01-1

On Board Diagnostic (OBD) - Multiport Fuel Injection (MFI)

Engine Control Module (ECM) versions - overview

Engine control modules: 4A0 906 266 A

4A0 906 266 AA

4A0 906 266 AB

These are the introductory version and successor versions for the USA Audi 100 with On Board Diagnostic (OBD I). The engine control modules are downwardly compatible. The function and structure of the system are described in Self-study Program No. 130.

Engine control module: 8A0 906 266 B

With this version, the MFI ECM was completely modified. Important new features are:

- Oxygen sensor control with learning function; CO adjustment on Mass Air Flow (MAF) sensor eliminated.
- Coding of MFI ECM using VAG 1551 scan tool and "Code Control Module" function 07.

Engine control modules: 8A0 906 266 E

8A0 906 266 H

8A0 906 266 J

These are the successor versions of the 8A0 906 266 B control module.

Engine control module: 8A0 906 266 D

With this version, the On Board Diagnostic II (OBD II) was used in the Audi A6 with 2.8 liter V6, manual transmission and front wheel drive. Important new features on vehicles with OBD II are:

- Additional Heated Oxygen Sensor (HO2S) probe after Three Way Catalytic Converter (TWC)
- New engine control module with five individual connectors, total of 96 terminals
- New On Board Diagnostic (OBD) program with address word 01 and address word 33.

Engine control modules: 8D0 906 266

8D0 906 266 A

These are the successor versions of the 8A0 906 266 D control module with On Board Diagnostic II (OBD II)

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On Board Diagnostic (OBD) II technical data

Memory

- Permanent memory (If the engine control module is disconnected from the permanent battery positive voltage (B+) supply, the Diagnostic Trouble Code (DTC) memory and "Readiness Code" will be erased.)

Data output

- Rapid data transfer
- Additional malfunction display by Malfunction Indicator Light (MIL) lighting up

Address words

Address word 00:	Automatic Test Sequence	Switch ignition on or let engine idle
Address word 01:	Engine Electronics	Switch ignition on or let engine idle
Address word 33:	OBD II	Switch ignition on or let engine idle

Functions under address word 01:

Function 01:	Check Control Module Versions	Switch ignition on or let engine idle
Function 02:	Check DTC Memory	Let engine idle, or, crank engine with starter for at least 5 sec. without switching ignition off
Function 03:	Output Diagnostic Test Mode	Switch ignition on

Function 04:	Basic Setting	Let engine idle
Function 07:	Code Control Module	Switch ignition on
Function 08:	Read Measuring Value Block	Switch ignition on or let engine idle, or driving

Modes under address word 33:

Mode 1:	Transfer diagnosis data	Switch ignition on or let engine idle
Mode 2:	Transfer operating conditions	Switch ignition on or let engine idle
Mode 3:	Check DTC memory	Switch ignition on or let engine idle
Mode 4:	Erase diagnosis information	Switch ignition on or let engine idle
Mode 5:	Output of HO2S signals	Switch ignition on or let engine idle
Mode 6:	Read test results (starting with control module 8D0 906 266 A)	Switch ignition on or let engine idle
Mode 7:	Read test results (starting with control module 8D0 906 266 A)	Switch ignition on or let engine idle

- Under address word 33, Mode 1 to Mode 5 can be selected starting from control module 8D0 906 266 and Mode 1 to Mode 7 starting from control module 8D0 906 266 A.

- Individual measuring values can be read under Mode 1. This is not recommended for Audi service department since this information is available more easily under address word 01, function 04 and/or function 08.

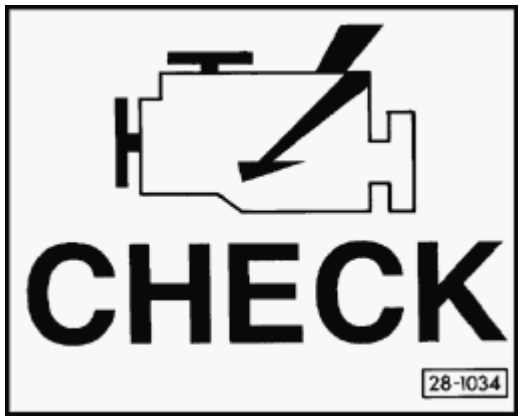
- Mode 2 shows the operating conditions under which a malfunction was recognized.

- Mode 3 is used to check the DTC memory and Mode 4 is used to erase the DTC memory. In the Audi service department, only address word 01, function 05 should be used to erase, since with Mode 4 the DTC memory is erased immediately even if it was not checked first.

- Static variables of HO2S probes, required by legal regulations, are displayed under Mode 5. Since these variables have no direct relationship to HO2S diagnosis, Mode 5 is not needed by the Audi service department.

- Mode 6 is used to read all test results from components and systems that are NOT continuously monitored.
- Mode 7 is used to read test results of components and systems that are continuously monitored.

01-4



Malfunction Indicator Lamp (MIL), functions

- The Malfunction Indicator Lamp (MIL) must light up every time the ignition is switched on and go out after the engine starts. If a malfunction is recognized by the engine control module or the transmission control module, this is indicated by the MIL lighting up.
- If the MIL lights up continuously, there is a malfunction present that makes the exhaust gas worse. In this case, the DTC memory for the engine control module and/or the transmission control module should be checked.
- If the MIL starts to blink, there is a malfunction that can lead to damage of the three way catalytic converter (e.g. combustion misfiring with high misfiring rate). In this case, driving should only continue with reduced power (until the MIL goes off or lights up continuously) and the malfunction should be eliminated as quickly as possible.

Functional testing:

- Switch ignition on: the MIL must light up. If the MIL does not light up, check wiring according to wiring diagram and/or replace lamp.
- Start engine and let idle: MIL must go out after a couple seconds. If the MIL does not go out after the engine starts, check DTC memory for the engine and/or transmission control modules (malfunctions in DTC memory).

01-5

Malfunction recognition and repair

Notes:

- *Before initiating the On Board Diagnostic (OBD) program, and before testing wiring and replacing components, check the following ground connections for corrosion and damaged connections and repair them if necessary*

- Check ground connections on intake manifold
- Battery ground strap OK
- Ground cable between engine and body OK

- *Malfunction recognition and repair is described for the VAG 1551 scan tool, since it offers significantly more functions. However, malfunction recognition and repair is also possible with a "generic" scan tool.*

- *A specific procedure must be used to evaluate malfunctions, since the engine electronics can be checked with address word 01 and address word 33 on OBD II vehicles. Address word 33 can only be used to check malfunctions that have already switched on the Malfunction Indicator Light (MIL). Address word 01 can also display the malfunctions that have not switched on the MIL. In contrast to before, the MIL is not switched on immediately with some malfunction types, but only after two successive trips with cold starts preceding them where the malfunction occurs. If there is a customer complaint and/or driving performance problem, the DTC memory should be checked thoroughly with address word 01, function 02. On vehicles with MIL lit up, the DTC memory should also be checked with address word 33, mode 3. If the DTC memory is checked with mode 3, mode 2 should also be checked which shows the operating conditions as they were when the malfunction was recognized.*

- *If a malfunction is present for longer than a specified time, the malfunction is stored as a static malfunction. Malfunctions that never or immediately switch the MIL on are set as "sporadic" at each engine start. If the malfunction occurs again, the "sporadic" status is erased again. The "sporadic" status is erased exclusively after an OK diagnosis for malfunctions that*

only switch the MIL on after two successive trips with prior cold start and malfunction occurring. This process repeats continuously. If the malfunction does not occur again within the next 40 engine starts, this sporadic malfunction is automatically erased.

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- *The MFI control module differentiates among approx. 150 different malfunctions after evaluating the information, and stores them until the DTC memory is erased ⇒ Diagnostic Trouble Code (DTC) table, ⇒ page 01-26 .*
- *If possible, the DTC memory should be checked with engine running.*
- *If no malfunction is stored in the DTC memory, do not additionally erase DTC memory with function 05 since the readiness code (if it has been set) will be erased.*
- *The DTC memory should only be erased with function 05 since the DTC memory is erased immediately with mode 4 even if the DTC memory was not checked before that.*
- *If a malfunction recognized by the On Board Diagnostic (OBD) is eliminated, the following work steps should be carried out after that:*

- Erase DTC memory
- Stop engine (switch ignition off) and start it again
- Take a test drive
- Carry out automatic test sequence by inserting address word 00

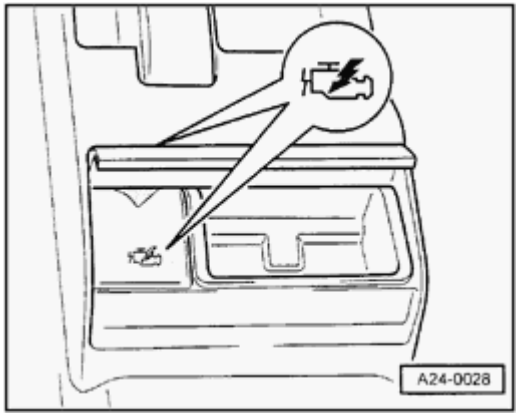
Note:

Every time the DTC memory is erased (both with function 05 and with mode 4), the readiness code is reset.

01-7

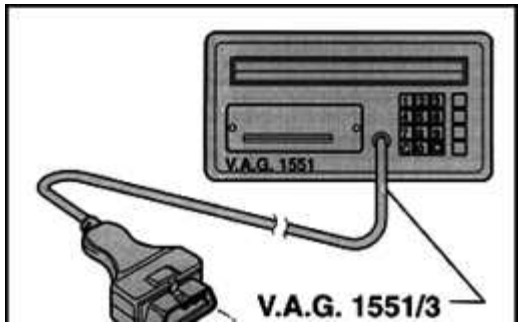
VAG 1551/1552 Scan Tool (ST), connecting and selecting Engine Electronics address word 01

- Fuses for engine electronics OK
- Fuel pump relay OK
- Ground connections OK ⇒ page 01-5



Connecting-m.y. 1996

- Open back seat ash tray (center console) and remove cover for data link connector.



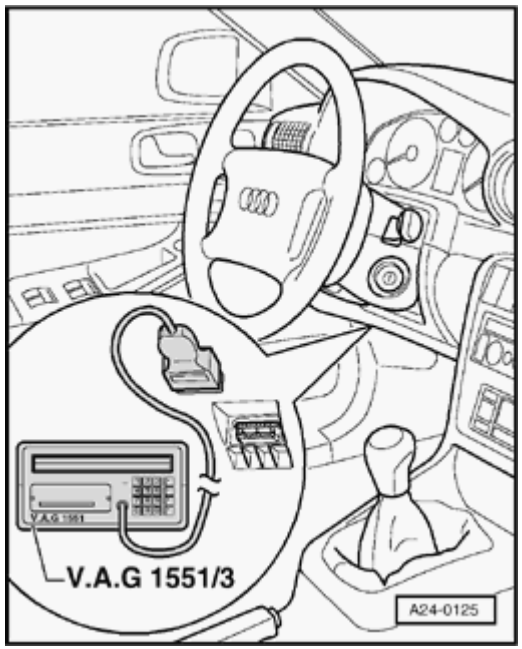
- Connect VAG 1551/1552 scan tool with adapter cable VAG 1551/3 to data link connector.

01-8

Connecting-m.y. 1997

Note:

The DLC is located below the driver's knee bar to the left of the steering wheel.



- Connect VAG1551 or VAG1552 Scan Tool (ST) with VAG1551/3 adapter to Data Link Connector (DLC).

All vehicles

V.A.G On Board Diagnostic (OBD) HELP

1 - Rapid data transfer

2 - Blink code output

Indicated on display1)

1) Operating modes 1 and 2 are displayed alternately.

Notes:

- *If there is no display, check voltage supply for data link connector:*

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- *Additional operating instructions can be obtained by using the VAG 1551 scan tool HELP button.*
- *The → button is used to advance to the next program step.*

01-9

For the function:

02:	Check DTC Memory	- Let engine idle, or, crank engine with starter for at least 5 seconds without switching ignition off
03:	Output Diagnostic Test Mode	- Switch ignition on
04:	Basic Setting	- Let engine run or switch ignition on
07:	Code Control Module	- Switch ignition on
08:	Read Measuring Value Block	- Let engine run or switch ignition on

- Switch printer on with PRINT button (indicator light in the button lights up).

- Press button -1- for "rapid data transfer" operating mode.

Rapid data transfer **HELP**

Insert address word XX

➢ Indicated on display

Note:

After inserting address word 00 and pressing -Q- button to confirm input,

an automatic test sequence is carried out (checks DTC memory of all systems with rapid data transfer).

- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

01-10

Rapid data transfer **Q**

01 - Engine Electronics

➢ Indicated on display

- Press -Q- button to confirm input.

Rapid data transfer

Scan Tool sends address word 01

➢ Indicated on display

Rapid data transfer **HELP**

Control module does not answer

➢ If the following is shown on the display:

- A list of possible malfunction causes can be printed out by pressing the HELP button.

Notes:

- *Check data link connector/engine control module wiring connection:*

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- *Engine control module faulty ⇒ Diagnostic Trouble Code (DTC) table, ⇒ page 01-26 .*

Rapid data transfer **HELP**

Error in communication link

➢ If the following is shown on the display:

Notes:

- *On vehicles with several On Board Diagnostic (OBD) systems, check wiring connection between the individual systems:*

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- *For vehicles with only MFI (Engine Electronics) On Board Diagnostic*

(OBD) capability, the engine control module is faulty ⇒ Diagnostic Trouble Code (DTC) table, ⇒ page 01-26 .

01-11

Rapid data transfer HELP **K wire not switching to Ground**	If one of the following two problems is shown on the display
Rapid data transfer HELP **K wire not switching to B+**	- A list of possible malfunction causes can be printed out by pressing the HELP button.

Note:

Check data link connector/engine control module wiring connection:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- After the malfunction cause is repaired, insert address word 01 again and press -Q- button to confirm input.

8D0906266 2.8l V6/2V MFI OBD2 D01 **Coding 01051 WSC 06388**	The control module identification and the coding are shown on the display:

- Engine control module replacement part no. 8D0906266

  For current engine control module version ⇒ Parts catalog

  - Engine displacement: 2.8 liters
  - Engine construction type: V-engine, 6-cylinder
  - Valves per cylinder: 2 valves
  - Fuel injection system: Multiport Fuel Injection (MFI)
  - Engine control module software version: OBD2, EPROM-status

of control module

- Engine control module hardware and software version: D_ _ Control module program status
- Engine control module coding: 01051 ⇒ Diagnostic Trouble Code (DTC) table, ⇒ page 01-247 .
- VAG plant number: WSC 06388 (where the VAG 1551 scan tool was used for the last coding and/or adaptation)

Notes:

If the engine control module version that corresponds to the vehicle is not displayed, replace engine control module ⇒ page 01-265 .

Incorrect engine control module coding leads to:

- *Driving performance problems (jerky shifting, abrupt load change, etc.)*
- *Increased fuel consumption*
- *Elevated exhaust gas values*
- *Reduction in transmission service life*

- *Malfunctions not present are stored in DTC memory*
- *Functions are not carried out (oxygen sensor control, actuation of EVAP canister system, etc.)*

- Press → button.

Rapid data transfer	**HELP**
Select function XX	

➢ Indicated on display

Note:

After pressing the HELP button, an overview of the possible functions is printed out.

01-13

DTC memory, checking and erasing

- Connect VAG 1551 scan tool and operate until the display shows "Select function XX" ⇒ page 01-7 .

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

- Press buttons -0- and -2- to select the"Check DTC Memory" function 02.

Rapid data transfer Q **02 - Check DTC Memory**	Indicated on display

- Press -Q- button to confirm input.

X DTC recognized	The number of stored Diagnostic Trouble Codes (DTC) or "No DTC recognized" is shown on the display.

Notes:

No DTC recognized	

- *If the printer is switched on, the stored malfunctions will be displayed and printed out in sequence.*
- *If the printer is switched off, the → button must be pressed to display the next malfunction.*

- After the last malfunction is displayed, press the → button.

Note:

If there is a complaint that is not recognized by the On Board Diagnostic

(OBD), carry out additional troubleshooting according to the Malfunction Table in the "Engine Troubleshooting" binder.

01-14

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -5- to select the "Erase DTC Memory" function 05.

Rapid data transfer **Q**

05 - Erase DTC Memory

Indicated on display

- Press -Q- button to confirm input.

Note:

Every time DTC memory is erased (both with function 05 and with address word 33, mode 4) the readiness code is erased.

Caution →

DTC Memory is not interrogated

If indicated on display

If the ignition was switched off between checking and erasing DTC memory, then DTC memory is not erased.

- Comply with work sequence exactly, i.e. first check DTC memory.

01-15

Rapid data transfer → **DTC Memory is erased**	➢ Indicated on display - Press → button.
Rapid data transfer HELP **Select function XX**	➢ Indicated on display - Repair malfunctions printed out according to Diagnostic Trouble Code (DTC) table ⇒ page 01-26 . - After repairing the malfunctions, check DTC memory again to erase any malfunctions that may have been stored (e.g. by disconnecting connectors). - Stop engine (switch ignition off) and start again. - Test drive for at least 10 minutes. - Carry out Automatic Test Sequence by inserting address word 00. ***Note:*** *After address word 00 is inserted, the DTC memory of all systems with rapid data transfer is checked.*

01-16

Diagnostic Trouble Code (DTC) overview

Notes:

- *The Diagnostic Trouble Code (DTC) overview is organized according to SAE and VAG trouble codes.*
- *Diagnostic Trouble Codes (DTC) for which the MIL is not switched on by the engine control module after a malfunction is recognized are identified with the MIL switching condition "off."*
- *Diagnostic Trouble Codes (DTC) for which the MIL is switched on by the engine control module immediately after a malfunction is recognized are identified with the MIL switching condition "immediately."*
- *Diagnostic Trouble Codes (DTC) for which the MIL is not switched on until the malfunction is recognized after taking 2 trips (FTP 72) are identified with the MIL switching condition "2 Trips."*
- *Always repair the malfunctions with the MIL switching condition "immediately" first, and then the malfunctions with the switching condition "2 Trips."*

Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P0102	16486	Mass or Volume Air Flow Circuit Low Input	immediately
P0103	16487	Mass or Volume Air Flow Circuit High Input	immediately
P0116	16500	Engine Coolant Temperature Circuit Range/Performance Problem	immediately
P0117	16501	Engine Coolant Temperature Circuit Low Input	immediately

P0118	16502	Engine Coolant Temperature Circuit High Input	immediately
P0120	16504	Throttle Position Sensor A Circuit Malfunction	immediately
P0121	16505	Throttle Position Sensor A Circuit Range/Performance Problem	immediately

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P0122	16506	Throttle Position Sensor A Circuit Low Input	immediately
P0123	16507	Throttle Position Sensor A Circuit High Input	immediately
P0130	16514	O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	immediately
P0132	16516	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	immediately
P0133	16517	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	2 Trips
P0134	16518	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	immediately
P0135	16519	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	immediately
P0136	16520	O2 Sensor Circuit Malfunction (Bank 1 Sensor 2)	immediately
P0138	16522	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	immediately
P0141	16525	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	immediately
P0150	16534	O2 Sensor Circuit Malfunction (Bank 2 Sensor 1)	immediately
P0152	16536	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	immediately
P0153	16537	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	2 Trips
P0154	16538	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	immediately
P0155	16539	O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)	immediately
P0156	16540	O2 Sensor Circuit Malfunction (Bank 2 Sensor 2)	immediately

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P0158	16542	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	immediately
P0161	16545	O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)	immediately
P0170	16554	Fuel Trim Malfunction (Bank 1)	2 Trips
P0171	16555	System too Lean (Bank 1)	2 Trips
P0172	16556	System too Rich (Bank 1)	2 Trips
P0173	16557	Fuel Trim Malfunction (Bank 2)	2 Trips
P0174	16558	System too Lean (Bank 2)	2 Trips
P0175	16559	System too Rich (Bank 2)	2 Trips
P0300	16684	Random Misfire Detected	2 Trips / blink
P0301	16685	Cylinder 1 Misfire Detected	2 Trips / blink
P0302	16686	Cylinder 2 Misfire Detected	2 Trips / blink
P0303	16687	Cylinder 3 Misfire Detected	2 Trips / blink
P0304	16688	Cylinder 4 Misfire Detected	2 Trips / blink
P0305	16689	Cylinder 5 Misfire Detected	2 Trips / blink
P0306	16690	Cylinder 6 Misfire Detected	2 Trips / blink

Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P0322	16706	Ignition/Distributor Engine Speed Input Circuit No Signal	immediately
P0327	16711	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	immediately
P0332	16716	Knock Sensor 2 Circuit Low Input (Bank 2)	immediately
P0337	16721	Crankshaft Position Sensor Circuit Low Input	immediately
P0401	16785	Exhaust Gas Recirculation Flow Insufficient Detected	2 Trips
P0402	16786	Exhaust Gas Recirculation Flow Excessive Detected	2 Trips
P0422	16806	Main Catalyst Efficiency Below Threshold (Bank 1)	2 Trips
P0432	16816	Main Catalyst Efficiency Below Threshold (Bank 2)	2 Trips
P0440	16824	Evaporative Emission Control System Malfunction	2 Trips
P0452	16836	Evaporative Emission Control System Pressure Sensor Low Input	immediately
P0453	16837	Evaporative Emission Control System Pressure Sensor High Input	immediately
P0461	16845	Fuel Level Sensor Circuit Range/Performance	immediately
P0501	16885	Vehicle Speed Sensor Range/Performance	immediately

Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P0605	65535	Internal Control Module Read Only Memory (ROM) Error (Module Identification Defined by SAE J1979)	
P0605	16989	Internal Control Module Read Only Memory (ROM) Error (Module Identification Defined by SAE J1979)	immediately
P0702	00545	Transmission Control System Electrical	
P0706	17090	Transmission Range Sensor Circuit Range/Performance	off
P0707	17091	Transmission Range Sensor Circuit Low Input	off
P0717	17101	Input/Turbine Speed Sensor Circuit No Signal	
P0722	00297	Output Speed Sensor Circuit No Signal	
P0726	00543	Engine Speed Input Circuit Range/Performance	
P0732	00652	Gear 2 Incorrect Ratio	
P0733	00652	Gear 3 Incorrect Ratio	
P0734	00652	Gear 4 Incorrect Ratio	
P0735	00652	Gear 5 Incorrect Ratio	

Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P0753	00258	Shift Solenoid A Electrical	
P0758	00260	Shift Solenoid B Electrical	
P0763	00262	Shift Solenoid C Electrical	
P1101	17509	(B1-S1) Voltage too Low/Air Leak	immediately
P1102	17510	Heating Circ. (B1-S1) Short to B+	immediately
P1104	17512	(B1-S2) Voltage too Low/Air Leak	immediately
P1105	17513	Heating Circ. (B1-S2) Short to B+	immediately
P1106	17514	(B2-S1) Voltage too Low/Air Leak	immediately
P1107	17515	Heating Circ. (B2-S1) Short to B+	immediately
P1109	17517	(B2-S2) Voltage too Low/Air Leak	immediately
P1110	17518	Heating Circ. (B2-S2) Short to B+	immediately

Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P1201	17609	Cyl.1-Fuel Injector Circ. Electrical Malfunction	immediately
P1202	17610	Cyl.2-Fuel Injector Circ. Electrical Malfunction	immediately
P1203	17611	Cyl.3-Fuel Injector Circ. Electrical Malfunction	immediately
P1204	17612	Cyl.4-Fuel Injector Circ. Electrical Malfunction	immediately
P1205	17613	Cyl.5-Fuel Injector Circ. Electrical Malfunction	immediately
P1206	17614	Cyl.6-Fuel Injector Circ. Electrical Malfunction	immediately
P1213	17621	Cyl.1-Fuel Injector Circ. Short to B+	immediately
P1214	17622	Cyl.2-Fuel Injector Circ. Short to B+	immediately
P1215	17623	Cyl.3-Fuel Injector Circ. Short to B+	immediately
P1216	17624	Cyl.4-Fuel Injector Circ. Short to B+	immediately
P1217	17625	Cyl.5-Fuel Injector Circ. Short to B+	immediately
P1218	17626	Cyl.6-Fuel Injector Circ. Short to B+	immediately
P1250	17658	Fuel level too low	off

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P1325	17733	Cyl.1-Knock Control Limit Attained	off
P1326	17734	Cyl.2-Knock Control Limit Attained	off
P1327	17735	Cyl.3-Knock Control Limit Attained	off
P1328	17736	Cyl.4-Knock Control Limit Attained	off
P1329	17737	Cyl.5-Knock Control Limit Attained	off
P1330	17738	Cyl.6-Knock Control Limit Attained	off
P1339	17747	Crankshaft Pos./Engine Speed Sensors Cross connected	immediately
P1341	17749	Ignition Coil Power Output Stage 1 Short to Ground	immediately
P1343	17751	Ignition Coil Power Output Stage 2 Short to Ground	immediately
P1345	17753	Ignition Coil Power Output Stage 3 Short to Ground	immediately
P1391	17799	Camshaft Pos.Sensor (B2) Short to Ground	immediately
P1392	17800	Camshaft Pos.Sensor Open Circ. (B2) Short to B+	immediately
P1393	17801	Ignition Coil Power Output Stage 1 Electrical Malfunction	immediately
P1394	17802	Ignition Coil Power Output Stage 2 Electrical Malfunction	immediately
P1395	17803	Ignition Coil Power Output Stage 3 Electrical Malfunction	immediately

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P1396	17804	Engine Speed Sensor Missing Tooth	immediately
P1400	17808	EGR Valve Circ. Electrical Malfunction	immediately
P1402	17810	EGR Valve Circ. Short to B+	immediately
P1407	17815	EGR Temp.Sensor Signal too Low	immediately
P1408	17816	EGR Temp.Sensor Signal too High	immediately
P1409	17817	Tank Ventilation Valve Electrical Malfunction	immediately
P1410	17818	Tank Ventilation Valve Short to B+	immediately
P1500	17908	Fuel Pump Relay Circ. Electrical Malfunction	immediately
P1504	17912	Intake Air Sys.Bypass Air Determined	immediately
P1505	17913	CTP Switch does not Close Open Circuit	immediately
P1506	17914	CTP Switch does not Open Short to Ground	immediately
P1509	17917	IAC Circ. Electrical Malfunction	immediately
P1510	17918	IAC Circ. Short to B+	immediately
P1511	17919	Intake Manifold Changeover Valve Circ. Electrical Malfunction	off
P1512	17920	Intake Manifold Changeover Valve Circ. Short to B+	off

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Diagnostic Trouble Code (DTC)		Malfunction text	MIL switching condition
SAE	VAG		
P1600	18008	Power Supply (B+) Terminal 15 Low Voltage	off
P1602	18010	Power Supply (B+) Terminal 30 Low Voltage	immediately
P1606	18014	Rough Road Spec Engine Torque ABS-SG Electrical Malfunction	off
P1611	18019	MIL Call-up Circ./Transm. Control Module Short to Ground	immediately
P1612	18020	ECM Incorrectly Coded	immediately
P1613	18021	MIL Call-up Circ.Open Short to B+	immediately
P1746	00532	⇒ Repair Manual, 5 Spd. Automatic Transmission 01V	
P1748	65535	⇒ Repair Manual, 5 Spd. Automatic Transmission 01V	
P1813	00264	⇒ Repair Manual, 5 Spd. Automatic Transmission 01V	
P1818	00266	⇒ Repair Manual, 5 Spd. Automatic Transmission 01V	
P1823	00268	⇒ Repair Manual, 5 Spd. Automatic Transmission 01V	
P1828	00270	⇒ Repair Manual, 5 Spd. Automatic Transmission 01V	

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Diagnostic Trouble Code (DTC) table

- Following are all the possible malfunctions that can be recognized by the Engine Control Module (ECM) -J192- and printed on the VAG 1551 scan tool printer, listed according to code identifier (SAE and VAG codes).
- Malfunctions that switch the MIL on never or immediately are set as "sporadic" each time the engine is started. If the malfunction occurs again, the "sporadic" status is set again. For malfunctions that only switch the MIL on after two trips with malfunction, the "sporadic" status is only erased after an OK diagnosis.
- If the MIL lights up with engine running, there is a malfunction that makes the exhaust gas worse. If the MIL lights up and the engine is running, there must in any case be a malfunction stored in the DTC memory of the engine control module and/or of the transmission control module. In this case, the DTC memory of the engine control module and/or the transmission control module must be checked.
- If the MIL starts to blink, there is a malfunction present that can lead to three way catalytic converter damage (e.g. combustion misfiring with high misfiring rate). In this case, the trip should be continued with reduced power (until the MIL goes out or lights up continuously) and the malfunction should be eliminated as quickly as possible.
- The malfunction is not stored in the DTC memory immediately and the MIL is not switched on immediately with some malfunction types, but only after two successive trips with or without preceding cold start (-10° to 30° C (14° to 86° F) and malfunction occurring (malfunction recognition twice).
- The MIL switching condition is always specified in the Diagnostic Trouble Code (DTC) table.
- Combustion misfiring with high misfiring rate is displayed immediately with the MIL blinking, since the three way catalytic converters can be damaged. In this case, driving should continue only with reduced power and the malfunction should be eliminated as soon as possible.

- If faulty components are found, also check wiring to the components according to wiring diagram for short and open circuit.

- Before repairing or replacing components, check ground connections for Engine Control Module (ECM) -J192- connector D on terminals 3, 7 and 12 and connector E on terminals 3, 7 and 11 (specified value approx. 0.5 Ω) and ground points on the engine for corrosion and damage, check fuel pump relay ⇒ Repair Group 24.

01-27

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0102 / 16486 Mass or Volume Air Flow Circuit Low Input	1 Harness connector on Mass Air Flow (MAF) sensor -G70- loose or corrosion because of moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Mass Air Flow (MAF) sensor -G70- faulty or sensor -G70- faulty	➡	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-81
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
For troubleshooting ⇒ Display groups 000, 001, 019	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0102 / 16486" is set as soon as the signal voltage drops below 0.5 volts for longer than 0.3 sec (engine speed under 2000 RPM).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0103 / 16487 Mass or Volume Air Flow Circuit High Input	1 Harness connector on Mass Air Flow (MAF) sensor -G70- loose or corroded due to dampness in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary retighten and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Mass Air Flow (MAF) sensor -G70- faulty or sensor -G70- faulty	➠	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-81
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
For troubleshooting ⇒ Display groups 000, 001, 019	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0103 / 16487" is set as soon as the signal voltage rises above 5 volts for longer than 0.5 sec (engine speed below 2000 RPM).

01-29

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0116 / 16500 Engine Coolant Temperature Circuit Range/Performance Problem	1 Harness connector on Engine Coolant Temperature (ECT) sensor -G62- loose or corroded due to dampness in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 28-7
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring conection to Engine Coolant Temperature (ECT) sensor -G62- faulty, or sensor -G62- faulty	➡	- Engine Coolant Temperature (ECT) sensor -G62-, checking ⇒ page 28-25
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
For troubleshooting ⇒ Display groups 000, 001	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0116 / 16500" is set as soon as the coolant temperature lies under 55° C (131° F) after engine start, but 18 minutes later the temperature has not risen to over 70° C (158° F).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0117 / 16501 Engine Coolant Temperature Circuit Low Input	1 Harness connector on Engine Coolant Temperature (ECT) sensor -G62- loose or corroded due to dampness in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 28-7
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Engine Coolant Temperature (ECT) sensor -G62- faulty, or sensor -G62- faulty	➡	- Engine Coolant Temperature (ECT) sensor -G62-, checking ⇒ page 28-25
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
For troubleshooting ⇒ Display groups 000, 001	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0117 / 16501" is set as soon as the signal voltage drops below 0.10 volts for longer than 1 sec when ignition is switched on (corresponds to a coolant temperature over 200° C (392° F).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0118 / 16502 Engine Coolant Temperature Circuit High Input	1 Harness connector on Engine Coolant Temperature (ECT) sensor -G62- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 28-7
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Engine Coolant Temperature (ECT) sensor -G62- faulty, or sensor -G62- faulty	➡	- Check Engine Coolant Temperature (ECT) sensor -G62- ⇒ page 28-25
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display groups 000, 001	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0118 / 16502" is set as soon as the signal voltage is over 4.98 volts for longer than 1 sec with ignition on (corresponds to a coolant temperature below -50° C (-58° F)).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0120 / 16504 Throttle Position Sensor A Circuit Malfunction	1 Harness connector on Throttle Position (TP) sensor -G69- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Closed Throttle Position (CTP) switch -F60- in throttle position sensor does not open or is faulty	➡	- Check and adjust Closed Throttle Position (CTP) switch -F60- ⇒ page 24-73
Note: The malfunction P1506 / 17914 is also stored	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 002	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0120 / 16504" is set, with idle switch closed, as soon as a position sensor signal voltage of over 0.72 volts is recognized for longer than 2 sec. (corresponds to a throttle opening of more than 7°).

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Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0121 / 16505 Throttle Position Sensor A Circuit Range/ Performance Problem	1 Harness connector on Throttle Position (TP) sensor -G69- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Harness connector on Mass Air Flow (MAF) sensor -G70- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 002	3 Throttle Position (TP) sensor -G69- loose, incorrectly adjusted or shaft connection eccentric	➠	- Check and adjust throttle position sensor -G69- ⇒ page 24-77

Notes:

The malfunction "P0121 / 16505" is set at a coolant temperature of over 70° C (158° F), engine speed between 1500 RPM and 3500 RPM for longer than 2 seconds and an engine load over 66% (Mass Air Flow sensor signal) as soon as the sensor signal voltage is less than 0.96 volts (corresponds to a throttle opening less than 12°).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0122 / 16506 Throttle Position Sensor A Circuit Low Input	1 Harness connector on Throttle Position (TP) sensor -G69- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Throttle Position (TP) sensor -G69- faulty, or sensor -G69- faulty	➡	- Check throttle position sensor -G69- ⇒ page 24-77
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 002	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0122 / 16506" is set as soon as the signal voltage is less than 0.1 volts for longer than 2 sec at an engine speed of over 6000 RPM.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0123 / 16507 Throttle Position Sensor A Circuit High Input	1 Harness connector on Throttle Position (TP) sensor -G69- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Throttle Position (TP) sensor -G69- faulty, or sensor -G69- faulty	➡	- Check throttle position sensor -G69- ⇒ page 24-77
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 002	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0123 / 16507" is set as soon as the signal voltage is greater than 4.9 volts for longer than 2 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0130 / 16514 O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	1 Wiring conection to Heated Oxygen Sensor (HO2S) -G39- (B1-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring conection to Heated Oxygen Sensor (HO2S) -G39- (B1-S1) faulty, or HO2S -G39- faulty	➡	- Check HO2S -G39- (B1-S1) ⇒ page 24-49
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 010	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0130 / 16514" is set as soon as the difference between minimum and maximum signal voltage is less than 500 mV at an engine temperature over 80 ° C (176 ° F), 60 sec after start of control.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0132 / 16516 O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	1 Harness connector for Heated Oxygen Sensor (HO2S) -G39- (B1-S1) loose or corroded due to moisture in the harness connector		- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring conection to Heated Oxygen Sensor (HO2S) -G39- (B1-S1) faulty, or HO2S -G39- faulty		- Check HO2S -G39- (B1-S1) ⇒ page 24-49
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 010	3 Engine Control Module (ECM) -J192- faulty		- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0132 / 16516" is set as soon as the HO2S voltage is greater than 1.4 volts for longer than 5 sec., 123 sec.

after engine start.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0133 / 16517 O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	1 Harness connector for Heated Oxygen Sensor (HO2S) -G39- (B1-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Heated Oxygen Sensor (HO2S) -G39- (B1-S1) faulty	➡	- Replace HO2S -G39- (B1-S1) and code engine control module ⇒ page 24-57
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display groups 032, 033, 034, 041, 042, 043	3 Has the malfunction occurred again within a short time after the Oxygen Sensor Probe was replaced?	➡	- Very poor fuel quality can possibly cause the malfunction "P0133 / 16517". Extract old fuel and fill vehicle with premium.
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory again

Notes:

The malfunction "P0133 / 16517" is set as soon as the flank rise time (limit value 90 ms) and/or flank drop time (limit value 100 ms) of the probe signal has been exceeded between 300 mV and 500 mV.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0134 / 16518 O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	1 Harness connector for Heated Oxygen Sensor (HO2S) -G39- (B1-S1) loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring conection to Heated Oxygen Sensor (HO2S) -G39- (B1-S1) faulty, or HO2S -G39- faulty	➠	- Check HO2S -G39- (B1-S1) ⇒ page 24-49
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 010	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0134 / 16518" is set as soon as the signal voltage is between 370 mV and 430 mV for longer than 4 sec, 123 sec after engine start and engine temperature over 30° C (86° F).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0135 / 16519 O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	1 Harness connector for Oxygen Sensor (O2S) heater -Z19- (B1-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection for Oxygen Sensor (O2S) heater -Z19- (B1-S1) faulty, or heater -Z19- faulty	➡	- Check O2S heater -Z19- (B1-S1) ⇒ page 24-51
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

- *The heating of the O2S in front of the Three Way Catalytic Converter (TWC) are switched on by the fuel pump relay.*

- *The malfunction "P0135 / 16519" is set as soon after engine start as the heating current, at a battery voltage between 9 volts and 16 volts is between 280 and 520 mA for longer than 1 sec (battery voltage fluctuations).*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0136 / 16520 O2 Sensor Circuit Malfunction (Bank 1 Sensor 2)	1 Harness connector for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) - G130- (B1-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) - G130- (B1-S2) faulty, or sensor -G130- faulty	➡	- Check O2S behind three way catalytic converter -G130- (B1-S2) ⇒ page 24-53
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 041	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0136 / 16520" is set, 123 sec after engine start, as soon as the signal voltage during a deceleration fuel shut off is greater than 300 mV at a coolant temperature over 80° C (176° F) and 45 sec behind the probe heating after the Three Way Catalytic Converter (TWC) is switched on. The length of the deceleration fuel shut off must be longer than 4 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0138 / 16522 O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	1 Harness connector for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) - G130- (B1-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) - G130- (B1-S2) faulty, or sensor -G130- faulty	➡	- Check O2S behind three way catalytic converter -G130- (B1-S2) ⇒ page 24-53
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 041	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0138 / 16522" is set 3 min. after engine start, as soon as the O2S voltage is greater than 1.4 volts for longer than 5 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0141 / 16525 O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	1 Harness connector for Oxygen Sensor (O2S) heater -Z29- (B1-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection for Oxygen Sensor (O2S) heater -Z29- (B1-S2) faulty, or heater -Z29- faulty	➡	- Check O2S heater -Z29- (B1-S2) ⇒ page 24-55
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The heater for the O2S behind the Three Way Catalytic Converter (TWC) is not switched on immediately at engine start, but only when the calculated exhaust gas temperature exceeds 308° C (586° F)(⇒ Read measuring value block, display group 42, channel 1).

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Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0150 / 16534 O2 Sensor Circuit Malfunction (Bank 2 Sensor 1)	1 Harness connector for Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) faulty, or HO2S 2 -G108- faulty	➡	- Check HO2S 2 -G108- (B2-S1) ⇒ page 24-49
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 010	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0150 / 16534" is set at an engine temperature over 80° C (176° F), 60 sec after control start the difference between minimum and maximum as soon as signal voltage is less than 500 mV.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0152 / 16536 O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	1 Harness connector for Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) faulty, or HO2S 2 -G108- faulty	➡	- Check HO2S 2 -G108- (B2-S1) ⇒ page 24-49
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 010	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0152 / 16536" is set 123 sec after engine start as soon as the HO2S voltage is greater than 1.4 volts for longer than 5 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0153 / 16537 O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	1 Harness connector for Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Heated Oxygen Sensor (HO2S) 2 - G108- (B2-S1) faulty	➡	- Replace HO2S 2 -G108- (B2-S1) and code engine control module ⇒ page 24-57
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display groups 032, 033, 034, 041, 042, 043	3 Has the malfunction occurred again shorty after replacement of the Oxygen Sensor Probe?	➡	- Very poor fuel quality can be the possible cause for the malfunction "P0133 / 16517". Extract old fuel and fill tank with premium.
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory again

Notes:

The malfunction "P0153 / 16537" is set as soon as the flank rise time (limit value 90 ms) and/or flank fall time (limit value 100 ms) of the probe signal is exceeded between 300 mV and 500 mV.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0154 / 16538 O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	1 Harness connector for Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) faulty, or HO2S 2 -G108- faulty	➡	- Check HO2S 2 -G108- (B2-S1) ⇒ page 24-49
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 010	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0154 / 16538" is set 123 sec. after engine start and engine temperature over 30° C (86° F), as soon as the signal voltage lies between 370 mV and 430 mV for longer than 4 sec.

01-48

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0155 / 16539 O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)	1 Harness connector for Oxygen Sensor (O2S) heater -Z28- (B2-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection for Oxygen Sensor (O2S) heater -Z28- (B2-S1) faulty, or heater -Z28- faulty	➡	- Check O2S heater -Z28- (B2-S1) ⇒ page 24-51
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The heater for the O2S in front of the Three Way Catalytic Converter (TWC) is switched on by the fuel pump relay.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0156 / 16540 O2 Sensor Circuit Malfunction (Bank 2 Sensor 2)	1 Harness connector for Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) - G131- (B2-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) - G131- (B2-S2) faulty, or sensor -G131- faulty	➡	- Check O2S 2 behind three way catalytic converter -G131- (B2-S2) ⇒ page 24-53
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 041	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0156 / 16540" is set 123 sec after engine start, at a coolant temperature over 80° C (176° F) and 45 sec

after the probe heater behind the Three Way Catalytic Converter (TWC) is switched on , as soon as the signal voltage during a deceleration fuel shut off is greater than 300 mV. The length of the deceleration fuel shut off must be longer than 4 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0158 / 16542 O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	1 Harness connector for Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) - G131- (B2-S2) loose or corroded due to moisture in the harness connector		- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) - G131- (B2-S2) faulty, or sensor -G131- faulty		- Check O2S 2 behind three way catalytic converter -G131- (B2-S2) ⇒ page 24-53
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 041	3 Engine Control Module (ECM) -J192- faulty		- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The malfunction "P0158 / 16542" is set 3 min after engine start, as soon as the O2S voltage is greater than 1.4 volts for

longer than 5 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0161 / 16545 O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)	1 Harness connector for Oxygen Sensor (O2S) heater -Z30- (B2-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection for Oxygen Sensor (O2S) heater -Z30- (B2-S2) or heater -Z30- (B2-S2) faulty	➡	- Check O2S heater -Z30- (B2-S2) ⇒ page 24-55
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

The heater for O2S behind Three Way Catalytic Converter (TWC) is not switched on immediately at engine start, but only when the calculated exhaust gas temperature exceeds 308° C (586° F) (⇒ Read measuring value block, display group 42, channel 1).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0170 / 16554 Fuel Trim Malfunction (Bank 1)	1 Air leak in the area of the intake manifold	➡	- Find and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	2 Oil dilution (fuel in the oil) because of frequent cold starts or driving short distances	➡	- Check, if necessary do oil change
MIL Status: MIL lights up after 2 Trips	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	3 Mass Air Flow (MAF) sensor -G70- supplies false signal	➡	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-81
For troubleshooting ⇒ Display groups 005, 007, 009 and 010	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	4 Oil burning with faulty piston	➡	- Check compression pressure ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 15*
	Malfunction cause found: Yes ▶		

	- Erase DTC memory, test drive and check DTC memory again

Note:

The malfunction "P0170 / 16554" is set in the learning procedure as soon as the difference between a newly learned oxygen sensor learning value and an optional stored oxygen sensor learning value is greater than ± 8%.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0171 / 16555 System too Lean (Bank 1)	1 Malfunction P0174 / 16558 "System too Lean (Bank 2)" Also in DTC memory No ▼	Yes ▶	- If the fuel-air mixture for both cylinder banks is too lean, a malfunction must be present that leads to incorrect mixture formation for both banks (B1 and B2) ⇒ Troubleshooting according to Diagnostic Trouble Code (DTC) ⇒ page 01-57
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Leak in the exhaust system for bank 1 up to Heated Oxygen Sensor (HO2S) -G39-	➠	- Find and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	3 Leak in intake system	➠	- Find and repair leak

For troubleshooting ⇒ Display groups 005, 007, 009 and 010	Malfunction cause found: Yes ▶ No ▼ Continued next page	- Erase DTC memory, test drive and check DTC memory again

4 Malfunction in spark plug(s) or ignition cable(s) in bank 1	➡	- Spark harness connector loose or faulty - Check ignition cable for damage (e.g. cracks, traces of burns, worn places) - Check face side of spark plug
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory
5 Malfunction in the fuel injectors in bank 1 because of - Resistance in fuel injector connectors - Fuel injector dirty, faulty or has carbon deposits	➡	- Check harness connector on fuel injector for tight fit - Check fuel injection quantity and for leaks in fuel injectors ⇒ page 24-33
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory
6 Intake valves have carbon deposits	➡	- Check intake valves for carbon deposits, if necessary clean valves
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory
7 Continue troubleshooting per Diagnostic Trouble Code (DTC) table ⇒ page 01-60		

Notes:

If the malfunction "P0171 / 16555" is set, the oxygen sensor control has exceeded the learning value limit in the "rich" direction, but the HO2S still recognizes "mixture too lean".

01-55

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0172 / 16556 System too Rich (Bank 1)	1 Malfunction P0175 / 16559 "System too Rich (Bank 2)" Also in DTC memory No ▼	Yes ▶	- Fuel pressure too high; check system pressure and residual pressure ⇒ page 24-20
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Fuel injector (Bank 1) does not close and/or leaks	➡	- Check fuel injection quantity of fuel injectors and for leaks ⇒ page 24-33
For troubleshooting ⇒ Display groups 005, 007, 009 and 010	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory again

Note:

If the malfunction "P0172 / 16556" is set, the oxygen sensor control has dropped below the learning value limit in the "lean" direction, but the (HO2S) still recognizes "mixture too rich".

01-56

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0173 / 16557 Fuel Trim Malfunction (Bank 2)	1 Air leak in the area of the manifold	➡	- Find and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	2 Oil diluted (fuel in the oil) because of frequent cold starts for driving short distances	➡	- Check and change oil if necessary
MIL Status: MIL lights up after 2 Trips	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	3 Mass Air Flow (MAF) sensor -G70- supplies false signal	➡	- Check Mass Air Flow (MAF) sensor -G70- ⇒ page 24-81
For troubleshooting ⇒ Display groups 006, 008, 009 and 010	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and check DTC memory again
	4 Oil burning with faulty piston	➡	- Check compression pressure ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair*

			Group 15
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory again

Note:

The malfunction "P0170 / 16554" is set in the learning process as soon as the difference between a newly learned (HO2S) learning value and any optional stored oxygen sensor learning value is greater than ± 8%.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0174 / 16558 System too Lean (Bank 2)	1 Malfunction P0171 / 16555 "System too Lean (Bank 1)" Also in DTC memory No ▼	Yes ▶	- If the fuel-air mixture is too lean for both cylinder banks, a malfunction must be present that leads to faulty mixture formation for both banks (B1 and B2) ⇒ Troubleshooting per Diagnostic Trouble Code (DTC) table, ⇒ page 01-53
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Leaks in the intake system for bank 2 up to Heated Oxygen (HO2S) sensor 2 -G108-	➡	- Find and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	3 Leaks in intake system	➡	- Find and repair leak

For troubleshooting ⇒ Display groups 006, 008, 009 and 010	Malfunction cause found: Yes ▶ No ▼ Continued next page	- Erase DTC memory, test drive and check DTC memory again

4 Malfunction on spark plug(s) or ignition cable(s) of Bank 1	➡	- Spark harness connector loose or faulty ⇒ check - Check ignition cable for damage (e.g. cracks, traces of burns, worn places) - Check face side of spark plugs
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory
5 Malfunction in the fuel injectors in Bank 2 because of - Resistance in the fuel injector connectors - Fuel injector that is dirty, faulty or has carbon deposits	➡	- Check harness connector on fuel injector for tight fit - Check fuel injection quantity and for leaks ⇒ page 24-33
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory
6 Intake valves have carbon deposits	➡	- Check intake valves for carbon deposits, if necessary clean valves
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory
7 Continue Troubleshooting per Diagnostic Trouble Code (DTC) table ⇒ page 01-16		

Notes:

If the malfunction "P0174 / 16558" is set, the oxygen sensor control has exceeded the learning value limit in the "rich" direction, but the (HO2S) still recognizes "mixture too lean".

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0175 / 16559 System too Rich (Bank 2)	1 Malfunction P0172 / 16556 "System too Rich (Bank 1)" Also in DTC memory No ▼	Yes ▶	- Fuel pressure too high. Check system pressure and residual pressure ⇒ page 24-20
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up after 2 Trips For troubleshooting ⇒ Display groups 006, 008, 009 and 010	2 Fuel injector (Bank 2) does not close or leaks	➡	- Check fuel injection quantity and for leaks ⇒ page 24-33
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory again

Notes:

If the malfunction "P0175 / 16559" is set, the oxygen sensor control has dropped below the learning value limit in the "lean" direction, but the (HO2S) still recognizes "mixture too rich".

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0171 / 16555 System too Lean (Bank 1)	1 Malfunction P1250 / 17658 "Fuel Level Too Low" also in DTC memory No ▼	Yes ▶	- For malfunctions that can be caused by fuel problems (e.g. fuel system too lean), the malfunction "Fuel Level Too Low" is also set if there is less than 12 liters (12.7 qt.) fuel in the tank ⇒check tank level and fill tank if necessary
P0174 / 16558 System too Lean (Bank 2)	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Large air leak quantity in intake system to Mass Air Flow (MAF) sensor - G70-	➠	- Determine cause of air leak and repair
For troubleshooting ⇒ Display groups 005, 006, 007, 008, 009 and 010	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and check DTC memory again

3 Fuel system pressure too low because of: - Leaks in the area of the fuel lines or the fuel distributor strip - Vacuum line to the fuel pressure regulator or fuel pressure regulator faulty - Fuel filter plugged - Fuel pump delivery quantity too low	➡	- Check system pressure and residual pressure ⇒ page 24-20
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory
4 EVAP canister purge regulator valve -N80- sticks mechanically in closed position	➡	- Check EVAP canister purge regulator valve -N80- ⇒ page 24-58
Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory

Notes:

If the malfunctions "P0171 / 16 555 and P0174 / 16558"are set, is set, the oxygen sensor control has exceeded the learning value limit in the "rich" direction, but the (HO2S) still recognizes "mixture too lean".

01-62

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0300 / 16684 Random Misfire Detected _____ **P0301 / 16685** Cylinder 1 Misfire Detected _____ **P0302 / 16686** Cylinder 2 Misfire Detected _____ **P0303 / 16687** Cylinder 3 Misfire Detected _____ MIL Status: MIL lights up or blinks For troubleshooting ⇒Display groups 031, 038, 039	1 Malfunction P1250 / 17658 "Fuel Level Too Low" also in DTC memory No ▼	Yes ▶	- For malfunctions that can be caused by fuel problems (e.g. fuel system too lean), the malfunction "Fuel Level Too Low" is also set if there is less than 12 liters (12.7 qt.) fuel in the tank ⇒ check tank level and fill tank if necessary
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	2 Are other Diagnostic Trouble Codes (DTC) present in the DTC memory (e.g fuel injector, heated oxygen sensor probes, fuel system etc.) when combustion misfiring is recognized No ▼	Yes ▶	- The combustion misfiring that has been recognized is a resulting malfunction from the stored Diagnostic Trouble Codes (DTC) ⇒ First repair this malfunction according to Diagnostic Trouble Code (DTC) table
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and check DTC memory again

	3 Has combustion misfiring only been recognized on one or two cylinders (2/4 or 3/5 or 1/6)? No ▼	Yes ▶	- Spark harness connector loose or faulty ⇒ check - Check ignition cable for damage (e.g. cracks, traces of burns, worn places) - Check face side of spark plug - Fuel injector of the cylinder faulty; check fuel injector ⇒ page 24-29
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	4 Has combustion misfiring occurred on two cylinders (2/4 or 3/5 or 1/6)? No ▼	Yes ▶	- Common ignition coil of both affected cylinders faulty, check ignition coil ⇒ page 28-16
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and check DTC memory

	5 Combustion misfiring has been stored in the DTC memory for several or all cylinders	➡	- Leaks in intake system ⇒ check intake system for air leaks - Fuel pressure not OK ⇒ Check system and residual pressure ⇒ page 24-20 - Exhaust gas recirculation too high ⇒check EGR system hoses and components - Carbon deposits on fuel injectors ⇒check - Carbon deposits on intake valves
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory

Notes:

- *The malfunction "P0300 / 16684" is set as soon as combustion misfiring has been recognized in more than one cylinder.*
- *If there is combustion misfiring with low misfiring rate, the MIL is only set after two successive trips without preceding cold start and the malfunction occurring.*
- *Combustion misfiring with high misfiring rate is displayed immediately by the MIL blinking, since the Three Way Catalytic Converter (TWC) can be damaged. In this case, driving should be continued with reduced power and the malfunction should be repaired as quickly as possible.*

01-65

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0300 / 16684 Random Misfire Detected _____ **P0304 / 16688** Cylinder 4 Misfire Detected _____ **P0305 / 16689** Cylinder 5 Misfire Detected _____ **P0306 / 16690** Cylinder 6 Misfire Detected _____ MIL Status: MIL lights up or blinks For troubleshooting ⇒Display groups 031, 038, 039	1 Malfunction P1250 / 17658 "Fuel Level Too Low" also in DTC memory No ▼	Yes ▶	- For malfunctions that can be caused by fuel problems (e.g. fuel system too lean), the malfunction "Fuel Level Too Low" is also set if there is less than 12 liters (12.7 qt.) fuel in the tank ⇒ check tank level and fill tank if necessary
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	2 When combustion misfiring is recognized, are there other Diagnostic Trouble Codes (DTC) (e.g. fuel injector, Oxygen Sensor Proben, Fuel system etc.) in DTC memory No ▼	Yes ▶	- The combustion misfiring that has been recognized is a resulting malfunction from the stored Diagnostic Trouble Codes (DTC) ⇒ First repair this malfunction according to Diagnostic Trouble Code (DTC) table
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and check DTC memory again

	3 Has combustion misfiring been recognized on only one or two cylinders (2/4 or 3/5 or 1/6)? No ▼	Yes ▶	- Spark harness connector loose or faulty ⇒ check - Check ignition cable for damage (e.g. cracks, traces of burns, worn places) - Check face side of spark plug - Fuel injector of the cylinder faulty ⇒Check fuel injector ⇒ page 24-29
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	4 Has misfiring occurred on two cylinders (2/4 or 3/5 or 1/6)? No ▼	Yes ▶	- Common ignition coil for the two cylinders affected faulty, check ignition coil ⇒ page 28-16
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and check DTC memory

	5 Combustion misfiring on several or all cylinders stored in the DTC memory	➡	- Leaks in intake system ⇒ check intake system for air leaks - Fuel pressure not OK ⇒ check system and residual pressure ⇒ page 24-20 - Exhaust gas recirculation too high ⇒check EGR system hoses and components - Carbon deposits on fuel injectors ⇒check - Carbon deposits on intake valves ⇒check
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and check DTC memory

Notes:

- *The malfunction "P0300 / 16684" is set as soon as combustion misfiring has been recognized on one or more cylinders.*
- *If there is combustion misfiring with low misfiring rate, the MIL is only switched on after two successive trips without preceding cold start and malfunction occurring.*
- *Combustion misfiring with high misfiring rate is displayed immediately by the MIL light blinking since the Three Way Catalytic Converter (TWC) can be damaged. In this case, driving should continue with reduced power and the malfunction should be repaired as quickly as possible.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0322 / 16706 Ignition/Distributor Engine Speed Input Circuit No Signal	1 Malfunction P1339 / 17747 "Crankshaft Pos./Engine Speed Sensors Cross connected" also in DTC memory No ▼	Yes ▶	- 3-pin harness connector on Crankshaft Position (CKP) sensor -G4- and engine speed (RPM) sensor -G28- transposed ⇒disconnect both connectors and connect correctly; installation location ⇒ page 28-7
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
MIL Status: MIL lights up immediately	2 Harness connector for engine speed (RPM) sensor -G28- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation ⇒ page 28-7
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	3 Holding socket for engine speed (RPM) sensor -G28- loose or -G28- incorrectly adjusted	➠	- Check mounting - Adjust engine speed bracket ⇒ page 28-23
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and check DTC memory again

4 Metal chips on engine speed (RPM) sensor -G28- or distance from the engine speed (RPM) sensor -G28- to the flywheel ring greater than 1.2 mm (0.049 in.)	➡	- Remove engine speed (RPM) sensor -G28-, check for contamination, clean if necessary
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
5 Wiring connection to engine speed (RPM) sensor -G28- faulty or sensor -G28- faulty	➡	- Check and adjust engine speed (RPM) sensor -G28- ⇒ page 28-21
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
6 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

If the malfunction "P0322 / 16706" is recognized during engine start, no ignition or fuel injection occurs.

