2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code(s): AAA m.y. 1996-1997

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On Board Diagnostic (OBD II)

Function

The Motronic Engine Control Module (ECM) -J220- for the fuel injection and ignition system is equipped with a Diagnostic Trouble Code (DTC) memory.

If malfunctions occur in the sensors and components being monitored, they will be stored in the DTC memory together with an indication of the type of malfunction.

The stored malfunctions are displayed after initiating the malfunction display ⇒ Page 01-12 .

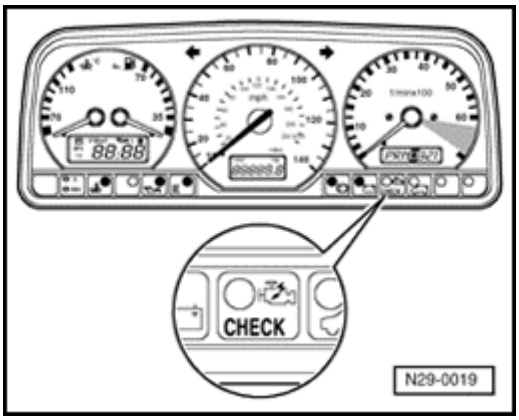
After malfunctions have been eliminated, DTC memory must be erased (⇒ Page 01-29) and the repair must be verified via the appropriate display group ⇒ Page 01-33 , Readiness code, creating.

The readiness code must be created again after every time the DTC memory is erased and when the voltage supply to ECM -J220- is interrupted ⇒ Page 01-33 .

01-2

Malfunction Indicator Lamp (MIL)

If malfunctions are recognized and verified by the engine control module, they will be indicated by switching on the MIL.



Location of Malfunction Indicator Lamp (MIL).

Note:

The MIL can be switched on in the flashing or permanently on mode. The Diagnostic Trouble Code (DTC) memory must be checked in every case ⇒ *Page 01-12* .

- *Flashing: There is a malfunction that can damage the Three Way Catalytic Converter (TWC) if driven in this condition. In this case, the vehicle must not be driven using wide open throttle, but with partial throttle only, during which the MIL is continuously illuminated rather than flashing.*
- *Permanently on: There is a malfunction which will increase exhaust emissions. Check engine and/or automatic transmission control modules.*
- *If the MIL does not light up: If there is an engine running problem, or a customer complaint of one, perform a functional check of the MIL. Then DTC memory must be checked because malfunctions that do not switch on the MIL immediately can also be stored.*

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Functional check:

- Switch ignition on.

  - The MIL must light-up.

If the MIL does not light with ignition switched on:

- Check wiring to MIL as follows:

Cause:	**Remedy:**
Malfunction Indicator Lamp (MIL) -K83- is not activated or does not light-up due to open circuit	- Switch ignition off - Connect VAG 1598/18 test box - Bridge test box sockets 1 and 5 - Switch ignition on • MIL must light-up If the MIL does not light-up: - Switch ignition off - Check MIL bulb If bulb is OK: - Locate and eliminate short or wiring open circuit from Engine Control Module (ECM) to MIL using wiring diagram
Malfunction cause: ▶	If no malfunction can be detected in the wiring to MIL: ECM -J220- faulty - Replace ECM, erase Diagnostic Trouble Code (DTC) memory.

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If the MIL lights with ignition switched on, continue check as follows:

- Start engine and run at idle speed: MIL must go out after a few seconds.

If the MIL does not go out:

- Check DTC memory ⇒ Page 01-12 .

If no malfunction is stored:

Cause:	**Remedy:**
Malfunction Indicator Lamp (MIL) -K83- is permanently activated by short circuit to Ground (GND)	- Switch ignition off - Connect VAG 1598/18 test box - Check resistance between test box socket 5 and vehicle Ground (GND). Specification: ∞ ohms (Ω) If the specification is not attained: ♦ Short circuit to Ground (GND) in the activation wire from Engine Control Module (ECM) -J220- to MIL - Locate and eliminate this malfunction using wiring diagram
Malfunction cause: ▶	If the specification ∞ ohms (Ω) is attained and no short circuit to Ground (GND) can be found: ECM -J220- faulty - Replace ECM, erase Diagnostic Trouble Code (DTC) memory.

On Board Diagnostic (OBD II), technical data

Equipped with

- Diagnostic Trouble Code (DTC) memory
- Rapid data transfer

Engine control module identification

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

Engine Control Module (ECM) functions

Note:

The ECM is equipped with various functions. Some functions can be carried out with ignition switched on or with engine running. The following table details the prerequisites for selecting the individual functions.

Function performable with		Ignition switched on	Engine idling
02	Check DTC Memory	Yes	Yes
03	Output Diagnostic Test Mode	Yes	No
04	Basic Setting	Yes[1)]	Yes[2)3)]
05	Erase DTC Memory	Yes	Yes
06	End Output	Yes	Yes
07	Code Control Module	Yes	No
08	Read Measuring Value Block	Yes	Yes

[1)] Must be performed after the following work: replacement of Engine Control Module (ECM), throttle valve control module or engine

[2)] Only possible when coolant temperature is above 80 ° C (176 ° F). Prior to this, function 04 is blocked.

[3)] Must be performed when checking idle speed.

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

Special tools, testers and auxiliary items

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

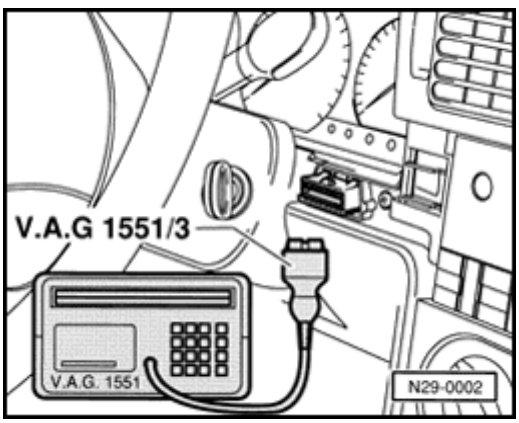
Note:

The vehicle system tester VAG 1552 can be used instead of the VAG 1551 scan tool, however a print-out is not possible.

Test conditions

- Fuse 21 OK
- Battery voltage at least 11 volts
- Ground (GND) connections on engine and transmission OK ⇒ Page 24-2 , item 7

Work sequence



- Open cover for Data Link Connector (DLC).
- Connect VAG 1551/1552 scan tool with VAG 1551/3 adapter cable.

Depending on desired function:

- Switch ignition on or start engine ⇒ Page 01-6 , Engine Control Module (ECM) functions

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Notes:

- *If the display does not show as indicated in the work sequence:*

⇒ VAG 1551 scan tool operating instructions

- *If due to an input malfunction "Error in communications link" is displayed, disconnect wire from VAG 1551/1552 scan tool, reconnect and repeat work step.*

- Operate VAG 1551/1552 scan tool taking into account information on the display.

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

- Press buttons -0- and -1- to select "Engine Electronics" address word 01 and press -Q- button to confirm input.

021 906 259B MOTRONIC M5.9 AT V0 1 →

Coding 00001 **WSC xxxxx**

The VAG 1551 scan tool display will show the control module identification, e.g.:

- 021 906 259B = Part no. of the control module (for latest control module version ⇒ Parts catalog microfiche)
- MOTRONIC M5.9 = Fuel injection and ignition system
- Coding 00001 = Coding variants

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Coding variants:

Coding	For following vehicles
00000	Passat VR6 with manual transmission
00001	Passat VR6 with automatic transmission

Note:

Correct engine control module number details and coding are displayed only with the engine running at idle speed.

If the coding differs from the vehicle version, then:

- Check engine control module coding ⇒ Page 01-10 .

- Press → button.

Rapid data transfer **HELP**  Indicated on display

Select function XX

- For additional steps see repair procedures.

Code Control Module (function 07)

If the appropriate code for the vehicle is not displayed or if the control module has been replaced, the control module must be coded as follows.

Special tools, testers and auxiliary items

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

Work sequence

- Connect the VAG 1551/1552 scan tool and with ignition switched on select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -1- and -1- to select "Login-Procedure" function 11 and press -Q- button to confirm input.

Log-in Procedure **HELP**

Input code number XXXXX

Indicated on display

- Press buttons -0-, -1-, -2-, -8- and -3- to input log-in code 01283 and press -Q- button to confirm input.

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

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Code Control Module HELP

Input code number XXXXX (0-32000)

Indicated on display

- Enter the appropriate code number for this vehicle and press -Q- button to confirm input.

Coding	For following vehicles
00000	Passat VR6 with manual transmission
00001	Passat VR6 with automatic transmission

021906259B MOTRONIC M5.9 AT V0 1 →

Coding 00001 WSC XXXXX

The VAG 1551 scan tool display will show the control module identification, e.g.:

- Press → button.

Rapid data transfer HELP

Select function XX

Indicated on display

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

Note:

The code entered and shown on the display will not be used by the Engine Control Module (ECM) until the ignition has been switched off once. An incorrect coding leads to:

- *Engine running malfunctions*
- *Increased fuel consumption*
- *Increased emissions*
- *Malfunctions stored in Diagnostic Trouble Code (DTC) memory which are not actually present*
- *Reduced transmission life*

Check DTC Memory (function 02)

Special tools, testers and auxiliary items

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

Work sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this the engine must be running at idle speed.

Note:

If engine does not start, operate starter for approx. 6 seconds and then do not switch ignition off.

- Switch printer on with PRINT button (warning lamp in button lights up).

Rapid data transfer **HELP** 

Indicated on display

Select function XX

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

X DTC recognized 

The number of malfunctions stored or "No DTC recognized" will be shown on the display.

Note:

If something different is indicated on the display:

⇒ VAG 1551 scan tool operating instructions

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If one or more malfunctions are stored: the malfunctions stored will be displayed and printed out one after the other.

- Locate and eliminate malfunctions printed out as per Diagnostic Trouble Code (DTC) table ⇒ Page 01-14 .

Note:

If no malfunction is stored:

- Press → button.

Rapid data transfer **HELP** 

Select function XX

Indicated on display

- Press buttons -0- and -6- to select "End Output" function 06 and press -Q- button to confirm input.
- Erasing DTC memory ⇒ Page 01-29 .

Note:

If a malfunction is present which is not recognized by On Board Diagnostic (OBD), perform further diagnosis using the troubleshooting table in:

⇒Electrical Wiring Diagrams, Troubleshooting & Component Locations

Diagnostic Trouble Code (DTC) table

Notes:

- *The DTC overview is listed according to SAE and VAG codes.*
- *After repairing malfunctions DTC memory must be erased (⇒ Page 01-29) and the repair verified via the appropriate display group ⇒ Page 01-33 , Readiness code, creating.*

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0102	16486	Mass or Volume Air Flow Circuit Low Input	- Check Mass Air Flow (MAF) sensor ⇒ Page 24-62
P0103	16487	Mass or Volume Air Flow Circuit High Input	
P0112	16496	Intake Air Temperature Circuit Low Input	- Check intake air temperature sensor ⇒ Page 24-94
P0113	16497	Intake Air Temperature Circuit High Input	
P0116	16500	Engine Coolant Temp.Circ. Range/Performance	- Check Engine Coolant Temperature (ECT) sensor ⇒ Page 24-88
P0117	16501	Engine Coolant Temperature Circuit Low Input	
P0118	16502	Engine Coolant Temperature Circuit High Input	

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0120	16504	Throttle Position Sensor A Circuit Malfunction	- Check throttle valve control module ⇒ Page 24-68 - Check MAF sensor ⇒ Page 24-62
P0121	16505	Throttle Position Sensor A Circuit Range/Performance Problem	
P0122	16506	Throttle Position Sensor A Circuit Low Input	
P0125	16509	Insufficient Coolant Temperature for Closed Loop Fuel Control	- Check ECT sensor ⇒ Page 24-88 - Check thermostat ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 19*
P0131	16515	O_2 Sensor Circuit Low Voltage (Bank 1, Sensor 1)	- Check Heated Oxygen Sensor (HO2S) and Oxygen Sensor (O2S) control (before three way catalytic converter) ⇒ Page 24-25 - Check O2S aging and HO2S (before three way catalytic converter) ⇒ Page 24-56 - Check HO2S and O2S control (after three way catalytic converter) ⇒ Page 24-42
P0132	16516	O_2 Sensor Circuit High Voltage (Bank 1, Sensor 1)	
P0133	16517	O_2 Sensor Circuit Slow Response (Bank 1, Sensor 1)	
P0134	16518	O_2 Sensor Circuit No Activity Detected (Bank 1, Sensor 1)	

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0135	16519	O_2 Sensor Heater Circuit Malfunction (Bank 1, Sensor 1)	- Check O2S heating (before three way catalytic converter) ⇒ Page 24-35
P0137	16521	O_2 Sensor Circuit Low Voltage (Bank 1, Sensor 2)	- Check HO2S and O2S control (after three way catalytic converter) ⇒ Page 24-42
P0138	16522	O_2 Sensor Circuit High Voltage (Bank 1, Sensor 2)	
P0140	16524	O_2 Sensor Circuit No Activity Detected (Bank 1, Sensor 2)	
P0141	16525	O_2 Sensor Heater Circuit Malfunction (Bank 1, Sensor 2)	- Check O2S heating (after three way catalytic converter) ⇒ Page 24-49

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0171	16555	System too Lean (Bank 1)	- Check intake air system for leaks (outside air) ⇒ Page 24-123
			- Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25
			- Check Secondary Air Injection (AIR) system ⇒ Page 01-71 output Diagnostic Test Mode (DTM), and: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA,Repair Group 26*
			- Check MAF sensor ⇒ Page 24-62
			- Check fuel pump: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*
			- Check fuel injectors ⇒ Page 01-71 output Diagnostic Test Mode (DTM), and ⇒ Page 24-115

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0172	16556	System too Rich (Bank 1)	- Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25
			- Check fuel pressure regulator ⇒ Page 24-120
			- Check exhaust system for leaks: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*
P0300	16684	Random Misfire Detected	- Check components of ignition system ⇒ Page 28-1
			- Check misfire detection ⇒ Page 28-10
			- Check ignition coil ⇒ Page 28-27
			- Check engine speed (RPM) sensor ⇒ Page 24-99
			- Change type of fuel

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0301	16685	Cylinder 1 Misfire Detected	- Check fuel injectors ⇒ Page 24-115 - Check ignition coil ⇒ Page 28-27 - Check misfire detection ⇒ Page 28-10
P0302	16686	Cylinder 2 Misfire Detected	
P0303	16687	Cylinder 3 Misfire Detected	
P0304	16688	Cylinder 4 Misfire Detected	
P0305	16689	Cylinder 5 Misfire Detected	
P0306	16690	Cylinder 6 Misfire Detected	
P0327[1)]	16711	Knock Sensor 1 Circuit Low Input (Bank 1)	- Check Knock Sensor (KS) and knock control ⇒ Page 28-19
P0332[1)]	16716	Knock Sensor 2 Circuit Low Input	- Check Knock Sensor (KS) and knock control ⇒ Page 28-19
P0341	16725	Camshaft Position Sensor Circuit Range/Performance	- Check Camshaft Position (CMP) sensor ⇒ Page 28-16
P0411	16795	Secondary Air Injection System Incorrect Flow Detected	- Check Secondary Air Injection (AIR) system: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*

[1)] Vehicle m.y. 97 ➢ the SAE diagnostic trouble code is not displayed.

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0422	16806	Main Catalyst Efficiency Below Threshold (Bank 1)	- Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25
P0440	16824	Evaporative Emission Control System Malfunction	- Check EVAP canister purge regulator valve ⇒ Page 01-71 , output Diagnostic Test Mode (DTM)
P0501	16885	Vehicle Speed Sensor Range/Performance	- Check Vehicle Speed Sensor (VSS) signal ⇒ Page 24-101
P0506	16890	Idle Control System RPM Lower than Expected	- Check fuel pressure regulator and holding pressure ⇒ Page 24-120 - Check ignition timing ⇒ Page 28-8 - Check Vehicle Speed Sensor (VSS) signal ⇒ Page 24-101
P0507	16891	Idle Control System RPM Higher than Expected	- Check battery voltage - Check idle speed ⇒ Page 24-22
P0510	16894	Closed Throttle Position Switch Malfunction	- Check throttle valve control module ⇒ Page 24-68
P0605	16989	Internal Control Module Read Only Memory (ROM) Error	- Replace Engine Control Module (ECM) ⇒ Page 24-1 , item 5

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Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P0722	17106	Output Speed Sensor Circ. No Signal	- Switch ignition off. - Connect VAG 1598/18 test box. - Measure resistance between test box sockets 20 and 65. • Specification: min. 0.8 KΩ; max. 0.9 KΩ If the specification is not attained: - Use wiring diagram to locate and repair short circuit to Ground. - Replace vehicle speed sensor. - After repairing malfunction, clear DTC memory.

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P1127	17535	Long Term Fuel Trim mul. System too Rich (Bank 1)	- Check MAF sensor ⇒ Page 24-62
			- Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25
			- Check HO2S and O2S control (after three way catalytic converter) ⇒ Page 24-42
			- Check fuel pump: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*
			- Check Secondary Air Injection (AIR) system ⇒ Page 01-71 output Diagnostic Test Mode (DTM), and: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*
			- Check fuel injectors ⇒ Page 01-71 output Diagnostic Test Mode, and (DTM) ⇒ Page 24-115

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P1128	17536	Long Term Fuel Trim mul. System too Lean (Bank 1)	- Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25
			- Check HO2S and O2S control (after three way catalytic converter) ⇒ Page 24-42
			- Check fuel pump: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*
			- Check fuel injectors ⇒ Page 01-71 output Diagnostic Test Mode (DTM), and ⇒ Page 24-115
			- Check EVAP canister purge regulator valve ⇒ Page 01-71 output Diagnostic Test Mode (DTM)
P1213	17621	Cyl. 1-Fuel Injector Circ. Short to B+	- Check fuel injectors ⇒ Page 01-71 output Diagnostic Test Mode (DTM), and ⇒ Page 24-115
P1214	17622	Cyl. 2-Fuel Injector Circ. Short to B+	
P1215	17623	Cyl. 3-Fuel Injector Circ. Short to B+	
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+	

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P1225	17633	Cyl.1-Injector Circ. Short to Ground	- Check fuel injectors ⇒ Page 01-71 output Diagnostic Test Mode (DTM), and ⇒ Page 24-115
P1226	17634	Cyl.2-Injector Circ. Short to Ground	
P1227	17635	Cyl.3-Injector Circ. Short to Ground	
P1228	17636	Cyl.4-Injector Circ. Short to Ground	
P1229	17637	Cyl.5-Injector Circ. Short to Ground	
P1230	17638	Cyl.6-Injector Circ. Short to Ground	
P1237	17645	Cyl.1-Injector Circ. Open Circuit	
P1238	17646	Cyl.2-Injector Circ. Open Circuit	
P1239	17647	Cyl.3-Injector Circ. Open Circuit	
P1240	17648	Cyl.4-Injector Circ. Open Circuit	
P1241	17649	Cyl.5-Injector Circ. Open Circuit	
P1242	17650	Cyl.6-Injector Circ. Open Circuit	

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P1340	17748	Camshaft/Crankshaft Pos.Sens.Signals Out of Sequence	- Check engine speed (RPM) sensor ⇒ Page 24-99
P1410	17818	Tank Ventilation Valve Short to B+	- Check EVAP canister purge regulator valve ⇒ Page 01-71 output Diagnostic Test Mode (DTM)
P1420	17828	Sec.Air Inj.Control Module Electrical Malfunction	- Check Secondary Air Injection (AIR) system ⇒ Page 01-71 output Diagnostic Test Mode (DTM), and: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*
P1421	17829	Sec.Air Inj.Valve Circ. Short to Ground	
P1422	17830	Sec.Air Inj.Sys.Control Valve Circ. Short to B+	
P1425	17833	Tank Vent. Valve Short to Ground	- Check EVAP canister purge regulator valve ⇒ Page 01-71 , output Diagnostic Test Mode (DTM)
P1426	17834	Tank Vent. Valve Open Circuit	

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P1450	17858	Sec.Air Inj.Sys.Circ. Short to B+	- Check Secondary Air Injection (AIR) pump relay - J299- ⇒Electrical Wiring Diagrams, Troubleshooting & Component Locations
P1451	17859	Sec.Air Inj.Sys.Circ. Short to Ground	
P1452	17860	Sec.Air Inj.Sys. Open Circuit	
P1500	17908	Fuel Pump Relay Circ. Electrical Malfunction	- Check fuel pump relay⇒Electrical Wiring Diagrams, Troubleshooting & Component Locations
P1502	17910	Fuel Pump Relay Circ. Short to B+	- Check fuel pump: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P1543	17951	Throttle Actuation Potentiometer Signal too Low	- Check throttle valve control module ⇒ Page 24-68
P1544	17952	Throttle Actuation Potentiometer Signal too High	
P1580	17988	Throttle Actuator (B1) Malfunction	
P1582	17990	Idle Adaption at Limit	- Check throttle valve control module ⇒ Page 24-68
			- Check intake air system for leaks (outside air) ⇒ Page 24-123
			- Check exhaust system for leaks: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*
			- Check fuel pressure regulator ⇒ Page 24-120

Diagnostic Trouble Code (DTC)		Malfunction text	Malfunction elimination
SAE	VAG		
P1611	18019	MIL Call-up Circ./Transm.Control Module Short to Ground	- Check wiring between Transmission Control Module (TCM) and Engine Control Module (ECM): ⇒*Electrical Wiring Diagrams, Troubleshooting & Component Locations* - Check MIL LED: ⇒*Electrical Wiring Diagrams, Troubleshooting & Component Locations* - Heavy wear on ignition/starter switch (D) contacts, replace
P1613	18021	MIL Call-up Circ.Open Short to B+	

Erase DTC Memory (function 05)

Special tools, testers and auxiliary items

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

Test conditions

- Malfunctions eliminated
- Engine coolant temperature must reach at least 80 °C (176 °F)

Note:

If DTC memory is erased, the repair must be verified via the appropriate display group ⇒ *Page 01-33* .

Work sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this engine must be running at idle speed.

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Rapid data transfer **HELP**

Select function XX

- Press → button until all malfunctions still stored have appeared and the display reads:
- Press buttons -0- and -5- to select "Erase DTC Memory" function 05 and press -Q- button to confirm input. Repair malfunction if necessary.

01-30

Rapid data transfer **DTC Memory is erased**	→	⮜	Indicated on display - Press → button.
Rapid data transfer **Select function XX**	**HELP**	⮜	Indicated on display - Allow the engine to idle for at least 1 minute and check DTC memory again.

If no malfunction is displayed:

- Press buttons -0- and -6- to select "End Output" function 06 and press -Q- button to confirm input.
- Road test the vehicle for at least 10 minutes.

Road test procedure

- Engine coolant temperature must reach at least 80 °C (176 °F)
- Briefly depress accelerator pedal to wide open throttle when engine speed is above 4600 RPM.
- Check DTC memory again, no malfunctions should be shown.
- Create readiness code ⇒ Page 01-33 .

Note:

If the same malfunction is stored in DTC memory after the test drive, check control module coding ⇒ Page 01-10 .

Readiness code, reading (function 15)

Special tools, testers and auxiliary items

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

Work sequence

- Connect the VAG 1551/1552 scan tool and with ignition switched on select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -1- and -5- to select "Readiness Code" function 15 and press -Q- button to confirm input.

• Must appear on display when all diagnosis functions have been successfully completed:

Readiness code

00000000 - Test complete

Indicated on display

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

Readiness code

01101011 - Test not complete

Indicated on display (possible example)

01-32

One or more diagnostic checks have not been completed successfully:

- Press → button.
- Create readiness code ⇒ Page 01-33 .
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, the repair must be verified via the appropriate display group ⇒ Page 01-33 , Readiness code, creating.

Relevance of 8-digit number block for readiness code

The readiness code is created only when all display fields show 0								
1	2	3	4	5	6	7	8	Diagnostic function
							0	Three way catalytic converter
						0		Three way catalytic converter heating (not available)
					0			Fuel tank venting system
				0				Secondary air injection system
			0					Air conditioner (no diagnostic capability)
		0						Heated oxygen sensor
	0							Oxygen sensor heating
0								Exhaust gas recirculation system (not available)

01-33

Readiness code, creating

Notes:

- *During test sequence the ignition must not be switched off.*
- *If the specifications are obtained before the time specified in the table, you can proceed to the next work step.*
- *On vehicles ➢ m.y. 96 the function bits in the readiness code are set to 0 together, when the last diagnosis has been successfully completed.*
- *On vehicles m.y. 97 ➢ the function bits in the readiness code are set to 0 individually, for each successfully completed diagnosis.*

Special tools, testers and auxiliary items

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

Test sequence

WARNING!

When driving or riding in an airbag-equipped vehicle:

- ***Never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.***
- ***Secure tools or test equipment on passenger side floor where it can be safely read by the second technician.***

Work step: 1

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

  When doing this, the ignition must be switched on.

Relevance of 8-digit number block in display field 4

1	2	3	4	5	6	7	8	Diagnostic status
							1	Diagnostic Trouble Code (DTC) memory 1 = Malfunction in system;0 = No DTCs recognized
						1		ERROR bit(specific to display group being viewed) 1 = Malfunction detected;0 = No malfunction detected
					1			CYCLE bit 1 = Diagnosis complete;0 = Diagnosis not performed yet
				1				ACTIVE bit1 = Diagnosis active;0 = Diagnosis inactive
			x					Function bit [1)]
		x						Function bit [1)]
	x							Function bit [1)]
x								Function bit [1)]
[1)] The relevance of the function bit varies depending upon the work step.								

01-35

Notes:

- *There must not be a malfunction stored in DTC memory and there must be no malfunction detected during the diagnosis.*
- *If the CYCLE bit has a 1, the diagnosis is completed and the test sequence can be implemented.*
- *The specifications for the function bits must only be satisfied during the diagnostic phase (ACTIVE bit = 1).*
- *An "x" shown as the specification in the diagnosis status table means the display can show either "0" or "1".*

Work step: 2

Rapid data transfer **HELP** ⮜

Select function XX

Indicated on display

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

X DTC recognized → ⮜

The number of malfunctions stored or "No DTC recognized" will be shown on the display.

- Locate and eliminate malfunctions printed out as per DTC table ⇒ Page 01-14 .
- Press → button.

Work step: 3

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Rapid data transfer →

DTC Memory is erased

Indicated on display

- Press → button.

Work step: 4

- Start engine and run at idle speed.

Work step: 5

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -0- and -3- to input display group 103 and press -Q- button to confirm input.

Read Measuring Value Block **103** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Increase engine speed to 3000-3500 RPM and check specifications after 60 seconds.

	Display fields			
	1	2	3	4
Display group 103				
Display	xx.xx ms	**xxx.x °C**	**xxx.x °C**	**xxxx xxxx**
Indicated	Engine load	**Engine coolant temperature**	**Three way catalytic converter temperature**	**Diagnosis conditions**
Specification	---	**At least 60 °C**	**At least 360 °C**	**xx1x xx00**
Working range	1.4...2.4 ms	-46.5...141.0 °C	0.0...999.9 °C	x = Not relevant

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
		1						Oxygen Sensor (O2S) control active
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press → key.

01-38

Work step: 6

Diagnosis: Secondary Air Injection (AIR) system

Test conditions

- Vehicle stationary, engine at idle

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

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -6- and -0- to input display group 160 and press -Q- button to confirm input.

System in Basic Setting 160 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Start engine and run at idle speed and check specifications after 20 seconds.

