volts).

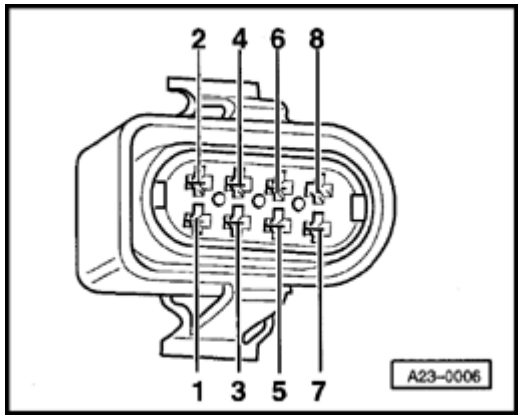
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- Switch ignition off.

- Continue test, depending on whether or not voltage was measured ⇒ Page 24-117 or page ⇒ Page 24-118 .

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24-117



Continuation (with measured voltage)

- Disconnect 8-pin harness connector from throttle valve control module -J338-.

If measured voltage was approx. 5 volts:

- Connect multimeter US 1119 (Fluke 83 or equivalent), using adapter cables from VW 1594 connector test kit.
- Measure resistance to check for short circuit between test box sockets 62 (power supply) and 75 (signal wire).
  - Test box sockets 62 and 75
  - Specified value: $\infty\ \Omega$

If measured voltage was approx. battery positive voltage (B+):

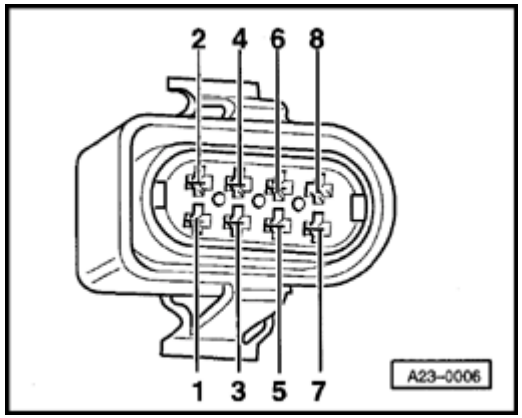
- Check wiring at 8-pin connector, terminal 5 for short circuit to battery B+.

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24-118

Continuation (with no measured voltage)

- Disconnect 8-pin harness connector from throttle valve control module -J338-.



- Check wiring for open circuit between ECM/test box and 8-pin harness connector.
  - Connector terminal 5 to ECM/test box socket 75
  - Specified value: max. 1.5 Ω

If wiring is OK:

- Replace throttle valve control module -J338-.
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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Throttle valve control module, adaptation to Engine Control Module (ECM)

If the throttle valve control module -J338- is removed and installed, or replaced, adaptation of the throttle valve control module to the Motronic ECM is required ⇒ Page 24-119 .

During "adaptation" with ignition switched on and the engine not running, the Motronic ECM "learns" the closed throttle position (CTP), wide open throttle (WOT) and other positions of the throttle valve control module, and a characteristic curve of the relationship between Throttle Position (TP) sensor -G69- and angle sensor for throttle drive -G187-.

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable

Test conditions

- No malfunctions stored in DTC memory ⇒ Page 01-15

- Throttle valve in closed throttle position; if necessary adjust accelerator pedal cable

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⇒ *Repair Manual, Fuel Supply System, Repair Group 20*

- Cruise control adjustment OK
- Power supply for throttle valve control module OK; checking ⇒ Page 24-101

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Test procedure

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with ignition switched on; engine not running) ⇒ Page 01-7 .

Rapid data transfer HELP
Select function XX

Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04, and press -Q- button to confirm input.

System in Basic Setting HELP
Input display group number XXX

Indicated on display

- Press buttons -0-, -6- and -0- to input display group number 60, and press -Q- button to confirm input.

System in Basic Setting 60 →
1 2 3 4

Indicated on display (1-4 = display fields)

Note:

- *After confirming input of display group 60, adaptation is started. The Throttle Position (TP)sensor is positioned in the closed throttle, wide open throttle and limp-home positions. Following this procedure, other intermediate steps will create a characteristic curve of the relationship between Throttle Position (TP) sensor -G69- and angle sensor for throttle drive -G187-.*
- *The Motronic ECM stores these values in permanent memory. Afterward, the throttle valve assumes the starting position.*

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- Compare display with specified values (display fields 1-4):

	Display fields			
	1	2	3	4
Display group 60: Basic setting-throttle valve control module				
Display	xxx ∠ °	xxx ∠ °	Idle Part throt Full throt Decel Enrich	ADP runs ADP. OK ADP. ERROR
Indicates	Throttle valve angle	Throttle drive angle	Operating condition	Adaptation condition
Range	0-90 ∠ °		---	---
Specified value	0-5 ∠ °		Idle	ADP. runs ADP. OK (ADP. ERROR indicates unsuccessful adaptation)
	If displayed values are NOT OK: - Check DTC memory (⇒ Page 01-15)			

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	- Check throttle valve control module (⇒ Page 24-99)

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If displayed values are OK:

- Allow at least 30 seconds.
- End adaptation as soon as possible after 30 seconds by pressing → button.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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Turbocharger boost controls, checking

Boost pressure regulation, checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer HELP
Select function XX

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP
Input display group number XXX

Indicated on display

- Press buttons -1-, -1- and -4- to input display group number 114, and press -Q- button to confirm input.

Read Measuring Value Block 114 →
1 2 3 4

Indicated on display (1-4 = display fields)

- Road test car at wide open throttle at 4000 RPM.

WARNING!

A second technician is required to operate the VAG 1551 scan tool during the road test.

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- Compare display with specified value for wastegate bypass regulator valve duty cycle in display field 4:

  Specified value: 5-95 %

If displayed value is OK:

- Change engine RPM until duty cycle is within specified value.

- Compare display with specified value for corrected specific engine load in display field 2:

  Specified value: 3.00-8.00 ms

- Compare display with specified value for actual engine load in display field 3:

  Specified value: must be same as corrected specified engine load in display field 2 (with tolerance of ± 0.50 ms)

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	Display fields			
	1	2	3	4
Display group 114: Boost pressure regulation				
Display	xx.xx ms	xx.xx ms	xx.xx ms	xx %
Indicates	Specified engine load	Corrected specified engine load	Actual engine load	Duty cycle of wastegate bypass regulator valve
Range	---	---	---	0-99 %
Specified value	---	3.00-8.00 ms	Same as corrected specific engine load in display field 2 (tolerance ± 0.50 ms)	5-99 %

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If the actual engine load is not within the tolerance, possible malfunctions are:

- Wastegate bypass regulator valve electrical malfunction
- Hoses for wastegate bypass regulator valve disconnected or blocked
- Wastegate bypass regulator valve -N75- blocked
- Air leaks between turbocharger and intake manifold
- Wastegate bypass regulator valve mechanical controls sticking (linkage, shaft)
- Turbocharger faulty (turbine blocked by foreign object)

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Wastegate bypass regulator valve, checking

Function

- With power off, the long connector is closed.
- Both short connecters are inter-connected.
- When triggered, the connection between the long and both short connectors is opened.

Check for leaks

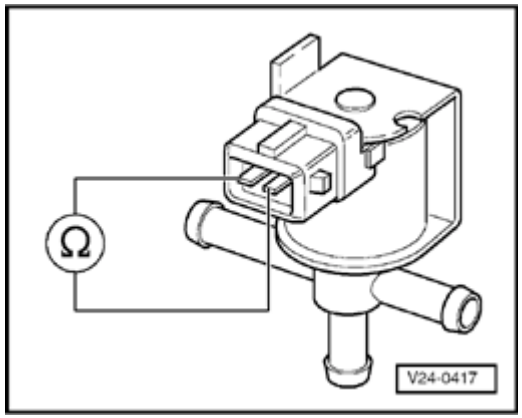
- Remove wastegate bypass regulator valve (⇒ component location, page ⇒ Page 24-1)
- Re-connect removed wastegate bypass regulator valve to wiring harness.
- Start output Diagnostic Test Mode (DTM) and advance through test program to select wastegate bypass regulator valve -N75- ⇒ Page 01-42
- Blow into long connector during DTM to check whether valve opens properly.