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Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0327 / 16711 Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor) MIL Status: MIL lights up immediately For troubleshooting ⇒Display group 015	1 Malfunction P0332 / 16716 "Knock Sensor 2 Circuit Low Input" Also in DTC memory No ▼	Yes ▶	- Check knock sensor 1 -G61- and knock sensor 2 -G66- ⇒ page 28-29
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	2 Harness connector for Knock Sensor (KS) 1 -G61- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	3 Knock Sensor (KS) 1 -G61- loose	➡	- Check mounting of knock sensor 1 -G61- and if necessary retighten ⇒ use insert 3247; tightening torque 20 Nm (15 ft lb)
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again

	Continued next page

	4 Wiring connection to Knock Sensor (KS) 1 - G61- faulty, or sensor -G61- faulty	➡	- Check knock sensor 1 -G61- ⇒ page 28-29
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and check DTC memory again
	5 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0327 / 16711" is set if the output voltage of the knock sensor is too low (below 0.2 V) (coolant temperature over 20° C (68° F)/ engine speed greater than 3500 RPM and engine load greater than 16%). The ignition angle is then retarded by 12° crankshaft in the knocking areas of the map (engine load greater than 40%).

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Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0332 / 16716 Knock Sensor 2 Circuit Low Input (Bank 2)	1 Malfunction P0327 / 16711 "Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)" also in DTC memory No ▼	Yes ▶	- Check knock sensor 1 -G61- and knock sensor 2 -G66- ⇒ page 28-29
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Harness connector for Knock Sensor (KS) 2 -G66- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 016	3 Knock Sensor (KS) 2 -G66- loose	➡	- Check mounting of knock sensor 2 -G66- and if necessary retighten ⇒use insert 3247; tightening torque 20 Nm (15 ft lb)
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again

	Continued next page

	4 Wiring connection to Knock Sensor (KS) 2 -G66- faulty or sensor -G66- faulty	➡	- Check knock sensor 2 -G66- ⇒ page 28-29
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	5 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0332 / 16716" is set when the knock sensor output voltage is too low (under 0.2 V) (coolant temperature over 20° C (68° F) / engine speed greater than 3500 RPM and engine load greater than 16%). The ignition angle is then retarded by 12° crankshaft in the knocking ranges of the map (engine load greater than 40%).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0337 / 16721 Crankshaft Position Sensor Circuit Low Input	1 Harness connector for Crankshaft Position (CKP) sensor -G4- loose or corroded due to moisture in the harness connector		- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 28-7
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Crankshaft Position (CKP) sensor -G4- loose or distance to groove on crankshaft counterweight greater than 1.3 mm (0.053 in.)		- Check crankshaft position sensor -G4- for correct installation and tight fit
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Wiring connection to Crankshaft Position (CKP) sensor -G4- faulty, or sensor -G4- faulty		- Check crankshaft position sensor -G4- ⇒ page 28-19
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again

	Continued next page

	4 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0337 / 16721" is set at an engine speed between 25 RPM and 400 RPM as soon as no crankshaft sensor signal is recognized for longer than 3 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0401 / 16785 Exhaust Gas Recirculation Flow Insufficient Detected	1 EGR system vacuum hose kinked or fallen off	➡	- Check vacuum hoses
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Leak in a vacuum hose of the EGR system (e.g. cracked, worn though, etc.)	➡	- Check vacuum hoses for leaks
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Vacuum hose between EGR vacuum regulator solenoid valve -N18- and mechanical EGR valve plugged	➡	- Check vacuum hoses for obstructions
For troubleshooting ⇒ Display group 017	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again

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	4 EGR vacuum regulator solenoid valve -N18- sticks in closed position	➠	- Check EGR vacuum regulator solenoid valve -N18- ⇒ page 24-67
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	5 EGR valve sticks in closed position	➠	- Check mechanical EGR valve ⇒ page 24-70
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Notes:

- *Recognition condition for the malfunction "P0401 / 16785" (mech. valve continuously closed) is a coolant temperature over 72° C (162° F), an open idle switch, a throttle angle less than 42.5°, a vehicle speed between 70 km/h and 105 km/h (44 and 66 mph), an EGR duty cycle greater than 50%, an engine speed between 1500 RPM and 3300 RPM and an engine load between 23% and 60%. If all these conditions are fulfilled and the EGR temperature signal is less than 50° C (122 ° F) for longer than 34 sec, the malfunction "P0401 / 16785" is set.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0402 / 16786 Exhaust Gas Recirculation Flow Excessive Detected	1 Vacuum line incorrectly connected and/or hose connections transposed	➠	- Check EGR system vacuum hose according to vacuum plan ⇒ page 24-111
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again DTC memory
MIL Status: MIL lights up after 2 Trips	2 EGR vacuum regulator solenoid valve -N18- stuck in open position	➠	- Check EGR vacuum regulator solenoid valve -N18- ⇒ page 24-67
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again DTC memory
	3 EGR valve leaks or is stuck in open position	➠	- Check mechanical EGR valve ⇒ page 24-70
For troubleshooting ⇒ Display group 017	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Notes:

- *The malfunction "16786" (mech. valve continuously open) is set if after a cold start (-12° C to 30° C (10 to 86° F) coolant temperature) the EGR temperature is greater than 50° C (122° F) at a coolant temperature of 35° C (95° F).*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0422 / 16806 Main Catalyst Efficiency Below Threshold (Bank 1)	1 Are other malfunctions stored in the DTC memory?	Yes ▶	- First correct these malfunctions according to Diagnostic Trouble Code (DTC) table.
	No ▼		
MIL Status: MIL lights up after 2 Trips	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again
	No ▼		
	2 Bank 1 Three Way Catalytic Converter (TWC) chemically or thermally aged or mechanically destroyed	➡	- Replace Three Way Catalytic Converter (TWC) Bank 1
For troubleshooting ⇒ Display groups 035, 036, 044	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Note:

- *With the help of the Oxygen Sensor Probe in front of and behind the Three Way Catalytic Converter (TWC), the rate of Three Way Catalytic Converter (TWC) deterioration is determined using the Three Way Catalytic Converter (TWC) oxygen storage capability.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0432 / 16816 Main Catalyst Efficiency Below Threshold (Bank 2)	1 Are other malfunctions stored in the DTC memory?	Yes ▶	- First repair these malfunctions according to Diagnostic Trouble Code (DTC) table.
	No ▼		
MIL Status: MIL lights up after 2 Trips	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again
	No ▼		
	2 Bank 2 Three Way Catalytic Converter (TWC) chemically or thermally aged or mechanically destroyed	➡	- Replace Bank 2 Three Way Catalytic Converter (TWC)
For troubleshooting ⇒ Display groups 035, 036, 044	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Note:

- *With the help of the Oxygen Sensor Probe in front of and behind the Three Way Catalytic Converter (TWC), the rate of Three Way Catalytic Converter (TWC) deterioration is determined using the Three Way Catalytic Converter (TWC) oxygen storage capability.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0440 / 16824 Evaporative Emission Control System Malfunction	1 Evaporative emissions system hoses kinked or pinched	➡	- Check hoses for correct fit
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up after 2 Trips	2 Leak in the EVAP system between ♦ Intake manifold and EVAP canister purge regulator valve -N80- or ♦ EVAP canister purge regulator valve -N80- and sensor for EVAP canister -G172- or ♦ Sensor for EVAP canister -G172- and EVAP canister	➡	- Check EVAP system for leaks
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again

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For troubleshooting ⇒ Display group 030	3 EVAP canister purge regulator valve -N80- sticks mechanically	➡	- Check solenoid valve for Evaporative Emission (EVAP) canister purge -N80- ⇒ page 24-58
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again
	4 Sensor for EVAP canister -G172- (differential pressure sensor) faulty	➡	- Check Sensor for EVAP canister -G172- (differential pressure sensor) ⇒ page 24-61
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Note:

- *With the help of the Sensor for EVAP canister -G172- (differential pressure sensor)the pressure is measured between the Evaporative Emissions (EVAP) canister and solenoid valve for Evaporative Emission (EVAP) canister purge -N80- with valve closed and open. If the difference in the two pressures is less than 4 mbar to 23 mbar (depending on air pressure), the malfunction is set.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0452 / 16836 Evaporative Emission Control System Pressure Sensor Low Input	1 Harness connector on sensor for EVAP canister -G172- (differential pressure sensor) loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to sensor for EVAP canister -G172- (differential pressure sensor) faulty, or sensor -G172- faulty	➠	- Check sensor for EVAP canister -G172- (differential pressure sensor) ⇒ page 24-61
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 030	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0542 / 16836" is set as soon after engine start as the differential pressure sensor signal is less than 0.1 V

for longer than 2 sec. with a evaporative emissions valve duty cycle greater than 91% (100% = closed).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0453 / 16837 Evaporative Emission Control System Pressure Sensor High Input	1 Harness connector on sensor for EVAP canister -G172- (differential pressure sensor) loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to sensor for EVAP canister -G172- (differential pressure sensor) faulty, or sensor -G172- faulty	➠	- Check sensor for EVAP canister -G172- (differential pressure sensor) ⇒ page 24-61
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 030	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P0453 / 16837" is set as soon after engine start as the differential pressure sensor signal is greater than 5.0

V for longer than 2 sec. with a evaporative emissions valve duty cycle greater than 91% (100% = closed).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0461 / 16845 Fuel Lever Sensor Circuit Range/Performance	1 Wiring connection between Engine Control Module (ECM) -J192- and instrument panel insert faulty	➡	- Check fuel level signal ⇒ page 24-107
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: Malfunction not displayed by MIL For troubleshooting ⇒ Display group 027	2 Malfunction on instrument cluster or fuel level sensor	➡	- Check instrument cluster ⇒ Repair Manual, Electrical Equipment
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Note:

The malfunction "P0461 / 16845" is set with ignition on as soon as a voltage signal over 10.8 V is recognized for longer than 15 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0501 / 16885 Vehicle Speed Sensor Range/Performance	1 Wiring connection between vehicle speed sensor and engine control module has open circuit	➠	- Check vehicle speed signal ⇒ page 24-97
MIL Status: MIL lights up immediately	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 019			

Notes:

The malfunction "P0501/ 16885" is set after engine start as soon as, at a coolant temperature over 80° C (176° F) and an engine speed signal between 1300 RPM and 6000 RPM the vehicle speed signal during a deceleration fuel shut off is less than 1 km/h (1 mph). The duration of the deceleration fuel shut off must be longer than 3 sec.

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Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0605 / 16989 Internal Control Module Read Only Memory (ROM) Error (Module Identification Defined by SAE J1979)	1 Engine Control Module (ECM) -J192- faulty	➠	- Replace engine control module ⇒code vehicle ⇒ erase DTC memory and test drive ⇒ check DTC memory
MIL Status: MIL lights up immediately			

Note:

The malfunction type "control module faulty" is set in the ROM/RAM or EEPROM when malfunctions are recognized.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0706 / 17090 Transmission Range Sensor Circuit Range/Performance	1 Engine control module incorrectly coded	➠	- Cause: the vehicle is equipped with manual transmission, but was coded for vehicle with automatic transmission. - Remedy: code vehicle correctly according to Coding Table
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: Malfunction not displayed by MIL	2 Automatic transmission: faulty wiring connection between Engine Control Module (ECM) -J192- and multi-function Transmission Range (TR) switch -F125-	➠	- Check gear recognition signal ⇒ page 24-99
For troubleshooting ⇒ Display group 004	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Automatic transmission: malfunction of multi-function Transmission Range (TR) switch -F125-	➠	- Check multi-function Transmission Range (TR) switch -F125- ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01*
	Malfunction cause found: Yes ▶		

		- Erase DTC memory, test drive and after test drive, check DTC memory again

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P0707 / 17091 Transmission Range Sensor Circuit Low Input	1 Wiring connection between Engine Control Module (ECM) -J192- and multi-function Transmission Range (TR) switch -F125- on automatic transmission faulty	➡	- Check gear recognition signal ⇒ page 24-99
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: Malfunction not displayed by MIL	2 Malfunction on multi-function Transmission Range (TR) switch -F125- of automatic transmission	➡	- Check multi-function Transmission Range (TR) switch -F125- ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01, Electrical testing*
For troubleshooting ⇒ Display group 004	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1101 / 17509 (B1-S1) Voltage too Low/Air Leak	1 Harness connector for Heated Oxygen Sensor (HO2S) -G39- (B1-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Leak in Bank 1 exhaust system before Heated Oxygen Sensor (HO2S) -G39- (B1-S1)	➡	- Determine and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Wiring connection to Heated Oxygen Sensor (HO2S) -G39- (B1-S1) faulty, or sensor -G39- faulty	➡	- Check HO2S -G39- (B1-S1) ⇒ page 24-49
For troubleshooting ⇒ Display group 010	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again

	4 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1101 / 17509" is set 123 sec after engine start and at a coolant temperature over 30° C (86° F) as soon as the oxygen sensor control has reached the rich limit for 2 sec more than 20 times (or 40 sec. without interruption).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1102 / 17510 Heating Circ. (B1-S1) Short to B+	1 Harness connector for Oxygen Sensor (O2S) heater -Z19- (B1-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection of Oxygen Sensor (O2S) heater -Z19- (B1-S1) faulty, or heater -Z19- faulty	➡	- Check O2S heater -Z19- (B1-S1) ⇒ page 24-51
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

- |*The heating of the oxygen sensor probes in front of Three Way Catalytic Converter (TWC) is switched on with the fuel pump relay, i.e. immediately at engine start.*

- *The malfunction "P1102 / 17510" is set after engine start as soon as the heating current is greater than 10 A for longer than 80 ms at a battery voltage between 9 V and 16 V.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1104 / 17512 (B1-S2) Voltage too Low/Air Leak	1 Harness connector for Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (B1-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Leak in bank 1 exhaust system between Heated Oxygen Sensor (HO2S) -G39- and Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130-	➡	- Find and repair leak
For troubleshooting ⇒ Display group 041	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again

	3 Wiring connection to Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (B1-S2) faulty, or sensor -G130- faulty	➡	- Check O2S behind three way catalytic converter -G130- (B1-S2) ⇒ page 24-53
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again
	4 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1104 / 17512" is set 123 sec after engine start, coolant temperature over 80° C (176° F), oxygen sensor control active, engine speed between 1500 min and 5000 min, load between 19% and 80% and probe heater switched on at least 45 sec, as soon as the signal voltage is less than 0.040 V for longer than 60 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1105 / 17513 Heating Circ. (B1-S2) Short to B+	1 Harness connector for Oxygen Sensor (O2S) heater -Z29- (B1-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection of Oxygen Sensor (O2S) heater -Z29- (B1-S2) faulty, or heater -Z29- faulty	➡	- Check O2S heater -Z29-(B1-S2) ⇒ page 24-55
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

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Notes:

- *The heating for Oxygen Sensor Probes behind Three Way Catalytic Converter (TWC) is not switched on immediately at engine start, but when the calculated exhaust gas temperature drops below 308° C (586° F) (⇒ Read measuring value block, display group 42, channel 1).*

- *The malfunction "P1105 / 17513" is set as soon as the probe heater is switched on (the vehicle must be driven approx. 60 sec. under load) and the heating current is greater than 10 A for longer than 80 ms.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1106 / 17514 (B2-S1) Voltage too Low/Air Leak	1 Harness connector for Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Leak in Bank 1 exhaust system up to Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1)	➡	- Find and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Wiring connection to r Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) or -G108- (B2-S1) faulty	➡	- Check Heated Oxygen Sensor (HO2S) 2 -G108- (B2-S1) ⇒ page 24-49
For troubleshooting ⇒ Display group 010	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again

	4 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1106 / 17514" is set 123 sec after engine start, with a coolant temperature over 30° C (86° F) as soon as the oxygen sensor control has reached the rich limit for 2 sec more than 20 times (or 40 sec. without interruption).

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1107 / 17515 Heating Circ. (B2-S1) Short to B+	1 Harness connector for Oxygen Sensor (O2S) heater -Z28- (B2-S1) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection of Oxygen Sensor (O2S) heater -Z28- (B2-S1) faulty, or heater -Z28- faulty	➡	- Check O2S heater -Z28- (B2-S1) ⇒ page 24-51
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

- *The heating of the oxygen sensor probes in front of Three Way Catalytic Converter (TWC) is switched on with the fuel pump relay, i.e. immediately at engine start.*

- *The malfunction "P1107 / 17515" is set after engine start as soon as the heating current is greater than 10 A for longer than 80 ms at a battery voltage between 9 V and 16 V.*

01-100

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1109 / 17517 (B2-S2) Voltage too Low/Air Leak	1 Harness connector for Heated Oxygen Sensor (HO2S) -G131- (B2-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Leak in bank 2 exhaust system between Heated Oxygen Sensor (HO2S) 2 -G108- and Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131-	➡	- Find and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 041	3 Wiring connection to Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- (B2-S2) faulty, or sensor -G131- faulty	➡	- Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- (B2-S2) ⇒ page 24-53
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory

	No ▼ Continued next page	again

01-101

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
	4 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1109 / 17517" is set 123 sec after engine start with coolant temperature over 80° C (176° F), oxygen sensor control active, engine speed between 1500 RPM and 5000 RPM, load between 19% and 80% and probe heater switched on at least 45 sec., as soon as the signal voltage is less than 0.040 V for longer than 60 sec.

01-102

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1110 / 17518 Heating Circ. (B2-S2) Short to B+	1 Harness connector for Oxygen Sensor (O2S) heater -Z30- (B2-S2) loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection for Oxygen Sensor (O2S) heater -Z30- (B2-S2) faulty, or heater -Z30- faulty	➡	- Check O2S heater -Z30- (B2-S2) ⇒ page 24-55
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 040	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

- *The heating for Oxygen Sensor Probes behind Three Way Catalytic Converter (TWC) is not switched on immediately at engine start, but when the calculated exhaust gas temperature drops below 308° C (586° F) (⇒ Read measuring value*

block, display group 42, channel 1).

- *The malfunction "P1105 / 17513" is set as soon as the probe heater is switched on (the vehicle must be driven approx. 60 sec. under load) and the heating current is greater than 10 A for longer than 80 ms.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1201 / 17609 Cyl.1-Fuel Injector Circ. Electrical Malfunction ---------- **P1202 / 17610** Cyl.2-Fuel Injector Circ. Electrical Malfunction _____ **P1203 / 17611** Cyl.3-Fuel Injector Circ. Electrical Malfunction _____	1 Are all 6 fuel injectors stored in the DTC memory with the malfunction type "Cyl. X Electrical circuit electrical malfunction" and malfunction P1500 / 17908 "Fuel pump relay Electrical circuit electrical malfunction"? No ▼	Yes ▶	- Check Fuel pump relay and control ⇒ page 24-24
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	2 Wiring connection to Cylinder 1, 2, or 3	➠	- Check fuel injectors ⇒ page 24-

	fuel injectors faulty, or fuel injectors -N30-, -N31- or -N32- faulty		29
MIL Status: MIL lights up immediately	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

01-104

Notes:

- *If the malfunction "P1201 / 17609" and/or "P1202 / 17610" and/or "P1203 / 17611" is recognized by the engine control module, the oxygen sensor control for bank 1 is blocked.*
- *If all 6 fuel injectors are stored with the malfunction type "Cyl. X Electrical circuit electrical malfunction", the malfunction "P1500 / 17908" is also stored.*

01-105

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1204 / 17612 Cyl.4-Fuel Injector Circ Electrical Malfunction ---------- **P1205 / 17613** Cyl. 5-Fuel Injector Circ Electrical Malfunction _____ **P1206 / 17614** Cyl. 6-Fuel Injector Circ Electrical Malfunction _____	1 Are all 6 fuel injectors stored in DTC memory with the malfunction "Cyl. X-Fuel Injector Circ Electrical Malfunction" and with DTC P1500 / 17908 "Fuel Pump Relay Circ Electrical Malfunction"? No ▼	Yes ▶	- Check fuel pump relay and control ⇒ page 24-24
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	2 Wiring connection to Cylinder 4, 5, or 6 fuel	➡	- Check fuel injectors ⇒ page

	injectors faulty, or fuel injectors -N33-, -N83- or -N84- faulty		24-29
MIL Status: MIL lights up immediately	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

01-106

Notes:

- *If the malfunction "P1204 / 7612" and/or "P1205 / 17613" and/or "P1206 / 17614" is recognized by the engine control module, the oxygen sensor control for bank 2 is blocked.*
- *If all 6 fuel injectors are stored with the malfunction type "Cyl. X Electrical circuit electrical malfunction" the malfunction "P1500 / 17908" is also set.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1213 / 17621 Cyl.1-Fuel Injector Circ. Short to B+ ---------- **P1214 / 17622** Cyl.2-Fuel Injector Circ. Short to B+ _____ **P1215 / 17623** Cyl.3-Fuel Injector Circ.	1 Wiring connection to Cylinder 1, 2, or 3 fuel injectors faulty, or fuel injectors -N30-, -N31- or -N32- faulty	Yes ▶	- Check fuel injectors ⇒ page 24-29

Short to B+ _____ MIL Status: MIL lights up immediately			
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	2 Engine Control Module (ECM) - J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

If the malfunction "P1213 / 17621" and/or "P1214 / 17622" and/or "P1215 / 17623" is recognized by the engine control module, the corresponding fuel injector is no longer triggered and the oxygen sensor control is blocked until ignition on.

01-107

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1216 / 17624 Cyl.4-Fuel Injector Circ. Short to B+ ---------- **P1217 / 17625** Cyl.5-Fuel Injector Circ. Short to B+ _____ **P1218 / 17626** Cyl.6-Fuel Injector Circ. Short to B+ _____ MIL Status: MIL lights up immediately	1 Wiring connection to Cylinder 4, 5, or 6 fuel injectors faulty, or fuel injectors -N33-, -N83- or -N84- faulty	Yes ▶	- Check fuel injectors ⇒ page 24-29
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and

	No ▼		after test drive, check DTC memory again
	2 Engine Control Module (ECM) - J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

If the malfunction "P1216 / 17624" and/or "P1217 / 17625" and/or "P1218 / 17626" is recognized by the engine control module, the corresponding fuel injector is no longer triggered and the oxygen sensor control is blocked until ignition on.

01-108

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1250 / 17658 Fuel Level Too Low	1 In addition, other malfunctions stored in the DTC memory?	➠	- If there are malfunctions that can be caused by fuel problems (e.g. combustion misfiring), the malfunction "tank level too low" if there is less than 12 liters (12.7 qt.) fuel in the tank ⇒ check tank level and fill tank if necessary ⇒ Troubleshooting on other Diagnostic Trouble Codes (DTC) that are stored in the DTC memory
For troubleshooting ⇒Display group 027			

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1325 / 17733 Cyl.1-Knock Control Limit Attained _____ **P1326 / 17734** Cyl.2-Knock Control Limit Attained _____ **P1327 / 17735** Cyl.3-Knock Control Limit Attained _____ MIL Status: Malfunction not displayed by MIL	1 Has the control limit been reached on all 6 cylinders (P1335, P1326, P1327, P1328, P1329, P1330) in DTC memory? No ▼	Yes ▶	- Poor fuel quality less than 91 AKI (CC) or 95 RON in tank ⇒ fill tank with fuel having min. 91 AKI (CLC) or 95 RON (ROZ) - Loose subassemblies or loud noises from subassemblies ⇒ check
	Malfunction cause found: Yes		

	▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	2 Was the control llimit reached on 3 cylinders in one bank? P1335, P1326, P1327 or P1328, P1329, P1330 are in the DTC memory. No ▼ Continued next page	Yes ▶	- Knock Sensor for corresponding bank (-G61- or -G66-) loose and/or tightening torque not OK; check mounting of Knock Sensors (KS) 1 -G61- and/or 2 -G66- and retighten if necessary ⇒use insert 3247; tightening torque 20 Nm (15 ft lb) - Abnormal engine noises (e.g. subassemblies loose) ⇒ check - Open circuit/loose connection in wiring of corresponding knock sensor or knock sensor faulty ⇒ check Knock Sensors (KS) 1 -G61- and 2 -G66- ⇒ page 28-29

01-110

For troubleshooting ⇒ Display groups 011, 012, 013	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Was the control limit reached on only one cylinder? (e.g. only P1328 is in the DTC memory)	Yes ▶	- Abnormal engine noises (e.g. subassemblies loose) ⇒ check - Check engine for mechanical damage
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Notes:

- *The malfunction "P1325 / 17733" and/or "P1326 / 17734" and/or "P1327 / 17735" is set as soon as the ignition angle is fully retarded for longer than 180 sec during the trip.*

01-111

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1328 / 17736 Cyl.4-Knock Control Limit Attained _____ **P1329 / 17737** Cyl.5-Knock Control Limit Attained _____ **P1330 / 17738** Cyl.6-Knock Control Limit Attained _____ MIL Status: Malfunction not displayed by MIL	1 Has the control limit been reached on all 6 cylinders (P1335, P1326, P1327, P1328, P1329, P1330) in the DTC memory? No ▼	Yes ▶	- Poor fuel quality less than 91 AKI (CLC) or 95 RON in tank ⇒ fill tank with fuel min. 91 AKI (CLC) or 95 RON - Loose subassembly or loud noises from subassemblies ⇒ check
	Malfunction cause found: Yes		

	▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	2 Was the control limit reached on 3 cylinders of one bank? P1335, P1326, P1327 or P1328, P1329, P1330 in the DTC memory. No ▼ Continued next page	Yes ▶	- Knock Sensor for corresponding bank (-G61- or -G66-) loose and/or tightening torque OK; check mounting of Knock Sensors (KS) 1 -G61- and/or 2 -G66- and retighten if necessary ⇒ use insert 3247; tightening torque 20 Nm (15 ft lb) - Abnormal engine noises (e.g. subassemblies loose)⇒ check - Open circuit/loose connection in the wiring of the corresponding knock sensor or knock sensor faulty ⇒ Check Knock Sensors (KS) 1 -G61- and 2 -G66- ⇒ page 28-29

01-112

For troubleshooting ⇒ Display group 011, 012, 014	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Was the control limit reached on only one cylinder? E.g., only P1328 is in the DTC memory.	Yes ▶	- Abnormal engine noises (e.g. subassembly loose) ⇒ check - Check engine for mechanical damage
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Notes:

- *The malfunction "P1328 / 17736" and/or "P1329 / 17737" and/or "P1330 / 17738" is set as soon as the ignition angle is fully retarded for longer than 180 sec during the trip.*

01-113

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1339 / 17747 Crankshaft Pos./Engine Speed Sensors Cross connected	1 3-pin connector from Crankshaft Position (CKP) sensor -G4- and engine speed (RPM) sensor -G28-	➡	- Disconnect both 3-pin harness connectors and connect correctly, installation location ⇒ page 28-7
P0322 / 16706 Ignition/Distributor Engine Speed Input Circuit No Signal			
MIL Status: MIL lights up immediately	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Notes:

- *The malfunction "P1339 / 17747" is set when -G4- and -G28- are transposed.*

01-114

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1340 / 17748 Camshaft/Crankshaft Pos.Sens.Signals (B2) Out of Sequence	1 Harness connector on Camshaft Position (CMP) sensor -G40- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
P1392 / 17800 Camshaft Pos.Sensor Open Circ. (B2) Short to B+			
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Camshaft Position (CMP) sensor -G40- faulty or sensor -G40- faulty	➠	- Check Camshaft Position (CMP) sensor -G40- ⇒ page 28-33
For troubleshooting ⇒ Display groups 012, 014	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again

01-115

	3 Camshaft Position (CMP) sensor -G40- oily or dirty on the inside because of leaking seal on the cylinder head.	➡	- Camshaft Position (CMP) sensor -G40- and check for contamination. If it is oily, replace seal on cylinder head
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	4 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Notes:

- *The malfunction "P1340 / 17748" is set as soon as the crankshaft position sensor signal is always "high" at an engine speed between 50 RPM and 4000 RPM and with more than 20 crankshaft sensor signals recognized.*

01-116

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1341 / 17749 Ignition Coil Power Output Stage 1 Short to Ground ---------- **P1343 / 17751** Ignition Coil Power Output Stage 2 Short to Ground ---------- **P1345 / 17753** Ignition Coil Power Output Stage 3 Short to Ground ----------	1 Harness connector for ignition coil power output stage -N122- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 28-7
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test

	No ▼		drive, check DTC memory again
	2 Wiring connection to ignition coil power output stage -N122- faulty or power output stage -N122- faulty	➡	- Check Power output stage -N122- for ignition coils ⇒ page 28-13
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again
	No ▼		
MIL Status: MIL lights up immediately	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The power output stage is not integrated in the Engine Control Module (ECM) -J192-, it is a separate component.

01-117

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1391 / 17799 Camshaft Pos.Sensor (B2) Short to Ground	1 Harness connector on Camshaft Position (CMP) sensor -G40- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Camshaft Position (CMP) sensor -G40- faulty or sensor -G40- faulty	➠	- Check Camshaft Position (CMP) sensor -G40- ⇒ page 28-33
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Camshaft Position (CMP) sensor -G40- oily or dirty on the inside because of leaking seal on the cylinder head	➠	- Remove Camshaft Position (CMP) sensor -G40- and check for contamination. If it is oily, replace seal on cylinder head
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again

01-118

	4 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1391 / 17799" is set as soon as the crankshaft position sensor signal is always "low" at an engine speed between 50 RPM and 400 RPM and with more than 3 crankshaft sensor signals recognized.

01-119

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1392 / 17800 Camshaft Pos.Sensor Open Circ. (B2) Short to B+	1 Harness connector on Camshaft Position (CMP) sensor -G40- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
P1340 / 17748 Camshaft/Crankshaft Pos.Sens.Signals (B2) Out of Sequence			
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Camshaft Position (CMP) sensor -G40- faulty or sensor -G40- faulty	➠	- Check Camshaft Position (CMP) sensor -G40- ⇒ page 28-33
	Malfunction cause found: Yes ▶ No ▼ Continued next page		- Erase DTC memory, test drive and after test drive, check DTC memory again

	3 Camshaft Position (CMP) sensor -G40- oily or dirty on the inside because of leaky seal on cylinder head	➡	- Remove Camshaft Position (CMP) sensor -G40- and check for contamination. If it is oily, replace seal on cylinder head
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	4 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ check DTC memory and test drive ⇒ check DTC memory

Notes:

- *The malfunction "P1392 / 17800"is set as soon as the crankshaft position sensor signal is always "high" at an engine speed between 50 RPM and 4000 RPM and with more than 20 crankshaft sensor signals recognized.*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1393 / 17801 Ignition Coil Power Output Stage 1 Electrical Malfunction ---------- **P1394 / 17802** Ignition Coil Power Output Stage 2 Electrical Malfunction ---------- **P1395 / 17803** Ignition Coil Power Output Stage 3 Electrical Malfunction ----------	1 Harness connector for Power output stage -N122- for ignition coils loose or corroded due to moisture in the harness connector		- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 28-7
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after

	No ▼		test drive, check DTC memory again
	2 Wiring connection to Power output stage -N122- for ignition coils or -N122- faulty	➡	- Check Power output stage -N122- for ignition coils ⇒ page 28-13
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again
	No ▼		
MIL Status: MIL lights up immediately	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ check DTC memory and test drive ⇒ check DTC memory

Note:

The power output stage is not integrated in the Engine Control Module (ECM) -J192-, it is a separate component.

01-122

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1396 / 17804 Engine Speed Sensor Missing Tooth	1 Starter ring gear damaged (teeth broken off)	➠	- Remove starter and carry out visual inspection of the starter ring gear. If broken teeth are found, replace starter ring gear
MIL Status: MIL lights up immediately	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 037			

Note:

The malfunction "P1396 / 17804" is set when the engine speed sensor does not supply 270 engine speed pulses per engine revolution.

01-123

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1400 / 17808 EGR Valve Circ. Electrical Malfunction	1 Harness connector for EGR vacuum regulator solenoid valve -N18- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to EGR vacuum regulator solenoid valve -N18- faulty or valve -N18- faulty	➠	- EGR vacuum regulator solenoid valve -N18- ⇒ page 24-67
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1400 / 17808" is set after engine start at an engine speed less than 900 RPM, an engine load less than 25% and EGR valve duty cycle less than 20%, as soon as the control module output of the EGR valve is "low" for longer than 1.2 sec.

01-124

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1402 / 17810 EGR Valve Circ. Short to B+	1 Harness connector for EGR vacuum regulator solenoid valve -N18- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to EGR vacuum regulator solenoid valve -N18- faulty, or valve -N18- faulty	➡	- EGR vacuum regulator solenoid valve -N18- ⇒ page 24-67
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory, test drive and ⇒ check DTC memory

Notes:

The malfunction "P1402 / 17810" is set after engine start at an engine speed between 1000 RPM and 3500 RPM, an engine load between 33% and 66% and an EGR valve duty cycle greater than 30%, as soon as the control module output of the EGR valve is "high" for longer than 1.2 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1407 / 17815 EGR Temp.Sensor Signal too Low	1 Harness connector for EGR temperature sensor -G98- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to EGR temperature sensor -G98- faulty or sensor -G98- faulty	➡	- Check EGR temperature sensor -G98- ⇒ page 24-71
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 017	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1407 / 17815" is set after a cold start (coolant starting temperature less than 30° C (86° F) as soon as an EGR temperature signal is received that lies over 200° C (392° F)

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1408 / 17816 EGR Temp.Sensor Signal too High	1 Harness connector for EGR temperature sensor -G98- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to EGR temperature sensor -G98- faulty or sensor -G98- faulty	➡	- Check EGR temperature sensor -G98- ⇒ page 24-71
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 017	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1408 / 17816" is set with open idle switch, a coolant temperature greater than 72° C (162° F), a throttle angle less than 42.5°, a vehicle speed between 70 km/h and 105 km/h (44 and 66 mph), an EGR valve duty cycle greater

than 50%, an engine speed between 1500 RPM and 3300 RPM and an engine load between 16% and 60%, as soon as the EGR temperature signal is less than 5° C (41° F) for longer than 34 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1409 / 17817 Tank Ventilation Valve Electrical Malfunction	1 Harness connector on Evaporative Emission (EVAP) canister purge regulator valve -N80- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Evaporative Emission (EVAP) canister purge regulator valve -N80- faulty or valve -N80- faulty	➡	- Check Evaporative Emission (EVAP) canister purge regulator valve -N80- ⇒ page 24-58
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 009	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1409 / 17817" is set after engine start at an engine speed less than 1100 RPM, engine load less than 33%

and an evaporative emissions valve duty cycle greater than 25%, as soon as the evaporative emissions valve control module output is "low" for longer than 1.2 sec.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1410 / 17818 Tank Ventilation Valve Short to B+	1 Harness connector on Evaporative Emission (EVAP) canister purge regulator valve -N80- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Evaporative Emission (EVAP) canister purge regulator valve -N80- faulty or valve -N80- faulty	➡	- Check Evaporative Emission (EVAP) canister purge regulator valve -N80- ⇒ page 24-58
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 009	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1410 / 17818" is set after engine start at an engine speed greater than 1250 RPM, an engine load greater

than 40% and an evaporative emissions valve duty cycle less than 19%, as soon as the evaporative emissions valve control module output is "high" for longer than 1.2 sec.

01-129

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1500 / 17908 Fuel Pump Relay Circ. Electrical Malfunction	1 Wiring connection to Fuel Pump (FP) relay -J17- faulty, or relay -J17- faulty	➡	- Check Intake manifold change-over valve -N156- and control ⇒ page 24-64
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1500 / 17908" is only stored as soon as the malfunctions "P1201 /17609", "P1202 / 17610", "P1203 / 17611", "P1204 / 17612", "P1205 / 17613", "P1206 / 17614" are stored simultaneously.

01-130

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1504 / 17912 Intake Air Sys.Bypass Air Determined	1 Air leak in intake system	➠	- Check intake system and repair leak
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Idle Air Control (IAC) valve -N71- sticks mechanically	➠	- Check Idle Air Control (IAC) valve -N71- ⇒ page 24-37
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Second stage of throttle body does not close completely	➠	- Check throttle body for mechanical damage
For troubleshooting ⇒ Display groups 018, 019	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Note:

If the malfunction "P1504 / 17912" is recognized, both power output stages ("+" and "-" output) are switched off. The Idle Air Control (IAC) valve -N71- has no power and opens the limp home cross section.

01-131

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1505 / 17913 CTP Switch does not Close Open Circuit	1 Floor mat presses on gas pedal	➡	- Visual inspection
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Throttle cable set too tight	➡	- Adjust throttle cable ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20, Adjust throttle cable*
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Harness connector on -G69- and Closed Throttle (CTP) switch -F60- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
For troubleshooting ⇒	Malfunction cause found: Yes ▶		

Display groups 000, 002, 004	No ▼ Continued next page	- Erase DTC memory, test drive and after test drive, check DTC memory again

4 Closed Throttle (CTP) switch -F60- in Throttle Position Sensor does not close or is faulty	➡	- Check Closed Throttle (CTP) switch -F60- and adjust ⇒ page 24-73
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
5 1st stage of throttle sticks	➡	- Check throttle body for mechanical damage
Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
6 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

The malfunction "P1505 / 17913" is set after 500 RPM has been exceeded (during start) and then a trip of at least 20 minutes at under 100 km/h (63 mph) as soon as the idle switch has not been recognized as closed even once.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1506 / 17914 CTP Switch does not Open Short to Ground	1 Harness connector on Throttle Position (TP) sensor -G69- and Closed Throttle (CTP) switch -F60- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Closed Throttle (CTP) switch -F60- in the Throttle Position Sensor does not open or is faulty	➠	- Check and adjust idle switch ⇒ page 24-73
Note: Malfunction P0120 / 16504 is also stored	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display groups 000, 002, 004	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

- *The malfunction "17914" is set as soon as the throttle opening is greater than 7° and the idle switch is closed for longer than 3 sec.*

01-134

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1509 / 17917 IAC Circ. Electrical Malfunction	1 Harness connector on Idle Air Control (IAC) valve -N71- loose or corroded due to moisture in the harness connector	➠	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Idle Air Control (IAC) valve -N71- faulty or valve -N71- faulty	➠	- Check Idle Air Control (IAC) valve -N71- ⇒ page 24-37
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 018	3 Engine Control Module (ECM) -J192- faulty	➠	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

If a malfunction is recognized in the electrical circuit, both power output stages ("+" and "-" output) are switched off. The Idle Air Control (IAC) -N71- has no power and opens the limp home cross section.

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1510 / 17918 IAC Circ. Short to B+	1 Harness connector for Idle Air Control (IAC) valve -N71- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Wiring connection to Idle Air Control (IAC) valve -N71- faulty or valve -N71- faulty	➡	- Check Idle Air Control (IAC) valve -N71- ⇒ page 24-37
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
For troubleshooting ⇒ Display group 018	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Note:

If a malfunction is recognized in the electrical circuit, both power output stages ("+" and "-" output) are switched off. The idle stabilizer valve -N71- has no power and opens the limp home cross section.

01-136

Output on GST and/or on VAG 1551 scan tool	**Possible malfunction cause**		**Malfunction repair**
P1511 / 17919 Intake Manifold Changeover Valve Circ. Electrical Malfunction	1 Harness connector on Intake manifold change-over valve -N156- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: Malfunction not displayed by MIL	2 Wiring connection to Intake manifold change-over valve -N156- faulty or valve -N156- faulty	➡	- Check Intake manifold change-over valve -N156- ⇒ page 24-64
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1512 / 17920 Intake Manifold Changeover Valve Circ. Short to B+	1 Harness connector on valve for Intake manifold change-over valve -N156- loose or corroded due to moisture in the harness connector	➡	- Check harness connector for tight fit and contact corrosion, if necessary reconnect and/or clean, installation location ⇒ page 24-1
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: Malfunction not displayed by the MIL	2 Wiring connection to Intake manifold change-over valve -N156- faulty or valve -N156- faulty	➡	- Check Intake manifold change-over valve -N156- ⇒ page 24-64
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code engine control module ⇒ page 01-265 ⇒ erase DTC memory and test drive ⇒ check DTC memory

01-138

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1600 / 18008 Power Supply (B+) Terminal 15 Low Voltage	1 Battery discharged or faulty	➡	- Check and charge battery ⇒ *Repair Manual, Electrical Equipment, Repair Group 27*
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: Malfunction not displayed by MIL	2 Bad ground connection to Engine Control Module (ECM) -J192-	➡	- Check voltage supply to the Engine Control Module (ECM) -J192- ⇒ page 28-27
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Excessive current draw with ignition off (e.g. because of luggage compartment light on continuously, etc.)	➡	- Carry out holding current test. The holding current must be greater than 50 mA
For troubleshooting ⇒ Display group 001	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again

	Continued next page

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	4 Malfunction on generator or controller	➡	- Check generator and controller
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive, check DTC memory again

Notes:

- *If the malfunction "18008" is displayed as a sporadic error, disregard malfunction display! This malfunction can be stored when the engine runs for a fairly long time in idle with a lot of consumers on if the battery is quite discharged.*
- *The malfunction "18008" is set as soon as the supply voltage lies under 10.08 V for longer than 1 sec (the control module does not operate under 6.5 V).*

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1602 / 18010 Power Supply (B+) Terminal 30 Low Voltage	1 The malfunction is set when the battery/control module is disconnected with ignition on or with a starting attempt with ignition/control module disconnected	➡	- The malfunction is erased after the second engine start if there is sufficient supply voltage. Therefore, start car after battery/control module is disconnected; shut off and start car again, then check DTC memory again.
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: MIL lights up immediately	2 Poor ground connection between battery and body	➡	- Check ground cable for good contact on battery terminal and check the threaded connection on the body
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Break in the wiring connection between battery and Engine Control Module (ECM) -J192-	➡	- Check voltage supply of engine control module ⇒ page 28-27
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive and after test drive,

	check DTC memory again

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1606 / 18014 Rough Road/Acceleration Sensor Electrical Malfunction	1 Was an exhaust test carried out in which only the front axle was moved and the rear axle was stationary?	➡	- These conditions cause a malfunction to be stored in the DTC memory. During exhaust tests, the fuse must be removed from the ABS control module. After the exhaust test, ABS control module and engine control module DTC memory must be erased.
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
MIL Status: Malfunction not displayed by MIL	2 If there are ABS system malfunctions, the malfunctions P1606 / 18014 are also stored in the engine control module. Is a malfunction stored in the ABS control module?	➡	- Check DTC memory of ABS control module ⇒ *Repair Manual, Brake System On Board Diagnostic (OBD), Repair Group 01, On Board Diagnostic (OBD)*
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive and after test drive, check DTC memory again
	3 Wiring connection between Engine Control Module (ECM) -J192- and ABS control module -J104- faulty	➡	- Check signal for rough road recognition from ABS control module for ABS/EDL and/or ABS/ASR ⇒ page 24-109

Notes:

- *If a rough road is recognized by the ABS control module, the combustion misfiring recognition in the engine control module is switched off by the "rough road info" from the ABS control module.*

01-142

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1611 / 18019 MIL Call-up Circ./ Transm.Control Module Short to Ground	1 Wiring connection between Engine Control Module (ECM) -J192- and Transmission Control Module (TCM) -J217- faulty	➡	- Check MIL wiring from Transmission Control Module (TCM) -J217- ⇒ page 24-105
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
MIL Status: MIL lights up immediately	2 Transmission Control Module (TCM) -J217- faulty	➡	- Replace Transmission Control Module (TCM) -J217- ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01*
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
For troubleshooting ⇒ Display group 027	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code ECM -J192- ⇒ page 01-265 ⇒ erase DTC memory and take test drive ⇒ check DTC memory

Notes:

- *This malfunction can only occur in connection with an automatic transmission.*
- *If there are malfunctions recognized that are related to the exhaust system, the automatic transmission switches the MIL on via the request wire.*

01-143

Output on GST and/or on VAG 1551 scan tool	**Possible malfunction cause**		**Malfunction repair**
P1612 / 18020 ECM Incorrectly Coded	1 Malfunction P1606 / 18014 "Rough Road Spec Engine Torque ABS-SG Electrical Malfunction" also stored in DTC memory No ▼	Yes ▶	- Engine control module incorrectly coded ♦ Cause: The vehicle is equipped with traction control, but coding was done for vehicle without traction control. ♦ Remedy: code vehicle correctly according to coding table.
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, take test drive, after test drive check DTC memory again
MIL Status: Malfunction not displayed by MIL	2 Engine control module incorrectly coded	➡	♦ Cause: Vehicle is equipped with automatic transmission, but was coded for manual transmission or otherwise incorrectly coded ♦ Remedy: code vehicle correctly according to coding table.
	Malfunction cause found: Yes ▶		- Erase DTC memory, test drive, after test drive check DTC memory again

01-144

Output on GST and/or on VAG 1551 scan tool	Possible malfunction cause		Malfunction repair
P1613 / 18021 MIL Call-up Circ.Open Short to B+	1 Wiring connection between Engine Control Module (ECM) -J192- and Transmission Control Module (TCM) -J217- faulty	➡	- Check MIL wiring from Transmission Control Module (TCM) -J217- ⇒ page 24-105
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, test drive, after test drive check DTC memory again
MIL Status: MIL lights up immediately	2 Transmission Control Module (TCM) -J217- faulty	➡	- Replace ABS control module -J104- ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01*
	Malfunction cause found: Yes ▶ No ▼		- Erase DTC memory, take test drive, after test drive check DTC memory again
For troubleshooting ⇒ Display group 027	3 Engine Control Module (ECM) -J192- faulty	➡	- Replace and code ECM -J192- ⇒ page 01-265 ⇒ erase DTC memory and take test drive ⇒ check DTC memory

Notes:

- *This malfunction can only occur in connection with an automatic transmission.*

- *If there are malfunctions recognized that are related to the exhaust system, the automatic transmission switches the MIL on via the request wire.*

01-145

Output Diagnostic Test Mode (scan tool function 03)

Test requirements:

- Fuses for engine electronics OK
- Fuel Pump (FP) Relay OK
- Ground connections OK ⇒ page 01-5

Triggering sequence:

- Fuel Pump (FP) relay -J17-
- Idle Air Control (IAC) valve -N71-
- Intake manifold change-over valve -N156-
- EVAP canister purge regulator valve -N80-
- EGR vacuum regulator solenoid valve -N18-
- Secondary Air Injection (AIR) solenoid valve -N112- (only on vehicles with secondary air system)

- Secondary Air Injection (AIR) pump relay -J299- (only on vehicles with secondary air system)

01-146

Notes:

- *The output diagnostic test mode can only be carried out with the ignition switched on and the engine NOT running.*
- *The output diagnostic test mode is interrupted if the engine is started or a rotary pulse is recognized.*
- *During the output diagnostic test mode, the individual outputs are triggered until the program is continued by pressing the → button.*
- *The outputs are checked by listening for the sound of the component being actuated, of by feeling for mechanical evidence of actuation (clicking, vibration, etc.).*
- *Without letting the engine run briefly, switch the ignition off for approx. 20 sec before repeating the output diagnostic test mode.*

- Connect VAG 1551 scan tool and initiate until "Select function" is indicated on the display ⇒ page 01-7 .

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

Note:

After pressing the HELP button, an overview of the possible functions is printed out.

- Press buttons -0- and -3- to select "Output Diagnostic Test Mode" function 03.

01-147

Rapid data transfer **Q**

03 - Output Diagnostic Test Mode

Indicated on display

- Press -Q- button to confirm input.

Output diagnostic test mode →

Fuel Pump (FP) Relay -J17

Indicated on display

The fuel pump relay must be triggers and the fuel pump must run; the flowing noise at the fuel pressure regulator can be clearly heard.

- If fuel pump relay is not triggered, check control ⇒ page 24-24 .
- Press → button.

Output diagnostic test mode →

Idle Air Control (IAC) valve -N71

Indicated on display

This valve is triggered (clicks) until moving on to the next output by pressing the → button.

- If the valve is not triggered (does not click), check -N71- ⇒ page 24-37 .
- Press → button.

Output diagnostic test mode →

Intake manifold change-over valve -N156

Indicated on display

This valve is triggered (clicks) until you move on to the next output by pressing the → button.

- If the valve is not triggered (does not click), check intake manifold change-over valve -N156- ⇒ page 24-64 .
- Press → button.

01-148

Output diagnostic test mode → **Evaporative Emission (EVAP) canister purge regulator valve -N80**	➢	Indicated on display This valve is triggered (clicks) until you move on to the next output by pressing the → button. - If the valve is not triggered (does not click), check EVAP canister purge regulator valve -N80- ⇒ page 24-58 . - Press → button.
Output diagnostic test mode → **EGR vacuum regulator solenoid valve -N18**	➢	Indicated on display This valve is triggered (clicks) until you move on to the next output by pressing the → button. - If the valve is not triggered (does not click), check EGR vacuum regulator solenoid valve -N18- ⇒ page 24-67 .

01-149

Only on vehicles with secondary air injection (AIR) system

Output diagnostic test mode → **Secondary Air Injection (AIR) solenoid valve -N112**	⮜	Indicated on display This valve is triggered (clicks) until you move on to the next output by pressing the → button. - If the valve is not triggered (does not click), check -N112-.
Output diagnostic test mode → **Secondary Air Injection (AIR) pump relay -J299**	⮜	Indicated on display The secondary air injection pump relay -J299- triggers the secondary air pump motor and it runs until the output DTM is ended by pushing the → button (maximum 10 sec.). - If secondary air injection pump motor does not run, check engine and -J299-. - Press → button.
Rapid data transfer HELP **Select function XX**	⮜	Indicated on display ***Note:*** *Before selecting "Output Diagnostic Test Mode" function 03 again, switch ignition off for approx. 20 sec.*

01-150

Basic Setting (scan tool function 04)

Notes:

- *Basic setting is carried out with engine running.*
- *The OBD II engine control module shows the "Readiness Code" in display group 29. The readiness code is reset when the engine control module power is off and each time the DTC memory is erased. In order to regenerate the readiness code it is necessary to take a trip in "mixed city and highway" driving-approx. 1-1/2 to 5 minute drive at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, preferably 4th gear, or automatic transmission selector lever in "D" position.*
- *When the "Basic Setting" function 04 is initiated with the VAG 1551 scan tool, the learning values are relearned in systems capable of learning. Learning is prohibited, as soon as a malfunction is stored in the DTC memory that relates to a system capable of learning (not with sporadic malfunctions).*
- *All learning values are erased by disconnecting the connector from the Engine Control Module (ECM). After that, uneven idle can occur briefly. In this case, let engine run in idle for a few*

minutes until the learning process is completed.

01-151

Note:

After function 04 is called up, the Engine Control Module (ECM) carries out the following operations:

- *Constant ignition timing point of 12° BTDC is output in idle.*
- *Digital idle speed control is blocked.*
- *Evaporative emissions canister purge regulator valve is closed.*
- *A/C compressor is switched off.*
- *EGR vacuum regulator solenoid valve is closed*
- *No coolant temperature correction-fixed value of 80° C (176° F)*
- *Learning values are relearned (idle and CO content are adjusted automatically)*

01-152

Requirements:

- Engine temperature at least 85 °C (185 °F)
- Do not operate accelerator pedal
- All electrical consumers switched off
- A/C system switched off. Push minus (-) button for A/C fresh air fan repeatedly until all the displays are cleared
- Move selector lever to P or N
- No malfunctions in Diagnostic Trouble Code (DTC) memory

01-153

- Check and erase DTC memory ⇒ page 01-13 .

- There must be no malfunctions stored (if necessary repair malfunction, erase DTC memory and test drive, switch engine off and start again, test drive and, as a check, check DTC memory again).

Note:

The readiness code is erased each time the DTC memory is erased (either with function 05 or with Mode 4).

- After checking and erasing DTC memory, let engine continue to run at idle.

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

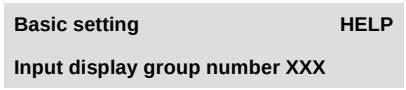
Note:

When the HELP button is pressed, an overview of possible functions is printed out.

- Press buttons -0- and -4- to select "Basic Setting" function 04.

Rapid data transfer Q **04 - Basic Setting**	⮜	Indicated on display

- Press Q-button to confirm input.



➢ Indicated on display

Note:

After the HELP button is pressed, the procedure for inputting the display group number is printed out.

01-154

- Select the desired display group number according to the following display group overview and press -Q- button to confirm input.

Note:

Display group 001 is used as an example to show the sequence.

- Press buttons -0-, -0- and -1- to input display group no. 001.

Initiate basic setting	**Q**
Input display group number	**01**

Indicated on display

- Press -Q- button to confirm input.

Basic setting 1	→
1 2 3 4	

Indicated on display

To change to a different display group, proceed as follows:

Display group	VAG 1551 scan tool	VAG 1552 scan tool
Higher	Press button -3-	Press ↑ button
Lower	Press button -1-	Press ↓ button
Skip	Press -C- button	Press -C- button

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Notes:

- *The values in display fields 1 to 10 are shown in decimal format in display group 000.*
- *In the "Basic Setting" display, the current 3-digit display group number is shown without the first zero. In display groups 000 to 009, the number is shown without the first two zeroes.*
- *If the printer is switched on, the current display will be printed out on the paper strip.*
- *Each time the PRINT button is pressed, the current display will be printed out.*

If the specified values are obtained in all display fields:

- Press → button.

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

- Press buttons -0- and -6- to select "End Output" function 06.

Rapid data transfer Q **06 - End Output**	⮜ Indicated on display

- Press -Q- button to confirm input.

Rapid data transfer	**HELP**
Insert address word XX	

< Indicated on display

01-156

Display group overview with test table

Note:

Display groups 000 to 010 are used for general troubleshooting.

Display group	Display shows	Designation
000	Basic setting 0 1 2 3 4 5 6 7 8 9 10	Key to displays ⇒ page 01-163
001	Basic setting 1 1 2 3 4	1 = Engine coolant temperature 2 = Mass Air Flow (MAF) sensor output voltage 3 = Altitude display (only on vehicles with secondary air system) 4 = Engine Control Module (ECM) voltage supply
002	Basic setting 2 1 2 3 4	1 = Throttle Position (TP) sensor voltage (coarse) 2 = Throttle Position (TP) sensor voltage (fine) 3 = Throttle Position (TP) sensor learning value 4 = Closed Throttle Position (CTP) switch
003	Basic setting 3 1 2 3 4	1 = Engine speed (RPM) 2 = Engine load 3 = Throttle angle

		4 = Vehicle speed
004	Basic setting 4 1 2 3 4	1 = Idle Air Control (IAC) valve 2 = Idle Speed Control (ISC) learning value 3 = Idle Speed Control (ISC) learning value 4 = Additional signals

01-157

Display group	Display shows	Designation
005	Basic setting 5 1 2 3 4	1 = Oxygen sensor-learning value at idle (bank 1) 2 = Oxygen sensor-learning value at partial throttle 1 (bank 1) 3 = Oxygen sensor-learning value at partial throttle 2 (bank 1) 4 = Oxygen sensor-learning value at partial throttle 3 (bank 1)
006	Basic setting 6 1 2 3 4	1 = Oxygen sensor-learning value at idle (bank 2) 2 = Oxygen sensor-learning value at partial throttle 1 (bank 2) 3 = Oxygen sensor-learning value at partial throttle 2 (bank 2) 4 = Oxygen sensor-learning value at partial throttle 3 (bank 2)
007	Basic setting 7 1 2 3 4	1 = Oxygen sensor control (bank 1) 2 = Learning range display 3 = Oxygen sensor-learning requirement diagnosis 4 = Oxygen sensor-learning requirement display
008	Basic setting 8 1 2 3 4	1 = Oxygen sensor control (bank 2) 2 = Learning range-display 3 = Oxygen sensor learning requirement-diagnose

		4 = Oxygen sensor learning requirement display
009	Basic setting 9 1 2 3 4	1 = Oxygen sensor control (bank 1) 2 = Oxygen sensor control (bank 2) 3 = EVAP canister purge regulator valve duty cycle 4 = Throttle angle
010	Basic setting 10 1 2 3 4	1 = Total of oxygen sensor control (bank 1) and momentary oxygen sensor learning value (bank 1) 2 = Total of oxygen sensor control (bank 2) and momentary oxygen sensor learning value (bank 2) 3 = Voltage signal, bank 1 heated oxygen sensor 1 4 = Voltage signal, bank 2 heated oxygen sensor 1

01-158

Note:

Display groups 11 to 45 are used for troubleshooting when there are driving performance problems, and used to evaluate components and systems that influence the exhaust.