01-39

	Display fields			
	1	2	3	4
Display group160				
Display	**xxx.x ° C**	**xx.x %**	**xx.x %**	xxxx xxxx
Indicated	**Engine coolant temperature**	**Secondary air injection valve open**	**Secondary air injection pump running**	Diagnosis conditions
Specification	**At least 60 ° C**	**At least 0.7%**	**At least 25%**	xx11 x100
		Secondary air injection valve causes deviations in Oxygen Sensor (O2S) control	Secondary air injection valve causes deviations in O2S control	x = Not relevant
Working range	-46.5...141.0 ° C			

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
		1						Engine running at idling speed
			1					Vehicle stationary
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press C key.

01-40

Work step: 7

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -0- and -3- to input display group 103 and press -Q- button to confirm input.

System in Basic Setting 103 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Increase engine speed to 2200-3300 RPM and check specifications after 120 seconds.

01-41

	Display fields			
	1	2	3	4
Display group 103				
Display	xx.xx ms	**xxx.x °C**	**xxx.x °C**	**xxxx xxxx**
Indicated	Engine load	**Engine coolant temperature**	**Three way catalytic converter temperature**	**Diagnosis conditions**
Specification		**At least 60 °C**	**At least 360 °C**	**xx1x xx00**
	---		---	x = Not relevant
Working range	1.4...2.4 ms	-46.5...141.0 °C	0.0...999.9 °C	

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
		1						Oxygen sensor control active
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press C key.

01-42

Work step: 8

Diagnosis: Oxygen Sensor (O2S) aging (regulating frequency extended)

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -3- and -1- to input display group 131 and press -Q- button to confirm input.

System in Basic Setting **131** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Run engine at idle speed for at least 30 seconds and check the specifications.

01-43

	Display fields			
	1	2	3	4
Display group 131				
Display	**xxxx rpm**	**x.xxx V**	**xxxx ms**	**xxxx xxxx**
Indicated	**Engine speed**	**Voltage of HO2S after three way catalytic converter**	**HO2S aging**	**Diagnosis conditions**
Specification	**650...750 rpm**	0.01...1.00 V fluctuating	**-1200...1200 ms**	**xx11 x100**
	---		HO2S aging: TV displacement by O2S control after three way catalytic converter	x = Not relevant
Working range	650...5500 rpm	0.01...1.00 V	-1200...1200 ms	

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
		1						O2S control after TWC active
			1					O2S control before TWC active
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C- button.

Work step: 9

Diagnosis: Oxygen Sensor (O2S) adaptation in partial load range

Basic Setting **HELP**

Input display group number XX

Indicated on display

- Press buttons -1-, -2- and -5- to input display group 125 and press -Q- button to confirm input.

System in Basic Setting **125** →

1 2 3 4

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

Note:

Avoid deceleration fuel cut-off during this diagnosis, as this causes the three way catalytic converter to store oxygen, and diagnosis will be blocked for at least 10 seconds.

- Test drive with the following special requirements:
  - Engine must be kept between 2500-4000 RPM
  - Automatic transmission: Drive range 2
  - Manual transmission: 2rd gear
- Continue test drive until the specifications are attained.
- Check the specifications during the test drive (second technician necessary). See airbag warning ⇒ Page 01-33 .

01-45

	Display fields			
	1	2	3	4
Display group 125				
Display	**xxxx rpm**	**x.x %**	x.x %	**xxxx xxxx**
Indicated	**Engine speed**	**O2S adaptation at partial load**	**O2S adaptation at idle**	**Diagnosis conditions**
Specification	**2500...3500 rpm**	**-10...10 %**	-12.4...12.4 %	**01x1 x100**
	Depending upon driving condition			x = Not relevant
Working range	650...5500 rpm	**-25...25 %**	-12.4...12.4 %	

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
0								Reduced correction range active
	1							Part load adaptation active
			1					O2S control active, before TWC
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C- button.

01-46

Work step: 10

Diagnosis: Oxygen Sensor (O2S) adaptation in idle range

Test conditions

- Engine coolant temperature min. 60 °C (140 °F) (⇒display group 001, display field 2)
- Intake air temperature max. 80 °C (176 °F) (⇒display group 003, display field 4)

System in Basic Setting **125** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Run engine at idle speed and check specifications after 40 seconds.

	Display fields			
	1	2	3	4
Display group 125				
Display	**xxxx rpm**	x.x %	**x.x %**	**xxxx xxxx**
Indicated	**Engine speed**	Oxygen sensor adaptation at part load	**Oxygen sensor adaptation at idle**	**Diagnosis conditions**
Specification	**650...880 rpm**	-23...23 %	**-12.4...12.4 %**	**01x1 x100**
				x = Not relevant
Working range	650...5500 rpm	-23...23 %	**-12.4...12.4 %**	

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
0								Reduced correction range active
	1							Part load adaptation active
			1					Oxygen sensor control before three way catalytic converter active
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C- button.

01-48

Work step: 11

Diagnosis: Oxygen Sensor (O2S) aging (regulating frequency extended)

Test conditions

- Vehicle stationary

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -3- and -0- to input display group 130 and press -Q- button to confirm input.

System in Basic Setting **130** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Increase engine speed to 2500-3500 RPM for 20 seconds and check the specifications.

Note:

In display field 3 (period counter) in the following table for vehicles m.y. 97 ➢ the specification is given as 10. Vehicles m.y. ➢97 only require 6 heated oxygen sensor periods for diagnosis.

01-49

	Display fields			
	1	2	3	4
Display group 130				
Display	**xxxx rpm**	**xx s**	**xx**	**xxxx xxxx**
Indicated	**Engine speed**	**Seconds**	**Period counter**	**Diagnosis conditions**
Specification	**2500...3500 rpm**	**0...2 s**	**10**	**1111 x100**
		Period duration of O2S control before Three Way Catalytic Converter (TWC)	Heated Oxygen Sensor (HO2S) periods recognized	
Working range	**650...5500 rpm**	**0...3 s**		

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
1								Oxygen sensor control before TWC active
	1							Speed/load range OK.
		1						TWC has its minimum temperature
			1					O2S heating before TWC diagnosis comp.
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C- button.

01-50

Work step: 12

Diagnosis: Three Way Catalytic Converter (TWC)

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -3- and -6- to input display group 136 and press -Q- button to confirm input.

System in Basic Setting **136** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Increase engine speed to 2500-3500 RPM and check specifications after 120 seconds.

01-51

	Display fields			
	1	2	3	4
Display group 136				
Display	**xxxx rpm**	**xxx.x °C**	**x.xx**	**xxxx xxxx**
Indicated	**Engine speed**	**Three way catalytic converter temperature**	**Amplitude ratio**	**Diagnosis conditions**
Specification	**2500...3500 rpm**	**At least 360 °C**	**max. 0.15**	**1111 x100**
				x = Not relevant
Working range	650...5500 rpm	0.0...999.9 °C		

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
1								Oxygen Sensor (O2S) control before Three Way Catalytic Converter (TWC) active
	1							TWC has its minimum temperature
		1						Load range OK.
			1					Heated Oxygen Sensor (HO2S) after TWC operationally ready
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C- button.

Work step: 13

Diagnosis: Fuel tank venting system (EVAP canister purge regulator valve)

Test conditions

- Vehicle stationary
- Electrical consumers switched off (radiator coolant fan must not run during the check)
- Air conditioner switched off

Note:

The engine must be at idle during this diagnosis because the diagnosis will be interrupted and will not be started again until the engine is revved-up.

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -5- and -0- to input display group 150 and press -Q- button to confirm input.

System in Basic Setting **150** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Run engine for 30 seconds at idle speed and check specifications.

01-53

	Display fields			
	1	2	3	4
Display group 150				
Display	**xx %**	**x.x %**	**x.xx g/s**	**xxxx xxxx**
Indicated	**Opening degrees**	**Oxygen Sensor (O2S) control**	**Idling control**	**Diagnosis conditions**
Specification	**0...100 %**	**-7.8...-23 or 7.8...23 or maximum 0.39 g/s**		**1110 x100**
	Minimum opening of EVAP valve	O2S control deviations during diagnosis	O2S control deviations during diagnosis	x = Not relevant
Working range	0...100 %	-25...25		

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
1								O2S control before three way catalytic converter active
	1							Idling
		1						Starting temperature warmer than -5 °C
			0					Altitude up to max. 2600 m above sea level
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press → button.

Work step: 14

- Read the readiness code ⇒ Page 01-31

- If the readiness code is not OK, perform optional work steps 15 through 22.

Work step: 15

Diagnosis: Vehicle Speed Sensor (VSS)

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -8- and -0- to input display group 180 and press -Q- button to confirm input.

System in Basic Setting **180** →

1 2 3 4

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

- Test drive according to the following special requirements:
  - ♦ Select drive range 2 (automatic) or 3rd gear (manual)
  - ♦ Engine speed above 3500 and 5 seconds ...

  ... then release accelerator pedal for 3 seconds.

- After 3 seconds, vehicle speed must still be at least 20 km/h (13 mph) and have been in deceleration fuel cut-off for a minimum of 2 secs.

- Check specifications during test drive (second technician necessary). See airbag warning ⇒ Page 01-33 .

	Display fields			
	1	2	3	4
Display group 180				
Display	**xxxx rpm**	**xxx.x °C**	**km/h**	**xxxx xxxx**
Indicated	**Engine speed**	**Coolant temperature**	**Vehicle speed**	**Diagnosis conditions**
Specification	**5...10 seconds at least 3500 rpm**	**At least 80 °C**	**25...50 km/h**	**x111 x100**
				x = Not relevant
Working range	650...5500 rpm	-46.5...141.0 °C		

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
	1							Engine speed for this check is OK.
		1						Coolant temperature OK.
			1					Overrun cut-off is active
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C- button.

01-56

Work step: 16

Diagnosis: Knock Sensor (KS) 1

Test conditions

- Vehicle stationary

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -4- and -5- to input display group 145 and confirm entry with -Q- button.

System in Basic Setting **145** →

1 2 3 4

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

- Increase engine speed to at least 3200 RPM and check specifications after 15 seconds.

01-57

	Display fields			
	1	2	3	4
Display group 145				
Display	**xxxx rpm**	**x**	**x**	**xxxx xxxx**
Indicated	**Engine speed**	**Knock Sensor (KS) 1**	**Wiring open circuit counter**	**Diagnosis conditions**
Specification	**At least 3200 rpm**	**max. 7**	**0**	**xxxx 1100**
		Amplification factor of knock sensor signal	Wiring open circuit diagnosed	x = Not relevant
Working range	650...5500 rpm			

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
				1				Knock sensor diagnosis is active
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -3- button ((VAG 1551) or ↑ button ((VAG 1552).

01-58

Work step: 17

Diagnosis: Knock Sensor (KS) 2

Test conditions

- Vehicle stationary

System in Basic Setting **145** →

1 2 3 4

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

- Increase engine speed to at least 3200 RPM and check specifications after 15 seconds.

01-59

	Display fields			
	1	2	3	4
Display group 146				
Display	**xxxx rpm**	**x**	**x**	**xxxx xxxx**
Indicated	**Engine speed**	**Knock Sensor (KS) 2**	**Wiring open circuit counter**	**Diagnosis conditions**
Specification	**At least 3200 rpm**	**max. 7**	**0**	**xxxx 1100**
		Amplification factor of knock sensor signal	Wiring open circuit diagnosed	x = Not relevant
Working range	650...5500 rpm			

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
				1				Knock sensor diagnosis is active
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C-button.

01-60

Work step: 18

Diagnosis: Heated Oxygen Sensor (HO2S) (before three way catalytic converter)

Basic Setting **HELP** 

Indicated on display

Input display group number XXX

- Press buttons -1-, -1- and -5- to input display group 115 and press -Q- button to confirm input.

System in Basic Setting **115** → 

Indicated on display (1-4 = display fields)

1 2 3 4

- Increase engine speed to 2200-2800 RPM and check the specifications.

	Display fields			
	1	2	3	4
Display group 115				
Display	**xxx.x °C**	**xxx.x °C**	**x.xx V**	**xxxx xxxx**
Indicated	**Engine coolant temperature**	**Three way catalytic converter temperature**	**Heated Oxygen Sensor (HO2S) voltage before three way catalytic converter**	**Diagnosis conditions**
Specification	**At least 60 °C**	**Approx. 360 °C**	**Fluctuating**	**1011 x100**
		---	---	x = Not relevant
Working range	-46.5...141.0 °C	0.0...999.9 °C	0...1.0 V	

01-61

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
1								HO2S before Three Way Catalytic Converter (TWC) is switched on
	0							HO2S is operationally warm
		1						HO2S before TWC is operationally ready
			1					Oxygen sensor control before TWC is active
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -3- button ((VAG 1551) or ↑ button ((VAG 1552).

01-62

Work step: 19

Diagnosis: Heated Oxygen Sensor (HO2S) after three way catalytic converter

System in Basic Setting **116** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Increase engine speed to 2200-2800 RPM for 15 seconds and check specifications.

	Display fields			
	1	2	3	4
Display group 116				
Display	**xxxx ms**	**xxx.x °C**	**x.xx V**	**xxxx xxxx**
Indicated	**Switching time delay of Heated Oxygen Sensor (HO2S) after three way catalytic converter**	**Three way catalytic converter temperature**	**HO2S voltage after three way catalytic converter**	**Diagnosis conditions**
Specification	**Approx. 1200 ms**	**At least 360 °C**	**At least 0.6 V**	**1011 x100**
	System will be enriched	---	---	x = Not relevant
Working range		0.0...999.9 °C	0...1.0 V	

01-63

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
1								Oxygen sensor heating after Three Way Catalytic Converter (TWC) is switched on
	0							HO2S is operationally warm
		1						HO2S after TWC operationally ready
			1					Oxygen sensor control before TWC is active
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C-button.

01-64

Work step: 20

Diagnosis: Oxygen Sensor (O2S) heating (before and after three way catalytic converter)

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -2- and -0- to input display group 120 and press -Q- button to confirm input.

System in Basic Setting **120** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Increase engine speed to 2200-2800 RPM and check the specifications.

01-65

	Display fields			
	1	2	3	4
Display group 120				
Display	**xxx.x °C**	**xxx s**	**xx.x Ω**	**xxxx xxxx**
Indicated	**Three way catalytic converter temp.**	**Seconds**	**Resistance**	**Diagnosis conditions**
Specification	**At least 360 °C**	**120 s**	**4.5...15.6 Ω**	**1111 x100**
		Time between O2S heating switches on and begin. of diagnosis	Resistance of O2S heating before three way catalytic converter	x = Not relevant
Working range	0.0...999.9 °C	0.0...500 s	0.0...65.0 Ω	

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
1								O2S heating before TWC switched on
	1							Heated Oxygen Sensor (HO2S) before TWC vaporization point exceeded
		1						HO2S before TWC operationally ready
			1					O2S heating before TWC operationally ready
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

01-66

- Press -3- button ((VAG 1551) or ↑ button ((VAG 1552).

System in Basic Setting 121 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Increase engine speed to 2200-2800 RPM and check specifications.

	Display fields			
	1	2	3	4
Display group 121				
Display	**xxx.x °C**	**xxx s**	**xx.x Ω**	**xxxx xxxx**
Indicated	**Three way catalytic converter temperature**	**Seconds**	**Resistance**	**Diagnosis conditions**
Specification	**At least 360 °C**	**120 s**	**4.5...15.6 Ω**	**1111 x100**
		Time between O2S heating switches on and beginning of diagnosis	Resistance of O2S heating after three way catalytic converter	x = Not relevant
Working range	0.0...999.9 °C	0.0...500 s	0.0...65.0 Ω	

Relevance of 8 digit number block in display field 4								
1	2	3	4	5	6	7	8	Specifications of diagnosis conditions
1								O2S heating after TWC switched on
	1							O2S after TWC vaporization point exceeded
		1						HO2S after TWC operationally ready
			1					O2S heating after TWC operationally ready
					1			CYCLE Bit = Diagnosis completed
						0		Diagnosis malfunction free
							0	DTC memory malfunction free

- Press -C- button.

Work step: 21

Diagnosis: Throttle valve control module

Note:

There are no specifications for this diagnosis. The values in the display fields are typical for this diagnosis. If other values are shown it does not indicate a system malfunction. The diagnostic functions run in the background during the check.

- Press buttons -1-, -4- and -0- to input display group 140 and press -Q- button to confirm input.

System in Basic Setting **140** → 

1 2 3 4

Indicated on display (1-4 = display fields)

- Run engine at idle speed and check specifications.

	Display fields			
	1	2	3	4
Display group 140				
Display	**x.xx ms**	**xx %**	**x.x V**	**xxxx xxxx**
Indicated	**Engine load**	**Idle actuator position**	**Throttle valve potentiometer voltage**	**Diagnosis conditions**
Specification	**1.4...2.4 ms**	**65...85 %**	**3.0...4.0 V**	**---**

- Run engine at idling speed.
- Press -3- button ((VAG 1551) or ↑ button ((VAG 1552).

01-69

System in Basic Setting **141** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Run engine at idle speed.

	Display fields			
	1	2	3	4
Display group 141				
Display	**xx %**	**xxx %**	**xxx**	**xxxx xxxx**
Indicated	**Throttle valve actuator**	**Throttle valve actuator**	**Throttle valve actuator**	**Diagnosis conditions**
Specification	**65...85 %**	**65...85 %**	**90...170**	**---**
	Actual position of throttle valve actuator	Throttle valve actuator specification	Throttle valve actuator integrator	

- Press -3- button ((VAG 1551) or ↑ button ((VAG 1552).

System in Basic Setting 142 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Run engine at idle speed.

	Display fields			
	1	2	3	4
Display group 142				
Display	**xx %**	**xxx %**	**xx.x %**	**xxxx xxxx**
Indicated	**Throttle valve actuator**	**Throttle valve actuator**	**Throttle valve actuator**	**Diagnosis conditions**
Specification	**65...85 %**	**80...90 %**	**20...30 %**	**---**
	Throttle valve actuator emergency running cross section	Throttle valve actuator minimum stop	Throttle valve actuator maximum stop	

- Press → button.

Work step: 22

- Read readiness code ⇒ Page 01-31 .
- Press buttons -0- and -6- to select "End Output" function 06 and press -Q- button to confirm input.

Output Diagnostic Test Mode (DTM) (function 03)

The output Diagnostic Test Mode (DTM) actuates the following components in the stated sequence:

1. Cylinder 1 fuel injector -N30-
2. Cylinder 2 fuel injector -N31-
3. Cylinder 3 fuel injector -N32-
4. Cylinder 4 fuel injector -N33-
5. Cylinder 5 fuel injector -N83-
6. Cylinder 6 fuel injector -N84-
7. Evaporative Emission (EVAP) canister purge regulator valve -N80-
8. Secondary Air Injection (AIR) solenoid valve -N112-
9. Secondary Air Injection (AIR) pump relay -J299-
10. Evaporative Emission (EVAP) canister purge solenoid valve -N115-

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Connector test kit VW 1594
- VAG 1527B voltage tester

Test conditions

- Fuse 18 OK
- Throttle position (TP) -G69- OK
- Closed throttle position switch OK, checking ⇒ Page 24-68 , checking throttle valve control module

Test sequence

- Connect the VAG 1551/1552 scan tool and with ignition switched on select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Operate VAG 1551/1552 scan tool taking into account the information on the display:
- Press buttons -0- and -3-to select "Output Diagnostic Test Mode" function 03.

Rapid data transfer **Q**

03 - Output Diagnostic Test Mode

Indicated on display

To activate cylinder 1 fuel injector -N30-:

- Press -Q- button to confirm input.

Output Diagnostic Test Mode →

Cylinder 1 fuel injector -N30

Indicated on display

- Open throttle valve fully and close again.
  - The cylinder 1 fuel injector must click.

01-73

Note:

All fuel injectors click extremely quietly!

To activate fuel injectors for cylinders 2-6, in each case:

- Open throttle valve fully again and close.

To skip individual tests:

- Press → button.

If one or more fuel injectors do not click:

- Continue Output DTM to the end.
- Switch ignition off.
- Check fuel injector actuation (resistance and current supply) ⇒ Page 24-115 .

To activate Evaporative Emission (EVAP) canister purge regulator valve -N80-:

- Press → button.

Output Diagnostic Test Mode →

EVAP canister purge regulator valve -N80

Indicated on display

- The EVAP canister purge regulator valve must click until the next component is activated by pressing the → button.
- Pull hose off purge regulator valve (from EVAP canister).
- Connect auxiliary hose.

- During Output DTM blow into auxiliary hose (in direction of throttle housing).

  - Valve must open and close

If the purge regulator valve does not open and close:

- Disconnect 2-pin connector at valve and connect VAG 1527B voltage tester with test leads from VW 1594 to disconnected connector.

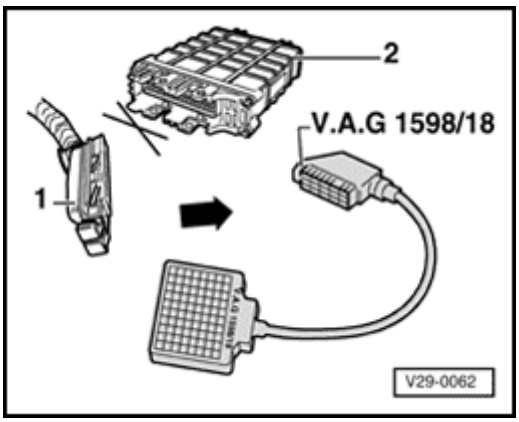
  - The LED must flash

If LED flashes:

- Replace EVAP canister purge regulator valve.

If LED does not flash:

- Switch ignition off.



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- Check wiring between test box and 2-pin connector for open circuit according to wiring diagram.

  Terminal 1 and test box socket 31

  Resistance: Max. 1.5 ohms (Ω)
- Check wiring between 2-pin connector terminal 2 and central electrical system for open circuit according to wiring diagram. Resistance: Max. 1.5 ohms (Ω)

- Check wiring between ECM connector and 2-pin connector terminal 1 for short circuit to wire terminal 2 and to vehicle Ground (GND), according to wiring diagram.

  Terminal 2 and test box socket 31

  Specification: ∞ ohms (Ω)

- Additionally, check wiring for short circuit to battery positive (B+).

  Specification: ∞ ohms (Ω)

If no malfunction in wiring is detected:

- Reconnect harness connector to EVAP canister purge regulator valve.

- Replace Engine Control Module (ECM) -J220-.

To activate Secondary Air Injection (AIR) solenoid valve -N112-:

- Press → button.

Output Diagnostic Test Mode →

Secondary AIR solenoid valve -N112

Indicated on display

- The Secondary air injection solenoid valve must run until the next component is activated by pressing the → button.

If the relay does not click:

- Disconnect 2-pin connector at Secondary Air Injection (AIR) solenoid valve -N112-.

- Connect VAG 1527B voltage tester using test leads from VW 1594 to disconnected connector.

- LED must light up

If LED lights up (voltage supply OK):

- Replace Secondary Air Injection (AIR) solenoid valve -N112-.

If LED does not light up:

- Check wiring to Secondary Air Injection (AIR) solenoid valve -N112- according to wiring diagram.

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

⇒*Electrical Wiring Diagrams, Troubleshooting & Component Locations*

To activate Secondary Air Injection (AIR) pump relay -J299-:

- Press → button.

Output Diagnostic Test Mode →

Secondary air injection pump relay -J299

Indicated on display

- The Secondary Air Injection (AIR) pump relay -J299- activates the secondary air pump motor, and this must run at intervals until the next component is activated by pressing the → button.

If the secondary air pump motor does not run:

- Disconnect 2-pin connector at Secondary Air Injection (AIR) pump motor -V101-.

- Connect VAG 1527B voltage tester using test leads from VW 1594 to disconnected connector.

- LED must light up

If LED lights up (voltage supply OK):

- Replace Secondary Air Injection (AIR) pump motor -V101-.

If LED does not light up:

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

⇒*Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check wiring to Secondary Air Injection (AIR) pump motor -V101- according to wiring diagram.

- Press → button.

Output Diagnostic Test Mode →

EVAP canister purge solenoid valve -N115

Indicated on display

Disregard display.

- Press → button.

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Read Measuring Value Block (function 08)

Note:

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
Skip	Press -C- button	Press -C- button

Test conditions

- Control module in "Read Measuring Value Block" function 08
- Vehicle stationary, engine idling
- Engine oil temperature min. 80 °C (176 °F)
- Electrical consumers switched off (radiator coolant fan must not run during the check)
- Air conditioner switched off

Display group overview

Display group 000 (decimal displayed value)

- Engine running at idle speed, control module in "Read Measuring Value Block" function 08

Display fields											Specification	Corresponds to
1	2	3	4	5	6	7	8	9	10	Partial load adaption value for Oxygen Sensor (O2S) control (before three way catalytic converter)	118 - 138	-7 to 7%
										Idle adaption value for O2S control (before three way catalytic converter)	241 - 255 or 0 - 14	-10 to 10%
										O2S control	96 - 160	-5 to 5%
										Mass air flow adaptation value at idle	112 - 144	-5 to 5 kg/h
										Idle control (idle mass air flow)	112 - 144	-5 to 5 kg/h
										Throttle valve angle	0 - 23	0 to 10 ∠°
										Battery voltage	176 - 212	12.0 to 14.0 V
										Engine speed	65 - 80	650 to 800 RPM
										Engine load	28 - 58	1.4 to 2.4 ms
										Engine coolant temperature	170 - 204	80° to 108 °C

- If one of the specifications are not attained ⇒ Page 01-80 , evaluating display group 000.