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If necessary:

- Replace wastegate bypass regulator valve -N75-.

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Checking wastegate bypass regulator valve - N75-

- Disconnect harness connector from valve -N75-.

- Connect multimeter US 1119 (Fluke 83 or equivalent) to check resistance between terminals of valve -N75-.

  Specified value: 25-35 Ω

If resistance is not OK:

- Replace valve.

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24-129

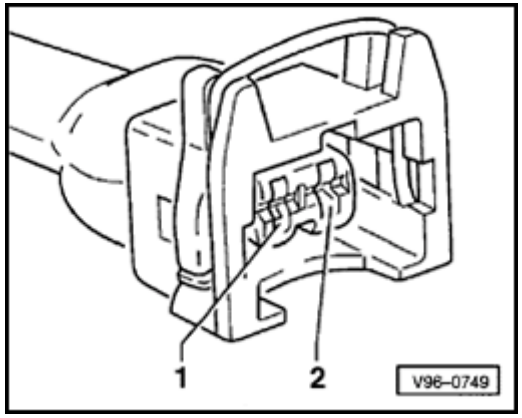
Check voltage supply for wastegate bypass regulator valve -N75-

Note:

Voltage supply for the wastegate bypass regulator valve is provided by the fuel pump relay.

- Fuse for -N75- OK

- Disconnect harness connector from valve.



- Connect VAG 1527B LED test light between harness connector terminal 1 and engine Ground.
- Operate starter motor.

  LED test light must light up

If LED does not light:

- Check wiring for open circuit between terminal 1 to and fuse, according to wiring diagram. Repair if necessary.

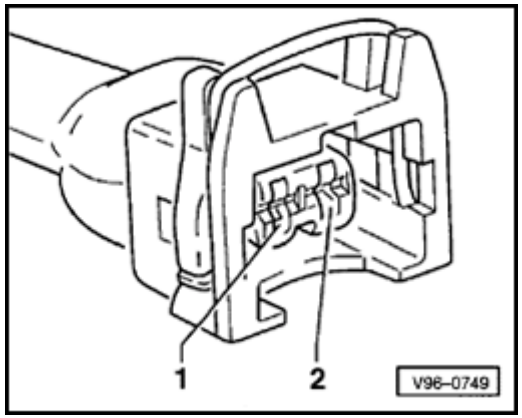
If wiring is OK:

- Check fuel pump relay ⇒ ⇒ Page 24-81 .

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Signal for wastegate bypass regulator valve, checking

- Disconnect harness connector for valve -N75 .

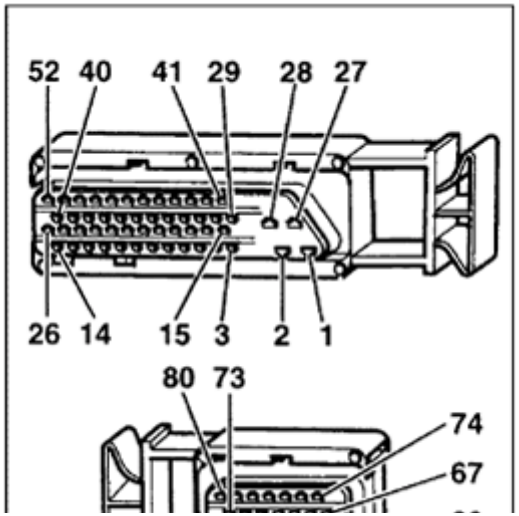


- Connect VAG 1527B LED voltage tester between connector terminals 1 (B+) and 2.
- Start output Diagnostic Test Mode (DTM) and advance through test program to select wastegate bypass regulator valve -N75- ⇒ Page 01-42

  LED test light must blink

If LED test light does not blink, or stays on continuously:

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit or short circuit to B+ between connector terminal 2 and ECM/test box socket 64. Repair if necessary.

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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Barometric Pressure (BARO) sensor, checking

Note:

The signal from Barometric Pressure (BARO) sensor -F96- influences:

- *Boost pressure limit*
- *Mixture composition at engine start-up*

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagrams

Checking

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- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer HELP **Select function XX**	Indicated on display

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- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -1-, -1- and -3- to input display group number 113, and press -Q- button to confirm input.

Read Measuring Value Block 113

1 2 3 4

Indicated on display (1-4 = display fields)

- Compare displayed value with specified air pressure value (display field 4):

	Display fields			
	1	2	3	4
Display group 113: Boost pressure regulation				
Display	xxx RPM	xx.xx ms	xxx °	xxxx mbar 1)
Indicates	Engine speed (in 40 RPM steps)	Engine load	Throttle valve angle	Air pressure
Range	0-6800 RPM	0.00-8.50 ms	0-90 °	559-1118 mbar
Specified value	0 RPM	0.00 ms	0-5 °	0 m ≈ 1013 mbar 400 m ≈ 970 mbar 1000 m ≈ 900 mbar

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				2000 m ≈ 800 mbar 3000 m ≈ 700 mbar

1) Pressure fluctuations caused by weather conditions are not considered

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- Check air pressure with turbocharger tester VAG 1597/A (actual pressure indication) and compare with displayed value.

If the displayed value is so high or low that it seems implausible for the altitude or the air pressure:

- Check wiring and terminals for excessive resistance ⇒ Page 24-134 .

If displayed value is NOT OK:

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

- Press → button to advance program sequence.

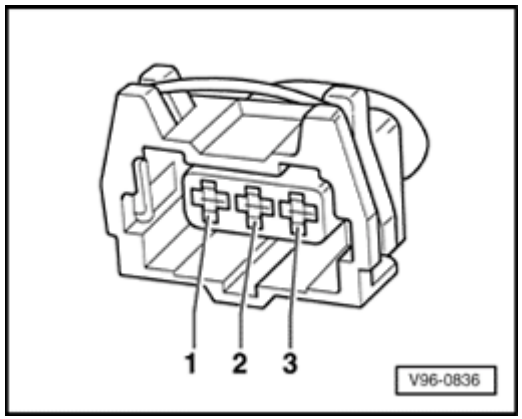
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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Checking wiring

- Disconnect harness connector from Barometric Pressure (BARO) sensor.

- Switch ignition on.

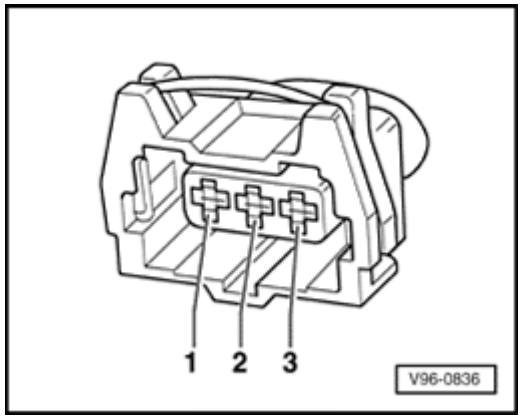


- Connect multimeter US 1119 (Fluke 83 or equivalent) and check voltage between connector terminals 1 and 3 (Ground) as well as 2 and 3 (Ground), using adapter cables from VW 1594 connector test kit.

  Specified value for both: 4.5-5.5 volts

If voltage is NOT OK:

- Switch ignition off.
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 61
  - Connector terminal 2 to ECM/test box socket 62
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω

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- Check wiring for short circuits between terminals of 3-pin connector, and between connector and ECM/test box.

  - Connector terminal 2 to ECM/test box socket 61
  - Connector terminal 3 to ECM/test box socket 61
  - Connector terminal 3 to ECM/test box socket 62
  - Specified value: ∞ Ω

If wiring is OK:

- Replace Barometric Pressure (BARO) sensor.

If an implausible value is still displayed after replacing the barometric pressure sensor:

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If

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Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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Evaporative Emissions (EVAP) system, checking

CAUTION!

Whenever carrying out work on the fuel supply and/or fuel injection systems, read and carefully follow the Cautions, Warnings, and rules of cleanliness ⇒ ***Page 24-5*** .