Display group	Display shows	Designation
011	Basic setting 11 1 2 3 4	1 = Ignition timing point w/o knock control, w/o idle speed control 2 = Ignition timing point with knock control and idle speed control 3 = Ignition timing point access to idle speed control 4 = Closed Throttle Position (CTP) switch function
012	Basic setting 12 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition timing point map switching 4 = Ignition timing point retarded by knock control
013	Basic setting 13 1 2 3 4	1 = Ignition timing point map switching 2 = Ignition timing point retarded by knock control (cylinder 1) 3 = Ignition timing point retarded by knock control (cylinder 2) 4 = Ignition timing point retarded by knock control (cylinder 3)
014	Basic setting 14	1 = Ignition timing point map switching

	1 2 3 4	2 = Ignition timing point retarded by knock control (cylinder 4) 3 = Ignition timing point retarded by knock control (cylinder 5) 4 = Ignition timing point retarded by knock control (cylinder 6)
015	Basic setting 15 1 2 3 4	1 = Engine speed (RPM) 2 = Knock sensor signal (cylinder 1) 3 = Knock sensor signal (cylinder 2) 4 = Knock sensor signal (cylinder 3)

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Display group	Display shows	Designation
016	Basic setting 16 1 2 3 4	1 = Engine speed (RPM) 2 = Knock sensor signal (cylinder 4) 3 = Knock sensor signal (cylinder 5) 4 = Knock sensor signal (cylinder 6)
017 (vehicles with EGR)	Basic setting 17 1 2 3 4	1 = Timer 1 2 = Timer 2 3 = Engine load 4 = Exhaust gas recirculation temperature
018	Basic setting 18 1 2 3 4	1 = Specified internal duty cycle of Idle Air Control (IAC) valve -N71- 2 = Current draw by Idle Air Control (IAC) valve -N71- 3 = Power control from Idle Air Control (IAC) valve -N71- 4 = Engine Control Module (ECM) voltage supply
019	Basic setting 19 1 2 3 4	1 = Engine power 2 = Intake air volume 3 = Vehicle speed 4 = Fuel injection time

020/021	Basic setting 20/21 1 2 3 4	Secondary air injection (AIR) system diagnosis (only for vehicles with secondary air injection system)
022	Basic setting 22 1 2 3 4	Traction control (only used for vehicles with traction control)
023	Basic setting 23 1 2 3 4	Additional signals
024	Basic setting 24 1 2 3 4	Not assigned

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Display group	Display shows	Designation
025	Basic setting 25 1 2 3 4	Used only for production and not for customer service
026	Basic setting 26 1 2 3 4	Used only for production and not for customer service
027	Basic setting 27 1 2 3 4	Fuel level display
028	Basic setting 28 1 2 3 4	Used only for production and not for customer service
029	Basic setting 29 1 2 3 4	Diagnostic status (readiness code)
030	Basic setting 30 1 2 3 4	Evaporative emissions (EVAP) system diagnosis (only on vehicles with sensor for EVAP canister -G172-)
031	Basic setting 31	Operating conditions when combustion misfiring recognized

	1 2 3 4	
032	Basic setting 32 1 2 3 4	Largest and smallest flank rise and flank fall time (response time) of bank 1 heated oxygen sensor voltage signal
033	Basic setting 33 1 2 3 4	Largest and smallest flank rise and flank fall time (response time) of bank 2 heated oxygen sensor voltage signal
034	Basic setting 34 1 2 3 4	Number of flank rise and/or flank fall checks
035	Basic setting 35 1 2 3 4	Three way catalytic convertor diagnosis, bank 1

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Display group	Display shows	Designation
036	Basic setting 36 1 2 3 4	Three way catalytic convertor diagnosis, bank 2
037	Basic setting 37 1 2 3 4	Sensor wheel learning value
038	Basic setting 38 1 2 3 4	Current data on combustion misfiring recognition
039	Basic setting 39 1 2 3 4	Statistical data on combustion misfiring recognition
040	Basic setting 40 1 2 3 4	Heating current of heated oxygen sensors in front of and behind three way catalytic convertors
041	Basic setting 41 1 2 3 4	Voltage signals of heated oxygen sensors in front of and behind three way catalytic convertor
042	Basic setting 42	Diagnostic conditions for diagnosing the flank rise and flank fall time (response time) of the voltage signals of the heated oxygen sensors in front of three way catalytic convertors

	1 2 3 4	
043	Basic setting 43 1 2 3 4	Current flank rise and flank fall time (response time) of the voltage signals of the heated oxygen sensors in front of three way catalytic convertors
044	Basic setting 44 1 2 3 4	Conditions for three way catalytic convertor diagnosis (bank 1 and bank 2)
045	Basic setting 45 1 2 3 4	Evaporative emissions (EVAP) system/tank diagnosis (only on vehicles with diagnosis pump for fuel system -V144-)

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099	Basic setting 99 1 2 3 4	1 = Momentary engine speed 2 = Momentary engine load 3 = Coolant temperature 4 = Oxygen sensor control OFF/ON

Note:

Display group 99 can switch the oxygen sensor control on or off.

01-163

Display group 000

Note:

If the values displayed do not correspond to the specified values, the following display groups 001 to 010 can be used to repair malfunctions.

Display field	Specified display value	Corresponds to physical values	Designation and conversion to physical values
1	135 - 160	85° - 110° C	Momentary coolant temperature, display -50 = ___° C
2	145 - 158	1.45 - 1.58 V	Mass Air Flow (MAF) sensor output voltage, display: 100 = 1 V
3	26-30	650-750 RPM	Momentary engine speed, display X 25 = ____RPM
4	0 - 14 or 255 - 240		Idle speed control learning value, with manual transmission in idle position and/or with automatic transmission with selector lever setting P or N (average = 0)
5	0 -10 or 255 - 236		Idle speed control learning value, with automatic transmission in selector lever setting D 1, 2, 3 or R (average = 0) (On manual transmission vehicles, 0 is always displayed.)
6	126 - 130		Idle speed control feedback (average 128)
7	20		Shift inputs
8	120-136		Oxygen sensor control (average 128/cylinders 1 to 3) "0" is always displayed on engines without oxygen sensor probe.

Note on display field 8:

Deviations in display field 8 should only be considered after the oxygen sensor learning process at idle has been completed ⇒ display field 9.

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Display field	Specified display value	Corresponds to physical values	Designation and conversion to physical values
9	3		Oxygen sensor learning requirement at idle and partial throttle range, 0 = Oxygen sensor learning requirement at idle and partial throttle range 3 = Oxygen sensor learning process at idle completed
10	50 - 100	250 - 500 mV	Throttle Position (TP) sensor -G69- learning value, display X 5 = ...mV

Note on display field 9:

If specified display values are greater than 3, display groups 007 and/or 008.

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Display group 001

Display shows	Display/specified value	Designation
Basic setting 1 1 2 3 4	85-110 ° C	1 = Coolant temperature
	1.450-1.580 V2)	2 = Mass Air Flow (MAF) sensor1) output voltage
	0 - 255	3 = Altitude display
	12.000 - 14.000 V	4 = Engine Control Module (ECM) voltage supply battery voltage

1) specified value minus 0.01 V per 500 m above sea level.

2) Mass Air Flow (MAF) sensor output voltage tolerance range can only be evaluated during basic setting at idle.

Note on display field 3:

The altitude display is a calculated value inside the engine control module that is calculated by a comparison of the intake air mass and the throttle angle.

Test table display group 001

Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1	Greater than 110 or Less than 85	♦ Engine Coolant Temperature (ECT) sensor -G62- ♦ Wiring connection to Engine Control Module (ECM) -J192- ♦ Coolant thermostat faulty	- Check DTC memory ⇒ page 01-13 - Check -G62- ⇒ page 28-25 - Check engine coolant thermostat ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 19*
2	Less than 1.450 V	♦ Large intake air leak between intake manifold and Mass Air Flow (MAF) sensor	Repair cause
	Greater than 1.580 V	♦ Electrical consumers on, steering wheel at end stop, driving mode selected (automatic transmission)	- Switch consumers off - Center steering wheel - Put selector lever in P or N position ⇒ display group 004, display field 4 Tolerance for new engines: • Max. 1.660 V • When engine speed increases, the display value increases to 2.500 V, falls to 0.000 V

			and starts to go up again
4	Greater than 14.000 V or Less than 12.000 V	♦ Generator faulty ♦ Overvoltage because of starting aid ♦ Poor ground connection to ECM -J192- ♦ Discharged battery ♦ Current draw with ignition off	- Check voltage - Check battery charging status - Check voltage supply of Engine Control Module (ECM) ⇒ Repair Group 28

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Notes on display field 1:

- *The Engine Coolant Temperature (ECT) sensor is a temperature-dependent resistor. If the sensor signal is falsified by e.g. dampness in the harness connection (effect as with resistors connected in parallel), this falsification can lie in a range that is not recognized by the DTC memory.*

- *If a malfunction relating to the Engine Coolant Temperature (ECT) sensor is stored, a coolant temperature of 20° C (68 ° F) is displayed in the measuring block at engine start. 10° C (50° F) is added to this for each minute of engine operation. The maximum replacement value is 85° C (185° F).*

01-168

Display group 002

Display shows	Display/specified value	Designation
Basic setting 2 1 2 3 4	0.250 - 4.750 V	1 = Throttle position sensor voltage (idle to full throttle range)
	0.250 - 1.275 V	2 = Throttle position sensor voltage (idle and lower partial throttle range)
	0.250 - 0.500 V	3 = Learning value of Throttle position sensor
	0 or 1	4 = Mechanical Closed Throttle Position (CTP) switch: 0 = open 1 = closed

Test table display group 002

Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1	Deviation from tolerance range	♦ Throttle position sensor -G69- incorrectly adjusted or faulty	- Check DTC memory ⇒ page 01-13 - Check and adjust -G69- ⇒ page 24-77 and/or display group 009, display field 4
2	Outside tolerance range	♦ Throttle position sensor -G69- incorrectly adjusted or faulty	- Check DTC memory ⇒ page 01-13 - Check and adjust -G69- ⇒ page 24-77 and/or display group 009, display field 4

Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
3	Outside tolerance range	♦ Closed Throttle Position (CTP) switch activated or faulty ♦ CTP switch or throttle position sensor -G69- incorrectly adjusted ♦ Electrical consumers on ♦ Steering wheel at end stop ♦ Driving mode selected (automatic transmission) ♦ Moisture in connector for -G69- ♦ Ground point on intake manifold	- Check DTC memory ⇒ page 01-13 - Check and adjust -G69- ⇒ page 24-77 - Switch electrical consumers off - Center steering wheel - Selector lever in P or N ⇒ display group 004, display field 4 - Visual inspection - Check ground connection according to wiring diagram
4	0 or 1	♦ Closed Throttle Position (CTP) switch -F60- faulty ♦ Throttle position sensor -G69- incorrectly adjusted ♦ Throttle sticks ♦ Floor mat presses against accelerator pedal ♦ Moisture in connector of -G69- ♦ Accelerator pedal cable adjustment	- Check DTC memory ⇒ page 01-13 - Check and adjust -F60- ⇒ page 24-73 ⇒ *Display group 011, display field 4* - Visual inspection - Adjust accelerator pedal cable: ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*

Notes on display field 3:

- *The mechanical Closed Throttle Position (CTP) switch must be closed for the testing on the Throttle position sensor learning values ⇒ display field 4.*
- *If the displays in display fields 2 and 3 match at idle, the learning process is OK. If no learning process takes place, the last value learned will be displayed continuously.*
- *If engine control module is without power, the throttle position sensor learning value will be set to 0.550 V.*

01-170

Display group 003

Display shows	Display/specified value	Designation
Basic setting 3 1 2 3 4	650 - 750 RPM	1 = Momentary idle speed
	15.0 - 35.0%	2 = Engine load idle1)
	0% and/or greater than 95%	3 = Throttle angle - at idle: 0%; at wide open throttle: > 95%
	... km/h	4 = Momentary vehicle speed

1) Evaluate engine load tolerance range only at idle during "Basic Setting" function 04.

Note on display field 1:

Idle speed on vehicles without A/C and rear windshield heater switched on: 750-850 RPM.

Notes on display field 3:

For the testing at wide open throttle, stop engine, and switch ignition on.

Since in vehicles with manual transmission and automatic transmission different throttle bodies are installed, the start of opening of the throttle body can be measured with ignition on and thus incorrect installation can be checked

- *Manual transmission: 45-53%*
- *Automatic transmission: 27-35%*

Test table display group 003

Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1	Greater than 750 RPM	♦ Closed Throttle Position (CTP) switch -F60- ♦ Large air leak quantity ♦ Idle Air Control (IAC) valve -N71- sticks or is hard to move ♦ Rear windshield heater on	⇒ *Display group 04, display field 4* - Check -F60- ⇒ page 24-73 - Repair cause - Check using output diagnostic test mode ⇒ page 01-145 - Switch electrical consumers off
	Less than 650 RPM	♦ Idle Air Control (IAC) valve -N71- sticks or is hard to move ♦ Closed Throttle Position (CTP) switch -F60- ♦ Driving mode selected (automatic transmission)	⇒ *Display group 004, display field 4* - Check using output diagnostic test mode ⇒ page 01-145 - Check -F60- ⇒ page 24-73 - Move selector lever to P or N
2	Outside tolerance range	♦ Poor idle (not running on all cylinders) ♦ Mass Air Flow (MAF) sensor -G70- faulty ♦ Idle Air Control (IAC) valve -N71- faulty ♦ Electrical consumers on	- Fuel injectors or spark plugs faulty - Check DTC memory ⇒ page 01-13 and/or display group 001, display field 2 and 3 - Check DTC memory ⇒ page 01-13 and/or display group 018 - Switch electrical consumers off - Center steering wheel

		♦ Steering wheel at end stop ♦ Driving mode selected (automatic transmission)	- Move selector lever to P or N

Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
3	Greater than 0% at idle	♦ Throttle position sensor -G69- faulty ♦ Accelerator pedal cable adjustment ♦ Throttle sticks	- Check DTC memory ⇒ page 01-13 and/or display group 002 - Adjust accelerator pedal cable: ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20* - Repair cause
	At wide open throttle less than 95%	♦ Throttle position sensor -G69- faulty ♦ Accelerator pedal cable adjustment ♦ Throttle position sensor -G69- incorrectly adjusted	- Check DTC memory ⇒ page 01-13 and/or display group 002 - Adjust accelerator pedal cable: ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20* - Check and adjust sensor -G69- ⇒Repair Group 24
4	No display	♦ Wiring connection between instrument panel insert and Engine Control Module (ECM) -J192- faulty ♦ Open circuit or short between Vehicle Speed Sensor (VSS) -G68- and -J192- -	- Check vehicle speed signal ⇒ page 24-97 - Check -G68- ⇒ check vehicle speed sensor: ⇒ *Electrical Wiring Diagrams,*

		G68- faulty	*Troubleshooting & Component Locations*

Note on display field 4:

If no vehicle speed is shown on VAG 1551 scan tool, first make sure the vehicle speed display is OK. If vehicle speed display is faulty, check vehicle speed sensor:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

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Display group 004

Display shows	Display/specified value	Designation
Basic setting 4 1 2 3 4	0 ± 2	1 = Idle air control valve at idle
	HS: +14 to -16 or AT: +10 to -20	2 = Idle speed control learning value in manual transmission (HS) at idle setting and/or with automatic transmission (AT) in selector lever setting P or N Variation permitted for new engines: HS: +20 to -16AT: +16 to -20)
	HS: 0 or AT: +10 to -20	3 = Idle speed control learning value in automatic transmission (AT) in selector lever setting D, 1, 2, 3 or R. (0 is always displayed in vehicles with manual transmission.)
	001 10	4 = Shift inputs at idle: 0 off 1 on

Notes:

- *Values in display fields 2 and/or 3 can only be evaluated with idle air control valve is within tolerance at idle (display value 1). If the idle air control valve is not within tolerance after 1 minute waiting time, no learning takes place in display fields 2 and/or 3 .*

- *Positive learning values show a greater learning value than in the basic setting: -N71- is further open.*
- *Negative learning values show a learning value that is less than in basic setting: -N71- is more closed.*

Test table display group 004

Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1	Outside tolerance range	♦ Malfunction in the DTC memory ♦ Closed Throttle Position (CTP) switch -F60- activated or faulty ♦ Idle Air Control (IAC) valve -N71- faulty ♦ Electrical consumers on ♦ Steering wheel at end stop ♦ Driving mode selected (automatic transmission) ♦ Throttle sticks, floor mat presses on accelerator pedal, air leak	- Check DTC memory ⇒ page 01-13 - Check -F60- ⇒ page 24-73 and display group 002, display field 4 - Check -N71- ⇒ page 24-37 - Switch electrical consumers off - Center steering wheel - Move selector lever to P or N - Repair cause

Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
2	Greater than +14(HS) and/or greater than + 10(AT)	♦ Idle Air Control (IAC) valve -N71- faulty ♦ Electrical consumers on ♦ Steering wheel at end stop ♦ Driving mode selected (automatic transmission) ♦ Intake manifold pump plugged in automatic transmission ♦ EGR vacuum regulator solenoid valve -N18- open	- Check DTC memory ⇒ page 01-13 and/or display group 018 - Switch electrical consumers off - Center steering wheel - Move selector lever to P or N - Repair cause - Check DTC memory and/or ⇒ display group 017, display field 3
2	Less than -16 (HS) and/or less than -20 (AT)	♦ Idle Air Control (IAC) valve -N71- faulty ♦ Large air leak, manifold area, throttle stop not OK ♦ Air leak on second stage of throttle	- Check DTC memory ⇒ page 01-13 and/or display group 018 - Repair cause
3	Outside tolerance range	Only on vehicles with automatic transmission: ♦ Display field 2 outside tolerance ♦ If display field 2 is within tolerance, move selector lever to D	⇒ *Display field 2* - Check transmission

		and observe idle for approx. 1 min.; if display field 3 stays outside tolerance, the transmission is hard to move	

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Display field	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
4	Not 001 10	♦ Closed Throttle Position (CTP) ♦ switch -F60 activated or faulty ♦ A/C compressor switched on ♦ Rear window heating switched on ♦ Driving mode selected (automatic transmission)	- Check and adjust -F60- ⇒ page 24-73 - Switch A/C off - Check A/C compressor shut-off ⇒ page 24-90 - Move selector lever to P or N

Note:

Display field 4 (shift inputs) can be used to recognize whether the components described below are recognized by the Engine Control Module (ECM) as switched on or off. Display group 023 gives an exact description of the shift inputs.

0	0	1	1	0	Meaning of 5-digit shift inputs
					1 = Shifting Signal (0 = not active / 1 = active)
					2 = Gear recognition signal (always "1" except that display = "0" for automatic transmission vehicles with gear engaged)
					3 = ----------
					4 = Mechanical Closed Throttle Position (CTP) switch (1 = closed / 0 = open)
					5 = A/C compressor OFF/ON (0 = off, 1 = on)
					6 = Rear window heater signal (always "0" except for vehicles without A/C and with rear window heater on)

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Display group 005

Display shows	Display/specified value	Designation
Basic setting 5 1 2 3 4	-25% to +25%	1 = Oxygen sensor learning value-idle (bank 1)
	-25% to +25%	2 = Oxygen sensor learning value-partial throttle 1 (bank 1)
	-25% to +25%	3 = Oxygen sensor learning value-partial throttle 2 (bank 1)
	-25% to +25%	4 = Oxygen sensor learning value-partial throttle 3 (bank 1)

Display group 006

Display shows	Display/specified value	Designation
Basic setting 6 1 2 3 4	-25% to +25%	1 = Oxygen sensor learning value-idle (bank 2)
	-25% to +25%	2 = Oxygen sensor learning value-partial throttle 1 (bank 2)
	-25% to +25%	3 = Oxygen sensor learning value-partial throttle 2 (bank 2)
	-25% to +25%	4 = Oxygen sensor learning value-partial throttle 3 (bank 2)

Notes:

- *Positive learning value (+ %): Mixture too lean, more fuel must be injected. (Programmed basic fuel injection time too short, actual fuel injection time - % longer, so that λ = 1 is obtained).*

- *Negative learning value (− %): Mixture too rich, less fuel must be injected. (Programmed basic fuel injection time too long, actual fuel injection time - % shorter so that λ = 1 is achieved).*

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Test table display group 005 and/or display group 006

Display fields	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1, 2, 3, 4	Low oxygen sensor learning values	♦ If first learning value in display field 1 is low, but learning value in display fields 2, 3 and 4 normal: oil dilution (large amount of fuel in the oil), fuel injector leaks	- Pull off cylinder block breather hose and close - If problem disappears after drive on expressway and/or oil change - Check fuel injector ⇒ page 24-29
		If all four oxygen sensor learning values very low overall: - Fuel system pressure too high - EVAP canister purge regulator valve -N80- open continuously	- Check system and residual pressure ⇒ page 24-20 - Check -N80- ⇒ page 24-58 and/or display group 009, display field 3 and/or display group 001, display field 2
		♦ Mass Air Flow (MAF) sensor -G70- faulty	- Check MAF sensor -G70 ⇒ page 24-81
		♦ Oxygen sensor (O2S) heating faulty or Heated Oxygen Sensor (HO2S) dirty	- Check HO2S and O2S heating ⇒ page 24-49 and/or display group 010, display fields 1 and 2

Display fields	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1, 2, 3, 4	High oxygen sensor learning values	♦ If learning value in display field 1 is low, but learning value in display fields 2, 3 and 4 normal: air leak in manifold area possible	- Repair cause - Check fuel injector ⇒ page 24-29
		♦ Fuel injector plugged	
		If all four oxygen sensor learning values are very high overall: - Mass Air Flow (MAF) sensor -G70- faulty	- Check MAF sensor -G70 ⇒ page 24-81 and/or display group 001, display field 2
		- Fuel system pressure too low (fuel supply)	- Check system and residual pressure ⇒ page 24-20
		- Intake air leak between sensor -G70- and throttle body - Intake air leak in manifold gasket	- Repair cause
		♦ Oxygen sensor (O2S) heating faulty or Heated Oxygen Sensor (HO2S) dirty	- Check HO2S and O2S heating ⇒ page 24-49 and/or display group 010, display fields 1 and 2

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Notes on display groups 005 and 006:

If there are differences in oxygen sensor learning values (⇒ display group 010, display fields 1 and 2) of more than 8% between display group 005 (bank 1) and display group 006 (bank 2), the following malfunctions are possible:

- *Spark plugs faulty*
- *Fuel injectors faulty (leaking, plugged)*
- *Intake air leak on one side*
- *Heated Oxygen Sensor (HO2S) faulty, dirty*
- *Mechanical engine basic settings (valve/camshaft timing) not OK*

If a difference of 9% is reached between the richest and leanest oxygen sensor learning value of one display group, further learning will be discontinued in the two affected learning ranges (⇒ display group 007 and/or 008). Learning requirements display (⇒ display groups 007 and/or 008) of these learning ranges cannot be 1.

If there is no power to the engine control module, all values are set back to 0.0%.

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Display group 007

Display shows	Display/specified value	Designation/diagnose
Basic setting 7 1 2 3 4	0.0 ± 6.0%1)	1 = Oxygen sensor (O2S) control (bank 1)
	XXXX	2 = Oxygen sensor learning range display
	XXXXXXXX	3 = Oxygen sensor learning requirement diagnosis
	XXXXXXXX	4 = Oxygen sensor learning requirement display

Display group 008

Display shows	Display/specified value	Designation/diagnose
Basic setting 8 1 2 3 4	0.0 ± 6.0%1)	1 = Oxygen sensor (O2S) control (bank 2)
	XXXX	2 = Oxygen sensor learning range display
	XXXXXXXX	3 = Oxygen sensor learning requirement diagnosis
	XXXXXXXX	4 = Oxygen sensor learning requirement display

1) Evaluate tolerance range of the oxygen sensor control only at idle during "Basic Setting" function 04, since the EVAP canister can also be controlled during "Read Measuring Value Block" function 08

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Test table display group 007 and/or display group 008

Display fields	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1	Outside tolerance range	Minus (-) display: engine too rich ♦ Effect: O2S control leans mixture Positive display: engine too lean ("+" is not displayed) ♦ Effect: O2S control enriches mixture Possible causes: ♦ Intake air leak ♦ Fuel injector faulty ♦ Successful learning has not taken place (⇒ display field 4) ♦ O2S learning value at stop (⇒ display groups 005 and/or 006)	- Wait 30 sec. until the display has stabilized
2	-		⇒ *Notes*
3	-		⇒ *Notes*
4	-		⇒ *Notes*

Notes on display field 1:

- *Oxygen sensor control can basically be evaluated both in "Basic Setting" function 04 as well as in "Read Measuring Value Block" function 08 only after successful learning (⇒ learning requirement display).*

- *Oxygen sensor control shows momentary control status. After successful learning, (⇒ learning requirement display), values vary around 0.0 ± 6.0%. If the learning process (display field 4) is ended and no value around 0.0 ± 6.0% is obtained, observe display group 010, display fields 3 and/or 4 and check control behavior of the two heated oxygen sensors. During this process, the display values must at times drop below 0.3 V and exceed 0.6 V, otherwise check oxygen sensor heating and the heated oxygen sensor.*

01-183

Notes on display field 1 (cont'd):

The oxygen sensor control stop evaluation is also done by the diagnosis only after successful learning ⇒ learning requirement display:

- *Control stop max.: + 32%*
- *Control stop min.: - 87.5%*

With values of more than ± 20% in "Basic Setting" function 04, the following malfunctions are possible:

- *Intake air leaks*
- *Engine damage (oil burning with faulty piston)*

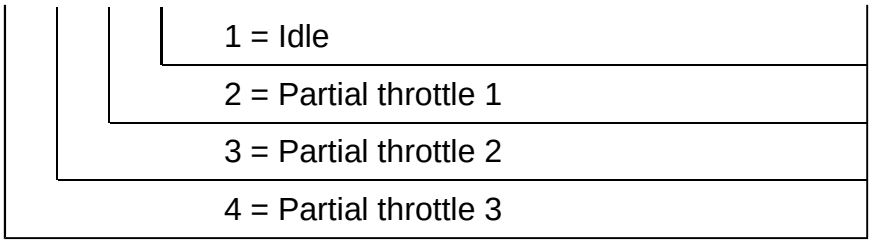
Notes on display field 2:

In display field 2 (learning range display), the momentary learning range (load status) is displayed. Only idle and partial throttle learning ranges are displayed since, at wide open throttle, no learning takes place.

In order to reach the corresponding learning range (load status):

- *Idle: the vehicle should be allowed to run at idle (650-900 RPM)*
- *Partial throttle 1, 2 or 3: during test drive (with second person), increase engine speed to 1500-3000 RPM and generate load by lightly operating the brake*

X	X	X	X	Meaning of 4-digit learning range display



- *Display value "0" = Engine speed and/or engine speed and load for this learning range not obtained.*
- *Display value "1" = Engine speed and/or engine speed and load for this learning range obtained.*

01-184

Notes on display field 3

- *The oxygen sensor learning requirement diagnosis shows what oxygen sensor learning value was checked in the learning process.*
- *If diagnosis is successful, the corresponding value is set to "1", independently of whether the diagnosis was recognized as OK or not OK.*
- *If an "oxygen sensor learning requirement diagnosis" value is set to "1" in display field 3, but the corresponding value of the "oxygen sensor learning requirement display" is not set to "1" in display field 4, the diagnosis was carried out but not recognized as OK by the Engine Control Module (ECM). The " oxygen sensor learning requirement diagnosis" is now continued.*
- *The oxygen sensor learning requirement diagnosis is reset to "0" every time there is a start with a coolant temperature less than 40° C (104° F).*

X	X	X	X	X	X	X	X	**Meaning of 8-digit oxygen sensor learning requirement diagnosis**
								1 = Idle (bank 1)
								2 = Idle (bank 2)
								3 = Partial throttle 1 (bank 1)
								4 = Partial throttle 1 (bank 2)
								5 = Partial throttle 2 (bank 1)
								6 = Partial throttle 2 (bank 2)
								7 = Partial throttle 3 (bank 1)

8 = Partial throttle 3 (bank 2)

- *Display value "0" = Diagnosis not carried out yet.*
- *Display value "1" = Diagnosis complete.*

01-185

Notes on display field 4

Display field 4 (learning requirement display) shows the learning range (display field 2) for which learning is required.

Requirement for learning:

- *No malfunction stored in DTC memory*
- *Engine speed at idle 650-900 RPM and/or 1500-3000 RPM*
- *Coolant temperature 80-110° C (176-230° F) (if learning does not start immediately after this requirement, step on the throttle).*

Learning is prohibited:

- *With uneven idle (hunting), during acceleration, at wide open throttle*
- *If malfunctions are stored in the DTC memory (not with sporadic malfunctions)*
- *If differences of 9% are obtained between the richest and leanest oxygen sensor learning value of one display group. If a 9% difference is obtained, continued learning of the learning range involved is discontinued. The learning requirement display of this learning range can not be 1 ⇒ display groups 005 and/or 006.*

Learning starts 20 sec. after initiation of "Basic Setting" function 04 and/or 2 to 4 min. after each start at a which the coolant temperature is less than 40° C (104° F).

The following listing shows when the request for new learning (learning requirement) is forced:

- *During "Basic Setting" function 04 with VAG 1551 scan tool and/or each time the DTC memory is erased, all learning requirement displays are set to 0 in order to force new learning of the oxygen sensor learning values after the shop visit.*
- *At each start, coolant temperature less than 40° C (104° F), the learning requirement is forced in all learning ranges.*
- *If there is a large learning value deviation (from the stored learning value to the newly learned value) in the learning process, all learning requirement displays are reset to 0.*

If there is successful learning, the learning requirement values of the respective learning ranges (display field 2) are set to 1.

01-186

X	X	X	X	X	X	X	X	**Meaning of 8-digit oxygen sensor learning requirement display**
								1 = Idle (bank 1)
								2 = Idle (bank 2)
								3 = Partial throttle 1 (bank 1)
								4 = Partial throttle 1 (bank 2)
								5 = Partial throttle 2 (bank 1)
								6 = Partial throttle 2 (bank 2)
								7 = Partial throttle 3 (bank 1)
								8 = Partial throttle 3 (bank 2)

- *Display value "0" = Request for new learning.*
- *Display value "1" = Learning process ended.*

01-187

Display group 009

Display shows	Specified display value	Designation
Basic setting 9 1 2 3 4	... %	1 = Oxygen sensor control (bank 1)
	... %	2 = Oxygen sensor control (bank 2)
	0 - 99%	3 = Duty cycle (triggering)-EVAP canister purge regulator valve -N80-
	0% and/or greater than 95%	4 = Throttle angle - at idle: 0%; at wide open throttle: > 95%

Note:

The oxygen sensor control should always be evaluated only after successful learning (⇒ learning requirement display, display group 007 and/or 008, display field 4) in both "Basic Setting" function 04 and "Read Measuring Value Block" function 08.

01-188

Test table display group 009

Display fields	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1	-		- ⇒ Display group 007, display field 1
2	-		- ⇒ Display group 008, display field 1
3	-		- ⇒ Note
4	-		- ⇒ Display group 003, display field 3

Notes on display field 3:

- *The evaporative emissions valve (EVAP canister valve) is closed during the learning process.*
- *The effect of the EVAP canister can be evaluated by comparing the display value during "Basic setting" (EVAP canister completely closed: 99%) and during "Read Measuring Value Block" (EVAP canister valve completely open: 0%).*
- *You can switch back and forth between "Basic Setting" function 04 and "Read Measuring Value Block" function 08 by pressing buttons -1- and -3- on VAG 1551 scan tool.*

01-189

Display group 010

Display shows	Specified display value	Designation
Basic setting 10 1 2 3 4	Difference between display values 1 and 2 less than 8%	1 = Total of oxygen sensor control (bank 1) and momentary oxygen sensor learning value (bank 1)
		2 = Total of oxygen sensor control (bank 2) and momentary oxygen sensor learning value (bank 2)
	At times greater than 0.6 V and/or less than 0.3 V (display must fluctuate)	3 = Voltage signal-bank 1 heated oxygen sensor 1
		4 = Voltage signal-bank 2 heated oxygen sensor 1

Note:

The total of the oxygen sensor control and oxygen sensor learning value shows the total effect of the oxygen sensor control. Bank differences can be evaluated directly by comparing display field 1 with display field 2.

Test table display group 010

Display fields	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
1/2	Difference between display value 1 (bank 1) and display value 2 (bank 2) greater than 8%	♦ Spark plug faulty ♦ Intake air leak on one side ♦ Fuel injectors faulty ♦ Heated Oxygen Sensor (HO2S) faulty (dirty) ♦ Mechanical engine basic setting (valve/camshaft timing) not OK	- Repair cause - Check DTC memory ⇒ page 01-13 and/or check fuel injectors ⇒ page 24-29 - Check DTC memory ⇒ page 01-13 and/or display fields 3 and 4 - Check valve/camshaft timing ⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 13*

01-191

Display fields	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
3/4	Display does not fluctuate-constant between 0.0 - 0.3 V and/or between 0.6 - 0.9 V	♦ Fuel injector faulty	- Check fuel injectors ⇒ page 24-29
		♦ Spark plug faulty	- Check spark plug
		♦ Large intake air leak	- Repair cause
		♦ Engine Coolant Temperature (ECT) sensor -G62- faulty	- Check DTC memory ⇒ page 01-13 and/or check -G62-
		♦ EVAP canister purge regulator valve -N80-	- Check using output diagnostic test mode ⇒ page 01-145 and/or check -N80-
		♦ Heated Oxygen Sensor (HO2S) -G39- faulty or dirty	- Check DTC memory ⇒ page 01-13 and/or check -G39-
		♦ Oxygen Sensor (O2S) heater -Z19- does not function	- Check -Z19- ⇒ page 24-49
		♦ Fuel system pressure too high or too low	- Check fuel pressure regulator and residual pressure ⇒ page 24-20
	Constant 2.550 V	Short to positive (B+) through: ♦ Heated Oxygen Sensor (HO2S) -G39- wiring ♦ Engine Control Module (ECM) -J192-	- Check -G39- ⇒ page 24-49

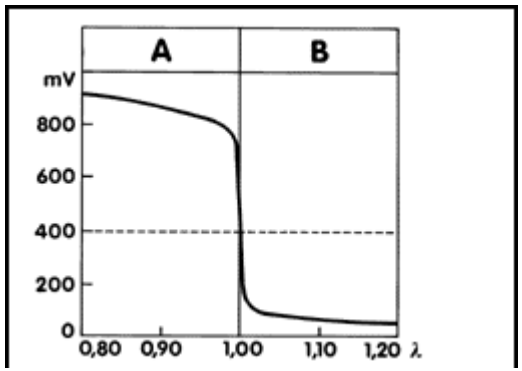
continued

01-192

Display fields	Display on VAG 1551 scan tool	Malfunction cause	Malfunction repair
3/4	Constant value between 0.350 - 0.450 V	Open circuit in: ♦ Heated Oxygen Sensor (HO2S) -G39- wiring ♦ Engine Control Module (ECM) -J192-	- Check -G39- ⇒ page 24-49
	Constant 0.000 V	Short to ground in: ♦ Heated Oxygen Sensor (HO2S) -G39- wiring ♦ Engine Control Module (ECM) -J192-	- Check -G39- ⇒ page 24-49

Notes on display field 4:

The display value at times must drop below 0.3 V and exceed 0.6 V. Display values less than 0.40 V indicate lean condition; greater than 0.40 V indicate rich condition.



HO2S voltage U λ (mV) vs. Lambda (λ)

A - HO2S voltage (mV) high

Rich mixture (fuel excess or lack of air)

High CO value

B - Oxygen sensor probes voltage (mV) low

Lean mixture (lack of fuel or excess air)

Low CO value

01-193

Display group 011

Display shows	Specified display value	Designation
Basic setting 11 1 2 3 4	... ° BTDC	1 = Ignition timing point without knock control and without idle speed control
	... ° BTDC	2 = Ignition timing point with knock control and digital idle speed control (average value for all cylinders)
	± _._ ° crankshaft	3 = Ignition timing point access to digital idle speed control
	0 and/or 1	4 = Closed Throttle Position (CTP) switch function: Open = 0; Closed = 1

Notes on display field 1:

- *At idle-Closed Throttle Position (CTP) switch closed-an ignition timing point of 12° BTDC is displayed.*
- *When the engine speed is increased-CTP switch open-the current ignition timing point is displayed without knock control and without digital idle speed control.*

Notes on display field 2:

- *Digital idle speed control is only active with Closed Throttle Position (CTP) switch closed.*
- *Knock control is active starting at an engine load greater than 40% ⇒ Display group 013 and/or 014.*

Notes on display field 3:

- *Digital idle speed control (ISC) is only active with the Closed Throttle Position (CTP) switch closed.*
- *Ignition timing point access to digital ISC with open CTP switch: 0.0° crankshaft.*
- *During "Basic Setting" function 04, digital ISC is blocked, display shows 0.0° crankshaft.*
- *Ignition timing point access to DLS during "Read Measuring Value Block" function 08 at idle without electrical consumers: 0.0 ± 3.0 ° crankshaft.*

01-194

Display group 012

Display shows	Specified display value	Designation
Basic setting 12 1 2 3 4	... RPM	1 = Momentary engine speed ⇒ Display group 003, display field 1
	... %	2 = Momentary engine load ⇒ Display group 003, display field 2
	First map or second map	3 = Ignition timing point map switching
	_._° crankshaft	4 = Ignition timing pt. retard by knock control (average of all cyl.)

Notes on display field 3:

The ignition timing point map switching is selected by knock control:

- *First map = Ignition timing point - basic map (98 octane)*
- *Second map = Ignition timing point - map with reduced ignition angles (95 octane)*

The ignition timing point difference between the first map and the second map is approx. 3° crankshaft. If an ignition timing point retarded by approx. 4° crankshaft is recognized (display field 4), the second map is selected ⇒ Display groups 013 and 014 for more exact evaluation.

The second ignition timing point map is selected:

- *If there is poor fuel quality (less than 95 RON)*
- *If there are abnormal engine noises (subassemblies loose)*

- *If there is engine damage (oil burning because of faulty piston)*

If a knock sensor malfunction is recognized in DTC memory, ignition map switching is blocked.

Notes on display field 4:

- *Knock control is active starting at an engine load greater than 40% ⇒ Display groups 013 and/or 014.*
- *The ignition timing point retarding values are only used when knock control is "active."*

Display group 013

Display shows	Specified display value	Designation
Basic setting 13 1 2 3 4	First map and/or second map	1 = Ignition timing point map switching ⇒ display group 012, display field 3
	_._° crankshaft	2 = Ignition timing point retarded by knock control (cylinder 1)
	_._° crankshaft	3 = Ignition timing point retarded by knock control (cylinder 2)
	_._° crankshaft	4 = Ignition timing point retarded by knock control (cylinder 3)

Display group 014

Display shows	Specified display value	Designation
Basic setting 14 1 2 3 4	First map and/or second map	1 = Ignition timing point map switching ⇒ display group 012, display field 3
	_._° crankshaft	2 = Ignition timing point retarded by knock control (cylinder 4)
	_._° crankshaft	3 = Ignition timing point retarded by knock control (cylinder 5)
	_._° crankshaft	4 = Ignition timing point retarded by knock control (cylinder 6)

01-196

Display groups 013 and 014

Notes on display fields 2, 3 and 4:

Knock control is active starting at an engine load greater than 40%. If the engine load exceeds 40%, the current ignition timing point retarding value is displayed; if the engine load drops below 40%, the last values used are displayed constantly.

If there is audible knocking without recognizable retarding of the ignition timing point, the engine speed should be increased over 3500 RPM for 5 seconds to initiate the knock sensor malfunction recognition (On Board Diagnostic).

If an ignition timing point retarding value of one cylinder deviates from the others, the following malfunctions are possible:

- *Loose subassemblies*
- *Corrosion on the harness connector*
- *Engine damage (e.g. oil combustion with faulty piston)*

If there are high ignition timing point retarding values on all cylinders of bank 1 or bank 2, the following malfunctions are possible:

- *Corrosion on the harness connector ⇒ display groups 015 and 016*
- *Knock sensor tightening torque, 20 Nm (14 ft lb), not OK*
- *Open circuit ⇒ display groups 015 and 016*
- *Knock sensor faulty*

- *Loose subassemblies*

If there are high ignition timing point retarding values on all six cylinders (banks 1 and 2), the car has been filled with fuel having low octane (less than 98 RON).

Display group 015

Display shows	Specified display value	Designation
Basic setting 15 1 2 3 4	___ RPM	1 = Momentary engine speed ⇒ display group 003, display field 1
	_._V	2 = Knock sensor signal (cylinder 1)
	_._V	3 = Knock sensor signal (cylinder 2)
	_._V	4 = Knock sensor signal (cylinder 3)

Display group 016

Display shows	Specified display value	Designation
Basic setting 16 1 2 3 4	___ RPM	1 = Momentary engine speed ⇒ display group 003, display field 1
	_._ V	2 = Knock sensor signal (cylinder 4)
	_._ V	3 = Knock sensor signal (cylinder 5)
	_._ V	4 = Knock sensor signal (cylinder 6)

01-198

Display groups 015 and 016

Notes on display fields 2, 3 and 4:

If there is a difference of more than a factor of 3 between the lowest and the highest knock sensor signal in one display group, the following malfunction is possible:

- *Corrosion on the harness connector*

If there are differences of more than 50% in knock sensor signal between display group 015 (cylinders 1 to 3) and display group 016 (cylinders 4 to 6), the following malfunctions are possible:

- *Corrosion on the harness connector*
- *Open circuit*
- *Knock sensor faulty*

If no malfunctions are found during the electrical testing of the knock sensor, the wiring and the connections, the engine should be checked for loose subassemblies or engine damage (e.g. oil burning due to faulty piston) ⇒ Display groups 013 and/or 014.

01-199

Display group 017

Note:

If in display group 029, display field 1, the value of the EGR system throughput diagnosis is not set to "0" during the regeneration of the "readiness code," and/or a malfunction relating to the exhaust system is stored in the DTC memory, display group 017 is used to carry out a selective diagnosis.

During cold start at idle, -10° C to 30° C (14 to 86° F), and during "Basic Setting" function 04, no exhaust gas recirculation takes place. Since exhaust gas recirculation is switched off automatically during "Basic Setting" function 04, diagnosis of EGR throughput is evaluated only in "Read Measuring Value Block." function 08.

If diagnostic conditions are fulfilled, the Engine Control Module (ECM) checks the flow through the EGR system after each start. The diagnostic conditions are only reached during a trip at 80-100 km/h (50-63 mph) in 4th or 5 gear and/or with selector lever in the "D"position, preferably in 4th gear position. If the diagnostic conditions are fulfilled, the diagnosis is active. In order to get a diagnostic result, the vehicle must be driven approx. 1-1/2 to 5 minutes under the diagnostic conditions. However, the diagnosis is only considered OK when the EGR temperature (display field 4) is greater than 50° C (122° F) during the reading time (display field 2).

Diagnosis of the EGR flow (exhaust gas recirculation quantity) is active as soon as the following diagnostic conditions are fulfilled:

- *Coolant temperature: greater than 8° C (46° F) (⇒ display group 001)*
- *Vehicle speed: constant drive*
- *Engine speed: 2000-3000 RPM (⇒ display group 003)*
- *Engine load: 30-60%*

01-200

Display shows	Specified display value	Designation
Basic setting 17 1 2 3 4	0 - 1	1 = Timer 1 (final value = 1)
	0 - 225	2 = Timer 2 (final value = 48 or 160)
	30% - 60%	3 = Momentary engine load
	0 ° C - 255 ° C	4 = Exhaust gas recirculation temperature (EGR temperature sensor -G98-)

Notes on display fields 1 and 2:

- *In display fields 1 and 2, the timers are displayed. The final value of timer 2 is "48" or "160". The final values "48" and "160" are reading times ("48" = reading time 1; "160" = reading time 2).*
- *If the diagnostic conditions are fulfilled, the timers are incremented, outside the diagnostic conditions they are decremented.*
- *Counter 1 is incremented by "1" as soon as counter 2 reaches the value "255." If the value 255 is reached, counter 2 goes back to "0" and starts to increment again up to "48" (reading time 1).*
- *If reading time 1 has been reached, the Engine Control Module (ECM) -J192- checks the EGR temperature (display field 4). If the EGR temperature is greater than 50 ° C (122 ° F), the diagnosis is OK and the diagnostic program is discontinued. If the EGR temperature during reading time 1 is less than 50 ° C (122 ° F),counter 2 counts up to "160"(reading time 2).*
- *When reading time 2 is reached, the -J192- checks the EGR temperature (display field 4) again. If the EGR temperature is now greater than 50 ° C (122 ° F), the diagnosis is OK and the diagnostic program will be discontinued. If the EGR temperature is again less than 50 ° C (122 ° F), the EGR flow test is carried out again.*

- *If the EGR flow test is to be carried out selectively or after an OK diagnosis, stop the engine and start it again.*

Display group 018

Display shows	Specified display value	Designation
Basic setting 18 1 2 3 4	__ %	1 = Internal duty cycle (triggering) - Idle Air Control (IAC) valve -N71-
	_.___ A	2 = Idle Air Control (IAC) valve -N71- current
	-40 to +60%	3 = Power control from Idle Air Control (IAC) valve -N71-
	12,000 - 14,000 V	4 = Engine Control Module (ECM) -J192- voltage supply (battery voltage) ⇒ display group 001, display field 1

Note on display field 1:

The internal calculation value in the engine control module for the duty cycle is displayed without power and voltage correction.

Note on display field 2:

The actual power draw by the Idle Air Control (IAC) valve -N71- is displayed.

Note on display field 3:

- *Positive values indicate increase in the duty cycle, in order to reach the specified current.*
- *Negative values indicate a decrease in the actual duty cycle to reach the specified current.*

- *If +60% is displayed for a longer time , this indicates contact resistance and/or an adjuster that is too hot.*
- *If -40% is displayed for a longer time, this indicates a winding short in the idle adjuster.*

01-202

Display group 019

Display shows	Specified display value	Designation/diagnose
Basic setting 19 1 2 3 4	At idle: 1.5 - 3.5%	1 = Momentary engine power (internal computation value)
	At 2500 RPM: 6.5 - 9.5%	
	At idle: 3.0 - 5.5 g/s	2 = Intake air quantity (via mass air flow sensor)
	At 2500 RPM: 9.5 - 13.5 g/s	
	___ km/h	3 = Momentary vehicle speed ⇒ display group 003, display field 4
	_._ m/s	4 = Fuel injection time (average of all cylinders)

Note on display field 1:

The momentary engine power is a control module-internal calculated value that is calculated from the amount of air taken in under normal conditions (air pressure 1013 mbar, air temperature 20° C or 68° F).

Display groups 020 and 021

Note:

Display groups 020 and 021 are only considered in vehicles with Secondary Air Injection (AIR) system.

Display shows	Display/specified value	Designation/diagnose
Basic setting 20 1 2 3 4	0%	1 = Lean time of bank 1, HO2S 1 voltage signal
	0%	2 = Lean time of bank 2, HO2S 1 voltage signal
	69%	3 = Diagnosis limit value
	00000000	4 = Diagnosis condition and/or result

Display group 021

Display shows	Display/specified value	Designation/diagnose
Basic setting 21 1 2 3 4	0.0%	1 = Oxygen sensor control, bank 1 richens
	0.0%	1 = Oxygen sensor control, bank 2 richens
	14.0%	3 = Diagnosis limit value
	00000000	4 = Diagnosis condition and/or result

01-204

Display group 022

Notes:

Display group 022 should only be considered on vehicles with traction control (ATC).

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

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

The wheel slip information for traction control (ATC) is calculated in the ABS control module. If slip is recognized, the ABS control module requests a reduction in torque from the Engine Control Module (ECM). This torque reduction is divided into 12 reducing stages.

With a cold engine, coolant temperature less than 20° C (68° F), the reduction of engine torque is obtained:

- *With retarded ignition timing angle for lower reducing stages (1-5)*
- *By brief shut-off of individual fuel injectors for higher reducing stages (6-12)*

If the engine is warm, coolant temperature greater than 40° C (104° F), the engine torque reduction is obtained only by briefly switching off individual fuel injectors.

Display shows	Display/specified value	Designation
Basic setting 22 1 2 3 4	0 - 12	1 = Reducing stages
	_._° crankshaft	2 = Ignition timing point retarded by ATC (only with cold engine)

	-68 Nm to 250 Nm	3 = Reduced engine torque (actual moment)
	-68 Nm to 250 Nm	4 = Unreduced engine torque

01-205

Display group 023

Display shows	Display/specified value	Designation
Basic setting 23 1 2 3 4	X	1 = Upshift or downshift signal
	XX	2 = Gear recognition signal and shifting signal
	XX	3 = A/C compressor off/on and rear window heater signal
	X	4 = A/C compressor shut-off

Notes on display field 1:

- *The signal for upshift and downshift will only be output by the Transmission Control Module (TCM) for the automatic transmission 01V. For vehicles without automatic transmission 01V, a "1" is always displayed.*

- *Check upshift and downshift signal* ⇒ *page 24-103* .

X	Meaning of 1-digit display:
	With vehicle not running: Value "0" = Selector lever in R Value "1" = Selector lever in 2,3,4,D,P,N
	When driving-vehicle speed greater than 14 km/h (9 mph): Value "0" = Ignition angle retarded for downshift selected

Value "1" = Ignition angle retarded for upshift selected

01-206

Note on display field 2:

X	X	Meaning of 2-digit display:
		1 = Shifting signal (ignition angle retard): Value "0" = Ignition angle retarding not active Value "1" = Ignition angle retarding active ***Notes:*** ♦ *Because of the brief signal, the shift is not always displayed.* ♦ *On vehicles without automatic transmission, "0" is always displayed.* ♦ *Check shift signal ⇒ page 24-101 .*
		2 = Gear recognition signal: Value "0" = Selector lever in R, D, 4, 3, or 2 (driving mode engaged) Value "1" = Selector lever in P or N ***Notes:*** ♦ *On vehicles without automatic transmission, "0" is always displayed.* ♦ *Check gear recognition signal ⇒ page 24-99 .*

01-207

Note on display field 3:

X	X	Meaning of the 2-digit display:
		1 = A/C compressor off/on (0 = off; 1 = on) ***Notes:*** ♦ *On vehicles without A/C "0" is always displayed.* ♦ *Check A/C compressor ⇒ page 24-90 .* ♦ *The A/C compressor is shut off for approx. 12 sec. by -J192- when accelerating from a stop and from low speed. If the gas pedal is released sooner, the time is reduced to a minimum of 3 sec. At wide open throttle, the A/C compressor is switched off by the automatic transmission (kick-down switch).*
		2 = Rear window heating - Signal (0 = off; 1 = on) ***Notes:*** ♦ *The rear window heating signal is only displayed on vehicles without A/C.* ♦ *On vehicles with A/C "0" is always displayed.* ♦ *Check rear window heater signal ⇒ page 24-88 .*

Notes on display field 4:

♦ *If the A/C compressor is off ⇒ display field 3; display field 4 can be used to recognize whether the compressor was switched off by the engine control module.*

♦ *Meaning of the 1-digit display:*

X	Meaning of 1-digit display
	Value "0" = A/C compressor not switched off by engine control module Value "1" = A/C compressor switched off by engine control module

01-208

Display groups 024, 025 and 026

Notes:

- *Display group 024 is currently not assigned.*
- *Display groups 025 and 026 are only used by Production.*

Display shows	Values	Designation
Basic setting 24 1 2 3 4	--------	----------
	--------	----------
	--------	----------
	--------	----------

Display shows	Values	Designation
Basic setting 25 1 2 3 4	0s	----------
	0.0s	----------
	0s	----------
	0.0s	----------

Display shows	Values	Designation

Basic setting 26 1 2 3 4	0 - 255	----------
	0 - 255	----------
	0 - 255	----------
	0 - 255	----------

01-209

Display group 027

Display shows	Display specified value	Designation/diagnosis
Basic setting 27 1 2 3 4	X	1 = Malfunction Indicator Lamp (MIL) wire from Transmission Control Module (TCM)
	X	2 = Fuel level signal from instrument cluster
	0.000 V	3 = ----------
	0.000 V	4 = ----------

Notes on display field 1:

- *On vehicles with manual transmission, "1" is always displayed.*
- *Checking Malfunction Indicator Lamp (MIL) wire from transmission control module* ⇒ *page 24-105* .

X	Meaning of the 1-digit display:
	Value "0" = ignition on, engine not running Value "1" = engine running

Note on display field 2:

- *Check fuel level signal from instrument cluster* ⇒ *page 24-107* .

X	Meaning of the 1-digit display:
	Value "0" = ignition on and engine not running, or, engine running and fuel tank contents less than 12 liters (3.2 gal) Value "1" = engine running and fuel tank contents greater than 12 liters (3.2 gal)

Display group 028

Note:

Display group 028 is only used by Production.

Display shows	Display/specified value	Designation
Basic setting 28 1 2 3 4	0 - 255	----------
	0 - 255	----------
	0 - 255	----------
	0 - 255	----------

01-211

Display group 029 (Diagnosis status)

Notes:

OBD II regulations require a display ("Readiness Code") that indicates readiness for inspection (annual exhaust emissions test). The readiness code display (display field 1) shows that every component and/or system that affects the exhaust, which can lead to switching on the MIL, has been operated at least once with positive result.

The readiness code is reset and/or erased:

- *Every time the DTC memory is erased (both with address word 01 function 05 and with address 33 mode 4).*
- *When the battery is disconnected.*
- *When the engine control module is disconnected (e.g. connecting test box VAG 1598/19, replacing ECM, etc.).*

To generate the readiness code, take a "mixed city and highway" drive (short test). A "mixed city and highway" drive is understood to be approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear.

The "Trip Status" display (display field 2) shows which components and/or systems have been checked since the start of the trip. After successful diagnosis, the current display value is set to "1" whether the diagnosis was recognized as OK or not OK. The trip-status display is reset to "0" at each start since the components and/or systems are checked at each new start. A "trip" is understood to be a drive of approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear, with preceding cold start.

The readiness code display (display field 1) shows whether the components and/or systems checked in display field 2 were recognized as OK or not OK by the engine control module.

- *If the diagnosis is recognized as OK, the current display value is set to "0."*

- *If the diagnosis is recognized as not OK, the current display value is not set to "0", it stays at "1."*
- *If every component and/or system has operated at least once with positive results, all display values of the readiness code are set to "0."*
- *If, during another diagnosis, a component and/or system is recognized as not OK, the readiness code is not reset to "1."*

01-212

If the trip status display is set to "1" when the readiness code is regenerated, but the corresponding display value of the readiness code is not set to "0", the diagnosis was carried out but recognized as not OK by the engine control module. In this case, the DTC memory should be checked to determine malfunctions and/or to carry out a selective diagnosis:

- *For three way catalytic converter diagnosis (Bank 1 and 2) also check display groups 035, 036 and 044.*
- *For the Evaporative Emissions (EVAP) system leak diagnosis, also check display group 030.*
- *For the Secondary Air Injection (AIR) system throughput and leak diagnosis, also check display groups 020 and 021.*
- *For oxygen sensor diagnosis, also check display groups 032, 033, 034, 041, 042 and 043.*
- *For oxygen sensor heating diagnosis, also check display group 040.*
- *For the Exhaust Gas Recirculation (EGR) system throughput diagnosis, also check display group 017.*

Display shows	Display specified value	Designation/diagnosis
Basic setting 29 1 2 3 4	X X X X X X	1 = Readiness Code
	X X X X X X X X	2 = Trip Status display
	0 - 40	3 = Counter for warm-up phases without new malfunctions except for "combustion misfiring" and/or "oxygen sensor control"
	0 - 40	4 = Counter for warm-up phases without new malfunctions except for "combustion

		misfiring" and/or "oxygen sensor control"

01-213

Notes on display field 1:

- *All readiness code values are set to "1" by disconnecting the ECM harness connector and/or disconnecting the battery, and every time DTC memory is erased (both with address word 01 function 05 and with address word 33 mode 4).*
- *To regenerate the readiness code, take a drive of approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear ("mixed city and highway" trip).*
- *Value "0" = Diagnosis carried out*
- *Value "1" = Diagnosis not OK and/or diagnosis not carried out yet*

X	X	X	X	X	X	Meaning of the 6-digit "readiness codes"
						1 = Three way catalytic converter diagnosis (Banks 1 and 2)
						2 = ----
						3 = Evaporative Emissions (EVAP) throughput diagnosis
						4 = Secondary air system throughput and leak diagnosis (Always "0" for vehicles without secondary air injection system)
						5 = ----
						6 = Heated oxygen sensor diagnosis (flank rise and/or flank fall time of the voltage signal of heated oxygen sensors in front of three way catalytic converters
						7 = Oxygen sensor heating diagnosis (all four O2S heaters)
						8 = Exhaust Gas Recirculation (EGR) throughput diagnosis

01-214

Notes on display field 2:

- *The display values are set to "0" at each start, since the function capability of components and systems that can affect the exhaust are checked again and again.*
- *Leak testing of the EGR system is only carried out after a preceding cold start (water temperature -10° C to 30° C (14° to 86° F).*
- *Value "0" = Diagnosis not carried out yet*
- *Value "1" = Diagnosis carried out*

X	X	X	X	X	X	X	X	**Meaning of 8-digit "Trip Status" display**
								1 = Three way catalytic converter diagnosis, banks 1 and 2 (for diagnostic conditions ⇒ display group 044)
								2 = Exhaust Gas Recirculation (EGR) system leak testing
								3 = Evaporative Emissions (EVAP) throughput diagnosis (for diagnostic conditions ⇒ display group 030)
								4 = Secondary air injection system throughput and leak testing (always "0" on vehicles without secondary air injection system; for diagnostic conditions ⇒ display groups 020 and 021)
								5 = Oxygen sensor control diagnosis

(for diagnostic conditions ⇒ display groups 007 and 008)

6 = Heated oxygen sensor diagnosis (flank rise and/or flank fall time of the voltage signal on the heated oxygen sensor in front of three way catalytic converter; for diagnostic conditions ⇒ display group 042)

7 = Oxygen sensor heating diagnosis (all four O2S heaters)

8 = Exhaust Gas Recirculation (EGR) system throughput diagnosis

(for diagnostic conditions ⇒ display group 017)

01-215

Notes on display fields 3 and 4:

- *Display field 3 evaluates all malfunctions except "Combustion misfiring and oxygen sensor control."*
- *Display field 4 evaluates only the malfunctions "Combustion misfiring and oxygen sensor control"*
- *If a malfunction is recognized, the corresponding counter will be set to "40." The counter is decremented, during a new start, when the trip was started at coolant temperature of 49° C (120° F) and ended at a water temperature of 71° C (160° F) and the malfunction is no longer recognized. However, decrementing is only allowed if the MIL has not lit up yet or is no longer lit. When counter status "0" is reached, the recognized malfunction is erased.*
- *If the DTC memory is erased, the counter is also decremented.*

01-216

Display group 030 (EVAP system diagnosis)

Notes:

- *Display group 030 is only considered on vehicles with sensor for EVAP canister -G172-.*
- *If the value of the EVAP throughput diagnosis is not set to "0" in display group 029, display field 1 during regeneration of the readiness code, and/or there is a malfunction in DTC memory that relates to the EVAP system, display group 030 is used to carry out a selective diagnosis.*
- *Since the EVAP system is automatically shut off during "Basic Setting" function 04, display group 030 can only be evaluated using "Read Measuring Value Block" function 08.*
- *When diagnostic conditions are fulfilled, the Engine Control Module (ECM) checks the EVAP system at each start with the help of the sensor for EVAP canister -G172-. The pressure between the EVAP canister and EVAP canister purge regulator valve is measured with the sensor for EVAP canister -G172-.*
- *The diagnostic conditions are only fulfilled during a drive of approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear. If the diagnostic conditions are fulfilled, the diagnosis is active. To get the diagnosis results, you have to drive approx. 1-1/2 to 5 minutes under the diagnostic conditions, while the pressure has to be measured with closed EVAP canister purge regulator valve. First, the pressure must be measured with the valve closed. You can get the valve to close most easily by having a preceding deceleration fuel shut-off. If there are problems in shutting the EVAP canister purge regulator valve by deceleration fuel shut-off, it can also be shut by running display group 030 in "Basic Setting" function 04. Then the pressure has to be measured again in "Read Measuring Value Block" function 08 with valve fully open.*
- The diagnosis is recognized as OK if the EVAP system low pressure measured in display field 1 is greater than the actual calculated EVAP system minimum low pressure in display field 2.