- For additional steps see Repair procedures:

Notes:

- *Press → button to end "Read Measuring Value Block".*
- *After terminating "Read Measuring Value Block", press buttons -0- and -6- to input "End Output" function 06 and press -Q- button to confirm input.*

Evaluating display group 000

Display field: 1	**Possible malfunction cause**	**Malfunction elimination**
More than 204	♦ Engine Coolant Temperature (ECT) sensor	- Check ECT sensor ⇒ Page 24-88
Less than 170	♦ ECT sensor ♦ Thermostat faulty (open)	- Check thermostat: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 19*
Display field: 2	**Possible malfunction cause**	**Malfunction elimination**
More than 58	♦ Electrical consumer switched on ♦ Oxygen Sensor (O2S) control on limit	- Switch off electrical consumers - Check Heated Oxygen Sensor (HO2S) and O2S control (before three way catalytic converter) ⇒ Page 24-25 - Check O2S aging (before three way catalytic converter) ⇒ Page 24-56
Less than 28	♦ Unmetered air (outside air) ♦ Fuel pressure regulator faulty/hose fallen off	- Check intake air system for leaks (outside air) ⇒ Page 24-123 - Check fuel pressure regulator ⇒ Page 24-120

Display field: 3	Possible malfunction cause	Malfunction elimination
Less than 65	♦ Driving range selected ♦ Throttle valve control module faulty	- Selector lever in P or N position - Check throttle valve control module ⇒ Page 24-68
More than 80	♦ Closed throttle position switch closed ♦ Throttle valve control module faulty ♦ Unmetered air	- Check throttle valve control module ⇒ Page 24-68 - Check intake air system for leaks (outside air) ⇒ Page 24-123
Display field: 4	**Possible malfunction cause**	**Malfunction elimination**
Less than 176	♦ Generator faulty ♦ Battery discharged/faulty	- Check Engine Control Module (ECM) voltage supply ⇒ Page 24-105 - Check generator - Check battery
More than 212	♦ Voltage regulator faulty	- Check voltage regulator
Display field: 5	**Possible malfunction cause**	**Malfunction elimination**
Less than 0	♦ Not possible	-
More than 23	♦ Basic setting of throttle valve control module has not been performed ♦ Throttle valve control module faulty ♦ Accelerator pedal cable adjustment	- Perform basic setting ⇒ Page 24-85 - Check throttle valve control module ⇒ Page 24-68 - Adjust accelerator pedal cable: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*

Display field: 6 + 7	Possible malfunction cause	Malfunction elimination
Less than 112	♦ Unmetered air after throttle valve	- Check intake air system for leaks (outside air) ⇒ Page 24-123
More than 144	♦ Increased engine load	- Switch off electrical consumer
Display field: 8	**Possible malfunction cause**	**Malfunction elimination**
Less than 96	♦ Engine too rich, O2S control weakens mixture ♦ O2S control at limit ♦ Lots of fuel from EVAP canister ♦ Fuel pressure regulator faulty/hose fallen off	- Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25 - Check fuel pressure regulator ⇒ Page 24-120
More than 160	♦ Engine too lean, O2S control enriches mixture ♦ Unmetered air (outside air) ♦ Fuel injectors faulty ♦ O2S control at limit	- Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25 - Check intake air system for leaks (outside air) ⇒ Page 24-123 - Check fuel injectors ⇒ Page 24-115
128	♦ Shortage of fuel ♦ O2S control blocked	- Check amount of fuel in tank - Check HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25

Display field: 9	Possible malfunction cause	Malfunction elimination
Less than 241 or more than 14	♦ ⇒ Page 24-29 , evaluating display group 025	
Display field: 10	**Possible malfunction cause**	**Malfunction elimination**
Less than 118 or more than 138	♦ ⇒ Page 24-29 , evaluating display group 025	

VAG 1551 Scan Tool (ST), connecting and selecting "CARB/OBD II" address word 33

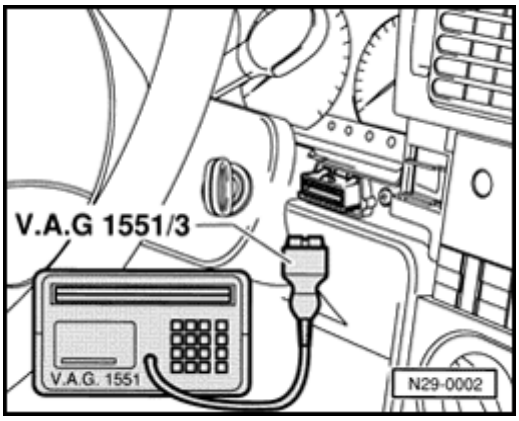
Special tools, testers and auxiliary items

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

Test conditions

- Fuses 15, 18 and 22 OK

Work sequence



- Open cover for Data Link Connector (DLC).
- Connect VAG 1551/1552 scan tool with VAG 1551/3 adapter cable.

Depending on desired function:

- Switch ignition on, or start engine.

Operate VAG 1551/1552 scan tool taking into account the information on the display:

Selectable functions for address word "33 CARB / OBDII"

- Press -1- button to select "Rapid data transfer" operating mode 1.
- Press the -3- button twice to select "CARB / OBD II" address word 33.

01-85

Rapid data transfer **Q**

33 - OBD II

Display will appear as shown

- Press Q button to confirm input.

OBD II Scan Tool

Select mode 1.. 2.. 3.. 4.. 5.. 6.. 7..

Display will appear as shown

The following modes can be selected:

Mode 1	Current data ⇒ Page 01-86
Mode 2	Freeze frame data ⇒ Page 01-95 or ⇒ Page 01-87
Mode 3	DTC memory ⇒ Page 01-96
Mode 4	Clear DTC memory ⇒ Page 01-97
Mode 5	Oxygen sensor signal (B1-S1) ⇒ Page 01-98
Mode 6	Transfer measured values. Measured values that are not being monitoring will be output.
Mode 7	Interrogate DTC memory. Malfunctions which have not switched ON the MIL can be interrogated.

Note:

When a mode is selected, the control module replies with a 4 on the display in front of the mode selected. Example: mode 2 will be indicated in the display with mode 42.

Current data, mode 1

In mode 1 the current diagnostic data can be interrogated. Additionally the readiness code can be displayed (PID1 display field 4).

Breakdown of parameter identification (PID) ⇒ Page 01-87 diagnostic data.

The On Board Diagnostic (OBD) program can be used to check whether individual parameters correspond to actual engine condition.

- Press button -1- to select mode 1, current data.

Mode 41 PID x Module 10* →

Current data

Display will appear as shown

Module 10* or 1A* will be displayed alternately when:

- Module 10 = Engine Control Module (ECM) -J220-, or
- Module 1A = Transmission Control Module (TCM) -J217- have the same parameter identifications (PID)

Example: Engine Coolant Temperature is measured at the ECM and ATF at the TCM.

The diagnostic data must be individually interrogated via the → button. Press the Print button to obtain a printout.

The MIL is said to be switched ON when the engine is not idling, and only the ignition is switched ON.

01-87

Diagnostic data

Relevance of figures in 8 digit number block

Mode 41 PID 1 Module 10 → ≺ Display will appear as shown

00000000 xxxxxxxx xxxxxxxx xxxxxxxx

Display positions 2...8 indicate number of DTCs stored									
Display positions									**Specification**
1	2	3	4	5	6	7	8	Number of DTCs stored	0
								MIL switched off 1)	0

1) When diagnostic data only is displayed, the specification = 1.

Relevance of figures in 8 digit number block

Mode 41 PID 1 Module 10 → ≺ Display will appear as shown

xxxxxxxx 00000111 xxxxxxxx xxxxxxxx

Display positions 1 to 5 are not required									
Display positions									**Specification**
1	2	3	4	5	6	7	8	Component monitoring	1
								Fuel system monitoring	1
								Misfire recognition	1
									0

01-88

Relevance of figures in 8 digit number block

Mode 41 PID 1 Module 10 → < Display will appear as shown

xxxxxxxx xxxxxxxx 01101101 xxxxxxxx

If specification is 0, the diagnostic capability is not recognized by ECM.									
If specification is 1, the diagnostic capability is recognized by ECM.									
Display fields									**Specification**
1	2	3	4	5	6	7	8	Three way catalytic converter	1
								Three way catalytic converter heating (not available)	0
								Fuel tank venting system	1
								Secondary air injection (AIR) system	1
								A/C (no diagnosticcapability)	0
								Heated Oxygen Sensor (HO2S)	1
								Oxygen Sensor (O2S) heating	1
								Exhaust Gas Recirculation (EGR) system (not available)	0

Mode 41 PID 1 Module 10 →

xxxxxxxx xxxxxxxx xxxxxxxx 00000000

Display will appear as shown

If the specification is not obtained in display field 4 and a 1 is displayed, then the appropriate diagnostic sequence has not yet been performed. The readiness code must still be created ⇒ Page 01-33 .

Relevance of figures in 8 digit number block

If specification is 0, the diagnostic program for the readiness code has been completed.									
Display fields									**Specification**
1	2	3	4	5	6	7	8	Three way catalytic converter	0
								Three way catalytic converter heating (not available)	0
								Fuel tank venting system	0
								Secondary air injection system	0
								A/C (no diagnostic capability)	0
								Heated oxygen sensor	0
								Oxygen sensor heating	0
								Exhaust Gas Recirculation (EGR) system (not available)	0

01-90

- Press → button to display any additional diagnostic data.

Mode 41 PID 3 Module 10 →

Fuel System xxx1xxxx xxxxxxxx

PID3: Injection status

When the 4th position from the left is 1, the injection status is recognized as available

- Press → button.

Mode 41 PID 4 Module 10 →

Calculated load value **2 %**

PID4: Calculated load value %

Specification at idle approx.: 2%

- Press → button.

Mode 41 PID 5 Module 10 →

Engine Coolant Temp. **°C**

PID5: Engine coolant temperature °C

Indicates the current engine coolant temperature.

Specification for engine at normal operating temperature: 80° to 105°C (176° to 221°F)

- Press → button.

Mode 41 PID 5 Module 1A →

Coolant temp. **°C**

PID5: Coolant temperature °C

Indicates the current ATF temperature.

When the ATF specification is above 140°C (284°F) with engine at normal operating temperature, 80° to 105°C (176° to 221°F) a DTC will be stored.

01-91

- Press → button.

Mode 41 PID 6 Module 10 →
Short Term Fuel Trim Bank 1 **x %**

PID6: Short term fuel trim, Bank 1 %

The Oxygen sensor control integrator in % is displayed here.

- Press → button.

Mode 41 PID 7 Module 10 →
Long Term Fuel Trim Bank 1 **x %**

PID7: Long term fuel trim, Bank 1 %

The adaptation increases the value in % depending upon altitude.

- Press → button.

Mode 41 PID 12 Module 10 →
Engine speed **rpm**

PID12: Engine speed (RPM)

The engine speed (RPM) is displayed here

- Press → button.

Mode 41 PID 12 Module 1A →
Speed **rpm**

PID12: Engine speed (RPM)

The input speed (RPM) from transmission is displayed here

01-92

- Press → button.

Mode 41 PID 13 Module 1A →

Speed **x km/h**

PID13: Vehicle speed (km/h)

Current vehicle speed display

- Press → button.

Mode 41 PID 13 Module 10 →

Speed **km/h**

PID13: Vehicle speed (km/h)

Current vehicle speed display

- Press → button.

Mode 41 PID 14 Module 10 →

Ignition Timing Advance **12°**

PID14: Ignition timing advance °

Specification at idle: 12° fluctuating.

If the displayed ignition angle is constant, and later than 12° then the cause can be a faulty knock sensor

- Press → button.

Mode 41 PID 15 Module 10 →

Intake Air Temp. **xxx° C**

PID15: Intake air temperature °C

Measured at idle, slightly above ambient temperature

01-93

- Press → button.

Mode 41 PID 16 Module 10 →
Air Flow Rate **4.30 g/sec**

PID16: Mass air flow g/sec

Measured at idle approx.: 4.3 g/sec.

If the value is below 2.5 g/sec. unmetered air can be the cause

- Press → button.

Mode 41 PID 17 Module 10 →
Throttle Valve Position **3 %**

PID17: Throttle position %

Specification at idle: 2-4%.

A too large or small a value leads to DTC: P1582

- Press → button.

Mode 41 PID 18 Module 10 →
Command Secondary Air **xxxxx1xx**

PID18: Secondary air injection status

When the 3rd position from right is 1, the secondary air injection system is recognized as available

- Press → button.

Mode 41 PID 19 Module 10 →
Location of Oxygen sensor **xxxxxx11**

PID19: Location / Heated oxygen sensor

When the 1st and the 2nd position from right is 1, the heated oxygen sensors are recognized as available.

01-94

- Press → button.

Mode 41 PID 20 Module 10 →

Bank 1 Sensor 1 0.445 V **x %**

PID20: Heated oxygen sensor 1: 0.445 V x%

- The displayed value in volts must fluctuate between 0 and 1.0 volts.

- Press → button.

Mode 41 PID 21 Module 10 →

Bank 1 Sensor 2 0.445 V **x %**

PID21: Heated oxygen sensor 2: 0.445 V x%

- The displayed value in volts must fluctuate between 0 and 1.0 volt, however it must be at a slower rate than the HO2S before three way catalytic converter.

- Press C button to exit mode 1.

Freeze frame data, mode 2

Note:

If a malfunction is detected by the Engine Control Module (ECM) and is then stored, simultaneously, the operating conditions existing at the time the malfunction was stored will also be stored, and can be interrogated via mode 2.

Breakdown of the (PID) identification parameters ⇒ *Page 01-87 current data.*

- Press button 2 to select mode 2 freeze frame data.

Mode 42 0 PID 0 Module 10 →

Freeze Frame Data

Display will appear as shown

- Press → button.

Module 10* or 1A* will be activated (alternately):

- Module 10 = Engine Control Module (ECM) -J220-
- Module 1A = Transmission Control Module (TCM) -J217-

- Press → button, and the operating conditions will be printed out as a block, assuming there is a DTC stored in DTC memory.
- Mode 2 can be exited by pressing the C button.

01-96

DTC memory, mode 3

- Press button -3- to select mode 3 DTC memory.

x Malfunction recognized

Module 10* → MIL off Module 1A*

Display will appear as shown

*Module 10 or 1A will be activated (alternately):

- Module 10 = Engine Control Module (ECM) -J220-
- Module 1A = Transmission Control Module (TCM) -J217-
- MIL OFF / ON = MIL switched OFF or ON

- Press → button, any stored DTCs will be displayed in sequence

P0422

Display will appear as shown (example)

- Press → button.

Notes:

- *If two or more DTCs are stored, the cause of the malfunction could be attributed to the second or following malfunction. Interpreting stored DTCs, ⇒ Page 01-14 , DTC table*
- *After malfunctions have been repaired, Clear DTC memory (⇒ Page 01-97) and create the readiness code again ⇒ Page 01-33 .*

- Press -C- button to exit mode 3.

01-97

Clear DTC memory, mode 4

- Start engine and let idle. Press button -4- to select mode 4 Clear DTC memory.

Note:

DTC codes (if any are stored) must first be read before they can be cleared. Pressing button -4- will not clear the data in DTC memory immediately. In case of operator error, the control module will respond:

OBD II Scan Tool

Cleared DTC memory ?

Display will appear as shown

By pressing the -C- button mode 4 will be exited

OBD II Scan Tool

Select mode 1.. 2.. 3.. 4.. 5.. 6.. 7..

Display will appear as shown

By pressing the -Q- button DTC memory will be cleared.

Mode 44 Module 10

DTC memory is cleared

Display will appear as shown

Note:

When the -Q- button is pressed it can cause the engine to run irregularly until mode 4 is exited.

- Press -C- button to exit mode 4.

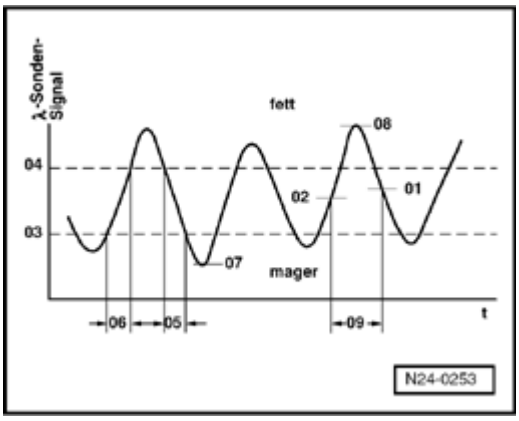
After repairing malfunctions and erasing DTC memory, the readiness code must be created ⇒ Page 01-33 . Then the readiness code must be interrogated via mode 41 transfer of current diagnostic data ⇒ Page 01-87 .

01-98

Oxygen sensor signal (B1-S1), mode 5

Note:

When a Heated Oxygen Sensor (HO2S) malfunction is stored, use mode 5 to check the HO2S signal output, to see whether the HO2S before three way catalytic converter is within specification, or whether another malfunction is present, e.g. the HO2S after three way catalytic converter is causing an O2S control malfunction.



➢ The points 01 to 09 represent:

01 - Rich/lean threshold voltage (constant value)

02 - Lean/rich threshold voltage (constant value)

03 - Lower voltage for calculating switching period

04 - Upper voltage for calculating switching period

05 - Calculated rich/lean switching time

06 - Calculated lean/rich switching time

07 - Minimum test voltage

08 - Maximum test voltage

09 - Time between threshold voltages

- Press button -5- to select mode 5 output oxygen sensor signal.

Mode 45 Test ID 1 Module 10 →

B1-S1 **0.445V**

➢ Display will appear as shown: Test ID 01

Rich/lean threshold voltage: Standard value 0.445 volts

- Press → button.

01-99

Mode 45 Test ID 2 Module 10 →

B1-S1 **0.445V**

Display will appear as shown: Test ID 02

- Lean/rich threshold voltage: constant value 0.445 volts
- If constant value is not obtained, the HO2S is faulty

- Press → button.

For the following HO2S signals three values are always displayed:

1st value =	Minimum value
2nd value =	Actual value
3rd value =	Maximum value

Note:

The displayed Min. and Max. values are constant and do not change. The actual value is displayed as a constant. It will only change when during the test the HO2S supplies a greater or smaller signal.

Mode 45 Test ID 7 Module 10 →

B1-S1 0.148V x.xxV **0.40V**

Display will appear as shown: Test ID 07

- Minimum test voltage
- If the actual value is below 0.148 volts, there is a short to ground.
- When the actual value exceeds 0.4 volts, the malfunction could be the HO2S is not at working temperature, sensor heating is faulty, wiring open circuit to HO2S or a short circuit to positive (B+).

01-100

- Press → button.

Mode 45 Test ID 8 Module 10 →

B1-S1 0.598V x.xxV **1.078V**

Display will appear as shown: Test ID 08

- Maximum test voltage
- If the actual value is above 1.078 volts, there is a short circuit to positive (B+)in the wire to HO2S
- If the actual value is below 0.598 volts, the malfunction could be a HO2S not reaching proper operating temperature, faulty O2S heating or an open circuit in the HO2S wiring.

- Press → button.

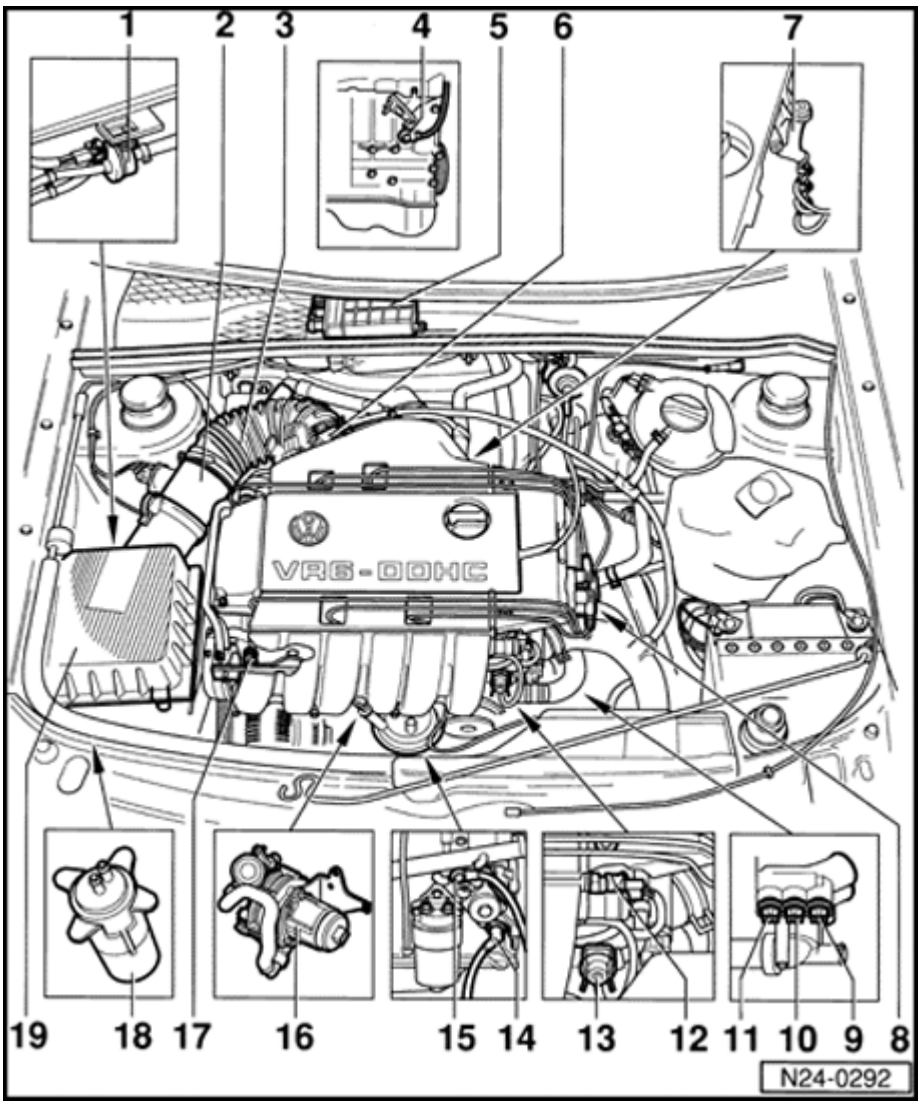
Mode 45 Test ID 9 Module 10 →

B1-S1 0.04s x.xxs **1.20s**

Display will appear as shown: Test ID 09

- The display shows the time between the threshold voltages
- If the actual value is below the minimum time of 0.04 seconds, there is a short circuit
- If the actual value exceeds the maximum time of 1.20 seconds, the malfunction could be due to an aged, lazy or contaminated oxygen sensor.

- Press -C- button to exit the program sequence.



Multiport fuel injection and ignition system

Component locations, overview

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

- EVAP canister system

⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*

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

3 - Intake air duct

- With connection for Positive Crankcase Ventilation (PCV) heating element -N79-

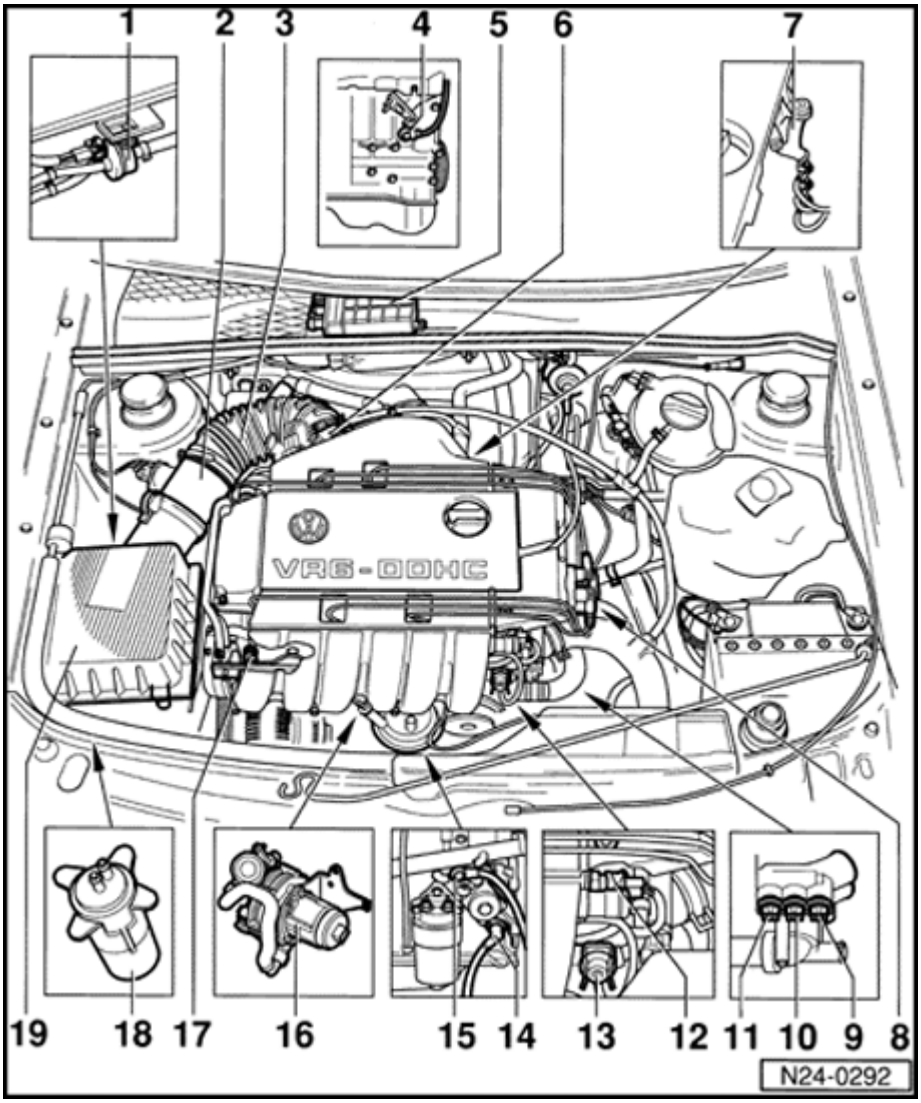
4 - Knock Sensor (KS) 1 - G61-

- ⇒ Page 28-4 , item 12

5 - Engine Control Module (ECM) -J220-

6 - Throttle valve control module -J338-

24-2



7 - Ground (GND) connection

8 - Ignition coil -N152-

- ⇒ Page 28-2 , item 6

9 - A/C cut-out thermal switch -F163-, and third speed coolant Fan Control (FC) thermal switch -F165-

- Brown, 4-pin
- On vehicles with A/C

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

- Blue, 2-pin
- For Motronic ECM

11 - After-run coolant Fan Control (FC) thermal switch -F87-, and Engine Coolant Temperature (ECT) sensor -G2-

- Yellow, 4-pin

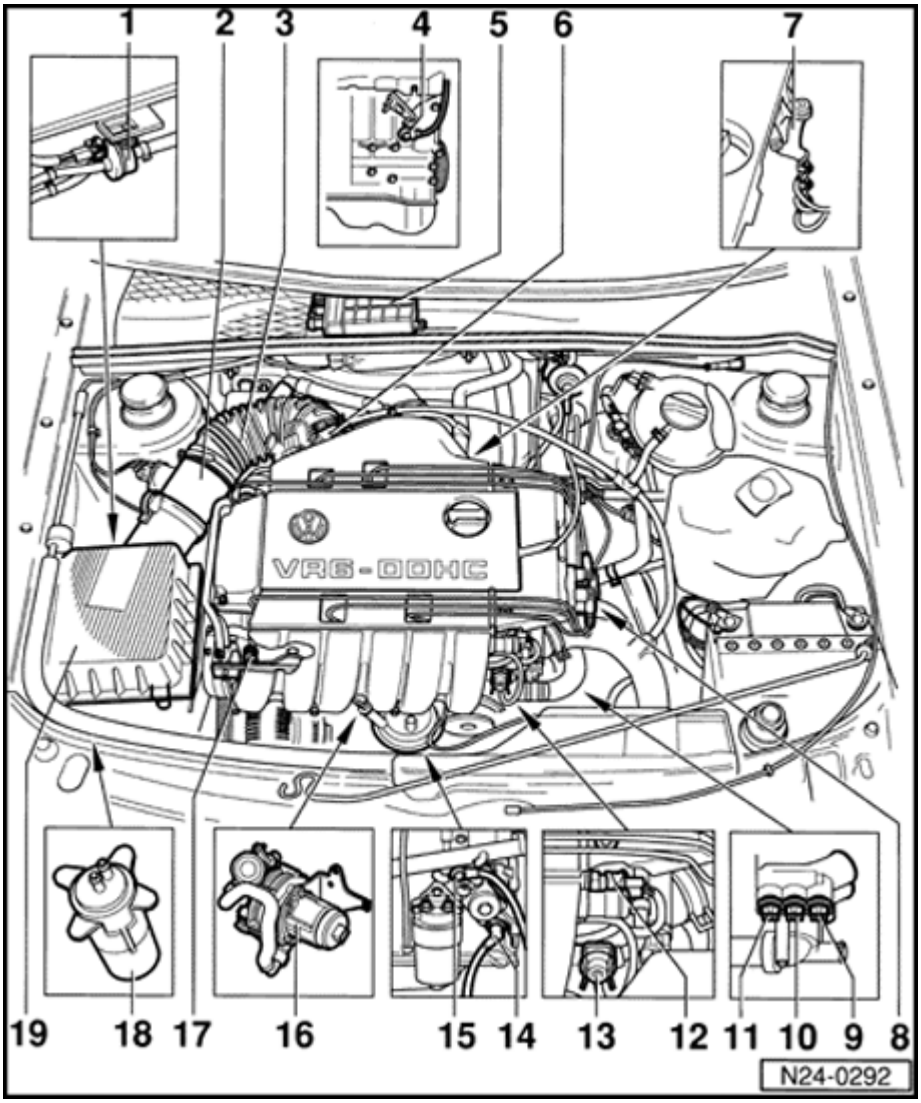
12 - Intake Air Temperature (IAT) sensor -G72-