Note:

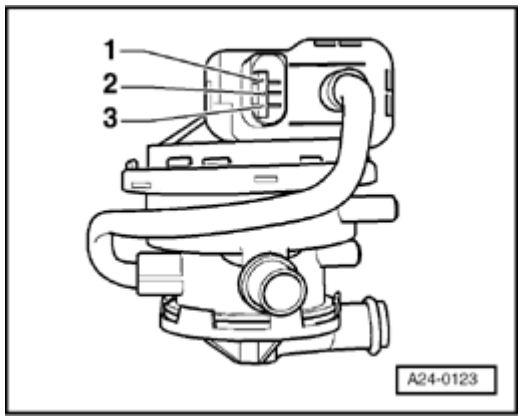
- *Always replace gaskets, O-rings and hose clamps.*
- *Hose connections must be secured with screw-type clamps or band clamps.*

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24-137

Leak Detection Pump (LDP), checking

Electrical testing



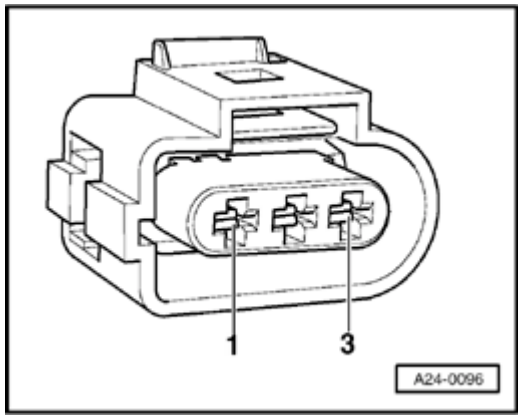
- Disconnect harness connector for LDP -V144-.
- Connect multimeter US 1119 (Fluke 83 or equivalent) and check resistance at leak detection pump. Specified values:
  - Connector terminal 1 to terminal 3: 640-720 Ω
  - Connector terminal 2 to terminal 3: 17.5-27.5 Ω

If resistance is NOT OK:

- Replace leak detection pump -V144-.

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Voltage supply, checking

- Disconnect harness connector for LDP -V144-.
- Connect VAG 1527B LED voltage tester between connector terminal 3 (B+) and engine Ground.
- Start engine and run engine at idle.

  LED must light up.

If LED tester does not light:

- Check fuse for LDP -V144-.
- Check wiring for open circuit between terminal 3 and fuse, according to wiring diagram. Specified value: max. 0.5 Ω.
- Check fuel pump relay and signal to relay ⇒ Page 24-81 .

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24-139

Evaporative Emission (EVAP) Canister Purge Regulator Valve, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable

Test conditions

- Engine coolant temperature at least 80 ° C (176 ° F)

Function check

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

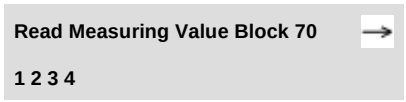
Rapid data transfer HELP **Selecting function XX**	Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block HELP **Input display group number XXX**	Indicated on display

- Press buttons -0-, -7- and -0- to input display group number 70, and press -Q- button to confirm input.

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Indicated on display (1-4 = display fields)

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- Press -4- button- to select "Basic Setting" function 04 (diagnosis for EVAP canister purge regulator valve is initiated).

Note:

During this diagnosis there should not be any load placed on the engine, otherwise the diagnosis is interrupted and must be started again.

System in Basic Setting 70 →

1 2 3 4

Indicated on display (1-4 = display fields)

If the diagnosis is initiated by the ECM, the display changes from "Test OFF" to "Test ON" in display field 4.

- Continue to run engine at idle until "EVAP OK" is indicated in display field 4.

Note:

If the display changes from "Test ON" to "Test OFF" during the test, accelerate with a brief burst to repeat the test.

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	Display fields			
	1	2	3	4
Display group 70: EVAP canister purge regulator valve				
Display	xxx %	xx.x %	xx.xx g/s	Test OFF/Test ON EVAP OK EVAP notOK
Indicated	EVAP canister purge regulator valve duty cycle during diagnosis	Oxygen sensor deviation during diagnosis	Idle Air Control (IAC) valve deviation during diagnosis	Diagnosis condition Diagnosis results
Range	0-100 %	-25.0 to 25.0 %	-2.70 to 4.16 g/s	---
Specified value	0-100 %	- 5.4 to 9.4 %	0.00-0.33 g/s	EVAP OK

If "EVAP notOK" is indicated in display field 4:

- Check for blockage or leaks ⇒ Page 24-142 .

If "EVAP OK" is indicated in display field 4:

- Press → button to advance program sequence.

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Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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24-142

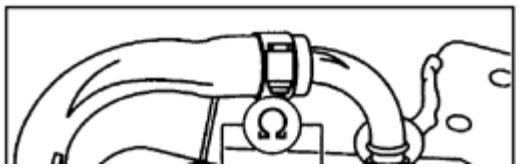
Checking for blockage and leaks

The EVAP canister purge regulator valve is closed when power is off.

- Remove EVAP canister purge regulator valve -N80- (component locations ⇒ Page 24-1)
- Connect removed valve to harness connector.
- Start output Diagnostic Test Mode (DTM) and select -N80- ⇒ Page 01-42 .
- Blow into long connection during output DTM, and check whether valve opens and closes properly. Replace valve if necessary.
- If valve is OK, check all hose connections between tank and valve for blockage or leaks.

EVAP canister purge regulator valve -N80- electrical test

- Disconnect harness connector from EVAP canister purge regulator valve.



- Connect multimeter US 1119 (Fluke 83 or equivalent) and check resistance at across valve terminals.

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Specified value: 22-30 Ω

If resistance is NOT OK:

- Replace EVAP canister purge regulator valve

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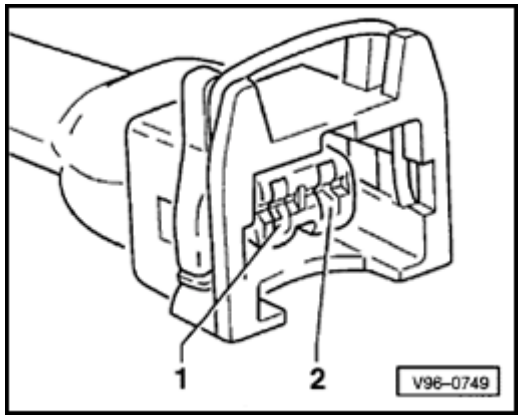
24-143

Checking EVAP canister purge regulator valve voltage supply

Test conditions

- Fuse for EVAP canister purge regulator valve OK.

- Disconnect harness connector from EVAP canister purge regulator valve.



- Connect VAG 1527B LED voltage tester between connector terminal 1 and engine Ground.
- Operate starter motor.

  Specified value: LED must light up

If LED test light does not light:

- Check wiring for open circuit between connector terminal 1 and fuse, according to wiring diagram. Repair if necessary.

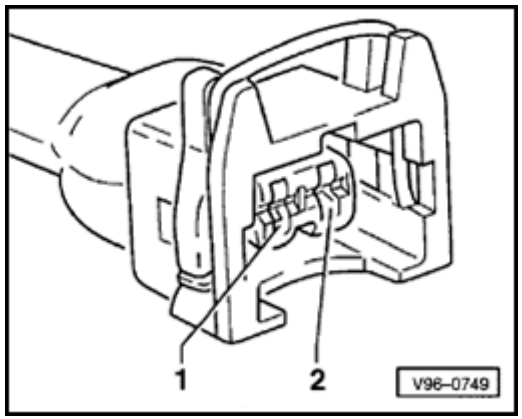
If wiring is OK:

- Check fuel pump relay ⇒ Page 24-81 .