- If the EVAP system is recognized as OK during the first diagnosis, the diagnosis is discontinued. If the EVAP system is recognized as not OK, the EVAP canister throughput test is continued.

- *If the EVAP system throughput diagnosis is to be carried out selectively and/or after a diagnosis, shut the engine off and start again.*

01-217

Display shows	Display/specified value	Designation/diagnosis
Basic setting 30 1 2 3 4	-- mbar	1 = Currently measured EVAP system under pressure
	-- mbar	2 = Currently calculated EVAP minimum under pressure
	0 - 99%	3 = Duty cycle (triggering) EVAP canister purge regulator valve 0% = completely open 99% = completely closed
	X X X X X	4 = Diagnosis status and/or result

Note on display field 2:

An under pressure calculated from the momentary throughput of the Mass Air Flow (MAF) sensor (intake air mass) is displayed.

Notes on display field 4:

0 1 X X X = Diagnosis carried out, diagnosis OK

1 0 X X X = Diagnosis carried out, malfunction recognized, diagnosis is continued

The display positions marked with X do not have to be fulfilled to evaluate the diagnostic status and/or result.

01-218

X	X	X	X	X	Meaning of 5-digit "Diagnostic Status and/or Result"
					1 = Diagnostic conditions during test drive (approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear) ♦ Engine speed: 1600 RPM - 4500 RPM (⇒ display group 003) ♦ Intake air through Mass Air Flow (MAF) sensor: 22 g/sec - 56 g/sec (⇒ display group 019) ♦ Throttle angle: (⇒ display group 003) Manual transmission: 8 - 45% Automatic Transmission: 8 - 20% Value "0" = Diagnostic conditions not fulfilled Value "1" = Diagnostic conditions fulfilled
					2 = Pressure measurement w/EVAP canister purge regulator valve completely closed Value "0" = Pressure measurement not completed yet Value "1" = Pressure measurement completed
					3 = Pressure measurement w/EVAP canister purge regulator valve completely open Value "0" = Pressure measurement not completed yet Value "1" = Pressure measurement completed
					4 = Diagnostic status

	Value "0" = Diagnosis not carried out yet and/or diagnosis continued (with EVAP canister malfunction recognized) Value "1" = Diagnosis carried out (no further diagnosis until engine stop)
	5 = Diagnosis result Value "0" = Diagnosis OK Value "1" = Diagnosis not OK (EVAP canister malfunction recognized)

01-219

Display group 031 (Operating conditions when combustion misfiring is recognized):

Notes:

- *If the malfunction "Combustion misfiring recognized" and "Cyl. X Combustion misfiring recognized" are stored in DTC memory, display groups 031, 037, 038 and 039 are used to carry out a selective diagnosis.*
- *Display group 031 shows the operating conditions that are present at the moment the malfunction is recognized. However, the operating conditions are only displayed if combustion misfiring is recognized by the Engine Control Module (ECM) and stored in DTC memory. If there is more combustion misfiring that has to be displayed, the operating conditions of the most recently recognized combustion misfiring is displayed.*
- *If the malfunction "Combustion misfiring" is stored in the DTC memory, at the same time a counter is set to the value of "40". This counter is displayed under display field 4 when display group 029 is called. If combustion misfiring is no longer recognized during the next 40 warm-up phases, the malfunctions in DTC memory and the operating conditions are erased.*

Display shows	Display specified value	Designation/diagnosis
Basic setting 31 1 2 3 4	... RPM	1 = Lowest engine speed at which combustion misfiring was recognized
	... RPM	2 = Highest engine speed at which combustion misfiring was recognized
	__._%	3 = Lowest engine load at which combustion misfiring was recognized
	__._%	4 = Highest engine load at which combustion misfiring was recognized

01-220

Display group 032 [Longest and shortest flank rise and flank fall time (response time) of the voltage signal for bank 1 heated oxygen sensor 1]

Display group 033 [Longest and shortest flank rise and flank fall time (response time) of the voltage signal for bank 2 heated oxygen sensor 2]

Display group 034 [Number of flank rise and flank fall tests]

Notes on display group 032, 033 and 034:

- *If the value of the heated oxygen sensor diagnosis is not set to "0" in display group 029, display field 1 during regeneration of the readiness code, and/or there is a malfunction in the DTC memory that relates to the heated oxygen sensors, display groups 032, 033 and 034, as well as display groups 042 and 043 are used to carry out a selective diagnosis.*

- *The Engine Control Module (ECM) checks the flank rise and/or flank fall time (response time) of the voltage signal for the heated oxygen sensors in front of three way catalytic converter after every start with diagnostic conditions fulfilled ⇒ display group 042.*

- *The display values for display group 034 are incremented with each diagnosis that is carried out, whether the diagnosis is recognized as OK or not OK. If the flank rise and/or flank fall time is recognized as OK during the first diagnosis, the display values are increased by the value "1" and the diagnosis is discontinued. If the limit values (flank rise time 90 ms/flank fall time 85 ms) are exceeded, the diagnosis is recognized as not OK. The flank rise and/or fall times now continue to be checked, whereby the display values are incremented with each additional diagnosis. However, the limit values can also be exceeded because combustion misfiring is recognized. In this case, the malfunction "Bank X probe Y signal too slow" is not stored in DTC memory, but" Cyl. x Combustion misfiring recognized" is stored.*

01-221

- *Display groups 032 and 033 show the highest and lowest flank rise and/or flank fall time for all tests carried out (number of tests ⇒ display group 034).*

- *If during one of the next tests, a higher or lower diagnosis time is recognized, the current value is overwritten. With diagnostic conditions fulfilled, display group 043 shows the current flank rise and flank fall times. After diagnosis is ended, the diagnosis times shown are those that were recognized at the last diagnosis that was carried out.*

- *The display values are only reset by erasing the DTC memory. Selective observation times can be defined by resetting the display values.*

Display shows	Display specified value	Designation/diagnosis
Basic setting 32 1 2 3 4	0.0 - 260.0 ms	1 = Highest flank rise time, bank 1, heated oxygen sensor 1 (limit value: 90 ms)
	0.0 - 260.0 ms	2 = Lowest flank rise time, bank 1, heated oxygen sensor 1 (limit value: 90 ms)
	0.0 - 260.0 ms	3 = Highest flank fall time, bank 1, heated oxygen sensor 1 (limit value: 100 ms)
	0.0 - 260.0 ms	4 = Lowest flank fall time, bank 1, heated oxygen sensor 1 (limit value: 100 ms)

01-222

Display shows	Display specified value	Designation/diagnosis
Basic setting 33 1 2 3 4	0.0 - 260.0 ms	1 = Highest flank rise time, bank 2, heated oxygen sensor 1 (limit value: 90 ms)
	0.0 - 260.0 ms	2 = Lowest flank rise time, bank 2, heated oxygen sensor 1 (limit value: 90 ms)
	0.0 - 260.0 ms	3 = Highest flank fall time, bank 2, heated oxygen sensor 1 (limit value: 100 ms)
	0.0 - 260.0 ms	4 = Lowest flank fall time, bank 2, heated oxygen sensor 1 (limit value: 100 ms)

Display shows	Display specified value	Designation/diagnosis
Basic setting 34 1 2 3 4	0 - 255	1 = Number of flank rise tests, bank 1, heated oxygen sensor 1
	0 - 255	2 = Number of flank fall tests, bank 1, heated oxygen sensor 1
	0 - 255	3 = Number of flank rise tests, bank 2, heated oxygen sensor 1
	0 - 255	4 = Number of flank fall tests, bank 2, heated oxygen sensor 1

01-223

Display group 035 (Three way catalytic converter diagnosis, bank 1)

Display group 036 (Three way catalytic converter diagnosis, bank 2)

Notes on display groups 035 and 036:

- *If the value of the three way catalytic converter diagnosis is not set to "0" in display group 029, display field 1 during regeneration of the readiness code and/or there is a malfunction in DTC memory that relates to the three way catalytic converter, display groups 035, 036 and 044 are used to carry out a selective diagnosis.*

- *At each start, when the diagnostic conditions are fulfilled (⇒ display group 044) the Engine Control Module (ECM) checks the deterioration rate of the three way catalytic converter by the heated oxygen sensors in front of and behind the three way catalytic converter.*

- *Display fields 1 and 2 display the largest and smallest rate of deterioration of all the diagnoses carried out. If a higher or lower rate of deterioration is recognized at the next diagnosis, the current value is overwritten.*

- *The number of three way catalytic converter diagnoses (display field 3) is incremented each time a diagnosis is carried out, no matter whether the diagnosis is considered OK or not OK.*

- *If the rate of deterioration is recognized as OK during the first diagnosis, the number of three way catalytic converter diagnoses is increased by the value of "1" and the diagnosis is discontinued.*

- *If the limit value of 50% is exceeded, the diagnosis is recognized as not OK. In this case, the rate of deterioration continues to be checked, while the number of three way catalytic converter diagnoses is incremented with each additional diagnosis.*

- *Display field 4 shows the current rate of deterioration recognized at the last diagnosis.*

- *The display values are only reset by erasing the DTC memory. Selective observation time periods can be defined by resetting the display values.*

01-224

Display shows	Display specified value	Designation/diagnosis
Basic setting 35 1 2 3 4	0 - 100%	1 = Maximum deterioration rate, bank 1 (limit value: 50%)
	0 - 100%	2 = Minimum deterioration rate, bank 1 (limit value: 50%)
	0 - 255%	3 = Number of three way catalytic converter diagnoses, bank 1
	0 - 100%	4 = Last calculated deterioration rate, bank 1 (limit value: 50%)

Display shows	Display specified value	Designation/diagnosis
Basic setting 36 1 2 3 4	0 - 100%	1 = Maximum deterioration rate, bank 2 (limit value: 50%)
	0 - 100%	2 = Minimum deterioration rate, bank 2 (limit value: 50%)
	0 - 255	3 = Number of three way catalytic converter diagnoses, bank 2
	0 - 100%	4 = Last calculated deterioration rate, bank 2 (limit value: 50%)

01-225

Display group 037 (Sensor wheel learning value)

Notes:

- *In order to be able to monitor and/or record combustion misfiring, a sensor wheel is necessary. The flywheel (starter ring gear) is used as the sensor wheel. The flywheel is checked for mechanical damage after each start, i.e. specified tolerances must not be exceeded.*
- *Small malfunctions in the flywheel (e.g. teeth worn) are compensated by learning values. If greater damage is recognized, the malfunction "engine speed sensor wheel tooth error recognized" is stored in the DTC memory.*
- *The sensor wheel is tested during a deceleration fuel shut-off in the engine speed range from 2200 -4000 RPM. In order to get a result, the length of the deceleration fuel shut off must be approx. 10 sec.*

Display shows	Display specified value	Designation/diagnosis
Basic setting 37 1 2 3 4	X X	1 = Sensor wheel condition and/or result
	_____	2 = _____
	_____	3 = _____
	_____	4 = _____

01-226

Note on display field 1

X	X	Meaning of 2-digit "Sensor Wheel Status and/or Result"
		1 = Sensor wheel result Value "0" = Sensor wheel OK Value "1" = Sensor wheel not OK
		2 =Sensor wheel status Value "0" = Sensor wheel not checked since start of trip Value "1" = Sensor wheel checked since start of trip

01-227

Display group 038 (Current data on combustion misfiring recognition)

Notes:

- *If the malfunctions "Combustion misfiring recognized" and "Cyl. X Combustion misfiring recognized"are stored in DTC memory, display groups 031, 037, 038 and 039 are used to carry out a selective diagnosis.*
- *Using display group 038, after a repair you can drive again in the load and engine speed range that was displayed in display group 031 as the combustion misfiring range and evaluated again.*

Display shows	Display/specified value	Designation/diagnosis
Basic setting 38 1 2 3 4	... RPM	1 = Momentary engine speed
	__._%	2 = Momentary engine load
	0 - 255	3 = Combustion misfiring per 1000 RPM (1000th revolution interval)
	X X X X X X	4 = Combustion misfiring including in this "1000th revolution interval"

01-228

Note on display field 4:

Value "0" = Cylinder without combustion misfiring

Value "1" = Cylinder with combustion misfiring

X	X	X	X	X	X	Meaning of 6-digit display
						1 = Cylinder 1
						2 = Cylinder 2
						3 = Cylinder 3
						4 = Cylinder 4
						5 = Cylinder 5
						6 = Cylinder 6

01-229

Display group 039 (Statistical data on combustion misfiring recognition)

Notes:

- *Combustion misfiring recognition always occurs in relation to 1000 RPM (1000th revolution interval).*
- *The display values are reset only be erasing DTC memory. Selected observation time periods can be defined by resetting the display values.*

Display shows	Display specified value	Designation/diagnosis
Basic setting 39 1 2 3 4	0 - 255	1 = Highest number of instances of combustion misfiring within 1000 RPM
	0 - 255	2 = Number of "1000the revolution intervals" with 30 and/or more than 30 instances of combustion misfiring
	0 - 255	3 = Number of "1000th revolution intervals" with 5 and/or more than 5 instances of combustion misfiring
	X X X X X X	4 = Cylinders involved in combustion misfiring during the entire statistics period

01-230

Note on display field 2:

The display shows the number of "1000th revolution intervals" in which 30 or more than 30 instances of combustion misfiring were recognized.

Note on display field 3:

The display shows the number of "1000th revolution intervals" in which 5 or more than 5 instances of combustion misfiring were recognized.

Note on display field 4:

Value "0" = Cylinder without combustion misfiring

Value "1" = Cylinder with combustion misfiring

X	X	X	X	X	X	Meaning of 6-digit display
						1 = Cylinder 1
						2 = Cylinder 2
						3 = Cylinder 3
						4 = Cylinder 4
						5 = Cylinder 5
						6 = Cylinder 6

01-231

Display group 040 (Heating current of oxygen sensors in front of and behind three way catalytic converter)

Display shows	Display specified value	Designation/diagnosis
Basic setting 40 1 2 3 4	At cold start, greater than 3 A after approx. 40 sec: 0.7 - 1.0 A	1 = Heating current, bank 1, heated oxygen sensor 1
		2 = Heating current, bank 2, heated oxygen sensor 1
	At cold start, greater than 3 A after approx. 80 sec: 1.2 - 1.4 A	3 = Heating current, bank 1, heated oxygen sensor 2
		4 = Heating current, bank 2, heated oxygen sensor 2

Notes:

- *The current values specified apply only at when battery positive voltage (B+) is 12-14 volts ⇒ display group 001, display field 4.*
- *The heating of the heated oxygen sensors in front of the three way catalytic converter is switched on with the fuel pump relay, i.e. immediately at engine start.*
- *The heating of the heated oxygen sensors behind the three way catalytic converter is not switched on immediately at engine start, but only when the calculated exhaust gas temperature in the three way catalytic converter exceeds 308° C (586° F) ⇒ display group 044, display field 2. In order to reach an exhaust gas temperature of 308° C (586° F) in the three way catalytic converter after a cold start, the car must be driven about 20 sec. with an increased engine speed of 2500 RPM.*

01-232

Display group 041 (Voltage signal of oxygen sensors in front of and behind three way catalytic converter)

Display shows	Display specified value	Designation/diagnosis
Basic setting 41 1 2 3 4	_.___ V	1 = Voltage signal, bank 1, heated oxygen sensor 1 ⇒ display group 010, display field 3
	_.___ V	2 = Voltage signal, bank 2, heated oxygen sensor 1 ⇒ display group 010, display field 4
	_.___ V	3 = Voltage signal, bank 1, heated oxygen sensor 2
	_.___ V	4 = Voltage signal, bank 2, heated oxygen sensor 2

Notes on display field 3 and 4:

- *The voltage signals of bank 1 heated oxygen sensor 2 and/or bank 2 heated oxygen sensor 2 should not be evaluated until at least 50 sec. after the oxygen sensor heating is switched on ⇒ display group 040.*

- *With cold engine and ignition on, a voltage signal of 0.400 volts is displayed in all four display fields. With very hot engine and ignition on, a signal of 0.000 volts is displayed in display field 3 and 4.*

- *The voltage signal of the heated oxygen sensors behind the three way catalytic converter must lie between about 0.5 volts and 0.6 volts with a three way catalytic converter with sufficient effect (conversion). During deceleration fuel shut off, the voltage signal must be less than 0.1 volts constantly. During operation with wide open throttle enrichment, the voltage signal must be greater than 0.6 volts.*

- *If there is wide open throttle (signal voltage during wide open throttle enrichment greater than 0.6 volts) with a new three way catalytic converter, distance driven less than 5,000 km (3,000 mi.) after a preceding deceleration fuel shut off (signal*

voltage less than 0.1 volts), the transition from low to high voltage can be delayed up to 10 seconds. If acceleration is uniform after a preceding deceleration fuel shut off, the transition from low to high voltage is delayed up to 3 minutes.

Display group 042 [Diagnostic conditions for diagnosis of the flank rise and/or flank fall time (response time) of the voltage signal of heated oxygen sensors in front of three way catalytic converters]

Notes:

- *If the value of the oxygen sensor diagnosis is not set to "0" in display group 029, display field 1 during regeneration of the readiness code and/or there is a malfunction in DTC memory that relates to the oxygen sensor, display group 042 can be used to set up the diagnostic conditions (display fields 3 and 4) and the diagnostic result (display field 2) can be read.*

- *If the diagnostic conditions are fulfilled, the Engine Control Module (ECM) checks the flank rise and/or flank fall time (response time) of the voltage signal of the heated oxygen sensors in front of the three way catalytic converters at each start, which is displayed each time display groups 032, 033, 034 and 43 are displayed.*

- *The diagnostic conditions are only fulfilled during a trip of approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear. If the diagnostic conditions are fulfilled, diagnosis is active. In order to get a diagnosis result, you have to drive approx. 1-1/2 to 5 minutes under diagnostic conditions.*

- *If a malfunction is stored in DTC memory, which affects diagnostic conditions 1 and 2, the diagnostic conditions can not be achieved. In this case repair the malfunction ⇒ "DTC memory, checking and erasing ⇒ page 01-13 .*

- *If a malfunction is stored that involves the heated oxygen sensors in front of three way catalytic converters, the diagnostic conditions can be achieved, but the diagnosis result can not be OK.*

- *If the flank rise and flank fall time is recognized as OK during the first diagnosis, the diagnosis is discontinued. If the times are recognized as not OK, the diagnosis of the flank rise and/or flank fall time is continued. If the diagnosis will be repeated selectively or after an OK diagnosis, switch engine off and restart.*

01-234

Display shows	Display specified value	Designation/diagnosis
Basic setting 42 1 2 3 4	400 - 640 °C	1 = Calculated exhaust gas temperature in front of three way catalytic converter (calculated value inside control module)
	X X X X X X X X	2 = Diagnosis status and/or result
	X X X X X X X X	3 = Diagnostic conditions 1 for heated oxygen sensor diagnosis (response time of heated oxygen sensor)
	X X X X X X X X	4 = Diagnostic conditions 2 for heated oxygen sensor diagnosis (response time of heated oxygen sensor)

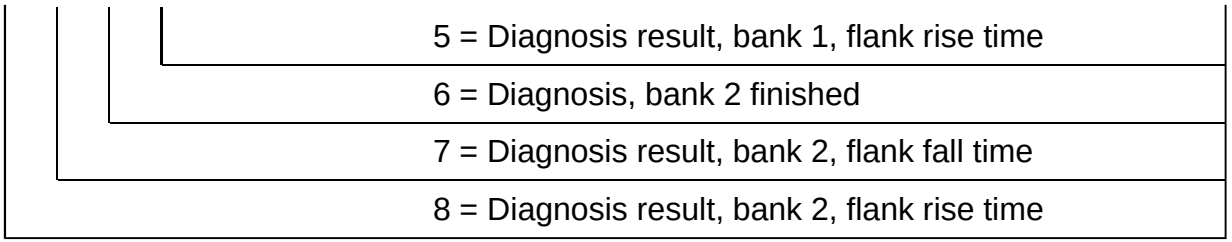
Note on display field 2:

If after diagnosis all 8 displays are "1" and the engine is stopped and started again, display values 1 and 2 are reset to "0" and values 3 to 8 remain at "1." If during the trip diagnostic conditions (display fields 3 and 4) are achieved, display values 1 and 2 are set to "1" (diagnosis active) and display values 3 to 8 are set to"0".

Value "0": Diagnosis not active and/or diagnosis not finished and/or diagnosis result not OK

Value "1": Diagnosis active and/or diagnosis finished (whether OK or not OK) and/or diagnosis result OK

X	X	X	X	X	X	X	X	**Meaning of 8-digit "Diagnosis status and/or result"**
								1 = Diagnosis, bank 1 active
								2 = Diagnosis, bank 2 active
								3 = Diagnosis, bank 1 finished
								4 = Diagnosis result, bank 1, flank fall time


5 = Diagnosis result, bank 1, flank rise time
6 = Diagnosis, bank 2 finished
7 = Diagnosis result, bank 2, flank fall time
8 = Diagnosis result, bank 2, flank rise time

01-235

Notes on display field 3 and 4:

Value "0" = Diagnosis condition not fulfilled.

Value "1" = Diagnosis condition fulfilled.

X	X	X	X	X	X	X	X	**Meaning of 8-digit "Diagnosis condition 1"**
								1 = Coolant temperature: 70 - 110 °C (⇒ display group 001)
								2 = Engine load: 27 - 66% (⇒ display group 003)
								3 = Engine speed: 1800 - 2700 RPM (⇒ display group 003)
								4 = Fuel throughput after engine start [only fulfilled after approx. 3 min. trip (no idle) after start]
								5 = No fuel enrichment (during diagnosis no enrichment can occur ⇒ display group 019)
								6 = Closed throttle position switch open (⇒ display group 008)
								7 = Oxygen sensor control, bank 2 active (⇒ display group 008)
								8 = Oxygen sensor control, bank 1 active (⇒ display group 007)

01-236

X	X	X	X	X	X	X	X	Meaning of 8-digit "Diagnosis condition 2"
								1 = Constant drive
								2 = Oxygen sensor heating, bank 1 OK (⇒ display group 040)
								3 = Oxygen sensor heating, bank 2 OK (⇒ display group 040)
								4 = Vehicle speed: 80 - 100 km/h (50 to 63 mph) (⇒ display group 003)
								5 = Value does not drop below or exceed oxygen sensor control limit for bank 2 (⇒ display group 008)
								6 = Value does not drop below or exceed oxygen sensor control limit for bank 1 (⇒ display group 007)
								7 = Calculated exhaust gas temperature in front of three way catalytic converter: 400 - 640 °C (752 - 1184 °F)
								8 = Throttle angle constant (⇒ display group 003)

Re: 5 and 6: With a lot of fuel vapor on the EVAP system diagnosis, use function 04 to carry out "Basic Setting" (EVAP system automatically shut off during function 04).

01-237

Display group 043 [Current flank rise and/or flank fall time (response time) of voltage signal of heated oxygen sensors in front of three way catalytic converters]

Notes:

- *When diagnostic conditions are fulfilled (⇒ display group 042) display group 043 shows the current flank rise and/or flank fall times. After diagnosis is ended, the diagnostic times shown are those that were recognized when the most recent diagnosis was carried out.*

- *If the limit values (flank rise time 90 ms/flank fall time 85 ms) are exceeded, the diagnosis is recognized as not OK. The flank rise and/or flank fall times now continue to be checked, while the display values in display group 034 are incremented with each additional test. However, the limit values can also be exceeded because of combustion misfiring being recognized. In this case, the malfunction "Bank X probe Y signal too slow" is not stored in DTC memory, but" Cyl. x Combustion misfiring recognized" is stored.*

Display shows	Display specified value	Designation/diagnosis
Basic setting 43 1 2 3 4	0.0 - 260.0 ms	1 = Flank rise time, bank 1, heated oxygen sensor 1 (limit value: 90 ms)
	0.0 - 260.0 ms	2 = Flank fall time, bank 1, heated oxygen sensor 1 (limit value: 85 ms)
	0.0 - 260.0 ms	3 = Flank rise time, bank 2, heated oxygen sensor 1 (limit value: 90 ms)
	0.0 - 260.0 ms	4 = Flank fall time, bank 2, heated oxygen sensor 1 (limit value: 85 ms)

01-238

Display group 044 (Diagnostic conditions for three way catalytic converter diagnosis, bank 1 and bank 2)

Notes:

- *When the diagnostic conditions are fulfilled (display fields 3 and 4) by using the heated oxygen sensors in front of and behind the three way catalytic converter, at each start the Engine Control Module (ECM) carries out a diagnosis of the three way catalytic converter. During this diagnosis, the deterioration rate of the three way catalytic converter is determined. The deterioration rate of the three way catalytic converter is displayed when display groups 035 and 036 are displayed. However, this diagnosis is "cross-blocked." That means that before the three way catalytic converter diagnosis can be evaluated, a result of the heated oxygen sensor diagnosis must be available to the Engine Control Module (ECM).*

- *If a malfunction is stored in DTC memory that affects the heated oxygen sensors in front of or behind the three way catalytic converter, the heated oxygen sensor diagnosis can not be carried out and the three way catalytic converter diagnosis can not be evaluated.*

- *If in display group 029, display field 1 the value of the three way catalytic converter diagnosis is not set to "0" during regeneration of the readiness code, and/or a malfunction is stored in DTC memory that affects the three way catalytic converter, display group 044 can be used to selectively call the diagnostic conditions (display fields 3 and 4).*

- *If in display group 029, display field 1 the value of the three way catalytic converter diagnosis and the value of the heated oxygen sensor diagnosis are not set to "0" during regeneration of the readiness code, display group 044, display field 1 can be used to determine whether the three way catalytic converter diagnosis has been carried out inside the engine control module, but the value of the three way catalytic converter diagnosis under display group 029, display field 1 can not be set to "0" because the heated oxygen sensor diagnosis has not been carried out.*

01-239

- *The diagnostic conditions are only achieved during a trip of approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear. However, the diagnostic conditions are only displayed 4 minutes after engine start, because until that time diagnosis is prohibited. If the diagnostic conditions are fulfilled, diagnosis is active. Now, obtaining a diagnostic result requires a test drive of approx. 1-1/2 to 5 min under the diagnostic conditions.*

- *If a malfunction is stored in DTC memory that affects diagnostic conditions 1 and 2, the diagnostic conditions can not be obtained. In this case repair the malfunction ⇒ "DTC memory, checking and erasing," ⇒ page 01-13 . If a malfunction is stored that involves the heated oxygen sensors in front of three way catalytic converter, the diagnostic conditions can be achieved, but the diagnosis result can not be OK.*

- *If the effect of the three way catalytic converter is recognized as OK during the first diagnosis, the diagnosis is discontinued. If the effect (conversion) is recognized as not OK, the three way catalytic converter diagnosis is continued. If the diagnosis will be repeated selectively and/or repeated after an OK diagnosis, stop the engine and start again.*

Display shows	**Display specified value**	**Designation/diagnosis**
Basic setting 44 1 2 3 4	X _ X _ X X X X	1 = Diagnosis status
	400 - 640 ° C	2 = Calculated temperature in three way catalytic converter (calculated value inside the engine control module)
	X X X X X X X X	3 = Diagnostic conditions 1 for three way catalytic converter diagnosis
	X X X X X X X X	4 = Diagnostic conditions 2 for three way catalytic converter diagnosis

01-240

Notes on display field 1:

Display field 1 shows which diagnosis has been carried out or has not been carried out yet. If the three way catalytic converter diagnosis is carried out inside the engine control module, but the heated oxygen sensor diagnosis has not been carried out yet, the three way catalytic converter diagnosis is not evaluated and therefore the deterioration rate is not set in display groups 035 and 036.

Value "0" = Diagnosis carried out

Value "1" = Diagnosis not carried out

X	X	X	X	X	X	Meaning of 6-digit display
						1 = Diagnosis flank fall time, bank 1, heated oxygen sensor 1
						2 = Diagnosis flank rise time, bank 1, heated oxygen sensor 1
						3 = Diagnosis flank fall time, bank 2, heated oxygen sensor 1
						4 = Diagnosis flank rise time, bank 2, heated oxygen sensor 1
						5 = ----------
						6 = Three way catalytic converter diagnosis, bank 1
						7 = ----------
						8 = Three way catalytic converter diagnosis, bank 2

01-241

Notes on display field 3 and 4:

Value "0" = Diagnosis condition not fulfilled

Value "1" = Diagnosis condition fulfilled

X	X	X	X	X	X	X	X	**Meaning of 8-digit display "Diagnosis condition 1"**
								1 = Coolant temperature: 70 - 110 ° C (⇒ display group 001)
								2 = Oxygen sensor heating (all four O2S heaters; ⇒ display group 040)
								3 = Momentary constant drive
								4 = No fuel enrichment (during diagnosis no enrichment can occur)
								5 = Long-term constant drive
								6 = Closed throttle position switch open (⇒ display group 002)
								7 = Oxygen sensor control, bank 2 active (⇒ display group 008)
								8 = Oxygen sensor control, bank 1 active (⇒ display group 007)

01-242

X	X	X	X	X	X	X	X	**Meaning of 8-digit display "Diagnosis Condition 2"**
								1 = Three way catalytic converter diagnosis, bank 2 active
								2 = Engine load: 27 - 66% (⇒ display group 003)
								3 = Engine speed: 1800 - 2700 RPM (⇒ display group 003)
								4 = Vehicle speed: 80 - 100 km/h (50 - 63 mph) (⇒ display group 003)
								5 = Three way catalytic converter diagnosis, bank 1 active
								6 = Value does not drop below or exceed oxygen sensor control limit (⇒ display group 007 and/or 008)
								7 = Intake air mass through Mass Air Flow (MAF) sensor: 12 - 36 g/sec (⇒ display group 019)
								8 = Calculated exhaust gas temperature in three way catalytic converter: 400 - 640 ° C (752 - 1184 ° F)

01-243

Display group 045

Notes:

- *Display group 045 is only assigned on vehicles with tank diagnosis.*
- *Vehicles with EVAP system/tank diagnosis can be recognized by Diagnostic Pump for Fuel System -V144-.*

Display shows	Display/specified value	Designation
Basic setting 45 1 2 3 4	--------	----------
	--------	----------
	--------	----------
	--------	----------

01-244

Display group 099

Display shows	Display/specified value	Designation/diagnosis
Basic setting 99 1 2 3 4	... RPM	1 = Momentary engine speed ⇒ Display group 003, display field 1
	...%	2 = Momentary engine load ⇒ display group 003, display field 2
	... °C	3 = Coolant temperature ⇒ display group 001, display field 1
	λ-Control OFF and/or λ-Control ON	4 = Oxygen sensor control OFF in "Basic Setting" function 04; Oxygen sensor control ON in "Read Measuring Value Block" function 08

Notes on display field 4:

- *For defined troubleshooting, the oxygen sensor control is switched off when display group 099 is selected under "Basic Setting" function 04, and switched on when display group 099 is selected under "Read Measuring Value Block"function 08. When leaving "Basic Setting" function 04, oxygen sensor control is automatically active again.*

- *You can switch back and forth between "Basic Setting" function 04 and "Read Measuring Value Block" function 08 by pressing buttons -4- and -8- on the VAG 1551 scan tool.*

01-245

Engine Control Module (ECM), coding

Notes:

- *During Engine Control Module (ECM) identification, a 5-digit code must always be displayed.*
- *Coding is carried out with the VAG 1551 scan tool.*

If coding that corresponds to the vehicle is not displayed or if the ECM has to be replaced, the ECM must be coded as follows:

- Connect VAG 1551 scan tool ⇒ 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.

Rapid data transfer Q
07 - Code Control Module

Indicated on display

- Press -Q- button to confirm input.

Code control module Q
Enter code number XXXXX (0-32000)

Indicated on display

- Enter code number for vehicle and press -Q- button to confirm input. Coding variations ⇒ page 01-247 .

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

If the following is indicated on the display:

A non-released code number has been entered.

01-246

8D0906266 2.8l V6/2V MPI OBD2 D01
Coding 01051 WSC 06388

➢ ECM identification and entered coding (e.g. 01051) are shown.

- Press → button.

Rapid data transfer HELP
Select function XX

➢ Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06.

Rapid data transfer Q
06 - End Output

➢ Indicated on display

- Press -Q- button to confirm input.

Rapid data transfer HELP
Insert address word XX

➢ Indicated on display

Notes:

The ECM uses the coding that is entered and displayed only after the ignition has been switched off once. Incorrect coding leads to:

- *Driving performance problems (jerky shifting, rough load change, etc.)*
- *Increased fuel consumption*
- *Elevated exhaust gas values*
- *Decrease in transmission service life*
- *Storing of malfunctions that are not present in DTC memory*
- *Functions are not carried out (oxygen sensor control, triggering of the EVAP canister system, etc.).*

Engine Control Module (ECM), coding variations

Country/exhaust gas	Drive/auxiliary function	Transmission	Vehicle type
00 = ----------	0 = Front wheel drive without traction control	0 = 5-speed manual transmission	0 = ----------
01 = Vehicle with Exhaust Gas Recirculation (EGR)	1 = Front wheel drive with traction control	1 = ----------	1 = A4
02 = ----------	2 = All wheel drive without traction control	2 = ----------	2 = ----------
03 = ----------	3 = ----------	3 = ----------	3 = ----------
04 = ----------	4 = ----------	4 = ----------	4 = ----------
05 = ----------	5 = ----------	5 = Automatic trans. 01V	5 = ----------
06 = ----------	6 = ----------	6 = ----------	6 = ----------

01-248

Note:

The code number will be composed as shown in the following example:

- Audi A4	1
- Automatic 01V	5
- Front wheel drive without traction control:	0
- Vehicle with EGR:	0 1
- Code number:	0 1 0 5 1

Note:

Vehicles with traction control (ATC) can be recognized by the ATC indicator light in the instrument cluster and/or by ABS control module identification using the ABS On Board Diagnostic (OBD) program.

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

01-249

Read Measuring Value Block (scan tool function 08)

Notes:

- *Display groups 000-045 and 099 are identical to the display groups 000-045 and 099 described with "Basic Setting" function 04.*
- *After "Basic Setting" function 04 is called up, the ECM initiates the operations described below. These operations are not carried out after calling up "Read Measuring Value Block" function 08.*

Operations after calling up "Basic Setting" function 04:

- Constant ignition timing point of 12° BTDC will be output in idle
- Digital idle speed control is blocked
- Evaporative Emissions (EVAP) canister purge regulator valve is closed
- A/C compressor is shut off

- EGR valve is closed
- No coolant temperature correction; fixed value 80 ° C (176 ° F)
- Learning values are relearned (idle and CO content are adjusted automatically)

- Connect VAG 1551 scan tool and operate until display shows "Select function XX" ⇒ page 01-7 .

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

Note:

After the HELP button is pressed, an overview of possible functions is printed out.

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.

Rapid data transfer **HELP** **08 - Read Measuring Value Block**	⇐	Indicated on display

- Press -Q- button to confirm input.

Read measuring value block **HELP** **Input display group number XXX**	⇐	Indicated on display

Note:

After the HELP button is pressed, the procedure for input of the display group number is printed out.

- Input desired display group number according to display group overview ⇒ "Basic Setting" function 04, ⇒ page 01-150 .

Note:

Display group number 001 is used as an example to show the input

sequence.

01-251

- Push buttons -0-, -0- and -1- for display group number 001.

Read measuring value block Q

Input display group number 001

➢ Indicated on display

- Press -Q- button to confirm input.

Read measuring value block 1

1 2 3 4

➢ Display fields 1 through 4 are indicated on the display.

Notes:

- *To change to another display group, proceed as follows:*

Display group	VAG 1551 scan tool	VAG 1552 scan tool
Higher	Press -3- button	Press ↑ button
Lower	Press -1- button	Press ↓ button
Skipped	Press -C- button	Press -C- button

- *The values in display fields 1 through 10 are shown in decimal form in display group 000.*
- *The current 3-digit display group number is shown without the first zero. In display groups 000 to 009, the number is shown without the first two zeroes.*
- *When the printer is switched on, the current display is printed on the paper strip.*
- *Every time the PRINT button is pressed, the current display is printed out again.*

01-252

- If the specified values are obtained in all display fields, press → button.

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

- Press buttons -0- and -6- to select "End Output" function 06.

Rapid data transfer Q **06 - End Output**	Indicated on display

- Press -Q- button to confirm input.

Rapid data transfer HELP **Insert address word XX**	Indicated on display

01-253

Read Individual Measuring Values (scan tool function 09)

Note:

The function "Read Individual Measuring Values" can be selected with buttons -0- and -9-. However, no display fields can be selected or information displayed since for OBD II the ECM does not currently carry out function 09.

01-254

Adaptation (scan tool function 10)

Note:

The function "Adaptation" is selected with buttons -1- and -0-. Display groups 001 and 002 can be called with function 10. If the stored adaptation value is changed in display group 001 and/or display group 002 by input of another adaptation value, this has no effect on the fuel injection and ignition system.

01-255

Test box VAG 1598/19, connecting

CAUTION!

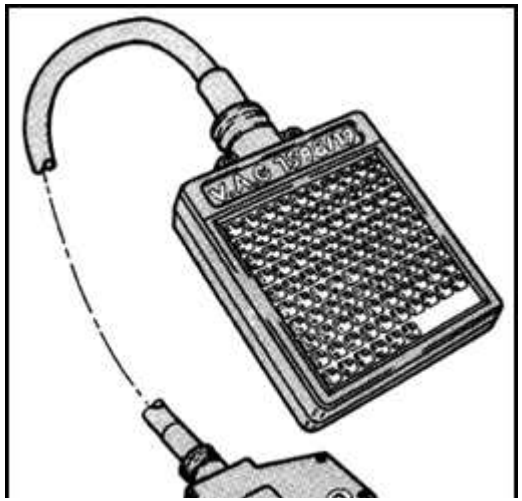
Wait at least 30 seconds after the ignition has been switched off before disconnecting the ECM harness connector.

Note:

By disconnecting the ECM, the permanent voltage supply is disconnected and therefore the learning values, DTC memory and readiness code are erased.

- Switch ignition off.

- Remove ECM.



- Connect test box VAG 1598/19 to wiring harness.

Note:

Terminal assignments of the connectors A, B, C, D and E are identical to the socket assignments of the test box.

01-256

Readiness code, reading and generating

Note:

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 MIL switching on, has been operated at least once with positive results.

Note:

The readiness code is reset and/or erased every time:

- *DTC memory is erased (either with display group 01 function 05 or display group 33 mode 4)*
- *ECM harness connector is disconnected from ECM -J192- (e.g. connecting test box VAG 1598/19, replacing ECM, etc.)*
- *Battery is disconnected*

01-257

Reading readiness code

- Select VAG 1551 "Read Measuring Value Block" function 08, display group 029 ⇒ page 01-249 .

Note:

The readiness code can be displayed with the VAG 1551 and/or VAG 1552 scan tools, and also with address word 33, mode 1 (Diagnosis data).

Read measuring value block 29 →

1 2 3 4

Display shows display fields 1 through 4.

- Read readiness code in display field 1.

  Specified value: 000_00_0

Note:

The readiness code is set as soon as all display positions is display field 1 are "0."

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

If the readiness code is not set:

- Generate readiness code ⇒ page 01-258 .

01-258

Generating readiness code

Notes:

- *In order to generate the readiness code, a "mixed city and highway" drive (short test) has to be taken. A "mixed city and highway" drive is understood as approx. 1-1/2 to 5 minutes at 80-100 km/h (50-63 mph) with manual transmission in 4th or 5th gear, or automatic transmission selector lever in "D" position, preferably in 4th gear.*

- *If a malfunction is recognized and stored by the engine control module during a "mixed city and highway" trip, and/or the Malfunction Indicator Lamp (MIL) is switched on, the brief test can be interrupted by the technician and the malfunction repaired according to the diagnostic trouble code.*

- *If the readiness code has to be generated, the DTC memory should be checked (no faults should be stored) and erased (readiness code will be reset) before taking the "mixed city and highway" trip.*

01-259

Step 1: Preparation

- Start engine and let idle.
- Connect VAG 1551 or VAG 1552 scan tool, switch on printer and select address word 01 (⇒ page 01-7)
- Check and erase DTC memory (⇒ page 01-13).

  No malfunctions may be stored. If necessary:

  - Repair malfunctions.
  - Erase DTC memory.
  - Stop engine and start again.
  - Test drive and, as a check, check and erase DTC memory again.
- After checking and erasing DTC memory, let engine run at idle again.

Step 2: System readiness checking and creating

- Select VAG 1551 "Read Measuring Value Block" function 08, display group 29 ⇒ page 01-249 .

Read measuring value block 29 →

1 2 3 4

Display shows display fields 1 through 4. Specified values:

- Display field 1: 111_01_1 (readiness code)
- Display field 2: 00000000 (trip status display)
- Display field 3: 0
- Display field 4: 0

- Press → button.

Read measuring value block →

Input display group number XXX

Indicated on display

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

Read measuring value block 1 →

1 2 3 4

Display shows display fields 1 through 4.

01-261

- Check display fields 1 and 3:

Display field	Designation	Specified value
1	Coolant temperature	Greater than 70 ° C
3	Altitude display	Less than 48

Note on display field 1:

If the displayed value is less than 70 ° C, let the vehicle warm up until at least 70 ° C coolant temperature is attained.

Note on display field 3:

If the displayed value is greater than 48 (corresponds to an altitude of approx. 1800 m) a diagnosis of the exhaust return can not be conducted due to altitude. Setting the readiness code at this altitude is not possible.

If specified values are attained ⇒ Step 3

01-262

Step 3: Road test

In order to set the readiness code, a "mixed city and highway" drive is required. The necessary driving conditions for the test drive ar listed in the following chart:

Speed	Between 50 and 62 mph
RPM	1800 - 2700 RPM Manual: 5th gear Automatic: Drive mode "4"
Drive Profile	After attaining the specified speed (50-62 mph) implement a short deceleration phase (approx. 5-8 seconds), then drive if possible at constant specified speed and RPM range
Drive Time	Approx. 1-1/2 to 5 minutes (as long as necessary)

01-263

Step 4: Checking readiness code

- Select VAG 1551 "Read Measuring Value Block" function 08, display group 29 ⇒ page 01-249 .

Read measuring value block 29 →

1 2 3 4

Display shows display fields 1 through 4. Specified values:

- Display field 1: 000_00_0 (readiness code)
- Display field 2: 111_01_1 (trip status display)
- Display field 3: 0
- Display field 4: 0

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

01-264

If, during regeneration of the readiness code, the trip status display is set to "1" but the corresponding readiness code display is not set to "0" the diagnosis was carried out but not recognized as OK by the ECM.

In this case, DTC memory should be checked for malfunctions and/or to carry out a selective diagnosis:

- For three way catalytic convertor diagnosis (bank 1 and bank 2), also check display groups 035, 036 and 044.
- For EVAP system leak diagnosis, also check display group 030.
- For heated oxygen sensor diagnosis, also check display groups 032, 033, 034, 041, 042 and 043.
- For oxygen sensor heating diagnosis, also check display group 040.
- For Exhaust Gas Recirculation (EGR) throughput diagnosis, also check display group 017.

01-265

Engine Control Module (ECM), replacing

Notes:

- *By disconnecting the ECM, the permanent voltage supply is disconnected and therefore the learning values, DTC memory and readiness code are erased.*

- *If uneven idle occurs after the ECM is installed, let the engine idle for a few minutes so that the learning process can be carried out ⇒ page 01-150 , Basic Setting, display groups 007 and/or 008.*

If the engine control module is replaced, carry out the following work steps in the specified sequence.

- Switch ignition on.

- Connect VAG 1551 scan tool and operate until control module identification is displayed ⇒ page 01-7 .

8D0906266 2.8l V6/2V MPI OBD2	**D01**
Coding 01051	**WSC 06388**

ECM identification and the coding are shown on the display.

- Print out ECM identification and compare coding to table of coding variations ⇒ page 01-247 .

- Press → button.

Rapid data transfer	**HELP**
Select function XX	

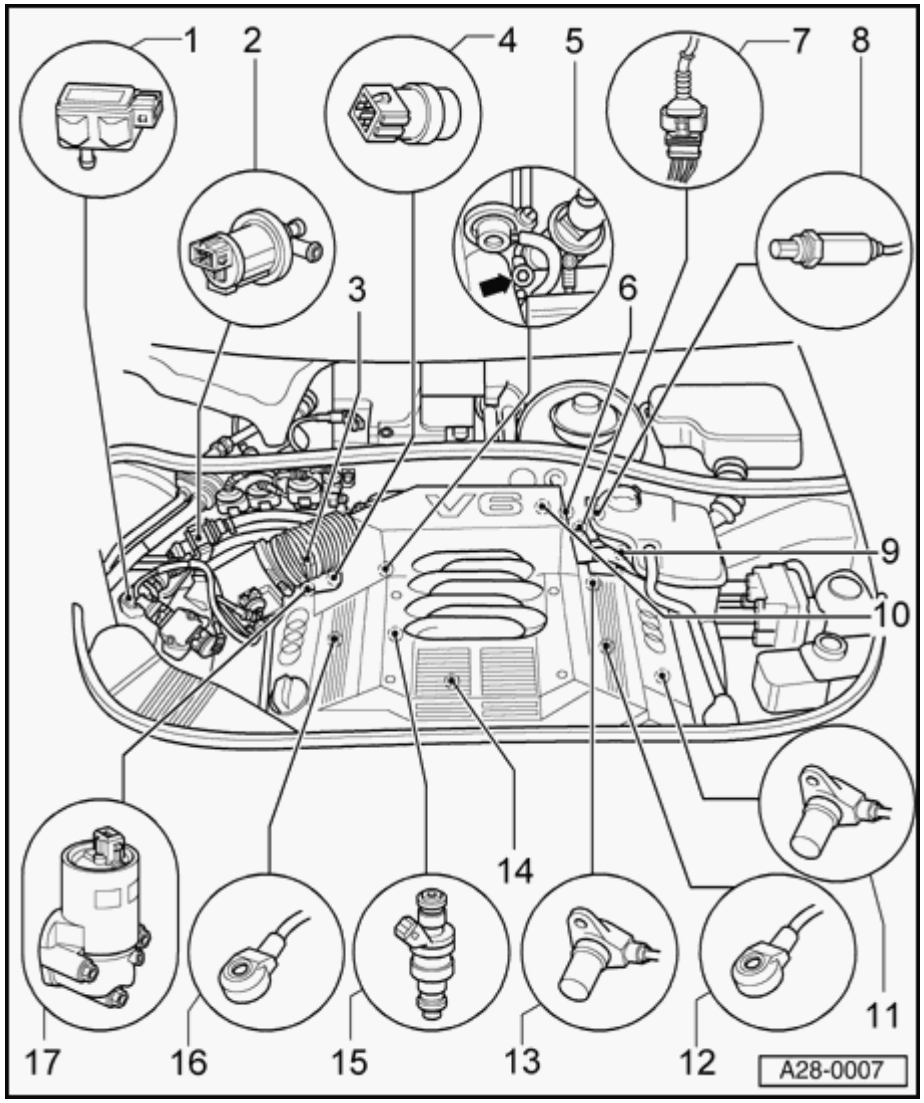
➢ Indicated on display

- Switch ignition off.

01-266

- Remove faulty ECM.
- Install new ECM.
- Re-code ECM with appropriate coding from table ⇒ page 01-245 .

24-1



Multiport Fuel Injection (MFI) and ignition system

Component overview

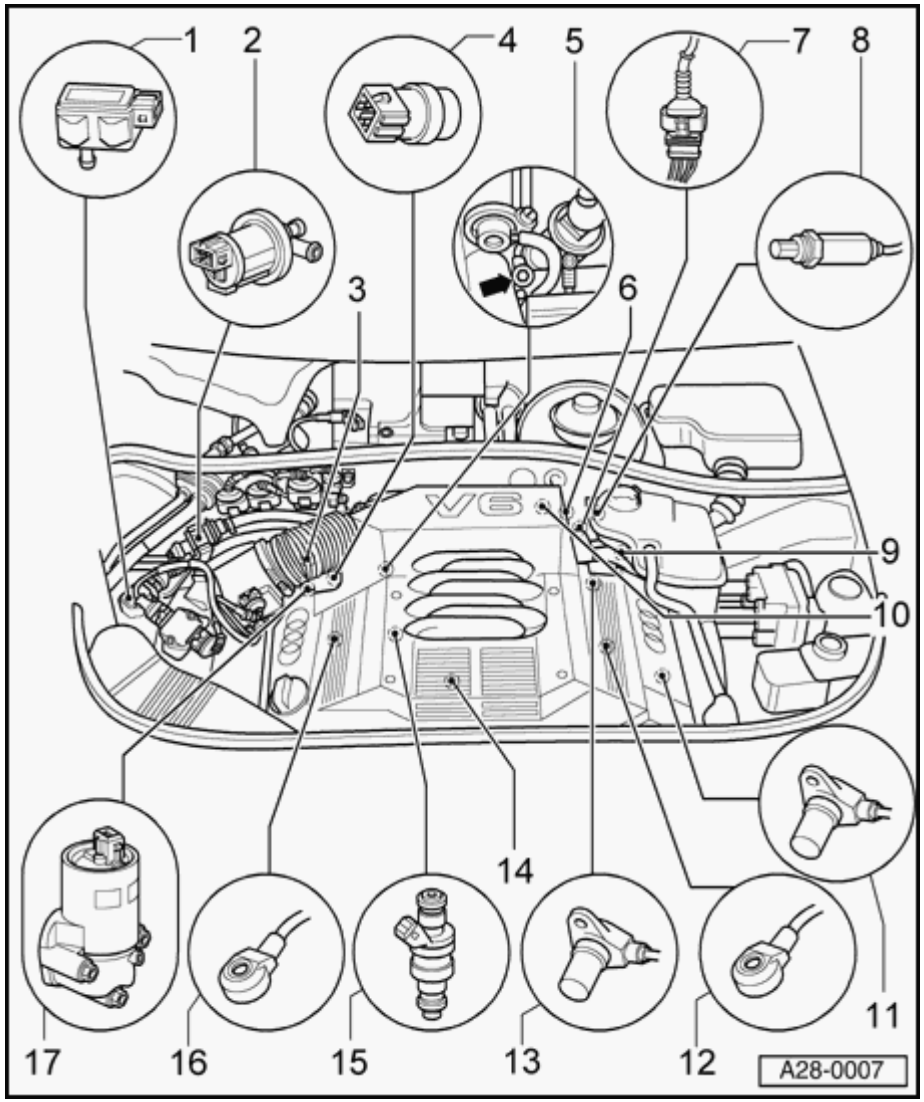
CAUTION!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

Not shown

- Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (bank 1, directly behind right-side three-way catalytic converter)
- Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- (bank 2, directly behind left-side three-way catalytic converter)

24-2



1 - Sensor for EVAP canister -G172-

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

3 - Fuel pressure regulator

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

- On coolant line behind cylinder head)

5 - Ground connection

- On intake manifold

6 - Harness connector

- 3-pin
- For Knock Sensor (KS) 2 -G66-

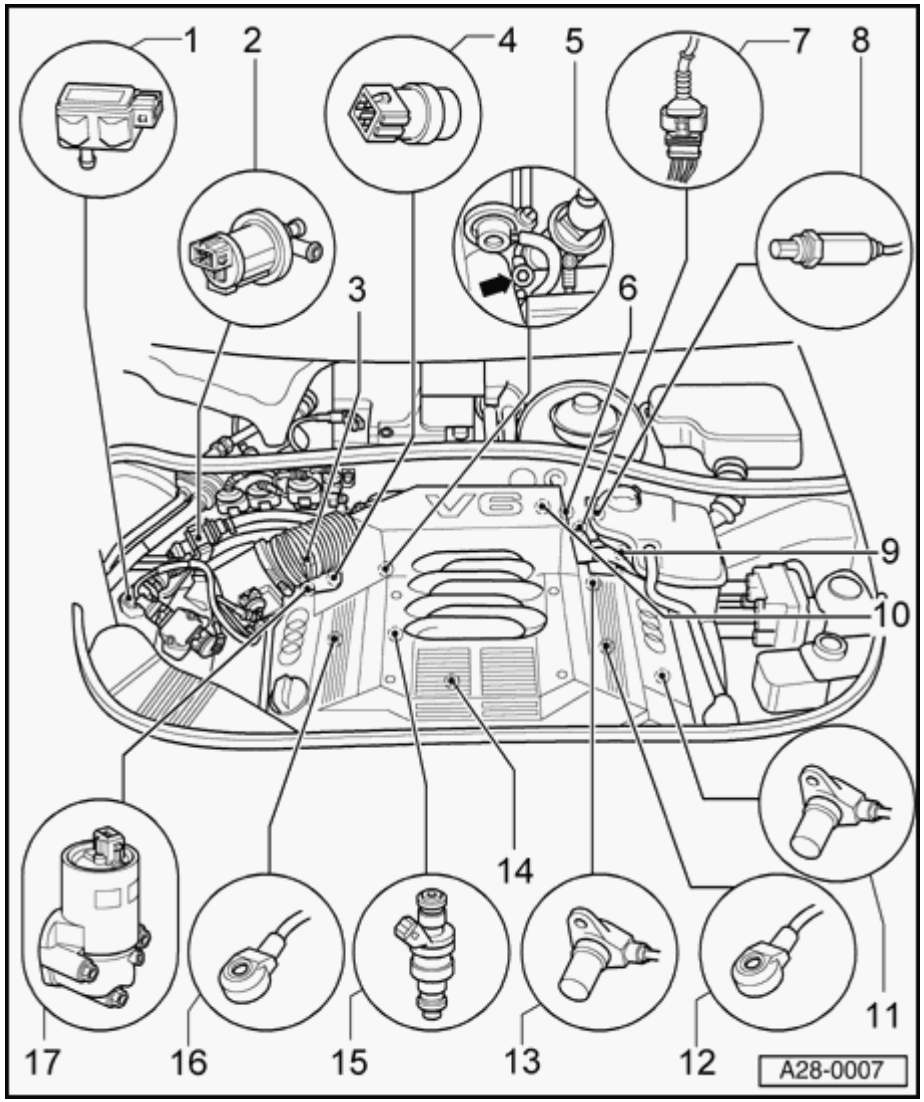
7 - Harness connector

- 4-pin, black
- For Heated Oxygen Sensor (HO2S) 2 -G108- and Oxygen Sensor (O2S) 2 heater -Z28- (bank 2)

8 - Heated Oxygen Sensor (HO2S) 2 -G108-

- Bank 2

24-3



9 - Harness connector

- 2-pin, black
- For EGR temperature sensor -G98-

10 - Harness connector

- 3-pin, white, voltage supply
- For ignition coils 1, 2 and 3, -N-, -N128- and -N158-