13 - Fuel pressure regulator

14 - Engine speed (RPM) sensor -G28-

15 - Knock Sensor (KS) 2 - G66-

24-3



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

- Exhaust gas recirculation system

⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*

17 - Fuel injectors

- Cylinder 1 -N30-
- Cylinder 2 -N31-
- Cylinder 3 -N32-
- Cylinder 4 -N33-
- Cylinder 5 -N83-
- Cylinder 6 -N84-

18 - EVAP canister

- Below air cleaner
- EVAP system

⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*

19 - Air cleaner (ACL)

24-4

General information

Fuel injection system, servicing

Ignition system, servicing ⇒ Page 28-1

Notes:

- *Fuel hoses in engine compartment must be secured with spring-type clips. The use of clamp or screw-type clips is not permissible.*
- *The control module for the fuel injection and ignition system is equipped with a Diagnostic Trouble Code (DTC) memory. Before carrying out repairs, adjustment work and troubleshooting DTC memory must be checked and vacuum connections checked (outside air).*
- *Components marked with an asterisk (*) are checked via the On Board Diagnostic (OBD) program ⇒ Page 01-12 .*
- *Components marked with a double asterisk (**) are checked via the output Diagnostic Test Mode (DTM) ⇒ Page 01-71 .*
- *For trouble-free operation of the electrical components, a voltage of at least 11.5 volts is necessary.*
- *Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be consumed during combustion and damage the Heated Oxygen Sensors (HO2S).*

24-5

- *Do not use contact sprays or similar agents in the area of the connector for the HO2S. To function correctly HO2S requires reference air, which they receive via the connector. If contact spray gets into the HO2S via this path it will lead to damage/malfunctions.*

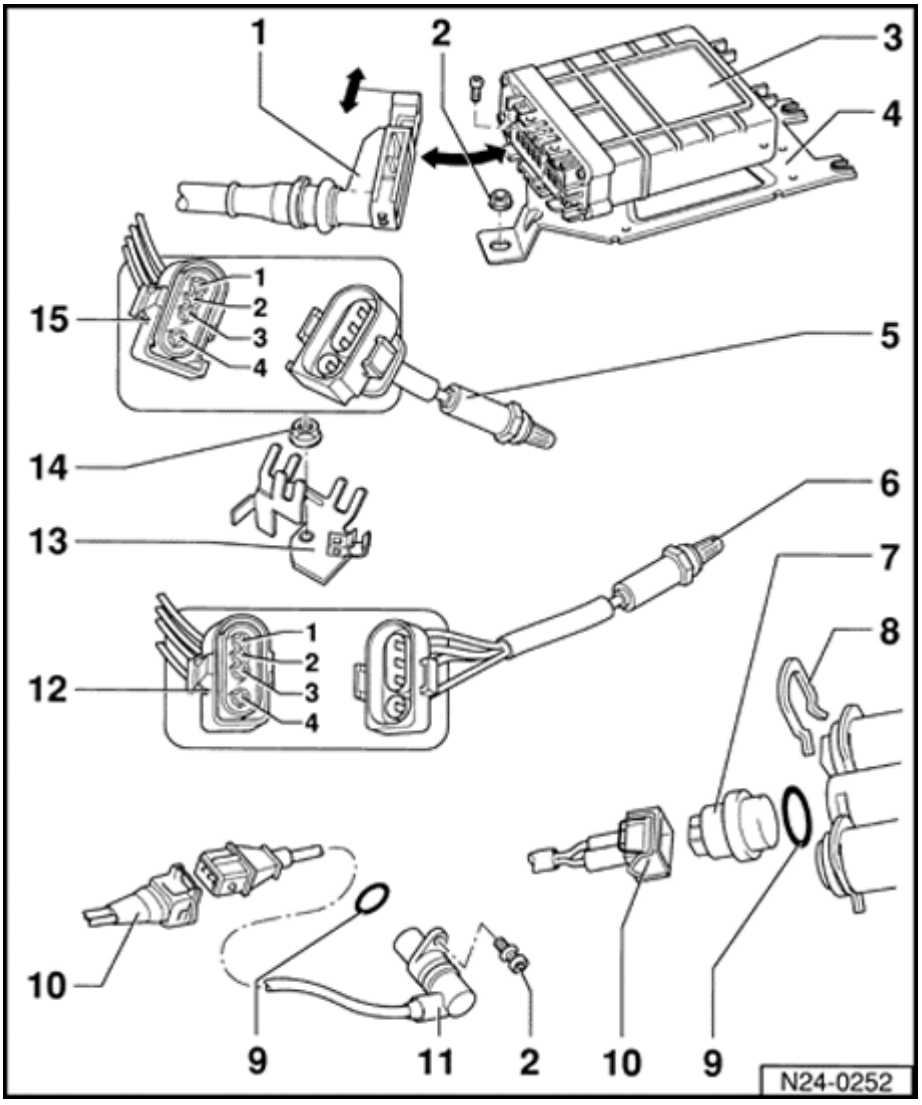
- *During some checks it can happen that the Engine Control Module (ECM) will recognize and store a malfunction. Therefore after completing all checks and repairs the DTC memory must be checked and if necessary erased* ⇒ *Page 01-12 , checking DTC memory.*

Safety precautions ⇒ Page 24-18

Rules for cleanliness ⇒ Page 24-20

Technical data ⇒ Page 24-21

24-6



Engine Control Module (ECM), Heated Oxygen Sensor (HO2S), Engine Coolant Temperature (ECT) sensor and engine speed (RPM) sensor, removing and installing

1 - Connector

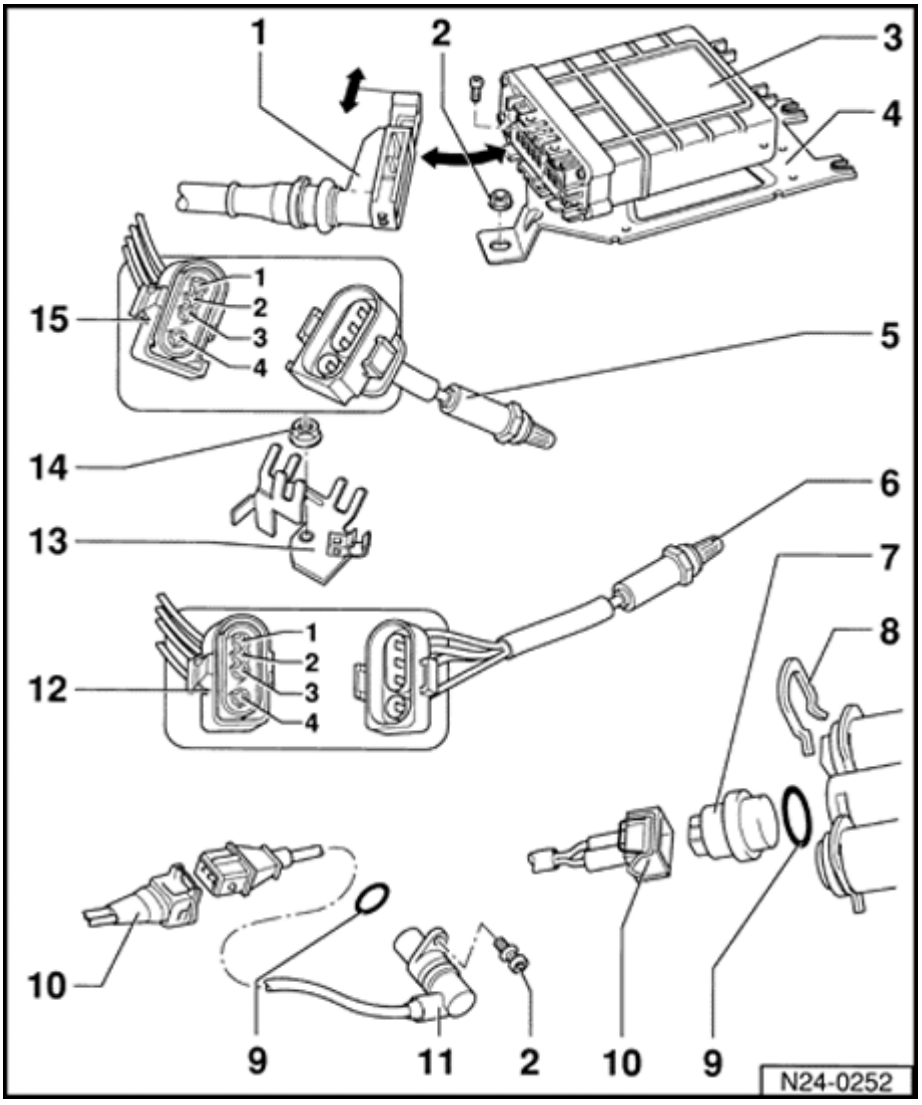
- Only disconnect or connect with ignition switched off
- Unlatch to disconnect

2 - 10 Nm (7 ft lb)

3 - Engine Control Module (ECM) -J220-*

- Location: in plenum chamber, right side
- For fuel injection system oxygen sensor control, EVAP canister purge regulator valve, speed governing via fuel pump relay, idle speed control, ignition and On Board Diagnostic (OBD)
- Check ECM coding ⇒ Page 01-10

24-7



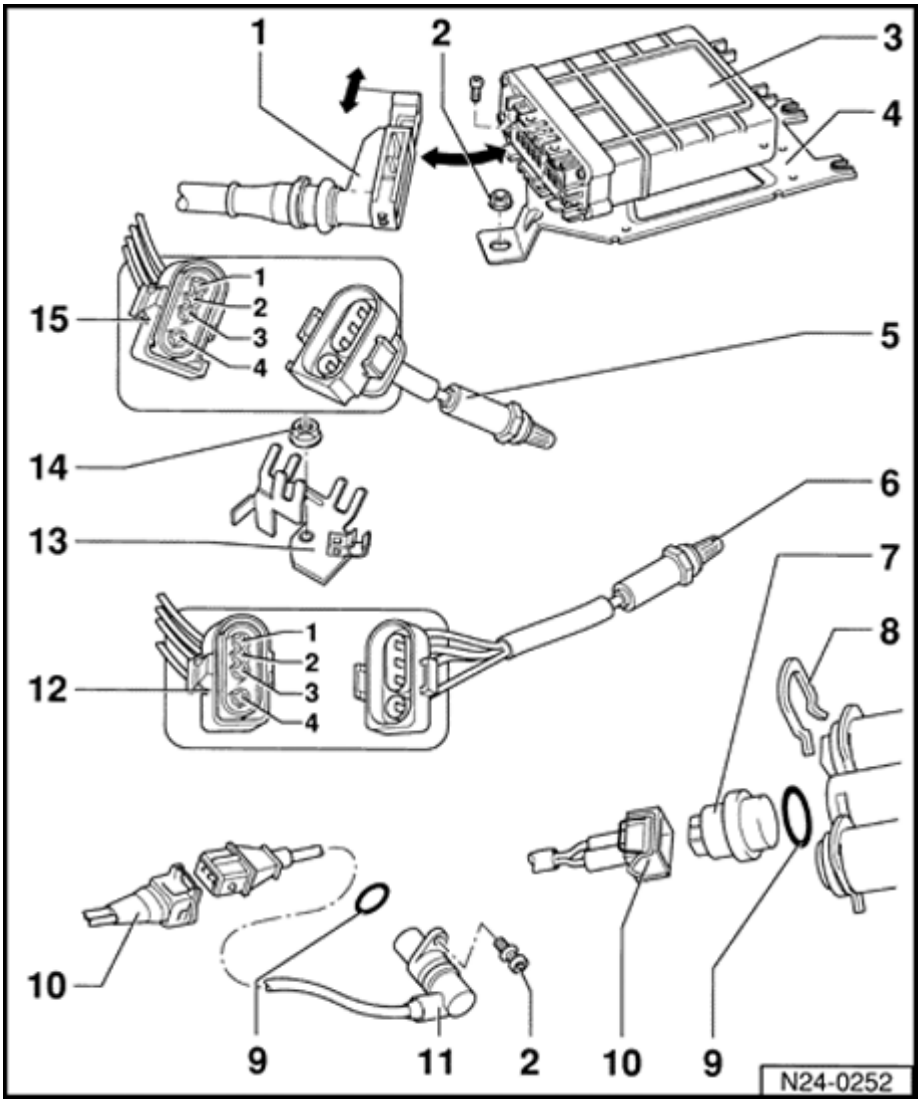
4 - Mounting plate

- For Engine Control Module (ECM) -J220-

5 - Heated Oxygen Sensor (HO2S) 2 -G108-*

- 50 Nm (37 ft lb)
- Installation position: Three Way Catalytic Converter (TWC)
- Only grease threads with "G5"; "G5" must not get into the slots on the HO2S body
- Checking HO2S and O2S control (after three way catalytic converter) ⇒ Page 24-42
- O2S heating voltage supply via Fuel Pump (FP) relay -J17-
- Checking O2S heating (after three way catalytic converter) ⇒ Page 24-49

24-8



6 - Heated Oxygen Sensor (HO2S) -G39-*

- 50 Nm (37 ft lb)
- Installation position: before three way catalytic converter
- Only grease threads with "G5"; "G5" must not get into the slots on the HO2S body
- Checking HO2S and O2S control (before three way catalytic converter) ⇒ Page 24-25
- O2S heating voltage supply via Fuel Pump (FP) relay -J17-
- Checking O2S heating (before three way catalytic converter) ⇒ Page 24-35

7 - Engine Coolant Temperature (ECT) sensor -G62-*

- Blue, 2-pin
- For ECM
- Checking ⇒ Page 24-88
- If necessary before removing, release pressure from cooling system

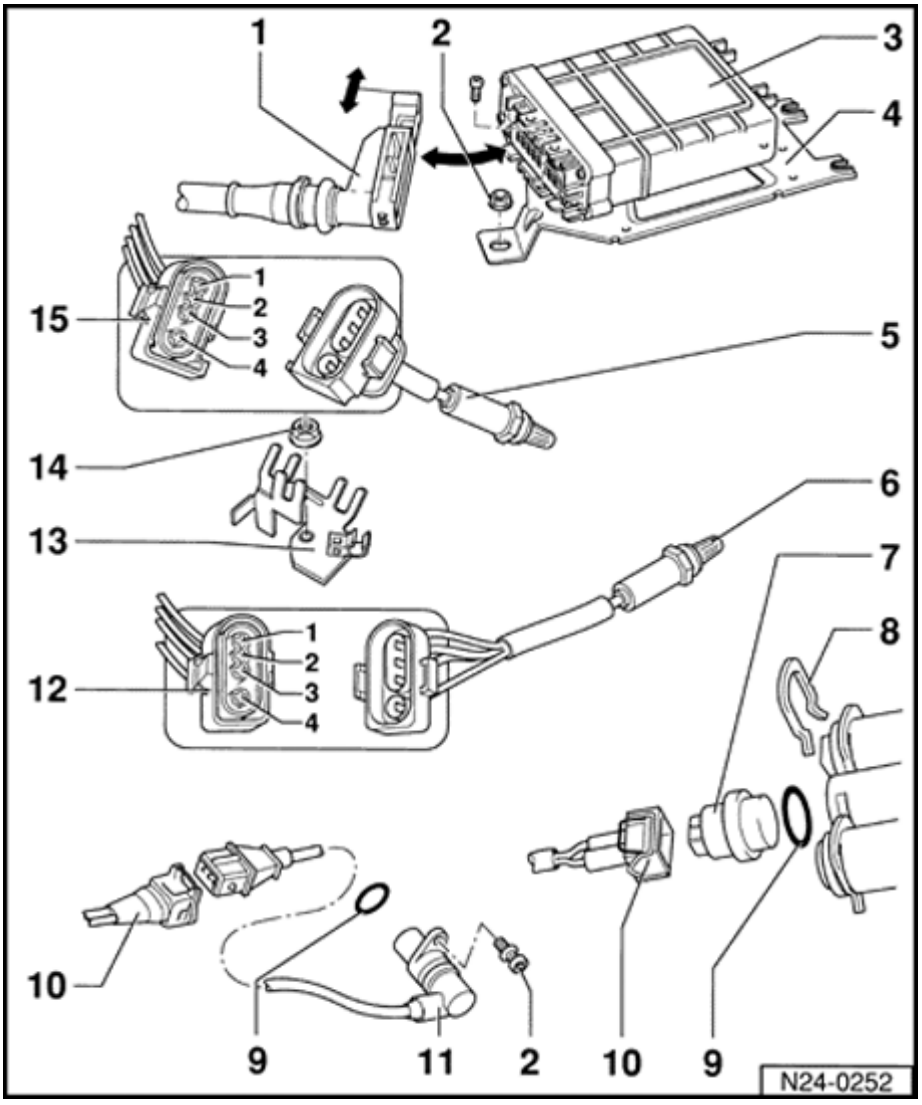
8 - Retaining clip

- Check seated securely

9 - O-ring

- Replace if damaged

24-9



10 - Connector

11 - Engine speed (RPM) sensor -G28-

- Installation position: cylinder block intake side

12 - Connector

- Black, 4-pin
- For HO2S and O2S heating (before three way catalytic converter)
- Secured to rear engine mount

13 - Retainer

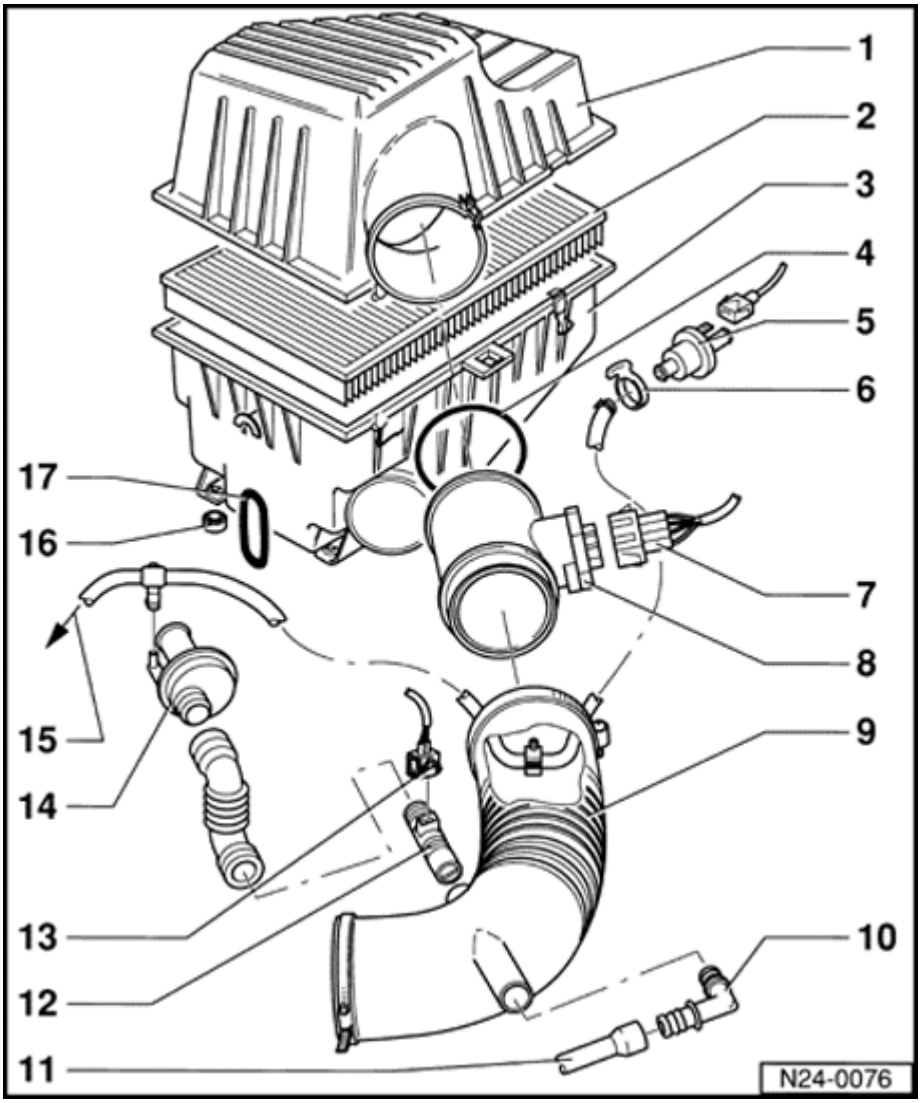
- For HO2S, HO2S 2, and Knock Sensor (KS) 1 connectors

14 - 20 Nm (15 ft lb)

15 - Connector

- Brown, 4-pin
- For HO2S and O2S heating (after three way catalytic converter)
- Secured to rear engine mount

24-10



Air cleaner (ACL), Mass Air Flow (MAF) sensor and Positive Crankcase Ventilation (PCV) heating element, removing and installing

1 - Air Cleaner (ACL), upper

2 - Filter element

3 - Air cleaner (ACL), lower

4 - O-ring

- Replace if damaged

5 - Evaporative Emission (EVAP) canister purge regulator valve -N80-*/

- EVAP canister system

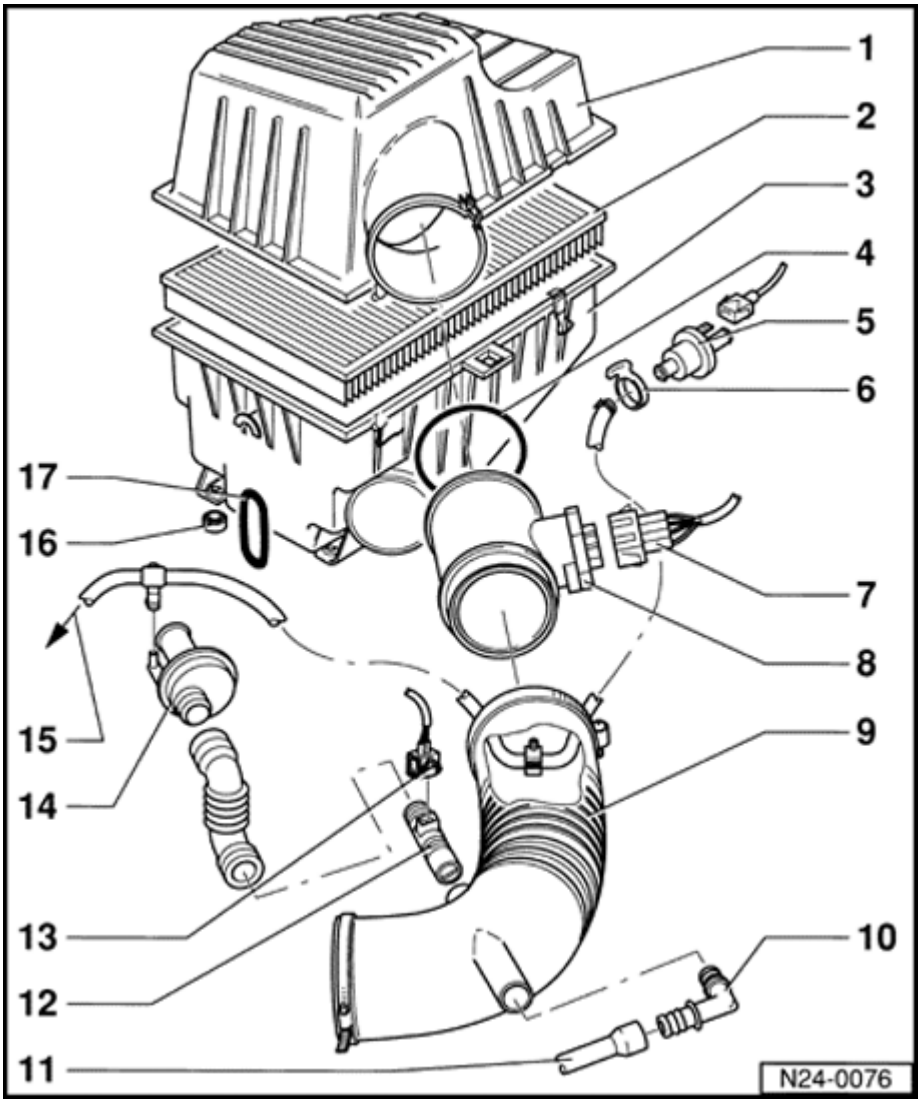
⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*

6 - Retaining ring

- For EVAP canister purge regulator valve

7 - Connector

- 4-pin
- For MAF sensor -G70-



8 - Mass Air Flow (MAF) sensor -G70-*

9 - Intake air duct

10 - Elbow

11 - Hose

12 - Positive Crankcase Ventilation (PCV) heating element -N79-

- Arrow on heater element shows air flow direction
- Resistance at ambient temperature of approx. 25 ° C (77 ° F) Specification: 7-12 ohms (W)

13 - Connector

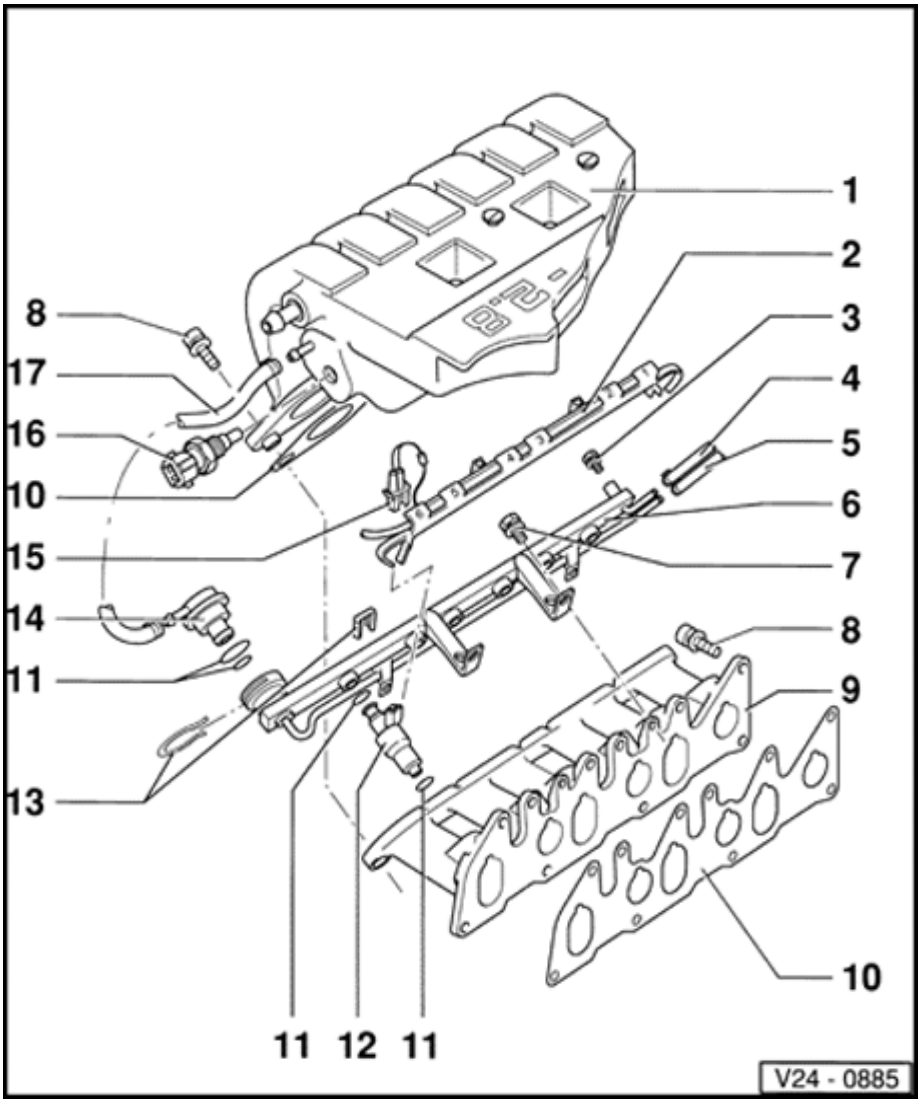
- 2-pin
- For PCV heating element -N79-
- Check O2S heating voltage supply between terminals 1 and 2 with ignition switched on: approx. battery voltage (B+)