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24-144

Checking signal to EVAP canister purge regulator valve

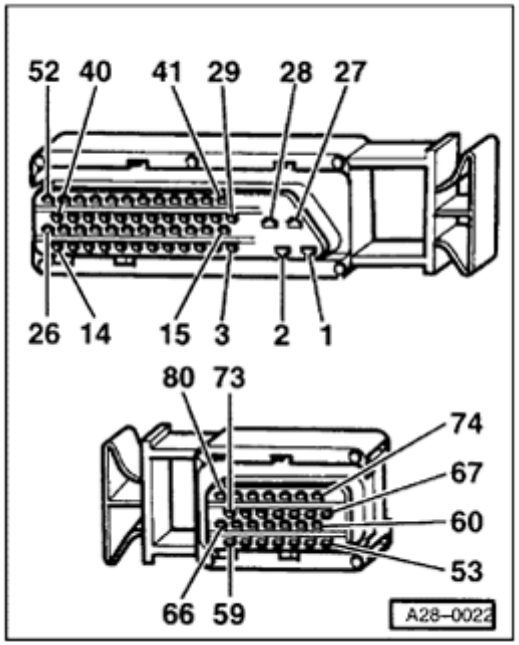


- Connect VAG 1527B LED voltage tester between connector terminals 1 (B+) and 2.
- Start output Diagnostic Test Mode (DTM) for EVAP canister purge regulator valve -N80 - ⇒ Page 01-42 .

  LED must blink

If LED test light does not blink, or stays on:

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit or short circuit to B+ between connector terminal 2 and Motronic ECM terminal 15.

If wiring is OK:

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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Additional signals

Signal from A/C compressor, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagrams

Test conditions

- A/C functions OK
- A/C is switched off
- Vehicle at room temperature-above 15 ° C (59 ° F)

No malfunctions stored in Diagnostic Trouble

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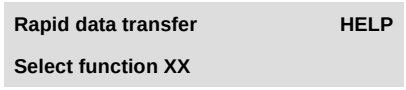
- Code (DTC) memory ⇒ Page 01-15 .

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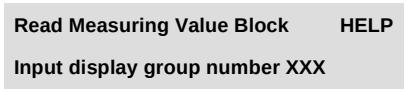
Checking

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .



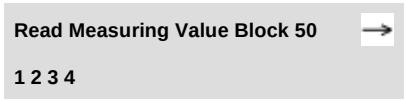
➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



➢ Indicated on display

- Press buttons -0-, -5- and -0- to input display group number 50, and press -Q- button to confirm input.



➢ Indicated on display (1-4 = display fields)

- Switch on A/C (lowest temperature and highest fan position).

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24-147

- Compare display with specified value in display field 4.

	Display fields			
	1	2	3	**4**
Display group 50: Signals to Engine Control Module (ECM)				
Display	xxxx RPM	xxxx RPM	A/C-LOW	**Compr. ON** **Compr. OFF**
Indicates	Actual engine speed (in 10 RPM steps)	Specified engine speed (in 10 RPM steps)	A/C status	**A/C compressor status**
Range	0-2550 RPM		---	**---**
Specified value	820-900 RPM	860 RPM	A/C-LOW	**Compressor on: Compr. On** **Compressor off: Compr. OFF**
	---	---	---	**If not as specified ⇒ Page 24-148 , Continuation**

Notes:

- *The A/C compressor is switched off during acceleration when the car is stationary or at slow speed.*

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- *At wide open throttle the A/C compressor is switched off by the Transmission Control Module (TCM) (kick down switch).*

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Continuation

If the displayed values are NOT OK:

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Check wiring for open circuit, short circuit to B+ or short circuit to Ground between ECM/test box terminal 8 and A/C control head -E87-, or Transmission Control Module (TCM).

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If the wiring is OK:

- Check function of A/C control head -E87-.

⇒ *Repair Manual, Heating & Air Conditioning, Repair Group 01*

Or:

⇒ *Repair Manual, 5 Spd. Automatic*

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Transmission 01V, Repair Group 01

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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Vehicle speed signal, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagrams

Test conditions

- Vehicle Speed Sensor (VSS) OK; checking:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90*

Notes:

- *To check Vehicle Speed Sensor -G68-, the vehicle must be driven. A second technician is required to operate the scan tool during the road test.*

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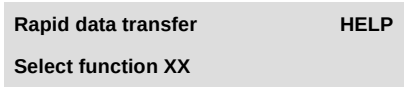
- *The speed signal is generated by the vehicle speed sensor (at the transmission), and processed at the speedometer/odometer in the instrument cluster.*

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24-150

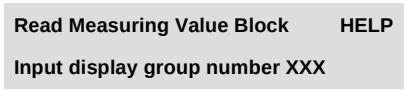
Test procedure

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .



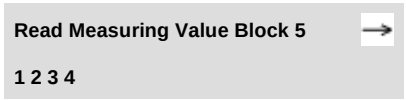
➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



➢ Indicated on display

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



➢ Indicated on display (1-4 = display fields)

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24-151

- Road test and compare indicated vehicle speed with value in display field 3 (2nd technician required).

	Display fields			
	1	2	3	4
Display group 5: Engine Electronics				
Display	xxx RPM	xx.xx ms	xxx kph	Idle Part throt Full throt Decel Enrich
Indicates	Engine speed (in 40 RPM steps)	Engine load	Vehicle speed	Operating condition
Range	0-6800 RPM	---	---	---
Specified value	---	---	Approx. vehicle speed	---
	---	---	If no vehicle speed is displayed ⇒ Page 24-152 , Continuation	---

If displayed value is OK:

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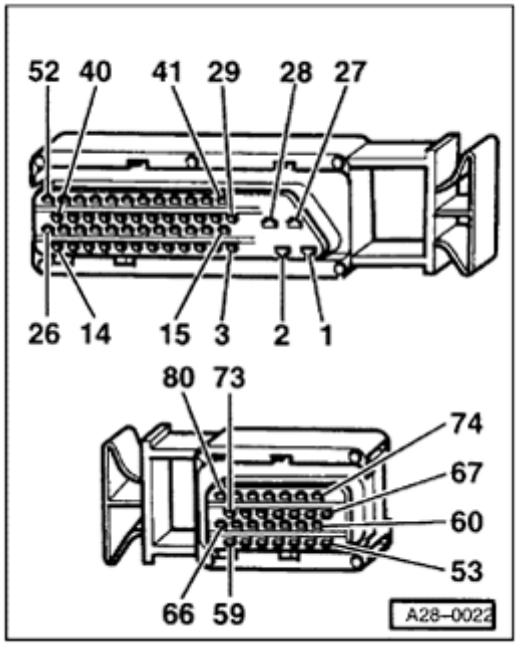
- Press → button toadvance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch off ignition.

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24-152



Continuation

If no speed was indicated:

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .
- Connect VAG 1527B LED voltage tester between ECM/test box sockets 3 (B+) and 20 (signal).
- Lift vehicle at left front until wheel is free.
- Switch ignition on and rotate left-front wheel by hand.

  LED must blink (very brief blink)

Notes:

- *The right-front wheel must not rotate; block it if necessary.*
- *For LEDs with little voltage consumption, the LED lights up at half strength when the ignition is switched on.*

If the LED does not blink:

- Check wiring from ECM connector, terminal 20 to instrument cluster for open circuit or short circuit

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If the wiring is OK and the LED does not blink:

⇒ *Repair Manual, Electrical Equipment, Repair Group 90*

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- Check readiness code ⇒ Page 01-59 . If DTC memory was erased, or ECM disconnected, generate new readiness code ⇒ Page 01-62

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24-153

Transmission Range (TR) signal, checking

Notes:

- *Through the multi-function Transmission Range (TR) program switch -F125- at the transmission, the Engine Control Module (ECM) recognizes whether a drive range is selected (selector lever in 2/3/4/R/D) or not (selector lever in P or N)*
- *The multi-function Transmission Range (TR) program switch -F125- at the transmission switches to Ground through terminal 22 of the ECM when the shift lever is in N or P.*
- *When a drive range is selected, the switch opens and terminal 22 now has power.*

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box

Test procedure

- Connect VAG 1551 or VAG 1552 scan tool and

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press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer	HELP
Select function XX	

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

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24-154

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -0-, -5- and -6- to input display group number 56, and press -Q- button to confirm input.