11 - Crankshaft Position (CKP) sensor -G4-

- Timing reference mark on left side of cylinder block

12 - Knock Sensor (KS) 2 -G66-

13 - Engine speed (RPM) sensor -G28-

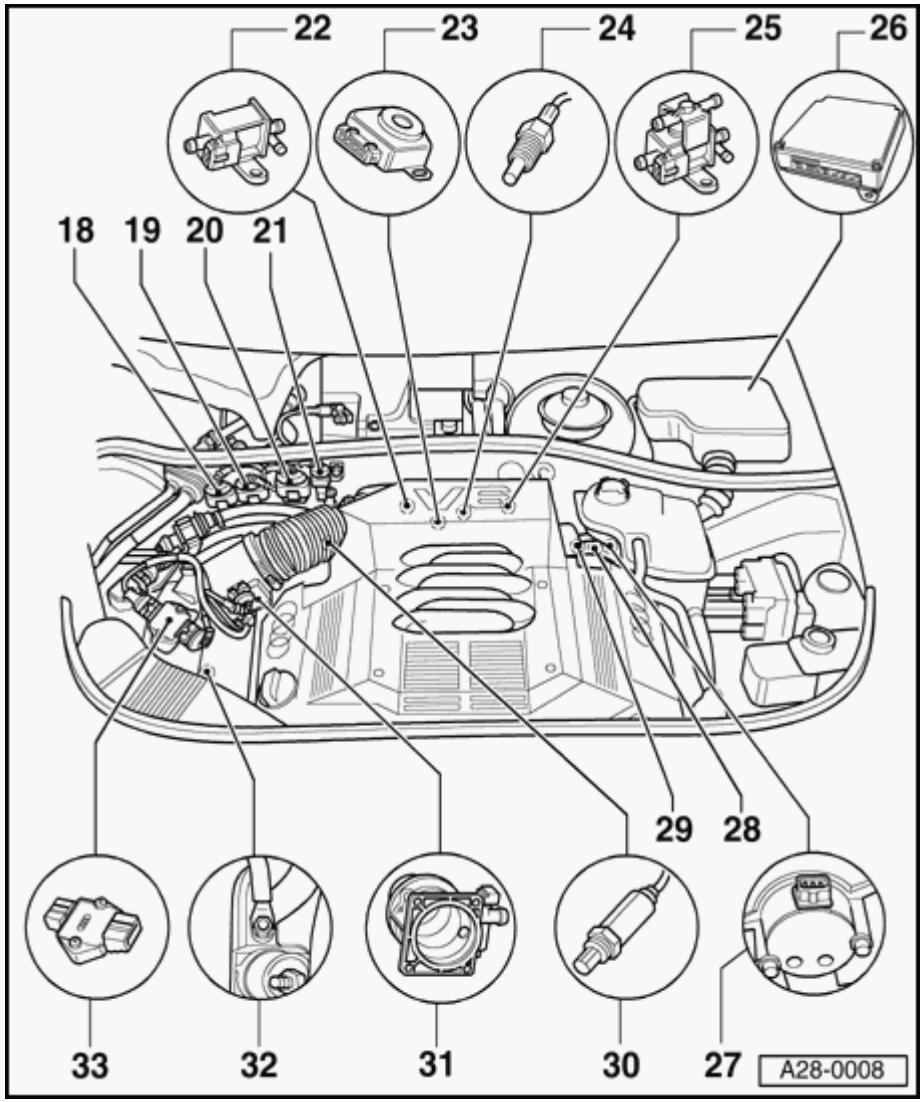
14 - Ignition coils 1, 2 and 3; -N-, -N128- and -N158-

15 - Fuel injectors

16 - Knock Sensor (KS) 1 -G61-

17 - Idle Air Control (IAC) valve -N71-

24-4



18 - Harness connector

- 4-pin, green
- For Heated Oxygen Sensor (HO2S) behind Three Way Catalytic Converter (TWC) -G130- and Oxygen Sensor (O2S) heater -Z29- (bank 1)

19 - Harness connector

- 4-pin, brown
- For Heated Oxygen Sensor (HO2S) 2 behind Three Way Catalytic Converter (TWC) -G131- and Oxygen Sensor (O2S) 2 heater -Z30- (bank 2)

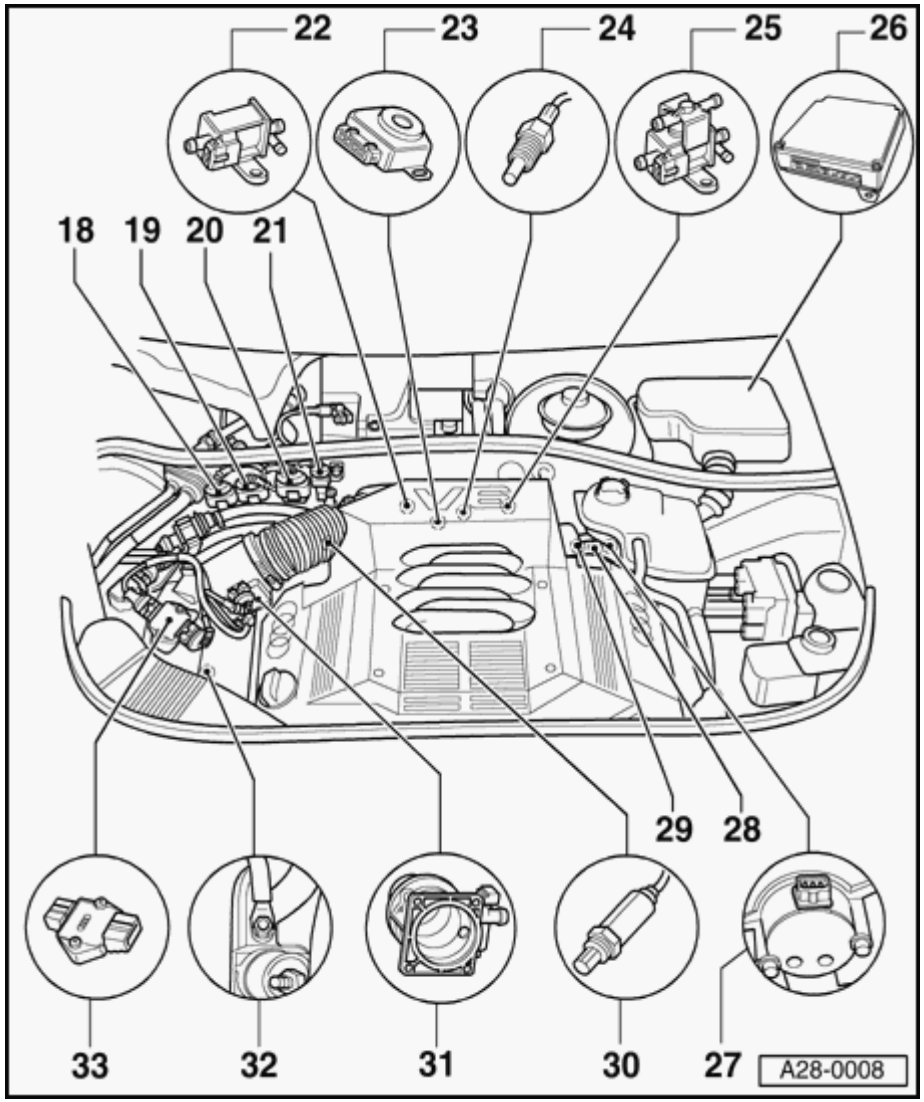
20 - Harness connector

- 4-pin, black
- For Heated Oxygen Sensor (HO2S) -G39- and Oxygen Sensor (O2S) heater -Z19- (bank 1)

21 - Harness connector

- 3-pin
- For Knock Sensor (KS) 1 -G61-

24-5



22 - Intake manifold change-over valve -N156-

23 - Throttle Position (TP) sensor -G69-

- With integral Closed Throttle Position (CTP) switch -F60-

24 - EGR temperature sensor -G98-

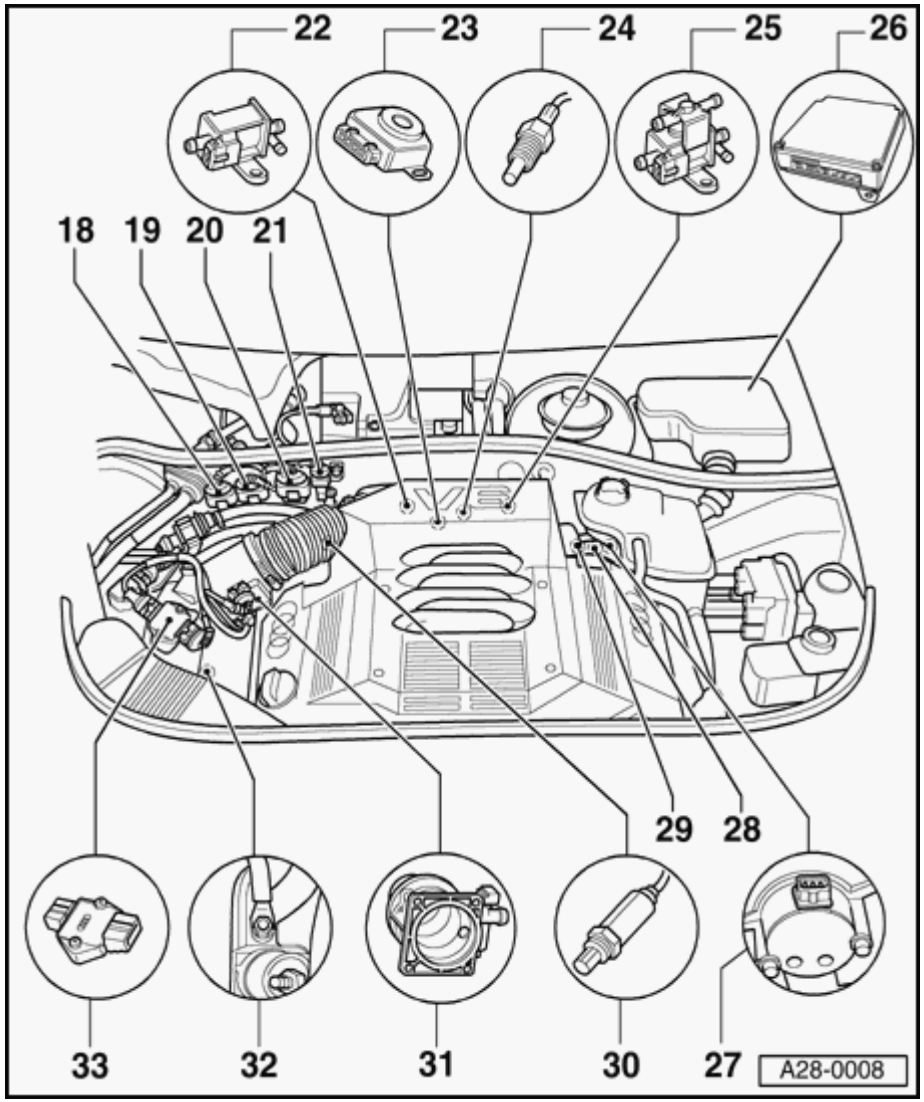
- On intake manifold under throttle body

25 - EGR vacuum regulator solenoid valve -N18-

26 - Engine Control Module (ECM) -J192-

- In plenum in electronics box

24-6



27 - Camshaft Position (CMP) sensor -G40-

28 - Harness connector

- 3-pin, gray
- For engine speed (RPM) sensor -G28-

29 - Harness connector

- 3-pin, black
- For Crankshaft Position (CKP) sensor -G4- (timing reference mark sensor)

30 - Heated Oxygen Sensor (HO2S) -G39-

- Bank 1

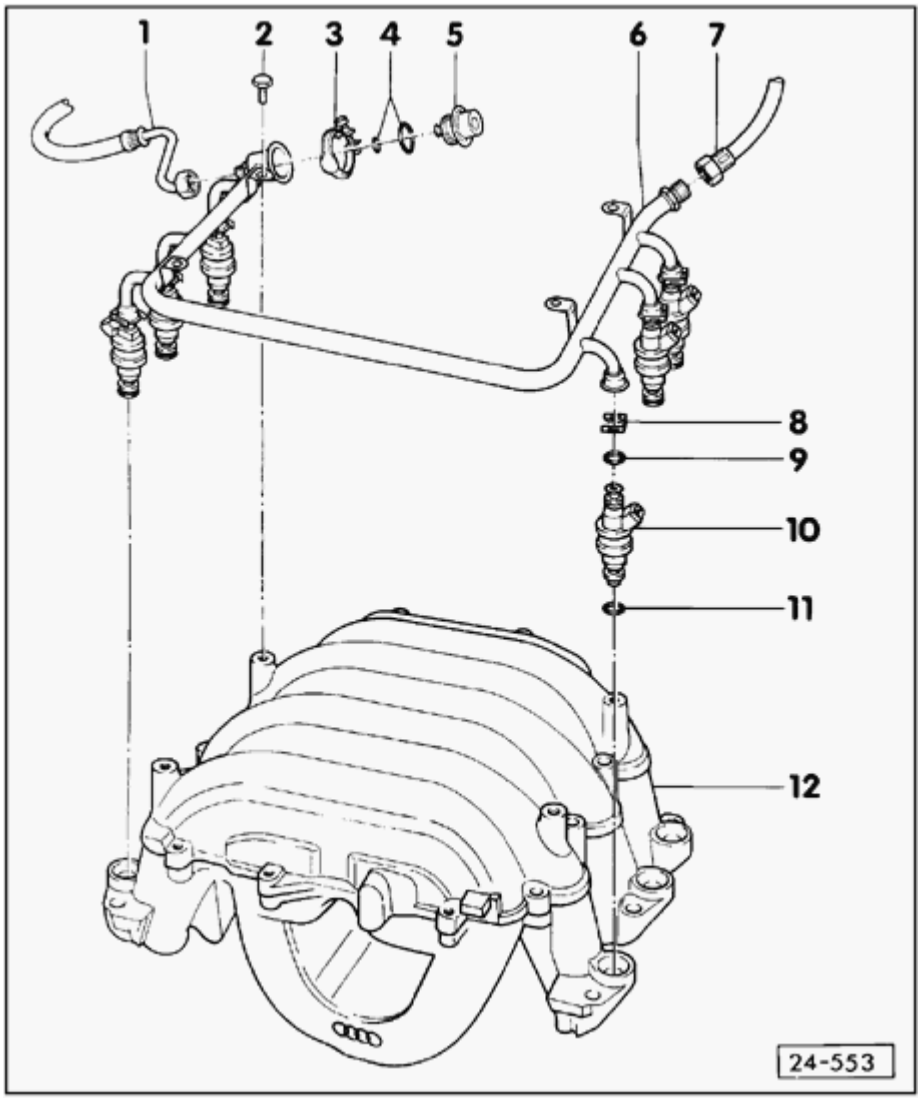
31 - Mass Air Flow (MAF) sensor -G70-

32 - Ground connection

- Right engine mount

33 - Power output stage -N122-

- For ignition coils
- A: 4-pin signal wires from ECM
- B: 3-pin ignition coil primary connections



Multiport Fuel Injection (MFI) system, servicing

CAUTION!

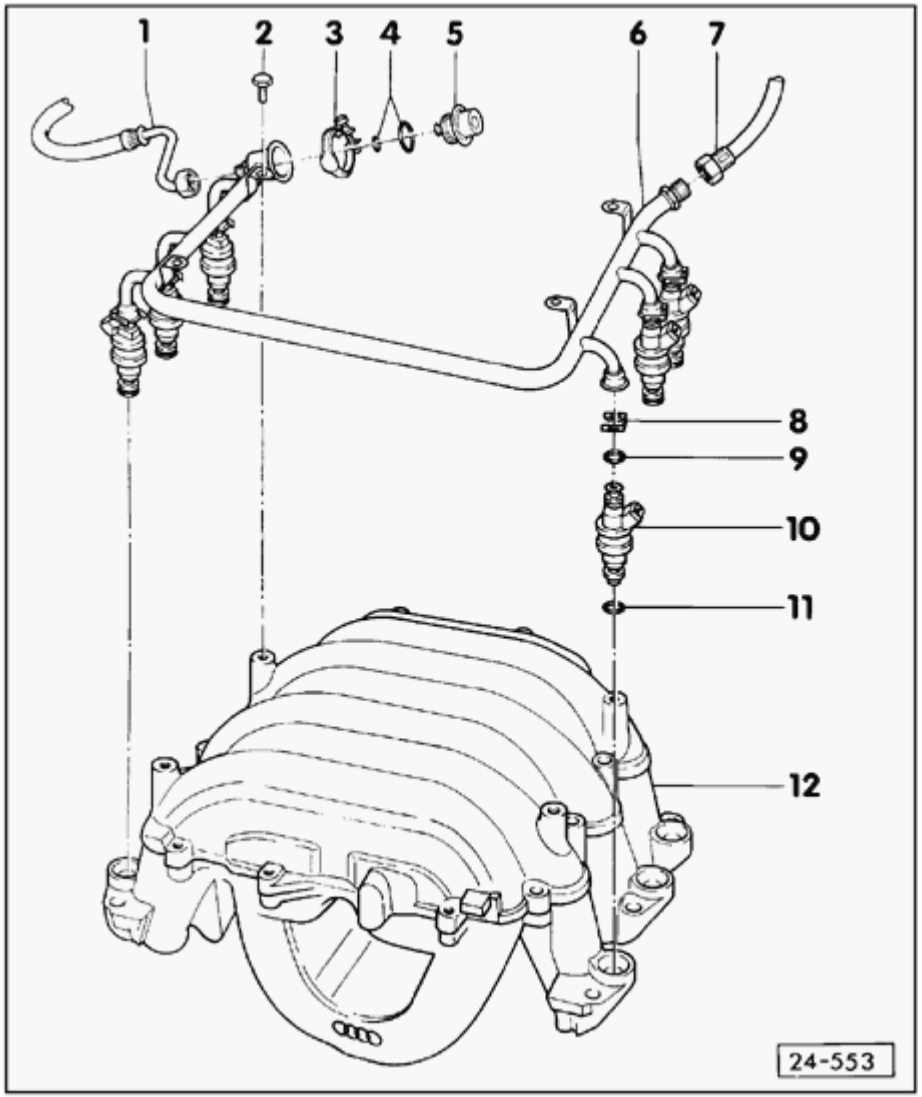
Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

Safety measures ⇒ page 24-13

Rules of cleanliness ⇒ page 24-15

Notes:

- *Before starting any repair work on the fuel injection system, check Diagnostic Trouble Code (DTC) memory and carry out component functional checks using the output Diagnostic Test Mode (DTM).*
- *Always replace seals.*
- *Check DTC memory (scan tool function 02) ⇒ page 01-13 .*
- *Output Diagnostic Test Mode (scan tool function 03) ⇒ page 01-145 .*



1 - Fuel return line

- 25 Nm (18 ft lb)

2 - 10 Nm (7 ft lb)

3 - Safety clip for pressure regulator

4 - O-ring

- Always replace

5 - Pressure regulator

- Check system and holding pressure ⇒ page 24-20

6 - Fuel rail

7 - Fuel supply line

- 25 Nm (18 ft lb)

8 - Fuel injector safety clips

9 - O-ring

- Always replace

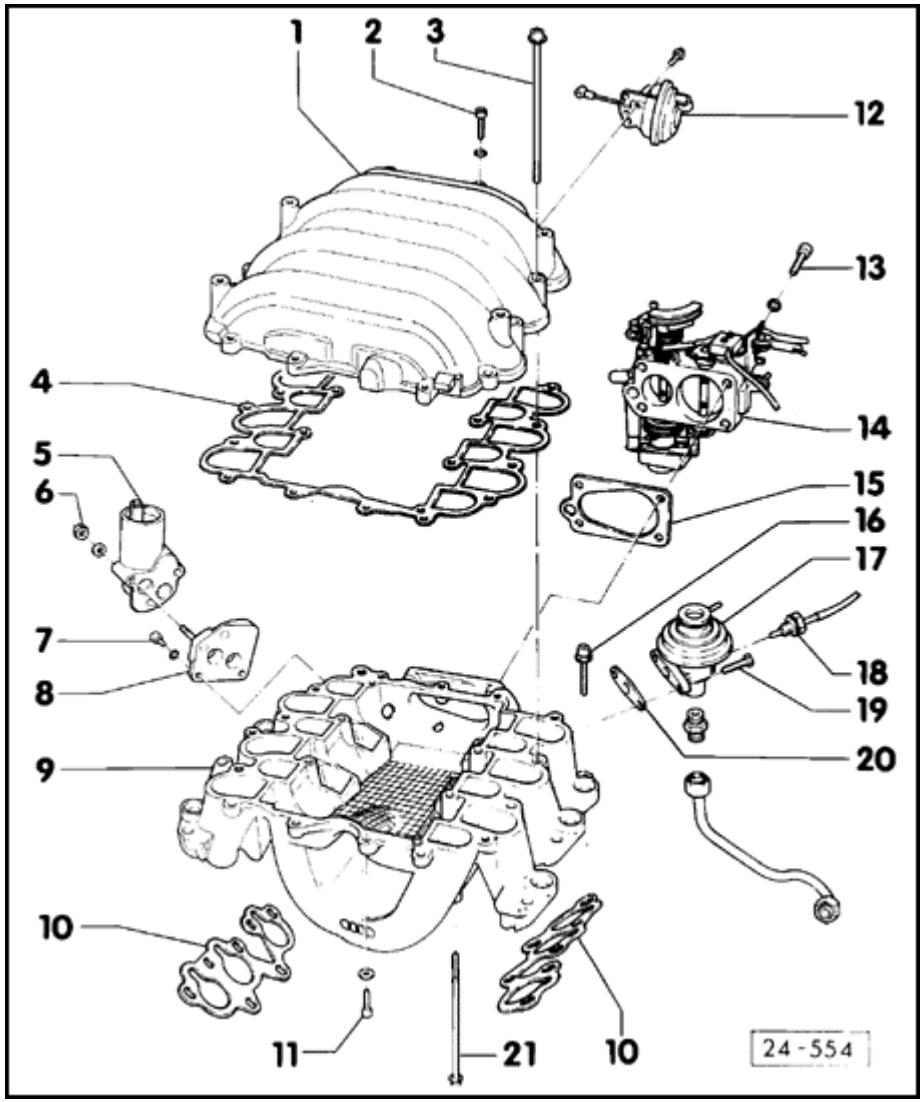
10 - Fuel injectors

- Checking ⇒ page 24-29

11 - O-ring

- Always replace

12 - Intake manifold



CAUTION!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

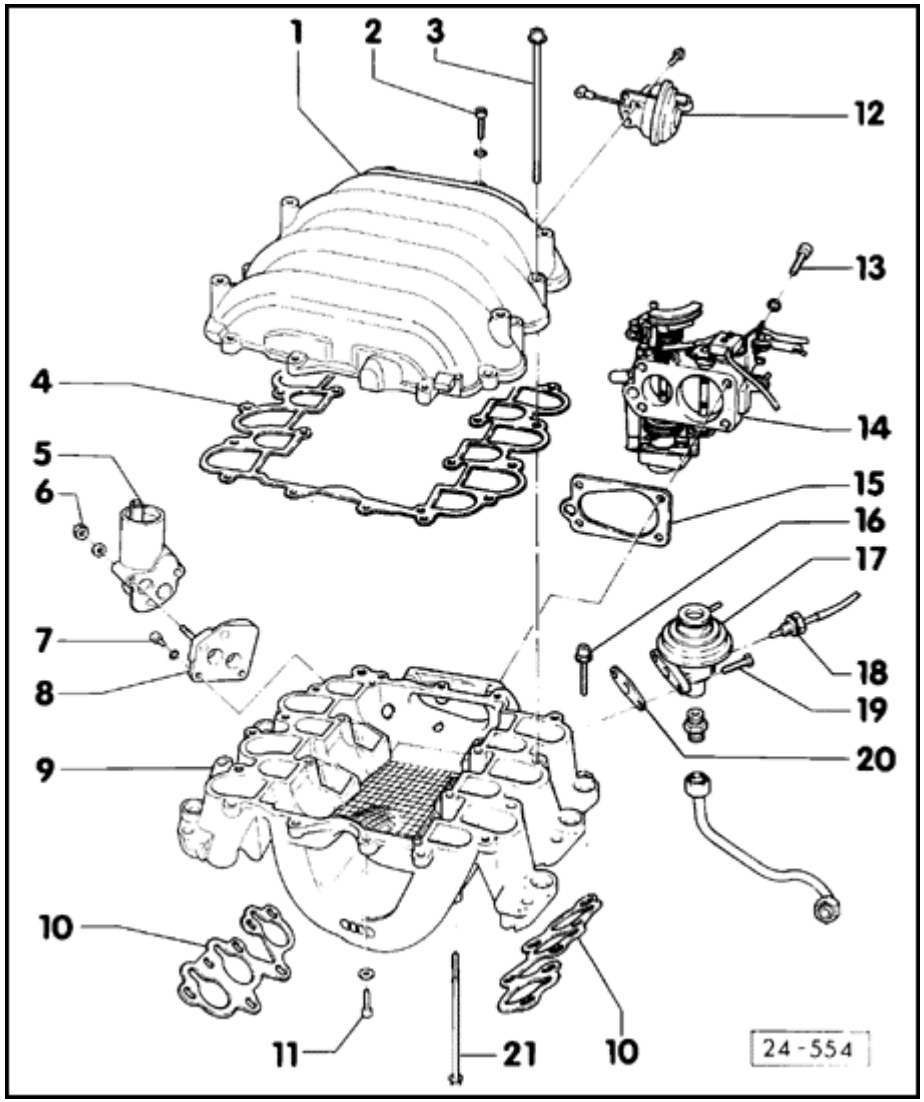
Safety measures ⇒ page 24-13

Rules of cleanliness ⇒ page 24-15

Notes:

- *Before starting any repair work on the fuel injection system, check Diagnostic Trouble Code (DTC) memory and carry out component functional checks using the output Diagnostic Test Mode (DTM).*
- *Always replace seals.*
- *Check DTC memory (scan tool function 02) ⇒ page 01-13 .*
- *Output Diagnostic Test Mode (scan tool function 03) ⇒ page 01-145 .*

24-10



1 - Intake manifold, upper

2 - 10 Nm (7 ft lb)

3 - 20 Nm (15 ft lb)

4 - Seal

- Always replace

5 - Idle Air Control (IAC) valve -N71-

- Checking ⇒ page 24-37

6 - 10 Nm (7 ft lb)

7 - 6 Nm (53 in. lb)

8 - Flange

9 - Intake manifold, lower

10 - Seal

- Always replace

11 - 10 Nm (7 ft lb)

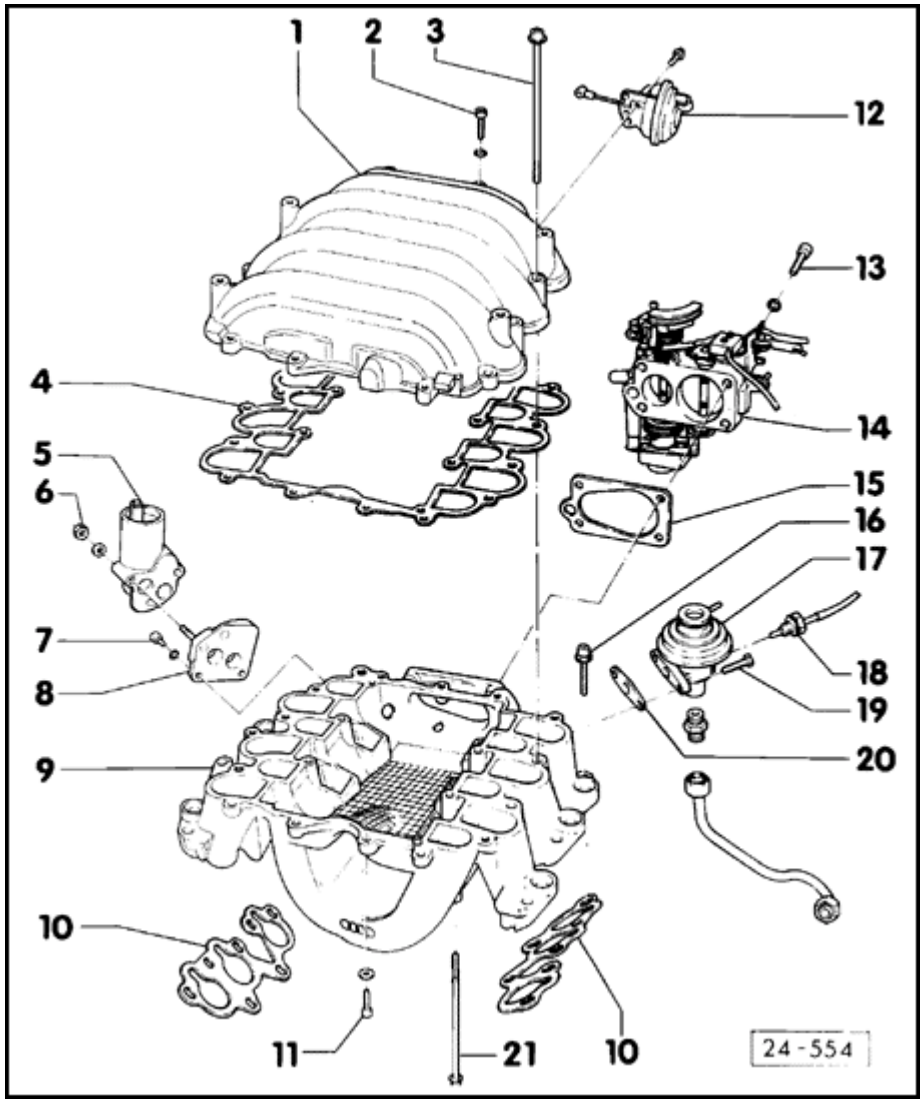
12 - Vacuum hose

- For intake manifold change-over valve

13 - 20 Nm (15 ft lb)

14 - Throttle body

24-11



15 - Seal

- Always replace

16 - 20 Nm (15 ft lb)

17 - EGR valve

18 - EGR temperature sensor -G98-

- On intake manifold lower section beneath throttle body

19 - 10 Nm (7 ft lb)

20 - Seal

- Always replace

21 - 10 Nm (7 ft lb)

24-12

Multiport fuel injection system, technical data

Engine code	AFC	
Idle speed • Not adjustable, maintained by idle speed control	650 - 750 RPM	
RPM upper limit • Actuated by switching off fuel injectors	6200 RPM	
CO content in front of Three Way Catalytic Converter (TWC) • Not adjustable, controlled by ECM	0.2 - 1.2 Vol. %	
Fuel pressure • At idle, with vacuum hose:	Connected	Approx. 3.2 - 3.8 bar (46 - 55 psi)
	Disconnected	Approx. 3.8 - 4.2 bar (55 - 61 psi)
Residual pressure • After 10 minutes with:	Cold engine	2.2 bar (32 psi)
	Warm engine	3.0 bar (44 psi)
Fuel injectors:	Spray pattern:	Approx. the same for all fuel

		injectors
	Fuel injection quantity using output Diagnostic Test Mode (DTM)	85 - 110 ml (2.9 - 3.7 oz.)
	Single fuel injector resistance:	Bosch: 15 - 17 Ω Siemens: 13.5 - 15.5 Ω

Safety measures

WARNING!

Be alert when working on or near the engine. High ignition secondary 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 the starter if the fuel injectors have been removed.***

Be sure the ignition is switched OFF, when:

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

BEFORE cranking the engine at starting RPM (such as for compression testing) disable the ignition and fuel injection systems:

- ***Disconnect the ignition coil power output stage.***
- ***Disconnect harness connectors from all fuel injectors.***
- ***After the work is completed, erase Diagnostic Trouble Code (DTC) memory.***

24-14

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***

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.***

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:

Avoid working with compressed air whenever possible.

Avoid moving the vehicle if possible.

Idle speed, checking

Notes:

- *Idle speed can NOT be manually adjusted.*
- *Idle speed is checked during "Basic Setting" function 04. After selecting function 04, the learning values for idle speed and oxygen sensor control are relearned (idle speed and CO content are adjusted independently)* ⇒ *page 01-150* .
- *CO content is controlled by oxygen sensor control for a specified value. Interference within oxygen sensor control will be captured via the On Board Diagnostic system and stored in DTC memory.*

Checking requirements:

- Engine coolant temperature: 85 ° C (185 ° F) minimum
- All electrical consumers must be switched off (A/C, rear window defroster, etc.)
- Transmission range selector lever in "P" or "N" position

- Throttle valve must be at closed throttle position (adjust accelerator pedal cable, if necessary)

⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*

- Exhaust system must be sealed leak-tight
- No pressure measuring devices connected to the system

- Check DTC memory ⇒ page 01-13 .

No DTCs should be stored. If necessary:

- Repair malfunction.
- Erase DTC memory.
- Stop off engine and restart.
- Test drive and, as a check, check DTC memory again.

Note:

Erasing DTC memory resets the readiness code (as well as with address word 01, "Basic Setting" function 04 and address word 33, mode 4).

- After checking DTC memory, start engine and let idle.

CAUTION!

Do NOT run tests or record displays while the radiator coolant fan is running.

- Using VAG 1551 scan tool, select "Basic

Setting" function 04, input display group number 003, and advance until the display shows "Basic Setting 3" ⇒ page 01-150 .

Basic Setting 3

1 2 3 4

Indicated on display

(1 to 4 = Display fields)

Notes:

- *Continue with test, if the engine coolant temperature exceeds 85° C (185° F) ⇒ display group 001, display field 1.*
- *In "Basic Setting" function 04 the EVAP canister purge regulator valve -N80- is closed ⇒ page 01-150 .*

- Briefly increase engine speed (RPM) and then let idle for another 2 minutes.
- Observe value in display field 1.

  Specified value: 650 to 750 RPM
- Push → button.
- Press buttons -0- and -6- to select "End Output" function 06.
- Press -Q- button to confirm input.

If the specified value is not obtained:

- Check DTC memory again ⇒ page 01-13 .

If the idle speed is too high and no DTC is found stored in DTC memory, perform the following checks:

- Check Closed Throttle Position (CTP) switch ⇒ page 24-73 .
- Check for large quantity intake air leak ⇒ Repair Group 01, "Basic Setting" function 04, display group 001, 005, 006, or 010.
- Check Idle Air Control (IAC) valve ⇒ page 24-37 .
- Check learning values for idle speed control ⇒ Repair Group 01, "Basic Setting" function 04, display group 004.

If idle speed is too low and no DTC is found stored in DTC memory; perform the following checks:

- Check Closed Throttle Position (CTP) switch ⇒ page 24-73 .
- Check Idle Air Control (IAC) valve ⇒ page 24-37 .

Fuel system pressure and residual pressure, checking

CAUTION!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

Checking requirements:

- Fuel pump relay OK; checking ⇒ page 24-24
- Fuel pump OK:

⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*

- Correct fuel filter installed
- Battery positive voltage (B+): 12 volts minimum

Checking system pressure



- Connect VAG 1318 pressure tester between fuel supply and fuel return

lines (tester handle shown in open position).

- Disconnect vacuum line (from fuel pressure regulator to intake manifold) at fuel pressure regulator and plug line.

Note:

If during subsequent pressure tests, fuel leaks from the pressure regulator vacuum connector, replace it.

24-21

- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger Fuel Pump (FP) relay -J17- ⇒ Repair Group 01.

If fuel pump does not run:

- Check fuel pump:

⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*

Specified value: 3.8 to 4.2 bar (55 - 61 psi)

If the specified value is not obtained:

- Replace fuel pressure regulator and perform pressure test again.

If the value is again not obtained:

- Check whether fuel pump or supply line is damaged (e.g. pinched), and replace if necessary.

If the specified value is exceeded:

- Check return line for damage (e.g. pinched locations), and replace if necessary.

Note:

During subsequent testing the engine should not run for an unnecessarily long time with the vacuum hose disconnected, because the increased fuel pressure will cause mixture enrichment which in turn may cause the oxygen sensor control limits to be exceeded and a malfunction to be registered and stored.

- Let engine idle.

  This will automatically halt the output DTM sequence.

- Switch off all electrical consumers (A/C etc.).

- Connect vacuum hose to pressure regulator and observe pressure drop on gauge.

  - Connecting the vacuum hose must reduce fuel pressure by approx. 0.5 bar (7 psi)

If change in pressure does not occur:

- Check vacuum hose for leaks (cracks, damage).

- Check vacuum hose on intake manifold for flow by disconnecting hose and blowing through it.

If there is no leakage and the vacuum connection is open:

- Replace fuel pressure regulator.

Residual pressure, checking

Residual pressure 10 minutes after stopping engine:

- With cold engine: 2.2 bar (32 psi) minimum
- With a hot engine: 3.0 bar (44 psi) minimum

Note:

The pressure increase for a hot engine is caused by fuel expansion and is normal.

If residual pressure is too low:

- Check pressure tester connections for leaks.
- Check fuel lines for leaks.
- Check fuel pump check valve:

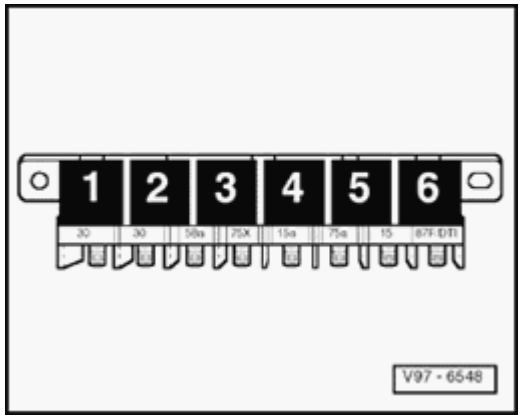
⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*

- Check fuel injectors for leaks ⇒ page 24-33 .

If there are no leaks and the fuel pump check valve is OK:

- Replace fuel pressure regulator and repeat residual pressure test.

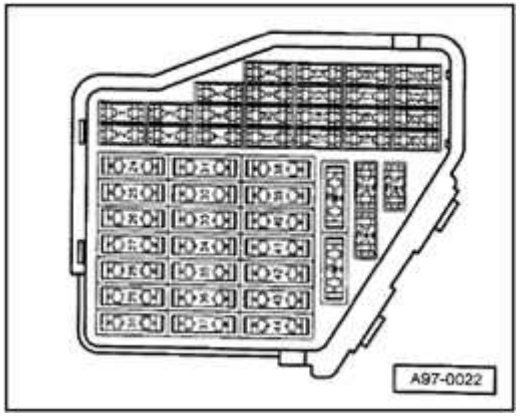
Fuel pump relay and relay triggering, checking



The fuel pump relay is located at position 6 of the central electrical panel under the left side of the instrument panel.

Checking fuel pump relay -J17-

- Remove shelf in left front footwell.



- Remove fuses 28, 29 and 34 from fuse relay panel.
- Connect VAG 1527B voltage tester between Ground (GND) and either of the fuse 28 terminals using jumper wires from the connector test kit VW 1594.
- Briefly operate starter.

- Fuel pump relay must be felt and heard ("click")
- Voltage tester must light up

24-25

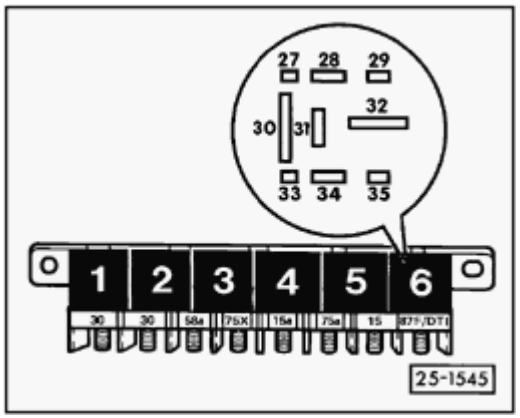
If fuel pump relay does not operate:

- Check triggering ⇒ page 24-27 .

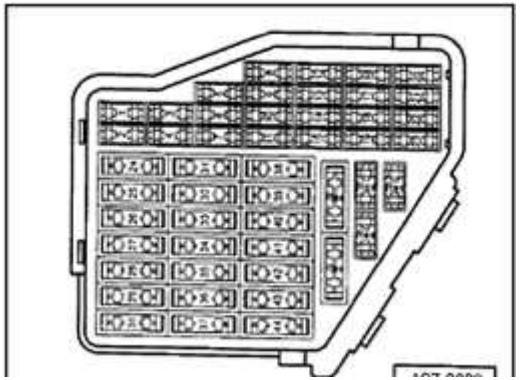
If voltage tester does not light up:

- Repeat test on other terminal for fuse 28.

If voltage tester still does not light up:



- Check fuse 28 wiring to terminal 30 (relay position 6), repair as necessary.



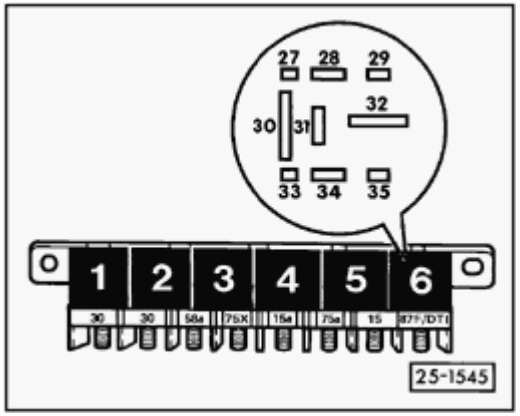
- Connect voltage tester between Ground (GND) and each terminal of fuse 29, in sequence.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ Repair Group 01.
  - Fuel pump relay must be felt and heard ("click")
  - Voltage tester must light up

If voltage tester does not light up:

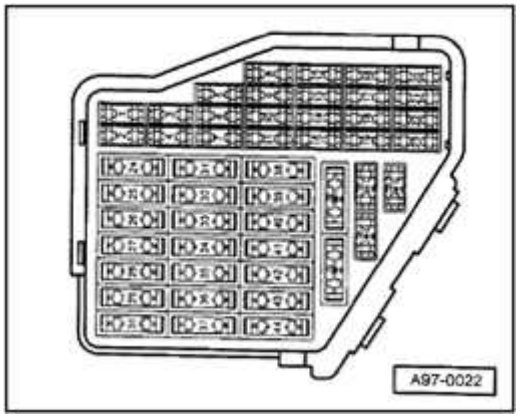
- Repeat test on the other terminal for fuse 28.

24-26

If voltage tester still does not light up:



- Check fuse 29 wiring for continuity to terminal 30 (relay position 6) using wiring diagram, correct as necessary.

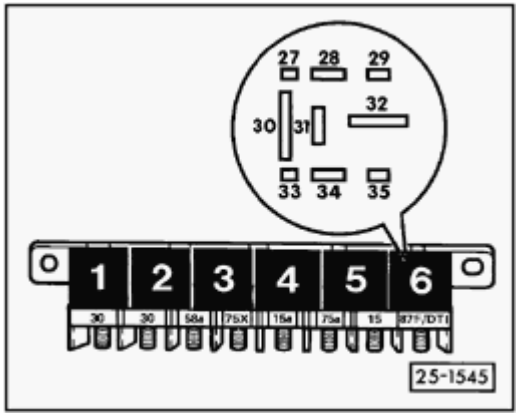


- Connect voltage tester between Ground (GND) and either terminal for fuse 34.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ Repair Group 01.
  - Fuel pump relay must be felt and heard ("click")
  - Voltage tester must light up

If the voltage tester does not light up

- Repeat the check using the other fuse 34 terminal.

24-27



If the voltage tester still does not light up:

- Check wiring for continuity between fuse 34 and terminal 31 (relay position 6) using wiring diagram, correct as necessary.

Checking voltage supply

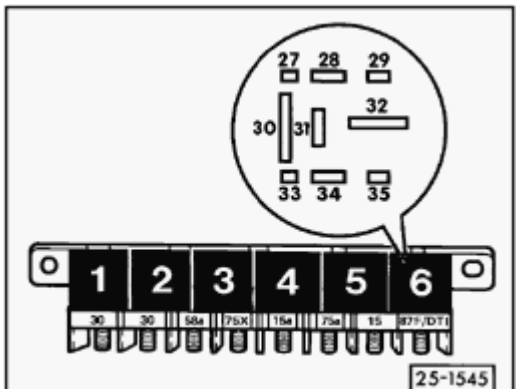
- Remove fuel pump relay -J17- from the fuse relay panel, relay position 6.
- Switch ignition ON.
- Connect multimeter (Fluke 83 or equivalent) between sockets 28 (B+) and 34, then between sockets 32 (B+) and 34.

  Specified value: approx. battery positive voltage (B+)

If the specified values are not obtained:

- Check for open circuit using wiring diagram, correct as necessary.

Checking fuel pump relay triggering

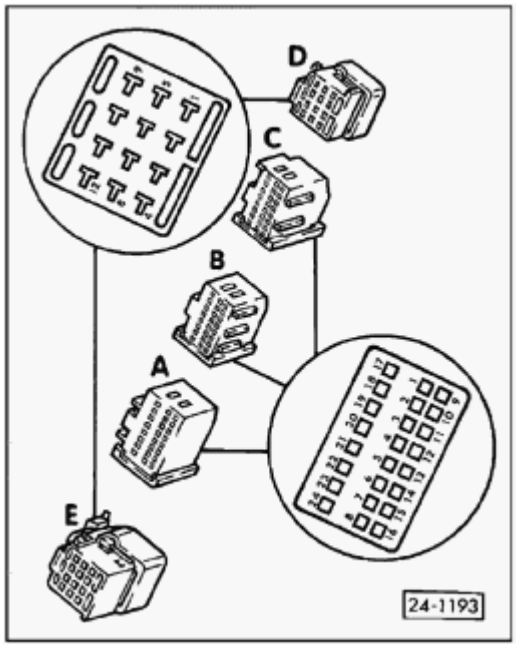


- Connect voltage tester between sockets 28 (B+) and 29.
  - Voltage tester must light up for approx. 1 second and then go out. Tester must stay lit while operating starter.

Note:

Only by operating the starter is it possible to make the voltage tester LED go out, otherwise it will appear dimly lit (due to low current draw).

24-28



If voltage tester does not light up, check wiring as follows:

- Connect VAG 1598/19 test box to ECM harness connector (ECM is left disconnected) ⇒ Repair Group 01.
- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and check for continuity between relay socket 29 and test box socket A5 using jumper wires from connector test kit VW 1594.

  Specified value: max. 1 Ω

If the specified value is not obtained:

- Check for open circuit using wiring diagram, and correct as necessary.

If the wiring is OK and the voltage tester does not light up:

- Replace ECM ⇒ Repair Group 01.

If the fuel pump relay triggering and the wiring is OK:

- Replace the fuel pump relay.
- Re-insert the removed fuses.

24-29

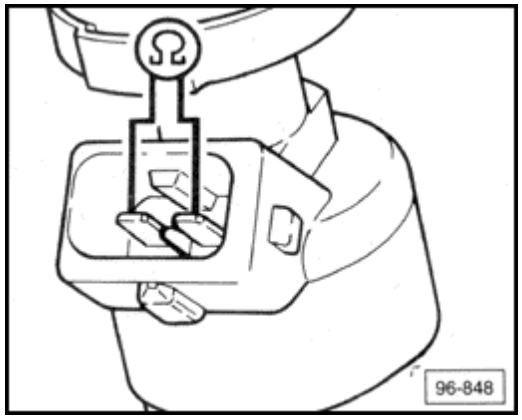
Fuel injectors, checking

CAUTION!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

Checking resistance

- Disconnect harness connector from fuel injector to be checked.



- Measure fuel injector resistance using multimeter (Fluke 83 or equivalent).

  Specified value:

  - Bosch: 15.0 to 17.0 Ω
  - Siemens: 13.5 to 14.5 Ω

- Replace any fuel injector for which resistance measurement does not fall within specified value.

Checking voltage supply

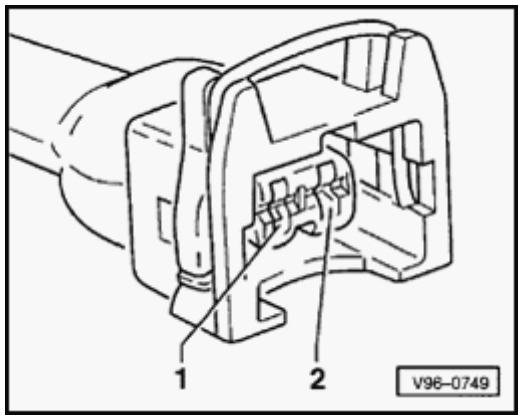
- Fuel pump relay OK ⇒ page 24-24
- Fuel pump OK:

⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*

- Fuse for fuel injectors OK

24-30

- Disconnect harness connector from fuel injector to be checked.



- Connect VAG 1527B voltage tester between harness connector terminal 1 and Ground (GND).
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ Repair Group 01.

  Specified value: voltage tester must light up

If voltage tester does not light up:

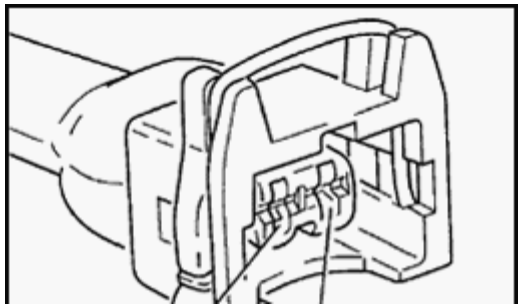
- Check wiring between terminal 1 and fuel injector fuse using wiring diagram.

If voltage tester does light up:

- Check fuel injector triggering.

Checking fuel injector triggering

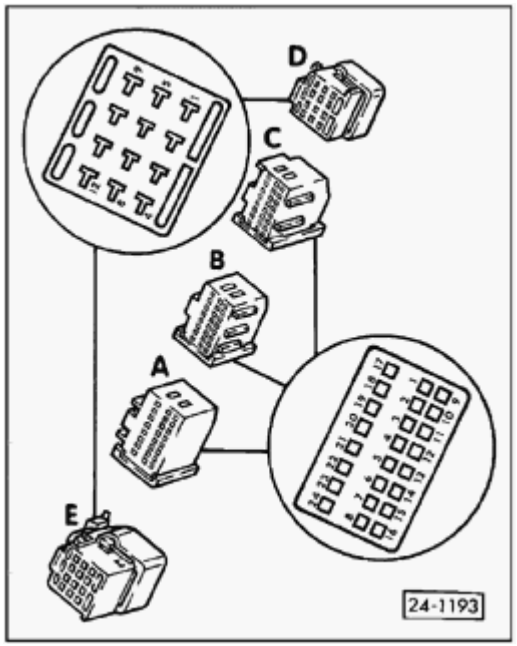
- Disconnect harness connector from fuel injector to be checked.



- Connect VAG 1527B voltage tester between terminal 2 and battery positive voltage (B+) using jumper wires from connector test kit VW 1594.
- Operate starter for several seconds (OK for engine to turn).

• Voltage tester must flash

24-31



If tester does not flash, check wiring between terminal 2 of the respective fuel injector and the ECM as follows:

- Connect VAG 1598/19 test box to ECM harness connector ⇒ Repair Group 01.
- Check fuel injector 1 signal wire for continuity between harness connector terminal 2 and test box socket D1.

  Specified value: max. 1 Ω
- Check fuel injector 2 signal wire for continuity between harness connector terminal 2 and test box socket D2.

  Specified value: max. 1 Ω
- Check fuel injector 3 signal wire for continuity between harness connector terminal 2 and test box socket D4.

  Specified value: max. 1 Ω
- Check fuel injector 4 signal wire for continuity between harness connector terminal 2 and test box socket D5.

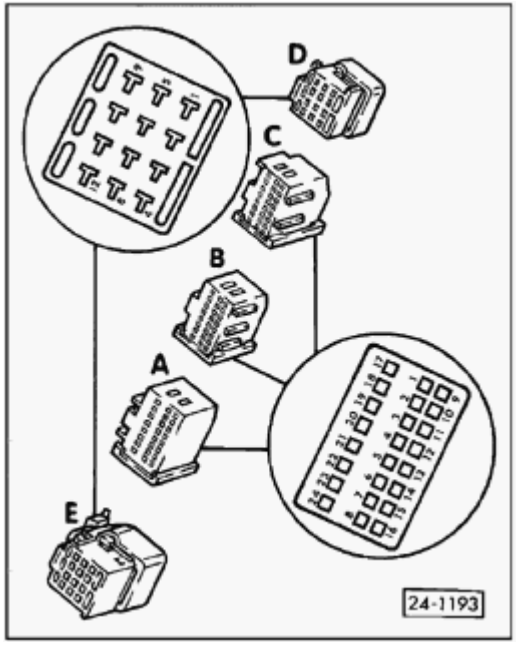
  Specified value: max. 1 Ω
- Check fuel injector 5 signal wire for continuity between harness connector terminal 2 and test box socket D6.

  Specified value: max. 1 Ω

- Check fuel injector 6 signal wire for continuity between harness connector terminal 2 and test box socket D8.

  Specified value: max. 1 Ω

If continuity is not obtained:



- Eliminate open or short circuit between terminal 2 of respective fuel injector connector, and ECM connector.

Cylinder number (fuel injector terminal 1)	Connector D terminal
1	1
2	2
3	4
4	5
5	6
6	8

If voltage tester does not flash for each fuel injector:

- Check voltage supply for ECM ⇒ page 28-27 .

If the voltage supply is OK:

- Replace ECM ⇒ Repair Group 01.

24-33

Fuel injector leak testing and delivery quantity, checking

CAUTION!

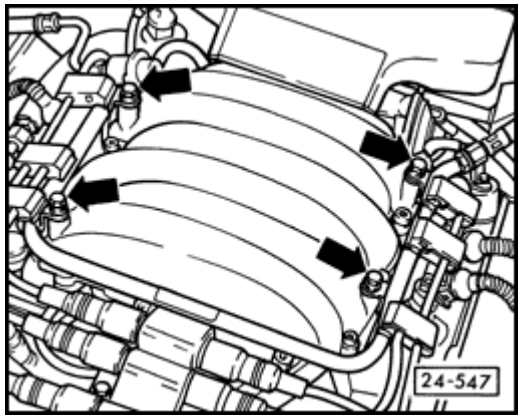
Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

- System pressure OK ⇒ page 24-20

- Remove intake air duct between Mass Air Flow (MAF) sensor and sound dampener.

- Loosen ignition wires only as far as necessary to remove fuel rail, and lay to one side.

- Disconnect fuel injector harness connectors.



- Disconnect fuel rail from intake manifold.
- Disconnect vacuum hose from fuel pressure regulator.
- Lift (and afterward support) fuel rail (complete with fuel injectors) from intake manifold.

Checking fuel injector leakage

CAUTION!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ Repair Group 01.

- Visually inspect fuel injector for leaks (with fuel pump running).

  Maximum: Two drops per minute per fuel injector

If fuel loss exceeds 2 drops per minute:

- Switch ignition OFF and replace leaking fuel injector.

Note:

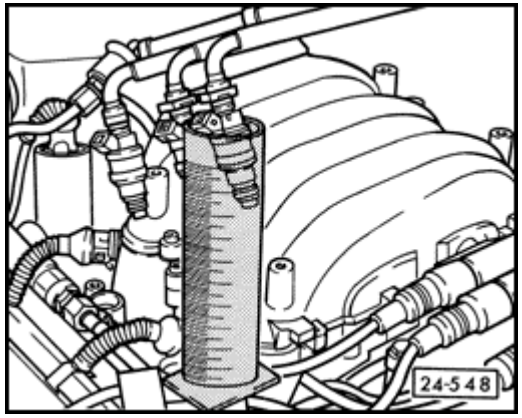
Always replace O-rings!

24-35

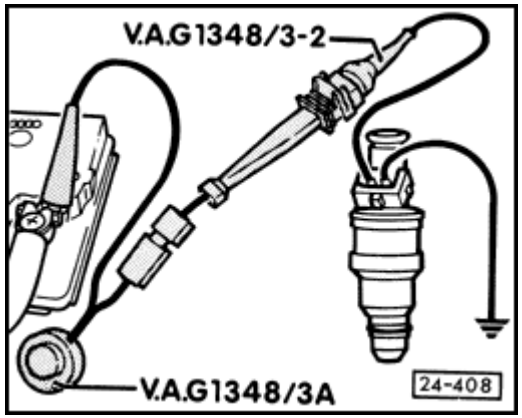
Checking fuel injector delivery quantity

CAUTION!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.



- Insert fuel injector to be tested into calibrated measuring container from 1602 fuel analyzer kit.



- Connect one terminal of each fuel injector being tested to engine Ground (GND) using jumper wire from connector test kit VW 1594.
- Connect remaining fuel injector terminal to B+ using remote control VAG 1348/3A, adapter wire VAG 1248/3-2 and jumper wire from connector test kit VW 1594.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ Repair Group 01.
- Operate remote control VAG 1348/3A for 30 seconds.

CAUTION!

Fire Hazard. Do NOT smoke or have anything in area that can ignite fuel.

- After each 30 second fuel injector fill, place measuring container on level surface (to facilitate accurate reading) and record fuel quantity delivered.

  Specified value (each fuel injector): 85-110 ml (2.9-3.7 oz.)

If the measured quantity for one or more fuel injectors is under or over the specified value:

- Replace faulty fuel injector(s).

If the measured values for all of the fuel injectors (as a set) are under or over the specified values:

- Check system pressure ⇒ page 24-20 .

- Re-install fuel injectors in reverse order of removal.

- Replace O-rings on all fuel injectors and lightly coat with engine oil.

- Slide fuel injectors into correct position in fuel rail and secure with retaining clips.

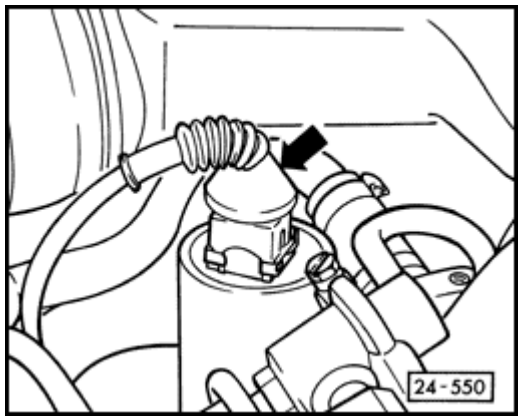
- Install fuel rail (complete with fuel injectors) into intake manifold by pressing it evenly all around.

Idle Air Control (IAC) valve, checking

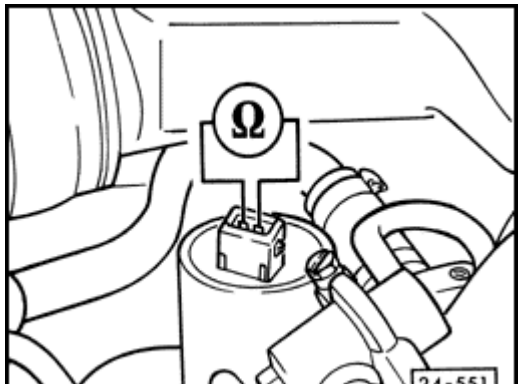
Note:

To functionally check the idle speed control system ⇒ "Read Measuring Value Block" function 08, display groups 004 through 018.

Electrical checks



- Disconnect Idle Air Control (IAC) valve harness connector.