14 - Positive Crankcase Ventilation (PCV) valve

15 - To intake manifold, upper

16 - Rubber disc

17 - Retaining ring



Fuel rail and intake manifold, removing and installing

1 - Intake manifold, upper

2 - Cable duct

3 - Sealing plug

- For test connection

4 - Supply line

- White marking

5 - Return line

- Blue marking

6 - Fuel rail

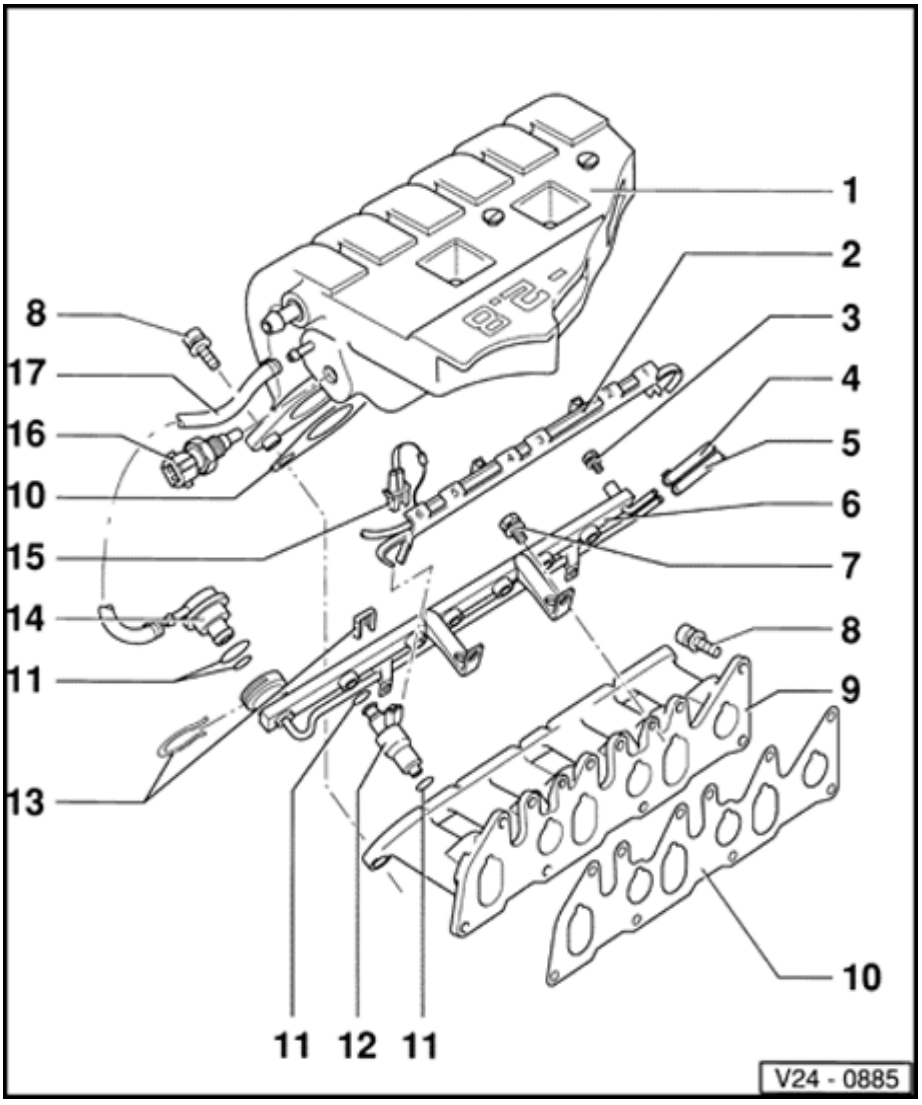
7 - 10 Nm (7 ft lb)

8 - 25 Nm (18 ft lb)

9 - Intake manifold, lower

10 - Gasket

- Always replace



11 - O-ring

- Replace if damaged

12 - Fuel injectors */**

- Cylinder 1 -N30-
- Cylinder 2 -N31-
- Cylinder 3 -N32-
- Cylinder 4 -N33-
- Cylinder 5 -N83-
- Cylinder 6 -N84-
- Checking ⇒ Page 24-115

13 - Retaining clip

- Check securely seated

14 - Fuel pressure regulator

- Checking ⇒ Page 24-120

15 - Connector

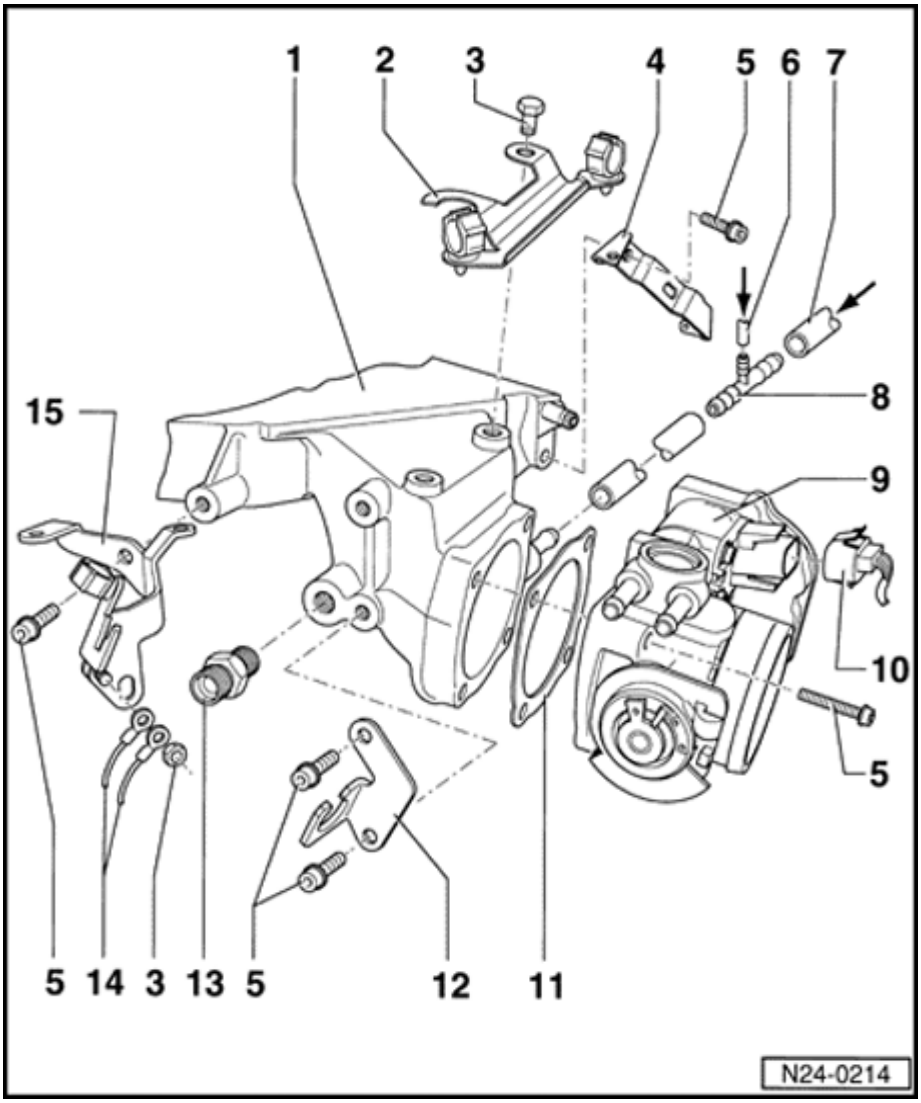
- 2-pin
- For fuel injectors, item - 12 -

16 - Intake Air Temperature (IAT) sensor -G72-*

- 10 Nm (7 ft lb)
- Checking ⇒ Page 24-94

17 - Vacuum line

- Replace if damaged
- Check securely seated



Throttle valve control module, removing and installing

1 - Intake manifold, upper

- First tighten to lower intake manifold and then to both rear supports

2 - Cable duct

3 - 10 Nm (7 ft lb)

4 - Support

- Between intake manifold upper section and cylinder head

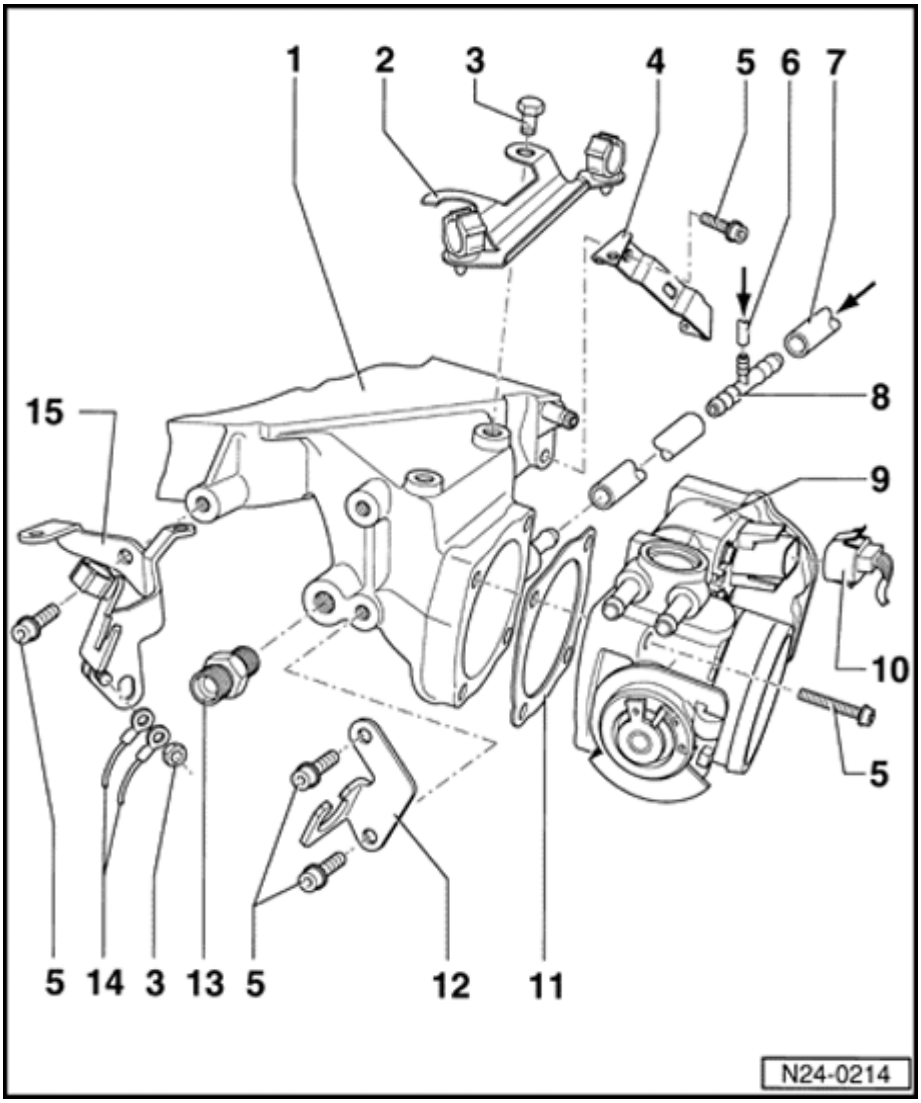
5 - 25 Nm (18 ft lb)

6 - Vacuum line

7 - Breather hose

- From Evaporative Emission (EVAP) canister purge regulator valve -N80- ⇒ Page 24-11 , item 15

8 - Junction piece



9 - Throttle valve control module -J338-*

- Checking ⇒ Page 24-68
- If replaced, initiate "Basic Setting" function 04 ⇒ Page 24-85

Components of the throttle valve control module -J338-:

- Throttle Position (TP) actuator -V60-
- Throttle Position (TP) sensor -G88-
- Throttle Position (TP) sensor -G69-
- Closed Throttle Position (CTP) switch -F60-

10 - Connector

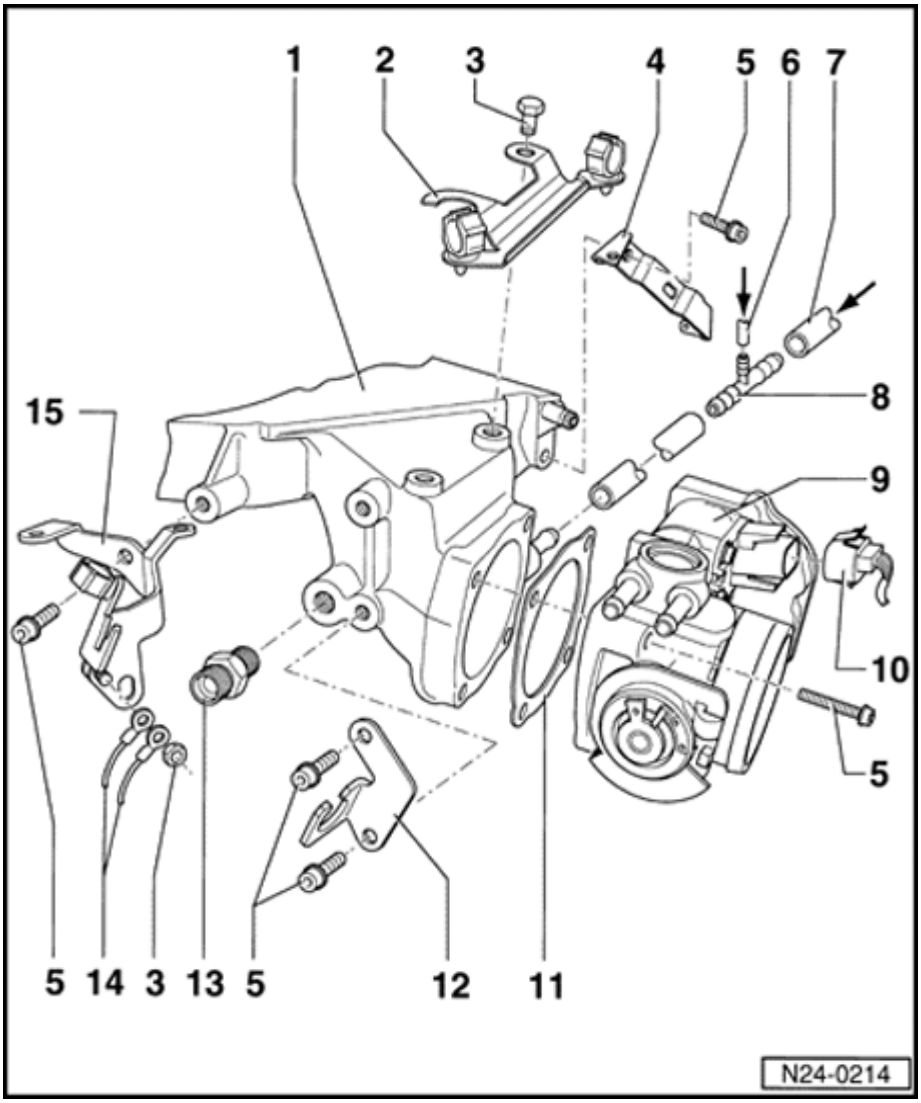
- 8-pin
- For throttle valve control module -J338-

11 - Gasket

- Always replace

12 - Support bracket

- For accelerator pedal cable
- Adjusting accelerator pedal cable *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*



13 - Ground (GND) wires

14 - Left rear support

- Between upper intake manifold and cylinder head
- With engine Ground (GND) connection

24-17

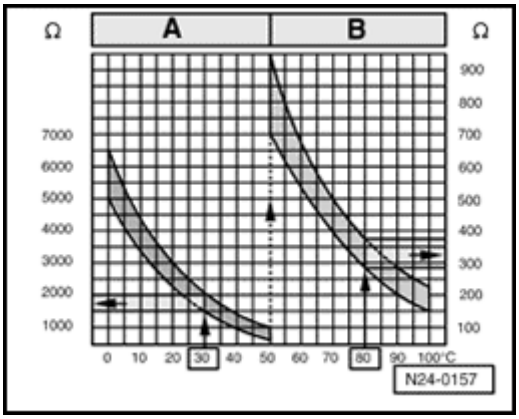


Fig. 1 Resistance graph

The diagram is valid for Engine Coolant Temperature (ECT) sensor -G62- and Intake Air Temperature (IAT) sensor -G72-.

Scale A shows resistance values for temperature range 0° -50° C (32° -122° F) and scale B the values for temperature range 50° -100° C (122° -212° F).

Examples:

- 30° C (86° F) corresponds to a resistance from 1500-2000 ohms (W)
- 80° C (176° F) corresponds to a resistance from 275-375 ohms (W)

Safety precautions

WARNING!

Fuel system is under pressure! Before opening the system place a rag around the connection. Then release pressure by slowly loosening the connection.

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 engine is running or 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 5-pin connector to ignition coil.***
- ***Disconnect harness connectors from all fuel***

injectors.

- ***After the work is completed, erase Diagnostic Trouble Code (DTC) memory.***

24-19

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 for 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.

Technical data

Engine code		AAA
Idle check[1)]		
Idle speed [3)]	RPM	650 - 750 [2)]
Oxygen sensor control factor	%	-5.0 to 5.0 [2)] [4)]
Engine Control Module (ECM) [5)]		
Part number		⇒ Parts catalog
Governed engine speed	RPM	6600

[1)] Observe test conditions ⇒ Page 24-22 .

[2)] Not adjustable.

[3)] If the battery voltage drops below 10.5 volts idle speed will be raised to 900 RPM.

[4)] Display fluctuates.

[5)] If replaced, initiate "Basic Setting" function 04 ⇒ Page 24-85 .

24-22

Idle speed, checking

- Idle speed, ignition timing and CO content not adjustable
- Idle speed is regulated by the throttle valve control module
- The position of the distributor has no influence on ignition timing
- The CO content is held to specification by the Oxygen Sensor (O2S) control. Malfunctions in O2S control will be detected by the On Board Diagnostic (OBD) program and stored in Diagnostic Trouble Code (DTC) memory

Special tools, testers and auxiliary items

- VAG 1551 scan tool with VAG 1551/3 adapter cable

Test conditions

- No malfunctions stored in DTC memory ⇒ Page 01-12
- Engine oil temperature min. 80 ° C (176 ° F)
- Electrical consumers switched off (radiator coolant fan must not run during the check)
- A/C switched off
- Exhaust system must be free of leaks

24-23

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Basic Setting **HELP**

Input display group number XXX

Indicated on display

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

System in Basic Setting **1** →

1 2 3 4

Indicated on display (1-4 = Display fields)

Note:

In "Basic Setting" function 04 Evaporative Emission (EVAP) canister purge regulator valve -N80- is closed.

Do not continue with check until engine temperature exceeds 80 ° C (176 ° F), display field 2.

- Briefly increase engine speed (rev-up) and then allow engine to run at idle speed for 2 minutes.
- Check specifications (display fields 1-4).

24-24

	Display fields			
	1	2	3	4
Display group 001: Idle test				
Display	**xxxx RPM**	**xxx.x ° C**	**xx.x%**	**xx.x ∠ °**
Indicated	**Engine speed**	**Engine coolant temperature**	**Oxygen Sensor (O2S) control**	**Ignition angle**
Working range	**650 - 6000 RPM**	**-**	**-25.0 to 25.0%**	**0.0 - 40.0 ∠ °**
Specification	**650 - 750 RPM**	**80.0 - 105.0 ° C**	**Must fluctuate by at least 2% in the range -5.0 to 5.0%**	**2.0 - 15.0 ∠ °**
	If specification is not attained ⇒ Page 24-68 , check throttle valve control module	**-**	**If specification is not attained ⇒ Page 24-25 , check HO2S and O2S control (before three way catalytic converter)**	**If specification is not attained ⇒ Page 28-8 , check ignition timing**

- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06 and press -Q- button to confirm input.
- Perform road test and repeat the check.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-25

Heated Oxygen Sensor (HO2S) and Oxygen Sensor (O2S) control, checking (before three way catalytic converter)

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test conditions

- Coolant temperature at least 80 °C (176 °F)

Functional check

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**  Indicated on display

Select function XX

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

24-26

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -0-, -2- and -5- to input display group 025 and press -Q- button to confirm input.

Read Measuring Value Block 25 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check specifications for O2S control before three way catalytic converter (display fields 1-3).

	Display fields			
	1	2	3	4
Display group 025: Oxygen Sensor (O2S) control before Three Way Catalytic Converter (TWC)				
Display	**xx.x %**	**xx.x %**	**xx.x %**	xxx ms
Indicated	**O2S control**	**Partial load adaption value**	**Idle adaptation value**	O2S control status (before TWC)
Working range	**-25.0 to 25.0%**	**-16.4 to 16.4%**	**-16.4 to 16.4%**	-
Specification	**The value must fluctuate at least 2% within range -5.0 to 5.0%**	**-5.0 to 5.0% (can fluctuate slightly)**	**-5.0 to 5.0% (can fluctuate slightly)**	Relevance ⇒ Page 24-31
	If specification is not attained ⇒ Page 24-27 , continuation	**If specification is not attained ⇒ Page 24-29 , evaluating display group 025**		-

24-27

Continuation

If the specification in display field 1 is not attained, or the value does not fluctuate at least 2%:

- Perform a test drive to remove possible residue on HO2S and repeat check.

If the the specification in display field 1 is not attained even after a road test, or the value does not fluctuate at least 2%:

- Check the O2S heating ⇒ Page 24-35 .

If the value displayed in display field 1 remains constant:

- Press -C- button.

- Press buttons -1-, -1- and -5- to input display group 115 and press -Q- button to confirm input.

Read Measuring Value Block 115 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Note HO2S voltage in display field 3.

24-28

	Display fields			
	1	2	3	4
Display group 115: Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter (TWC)				
Display	xxx.x ° C	xxx.x ° C	**x.xxx V**	xxxxxxxx
Indicated	Coolant temperature	Exhaust gas temperature (calculated)	**HO2S voltage (before TWC)**	O2S control status (before TWC)
Working range	-46.5 to 141.0 ° C	0.0 - 999.9 ° C	**0.000 - 1.000 V**	-
Specification	80.0 - 105.0 ° C	min.140.0 ° C	**The voltage must fluctuate at least 0.3 V at least 30 times per minute in the range 0.000 - 1.000 V**	Relevance ⇒ Page 24-31
	-	-	**If specification is not attained ⇒ Page 24-30 , evaluating display group 115**	-

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

24-29

Evaluating display group 025

Display group: 025 Display field: 2 + 3	Possible malfunction cause	Malfunction elimination
Adaption values in range: -5 to -16.4%	♦ Crankcase dilution: When the partial load adaptation value (display field 2) is normal	- Oil change or a fast drive on country roads
	♦ Fuel pressure too high	- Check fuel pressure regulator ⇒ Page 24-120
	♦ Fuel injector leaking	- Check fuel injectors ⇒ Page 24-115
	♦ O2S heating	- Check O2S heating ⇒ Page 24-35
Adaptation values in range: 5 to 16.4%	♦ Unmetered air in air intake system or exhaust manifold/front pipe: When the partial load adaptation value (display field 2) is normal	- Check intake air system for leaks (unmetered air) ⇒ Page 24-123 - Check exhaust system: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*
	♦ Fuel pressure too low	- Check fuel pressure regulator ⇒ Page 24-120
	♦ Check O2S heating	- Check O2S heating ⇒ Page 24-35
	♦ Fuel injector not opening or only partly opening	- Check fuel injectors ⇒ Page 24-115
Adaptation values: constant 0.0%	♦ O2S adaptation not active	- Check whether O2S adaptation is active ⇒ Page 24-31 , O2S control status If O2S control adaption is not active: - Check Mass Air Flow (MAF) sensor ⇒ Page 24-62

Evaluating display group 115

Display group: 115 Display field: 3	Possible malfunction cause	Malfunction elimination
Approx. 0.435 V	♦ Open circuit in wire 4 between HO2S and Engine Control Module (ECM)	- Check basic voltage ⇒ Page 24-32
Approx. 0.440 V	♦ Open circuit in wire 3 between HO2S and ECM	
Approx. 1.085 V	♦ Short circuit to positive (B+) in wire 4 between HO2S and ECM	- Check HO2S wiring ⇒ Page 24-33
Approx. 0.000 V	♦ Short circuit to Ground (GND) in wire 4 between HO2S and ECM	

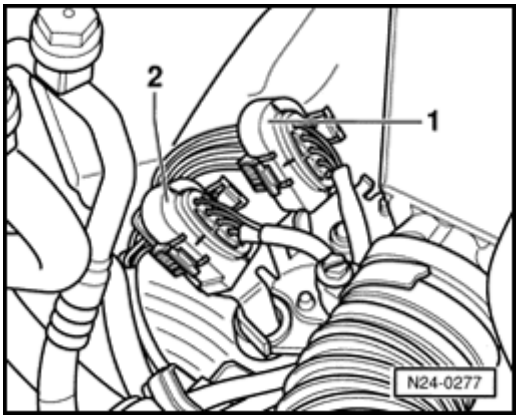
24-31

Relevance of values in 8-digit number block

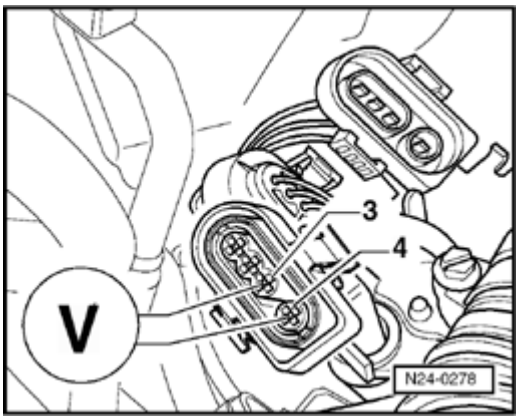
Relevance when display = 1									
x	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**Oxygen Sensor (O2S) control status (display group 025)**	**O2S control status (display group 115)**
							1	HO2S ready (before TWC)	Malfunction in DTC memory
						1		HO2S ready (after TWC)	Malfunction detected during this diagnosis
					1			O2S control active (before TWC)	Diagnosis completed during this drive
				1				O2S adaptation active	Diagnosis currently active
			1					Not relevant	O2S control active (before TWC)
		1						HO2S voltage initial sign	HO2S ready (before TWC)
	1							Not relevant	Both HO2S cold
1								1 = O2S control regulating frequency rich 0 = O2S control regulating frequency lean	O2S heating on (before TWC)

24-32

Checking basic voltage



- Disconnect 4-pin connector -1- (black) to HO2S -G39- (before three way catalytic converter).



- Connect multimeter with test leads from VW 1594 to measure voltage at ECM connector terminals 3 and 4.
- Start engine and measure basic voltage.

  Specification: 0.40-0.50 volts
- Switch ignition off.

If the specification is not attained:

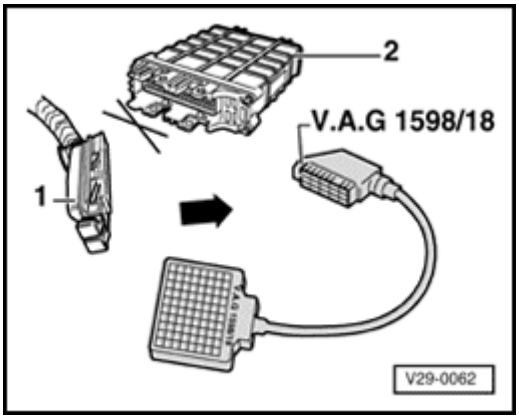
- Check HO2S wiring ⇒ Page 24-33 .