Read Measuring Value Block 56

1 2 3 4

Indicated on display (1-4 = display fields)

- Compare display with specified value in display field 4:

	Display fields			
	1	2	3	**4**
Display group 56: Engine idle				
Display	xxxx RPM	xxxx RPM	x.xx g/s	**xxxx**
Indicates	Actual engine speed (in 10 RPM steps)	Specified engine speed (in 10 RPM steps)	Control value-Idle mass air flow (idle air control valve)	**Operating condition**
Range	0-2550 RPM	---	---	**---**
Specified value	0 RPM	0 RPM	-1.11 to 1.11 g/s	**0000 = Selector lever in P or N** **0010 = Selector lever in 2/3/4/R/D**
	---	---	---	**If not as specified ⇒ Page 24-155 , Continuation;** **Explanation of display ⇒ Page 24-16**

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24-155

If displayed value is OK (as specified):

- Press →button toadvance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

Continuation:

If displayed value is NOT OK (not as specified):

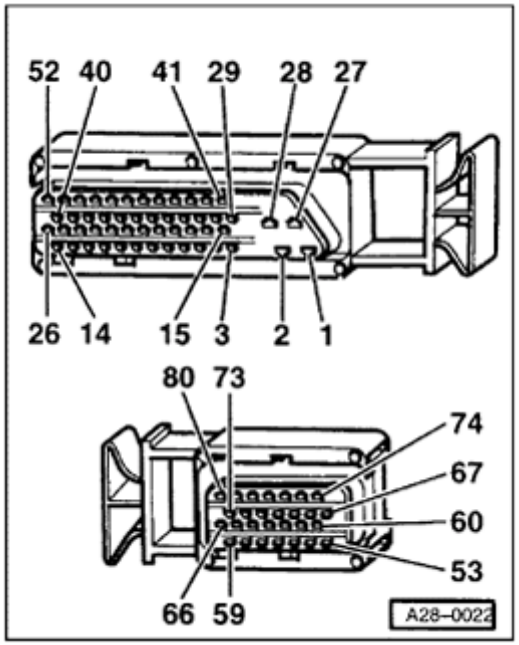
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .

- Connect VAG 1527B LED voltage tester between ECM/test box sockets 3 (battery voltage, terminal 30) and 22.

  - LED must come on with selector lever in P or N

  - LED must then go out when selecting 2/3/4/R/D

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If the LED lights up continuously or does not light up at all:

- Check wiring for open circuit, short circuit to Ground or short circuit to B+ between ECM/test box socket 22 and multi-function Transmission Range (TR) program switch -F125-.

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24-156

If the wiring is OK:

- Check multi-function Transmission Range (TR) program switch -F125-.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01*

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

Explanation of 4-digit display

Explanation when display field is = 0				
x	x	x	x	(Display group 56)
			0	A/C compressor off (0 = A/C compressor off / 1 = A/C compressor on)
		0		Selector lever in P or N (0 = selector lever in P or N /1 = selector lever in 2/3/4/R/D)
	0			Always "0"
0				Always "0"

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24-157

Timing control during shifting, checking

Notes:

- *When shifting the automatic transmission, this signal from the Transmission Control Module (TCM) retards the ignition timing briefly, depending on vehicle speed and engine RPM (reduction of torque), to reduce shift pressure.*

- *Because of the very brief signal to reduce torque, the signal is not always recognized by the VAG 1551 scan tool, and therefore is not always indicated.*

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable

- VAG 1598/22 test box

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Test procedure

- Connect VAG 1551 or VAG 1552 scan tool and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (with engine running at idle) ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

➢ Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block **HELP**

Input display group number XXX

➢ Indicated on display

- Press buttons 1, 2 and 2- to input display group number 122, and press -Q- button to confirm input.

Read Measuring Value Block 122 →

1 2 3 4

➢ Indicated on display (1-4 = display fields)

- Road test.

WARNING!

A second technician is required to operate the VAG 1551 scan tool during the road test.

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24-159

- Compare display with specified value in display field 4:

	Display fields			
	1	2	3	4
Display group 122: Engine torque reduction during shifting				
Display	xxxx RPM	xxx Nm	xxx Nm	TCS active Motor enga
Indicates	Engine speed (in 40 RPM steps)	Required engine torque (Specified torque)	Actual engine torque (Actual torque)	Timing angle retard active or not active
Range	0-6800 RPM	-100 to 410 Nm	-100 to 310 Nm	---
Specified value	---	---	---	When shifting, "Motor enga" must be displayed briefly
	---	---	---	If not as specified ⇒ Page 24-160

If display is OK (as specified):

- Press →button to advance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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- Switch ignition off.

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24-160

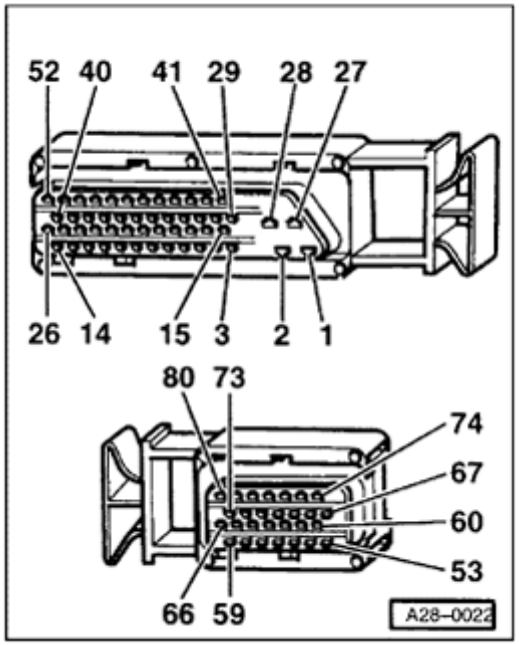
Continuation

Note:

The wiring to the Transmission Control Module is monitored by On Board Diagnostic and stores the Diagnostic Trouble Code 00545 if there is a malfunction.

If displayed value is NOT OK (not as specified), or if DTC 00545 is stored in DTC memory:

- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .



- Check wiring for short circuit or open circuit between ECM harness connector terminal 23 and to Transmission Control Module (TCM), according to wiring diagram

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

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24-161

Rough road signal from ABS/EDL control module, checking

Notes:

- *When the ABS/EDL control module senses a wheel spinning, it produces the rough road signal. When the ECM recognizes the rough road signal, the misfire recognition is switched off.*
- *Check the rough road signal only when the trouble code 18014 "Rough Road Spec Engine Torque ABS-ECU Electrical Malfunction" is stored. The "Misfire" malfunction is in this case a subsequent malfunction that can be disregarded.*
- *The wiring and the rough road signal are monitored by the ECM.*
- *Emissions testing on a front-wheel drive vehicle with ABS/EDL, during which only the front wheels turn while the rear wheels are stationary, can result in the DTC 18014 being stored in DTC memory. Therefore, the fuse for the ABS/EDL control module must be removed. After the test, check DTC memory for the ABS/EDL control module and the ECM. Then erase DTC memory.*

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Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable
- VAG 1598/22 test box

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24-162

Test requirements

- ECM coding OK ⇒ Page 01-13

Test sequence

- Switch ignition off.
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .
- Check signal wiring for short circuit or open circuit between ECM/test box and ABS control module, according to wiring diagram.

If the wiring is OK:

- Replace ABS control module.