- Measure IAC valve resistance by connecting multimeter (Fluke 83 or equivalent) between connector terminals using jumper wires from connector test kit VW 1594.

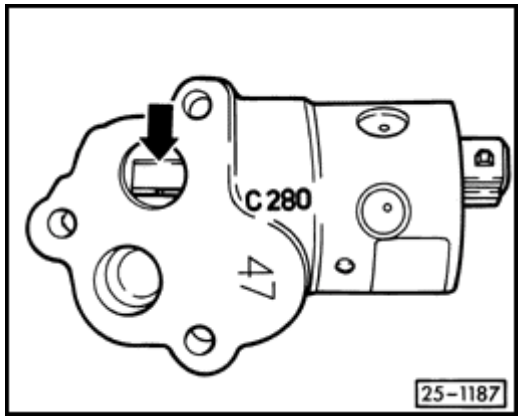
  Specified value: 7 to 11 Ω

If the specified resistance is not obtained:

- Replace Idle Air Control (IAC) valve.

Note:

At room temperature, the resistance value will be lower. The resistance value will be higher if the Idle Air Control (IAC) valve is measured at under-hood operating temperatures.



Checking mechanical function

- Remove Idle Air Control (IAC) valve.

- Visually check surface of rotary slide (arrow) for signs of wear.

CAUTION!

Do not check for ease of movement by prying on the rotary slide using a screwdriver or other tools that could potentially cause scratching.

- Re-connect valve (still removed) to harness connector.
- Switch ignition ON.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger Idle Air Control (IAC) valve -N71- ⇒ Repair Group 01.
- Check whether rotary slide moves smoothly and freely from stop to stop.

If there are signs of scoring that impair free movement, or if the rotary slide does not move freely (sticks, moves slowly or does not move fully in both directions):

- Replace Idle Air Control (IAC) valve.

If the valve does not react (not triggered) during the output Diagnostic Test Mode:

- Check triggering.

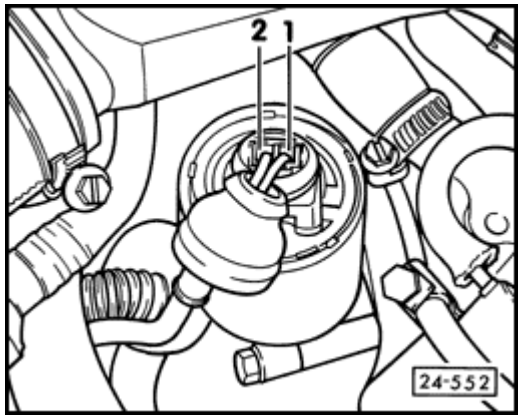
24-39

Checking Idle Air Control (IAC) valve triggering

- Idle Air Control (IAC) valve electrically OK

- Slide up boot on Idle Air Control (IAC) valve connector.

- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger Idle Air Control (IAC) valve -N71- ⇒ Repair Group 01.



- Connect VAG 1527B voltage tester between connector terminal 1 and engine Ground (GND).

  Specified result: voltage tester must flash

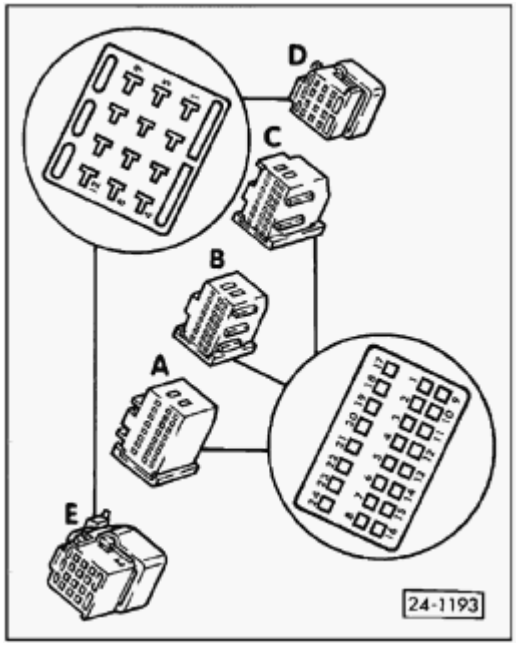
- Connect voltage tester between connector terminal 2 and battery positive voltage (B+).

  Specified result: voltage tester must light up

If specified results are not obtained:

- Connect VAG 1598/19 test box to ECM harness connector (ECM is left disconnected) ⇒ Repair Group 01.

24-40



- Check wiring between harness connector terminal 1 (in engine compartment) to test box socket D11, then check wiring between harness connector terminal 2 and test box socket D9 using wiring diagram; correct as necessary.

If the wiring is OK but triggering still does NOT occur:

- Replace ECM ⇒ Repair Group 01.

If the triggering signal and the wiring are OK and the valve still does not react:

- Replace Idle Air Control (IAC) valve.

Oxygen Sensor (O2S) control, checking

Notes:

- *Do not use sealants containing silicone to seal the intake area on engines with oxygen sensors. Silicone particles are not consumed during combustion, consequently the unburned particles travel via the exhaust stream to the oxygen sensor where they can eventually coat the sensor probe and interrupt or destroy proper oxygen sensor function. Do not use electrical contact cleaner (or equivalent) in the area of the heated oxygen sensor harness connector because it can lead to corrosion damage of the oxygen sensor.*

- *The heated oxygen sensor compares the oxygen content of the "outside" air with the quantity of oxygen in the exhaust stream and generates a corresponding voltage signal as an input to the Engine Control Module (ECM). The "mixture too rich" voltage signal (low oxygen content) is approx. 0.6 to 0.9 volts. The "mixture too lean" voltage signal (high oxygen content) is about 0.0 to 0.3 volts. During the transition from "rich" to "lean" (or the reverse) the voltage fluctuates between 0.6 to 0.9 volts and 0.0 to 0.3 volts.*

- *Due to the abrupt voltage fluctuation, oxygen sensor output can correspond to the ideal or "stoichiometric" mixture (λ = 1.0), but mixture control is not held constant to this value; instead, the control constantly fluctuates back and forth in a window between the "mixture too lean" and "mixture too rich" conditions. For a warm engine, the control frequency during idle is 0.5 Hz. minimum (30 cycles per minute). With increased engine speed (2500 to 2800 RPM) the control frequency must be at least 1Hz.(60 cycles per minute). One cycle means a voltage swing from the highest value to the lowest value and back again to the highest.*

24-42

If the voltage does not fluctuate, or the sensor responds too slowly (lazy), the following conditions are possible causes:

- *Slits or holes in the oxygen sensor tip are plugged*
- *Sensor was thermally overloaded*
- *Sensor damaged via silicone contamination (various sprays)*
- *Sensor was lead poisoned with fuel containing lead. Check for lead content using a "PLUMBTESMO" test strip*
- *Terminal resistance in the signal wire*
- *Oxygen sensor too cold-oxygen sensor heater does not function and sensor does not reach ideal operating temperature*
- *Oxygen sensor control switched off (fuel injection system malfunctions stored in DTC memory)*
- *Oxygen sensor damaged with electrical contact cleaner (or equivalent). The spray is drawn in through the signal wire via capillary action resulting from pressure differential and temperature fluctuation and ends up coating the sensor element and air passages causing reduced sensitivity or control failure.*

24-43

Cold start driveability problems, overview

The time interval between cold start (open loop) and oxygen sensor control (closed-loop), which requires an oxygen sensor temperature of approx. 300 ° C (572 ° F), is influenced by the following variables:

- Ambient temperature (summer/winter)
- Operating conditions after start
- Proper function of the oxygen sensor heater

If driveability difficulties occur during cold start, determine whether the problem occurred during the open- or closed-loop phase of the startup as follows (under cold-start conditions):

- Connect VAG 1551 scan tool ⇒ Repair Group 01.
- Switch ignition ON but do not start engine.
- Select "Read Measuring Value Block" function 08 and advance until display shows "Read measuring value block 10" (display group 010) ⇒ Repair Group 01.

Read measuring value block 10 →

1 2 0.4V 0.4V

Indicated on display

Display fields 3 and 4 show signal voltage for oxygen sensors before the three way catalytic converters (vehicle cold; oxygen sensor control does not function; values = 0.350 to 0.450 volts).

24-44

CAUTION!

Use a second technician to operate the VAG 1551 scan tool.

- Start engine (without previously switching ignition off), drive and record voltage signal (display field 3 shows bank 1; display field 4 shows bank 2).

- When oxygen sensor control starts, the voltage signal fluctuates between 0.0 and 0.9 volts (the voltage signals of both banks do not need to be synchronous with one another).

- If driveability difficulties occur before the start of oxygen sensor control, oxygen sensor control can not be the cause of the problem.

- If driveability difficulties occur after the start of oxygen sensor control, check function of heated oxygen sensor ⇒ page 24-45 .

- If driveability improves after the start of closed-loop oxygen sensor control, the cause (e.g. air leak, faulty fuel injector) works against the improvement by interrupting control. This can be recognized by reading the oxygen sensor learned values ⇒ Repair Group 01, "Read Measuring Value Block" function 08, display

group 005 or 006.

Note:

For troubleshooting driveability problems, oxygen sensor control can be programmed to switch ON or OFF using display group 099. By pushing buttons -4- and -8- on the VAG 1551 scan tool (selecting between "Basic Setting" function 04 and "Read Measuring Value Block" function 08), oxygen sensor control can be switched ON and OFF.

Oxygen Sensor (O2S) control, checking (before three way catalytic converter)

Note:

- *G39 = Heated Oxygen Sensor (HO2S), bank 1*
- *G108 = Heated Oxygen Sensor (HO2S) 2, bank 2*

- Read measuring value block using VAG 1551 scan tool until display shows "Read measuring value block 1" (display group 001) ⇒ Repair Group 01.

Read measuring value block 1 →

1 2 3 4

≺ Indicated on display

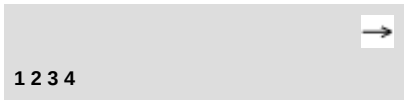
Note:

Continue with the test only if the value in display field 1 (engine coolant temperature) is at least 80° C (176° F).

- Press -C- button.
- Press buttons -0-, -1- and -0- to input display group 010.
- Press -Q- button to confirm input.

Read measuring value block 10

≺ Indicated on display



Display fields 3 and 4 show the signal voltages of both heated oxygen sensors.

If sensor voltage fluctuates very slowly ⇒ page 24-41 .

24-46

If a constant sensor voltage of 0.000V is displayed, there is a short to Ground (GND).

- Check DTC memory ⇒ Repair Group 01.

If sensor voltage is constant between 0.350 and 0.450 volts, the signal is interrupted:

- Check DTC memory ⇒ page 01-13 .

If sensor voltage is a constant 2.550 volts, there is a short to battery positive voltage (B+):

- Check DTC memory ⇒ page 01-13 .

- If sensor voltage is a constant 0.0 to 0.3 volts, the oxygen sensor measures a lean mixture:

- Check DTC memory ⇒ page 01-13 .

- If sensor voltage is a constant 0.6 to 0.9 volts, the oxygen sensor measures a rich mixture:

- Check DTC memory ⇒ page 01-13 .

- Press -C- button.

Read measuring value block Q

- Indicated on display

Input display group number XXX

With a properly functioning oxygen sensor, the actual control learning values can be checked.

Various malfunctions (e.g. intake air leakage, faulty fuel injectors etc.) can cause a change in the mixture composition. These malfunctions are recognized by the oxygen sensor and are corrected via oxygen sensor control by adjusting the fuel injection time via the ECM. Fuel injection time that deviates from the programmed basic fuel injection time indicates a malfunction of some type.

These deviations are shown (oxygen sensor control learned values) in display group 005 (bank 1) or 006 (bank 2). There is a deviation between idle and partial load readings; the deviation between actual fuel injection times and the programmed basic settings are indicated as a percentage (%).

Positive oxygen sensor control learned values (+%):

Programmed basic fuel injection time too short (mixture too lean), actual fuel injection time by ...% longer , so that λ = 1 can be obtained.

Negative oxygen sensor control learned value (-%):

Programmed basic fuel injection time too long (mixture too rich) , actual fuel injection time

by ...% shorter, so that λ = 1 can be obtained.

24-48

- Press buttons -0-, -0- and -5- to input display group number 005 for bank 1, or press buttons -0-, -0- and -6- to input display group number 006 for bank 2.

- Press -Q- button to confirm input.

Read measuring value block 5 →

-4.6% 0.7% 0 % 0 %

➢ Indicated on display (example)

Note:

If necessary, display group 005 (bank 1) or 006 (bank 2) for troubleshooting can be read using "Basic Setting" function 04 and then printed out ⇒ page 01-150 , Basic Setting. By selecting this function (among other things) the evaporative emissions factor is not included.

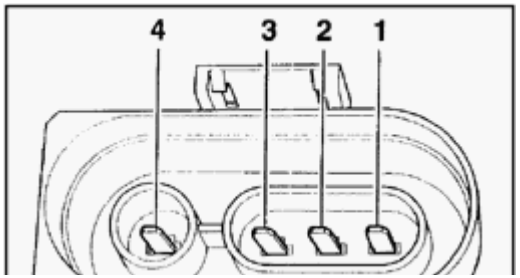
Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC), checking

Heated oxygen sensor, checking

Notes:

- *G39 = Heated Oxygen Sensor (HO2S), bank 1*
- *G108 = Heated Oxygen Sensor (HO2S) 2, bank 2*
- *Functional check of HO2S -G39- or -G108- ⇒ Repair Group 01, Read measuring value block, display group 010 or 041*

- Disconnect Heated Oxygen Sensors (HO2S) -G39- or -G108- harness connector (component locations ⇒ page 24-1).

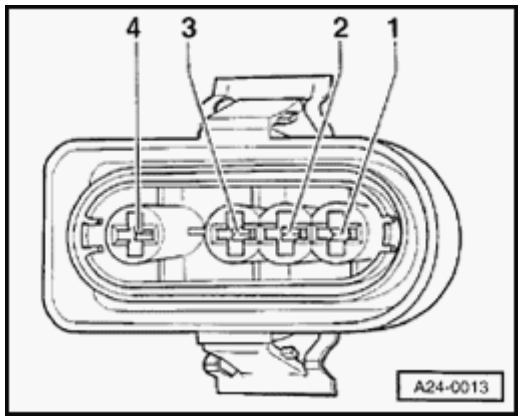


- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and check for continuity between terminal 4 oxygen sensor signal wire (measured at oxygen sensor connector) and engine Ground (GND).

If continuity is not obtained:

- Replace heated oxygen sensor.

If continuity obtained:



- Switch multimeter to 2 volt range and connect between terminal 4 on harness connector and engine Ground (GND).

24-50

- Switch ignition ON.

Specified value: 400 ± 50 mV

If the specified value is not obtained, check wiring to ECM as follows:

- Switch ignition OFF.

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .

- Check wiring for continuity between terminal 4 (HO2S -G39-) and terminal 20 on ECM connector A.

Specified value: max. 1 Ω

- Check wiring for continuity between terminal 4 (HO2S 2 -G108-) and terminal 21 on ECM connector A.

Specified value: max. 1 Ω

If the specified value is not obtained:



- Eliminate short or open circuit in wiring using wiring diagram.

If wiring OK:

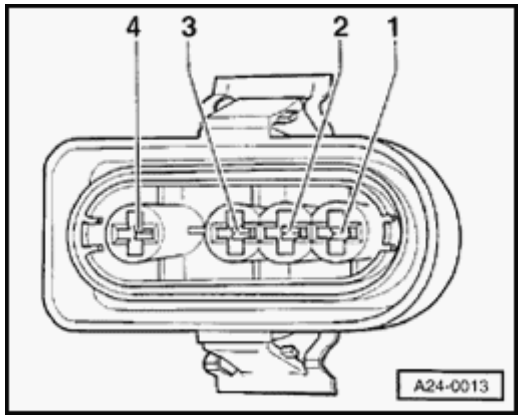
- Replace ECM ⇒ page 01-265 .

Oxygen sensor heater, checking

Notes:

- *Z19 = Oxygen Sensor (O2S) heater, bank 1*
- *Z28 = Oxygen Sensor (O2S) heater, bank 2*
- *For functional check of O2S heaters -Z19- or -Z28- ⇒ Repair Group 01, Read measuring value block, display group 040*

- Disconnect O2S heater connector -Z19- or -Z28- (component locations ⇒ page 24-1).



- Switch multimeter (Fluke 83 or equivalent) to measure voltage and connect between terminals 1 (B+) and 2 (GND).
- Start engine and let idle.

  Specified value: approx. 12 to 14 volts

If the specified value is not obtained:

- Check oxygen sensor heater fuse.
- Check fuel pump relay ⇒ page 24-24 .



- Check wiring for continuity between terminal 1 and fuse in fuse holder using wiring diagram (if necessary check terminal assignments).

Specified value: max. 1 Ω

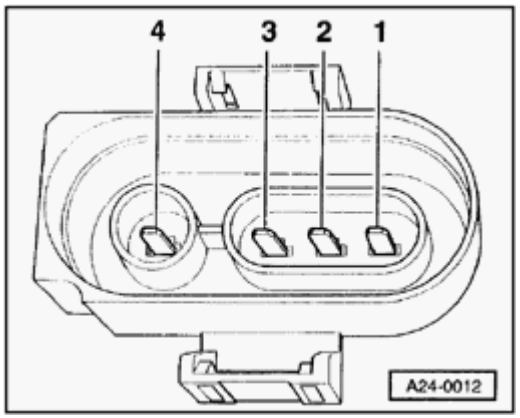
- Check wiring for continuity between terminal 2 (O2S heater -Z19-) and terminal 10 on ECM connector E.

  Specified value: max. 1 Ω

- Check wiring for continuity between terminal 2 (O2S heater -Z28-) and terminal 9 on ECM connector E.

  Specified value: max. 1 Ω

If the specified value is obtained:



- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and connect between between terminals 1 and 2.

  Specified value at room temperature: approx. 2 to 5 Ω

Note:

With small increases in temperature, resistance will increase sharply.

If the specified value is not obtained:

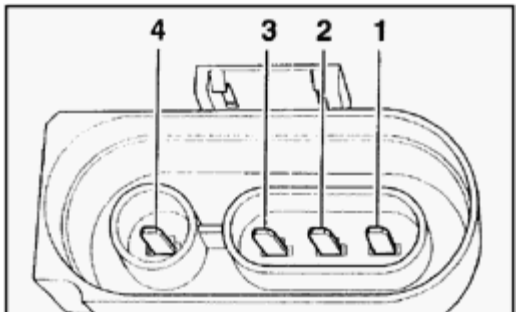
- Replace heated oxygen sensor.

Heated Oxygen Sensor (HO2S) after Three Way Catalytic Converter (TWC), checking

Notes:

- *G130 = O2S behind three way catalytic converter, bank 1*
- *G131 = O2S behind three way catalytic converter, bank 2*
- *For functional check of O2S behind three way catalytic converter -G130- or -G131- ⇒ Repair Group 01, Read measuring value block, display group 041*

- Disconnect connector for O2S behind three way catalytic converter -G130- or- G131- (component locations ⇒ page 24-1).

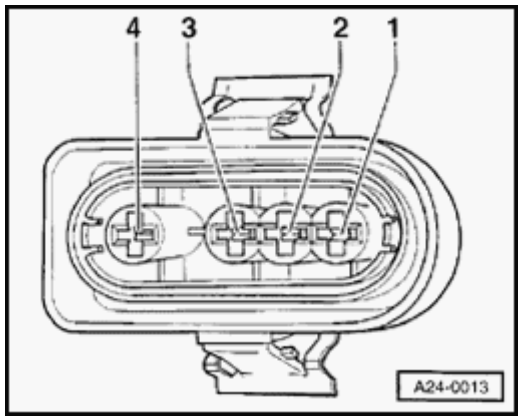


- Using multimeter (Fluke 83 or equivalent) set for measuring resistance (Ω), check for continuity (short circuit) between oxygen sensor terminals 3 (GND wire) and 4 (signal wire).

If there is continuity:

- Replace heated oxygen sensor.

If the wiring is OK (no continuity):



- Switch multimeter (Fluke 83 or equivalent) to measure voltage (2 volt range) and connect between harness connector terminals 3 (GND) and 4 (signal wire).

- Switch ignition ON.

Specified value: 400 ± 50 mV

If the specified value is not obtained, check wiring to ECM as follows:

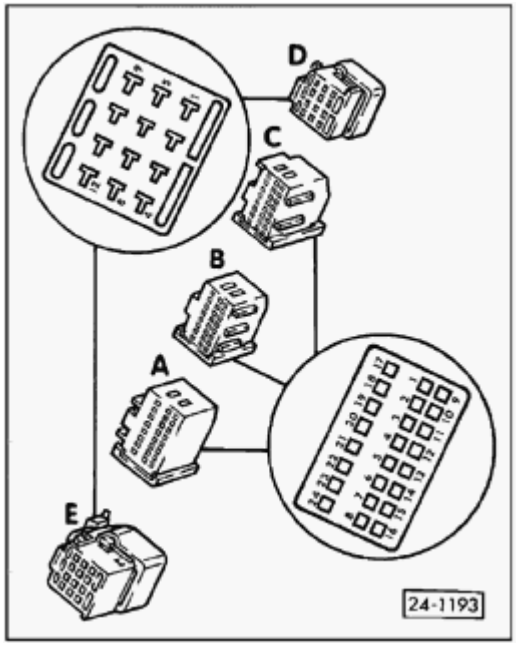
- Switch ignition OFF.

- Connect VAG 1598/19 test box to ECM wiring harness ⇒ page 01-255 .

- Check following wiring connections for continuity.

Specified value: max. 1 Ω

Heated oxygen sensor	Connector terminal	VAG 1598/19 test box socket number
-G130-	3	C17
	4	C20
-G131-	3	C17
	4	C21



If the specified value is not obtained:

- Eliminate open or short circuit using wiring diagram.

If wiring OK:

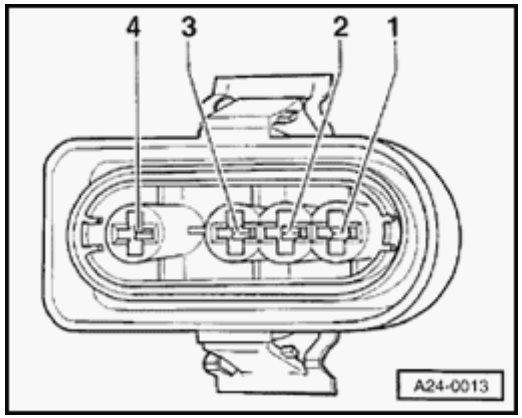
- Replace ECM ⇒ page 01-265 .

Oxygen sensor heater, checking

Notes:

- *Z29 = Oxygen Sensor (O2S) heater, bank 1*
- *Z30 = Oxygen Sensor (O2S) heater, bank 2*
- *For functional check of O2S heater -Z29- or -Z30- ⇒ Repair Group 01, Read measuring value block, display group 040*

- Disconnect heated oxygen sensor harness connector (component locations ⇒ page 24-1)



- Switch multimeter (Fluke 83 or equivalent) to 20 volt range and connect between terminals 1 (B+) and 2 (GND).
- Start engine and let idle.

  Specified value: approx. 12 to 14 V

If the specified value is not obtained:

- Check oxygen sensor heater fuse.
- Check fuel pump relay ⇒ page 24-24 .



- Check wiring for continuity between terminal 1 and fuse in fuse holder using wiring diagram, if necessary check terminal assignments.

Specified value: max. 1 Ω

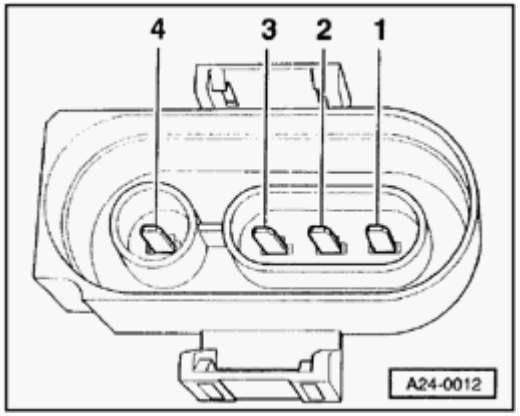
- Check wiring for continuity between terminals 2 and 8 on ECM connector E.

  Specified value: max. 1 Ω

- Check wiring for continuity between terminals 2 and 3 of ECM connector E (O2S heater -Z30-).

  Specified value: max. 1 Ω

If the specified value is obtained:



- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and connect between terminals 1 and 2.

  Specified value (room temperature): approx. 2 to 5 Ω

Note:

With small increases in temperature, resistance will increase sharply.

If the specified value is not obtained:

- Replace heated oxygen sensor.

Heated oxygen sensor, removing and installing

- Disconnect heated oxygen sensor harness connector

  Component locations ⇒ page 24-1 .

- Open tie wrap.

- Remove heated oxygen sensor.

When installing a heated oxygen sensor, note the following:

- Install tie wraps in original locations, to prevent sensor wiring from contacting exhaust system.

- Coat oxygen sensor threads with anti-seize compound but do not allow compound to enter sensor slots.

  Tightening torque: 50 Nm (37 ft lb)

24-58

EVAP canister purge regulator valve, checking

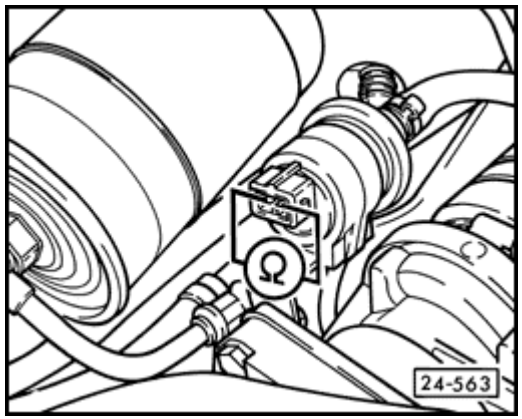
Notes:

- *For a functional check of the EVAP canister purge regulator valve duty cycle (triggering) ⇒ Repair Group 01, Read measuring value block, display group 030, display field 3.*

- *Component locations ⇒ page 24-1 .*

Checking resistance

- Disconnect EVAP canister purge regulator valve harness connector.



- Measure resistance of EVAP canister purge regulator valve.

  Specified value: 20 to 28 Ω

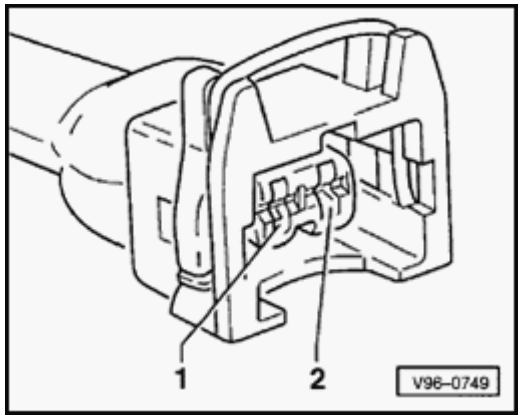
If the specified value is not obtained:

- Replace EVAP canister purge regulator valve.

24-59

Checking voltage supply

- Disconnect EVAP canister purge regulator valve harness connector.

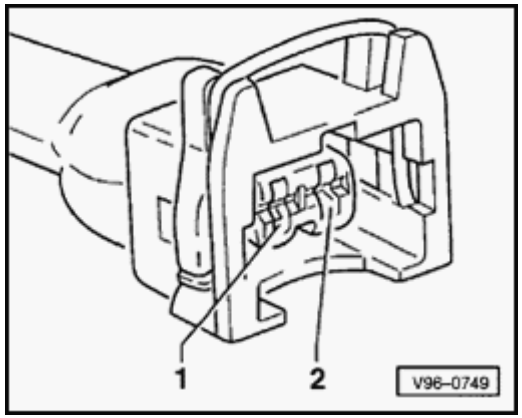


- Connect VAG 1527B voltage tester between connector terminal 1 and engine Ground (GND) using jumper wires from connector test kit VW 1594.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ page 01-145 .

• Voltage tester must light up

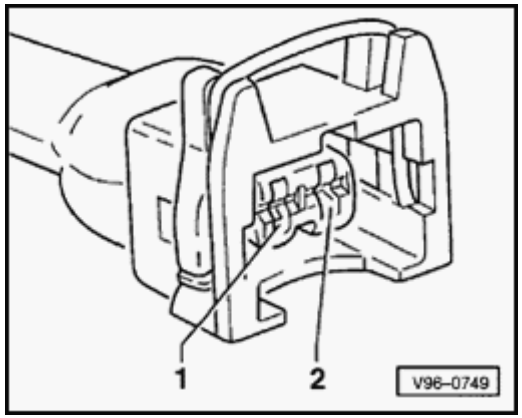
If voltage tester does not light up:

- Check fuse for EVAP canister purge regulator valve.



- Check wiring for continuity between EVAP canister purge regulator valve connector terminal 1 and fuse, using wiring diagram.
- Check fuel pump relay and triggering ⇒ page 24-24 .

Checking triggering

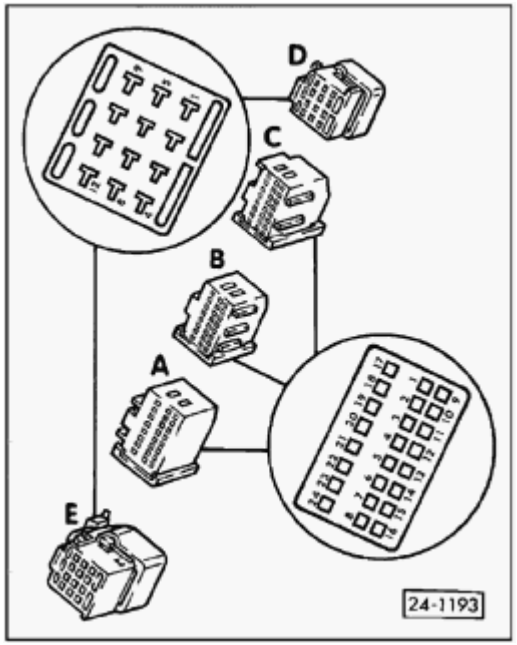


- Connect voltage tester VAG 1527 between EVAP canister purge regulator valve connector terminals 1 (B+) and 2 using jumper wires from connector test kit VW 1594.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger EVAP canister purge regulator valve ⇒ page 01-145 .

• Voltage tester must flash

If voltage tester does not flash or lights up constantly:

- Connect VAG 1598/19 test box to ECM ⇒ page 01-255 .



If voltage tester lights up constantly:

- Check wiring between EVAP canister purge regulator valve connector terminal 2 and test box socket E12 (GND).

If voltage tester does not flash:

- Check wiring for continuity between EVAP canister purge regulator valve connector terminal 2 and test box socket E12.

  Specified value: max. 1.0 Ω
- If necessary, eliminate short or open circuit in wiring.

If there is neither a break nor a short:

- Replace ECM ⇒ page 01-265 .

Sensor for EVAP canister, checking

Checking function

- Use VAG 1551 scan tool to select "Read Measuring Value Block" function 08 and display group 030 ⇒ page 01-249 .

Read measuring value block 30

1 2 3 4

Indicated on display

- Carry out test drive.

CAUTION!

Always use a second person to operate the VAG 1551 scan tool.

- Check value in display field 4.

  Specified value: 0_11X

If display shows 0_00X

On Board Diagnostic program is not yet concluded.

- Carry out test drive under conditions described in Repair Group 01, until display shows 0_11X.

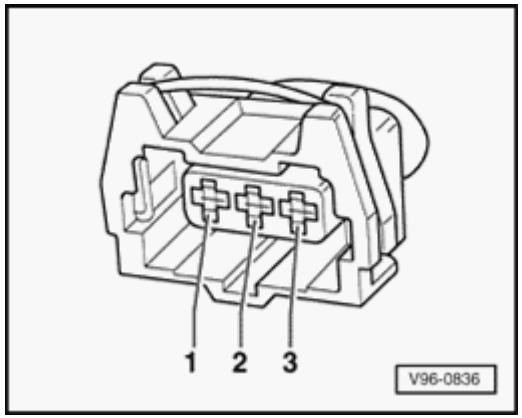
If display shows 1_11X

This indicates how On Board Diagnostic recognizes a malfunction in the

fuel tank system.

- Check vacuum hose for leakage between EVAP canister and throttle body ⇒ page 24-111 .

24-62



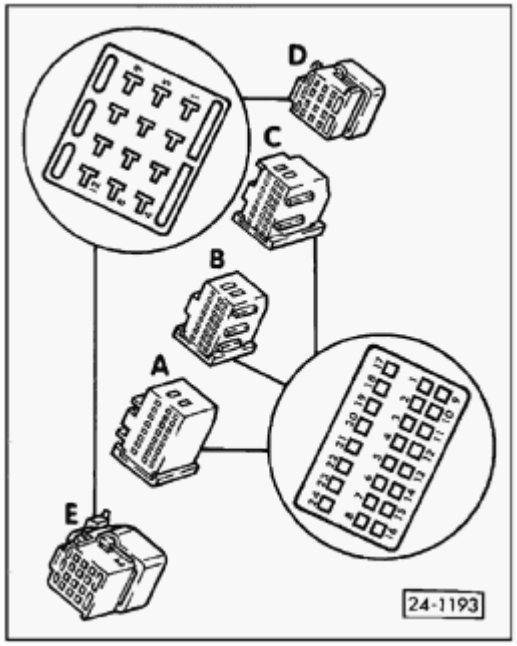
If vacuum hose is OK:

- Remove harness connector from sensor for EVAP canister.
- Switch multimeter (Fluke 83 or equivalent) to 20 volt range and connect between harness connector terminals 1 (GND) and 3 (B+).
- Switch ignition ON.

  Specified value: approx. 5 volts

If the specified value is not obtained:

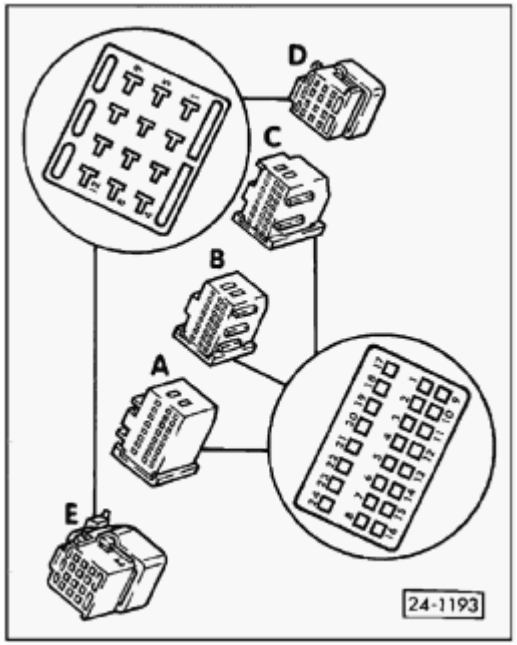
- Check wiring to ECM.



- Connect VAG 1598/19 test box to ECM ⇒ page 01-255 .
- Check following wiring connections for continuity.

Sensor -G172- connector terminal number	VAG 1598/19 test box socket number
1	C2
3	C6

- If necessary, eliminate open or short in wiring.



If wiring is OK and there is not at least 5 volts at the sensor harness connector:

- Replace ECM ⇒ page 01-265 .

- Check wiring for continuity between harness connector and ECM.

Sensor -G172- connector terminal number	VAG 1598/19 test box socket number
2	B16

- If necessary, eliminate open or short in wiring.

If wiring is OK:

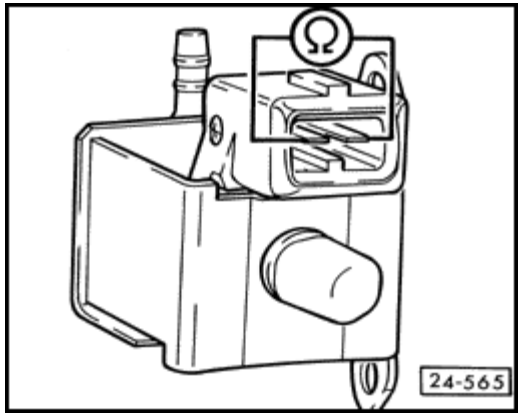
- Replace sensor for EVAP canister -G172-.

24-64

Intake manifold change-over valve, checking

Component locations ⇒ page 24-1 .

- Disconnect intake manifold change-over valve harness connector.



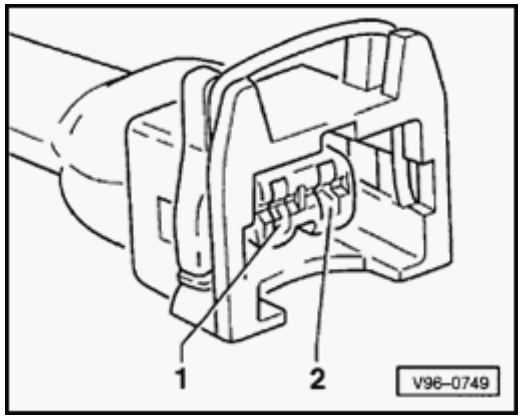
- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and connect between terminals on valve.

  Specified value: 25 to 35 ohms (Ω)

If the specified value is not obtained:

- Replace intake manifold change-over valve.

Checking voltage supply

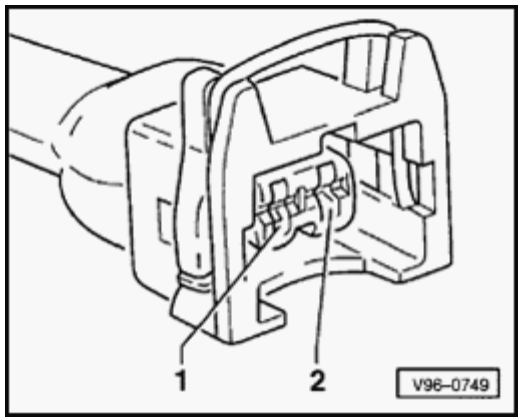


- Disconnect intake manifold change-over valve harness connector.
- Connect VAG 1527B voltage tester between harness connector terminal 1 and Ground (GND) using jumper wires from connector test kit VW 1594.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ page 01-145 .

• Voltage tester must light up

If voltage tester does not light up:

- Check fuse for intake manifold change-over valve.

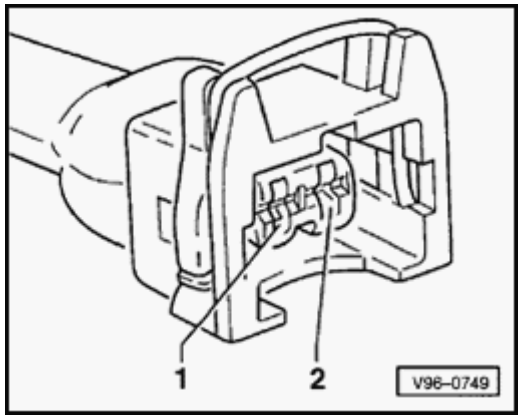


- Check wiring for continuity between intake manifold change-over valve harness connector terminal 1 and fuse, using wiring diagram.

  Specified value: max. 1.0 Ω
- Check fuel pump relay and triggering ⇒ page 24-24 .

24-66

Checking triggering



- Connect VAG 1527B voltage tester between intake manifold change-over valve connector terminal 1 (B+) and 2 using jumper wires from connector test kit VW 1594.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger Intake manifold change-over valve ⇒ page 01-145 .

• Voltage tester must flash

If voltage tester does not flash, or lights up constantly:

- Connect VAG 1598/19 test box to ECM ⇒ page 01-255 .

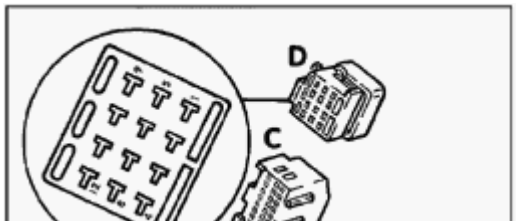
If voltage tester lights constantly:

- Check wiring from intake manifold change-over valve connector terminal 2 to test box socket B4 to Ground (GND).

If voltage tester does not flash:

- Check wiring for continuity between terminal 2 of intake manifold change-over valve connector and socket B4 of test box.

  Specified value: max. 1.0 Ω



- If necessary eliminate break in wiring or short to Ground.

If wiring is OK:

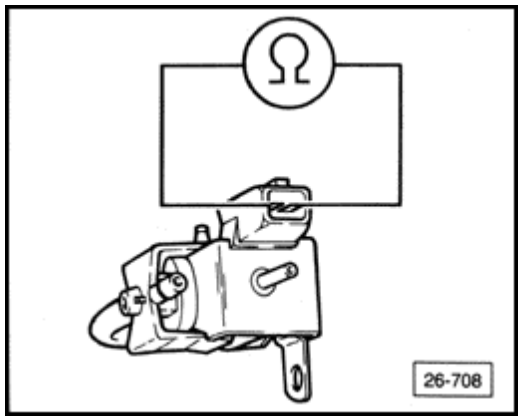
- Replace ECM ⇒ page 01-265 .

Exhaust Gas Recirculation (EGR) vacuum regulator solenoid valve, checking

Note:

For a functional check of the EGR system ⇒ Repair Group 01, Read measuring value block, display group 001.

- Disconnect EGR vacuum regulator solenoid valve harness connector.



- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and connect between valve terminals.

  Specified value: 25 to 35 Ω

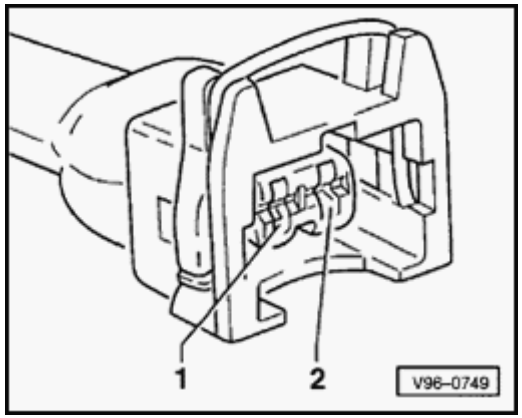
If the specified value is not obtained:

- Replace EGR vacuum regulator solenoid valve.

24-68

Checking voltage supply

- Disconnect EGR vacuum regulator solenoid valve harness connector.

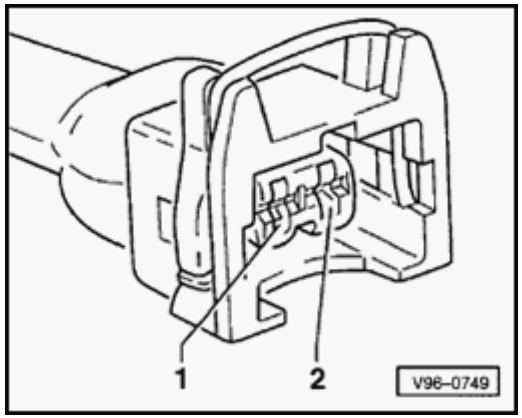


- Connect VAG 1527B voltage tester between connector terminal 1 (B+) and engine Ground (GND) using jumper wires from connector test kit VW 1594.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger fuel pump relay -J17- ⇒ page 01-145 .

• Voltage tester must light up

If voltage tester does not light up:

- Check fuse for EGR vacuum regulator solenoid valve.



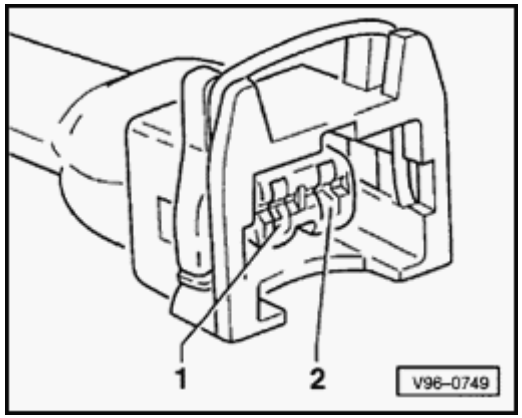
- Check wiring for continuity between EGR vacuum regulator solenoid valve connector terminal 1 and fuse, using wiring diagram.

  Specified value: max. 1.0 ohm (Ω)

- Check fuel pump relay and triggering ⇒ page 24-24 .

24-69

Checking triggering



- Connect VAG 1527B voltage tester between EGR vacuum regulator solenoid valve connector terminals 1 (B+) and 2 using jumper wires from connector test kit VW 1594.
- Use scan tool "Output Diagnostic Test Mode" function 03 to trigger EGR vacuum regulator solenoid valve ⇒ page 01-145 .

• Voltage tester must flash

If voltage tester does not flash, or lights up constantly:

- Connect VAG 1598/19 test box to ECM wiring harness ⇒ page 01-255 .

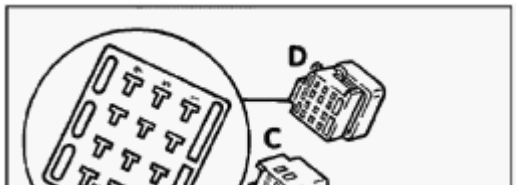
If voltage tester lights up constantly:

- Check wiring for short to Ground (GND) between valve connector terminal 2 and test box socket E1.

If voltage tester does not flash:

- Check wiring for continuity and short to B+ between valve connector terminal 2 and test box socket E1.

  Specified value: max. 1.0 ohm (Ω)



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

If wiring is OK:

- Replace ECM ⇒ page 01-265 .

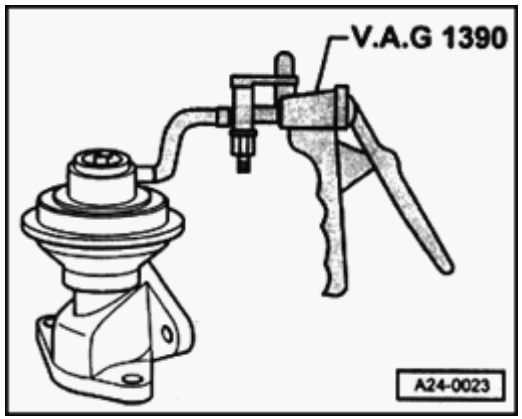
Exhaust Gas Recirculation (EGR) valve, checking

Requirements

- Vacuum lines and intake manifold connections free of leaks
- Vacuum lines not plugged or bent
- Engine oil 50 ° C (122 ° F) minimum

Checking

- Start engine and let idle.
- Disconnect vacuum hose at EGR valve.



- Connect US 8026 hand vacuum pump to EGR valve using spare piece of hose.
- Operate hand pump to create vacuum.
- Idle quality must degenerate

If NO (idle improves or stays the same):

- Check lines and connections for plugging; replace EGR valve if necessary.

24-71

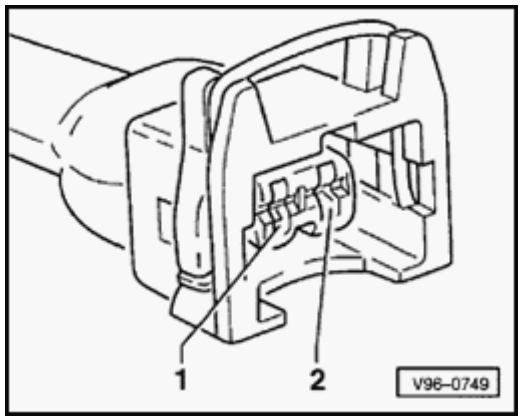
Exhaust Gas Recirculation (EGR) temperature sensor, checking

Notes:

- *For a functional check of the EGR temperature sensor ⇒ Repair Group 01, Read measuring value block, display group 017.*

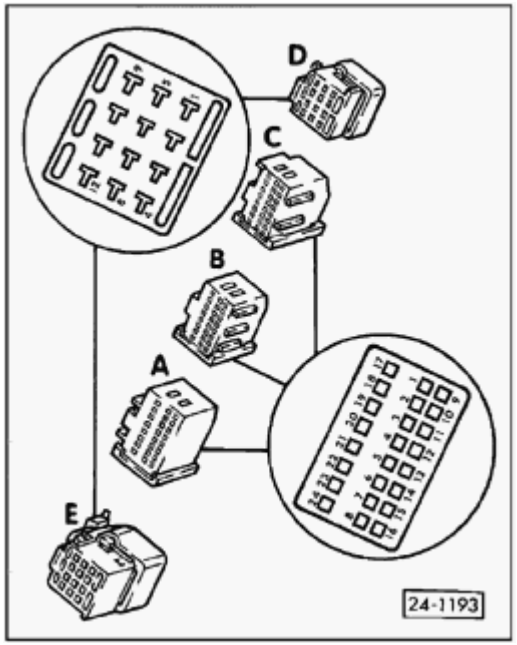
- *Component locations ⇒ page 24-1 .*

- Disconnect EGR temperature sensor harness connector.



- Switch multimeter (Fluke 83 or equivalent) to 20 volt range and connect between both terminals of connector using jumper wires from connector test kit VW 1594.
- Switch ignition ON.

  Specified value: approx. 5.0 volts



If the specified value is not obtained:

- Find and eliminate open circuit in wiring between EGR temperature sensor connector terminal 1 and ECM terminal A23, and then between connector terminal 2 and engine Ground (GND), using wiring diagram.

Note:

If it becomes necessary to repair or replace any of the EGR temperature sensor electrical terminals, ONLY replace with gold plated terminals.

If the specified value is obtained:

- Disconnect multimeter and jumper wires from EGR temperature sensor harness connector.
- Switch ignition OFF.
- Remove EGR temperature sensor.
- Switch multimeter (Fluke 83 or equivalent) to 200 kΩ resistance range and connect to EGR temperature sensor terminals using jumper wires from connector test kit VW 1594.
- Immerse temperature sensor in hot water (80° to 100° C) (176° to 212° F) and measure resistance.

• Resistance must change

If resistance does not change:

- Replace EGR temperature sensor.

Closed Throttle Position (CTP) switch, checking and adjusting

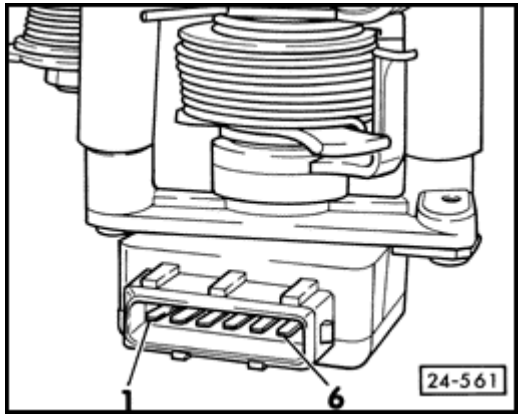
Notes:

- *To functionally check the Closed Throttle Position (CTP) switch ⇒Repair Group 01, Read measuring value block, display group 002, display field 4.*
- *The Closed Throttle Position (CTP) switch is located in the Throttle Position (TP) sensor assembly.*
- *Component locations ⇒ page 24-1 .*
- *If, while checking or adjusting the Closed Throttle Position (CTP) switch, the noise deadener is removed; make sure during re-assembly that there is a tight fit to the throttle body to avoid the possibility of an intake air leak.*
- *For safety, make sure that the Mass Air Flow (MAF) sensor output voltage is correct ⇒ page 01-150 , "Basic Setting" function 04, display group 002, display field 2.*

Requirements

- Accelerator pedal cable adjustment OK:

⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*



Electrical check

- Remove intake air sound absorber.

- Disconnect harness connector at throttle body.

- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and connect between terminals 4 and 6 using jumper wires from connector test kit VW 1594.

  Specified value: 0 ohms (continuity)

- Open throttle slightly.

  Specified value: ∞ Ω (no continuity)

If the specified value is not obtained by opening the throttle slightly, or if the specified value is obtained only by moving the throttle:

- Adjust CTP switch ⇒ page 24-75 .

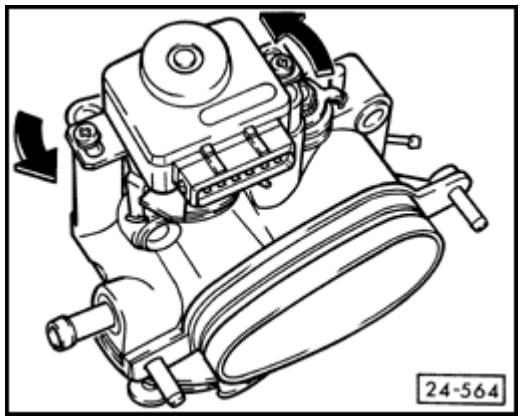
If, after adjusting the CTP switch, it is still not possible to obtain the specified function:

- Replace throttle position sensor assembly.

24-75

Adjusting

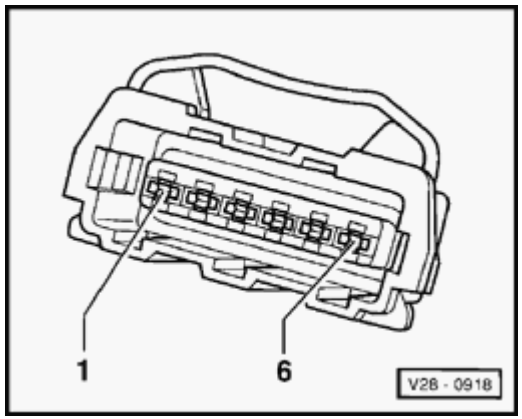
- Remove throttle body.
- Loosen two throttle position sensor mounting screws.



- Turn throttle position sensor in direction shown (arrows), without moving throttle valve shaft, until stop can be felt.
- Tighten throttle position sensor in this position.
- Check CTP switch again ⇒ page 24-74 .
- Re-install throttle body and adjust accelerator pedal cable

⇒ *Repair Manual, 2.8 Liter V6 2V Engine Mechanical, Engine Code(s): AFC, Repair Group 20*

Checking wiring between CTP switch and ECM



Terminal assignments for throttle position sensor connector.

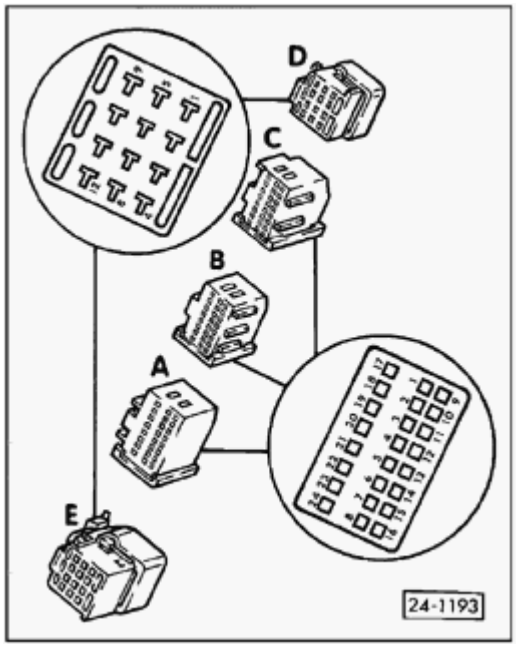
- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .
- Check wiring for continuity or short to B+ between throttle position sensor connector terminal 4 (GND) and test box socket D12.

  Specified value: max. 1 ohm (Ω)

- Check wiring for continuity or short to Ground (GND) between throttle position sensor connector terminal 6 (signal) and test box socket A4.

  Specified value: max. 1 Ω

If the specified value is not obtained:



- Determine open or short circuit in wiring using wiring diagram; repair as necessary.

6-pin TP sensor connector terminal	ECM connector A terminal
6	A4
4	Intake manifold Ground (GND)

Note:

If it becomes necessary to repair or replace any of the throttle position sensor electrical terminals, ONLY replace with gold-plated terminals.

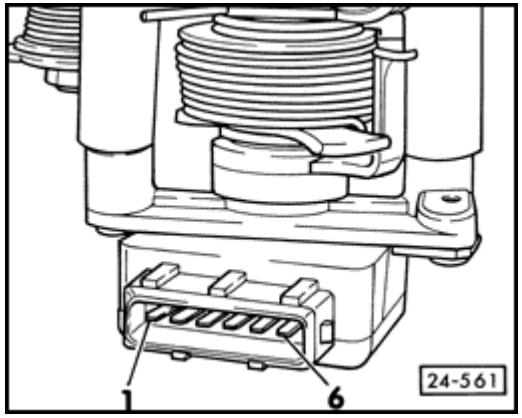
Throttle Position (TP) sensor, checking and adjusting

Notes:

- *To functionally check the Throttle Position (TP) sensor ⇒ Repair Group 01, Read measuring value block, display group 002.*

- *Component locations ⇒ page 24-1 .*

Checking resistance



- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and connect between terminals 1 and 2.

  Specified value: 1500 to 2600 Ω

- Measure resistance between terminals 2 and 3.

  Specified value (closed throttle): approx. 750 to 1300 Ω

- Slowly move throttle from closed throttle position to wide open throttle position.

  • Resistance must increase gradually to max. 3600 Ω

If any one of the specified values is not obtained:

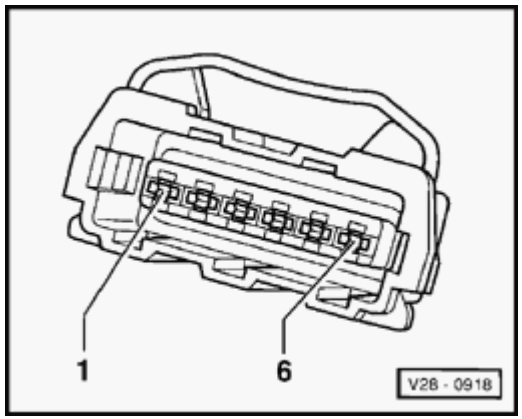
- Replace throttle position sensor.

24-78

Checking voltage supply

- Disconnect TP sensor harness connector.

- Switch ignition ON.