If the specification is attained:

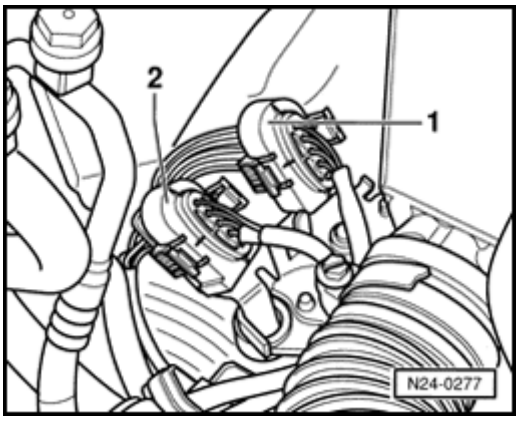
- Replace HO2S -G39- (before three way catalytic converter).

24-33

Checking HO2S wiring

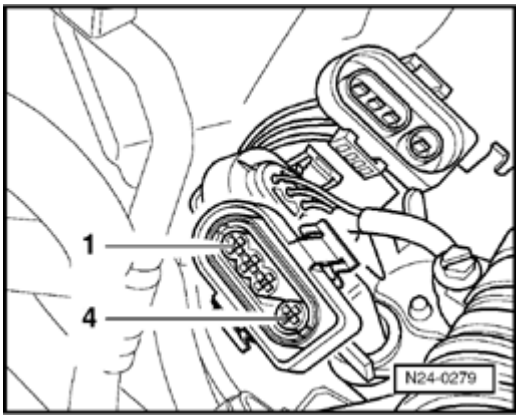


- Connect VAG 1598/18 test box to ECM wiring harness (arrow).



- Disconnect 4-pin connector -1- (black) to HO2S - G39- (before three way catalytic converter).

24-34



- Check wiring between test box and 4-pin connector to ECM for open circuit according to wiring diagram.
  - Terminal 3 and test box socket 42
  - Terminal 4 and test box socket 20

  Resistance: max. 1.5 ohms (W)
- Additionally, check wiring at 4-pin connector for short circuit to one another.

  Terminal 4 and test box socket 42

  Specification: ∞ ohms (W)
- Check shielding for short circuit to HO2S wiring according to wiring diagram.
  - Terminal 4 and test box socket 56
  - Terminal 3 and test box socket 56

  Specification: ∞ ohms (W)

If no wiring malfunction is detected:

- Replace ECM -J220-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-35

Oxygen Sensor (O2S) heating, checking (before three way catalytic converter)

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test conditions

- Fuse 18 OK

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer

Select function XX

HELP

Indicated on display

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

24-36

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -1-, -2- and -0- to input display group 120 and press -Q- button to confirm input.

Read Measuring Value Block 120 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check the resistance value for O2S heating before three way catalytic converter (display field 3).

	Display fields			
	1	2	3	4
Display group 120: Oxygen Sensor (O2S) heating before Three Way Catalytic Converter (TWC)				
Display	xxx.x ° C	xxx.xx sec.	**xx.x Ω**	xxxxxxxx
Indicated	Exhaust gas temperature	Time to start of diagnosis after heating on	**O2S heating resistance (before TWC)**	O2S control status (before TWC)
Working range	0.0 - 999.9 ° C	0.00 - 500.00 sec.	**0.0 - 65.0 Ω**	Relevance ⇒ Page 24-37
Specification	-	100.00 - 200.00 sec.	**5.9 - 24.2 Ω**	
	-	-	**If specification is not attained ⇒ Page 24-38 , continuation**	-

24-37

- Press → button.

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

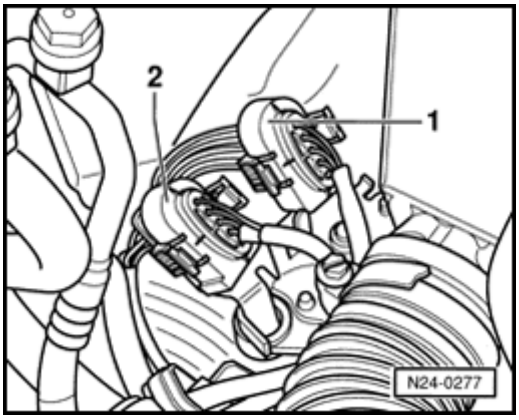
- Switch ignition off.

Relevance of values in 8-digit number block

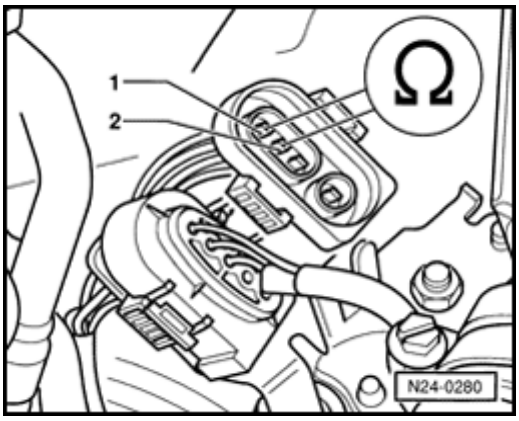
Relevance if display = 1								
x	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**Oxygen Sensor (O2S) control status (display group 120)**
							1	Malfunction in DTC memory
						1		Malfunction detected during this diagnosis
					1			Diagnosis complete during this drive
				1				Diagnosis currently active
			1					O2S heating ready (before TWC)
		1						HO2S ready (before TWC)
	1							Vapor point exceeded (before TWC)
1								1 = O2S heating on (before TWC) Alternately 0 and 1 = O2S heating is fluctuating

24-38

Continuation



- Disconnect 4-pin connector -1- (black) to HO2S -G39- (before three way catalytic converter).



- Connect multimeter with test leads from VW 1594 to measure resistance at HO2S connector terminals 1 and 2.
- Check the resistance value.

  Specification: 0.0-24.2 ohms (W)

If the specification is not attained:

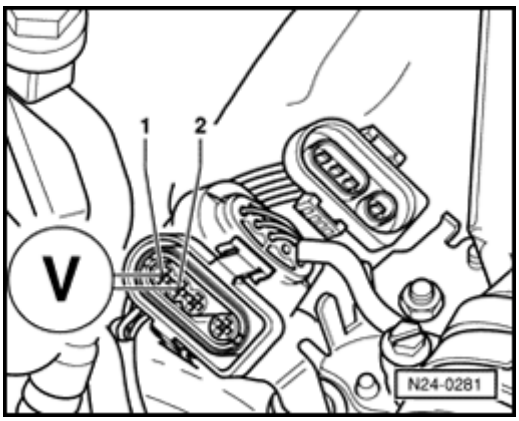
- Replace HO2S -G39- (before three way catalytic converter).

24-39

If the specification is attained:

- Check relevance table ⇒ Page 24-37 for value of O2S control status, display group 120, display field 4, 1st position from left.

- Set multimeter to voltage measurement range.

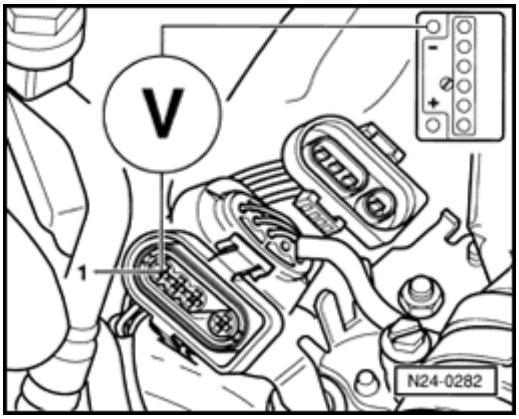


- Connect multimeter using test leads from VW 1594 to measure voltage at ECM connector terminals 1 and 2.
- Measure the voltage supply.

  When display = 1: specification is 11.0-14.5 volts

  When display = alternately 0 and 1: specification is fluctuating between 0.0-12.0 volts

If no voltage is present:



- Connect multimeter with test leads from VW 1594 to measure voltage at ECM connector terminal 1 and vehicle Ground (GND).

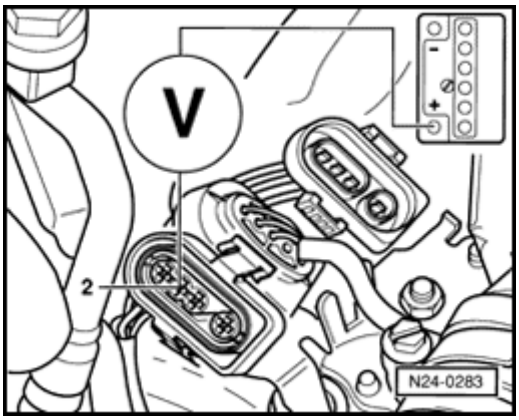
  Specification: 11.0-14.5 volts

If again no voltage is present:

- Check wiring from terminal 1 to relay panel according to wiring diagram.

If voltage was present:

- Check relevance table ⇒ Page 24-37 for value of O2S control status, display group 120, display field 4, 1st position from left.



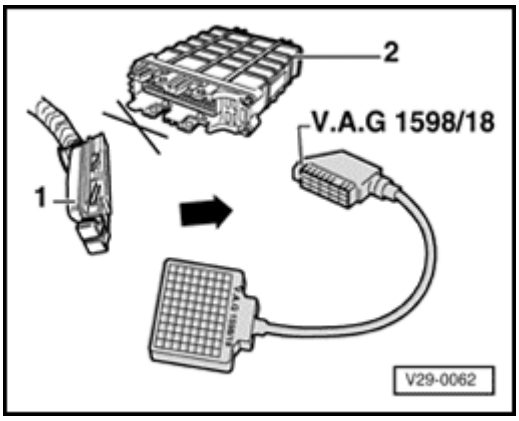
- Connect multimeter using test leads from VW 1594 to ECM connector terminal 2 and battery positive (B+).

  When display = 1: specification is 11.0-14.5 volts.

  When display = alternately 0 and 1: specification is fluctuating between 0.0-12.0 volts

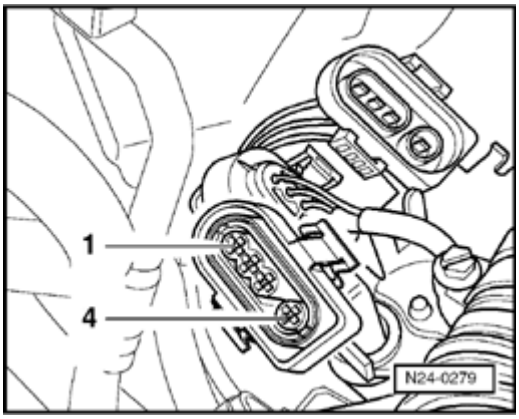
- Switch ignition off.

If no voltage is present:



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).

24-41



- Check wiring between test box and 4-pin connector for open circuit according to wiring diagram.

  Terminal 2 and test box socket 12

  Resistance: max. 1.5 ohms (W)

If no wiring malfunction is detected:

- Replace Engine Control Module (ECM) -J220-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-42

Heated Oxygen Sensor (HO2S) 2 and Oxygen Sensor (O2S) control, checking (after three way catalytic converter)

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test conditions

- Coolant temperature at least 80 ° C (176 ° F)

Functional check

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

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

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

24-43

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -1-, -1- and -6- to input display group 116 and press -Q- button to confirm input.

Read Measuring Value Block 116 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Note HO2S voltage (display field 3).

	Display fields			
	1	2	3	4
Display group 116: Heated Oxygen Sensor (HO2S) 2 after Three Way Catalytic Converter (TWC)				
Display	xxx ms	xxx.x° C	**x.xxx V**	xxxxxxxx
Indicated	Regulating frequency	Exhaust gas temperature (calculated)	**HO2S voltage (after TWC)**	O2S control status (after TWC)
Working range	-	0.0 - 999.9° C	**0.000 - 1.000 V**	-
Specification	-	Min.140.0° C	**0.000 - 1.000 V (can fluctuate marginally)**	Relevance ⇒ Page 24-45
	-	-	**If specification is not attained ⇒ Page 24-44 , continuation**	-

24-44

Continuation

- Perform test drive to remove possible residue from HO2S and repeat the check.

If the specification in display field 3 is not attained even after a test drive:

- Check O2S heating ⇒ Page 24-49 .

- Rev-up to above 3000 RPM.

If the value in display field 3 remains constant ⇒ Page 24-44 , evaluating display group 116.

Evaluating display group 116

Display group: 116		
Display field: 3	**Possible malfunction cause**	**Malfunction elimination**
Approx. 0.435 V	♦ Wiring open circuit in wire 4 between HO2S and ECM.	- Check basic voltage ⇒ Page 24-46
Approx. 0.440 V	♦ Wiring open circuit in wire 3 between HO2S and ECM	
Approx. 1.085 V	♦ Short circuit to positive (B+) in wire 4 between HO2S and ECM	- Check HO2S wiring ⇒ Page 24-47
Approx. 0.000 V	♦ Short circuit to Ground (GND) in wire 4 between HO2S and ECM	

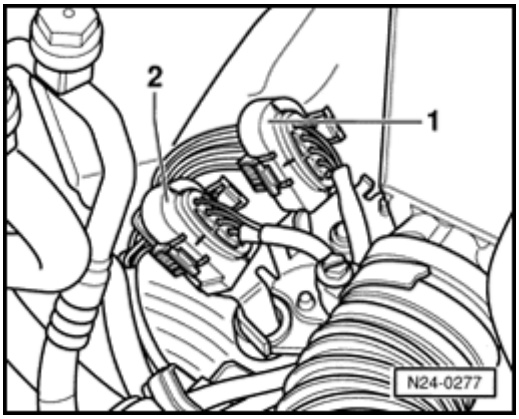
24-45

Relevance of values in 8-digit number block

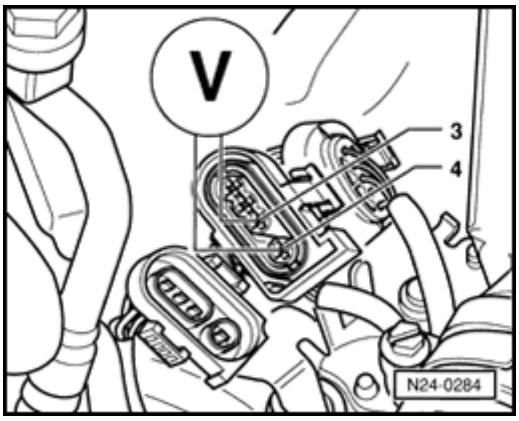
Relevance if display = 1								
x	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**Oxygen Sensor (O2S) control status (display group 116)**
							1	Malfunction in DTC memory
						1		Malfunction detected during this diagnosis
					1			Diagnosis complete during this drive
				1				Diagnosis currently active
			1					O2S control active (before TWC)
		1						HO2S ready (after TWC)
	1							Both HO2S and HO2S 2 cold
1								O2S heating on (after TWC)

24-46

Checking basic voltage



- Disconnect 4-pin connector -2- (brown) to HO2S 2 -G108- (after three way catalytic converter).



- Connect multimeter using test leads from VW 1594 to measure voltage at ECM connector terminals 3 and 4.
- Start engine and measure basic voltage.

  Specification: 0.40-0.50 volts
- Switch ignition off.

If the specification is not attained:

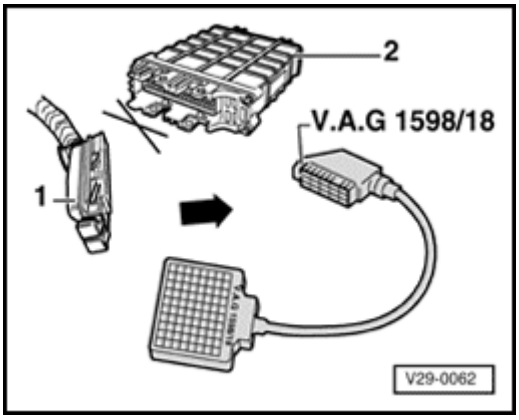
- Check HO2S wiring ⇒ Page 24-47 .

If the specification is attained:

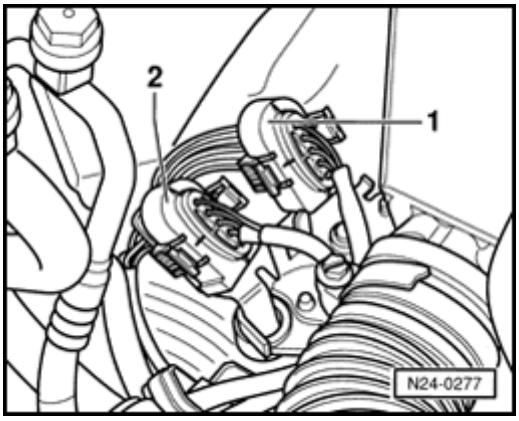
- Replace Heated Oxygen Sensor (HO2S) 2 -G108- (after three way catalytic converter).

24-47

Checking Heated Oxygen Sensor (HO2S) wiring

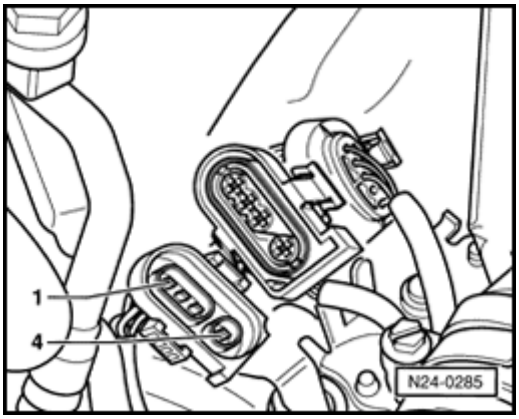


- Connect VAG 1598/18 test box to ECM wiring harness (arrow).



- Disconnect 4-pin connector -2- (brown) to HO2S 2 -G108- (after three way catalytic converter).

24-48

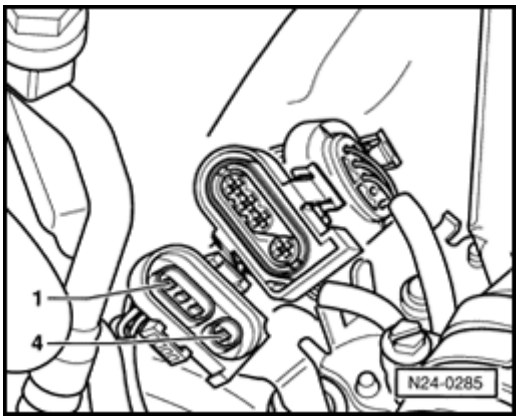


- Check wiring between test box and 4-pin connector to ECM for open circuit according to wiring diagram.
  - Terminal 3 and test box socket 58
  - Terminal 4 and test box socket 13

  Resistance: max. 1.5 ohms (W)
- Additionally, check wiring to 4-pin connector for short circuit to one another.

  Terminal 4 and test box socket 58

  Specification: ∞ ohms (W)



- Check shielding for short circuit to HO2S wiring.
  - Terminal 4 and test box socket 56
  - Terminal 3 and test box socket 56

  Specification: ∞ ohms (W)

If no wiring malfunction is detected:

- Replace Engine Control Module (ECM) -J220-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-49

Oxygen Sensor (O2S) heating, checking (after three way catalytic converter)

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test conditions

- Fuse 18 OK

Test sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this the engine must be running at idle speed.

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

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

24-50

Read Measuring Value Block HELP

Input display group number XXX

⮜ Indicated on display

- Press buttons -1-, -2- and -1- to input display group 121 and press -Q- button to confirm input.

Read Measuring Value Block 121 →

1 2 3 4

⮜ Indicated on display (1-4 = Display fields)

- Check resistance value for O2S heating after three way catalytic converter (display field 3).

	Display fields			
	1	2	3	4
Display group 121: Oxygen Sensor (O2S) heating after Three Way Catalytic Converter (TWC)				
Display	xxx.x° C	xxx.xx sec.	**x.x Ω**	xxxxxxxx
Indicated	Three way catalytic converter temperature	Time from heating on to diagnosis start	**O2S heating resistance (after TWC)**	O2S control status (after TWC)
Working range	0.0 - 999.9° C	Approx.150.00 sec.	**0.0 - 65.0 Ω**	Relevance ⇒ Page 24-51
Specification	-	-	**5.9 - 24.2 Ω**	
	-	-	**If specification is not attained ⇒ Page 24-52 , continuation**	-

24-51

- Press → button.

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

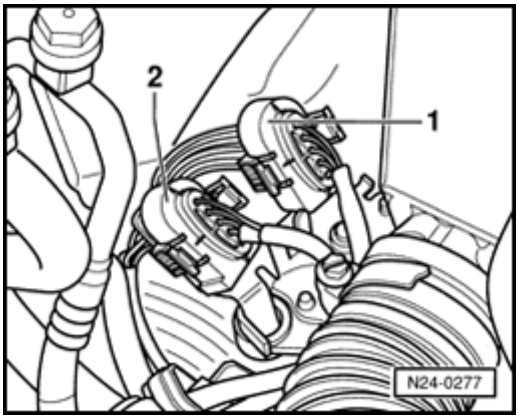
- Switch ignition off.

Relevance of values in 8-digit number block

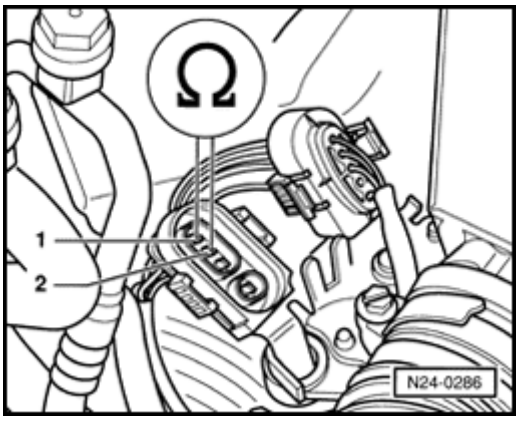
Relevance when display = 1								
x	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**Oxygen Sensor (O2S) control status (display group 121)**
							1	Malfunction in DTC memory
						1		Malfunction detected during this diagnosis
					1			Diagnosis complete during this drive
				1				Diagnosis currently active
			1					O2S heating ready (after TWC)
		1						HO2S ready (after TWC)
	1							Vapor point exceeded (after TWC)
1								1 = O2S heating on (after TWC) Alternately 0 and 1 = O2S heating is fluctuating

24-52

Continuation



- Disconnect 4-pin connector -2- (brown) to HO2S 2 -G108- (after three way catalytic converter).



- Connect multimeter with test leads from VW 1594 to measure resistance at terminals 1 and 2 on connector to HO2S.
- Measure the resistance value.

  Specification: 0.00-24.2 ohms (W)

If the specification is not attained:

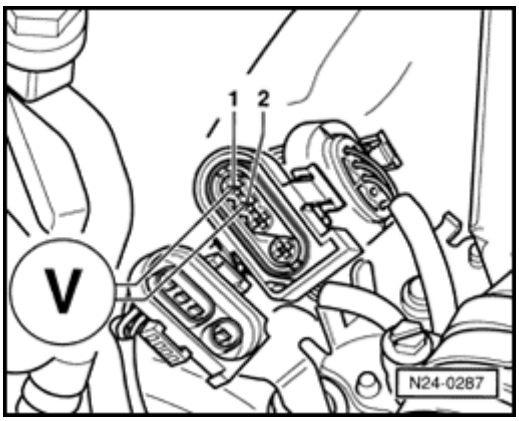
- Replace Heated Oxygen Sensor (HO2S) 2 -G108- (after three way catalytic converter).

24-53

If the specification is attained:

- Check relevance table ⇒ Page 24-51 for value of O2S control status, display group 121, display field 4, 1st position from left.

- Set multimeter to voltage measurement range.

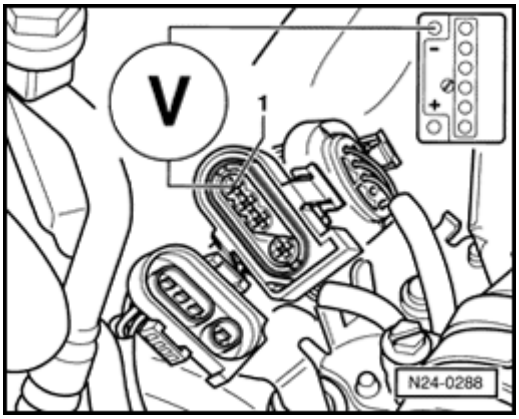


- Connect multimeter with test leads from VW 1594 to measure voltage at ECM connector terminals 1 and 2.
- Measure the voltage supply.

  When display = 1: specification is 11.0-14.5 volts

  When display = alternately 0 and 1: specification is fluctuating between 0.0-12.0 volts

If no voltage is present:



- Connect multimeter using test leads from VW 1594 to measure voltage at ECM connector terminal 1 and vehicle Ground (GND).

  Specification: 11.0-14.5 volts

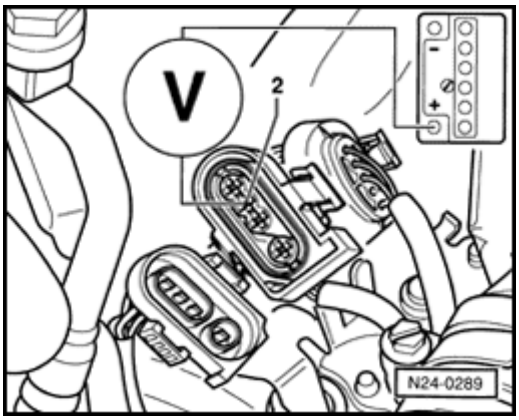
If again no voltage is present:

- Check wiring from terminal 1 to relay panel according to wiring diagram.

24-54

If voltage was present:

- Check relevance table ⇒ Page 24-51 for value of O2S control status, display group 121, display field 4, 1st position from left.



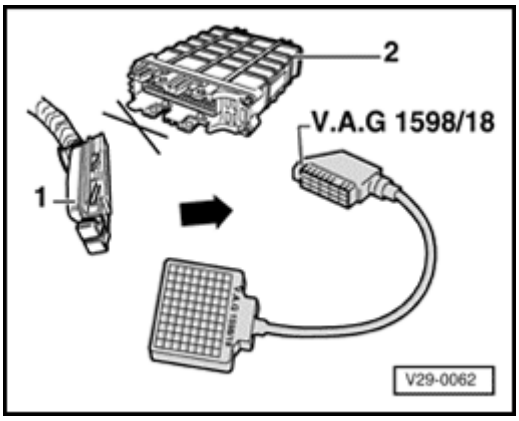
- Connect multimeter with test leads from VW 1594 to ECM connector terminal 2 and battery positive (B+).

  When display = 1: specification is 11.0-14.5 volts

  When display = alternately 0 and 1: specification is fluctuating between 0.0-12.0 volts

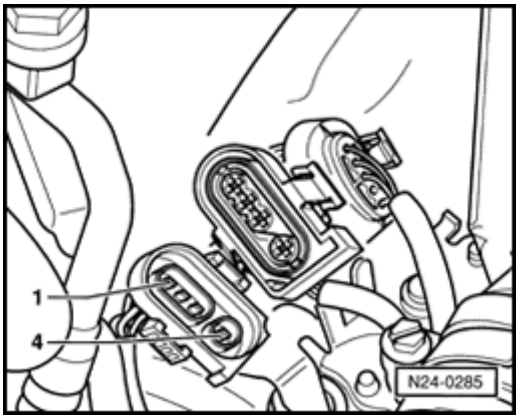
- Switch ignition off.