If the malfunction occurs again after the ABS control module has been replaced:

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If

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Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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28-1

Technical data, spark plugs

Engine code		AEB
Engine idle RPM • Idle RPM cannot be adjusted, is corrected by idle air control		820-900 RPM
RPM limit • Operates by shutting off fuel injectors		approx. 6500 RPM
Ignition timing • Ignition timing cannot be adjusted, is monitored by Engine Control Module (ECM)		
Firing order		1-3-4-2
Spark plugs	Tightening torque	30 Nm (22 ft lb)
	Part No. (Always check with your Parts Department for correct part numbers)	101 000 033 AB (NGK) 101 000 051 AB (BOSCH)
	Manufacturer's codes (if applicable)	BKUR 7 ET (NGK) F6 LTCR (BOSCH)
	Electrode gap - mm	0.7 to 0.9 mm
	Maintenance interval	See Owner's Manual
Spark plug connector resistance		approx. 2 kΩ

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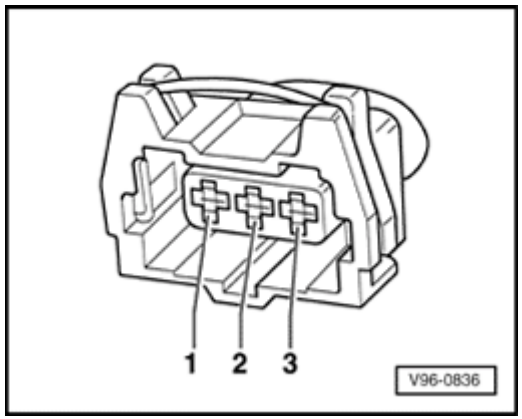
Camshaft Position (CMP) sensor -G40-, checking

Required special tools and test equipment

- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagrams

Checking

- Disconnect 3-pin connector from Camshaft Position -G40- sensor.



- Connect multimeter US 1119 (Fluke 83 or equivalent) to measure voltage across CMP connector terminals 1 (B+) and 3 (Ground), using adapter cables from VW 1594 connector test kit.
- Switch ignition on.
- Measure voltage between terminals 1 and 3.

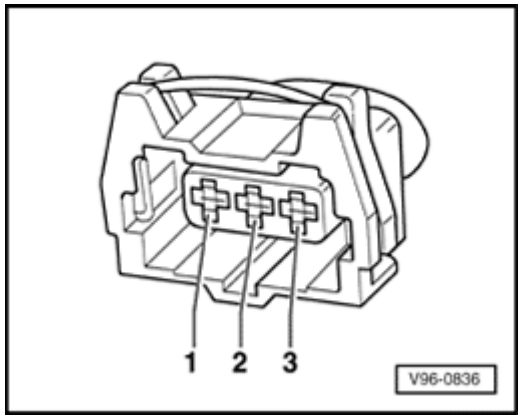
  Specified value: 4.5 volts minimum
- Switch ignition off.

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28-3

If voltage is OK:

- Connect VAG 1598/22 test box to Motronic ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 11
  - Connector terminal 2 to ECM/test box socket 76
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: max. 1.5 Ω
- Check wiring for short circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 2 to ECM/test box socket 11
  - Connector terminal 3 to ECM/test box socket 11
  - Connector terminal 3 to ECM/test box socket 76
  - Specified value: ∞ Ω

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If wiring is OK (and voltage across terminals 1 and 3 is OK):

- Replace Camshaft Position (CMP) sensor.

If wiring is OK (but still no voltage across terminals 1 and 3 :

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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28-5

Knock sensor and knock sensor system, checking

Required special tools and test equipment

- VAG 1551/1552 Scan Tool (ST) with adapter cable VAG 1551/3
- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit
- Wiring diagrams

Checking

- Connect VAG 1551/1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (engine running at idle) ⇒ Page 01-7 .

Rapid data transfer HELP
Select function XX

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

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Read Measuring Value Block	HELP
Input display group number XXX	

➢ Indicated on display

- Press buttons -0-, -2- and -0- to input display group number 20, and press -Q- button to confirm input.

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28-6

Read Measuring Value Block 20 →

1 2 3 4

Indicated on display (1-4 = display groups)

Note:

The test must be carried out during a road test because the knock sensor system is only active as of a certain engine speed.

- Road test car and compare display with specified values for knock sensor system in display field 1-4.

WARNING!

A second technician is required to operate the VAG 1551 scan tool during the road test.

	Display groups			
	1	2	3	4
Display group 20: Knock sensor system				
Display	xx.x °	xx.x °	xx.x °	xx.x °
Indicates	Timing correction, cylinder 1	Timing correction, cylinder 2	Timing correction cylinder 3	Timing correction, cylinder 4
Range	0.0 °-15.0 ° (crankshaft)	0.0 °-15.0 ° (crankshaft)	0.0 °-15.0 ° (crankshaft)	0.0 °-15.0 ° (crankshaft)
Specified value	0.0 °-10.0 ° (crankshaft)	0.0 °-10.0 ° (crankshaft)	0.0 °-10.0 ° (crankshaft)	0.0 °-10.0 ° (crankshaft)

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	If displayed values are NOT OK ⇒ Page 28-7 , Evaluating display group 20

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28-7

If displayed values are OK:

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

- Press → button to advance program sequence.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

Evaluating display group 20

Display group: 20 Display fields: 1-4	Possible cause	Correcting action
All cylinders retarded more than 10° (crankshaft)	♦ Knock sensor faulty	- Continuation ⇒ Page 28-8
	♦ Connector corroded	
	♦ Knock sensor incorrectly torqued	- Loosen knock sensor and re-tighten to 20 Nm (15 ft lb)
	♦ Components loose on engine	- Tighten components

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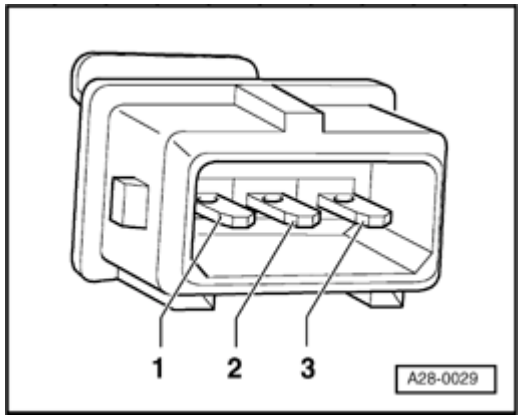
	♦ Poor fuel quality	- Change fuel
One cylinder reading is very different from the others	♦ Connector corroded	- Continuation ⇒ Page 28-8
	♦ Engine failure	- Check compression ⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Engine Mechanical, Engine Code(s): AEB, ATW, Repair Group 15*
	♦ Components loose on engine	- Tighten components

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28-8

Continuation

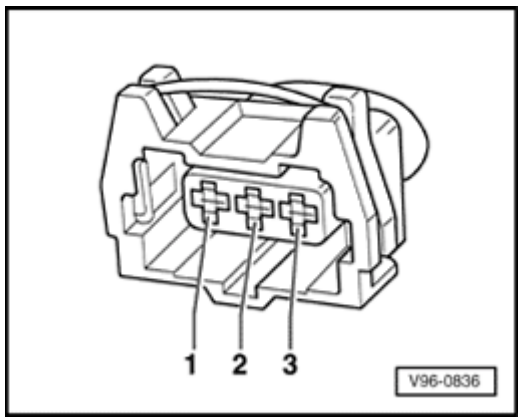
- Disconnect 3-pin connector from Knock Sensor (KS) 1 -G61-.



- Connect multimeter US 1119 (Fluke 83 or equivalent) to measure resistance between connector terminals, using adapter cables from VW 1594 connector test kit.
  - Connector terminal 1 to terminal 2
  - Connector terminal 1 to terminal 3
  - Connector terminal 2 to terminal 3
  - Specified value: ∞ Ω

If resistance is OK (no continuity):

- Connect VAG 1598/22 test box to Motronic ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 68
  - Connector terminal 2 to ECM/test box socket 67
  - Connector terminal 3 to ECM/test box socket 2
  - Specified value: max. 1.5 Ω

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28-9

- Check wiring for short circuits between terminals of 3-pin connector, and between connector and ECM/test box.

  - Connector terminal 2 to ECM/test box socket 68
  - Connector terminal 3 to ECM/test box socket 68
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: $\infty\ \Omega$

If the wiring is OK:

- Loosen knock sensor and re-tighten to 20 Nm (15 ft lb).

If the malfunction still exists (stored in DTC memory):

- Replace Knock Sensor (KS) 1 -G61-.