- Switch multimeter (Fluke 83 or equivalent) to measure resistance (Ω) and connect in sequence between terminals 1 (B+) and 2 (GND), then between terminals 1 (B+) and 3 (signal).

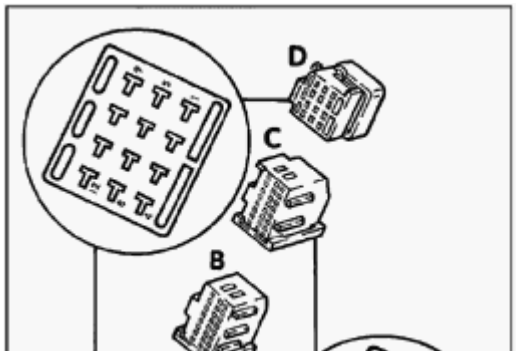
  Specified value: 4.5 to 5.5 volts

If neither specified value is obtained:

- Check TP sensor resistance ⇒ page 24-77 .

If one of the specified values is not obtained, check ECM wiring as follows:

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .



- Check Ground (GND) wire for continuity between TP sensor connector terminal 2 and test box socket D12.

  Specified value: max. 1 ohm (Ω)

- Check B+ wire for continuity between TP sensor connector terminal 1 and test box socket A3.

  Specified value: max. 1 ohm (Ω)

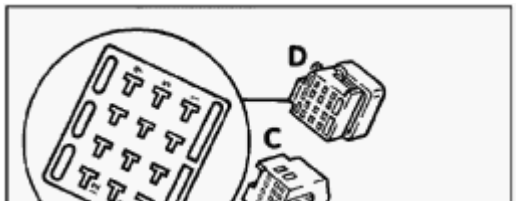
- Check signal wire for continuity between TP sensor connector terminal 3 and test box socket A24.

  Specified value: max. 1 ohm (Ω)

If the specified value is not obtained:

- Determine open or short circuit in wiring using wiring diagram; repair as necessary.

6-pin TP sensor connector terminal	ECM connector A terminal or Ground
1	A3
3	A24
2	Intake manifold Ground (GND)



Note:

If it becomes necessary to repair or replace any of the throttle position sensor electrical terminals, ONLY replace with gold-plated terminals.

If the wiring is OK:

- Replace ECM ⇒ page 01-265 .

Adjusting Throttle Position (TP) sensor

Notes:

- *By adjusting the Closed Throttle Position (CTP) switch, the Throttle Position (TP) sensor becomes automatically adjusted.*

- *Adjusting Closed Throttle Position (CTP) switch* ⇒ *page 24-73* .

24-81

Mass Air Flow (MAF) sensor, checking

Notes:

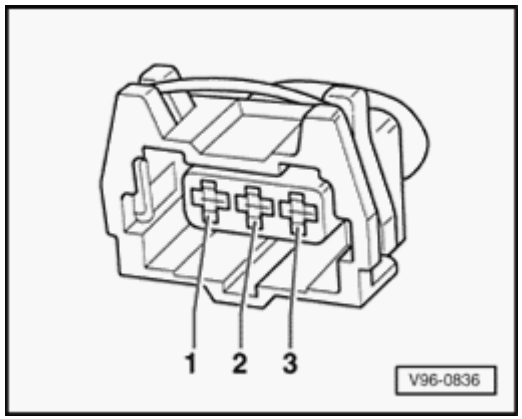
- *To functionally check the Mass Air Flow (MAF) sensor ⇒ Repair Group 01, Basic setting, display group 001, display field 2.*

- *Component locations ⇒ page 24-1 .*

Checking voltage supply

- Mass Air Flow (MAF) sensor fuse OK

- Disconnect MAF sensor harness connector.



- Switch multimeter (Fluke 83 or equivalent) to measure voltage and connect between connector terminals 2 (GND) and 3 (B+) using jumper wires from connector test kit VW 1594.
- Switch ignition ON.

  Specified value: approx. 12 to 14 volts

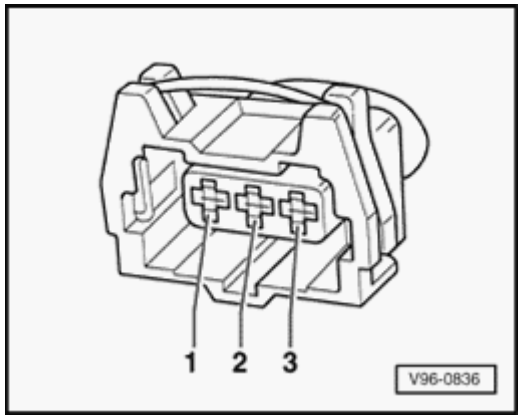
If the specified value is not obtained, perform the following tests:

- Check Mass Air Flow (MAF) sensor fuse.
- Check wiring for continuity between terminal 3 and fuse using wiring diagram.

  Specified value: max. 0.5 ohms(Ω)

- Check wiring for continuity between terminal 2 and intake manifold Ground (GND).

  Specified value: max. 0.5 Ω

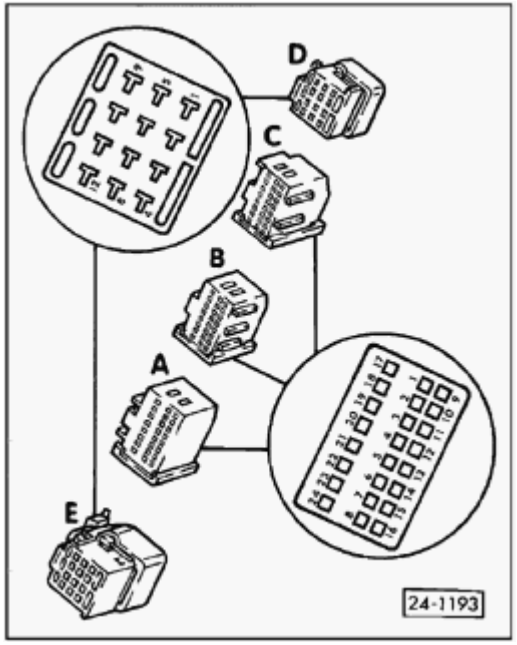


Checking signal wire

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .
- Check signal wire for continuity between MAF sensor connector terminal 1 and test box socket A12.

  Specified value: max.1.0 Ω

If the specified value is not obtained:



- Find short circuit or open circuit; repair as necessary.

MAF sensor connector terminal	ECM connector A terminal
1	A12

Note:

If it becomes necessary to repair or replace any of the Mass Air Flow (MAF) sensor electrical terminals, ONLY replace with gold-plated terminals.

Checking function

- Slide back protective boot from back of MAF sensor connector (leaving it connected).

Note:

The connector pin numbers are marked on the back of the connector itself.

- Switch multimeter (Fluke 83 or equivalent) to measure voltage and connect between terminal 2 (GND) and terminal 1 (B+) using jumper wires from connector test kit VW 1594.

- Switch ignition ON.

  Specified value: 0.3 to 1.1 volts

- Start engine and let idle.

- Switch off all electrical consumers (engine coolant fan should not run during measurement).

  Continuously vary engine speed between idle and 4000 RPM.

  Specified value: 1.5 volts minimum to 3.4 volts

max. depending on engine speed (RPM)

If the specified value is not obtained:

- Replace Mass Air Flow (MAF) sensor.

Intake manifold change-over, checking

Carry out this check only if complaints of "vehicle under-powered" are received.

Intake manifold change-over from the "long" to "short" intake path occurs at approx. 4000 RPM.

Checking function

- Raise engine speed above 4000 RPM.

- Vacuum canister for intake manifold change-over valve (on intake manifold, left rear) must tighten.

If canister does not tighten:

- Check intake manifold change-over valve using output Diagnostic Test Mode ⇒ page 01-145 ,.

  If necessary check valve and triggering ⇒ page 24-64 .

- Check vacuum reservoir for leaks ⇒ page 24-111 .

-
  Check vacuum lines for correct routing, leakage

and flow (blockage) ⇒ page 24-111 .

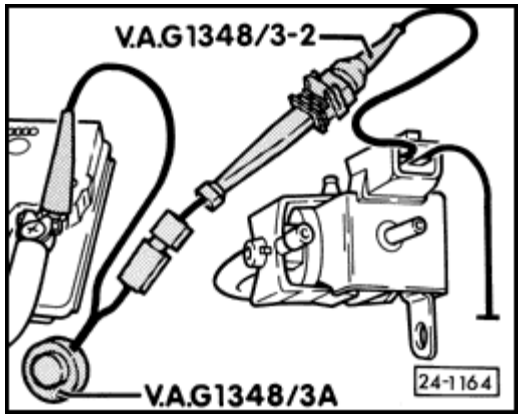
- Actuate change-over linkage by hand to check change-over system mechanical components for ease of movement.

Checking vacuum system

- Start engine and let idle for two to three minutes to build up vacuum.

- Switch ignition OFF.

- Disconnect 2-pin harness connector from intake manifold change-over valve.



- Using jumper wires from connector test kit VW 1594:
  - Connect either connector terminal to intake manifold Ground (GND) point.
  - Connect remaining terminal to VAG1348/3A remote control.
  - Connect VAG1348/3-2 adapter wire to B+.
- Activate remote for approx. 2 to 3 minutes, during which time vacuum canister must remain connected.

If the vacuum canister returns to its original position, check as follows:

- Switch ignition OFF.
- Disconnect vacuum lines from intake manifold change-over vacuum canister.
- Connect US 8026 hand pump to vacuum canister.
- Operate hand pump and note change-over operation.

24-87

- Check vacuum canister for leaks

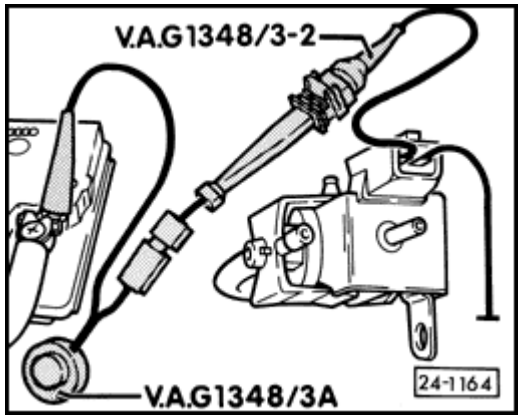
  - Vacuum canister should tighten and not return to its original position until the vacuum is released at the hand pump

If vacuum canister returns to its original position (while vacuum is applied):

- Replace intake manifold change-over canister.

If vacuum canister does not tighten, check intake manifold change-over valve for continuity as follows:

- Using jumper wires from connector test kit VW 1594:



  - Connect either of valve terminals to intake manifold Ground (GND) connection.
  - Connect remaining terminal to VAG1348/3A remote control.
  - Connect VAG1348/3-2 adapter wire to B+.
- Operate VAG1348/3A remote control.
- Check valve for flow (remove vacuum lines and blow through them).
- If necessary, replace intake manifold change-over valve.

If no malfunction was found during these checks:

- Check vacuum system for leakage ⇒ page 24-111 .

Auxiliary input signals, checking

Rear window defroster signal, checking

Requirement

- Engine Control Module (ECM) coding OK ⇒ page 01-247 .

Checking

- Using VAG 1551 scan tool, select "Read Measuring Value Block" function 08, display group 004, display field 4 ⇒ page 01-249 .

Read measuring value block 4 →

1 2 3 4

➢ Indicated on display, note value in display field 4

Specified value: 0XX_XX

CAUTION!

Do not use the shift inputs (identified by an X) during the RPM increase check.

- Switch ON rear window defroster.

Specified value: 1XX_XX

If display value is OK:

- Press → button.
- Select "End Output" function 06.
- Press -Q- button to confirm input.

24-89

If display value does not change:

- Switch ignition OFF and connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .

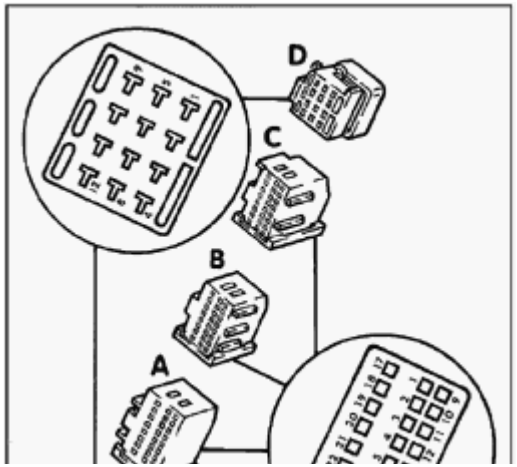
- Connect VAG 1527B voltage tester between VAG 1598/19 test box socket C14 and Ground (GND).

- Switch ignition ON.

- Switch ON rear window defroster.

  - Voltage tester must light up

If voltage tester does not light up:



- Check wiring for continuity between C14 and rear window defroster using wiring diagram.

If wiring is OK:

- Check rear window defroster using wiring diagram.

If rear window defroster is OK:

- Replace ECM ⇒ page 01-265 .

24-90

A/C compressor shut-off signal, checking

Note:

The A/C compressor is switched off during acceleration by the Engine Control Module (ECM) and at wide open throttle by the Transmission Control Module (TCM) via the kickdown switch.

A/C compressor shut-off is bi-directional ("in"and "out").

- *IN: Shortly before switching the A/C compressor on, voltage is applied to the ECM which causes the Idle Air Control (IAC) valve to open a little more to adjust to the higher load.*

- *OUT: When accelerating from a standstill position and at lower speed, the A/C compressor is shut off for approx. 12 seconds via control by the ECM. If the accelerator pedal is released early enough, the duration is reduced to a minimal 3 seconds.*

Checking requirements

- A/C function OK

- No malfunctions stored in DTC memory
- Vehicle at room temperature; above 15 °C (59 °F)

24-91

Checking

- Start engine and let idle.

- Switch A/C on, push "AUTO" button, set temperature to "LO" and blower speed to "HI".

  - A/C compressor symbol must light up and A/C must run.

- Using VAG 1551 scan tool, select "Basic Setting" function 04, display group 004 ⇒ page 01-150 .

  - A/C compressor must stop (visual check)

If the A/C compressor does not shut off:

- Switch A/C off (press "minus" button for fresh air blower in A/C control head repeatedly, until all indicators are off).

  Continue to let engine run in idle.

- Using VAG 1551 scan tool, select "Read Measuring Value Block" function 08, display group 004.

Read measuring value block 4 →

1 2 3 4

Indicated on display; note value in display field 4

CAUTION!

Do not use the shift inputs (identified by an X) during the RPM increase check.

- Switch on A/C as described.

  Specified value: X1X_XX

24-92

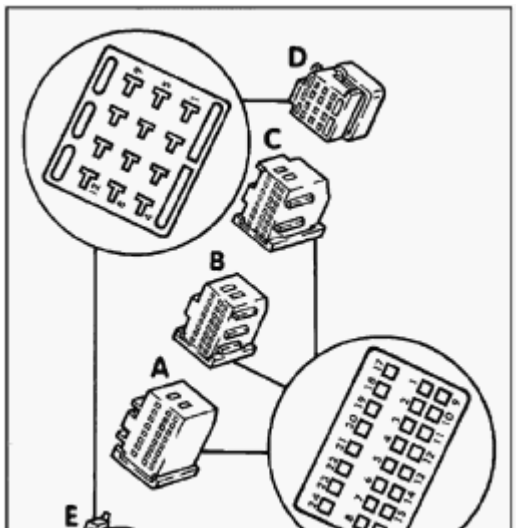
If the specified values are obtained:

- Press → button.
- Select "End Output" function 06.
- Press -Q- button to confirm input.

If display value changes:

- The following display is possible: "A/C system not switched on as described."

If the display value does not change, even though the A/C system was switched on as described:



- Check wiring for continuity between connector terminal C11 and ECM or TCM using wiring diagram.

If wiring is OK:

- Check A/C system or automatic transmission:

⇒ *Repair Manual, Heating & Air Conditioning, Repair Group 01; connect VAG 1551 scan tool and select "Check DTC Memory" function 02*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01; connect VAG 1551 scan tool and select "Check DTC Memory" function 02*

24-93

If X1X_XX is displayed:

- Briefly press accelerator pedal to apply wide open throttle.

  - Display must switch briefly to X0X_XX, then X1X_XX must appear again after several seconds.

If display does not change as described:

- Check whether A/C compressor was shut off while accelerator pedal was being pressed.

- Check A/C system or automatic transmission.

⇒ *Repair Manual, Heating & Air Conditioning, Repair Group 01; connect VAG 1551 scan tool and select "Check DTC Memory" function 02*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01* ; connect VAG 1551 scan tool and select "Check DTC Memory" function 02

If the display does not change as described:

- Replace ECM ⇒ page 01-265 .

24-94

Engine speed (RPM) signal, checking

Notes:

The RPM signal is routed from the ECM to various electronic systems (e.g. automatic transmission, ABS, etc.). The RPM signal is monitored by the different electronic systems.

Carry out the following check only if the tachometer (in the instrument cluster) is inoperative, or if the A/C compressor is not running.

- Connect VAG 1367 engine-tester to tachometer using wiring diagram.

- Connect VAG 1367 engine-tester signal wire (green terminal) to instrument cluster RPM terminal and A/C control module RPM terminal (connector remains connected).

- Start engine and let idle.

  - RPM must be displayed again

If the specified value is obtained, the malfunction is in instrument cluster or on A/C control module.

If the RPM is not displayed on VAG 1367 engine-

tester:

- Check wiring between ECM terminal C10 and instrument cluster or A/C control module using wiring diagram.

If wiring is OK:

- Replace ECM ⇒ page 01-265 .

24-95

Fuel consumption signal, checking

Notes:

- *The consumption signal is internally calculated by the ECM using "injection time."*
- *The consumption signal is routed to both the trip computer and the Transmission Control Module (TCM).*
- *The consumption signal is monitored by the TCM*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01; On Board Diagnostic*

Carry out the following check only if DTC memory contains a stored DTC for the TCM related to the consumption signal, or a missing or false consumption signal, determined during the trip computer check.

- Remove instrument cluster or TCM.

⇒ *Repair Manual, Electrical Equipment, Repair*

Group 90; Instrument cluster, repairing

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

- Connect VAG 1598 test box to instrument cluster harness connector (I/P insert not connected) or to TCM harness connector (TCM not connected).

⇒ *Repair Manual, Electrical Equipment, Repair Group 90; Instrument cluster, repairing*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V; Repair Group 01, On Board Diagnostic*

24-96

- Switch Fluke 83 multimeter to voltage measurement range and connect between signal wire (trip computer 20-pin connector) and Ground (GND), using wiring diagram.

- Start engine and let idle.

  Specified value: approx. 0.3 to 0.6 volts, corresponding to engine speed (RPM)

- Vary engine speed continuously from 1000 to 4000 RPM.

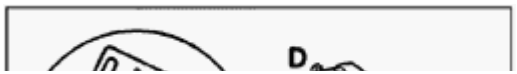
  Specified value: approx. 0.3 to 0.6 volts, corresponding to engine speed (RPM)

If the specified value is not obtained, even though the trip computer shows no consumption value or there is a stored malfunction in the TCM:

- Stop engine (switch ignition off).

- Replace trip computer and/or TCM as required.

If the specified value is not obtained:



- Check wiring between ECM terminal C12 and black 20-pin trip computer connector, using wiring diagram.

If wiring OK and the specified value is not obtained:

- Replace ECM ⇒ page 01-265 .

24-97

Vehicle speed signal, checking

Note:

The vehicle speed signal originates from the vehicle speed sensor (on the transmission) and is routed to the instrument cluster as well as to the Engine Control Module (ECM).

- Speedometer in instrument cluster OK

Checking

- Using VAG 1551 scan tool, select "Read Measuring Value Block" function 08, display group 003 ⇒ page 01-249 .

Read measuring value block 3 →

1 2 3 4

Indicated on display

- Observe display field 4 while accelerating from standstill.

  Specified values:

  - 0 mph (at standstill)
  - Actual speed (vehicle driven)

- Press → button.
- Select "End Output" function 06.
- Press -Q- button to confirm input.

24-98

If no vehicle speed is displayed between standstill and moving:

- Switch ignition OFF and connect VAG 1598/19 test box ⇒ page 01-255 .

- Connect VAG 1527B voltage tester between test box sockets 13C (signal) and 10D (B+).

- Raise front of vehicle until left-front wheel is free to rotate.

Note:

The right front wheel must NOT rotate.

- Switch ignition ON.

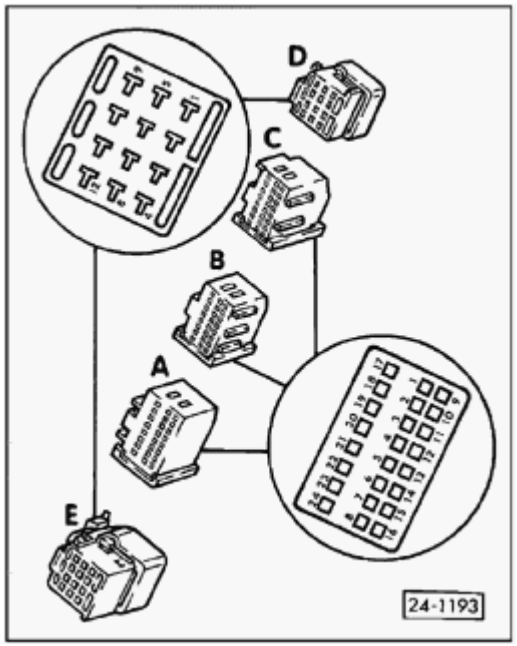
  - Voltage tester must light up at half strength

- Rotate left front wheel by hand.

  - Voltage tester must become brighter (flash)

If tester does not light up (become brighter) or flash:

- Check wiring between test box socket 13X and



vehicle speed sensor, using wiring diagram.

- Find and eliminate open circuit in wiring between terminal C13 and vehicle speed sensor.

If wiring is OK, replace vehicle speed sensor.

If voltage tester does not light up (become brighter) or flash, replace ECM ⇒ page 01-265 .

24-99

Transmission Range (TR) selector lever position signal, checking

Note:

The Engine Control Module (ECM) uses this signal to recognize the transmission range selector lever position. When a driving mode is selected, idle speed should drop by approx. 50 RPM to reduce creep.

Checking requirement

- Control module coding OK ⇒ page 01-247 .

- Switch ignition ON.

- Using VAG 1551 scan tool, select "Read Measuring Value Block" function 08, display group 004, display field 4 ⇒ page 01-249 .

Read measuring value block 4 →

1 2 3 4

Indicated on display

Specified value: XXX_1X (TR selector lever in P or N)

- Apply brake and select drive mode (1, 2, 3, R or D).

Specified value: XXX_0X

CAUTION!

Do not use the shift inputs (identified by an X) during the selector lever position check.

24-100

- Press → button.

- Select "End Output" function 06 and press -Q- button to confirm input.

If a display did NOT change, even though coding is OK:

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .

- Connect VAG 1527B voltage tester between test box sockets 11B (signal) and 10B (constant B+/terminal 30).

  - Voltage tester must light up (with TR selector lever in P or N), then go out with drive mode (1, 2, 3, R or D) selected

If voltage tester lights up and goes out when drive mode is selected, even though the range indicator in the "Read measuring value block" is OK:

- Replace ECM ⇒ page 01-265 .

If voltage tester lights up constantly or not at all:



- Check wiring for short to ground, short to B+ or open circuit between

ECM terminal 11B and multi-function switch, using wiring diagram.

If wiring is OK:

- Check multi-function switch.

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

24-101

Shift procedure, checking

Notes:

- *The Engine Control Module (ECM) uses this signal to briefly retard the ignition during shifting to reduce the mechanical jerking felt between shifts.*
- *The shift signal is monitored by the Transmission Control Module (TCM).*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01; On Board Diagnostic*

Carry out the following check only if a shift-related DTC is stored in the TCM DTC memory.

Checking requirement

- Control module coding OK ⇒ page 01-247

CAUTION!

Always use a second technician to operate the VAG 1551 scan tool while driving.

- Test drive and select "Read Measuring Value Block" function 08, display group 004 ⇒ page 01-249 .

24-102

Read measuring value block 4 →

1 2 3 4

Indicated on display; note display field 4

Specified value: XXX_X0

- Shift value must increase briefly during shifting.

Specified value: XXX_X1

Notes:

Due to its short signal duration, shifting cannot always be observed on the VAG 1551 scan tool.

CAUTION!

Do not use the shift inputs (identified by an X) during the shift signal check.

- Press → button.
- Select "End Output" function 06.
- Press -Q- button to confirm input.

If the change in the shift signal display did not occur, even though the control module coding was OK:

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .
- Check wiring for open or short circuit between ECM and TCM, using wiring diagram.

24-103

Upshift and downshift signals, checking

Notes:

- *The Engine Control Module (ECM) uses this signal in connection with the shift signal to determine whether the current signal is an upshift or downshift.*
- *The signal for upshift and downshift is monitored by the Transmission Control Module (TCM).*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01; On Board Diagnostic*

Checking requirement

- Control module coding OK ⇒ page 01-247 .

24-104

Throttle position sensor output signal, checking

Notes:

- *The Transmission Control Module (TCM) interprets this information as a load signal.*
- *This signal is monitored by the TCM.*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 01; On Board Diagnostic*

Checking requirement

- Control module coding OK ⇒ page 01-247 .

24-105

Malfunction Indicator Lamp (MIL) wire from Transmission Control Module (TCM), checking

Notes:

- *If a malfunction is recognized by the Engine Control Module (ECM) or the Transmission Control Module (TCM), it is indicated by the Malfunction Indicator Lamp (MIL) in the instrument cluster.*
- *If the TCM recognizes a malfunction, the MIL is switched on via the ECM.*
- *The MIL wiring is monitored by the ECM.*

Checking requirement

- Control module coding OK ⇒ page 01-247 .

24-106

- Switch ignition ON.

- Using VAG 1551 scan tool, select "Read Measuring Value Block" function 08, display group 027, display field 1 ⇒ page 01-249 .

Read measuring value block 27 →

1 2 3 4

Indicated on display; note display field 1

Specified value: 0

- Start engine and let idle.

Specified value: 1

- Press → button.
- Select "End Output" function 06.
- Press -Q- button to confirm input.

If the specified value is not obtained, even though coding is OK:

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .
- Check wiring for open or short circuit between ECM and TCM, using wiring diagram.

24-107

Fuel level signal (from instrument cluster), checking

Notes:

- *If the fuel level in the tank is too low (less than 3.2 gal); combustion misfire, oxygen sensor and fuel system malfunctions could occur. In these cases the malfunction "Fuel tank level too low" is stored in DTC memory.*
- *The fuel tank level signal is monitored by the Engine Control Module (ECM).*

Checking requirements:

- Control Module coding OK ⇒ page 01-247 .
- Fuel content greater than 3.2 gal (12 liters).
- Instrument cluster fuel gauge OK.

24-108

- Switch ignition ON.

- Using VAG 1551 scan tool, select "Read Measuring Value Block" function 08, display group 027, display field 2 ⇒ page 01-249 .

Read measuring value block 27 →

1 2 3 4

Indicated on display; note display field 2

Specified value: 0

- Start engine and let idle.

Specified value: 1

- Press → button.
- Select "End Output" function 06.
- Press -Q- button to confirm input.

If the specified value is not obtained, even though coding is OK:

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .
- Check wiring for open or short circuit between ECM and instrument cluster, using wiring diagram.

24-109

Rough road condition signal, checking

ABS control module with ABS/EDL

Notes:

- *Misfires can result in malfunctions such as "Combustion misfire" being recorded in DTC memory due to road wheel malfunctions.*
- *If the ABS control module recognizes a free turning wheel, it generates a rough road signal.*
- *If the Engine Control Module (ECM) recognizes the rough road signal, misfire recognition is switched off in the ECM.*
- *The rough road signal is created to check whether DTC 18014 "Rough Road Spec Engine Torque ABS-SG Electrical Malfunction" is stored in DTC memory. The "Combustion misfire" malfunction results from this signal and can be ignored.*
- *The rough road signal is monitored by the ECM.*

Checking requirement

- Control module coding OK ⇒ page 01-247 .

Checking

- Switch ignition OFF.

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .

- Check signal wire for open or short circuit between ECM and ABS control module, using wiring diagram.

- Find and eliminate open or short circuit; repair as necessary.

If wiring is OK:

- Replace ABS control module.

If the ABS control module is OK, but the malfunction is still occurring:

- Replace ECM ⇒ page 01-265 .

ABS control module with ABS/EDL/ASR

Notes:

- *The torque signal is monitored by the "Automatic Traction Control" Control Module and by the ECM.*

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

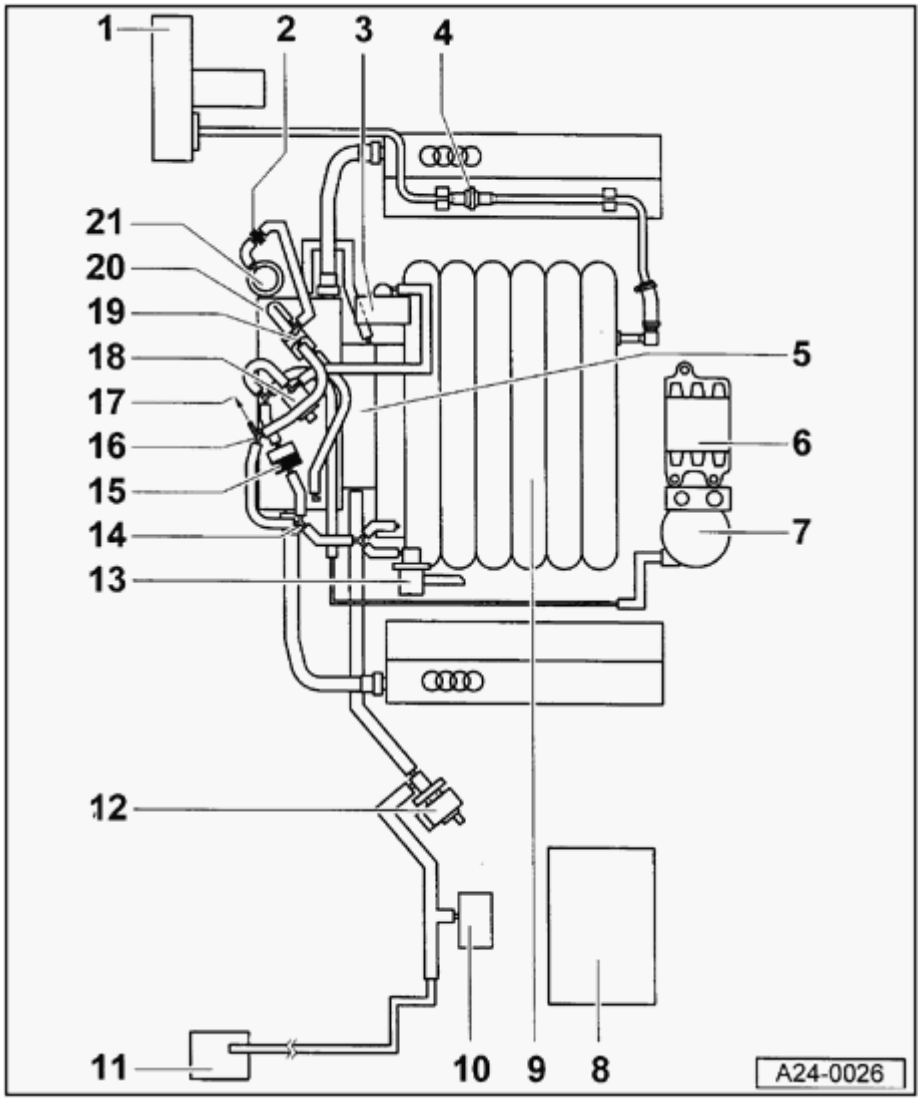
- *Vehicles with automatic traction control (ASR) can be recognized by the ASR indicator light in the instrument cluster or by control module identification displayed during the ABS On Board Diagnostic program sequence.*

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

Checking requirement

- Control module coding OK ⇒ page 01-247 .

24-111



Vacuum connections

Vehicles with manual transmission

1 - Brake booster

2 - Check valve

3 - Vacuum canister

- For intake manifold change-over valve

4 - Check valve

5 - Throttle body

6 - Ignition coils

- Ignition coil 1 -N-
- Ignition coil 2 -N128-
- Ignition coil 3 -N158-

7 - Vacuum reservoir

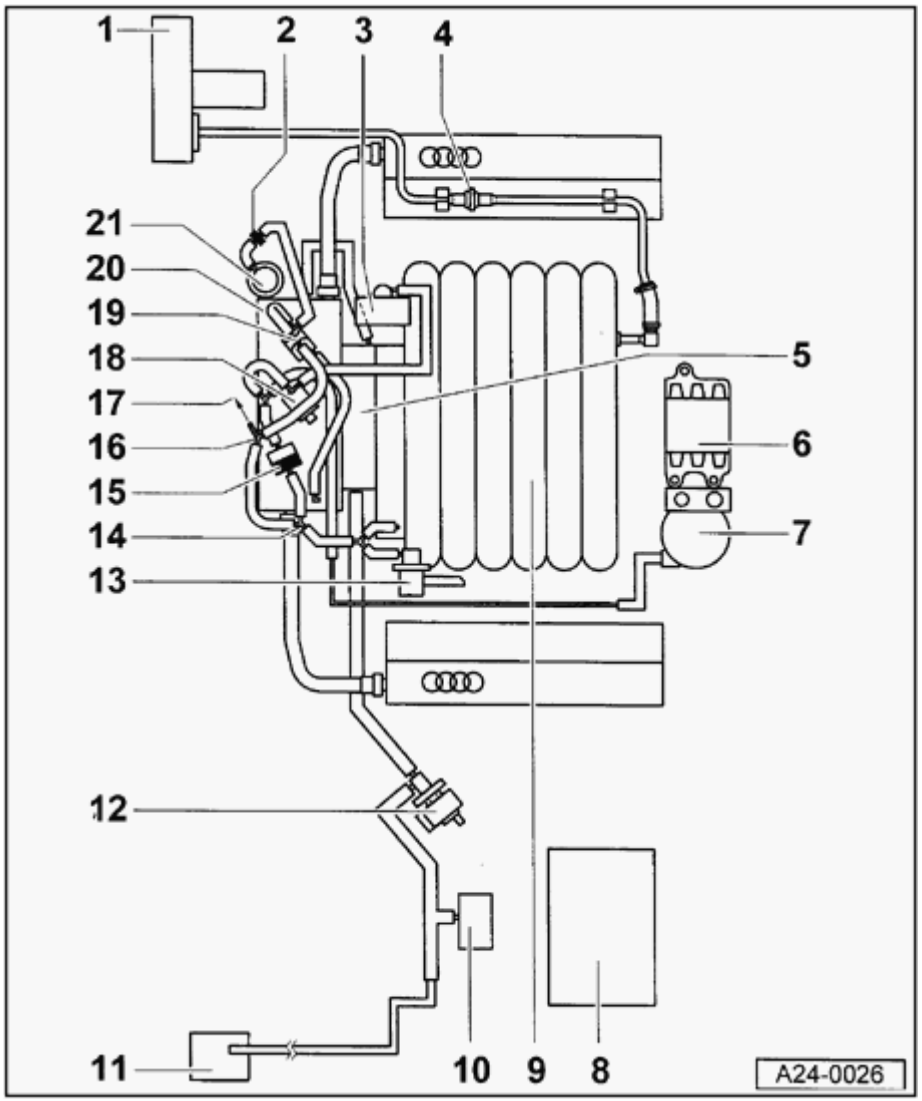
- For intake manifold change-over valve

8 - Air cleaner

9 - Intake manifold

10 - Sensor for EVAP canister

24-112



11 - EVAP canister

12 - EVAP canister purge regulator valve

13 - Fuel pressure regulator

14 - T-connector

- Only for vehicles with A/C and/or EGR

15 - Check valve

16 - T-connector

- Only for vehicles with A/C

17 - To A/C

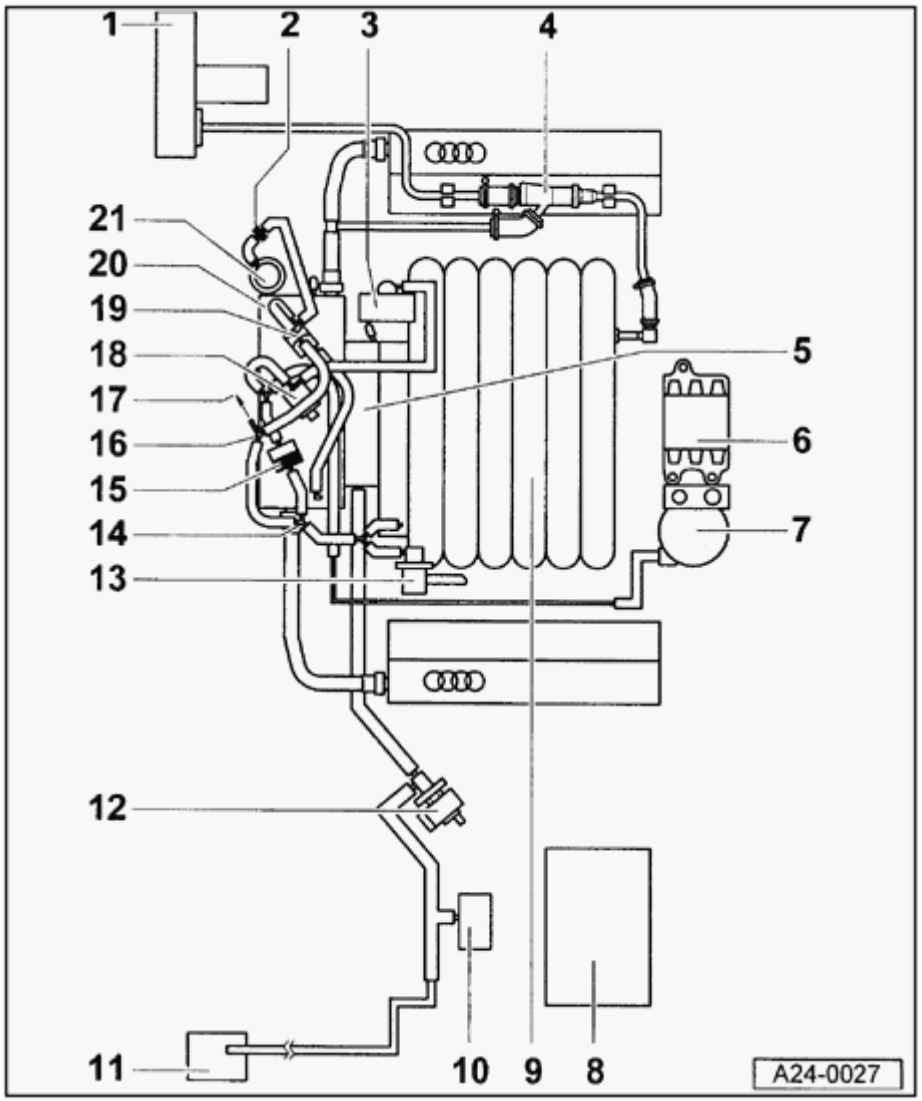
18 - Intake manifold change-over valve

19 - EGR vacuum regulator solenoid valve

20 - Sound dampener

21 - EGR valve

24-113



Vehicles with automatic transmission

1 - Brake booster

2 - Check valve

3 - Vacuum canister

- For intake manifold change-over valve

4 - Vacuum booster

5 - Throttle body

6 - Ignition coils

- Ignition coil 1 -N-
- Ignition coil 2 -N128-
- Ignition coil 3 -N158-

7 - Vacuum reservoir

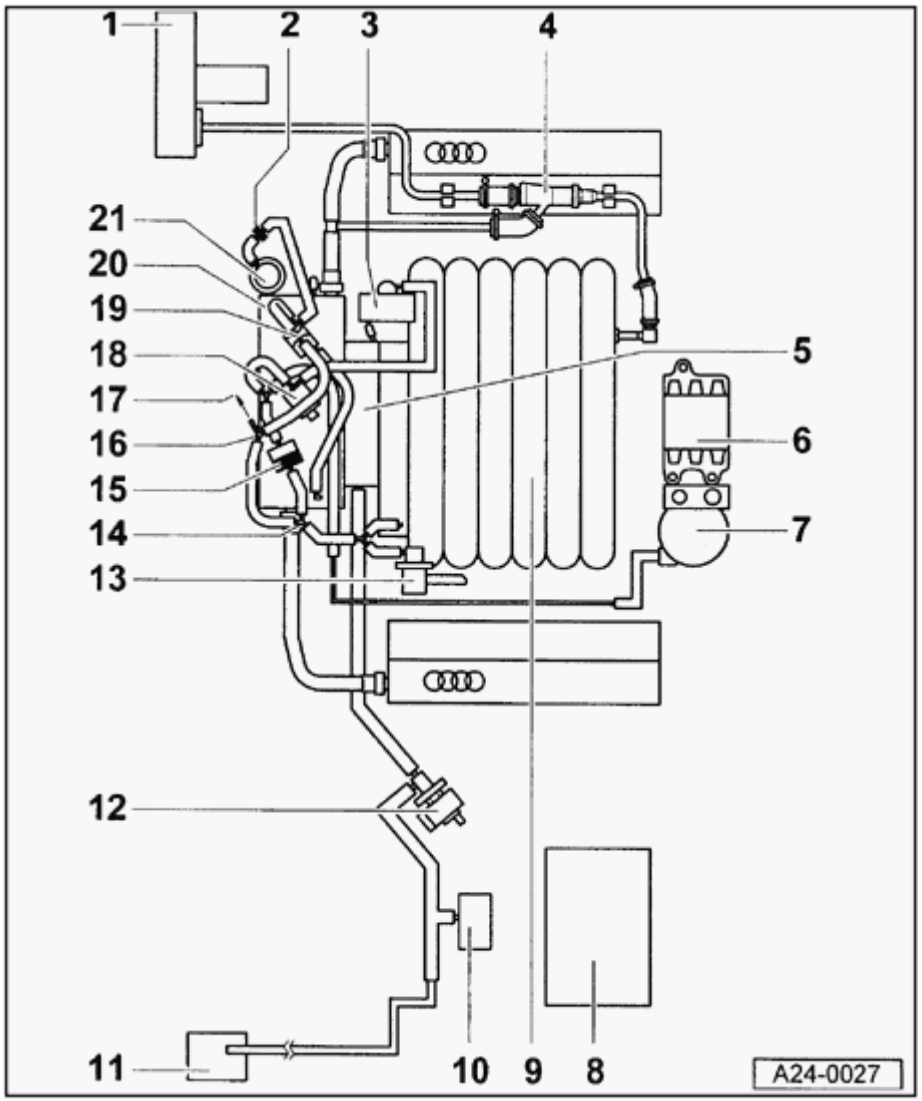
- For intake manifold change-over valve

8 - Air cleaner

9 - Intake manifold

10 - Sensor for EVAP canister

24-114



11 - EVAP canister

12 - EVAP canister purge regulator valve

13 - Fuel pressure regulator

14 - T-connector

15 - Check valve

16 - T-connector

17 - To A/C

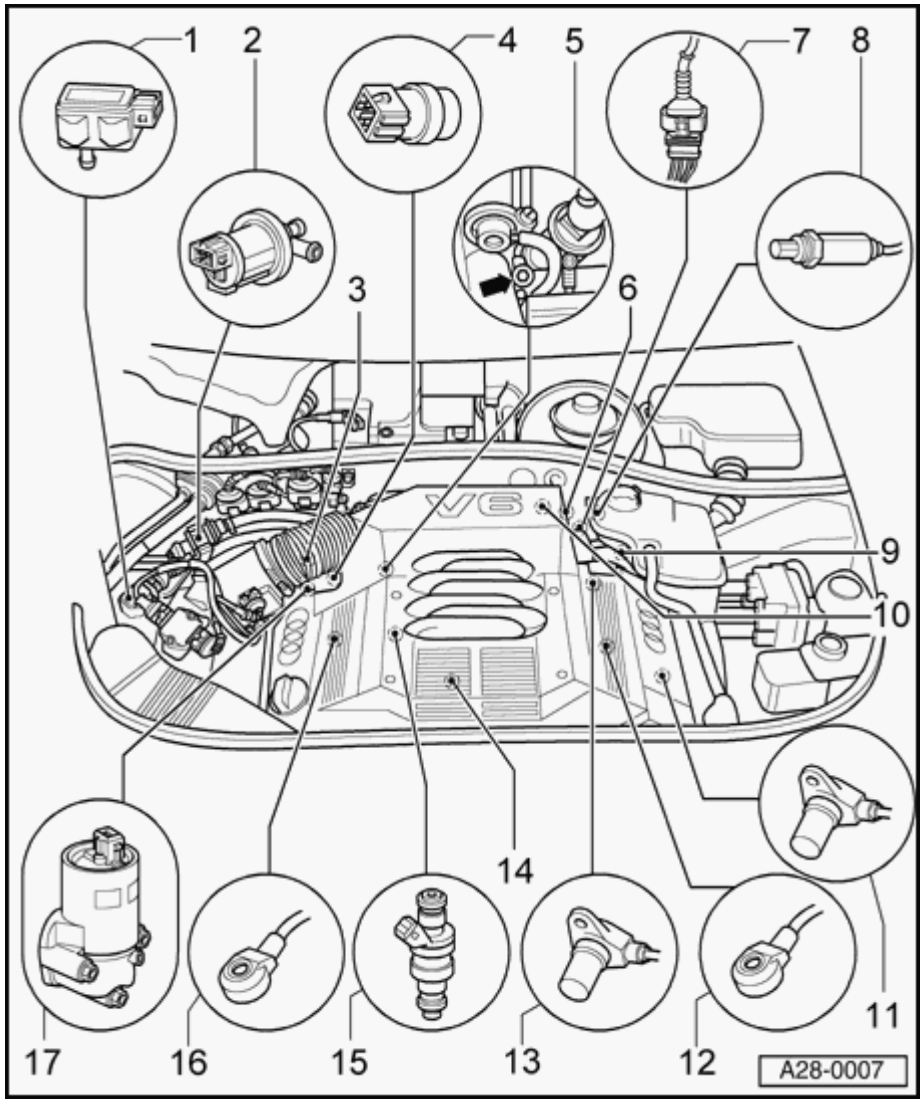
18 - Intake manifold change-over valve

19 - EGR vacuum regulator solenoid valve

20 - Sound dampener

21 - EGR valve

28-1



Multiport Fuel Injection (MFI) and ignition system

Component overview

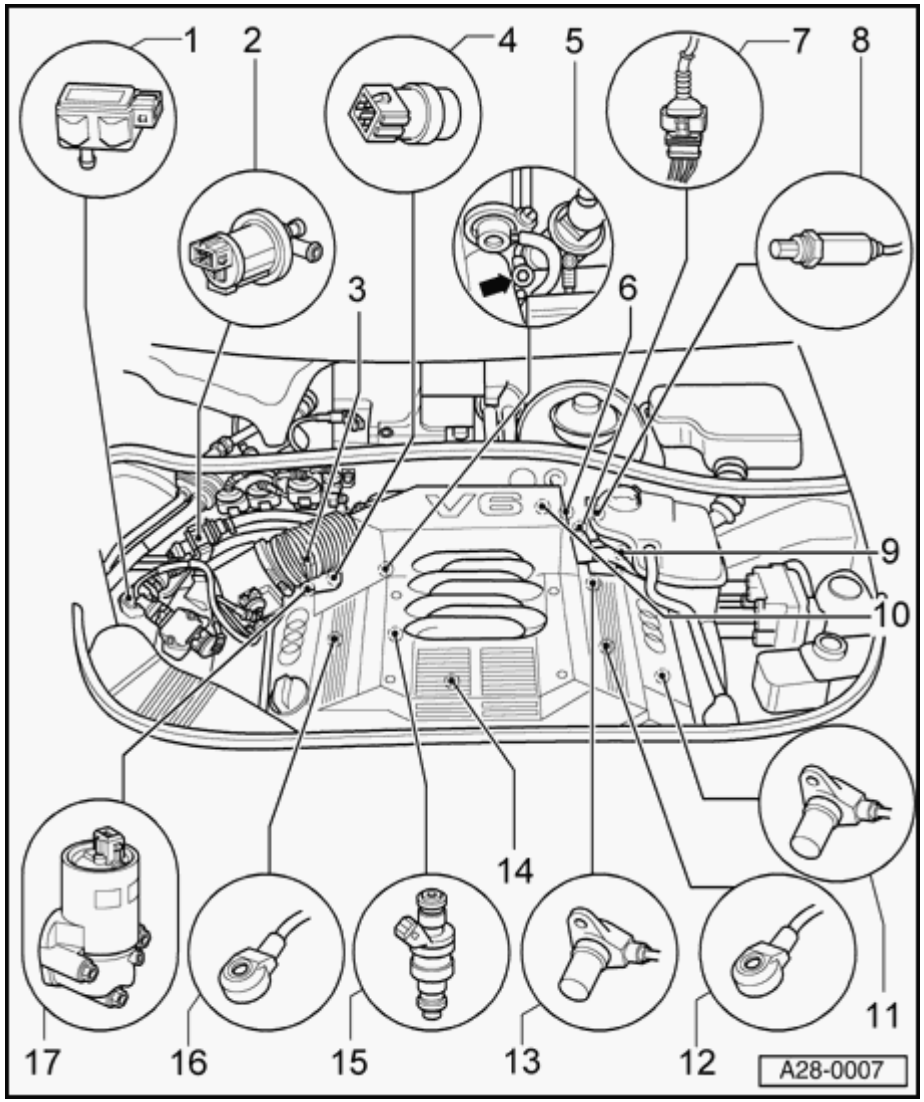
CAUTION!

Fire hazard! Do not smoke, work near heaters or open flame, or have anything in the area that could ignite fuel.