If the specification is not attained:



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).

24-55



- Check wiring between test box and 4-pin connector for open circuit according to wiring diagram.

  Terminal 2 and test box socket 66

  Resistance: max. 1.5 ohms (W)

If no wiring malfunction is detected:

- Replace Engine Control Module (ECM) -J220-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-56

Oxygen Sensor (O2S) aging, checking (before three way catalytic converter)

Special tools, testers and auxiliary items

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

Test conditions

- Coolant temperature at least 80 °C (176 °F)

Functional check

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -3- and -0- to input display group 130 and press -Q- button to confirm input.

System in Basic Setting **130** →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Increase engine speed to 2200-2800 RPM and check the specifications for HO2S aging before three way catalytic converter (display field 1-4).

24-57

Note:

So that the exhaust gas temperature is within specification range during the test, the test RPM must be held for at least 1 minute. Observe the O2S control status in display field 4.

	Display fields			
	1	2	3	4
Display group 130: Heated Oxygen Sensor (HO2S) aging (monitoring signal frequency of HO2S)				
Display	**xxxx RPM**	**xx.xx sec.**	**xxx**	**xxxxxxxx**
Indicated	**Engine speed**	**HO2S before three way catalytic converter, signal frequency**	**Valid HO2S signal frequency (counted)**	**O2S control status**
Working range	**650 - 6000 RPM**	**0.00 - 5.00 sec.**	**0 - 4**	**-**
Specification	**2200 - 2800 RPM**	**0.00 - 2.80 sec.**	**4**	**1111x100**
	-	**If specification is not attained ⇒ Page 24-58 , continuation**		**Relevance ⇒ Page 24-59**

- Press -C- button.

- Press buttons -1-, -3- and -1- to input display group 131 and press -Q- button to confirm input.

24-58

System in Basic Setting **131** →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Run engine at idle speed and check specifications.

	Display fields			
	1	2	3	4
Display group 131: Heated Oxygen Sensor (HO2S) aging, (O2S) control signal frequency extended				
Display	xxxx RPM	xx.xxx V	xxx ms	xxxxxxxx
Indicated	Engine speed	HO2S voltage after three way catalytic converter	Signal frequency extended	O2S control status
Working range	650 - 6000 RPM	0.000 - 1.000 V	-	-
Specification	2200 - 2800 RPM	0.500 - 0.700 V (can fluctuate marginally)	-1200 to 1200 ms	1111x100
	-	If specification is not attained ⇒ Page 24-58 , continuation		Relevance ⇒ Page 24-59

Continuation

If specification is not attained:

- Perform a road test to clear HO2S of possible residue and repeat the test.

24-59

If the specification is again not attained:

- Replace HO2S -G39- (before three way catalytic converter).

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

Relevance of values in 8-digit number block

Relevance when display = 1									
x	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**O2S control status (display group 130)**	**O2S control status (display group 131)**
							1	Malfunction in DTC memory	Malfunction in DTC memory
						1		Malfunctions detected during this diagnosis	Malfunctions recognized during this diagnosis
					1			Diagnosis completed during this drive	Diagnosis completed during this drive
				1				Diagnosis currently active	Diagnosis currently active
			1					Diagnosis O2S heating ready (before TWC)	O2S control active (before TWC)
		1						Three way catalytic converter temperature within specified range	O2S control active (after TWC)
	1							Engine speed and load within specified range	Engine speed and load within specified range
1								O2S control active (before TWC)	Three way catalytic converter temperature within specified range

24-60

Engine operation, checking

Note:

Check establishes whether Engine Control Module (ECM) -J220- recognizes the engine operating condition.

Special tools, testers and auxiliary items

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

Test conditions

- Engine oil temperature min. 80 °C (176 °F)

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -0- and -5- to input display group 005 and press -Q- button to confirm input.

24-61

Read Measuring Value Block 5 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check whether the ECM recognizes the operating mode (display field 4).

	Display fields			
	1	2	3	4
Display group 005: General engine data				
Display	xxx RPM	xx.xx ms	xxx km/h	**Idle**
Indicated	Engine speed	Engine load	Vehicle speed	**Operating mode**
Working range	650 - 6000 RPM	0.00 - 25.00 ms	-	**-**
Specification	650 - 750 RPM	-	0 km/h	♦ Idle = Idle ♦ Partial load = Throttle valve slightly open ♦ Enrich. = Rev-up above 3000 RPM; Then overrun = Close throttle valve abruptly ♦ Full load = Only possible when driving

If the specifications are not attained:

- Check accelerator mechanism for ease of operation.
- Checking throttle valve control module ⇒ Page 24-68 .

24-62

Mass Air Flow (MAF) sensor, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test conditions

- Electrical consumers switched off (radiator coolant fan must not run during the check)
- A/C switched off

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

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

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

24-63

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -0-, -1- and -5- to input display group 015 and press -Q- button to confirm input.

Read Measuring Value Block 15 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check load registration specifications 1 (display fields 2 and 3).

	Display fields			
	1	2	3	4
Display group 015: Load registration 1				
Display	xxx RPM	**xx.xx ms**	**xx %**	xx.x g/s
Indicated	Engine speed	**Engine load**	**Engine load**	Mass air flow
Working range	650 - 6000 RPM	**0.00 - 25.00 ms**	**0 - 40%**	-
Specification	650 - 750 RPM	**1.00 - 3.00 ms**	**10 - 30%**	3.0 - 4.0 g/s
	-	**If specification is not attained ⇒ Page 24-65 , check voltage supply and ⇒ Page 24-66 , check wiring**		-

24-64

- Press -C- button.

- Press buttons -0-, -1- and -6- to input display group 016 and press -Q- button to confirm input.

Read Measuring Value Block 16 →

1 2 3 4

Indicated on display (1-4 = Display fields)

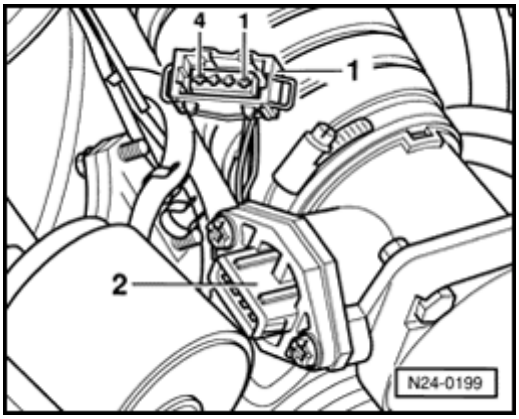
- Check load registration specifications 2 (display field 3).

	Display fields			
	1	2	3	4
Display group 016: Load registration 2				
Display	xxx RPM	xx.xx ms	**xx.xx ms**	xx.xx ms
Indicated	Engine speed	Engine load	**Engine load**	Engine load substitute value from throttle valve angle
Working range	650 - 6000 RPM	0.00 - 25.00 ms	**0 - 25.00 ms**	0.00 - 25.00 ms
Specification	650 - 750 RPM	1.00 - 3.00 ms	**1.00 - 3.00 ms**	1.00 - 3.00 ms
	-	-	**If specification is not attained ⇒ Page 24-65 , evaluating display group 016**	-

24-65

Evaluating display group 016

Display group: 016 Display field: 3	Possible malfunction cause	Malfunction elimination
0.00 ms	♦ Wiring open circuit in wire 3 or 4 between MAF sensor and ECM	- Check voltage supply ⇒ Page 24-65
Smallest value: 5.30 ms	♦ Wiring open circuit in wire 1 or 2 between MAF sensor and ECM	- Check wiring ⇒ Page 24-66



Checking voltage supply

- Disconnect 4-pin connector from Mass Air Flow (MAF) sensor.
- Connect multimeter with test leads from VW 1594 to measure voltage at terminals 1 and 3.

  Specification: 9.0-14.5 volts

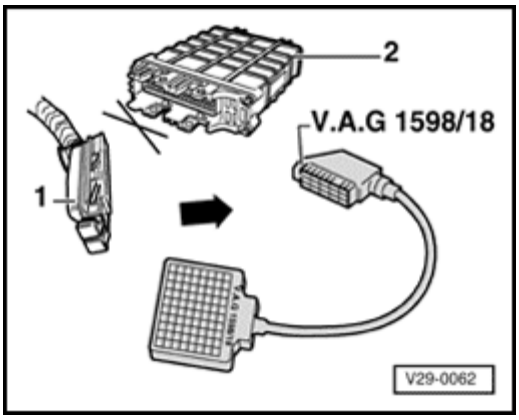
If no voltage is present:

- Switch ignition off.
- Check wiring according to wiring diagram.

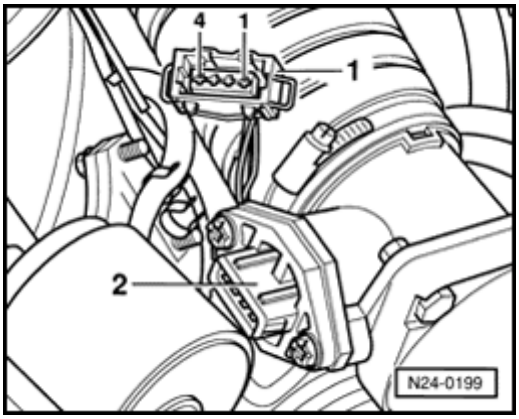
24-66

Checking wiring

- Switch ignition off.



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).



- Check wiring between test box and 4-pin connector for open circuit according to wiring diagram.
  - Terminal 2 and test box socket 16
  - Terminal 4 and test box socket 17

  Resistance: max. 1.5 ohms (W)
- Additionally, check 4-pin connector terminals for short circuit to one another.
  - Terminal 4 and test box socket 16

  Specification: ∞ ohms (W)

24-67

- Set multimeter to voltage measurement range.

- Check 4-pin connector terminals for short circuit to battery positive (B+) according to wiring diagram.

  - Terminal 2 and vehicle Ground (GND)

  - Terminal 4 and vehicle Ground (GND)

  Specification: 0 volts

If no wiring malfunction is detected:

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

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-68

Throttle valve control module, checking

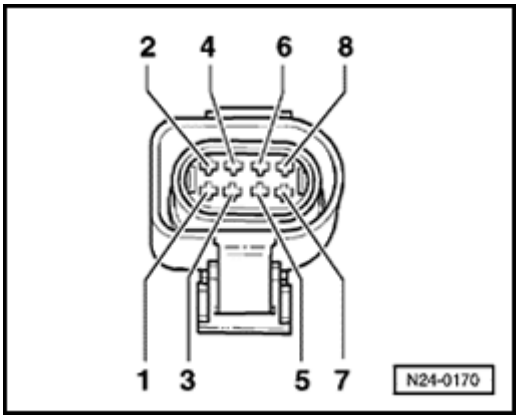
Note:

If the throttle valve control module -J338- is removed and installed or replaced, "Basic Setting" function 04 must be initiated ⇒ Page 24-85 .

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Checking voltage supply



- Separate 8-pin connector to throttle valve control module -J338-.
- Connect multimeter using test leads from VW 1594 to measure voltage at terminals 3 and 7 of connector.
- Switch ignition on.

  Specification: 9.0-14.5 volts

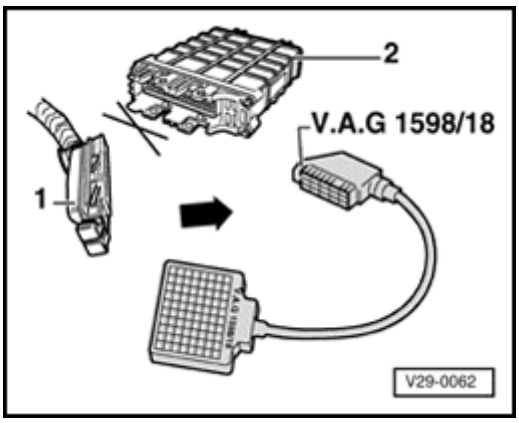
24-69

- Connect multimeter using adapter cables from VW 1594 to measure voltage at terminals 4 and 7 of connector.

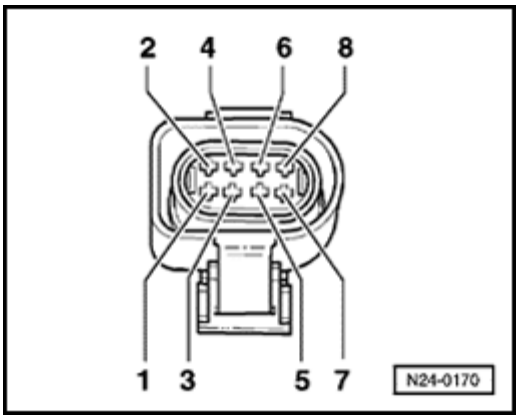
  Specification: 4.0-6.0 volts

- Switch ignition off.

If the specifications are not attained:



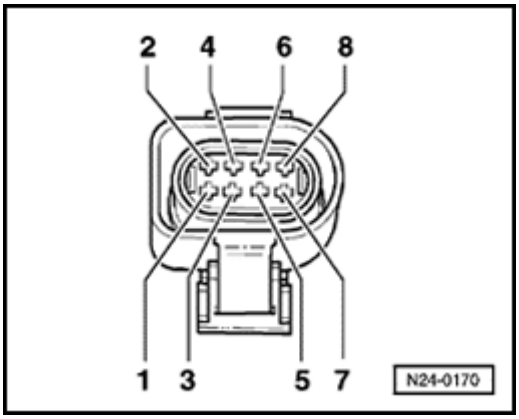
- Connect VAG 1598/18 test box to ECM wiring harness (arrow).



- Check wiring between test box and 8-pin connector for open circuit according to wiring diagram.
  - Terminal 3 and test box socket 10
  - Terminal 4 and test box socket 41
  - Terminal 7 and test box socket 33

  Resistance: max. 1.5 ohms (W)

24-70



- Check wiring at 8-pin connector for short circuit to each other.
  - Terminal 7 and test box socket 10
  - Terminal 7 and test box socket 41
  - Terminal 4 and test box socket 33

  Specification: ∞ ohms (W)
- Reconnect connector.

If no wiring malfunction is detected:

- Replace Engine Control Module (ECM) -J220-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

Checking Closed Throttle Position (CTP) switch

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this the engine must be running at idle speed.

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

24-71

Read Measuring Value Block HELP

Input display group number XXX

⮜ Indicated on display

- Press buttons -0-, -0- and -5- to input display group 005 and press -Q- button to confirm input.

Read Measuring Value Block 5 →

1 2 3 4

⮜ Indicated on display (1-4 = Display fields)

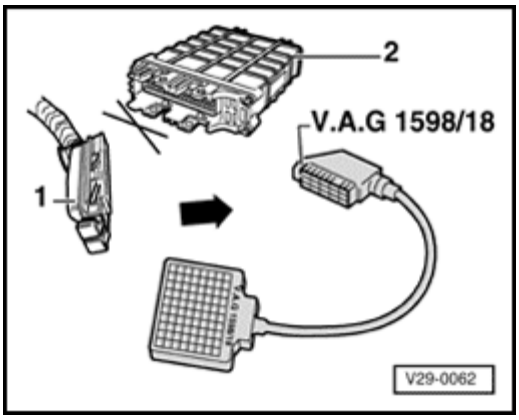
- Check Closed Throttle Position (CTP) switch (display field 4).

	Display fields			
	1	2	3	4
Display group 005: General engine data				
Display	xxx RPM	xx.xx ms	xxx km/h	**Text**
Indicated	Engine speed	Engine load	Vehicle speed	**Operating modes**
Working range	650 - 6000 RPM	0.00 - 25.00 ms	-	**-**
Specification	650 - 1100 RPM	1.00 - 3.00 ms	0 km/h	**Throttle valve closed = idle** **Throttle valve slightly open = partial load**
	-	-	-	**If specification is not attained ⇒ Page 24-72 , continuation**

24-72

Continuation

- Switch ignition off.

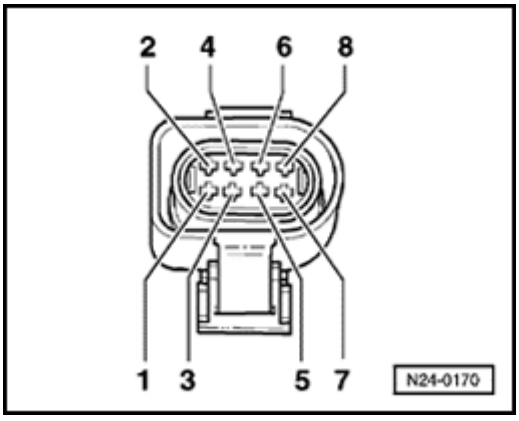


- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- With throttle valve closed connect multimeter to measure resistance at test box sockets 10 and 33.

  Specification: max. 5.0 ohms (W)
- Slowly open throttle valve.

  Specification: ∞ ohms (W)

If the specifications are not attained:



- Separate 8-pin connector to throttle valve control module -J338-.
- Check wiring between test box and 8-pin connector for open circuit according to wiring diagram.
  - Terminal 3 and test box socket 10
  - Terminal 7 and test box socket 33

  Resistance: max. 1.5 ohms (W)

24-73

- Check wiring at 8-pin connector for short circuit to each other.

  ♦ Terminal 7 and test box socket 10

  Specification: ∞ ohms (W)

- Reconnect connector.

If no wiring malfunction is detected:

- Replace throttle valve control module -J338-.

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

Checking Throttle Position (TP) actuator and Throttle Position (TP) sensor

Test conditions

- Coolant temperature at least 80 ° C (176 ° F)

Test sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this the engine must be running at idle speed.

Rapid data transfer	**HELP**	⮜
Select function XX		

Indicated on display

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

24-74

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

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

Read Measuring Value Block 37 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check the specifications for idle control (display field 1-4).

	Display fields			
	1	2	3	4
Display group 037: Idle control				
Display	**xxx RPM**	**xxx RPM**	**xx.x %**	**xx.x g/s**
Indicated	**Engine speed**	**Engine speed specification**	**Idle control**	**Mass air flow**
Working range	**650 - 6000 RPM**	**-**	**-16.0 to 16.0%**	**0.0 - 20.0 g/s**
Specification	**650 - 750 RPM**	**840 RPM**	**-4.0 to 4.0%**	**2.5 - 4.5 g/s**
	If specification is not attained ⇒ Page 24-78 , continuation		**If specification is not attained ⇒ Page 24-76 , evaluating display group 037**	**If specification is not attained ⇒ Page 24-78 , continuation**

24-75

- Press -C- button.

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

Read Measuring Value Block 36 →

1 2 3 4

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

- Check specifications for idle control (display field 2 and 3).

	Display fields			
	1	2	3	4
Display group 036: Idle control				
Display	xx.x ∠ °	**x.xx g/s**	**x.xx g/s**	-
Indicated	Throttle valve angle	**Mass air flow adaptation value at idle**	**Mass air flow adaptation value with driving range selected**	-
Working range	0.0 - 90.0 ∠ °	**-1.70 to 1.70 g/s**	**-1.70 to 1.70 g/s**	-
Specification	3.0 - 7.0 ∠ °	**-0.50 to 0.50 g/s**	**-0.40 to 0.40 g/s[1)]**	-
	-	**If specification is not attained ⇒ Page 24-77 , evaluating display group 036**		-

1) On vehicles with manual transmission "0" is always displayed.

24-76

Evaluating display group 037

Display group: 037 **Display field: 3**	**Possible malfunction cause**	**Malfunction elimination**
Idle control in range: 4.0 - 16.0%	♦ Load increased (electrical consumers switched on)	- Switch off electrical consumers
-4.0 to -16.0%	♦ Unmetered air behind throttle valve (also note display group 036, display fields 2 and 3)	- Check intake air system for leaks (unmetered air) ⇒ Page 24-123 - Check exhaust system *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*
0.0%	♦ Wiring open circuit	⇒ Page 24-78 , continuation
-1.5%	♦ Short circuit to Ground (GND)	

24-77

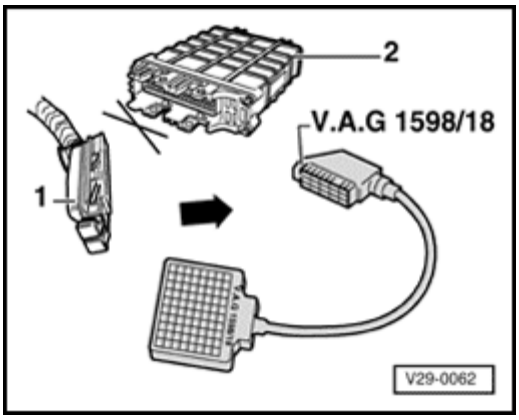
Evaluating display group 036

Display group: 036		
Display field: 2	**Possible malfunction cause**	**Malfunction elimination**
Mass air flow adaption value: 0.50 to 1.70%	♦ Load increased (electrical consumers switched on)	- Switch off electrical consumers
-0.50 to -1.70%	♦ Unmetered air behind throttle valve	- Check intake air system for leaks (unmetered air) ⇒ Page 24-123 - Check exhaust system for leaks: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*
Display field: 3	**Possible malfunction cause**	**Malfunction elimination**
Mass air flow adaption value: 0.40 to 1.70%	♦ Load increased (consumers switched on)	- Switch off consumers
-0.40 to -1.70%	♦ Unmetered air behind throttle valve	- Check intake air system for leaks (unmetered air) ⇒ Page 24-123 - Check exhaust system for leaks: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 26*

24-78

Continuation

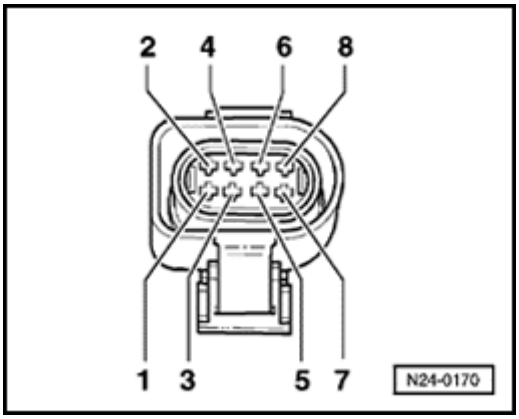
- Switch ignition off.



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- Switch ignition on.
- With throttle closed connect multimeter to measure resistance at test box sockets 27 and 53.

  Specification: 3-200 ohms (W)

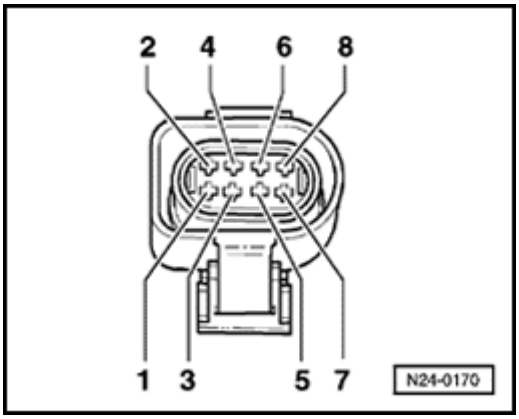
If the specification is not attained:



- Disconnect 8-pin connector from throttle valve control module -J338-.
- Check wiring between test box and 8-pin connector for open circuit according to wiring diagram.
  - Terminal 1 and test box socket 27
  - Terminal 2 and test box socket 53
  - Terminal 7 and test box socket 33
  - Terminal 8 and test box socket 62

  Resistance: max. 1.5 ohms (W)

24-79



- Check wiring at 8-pin connector for short circuit to one another according to wiring diagram.
  - Terminal 1 and test box socket 53
  - Terminal 1 and test box socket 62
  - Terminal 1 and test box socket 33
  - Terminal 2 and test box socket 33
  - Terminal 2 and test box socket 62
  - Terminal 7 and test box socket 62

  Specification: ∞ ohms (W)

If no wiring malfunction is detected:

- Replace throttle valve control module -J338-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-80

Checking Throttle Position (TP) sensor

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this the ignition must be switched on but engine not running.

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -0- and -3- to input display group 003 and press -Q- button to confirm input.

Read Measuring Value Block **3** →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check TP sensor specification (display field 3).

24-81

	Display fields			
	1	2	3	4
Display group 003: Load registration 1				
Display	xxx RPM	xx.x g/s	**xxx** ∠°	xx.x °C
Indicated	Engine speed	Mass air flow	**Throttle valve angle**	Intake air temperature
Working range	650 - 6000 RPM	-	**0 - 90** ∠°	-46.5 to 141.0
Specification	0 RPM	-	**3 - 7** ∠°	Approx. ambient temperature
	-	-	**If specification is not attained ⇒ Page 24-82 , evaluating display group 003**	-

- Slowly open throttle valve and watch angle display in display field 3.

  - The value must increase uniformly over the complete range.

- Press → button.

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

- Switch ignition off.

24-82

Note:

The displayed value is dependent on the tolerances of the throttle position sensor and does not correspond to the actual opening angle. The maximum permissible displayed value is 90.0 ∠ ° .

If the value does not increase uniformly:

- Replace throttle valve control module -J338-.

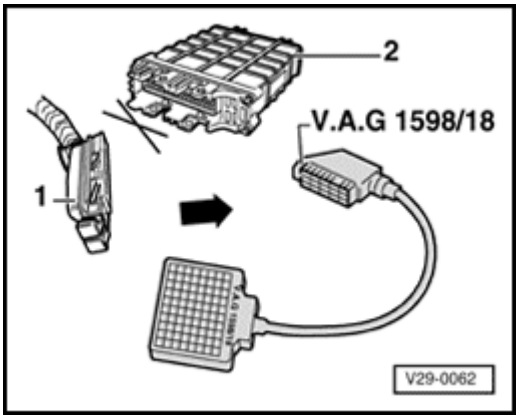
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

Evaluating display group 003

Display group: 003		
Display field: 3	**Possible malfunction cause**	**Malfunction elimination**
0.0 ∠ °	♦ Wiring open circuit	- Check wiring ⇒ Page 24-83
99.0 ∠ °	♦ Short circuit to Ground (GND)	

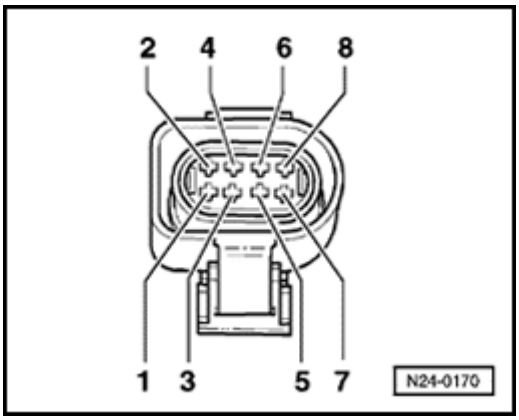
24-83

Check wiring



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- Connect multimeter using test leads from VW 1594 to measure resistance at test box sockets 01 and 40 and check wiring for short circuit to Ground (GND).

  Specification: ∞ ohms (W)
- Set multimeter to voltage measurement range.
- Switch ignition on.
- Check wiring for short circuit to positive (B+), if necessary note voltage value.
- Switch ignition off.



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

Continuation if voltage is present:

If voltage of about 5 volts was present:

- Connect multimeter using test leads from VW 1594 to measure resistance at test box sockets 40 and 41 and check wiring for short circuit to one another.

  Specification: ∞ ohms (W)

24-84

If the voltage was approx. battery voltage:

- Check wire at 8-pin connector terminal 5 for short circuit to battery positive (B+) according to wiring diagram.

Continuation if no voltage is present:

- Check wiring between test box and 8-pin connector for open circuit according to wiring diagram.

  Terminal 5 and test box socket 40

  Resistance: max. 1.5 ohms (W)

If no wiring malfunction is detected:

- Replace throttle valve control module -J338-.