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected,

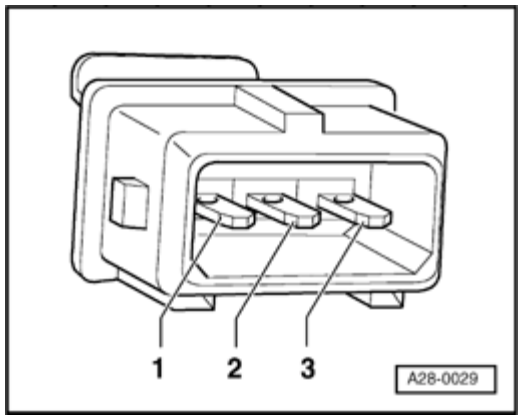
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generate new readiness code ⇒ Page 01-62 .

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28-10

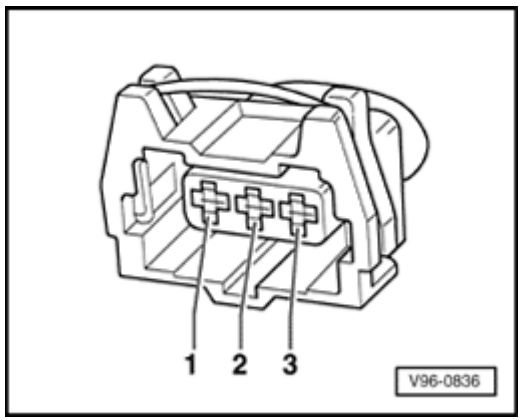
- Disconnect 3-pin connector from Knock Sensor (KS) 2 -G66-.



- Connect multimeter US 1119 (Fluke 83 or equivalent) to measure resistance between connector terminals, using adapter cables from VW 1594 connector test kit.
  - Connector terminal 1 to terminal 2
  - Connector terminal 1 to terminal 3
  - Connector terminal 2 to terminal 3
  - Specified value: ∞ Ω

If resistance is OK (no continuity):

- Connect VAG 1598/22 test box to Motronic ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit between ECM/test box and 3-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 60
  - Connector terminal 2 to ECM/test box socket 67
  - Connector terminal 3 to ECM/test box socket 2
  - Specified value: max. 1.5 Ω

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28-11

- Check wiring for short circuits between terminals of 3-pin connector, and between connector and ECM/test box.

  - Connector terminal 2 to ECM/test box socket 60
  - Connector terminal 3 to ECM/test box socket 60
  - Connector terminal 3 to ECM/test box socket 67
  - Specified value: $\infty\ \Omega$

If the wiring is OK:

- Loosen knock sensor and re-tighten to 20 Nm (15 ft lb).

If the malfunction still exists (stored in DTC memory):

- Replace Knock Sensor (KS) 2 -G66-.

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected,

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generate new readiness code ⇒ Page 01-62 .

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28-12

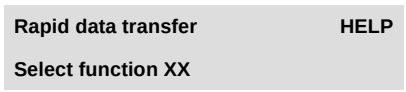
Misfiring recognition, checking

Required special tools and test equipment

- VAG 1551 or VAG 1552 Scan Tool (ST) with VAG 1551/3 adapter cable

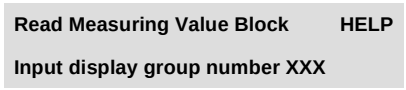
Checking

- Connect VAG 1551/1552 Scan Tool (ST) and press buttons -0- and -1- to insert "Engine Electronics" address word 01 (engine running at idle) ⇒ Page 01-7 .



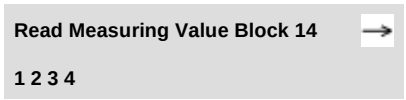
Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.



Indicated on display

- Press buttons -0-, -1- and -4- to input display group number 14, and press -Q- button to confirm input.



Indicated on display (1-4 = display groups)

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28-13

- Compare displayed values with specified values for misfire recognition (display fields 3-4):

	Display groups			
	1	2	3	4
Display group 14: Misfire recognition				
Display	xxx RPM	xx.xx ms	xxx	activated deact
Indicates	Engine speed (in 40 RPM steps)	Engine load	Misfire harmful to emissions (total)	Misfire recognition status
Range	0-6800 RPM	0.00-8.50 ms	---	---
Specified value	760-960 RPM	0.5-1.5 ms	20	activated
	---	---	If displayed values are NOT OK ⇒ Page 28-14	

If displayed values are OK:

- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

- Press → button to advance program sequence.

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- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

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28-14

If displayed values are NOT OK:

- Press -C- button.

- Press buttons -0-, -1- and -5- to input display group number 15, and press -Q- button to confirm input.

Read Measuring Value Block 15 →

1 2 3 4

Indicated on display (1-4 = display groups)

- Compare displayed values with specified values for misfire recognition (display fields 1-4):

	Display groups			
	1	2	3	4
Display group 15: Misfire recognition				
Display	xxx	xxx	xxx	activated deact
Indicates	Misfire harmful to emissions, Cyl. 1	Misfire harmful to emissions, Cyl. 2	Misfire harmful to emissions, Cyl. 3	Misfire recognition status
Range	500	500	500	---
Specified value	0-5	0-5	0-5	activated
	If displayed values are NOT OK ⇒ Page 28-16 , Evaluating display groups 15 and 16			

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28-15

If displayed values are OK:

- Press -C- button.

- Press buttons -0-, -1- and -6- to input display group number 16, and press -Q- button to confirm input.

Read Measuring Value Block 16 →

1 2 3 4

Indicated on display (1-4 = display groups)

- Compare displayed values with specified values for misfire recognition (display fields 1 and 4):

	Display groups			
	1	2	3	4
Display group 16: Misfire recognition				
Display	xxx			activated deact
Indicates	Misfire harmful to emissions, Cyl. 4			Misfire recognition status
Range	500			---
Specified value	0-5			activated
	If displayed values are NOT OK ⇒ Page 28-16 , Evaluating display groups 15 and 16			

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28-16

Evaluating display groups 15 and 16

Display groups: 15 and 16 Display fields: 1-4	Possible cause	Corrective action
larger than 5	♦ Ignition coil faulty ♦ Spark plug connector faulty ♦ Spark plug faulty	- Check ignition coil ⇒ Page 28-17
	♦ Power output stage for ignition coil faulty	- Check power output stage for ignition coil ⇒ Page 28-21
	♦ Fuel injector faulty	- Check fuel injectors ⇒ Page 24-87
	♦ Not enough fuel	- Check fuel in tank

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Individual ignition coil system, checking

Ignition coils, checking

Notes:

- *Measuring the primary resistance of the ignition coils is normally not necessary for this test (primary resistance approx. 0.4 to 0.6 Ω, measured between coil terminals 1 and 15).*
- *A high tension isolation diode is installed in the secondary circuit of the ignition coil. Measuring the resistance of the secondary coil is therefore not possible with conventional measuring instruments.*

Required special tools and test equipment

- Multimeter US 1119 (Fluke 83 or equivalent)
- VW 1594 connector test kit

Test conditions

- No fuel injector malfunction stored in DTC memory

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Checking

- Check DTC memory ⇒ Page 01-15 .

There must be no malfunctions stored

- If DTC memory is not clear, make necessary repairs and erase DTC memory, stop engine and start engine again, road test, check and erase DTC memory again.

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28-18

- By briefly disconnecting fuel injector connectors with engine running, check which cylinder is misfiring, or not firing at all.

Note:

A misfiring cylinder can also be isolated by pulling the spark plug connectors (carbon-fouled plug).

- Check spark plug connector resistance.

  Specified value: approx. 2 kΩ

If resistance is NOT OK:

- Reconnect spark plug connector.

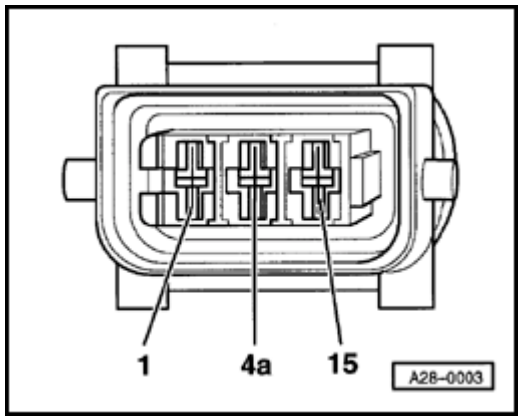
- Interchange spark plug with one from cylinder that is OK.