Not shown

- Oxygen Sensor (O2S) behind Three Way Catalytic Converter (TWC) -G130- (bank 1, directly behind right-side three-way catalytic converter)
- Oxygen Sensor (O2S) 2 behind Three Way Catalytic Converter (TWC) -G131- (bank 2, directly behind left-side three-way catalytic converter)

28-2



1 - Sensor for EVAP canister -G172-

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

3 - Fuel pressure regulator

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

- On coolant line behind cylinder head)

5 - Ground connection

- On intake manifold

6 - Harness connector

- 3-pin
- For Knock Sensor (KS) 2 -G66-

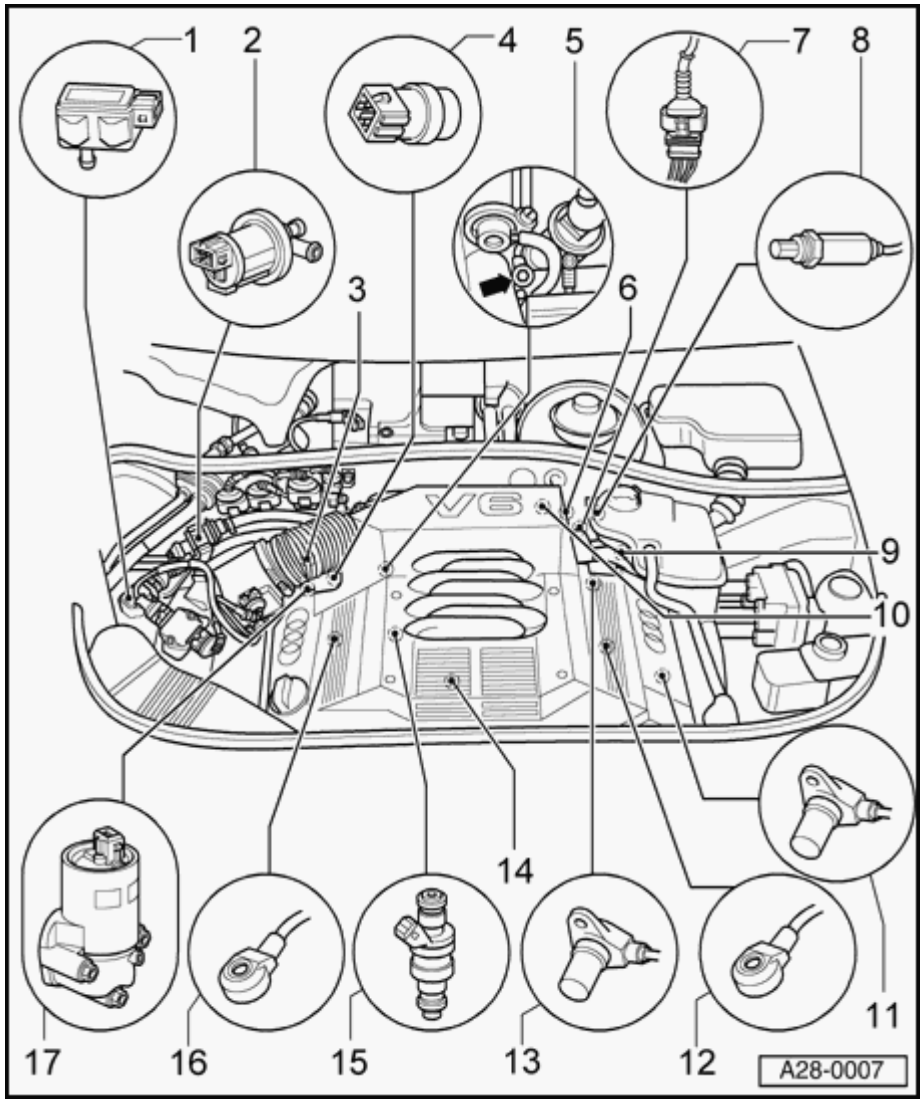
7 - Harness connector

- 4-pin, black
- For Heated Oxygen Sensor (HO2S) 2 -G108- and Oxygen Sensor (O2S) 2 heater -Z28- (bank 2)

8 - Heated Oxygen Sensor (HO2S) 2 -G108-

- Bank 2

28-3



9 - Harness connector

- 2-pin, black
- For EGR temperature sensor -G98-

10 - Harness connector

- 3-pin, white, voltage supply
- For ignition coils 1, 2 and 3, -N-, -N128- and -N158-

11 - Crankshaft Position (CKP) sensor -G4-

- Timing reference mark on left side of cylinder block

12 - Knock Sensor (KS) 2 -G66-

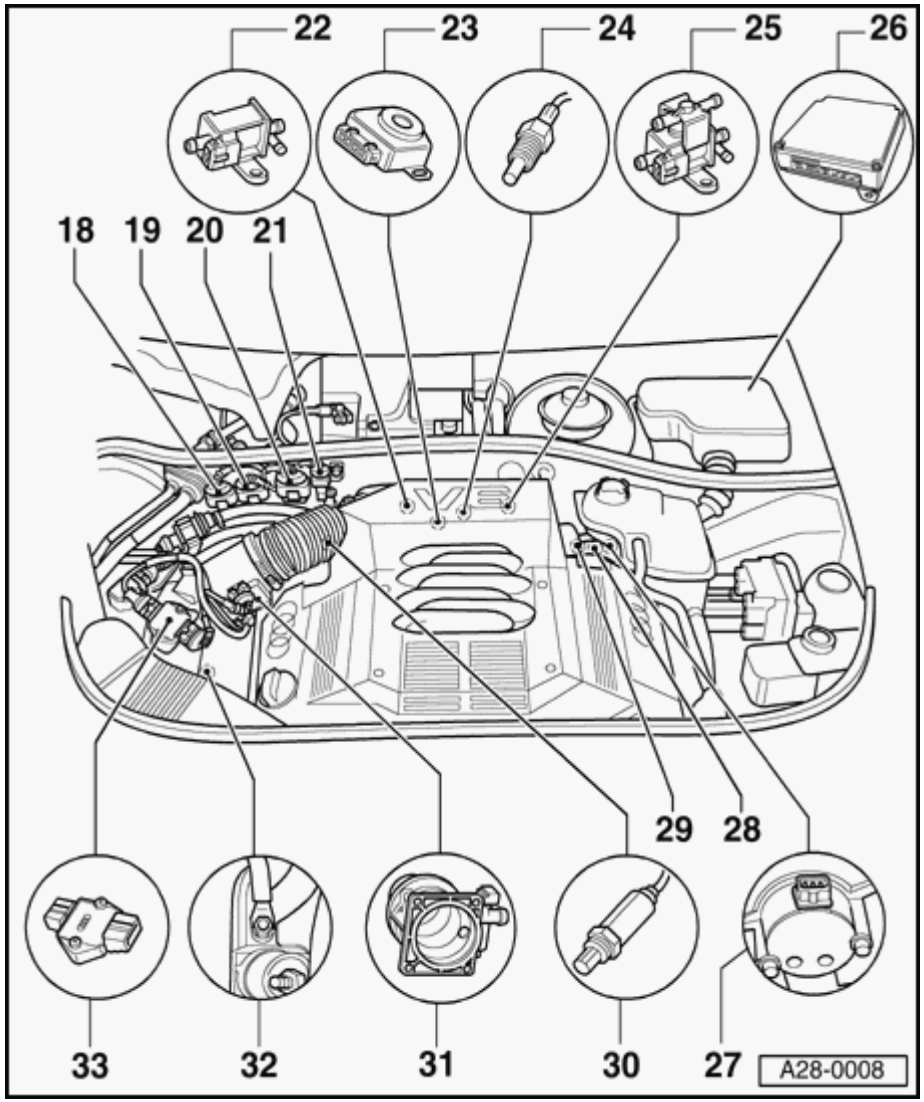
13 - Engine speed (RPM) sensor -G28-

14 - Ignition coils 1, 2 and 3; -N-, -N128- and -N158-

15 - Fuel injectors

16 - Knock Sensor (KS) 1 -G61-

17 - Idle Air Control (IAC) valve -N71-



18 - Harness connector

- 4-pin, green
- For Heated Oxygen Sensor (HO2S) behind Three Way Catalytic Converter (TWC) -G130- and Oxygen Sensor (O2S) heater -Z29- (bank 1)

19 - Harness connector

- 4-pin, brown
- For Heated Oxygen Sensor (HO2S) 2 behind Three Way Catalytic Converter (TWC) -G131- and Oxygen Sensor (O2S) 2 heater -Z30- (bank 2)

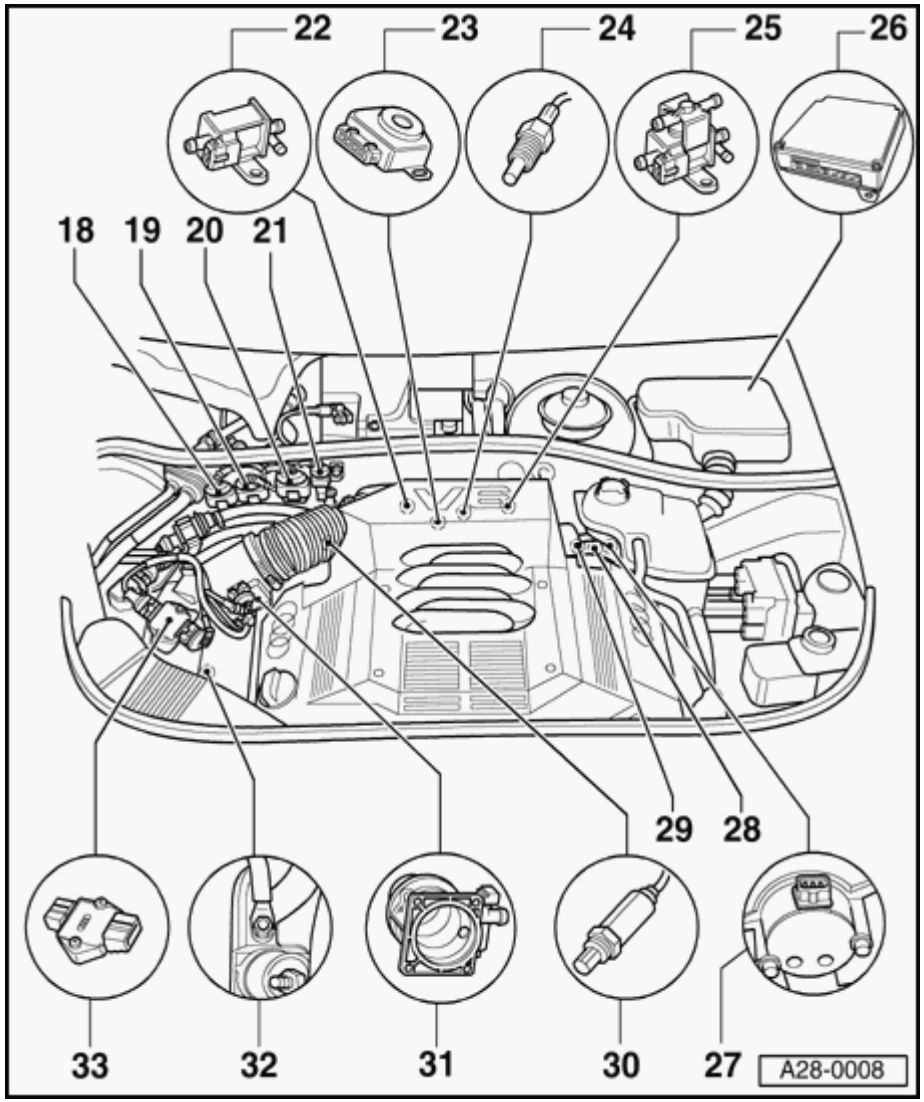
20 - Harness connector

- 4-pin, black
- For Heated Oxygen Sensor (HO2S) -G39- and Oxygen Sensor (O2S) heater -Z19- (bank 1)

21 - Harness connector

- 3-pin
- For Knock Sensor (KS) 1 -G61-

28-5



22 - Intake manifold change-over valve -N156-

23 - Throttle Position (TP) sensor -G69-

- With integral Closed Throttle Position (CTP) switch -F60-

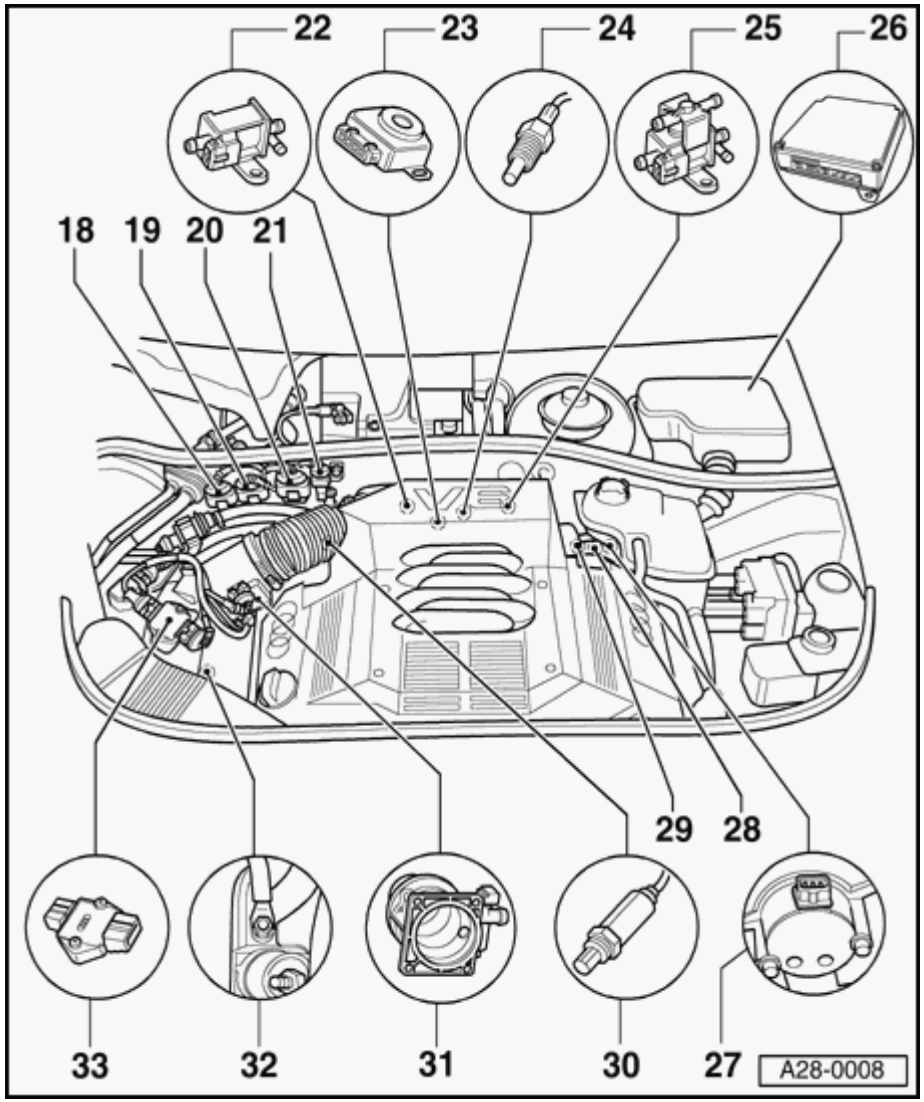
24 - EGR temperature sensor -G98-

- On intake manifold under throttle body

25 - EGR vacuum regulator solenoid valve -N18-

26 - Engine Control Module (ECM) -J192-

- In plenum in electronics box



27 - Camshaft Position (CMP) sensor -G40-

28 - Harness connector

- 3-pin, gray
- For engine speed (RPM) sensor -G28-

29 - Harness connector

- 3-pin, black
- For Crankshaft Position (CKP) sensor -G4- (timing reference mark sensor)

30 - Heated Oxygen Sensor (HO2S) -G39-

- Bank 1

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

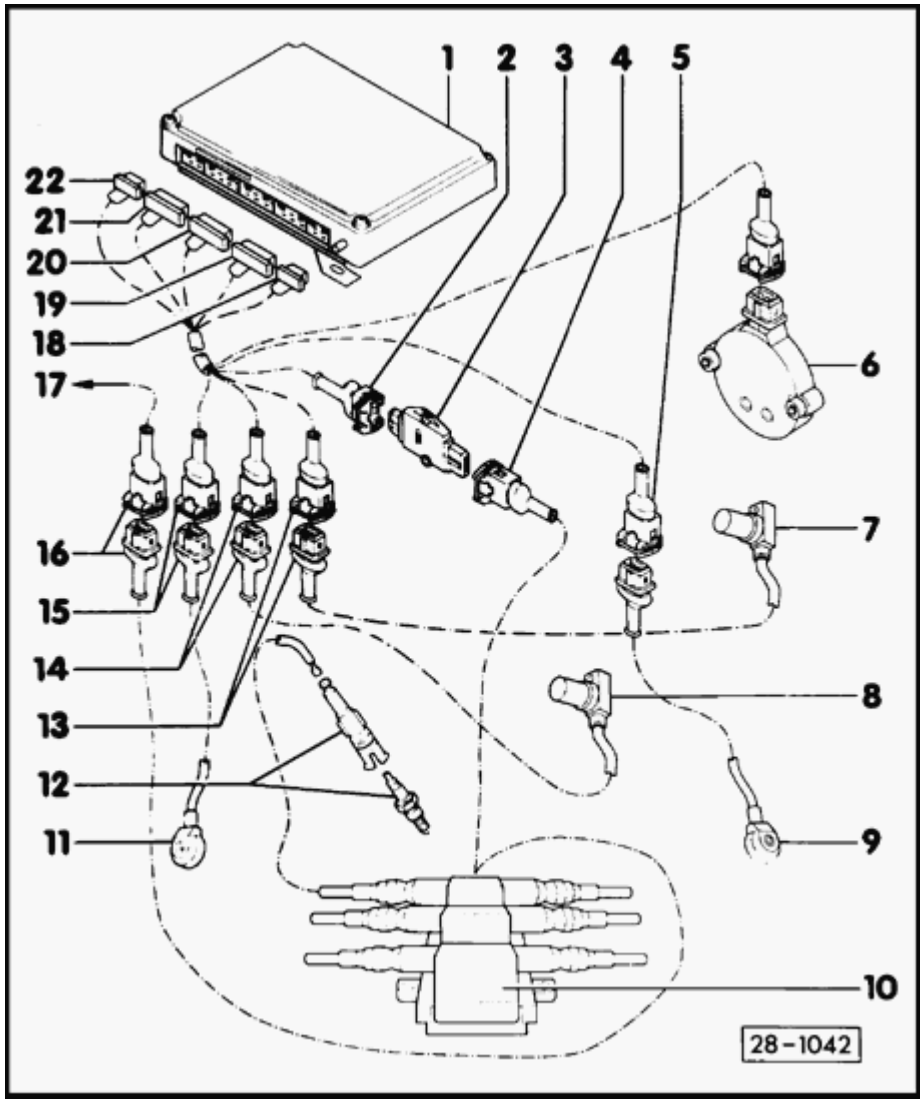
32 - Ground connection

- Right engine mount

33 - Power output stage -N122-

- For ignition coils
- A: 4-pin signal wires from ECM
- B: 3-pin ignition coil primary connections

28-7



Ignition system, servicing

1 - Engine Control Module (ECM) -J192-

2 - ECM signal wires

- 4-pin, light-brown

3 - Power output stage -N122-

- For ignition coils

4 - Ignition coil primary connections

- 3-pin, dark brown

5 - Harness connector

- 3-pin
- For Knock Sensor (KS) 2 -G66-

6 - Camshaft Position (CMP) sensor -G40-

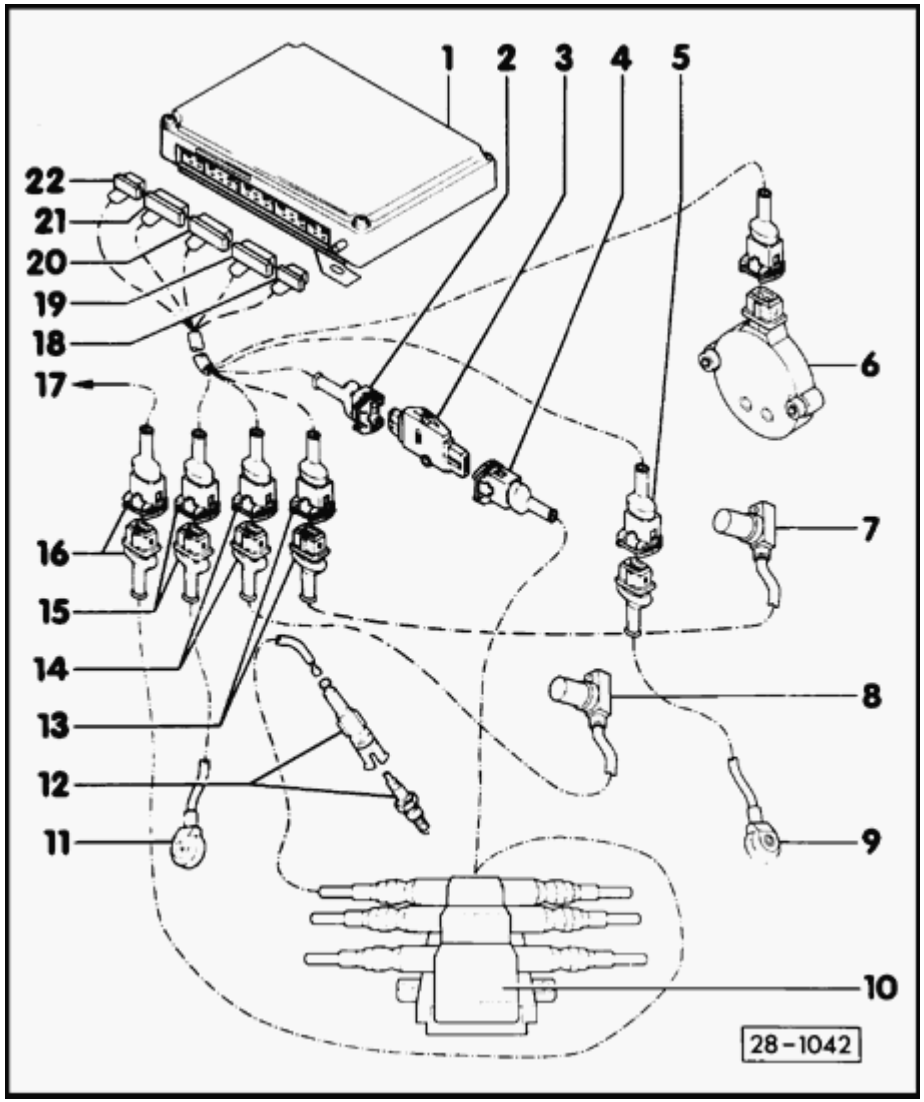
7 - Engine speed (RPM) sensor -G28-

8 - Crankshaft Position (CKP) sensor -G4-

9 - Knock Sensor (KS) 2 -G66-

10 - Ignition coils 1, 2 and 3; -N-, -N128- and -N158-

28-8



11 - Knock Sensor (KS) 1 -G61-

12 - Spark plug connector

13 - Harness connector

- 3-pin, gray
- For engine speed (RPM) sensor -G28-

14 - Harness connector

- 3-pin, black
- For Crankshaft Position (CKP) sensor -G4-

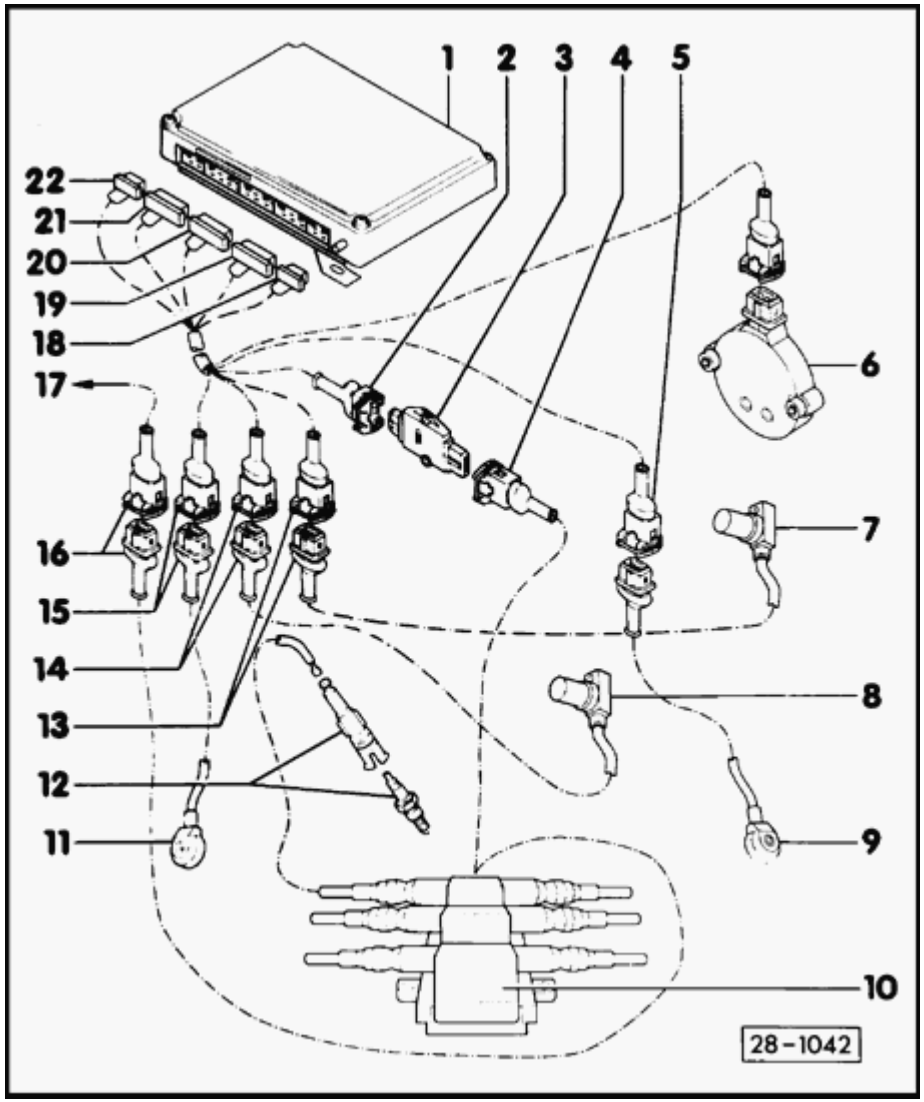
15 - Harness connector

- 3-pin
- For Knock Sensor (KS) 1 -G61-

16 - Harness connector

- 3-pin, white, voltage supply
- For ignition coils 1, 2 and 3, -N-, -N128- and -N158-

28-9



17 - To fuse for ignition coils

18 - ECM connector E

- 12-pin, black

19 - ECM connector A

- 24-pin, black

20 - ECM connector B

- 24-pin, red

21 - ECM connector C

- 24-pin, brown

22 - ECM connector D

- 12-pin, brown

28-10

Technical data

Engine code	AFC	
Idle RPM1) • NOT adjustable; regulated by Idle Speed Control (ISC)	650 to 750 RPM	
Engine speed limiting (upper limit) • By switching off fuel injectors	6200 RPM	
Firing order	1 - 4 - 3 - 6 - 2 - 5	
Spark plugs	Tightening torque	30 Nm (22 ft lb)
	Part No.	101 000 033 AA
	Manufacturer code	BKUR 6 ET - 10
	Electrode gap	0.9 to 1.1 mm (0.035 to 0.041 in.)
	Replacement interval	Every 37,000 miles or every 3 years (whichever occurs first)

1) Idle speed ⇒ page 24-16 .

28-11

Safety measures

WARNING!

Be alert when working on or near the engine. High ignition secondary 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 the starter if the fuel injectors have been removed.***

Be sure the ignition is switched OFF, when:

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

BEFORE cranking the engine at starting RPM (such as for compression testing) disable the ignition and fuel injection systems:

- ***Disconnect the ignition coil power output stage.***
- ***Disconnect harness connectors from all six fuel injectors.***
- ***After the work is completed, erase Diagnostic Trouble Code (DTC) memory.***

28-12

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***

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.***

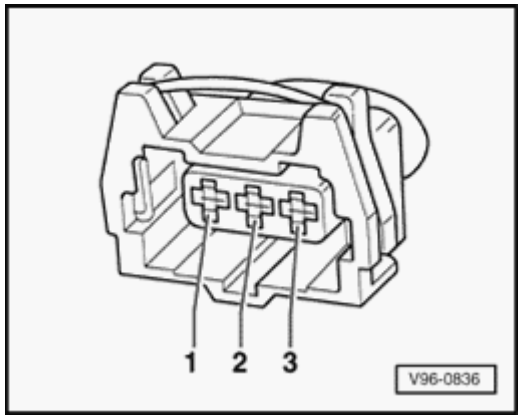
28-13

Ignition coil power output stage, checking

Component locations ⇒ page 28-1 .

- Fuse for ignition coils OK
- Ignition coils OK; checking ⇒ page 28-16

Checking voltage supply



- Disconnect 3-pin power output stage harness connector.
- Switch Fluke 83 multimeter to voltage range and connect between Ground (GND) and terminals 1, 2 and 3 in sequence.
- Switch ignition on.

  Specified value: approx. battery voltage

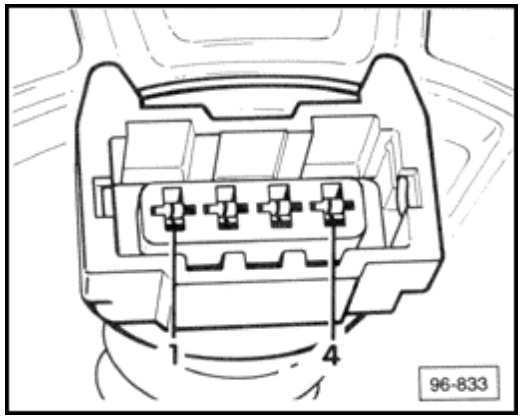
If the specified value is not obtained:

- Eliminate open circuit in wiring using wiring diagram.

28-14

Checking Ground (GND)

- Disconnect 4-pin power output stage harness connector.



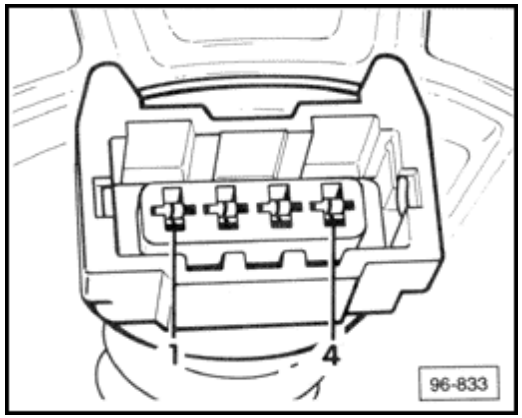
- Switch Fluke 83 multimeter to voltage range, connect between connector terminal 2 (GND) and battery positive voltage (B+).

  Specified value: approx. battery voltage

If the specified value is not obtained:

- Eliminate open circuit using wiring diagram; repair as necessary.

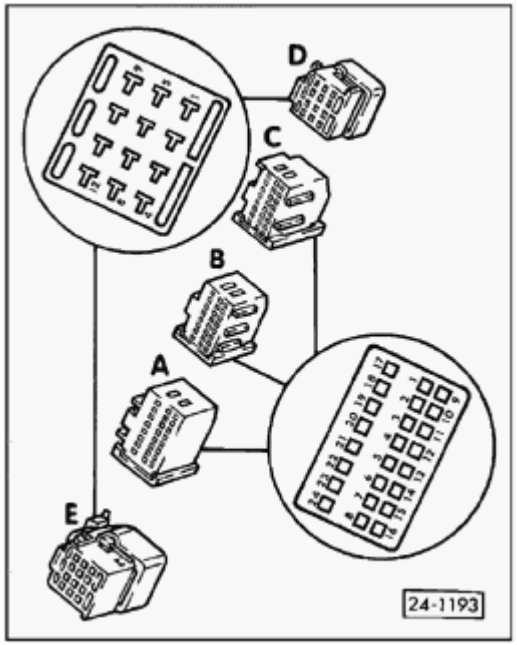
Checking triggering



- Disconnect 4-pin power output stage harness connector.
- Disconnect all six fuel injector harness connectors.
- Connect voltage tester between Ground (GND) and connector terminals 1, 3 and 4 in sequence.
- Switch ignition on.
- Operate starter for several seconds.

• Voltage tester must flash

28-15



If voltage tester does not flash:

- Switch ignition off.

- Switch Fluke 83 multimeter to resistance range and check wiring for continuity between power output stage harness connector and ECM harness connector.
- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .
- Locate open circuit using wiring diagram; repair as necessary.

Power output stage terminal number	ECM connector B terminal number
1	B7
3	B6
4	B5

If wiring is OK:

- Replace ECM ⇒ page 01-265 .

If voltage tester flashes, wiring is OK.

If, during On Board Diagnostic, the diagnostic trouble codes P1393/17801, P1394/17802, or P1395/17803 ("Ignition Coil Power Output Stage 1/2/3 Electrical Malfunction") are displayed:

- Replace ignition coil power output stage.

Ignition coils, checking

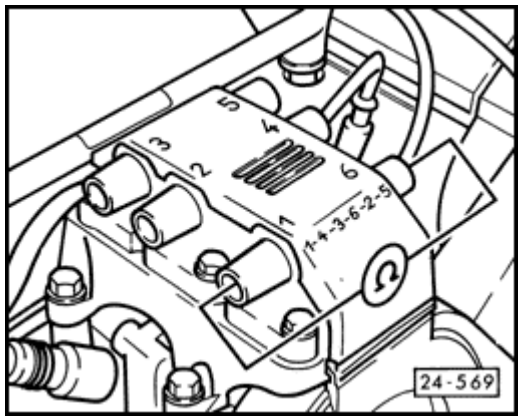
Notes:

- *Check wiring between power output stage and ignition coils, and between the ignition coils and the connector set in the connector bracket, for insulation damage.*

- *Component locations* ⇒ *page 28-1* .

Checking secondary resistance

- Disconnect ignition wires from the ignition coils.



- Switch Fluke 83 multimeter to resistance range and connect between the two posts of the ignition coil being tested.

  Specified value: 9000-14000 Ω

If the specified resistance is not obtained for any one coil:

- Replace ignition coil.

28-17

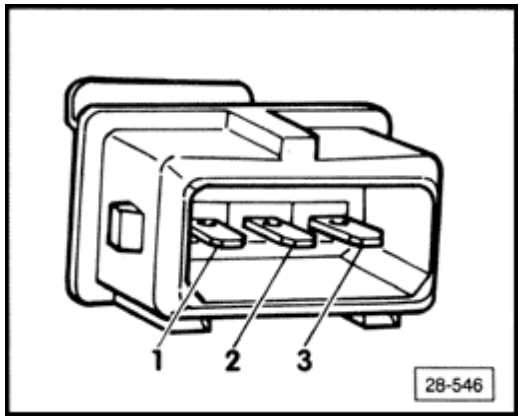
Checking primary resistance

- Disconnect power output stage harness connector ⇒ page 28-7 .

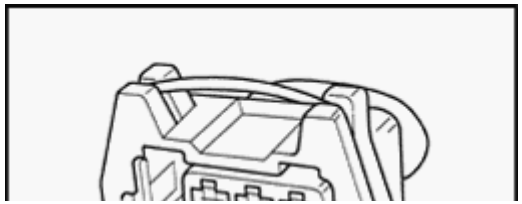
- Check connectors for loose, corroded terminals or terminals that have been pushed out of their connector housing, and repair as necessary.

Note:

The connector sequence in the connector bracket is immaterial because all three B+ terminals route to the ignition coils.



- Connect one multimeter test leads between ignition coil connector terminal in connector bracket...



... and 3-pin power output stage connector (for each coil).

Specified value: max. 5.0 Ω

If the specified resistance is not obtained for any coil:

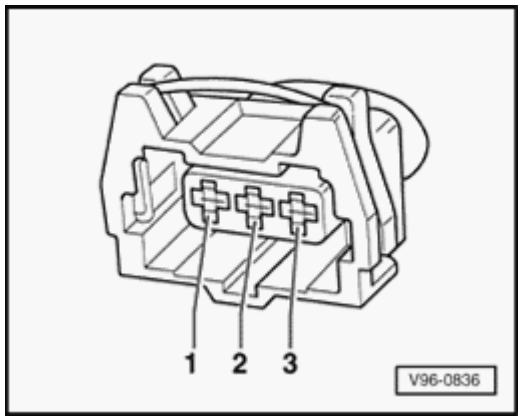
- Replace ignition coil.

Checking voltage supply

- Fuse for ignition coils OK

- Disconnect white connector on connector bracket ⇒ page 28-1 .

- Switch ignition on.



- Switch Fluke 83 multimeter to voltage range and connect in sequence between Ground (GND) and all three terminals of the connector.

  Specified value: approx. battery voltage

If the specified values are not obtained:

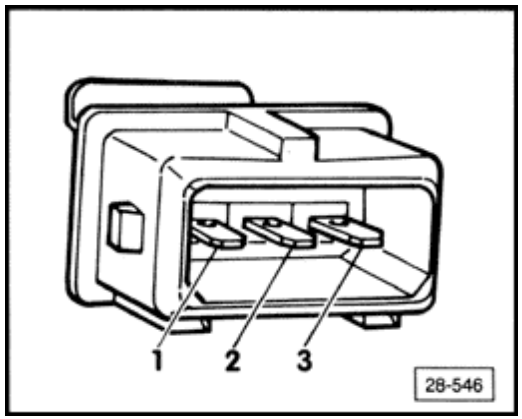
- Check for open circuit using wiring diagram, repair as necessary, also check fuses.

Crankshaft Position (CKP) sensor, checking

Component locations ⇒ page 28-1 .

- All sensors correctly installed, securely connected

- Disconnect (black) harness connector.



- Switch Fluke 83 multimeter to resistance range and connect between CKP sensor connector terminals 1 and 2 (in connector bracket) using jumper wires from VW 1594 test kit.

  Specified value: approx.1000 Ω

If the specified value is not obtained:

- Replace Crankshaft Position (CKP) sensor.

If the specified value is obtained:

- Connect multimeter between terminal 1 and 3 (GND), then between terminals 2 and 3 (GND).

  Specified value: infinite Ω (open)

If the specified value is not obtained:

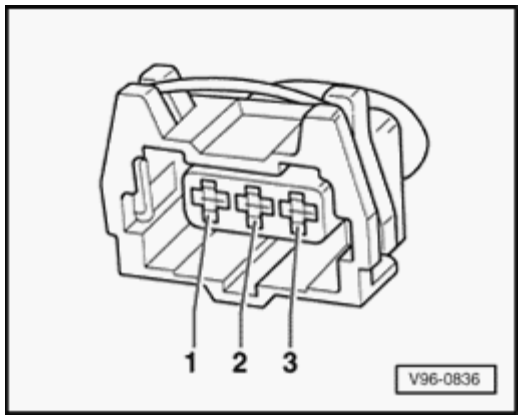
- Replace Crankshaft Position (CKP) sensor.

If the specified value is obtained:

- Check wiring for continuity or short between CKP sensor and ECM using wiring diagram.

28-20

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .



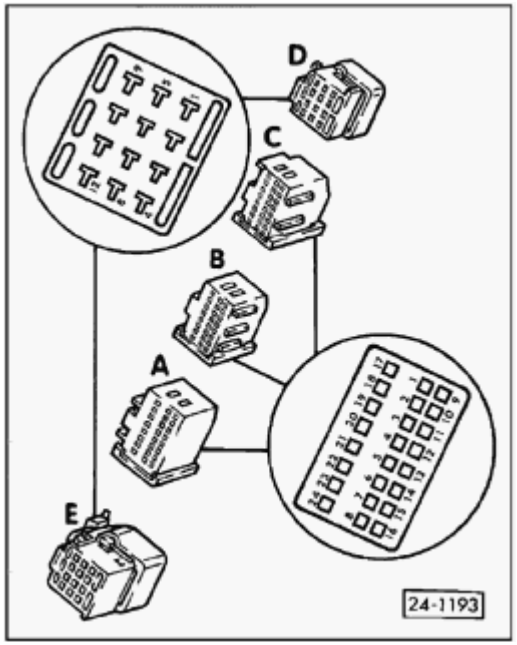
- Check CKP sensor shielding for continuity by connecting multimeter between terminal 3 and engine Ground (GND).

  Specified value: max. 1 Ω

- Check wiring for continuity between CKP sensor connector terminal 1 and test box socket A9, then between CKP sensor connector terminal 2 and test box socket A10.

  Specified value: max. 1 Ω

If the specified values are not obtained:



- Eliminate short or open circuit in wiring.

CKP sensor terminal number	ECM connector A or engine ground (GND)
1	A9
2	A10
3	Engine Ground (GND)

If wiring is OK:

- Replace ECM ⇒ page 01-265 .

28-21

Engine speed (RPM) sensor, checking and adjusting

Notes:

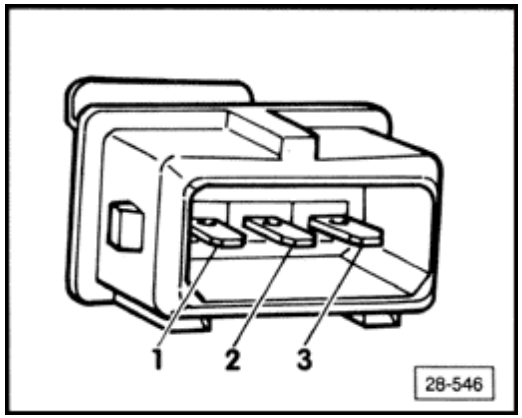
- *To functionally check the engine speed sensor ⇒ Repair Group 01, Read measuring value block, display group 003.*

- *Component locations ⇒ page 28-1 .*

Checking

- Make sure sensor is correctly installed and securely connected.

- Disconnect (gray) engine speed sensor harness connector.



- Switch Fluke 83 multimeter to resistance range and connect between terminals 1 and 2 of engine speed sensor connector using jumper wires from VW 1594 connector test kit.

  Specified value: approx. 1 Ω

If the specified value is not obtained:

- Replace engine speed sensor.

If the specified value is obtained:

- Connect multimeter between terminals 1 and 3, then between terminals 2 and 3.

  Specified values: infinite Ω (open)

28-22

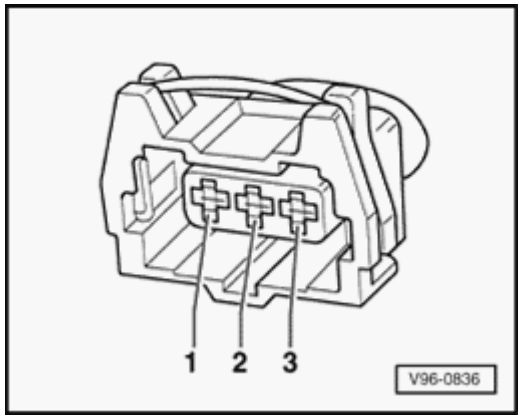
If the specified value is not obtained:

- Replace engine speed sensor.

If the specified value is obtained:

- Check wiring between engine speed sensor harness connector and ECM harness connector as follows:

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .



- Check engine speed sensor shielding for continuity between connector terminal 3 and engine Ground (GND).

  Specified value: max. 1 Ω

- Check engine speed sensor ground (GND) wire for continuity between connector terminal 1 and test box socket A11.

  Specified value: max. 1 Ω

- Check engine speed sensor signal wire for continuity between connector terminal 2 and test box socket A9.

  Specified value: max. 1 Ω

If the specified values are not obtained:

- Eliminate short circuit to Ground (GND).

RPM sensor terminal number	ECM connector A or Engine Ground (GND)
1	A11
2	A9
3	Engine Ground (GND)

If no malfunction is found:

- Check condition of starter ring gear teeth (starter must be removed).

- Turn engine slowly and check ring gear at edge surface, also check for broken or damaged teeth, and replace if necessary.

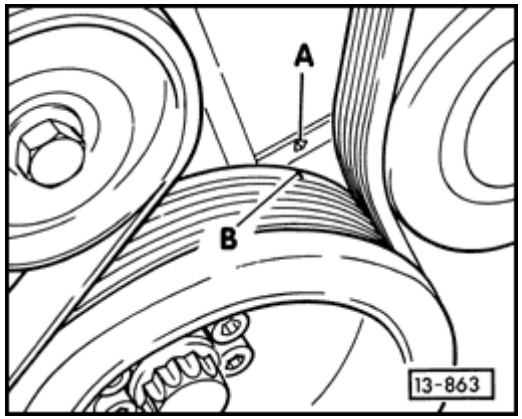
If no malfunction was found in any of these checks:

- Replace ECM ⇒ page 01-265 .

Adjusting

Note:

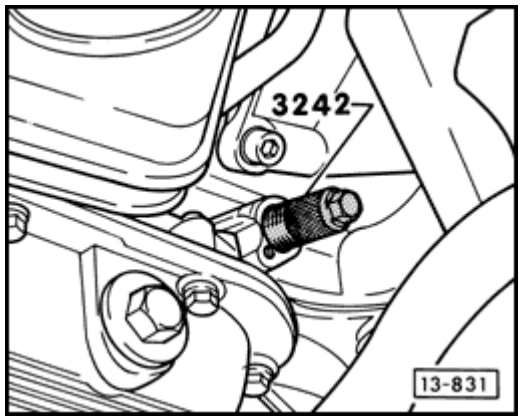
The bracket for the engine speed sensor is movable via slots. Bracket position is adjusted at the factory and should not be changed. If for any reason the bolts were loosened, and the bracket moved, adjust as follows:



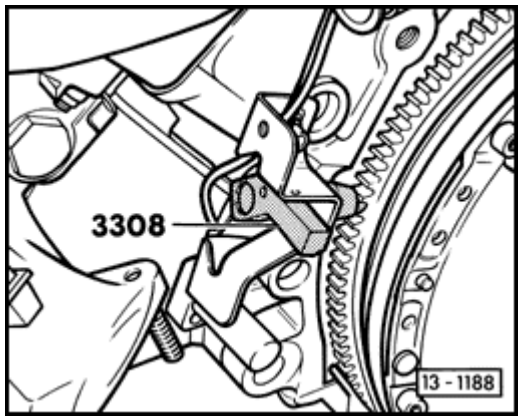
- Turn crankshaft to TDC position.

- Remove engine speed sensor from left side of cylinder block.

TDC opening in cylinder block must be located behind hole for crankshaft position sensor (which can be seen and felt).



- Thread in crankshaft mounting tool 3242 into hole of removed crankshaft position sensor and tighten slightly.
- Remove engine speed sensor and heat shield.
- Loosen bracket.



- Insert adjustment tool 3308 (must lock into ring gear).
- Tighten bracket.
- Install sensor and attach heat shield.

28-25

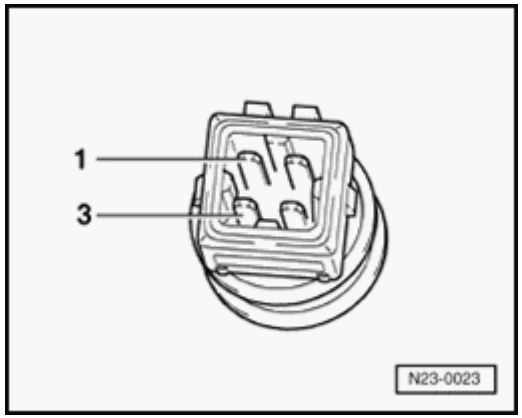
Engine Coolant Temperature (ECT) sensor, checking

Notes:

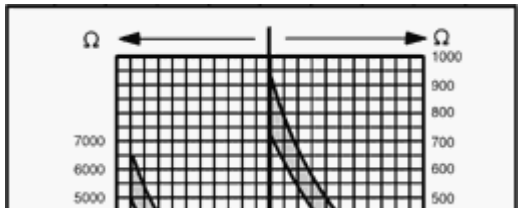
- *To functionally check the Engine Coolant Temperature (ECT) sensor ⇒ Repair Group 01, Read measuring value block, display group 001, display field 1.*

- *Component locations ⇒ page 28-1 .*

- Disconnect ECT sensor harness connector.



- Switch Fluke 83 multimeter to resistance range and measure between ECT sensor terminals 1 (signal) and 3 (GND).



Specified values:

- At approx. 20 ° C (68 ° F): approx. 2500 Ω
- At approx. 80 ° C (176 ° F): approx. 330 Ω

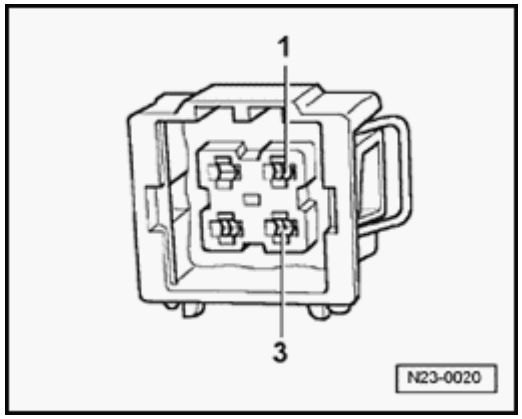
If the specified value is not obtained:

- Replace ECT sensor.

If the specified value is obtained:

- Check wiring between ECT sensor and ECM as follows:
- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .

28-26



- Check wiring for continuity between terminal 3 of ECT sensor harness connector and engine Ground (GND).

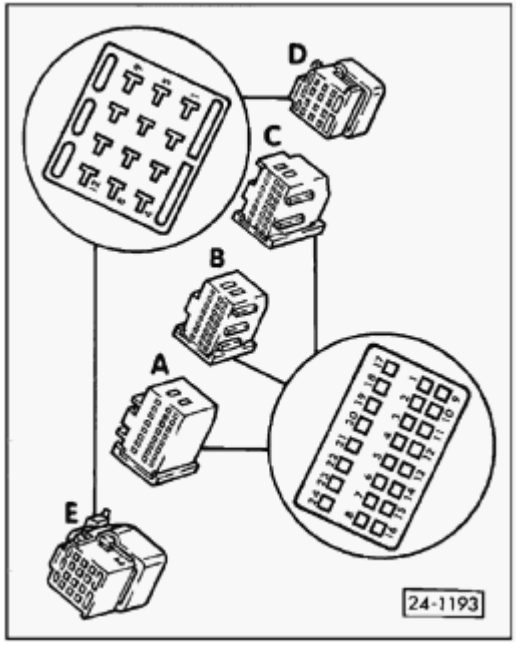
  Specified value: max. 1 Ω

- Check signal wire for continuity between ECT sensor harness connector terminal 1 and test box socket 16A.

  Specified value: max. 1 Ω

- Check both wires for short circuit to each other.

If the specified values are not obtained:



- Eliminate short or open circuit in wiring between ECT sensor and ECM connector -A- or engine Ground (GND).

ECT sensor terminal number	ECM Connector A or engine Ground (GND)
1	16A
3	Engine Ground (GND)

If wiring is OK and the ECT sensor is OK:

- Replace the ECM ⇒ page 01-265 .

28-27

Engine Control Module (ECM) voltage supply, checking

Note:

To check the ECM voltage supply ⇒ Repair Group 01, Read measuring value block, display group 001, display field 4.

- Fuse for ECM OK

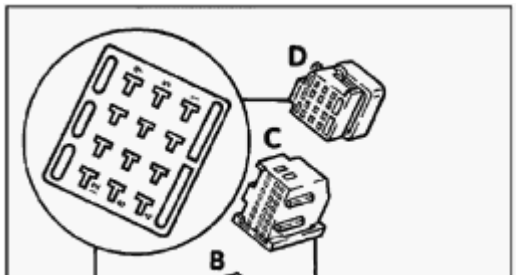
- Connect test box VAG 1598/19 to ECM wiring harness ⇒ page 01-255 .

- Switch ignition on.

- Connect VAG 1527B voltage tester between test box socket D10 (B+) and Ground (GND).

- Voltage tester must light up

If voltage tester does not light up:



- Check for open circuit using wiring diagram, and repair as necessary.

If voltage tester lights up:

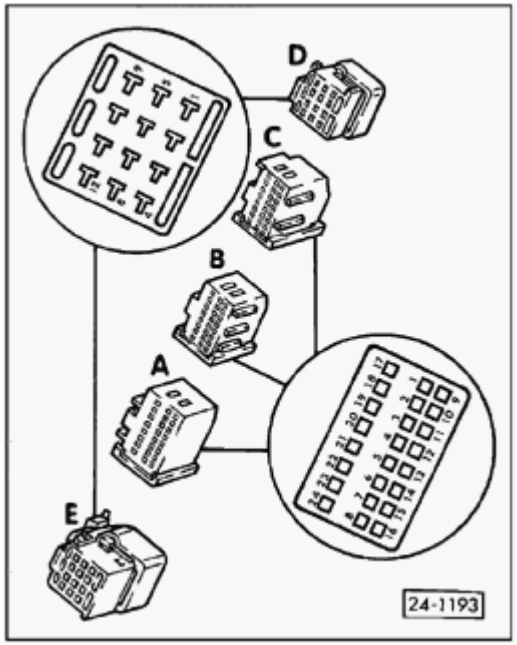
- Connect voltage tester between test box socket D10 (B+) and then in sequence to test box Ground (GND) sockets A19, D3, D7, D12, E3, E7

and E11.

- Voltage tester must light up

7

28-28



If voltage tester does not light up:

- Check wiring using wiring diagram and eliminate open circuit if necessary.
- Connect VAG 1527B voltage tester between test box socket B10 (B+) and engine Ground (GND).

• Voltage tester must light up

If voltage tester does not light up:

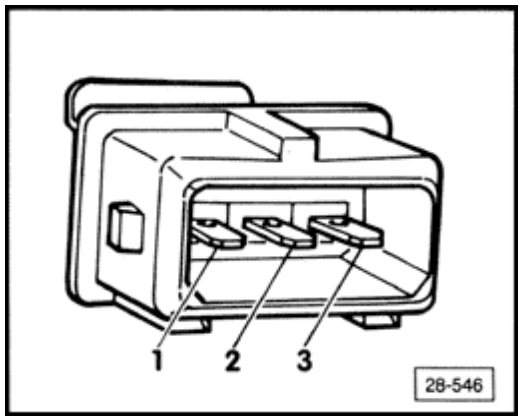
- Check wiring between ECM connector B terminal 10 and central electrical panel using wiring diagram and, if necessary, eliminate open circuit.

Knock sensors, checking

Notes:

- *To functionally check knock sensors ⇒ Repair Group 01, Read measuring value block, display group 015 and/or 016.*
- *Component locations ⇒ page 28-1 .*
- *Knock sensors can not be checked electrically, check DTC memory ⇒ page 01-13 .*
- *Use connector insertion tool 3247 for knock sensor removing and installing.*
- *It is important that exact knock sensor tightening torque of 20 Nm (15 ft lb) be maintained to make sure that there is proper knock sensor function.*
- *Visually check the knock sensor connector for corrosion.*
- *When repairing or replacing knock sensor connector terminals, ONLY replace with gold plated terminals.*

Checking knock sensor wiring



- Disconnect knock sensor harness connectors in engine compartment.

- Check all three terminals in knock sensor harness connector for shorting to each other.

  - Wires must not be short circuited to each other

If there is a short circuit:

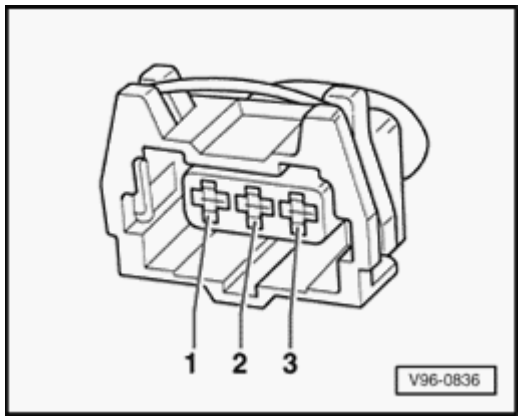
- Replace knock sensor.

28-30

Checking wiring between knock sensor and ECM

- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .

- Check wiring for continuity or short between knock sensor and ECM using wiring diagram.



Terminal assignments (inside connector)

1 - Ground (GND) wire

2 - Signal wire

3 - Shield

Knock Sensor (KS) 1 -G61-

- Check signal wire for continuity between harness connector terminal 2 (in engine compartment) and test box socket A13.

  Specified value: max. 1 Ω

- Check Ground (GND) wire for continuity between harness connector terminal 1 and test box socket A14.

  Specified value: max. 1 Ω

- Check shielding for continuity between harness connector terminal 3 (in engine compartment) and engine Ground.

  Specified value: max. 1 Ω

If specified values are not obtained, repair open or short circuit.

28-31

Knock Sensor (KS) 2 -G66-

- Check signal wire for continuity between harness connector terminal 2 (in engine compartment) and test box socket A15.

  Specified value: max. 1 Ω

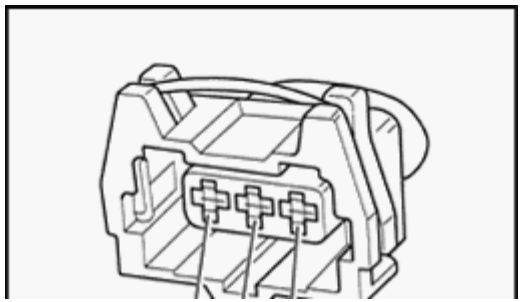
- Check Ground (GND) wire for continuity between harness connector terminal 1 and test box socket A14.

  Specified value: max. 1 Ω

- Check shielding for continuity between harness connector terminal 3 (in engine compartment) and engine Ground.

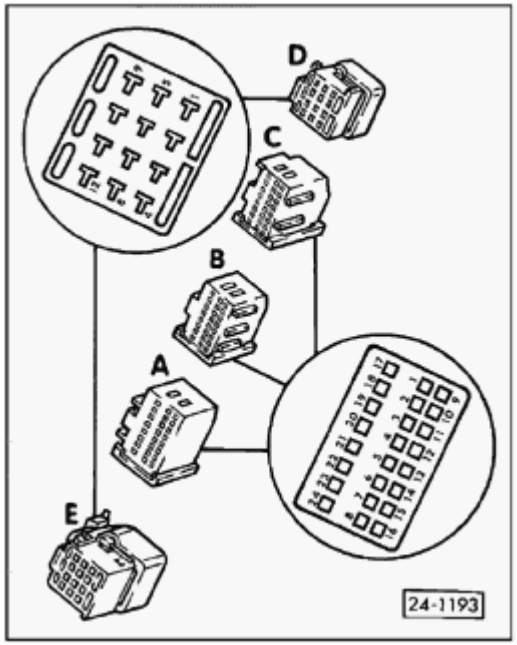
  Specified value: max. 1 Ω

If the specified values are not obtained:



- Eliminate open or short circuit in wiring.

28-32



- Knock sensor 1 (bank 1):

Knock sensor terminal number	ECM connector A or engine ground (GND)
1 (Signal)	A13
2 (Ground)	A14
3 (shield)	Engine Ground (GND)

- Knock sensor 2 (Bank 2):

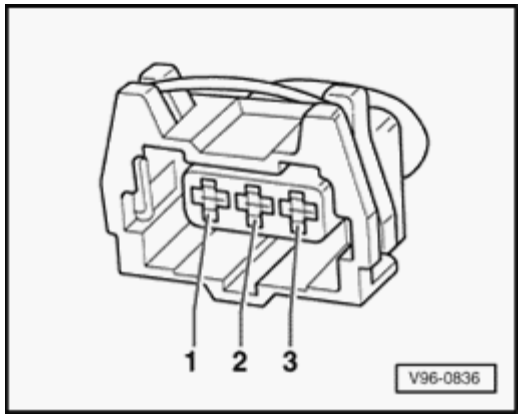
Knock sensor terminal number	ECM connector A or engine ground (GND)
1 (Signal)	A15
2 (Ground)	A14
3 (Shield)	Engine Ground (GND)

28-33

Camshaft Position (CMP) sensor (bank 2), checking

The camshaft position sensor is located on the left rear of the cylinder head ⇒ page 28-1 .

Checking voltage supply



- Disconnect camshaft position sensor harness connector.
- Switch Fluke 83 multimeter to 20 volt range and connect between terminal 1 (B+) and terminal 3 (GND).
- Switch ignition on.

  Specified value: min. 9 volts

If the specified value is not obtained:

- Check wiring for continuity or short between camshaft position sensor and ECM using wiring diagram.
- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .
- Check camshaft position sensor Ground (GND) wire for continuity between connector terminal 3 and engine Ground.

  Specified value: 1 Ω

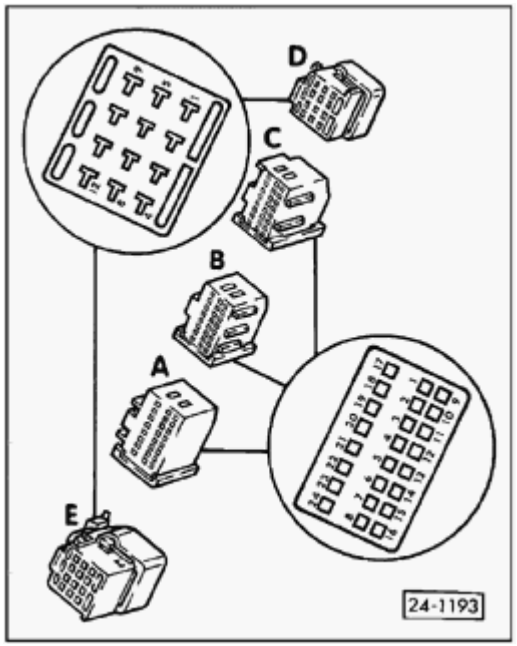
28-34

- Check camshaft position sensor B+ wire for continuity between connector terminal 1 and test box socket A2.

  Specified value: max. 1 Ω

- Check both wires for possible short to each other.

If the specified values are not obtained:



- Check for open or short circuit in wiring between the camshaft position sensor connector and ECM connector -A- or engine Ground (GND), eliminate as necessary.

Camshaft position sensor connector terminal number	**ECM connector A terminal number or engine ground (GND)**
1 (B+)	A2
3 (Ground)	Engine Ground (GND)

If there is neither an open nor short circuit:

- Replace ECM ⇒ page 01-265 .

28-35

Function, checking

Note:

For functional check of camshaft position sensor, disconnect the 4-pin connector from the ignition coil power output stage and check DTC memory.

- Camshaft position sensor voltage supply OK ⇒ page 28-33

- Push back rubber boot on camshaft position sensor connector (sensor remains connected).

- Connect VAG 1527B voltage tester between terminal 1 (B+) and 2 (signal).

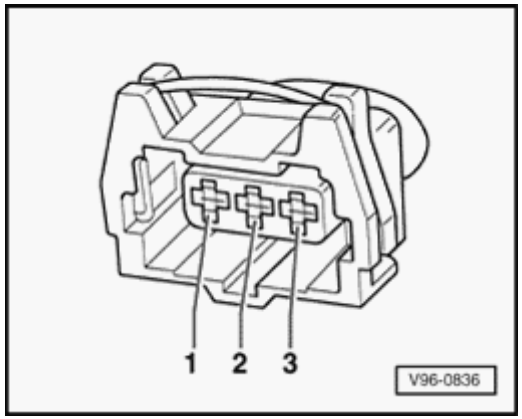
- Operate starter for several seconds.

- Voltage tester must flash briefly every second engine rotation

If voltage tester does not flash:

- Switch ignition off and disconnect 3-pin harness connector from camshaft position sensor.

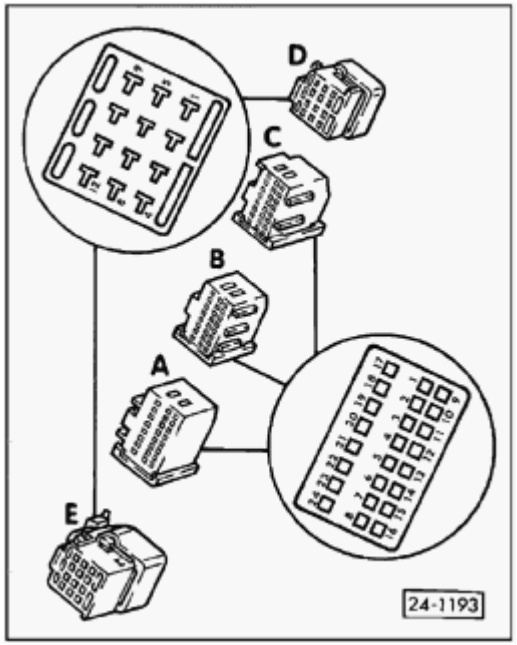
- Connect VAG 1598/19 test box to ECM harness connector ⇒ page 01-255 .



- Check signal wire for continuity between harness connector terminal 2 and test box socket B2.

  Specified value: max. 1 Ω

28-36



If the specified value is not obtained:

- Eliminate short or open circuit in wiring between camshaft position sensor harness connector ...

... and ECM harness connector -B-.

Camshaft position sensor connector terminal number	ECM connector A terminal number or engine ground (GND)
2 (signal)	8

If wiring is OK:

- Connect Fluke 83 multimeter between test box socket B2 and vehicle Ground (GND).
- Switch ignition on.

  Specified value: min. 4.0 volts

If the specified value is not obtained:

- Replace ECM ⇒ page 01-265 .

If the specified value is obtained:

- Replace Camshaft Position (CMP) sensor.