- If other cylinder now misfires, replace faulty spark plug.

- If same cylinder misfires, interchange ignition coil with one from cylinder that is OK.

- If other cylinder now misfires, replace faulty

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coil.

- If original cylinder still misfires, check secondary circuit ground connection for open circuit between coil connector terminal 4a and engine Ground.
- If Ground connection is OK, check:
  - Primary wiring and power supply ⇒ Page 28-19
  - Final output stage for ignition coils ⇒ Page 28-21

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28-19

Wiring for primary coil and power supply, checking

Required special tools and test equipment

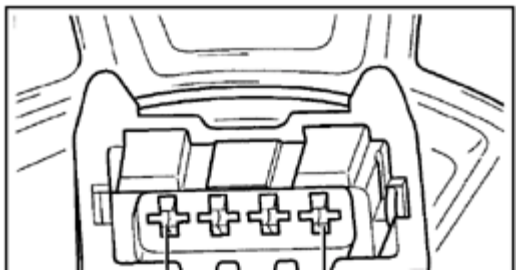
- VAG 1527B LED voltage tester
- VW 1594 connector test kit
- Wiring diagrams

Test conditions

- Fuse for ignition coils OK

Checking

- Disconnect 4-pin harness connector from power output stage.
- Switch ignition on.



- Connect VAG 1527B LED voltage tester in turn between 4-pin connector terminals 1, 2, 3 and 4, and engine ground.

  LED must light up for all 4 terminals

Note:

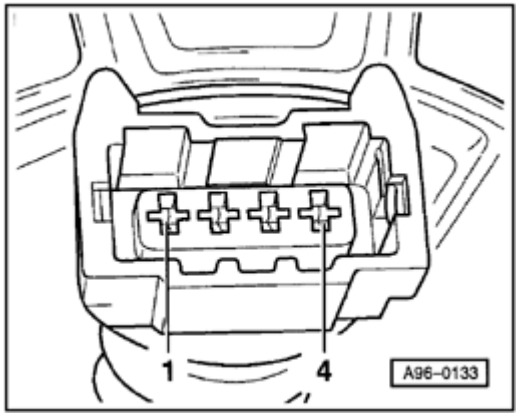
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The power supply for the primary circuit is measured via the fuse and primary coil of the ignition coil.

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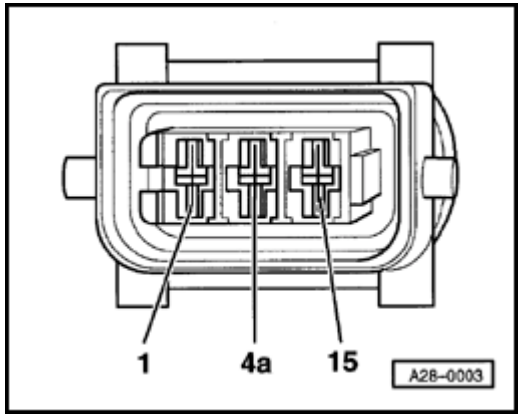
28-20

If the LED in the tester does not light up:



- Check wiring for open circuits between power output stage and terminal 1 at each coil connector, according to table.

  Specified value: max. 1.5 Ω



- Ignition coil connector terminal identification

Black 4-pin connector terminal number (power output stage)	Ignition coil terminal 1 at connector for cylinder number:
1	1
2	2
3	3
4	4

If the wiring is OK:

- Check wiring for open circuit between each coil terminal 15 and fuse and power supply, according to wiring diagram.

  Specified value: max. 1.5 Ω

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28-21

Power output stage for ignition coils, checking

Required special tools and test equipment

- VAG 1598/22 test box
- Multimeter US 1119 (Fluke 83 or equivalent)
- VAG 1527B LED voltage tester
- VW 1594 connector test kit
- Wiring diagrams

Note:

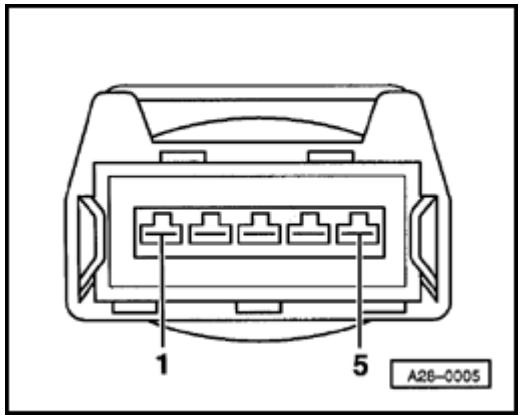
To check power output stage, disconnect all connectors for fuel injectors and then erase DTC memory.

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28-22

Checking signal for power output stage

- Disconnect 5-pin harness connector from power output stage.

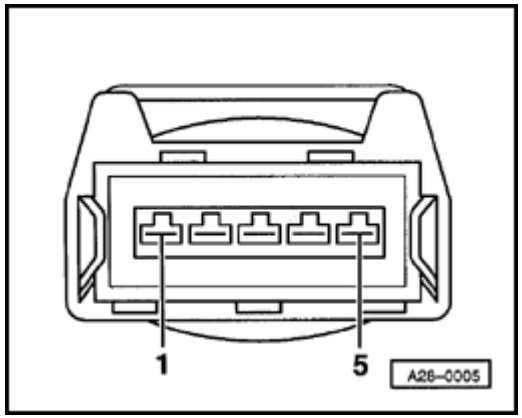


- Connect VAG 1527B LED voltage tester in turn between 5-pin connector terminals 1, 2, 4 and 5, and engine ground.
- Crank starter for a few seconds in each case.

  LED must blink all 4 times

If the LED in the tester does not blink:

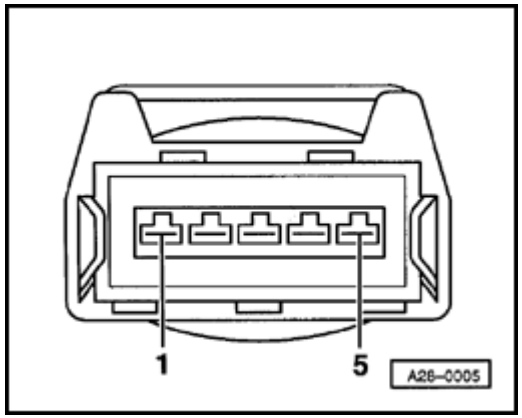
- Connect VAG 1598/22 test box to ECM harness connector ⇒ Page 01-56 .



- Check wiring for open circuit between ECM/test box and 5-pin harness connector, according to wiring diagram.
  - Connector terminal 1 to ECM/test box socket 70
  - Connector terminal 2 to ECM/test box socket 78
  - Connector terminal 4 to ECM/test box socket 77
  - Connector terminal 5 to ECM/test box socket 71
  - Specified value: max. 1.5 Ω

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28-23



If the wiring is OK:

- Check for open circuit between 5-pin connector terminal 3 and engine Ground.

  Specified value: max. 1.5 Ω

If the wiring is OK, but the LED in the tester did not blink:

- Replace Motronic ECM -J220- ⇒ Page 01-57 .
- Carry out adaptation of throttle valve control module to ECM ⇒ Page 24-119 .
- Check readiness code ⇒ Page 01-59 . If Diagnostic Trouble Code (DTC) memory has been erased, or ECM was disconnected, generate new readiness code ⇒ Page 01-62 .

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28-24

Checking power output stage

- Signals to power output stage OK ⇒ Page 28-22 .

- Disconnect 4-pin harness connector from power output stage.

- Connect VAG 1527B LED voltage tester between Battery Positive Voltage (B+) and, in turn, each terminal of power output stage 4-pin connector.

- Crank starter for a few seconds in each case.

LED must blink all 4 times

If the LED in the tester does not blink for all terminals:

- Replace power output stage.

Note:

LED testers with very little power consumption glow slightly before cranking the engine. During cranking they will get brighter or darker.

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