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-85

Basic Setting (function 04)

Note:

- *Only initiate "Basic Setting" function 04 when the throttle valve control module -J338-, the Engine Control Module (ECM) -J220- or the engine has been replaced.*
- *Initiating basic setting matches the ECM to the throttle valve control module with the ignition switched on.*
- *If the basic setting is interrupted by the ECM, it can be, that the throttle valve is not at the mechanical idle stop due to contamination (e.g. coking) or an incorrectly adjusted accelerator cable. In this case the malfunction "Basic setting not performed" will be stored in DTC memory. Thoroughly clean the soiled area in throttle valve control module. The next time the ignition is switched on, basic setting will be automatically performed again.*

Special tools, testers and auxiliary items

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

Test conditions

- No malfunctions stored in Diagnostic Trouble Code (DTC) memory ⇒ Page 01-12 , checking DTC memory

Test sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this ignition must be switched on but engine not running.

24-86

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Basic Setting **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -9- and -8- to input display group 098 and press -Q- button to confirm input.

System in Basic Setting **98** →

1 2 3 4

Indicated on display (1-4 = Display fields)

Note:

After confirming display group number 098, throttle position actuator will be moved from min. to max., then start position. The control module stores appropriate throttle valve angle in permanent memory. Throttle then returns to start position.

- Check the specifications (display fields 1-4).

24-87

	Display fields			
	1	2	3	4
Display group 098: Basic setting, throttle valve control module				
Display	**x.xxx V**	**x.xxx V**	**Text**	**Text**
Indicated	**Throttle valve potentiometer voltage**	**Throttle valve positioner voltage**	**Operating mode**	**Basic setting status**
Working range	**0.000 - 5.000 V**	**0.000 - 5.000 V**	**-**	**-**
Specification	**-**	**-**	**Idle**	**ADP. runs**
	4.000 - 5.000 V	**3.000 - 4.000 V**	**Idle**	**ADP. OK (ADP. ERROR appears if basic setting is unsuccessful**
	If specification is not attained ⇒ Page 24-68 , check throttle valve control module			

- Terminate engine basic setting at earliest after 30 seconds by pressing the → button.

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

24-88

Engine Coolant Temperature (ECT) sensor, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test conditions

- Engine cold

Test sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this ignition must be switched on.

Rapid data transfer **HELP** 

Select function XX

Indicated on display

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

24-89

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

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

Read Measuring Value Block 1 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check the specification for coolant temperature sensor (display field 2).

	Display fields			
	1	2	3	4
Display group 001: Idle test				
Display	xxxx RPM	**xxx.x° C**	xx.x%	xx.x ∠°
Indicated	Engine speed	**Coolant temperature**	O2S control	Ignition angle
Working range	650 - 6000 RPM	**-46.5 to 141.0° C**	-25.0 to 25.0%	0.0 - 50.0 ∠°
Specification	0 RPM	**Approx. ambient temperature 1)**	The value must fluctuate at least 3% in range -5.0 to 5.0%	2.0 - 15.0 ∠°
	-	**If specification is not attained ⇒ Page 24-91 , evaluating display group 001**	-	-

1) If a temperature is displayed which deviates greatly from the ambient temperature of the sensor, check sensor wiring for resistance/open circuit.

24-90

Continuation

- Start engine and run at idle speed.

  - The temperature value must increase uniformly.

If the specification is not attained:

- Replace Engine Coolant Temperature (ECT) sensor -G62-.

WARNING!

The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth, and open carefully to relieve system pressure slowly.

- Press → button.

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

- Switch ignition off.

Notes:

- *Display on VAG 1551 scan tool jumps by 1.5 °C increments.*

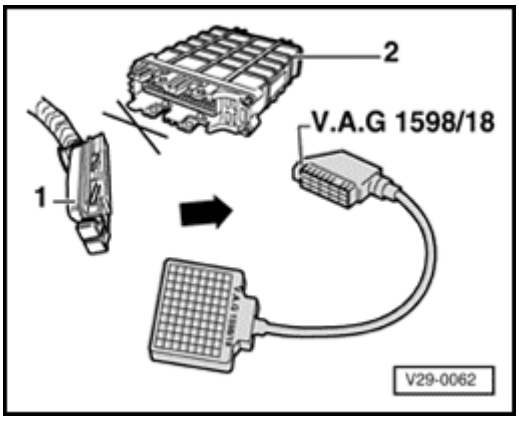
- *If irregular engine running occurs in certain temperature ranges and the temperature value does not increase without interruption, the temperature signal is temporarily interrupted and the sensor must be replaced.*

24-91

Evaluating display group 001

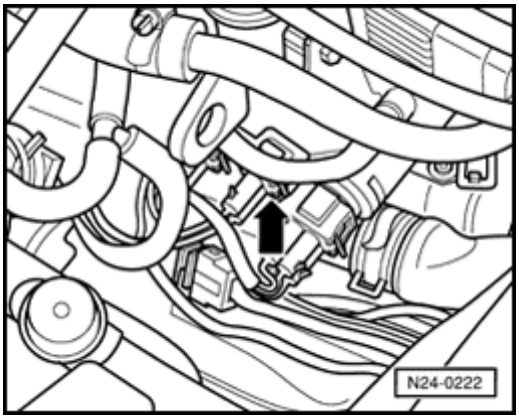
Display group: 001 Display field: 2	Possible malfunction cause	Malfunction elimination
Approx. -46.6 ° C	◆ Wiring open circuit or short circuit to positive (B+)	- Check wiring ⇒ Page 24-90
Approx. 141.0 ° C	◆ Short circuit to Ground (GND)	

Check wiring

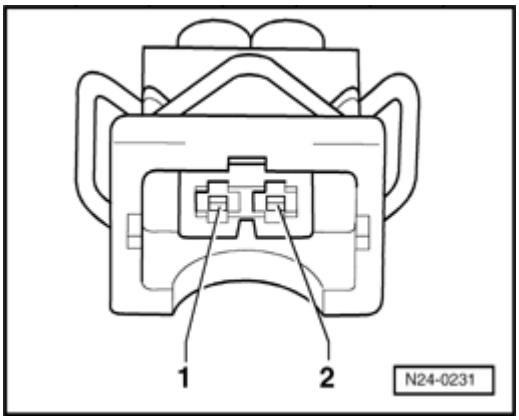


- Connect VAG 1598/18 test box to ECM wiring harness (arrow).

24-92



- Disconnect 2-pin connector from Engine Coolant Temperature (ECT) sensor -G62-.



- Check wiring between test box and 2-pin connector for open circuit according to wiring diagram.
  - Terminal 1 and test box socket 14
  - Terminal 2 and test box socket 33

  Resistance: max. 1.5 ohms (W)
- Check wire between ECM connector and 2-pin connector terminal 2 for short circuit to wire terminal 1 and to vehicle Ground (GND), according to wiring diagram.
  - Terminal 2 and test box socket 14

  Specification: ∞ ohms (W)

24-93

- Additionally, check both wires for short circuit to battery positive (B+).

  Specification: ∞ ohms (W)

If no malfunction in wire is detected:

- Perform resistance measurement at ECT sensor -G62- terminals 1 and 2, resistance values ⇒ Page 24-17 , ⇒ Fig. 1 .

If the specification is not attained:

- Replace ECT sensor -G62-.

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-94

Intake Air Temperature (IAT) sensor, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram
- Freeze spray (commercially available)

Test sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this ignition must be switched on.

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

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 06 and press -Q- button to confirm input.

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

- Press buttons -0-, -0- and -3- to input display group 003 and press -Q- button to confirm input.

24-95

Read Measuring Value Block 3 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check the specification for intake air temperature sensor (display field 4).

	Display fields			
	1	2	3	4
Display group 003: Load registration 1				
Display	xxx RPM	xx.x g/s	xxx ∠ °	**xx.x ° C**
Indicated	Engine speed	Mass air flow	Throttle valve angle	**Intake air temperature**
Working range	650 - 6000 RPM	0.0 - 25.0 g/s	0 - 90 ∠ °	**-6.5 to 141.0**
Specification	0 RPM	-	3 - 7 ∠ °	**Approx. ambient temperature 1)**
	-	-	-	**Continue ⇒ Page 24-96 , evaluating display group 003**

1) If a temperature is displayed which deviates greatly from the ambient temperature of the sensor, check sensor wiring for resistance/open circuit.

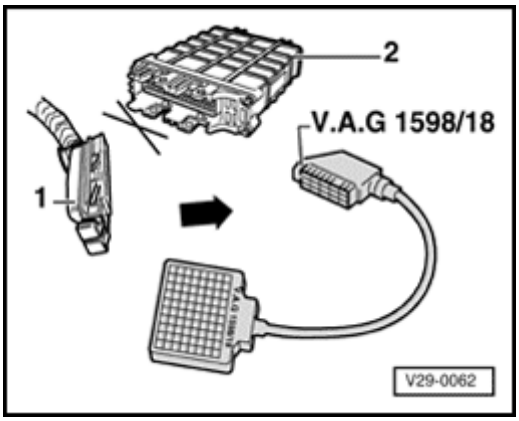
24-96

Evaluating display group 003

Display group: 003 Display field: 4	Possible malfunction cause	Malfunction elimination
-46.5 ° C	♦ Wiring open circuit or short circuit to positive (B+)	- Check wiring ⇒ Page 24-96
141.0 ° C	♦ Short circuit to Ground (GND)	
Approx. ambient temperature	♦ Signal periodically interrupted	- Check IAT sensor ⇒ Page 24-98 , continuation at ambient temperature

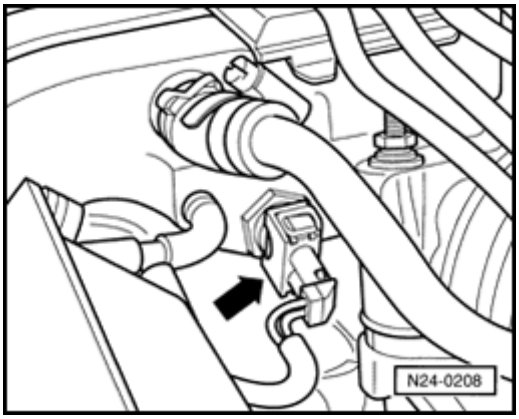
Checking wiring

- Switch ignition off.



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).

24-97



- Disconnect 2-pin connector (arrow) at Intake Air Temperature (IAT) sensor -G72-.
- Check wiring between test box and 2-pin connector for open circuit according to wiring diagram.
  - Terminal 1 and test box socket 36
  - Terminal 2 and test box socket 33

  Resistance: max. 1.5 ohms (W)
- Check wire between ECM connector and 2-pin connector terminal 2 for short circuit to wire terminal 1 and to vehicle Ground (GND), according to wiring diagram.
  - Terminal 2 and test box socket 36

  Specification: ∞ ohms (W)
- Additionally, check both wires for short circuit to battery positive (B+).

  Specification: ∞ ohms (W)

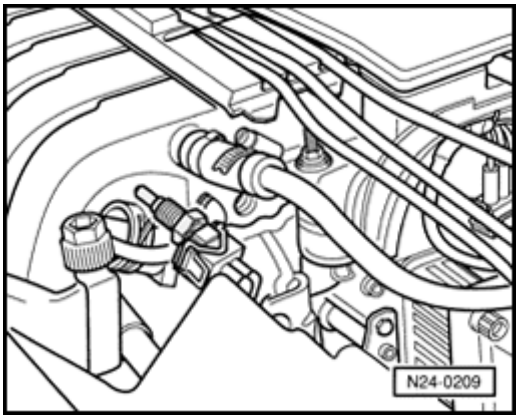
If no malfunction in wire is detected:

- Perform resistance measurement on IAT sensor -G72- terminals 1 and 2, resistance values ⇒ Page 24-17 , ⇒ Fig. 1 .

If the specification is not attained:

- Replace Intake Air Temperature (IAT) sensor -G72-.

24-98



Continuation of check when display = ambient temperature

- Remove IAT sensor -G72- (harness remains connected).
- Read intake air temperature value in display field 4.
- Spray sensor with a commercially available freeze spray and at the same time observe temperature value.

  • Temperature value must decrease

If the specification is not attained:

- Replace Intake Air Temperature (IAT) sensor -G72-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

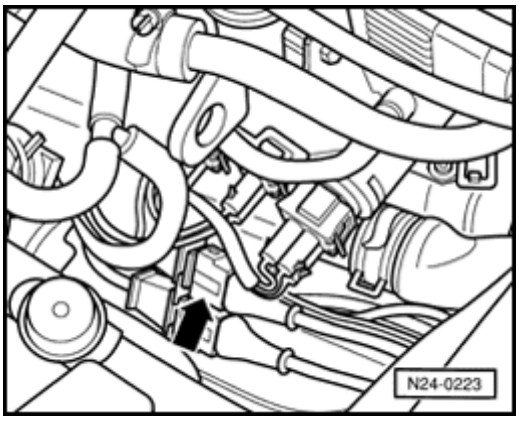
24-99

Engine speed (RPM) sensor, checking

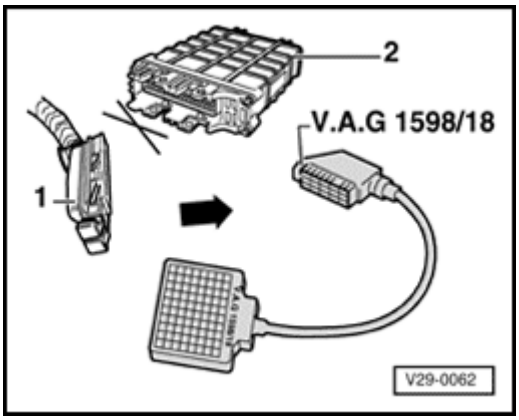
Special tools, testers and auxiliary items

- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test sequence

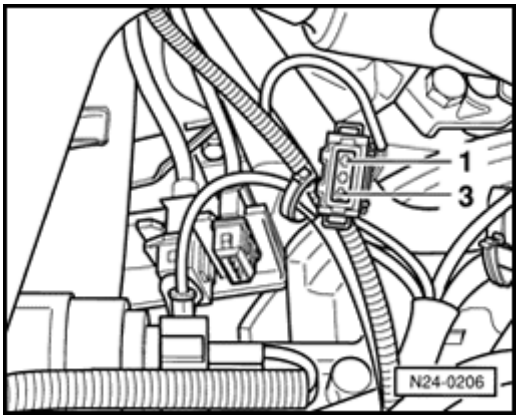


- Disconnect white 3-pin connector from engine speed sensor (arrow).



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).

24-100



- Check wiring between test box and 3-pin connector for open circuit according to wiring diagram.
  - Terminal 1 and test box socket 67
  - Terminal 2 and test box socket 68
  - Terminal 3 and test box socket 56

  Resistance: max. 1.5 ohms (W)
- Additionally, check wiring for short circuit to one another.
  - Terminal 2 and test box socket 56
  - Terminal 1 and test box socket 56
  - Terminal 1 and test box socket 68

  Specification: ∞ ohms (W)

If no wiring malfunction is detected:

- Replace engine speed (RPM) sensor -G28-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-101

Speedometer Vehicle Speed Sensor (VSS) signal, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test conditions

- Speedometer OK, checking:

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

Note:

To check the vehicle speed sensor signal, vehicle must be test driven. To do this a second technician is necessary.

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

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

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

24-102

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

- Press buttons -0-, -0- and -5- to input display group 005 and press -Q- button to confirm input.

Read Measuring Value Block 5 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Perform test drive and observe display in display field 3 (second technician necessary).

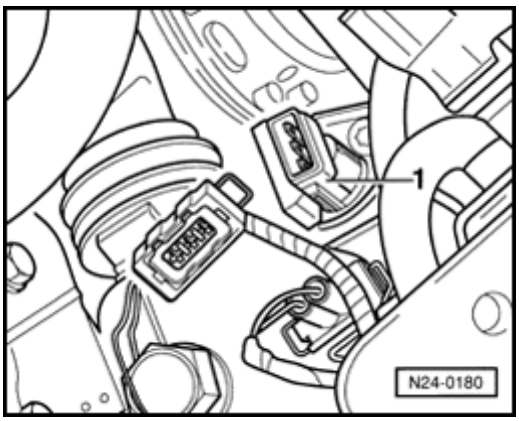
	Display fields			
	1	2	3	4
Display group 005: General engine data				
Display	xxx RPM	xx.xx ms	**xxx km/h**	Idle
Indicated	Engine speed	Engine load	**Driving speed**	Operating modes
Working range	650 - 6000 RPM	0.00 - 25.00 ms	**-**	-
Specification	-	-	**Approx. driving speed**	-
	-	-	**If no driving speed is displayed ⇒ Page 24-103 , continuation**	

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

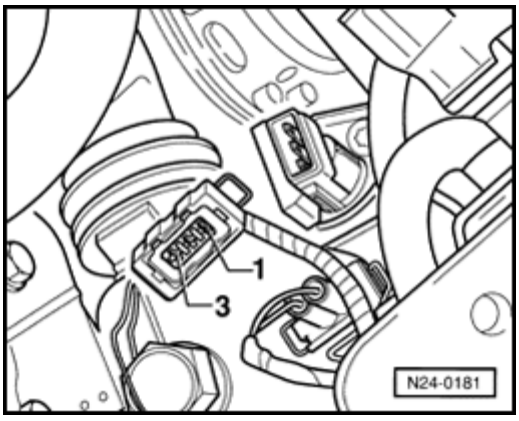
24-103

Continuation

If no speed is indicated:



- Disconnect 3-pin connector from vehicle speed sensor -1-.
- Switch ignition on.



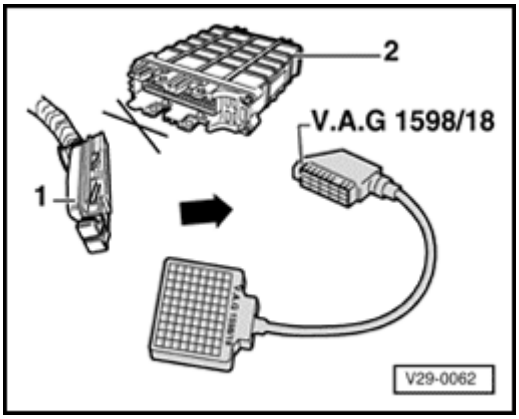
- Connect multimeter using test leads from VW 1594 to measure voltage at terminals 1 and 3 of connector.

  Specification: 9-14.5 volts
- Switch ignition off.
- Reconnect connector.

If no voltage was present:

- Check wiring according to wiring diagram.

24-104



If voltage was 9-14.5 volts:

- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- Check wiring between central electrical panel and test box socket 65 for open circuit according to wiring diagram.

  Resistance: max. 1.5 ohms (W)
- Connect multimeter using test leads from VW 1594 to measure voltage at test box sockets 56 and 65.
- Switch ignition on.
- Lift left front wheel and rotate by hand or push vehicle.

  • The voltage must fluctuate between 0 and at least 4 volts.

If no wiring malfunction is detected and voltage was present between terminals 1 and 3:

- Replace speedometer Vehicle Speed Sensor (VSS) -G22-.
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

24-105

Engine Control Module (ECM) voltage supply, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test sequence

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 . When doing this ignition must be switched on.

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

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

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

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

24-106

Read Measuring Value Block 2 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check battery voltage (display field 3).

	Display fields			
	1	2	3	4
Display group 002: General engine data				
Display	xxxx RPM	xx.xx ms	**xx.xxx**	xxx.x° C
Indicated	Engine speed	Fuel injection period	**Battery voltage**	Intake air temperature
Working range	650 - 6000 RPM	0.00 - 25.00 ms	**0.000 - 16.500 V**	-46.5 to 141.0° C
Specification	0 RPM	-	**12.000 - 14.500 V**	-
	-	-	**If specification is not attained ⇒ Page 24-107 , evaluating display group 002**	-

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

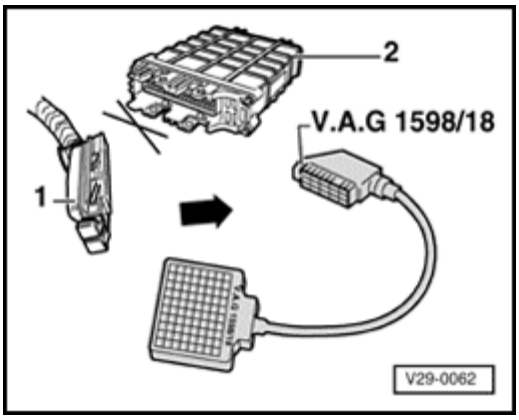
Evaluating display group 002

Display group: 002 Display field: 3	Possible malfunction cause	Malfunction elimination
If no display appears on VAG 1551	♦ Fuse 15 faulty	- Replace fuse
	♦ Wiring open circuit	- Check voltage supply terminal 15 ⇒ Page 24-108
If value displayed fluctuates between 12.0 - 14.5 V	♦ Loose connection	- Check voltage supply terminal 30 ⇒ Page 24-108
0.0 - 12.0 V	♦ Battery discharged/faulty ♦ Voltage regulator faulty	- Check battery - Check generator - Check voltage regulator
14.5 - 16.5 V	♦ Generator faulty ♦ Voltage regulator faulty	- Check generator - Check voltage regulator

24-108

Checking voltage supply terminal 30

- Switch ignition off.



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- Connect multimeter using test leads from VW 1594 to measure voltage at test box sockets 1 and 54.

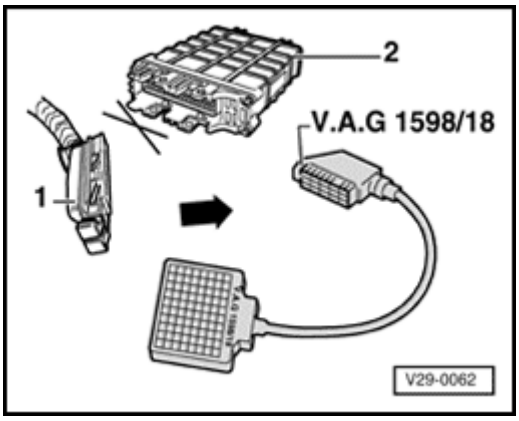
  Specification: 12-14.5 volts

If the specification is not attained:

- Check wiring according to wiring diagram.

Checking voltage supply terminal 15

- Switch ignition off.



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- Switch ignition on.
- Connect multimeter using test leads from VW 1594 to measure voltage at test box sockets 1 and 23.

  Specification: 12-14.5 volts

If the specification is not attained:

- Check wiring according to wiring diagram.

24-109

Signal from automatic transmission, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

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

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

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

- Press buttons -0-, -0- and -8- to input display group 008 and press -Q- button to confirm input.

24-110

Read Measuring Value Block 8 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Check signals from automatic transmission (display field 2).

	Display fields			
	1	2	3	4
Display group 008: Signals to Engine Control Module (ECM)				
Display	xxxx RPM	**Text**	Text	Text
Indicated	Engine speed	**Driving range status**	Air conditioner status	Air conditioner compressor status
Working range	650 - 6000 RPM	**-**	-	-
Specification	650 - 750 RPM	**P and N: NEUTRAL** **1, 2, 3 and D: ON**	-	-
	-	**If specification is not attained ⇒ Page 24-110 , continuation**	-	-

Continuation

If the display does not read as described:

- Check wiring between ECM (terminals 07, 11, 18 and 21) and Transmission Control Module (TCM) according to wiring diagram.

24-111

Signal from A/C compressor, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Check conditions

- Function of A/C OK
- A/C switched off
- Interior of vehicle is at room temperature (above 15 ° C (59 ° F))
- No malfunctions stored in DTC memory ⇒ Page 01-12 , checking DTC memory

24-112

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -0- and -8- to input display group 008 and press -Q- button to confirm input.

Read Measuring Value Block 8 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Switch on A/C (lowest temperature and highest blower speed).
- Check specifications for A/C (display fields 3 and 4).

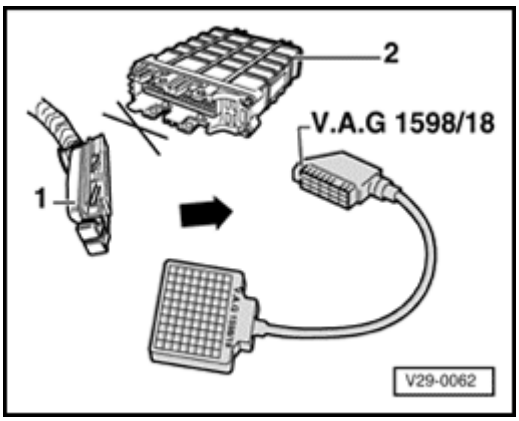
24-113

	Display fields			
	1	2	3	4
Display group 008: Signals to Engine Control Module (ECM)				
Display	xxxx RPM	Text	**Text**	**Text**
Indicated	Engine speed	Driving range status	**Air conditioning status**	**A/C compressor status**
Working range	650 - 6000 RPM	-	**-**	**-**
Specification	650 - 750 RPM	Neutral	**Air conditioning on:** **A/C-HIGH** **Air conditioning off:** **A/C-LOW**	**Compressor on: ON Compressor off: Compr. OFF**
	-	-	**If specification is not attained ⇒ Page 24-114 , continuation**	

Note:

The A/C compressor will be switched off (Compr. OFF) when the ECM recognizes full load and the air conditioning is switched on (A/C-HIGH).

24-114



Continuation

If the display does not indicate as described:

- Connect VAG 1598/18 test box to ECM wiring harness (arrow).
- Check wiring between test box sockets 37 and 39 respectively and A/C for open circuit according to wiring diagram.

  Resistance: max. 1.5 ohms (W)

If the specification is not attained:

- Check wiring according to wiring diagram.

24-115

Fuel injectors, checking

Checking activation

Check activation of fuel injectors ⇒ Page 01-71 , Output Diagnostic Test Mode (DTM).

Special tools, testers and auxiliary items

- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VAG 1527B voltage tester
- Connector test kit VW 1594
- Wiring diagram

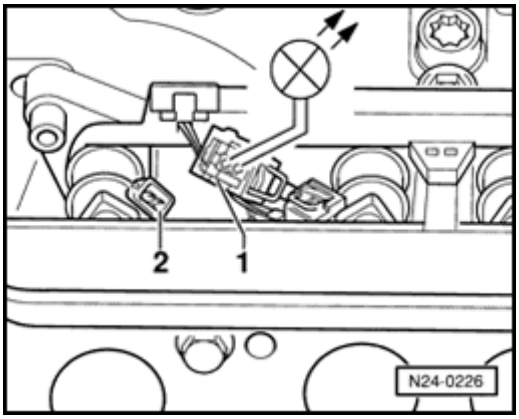
Check conditions

- Engine speed sensor OK
- Fuel pump relay OK

Test sequence

- Remove intake manifold, upper ⇒ Page 24-14 , item 1 .
- Disconnect 5-pin connector from ignition coil.

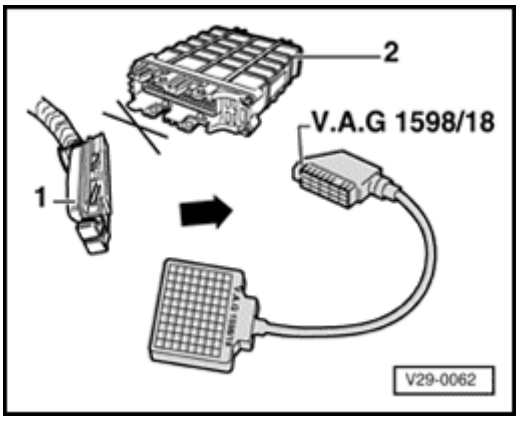
24-116



- Disconnect harness connector -1- from connection -2- and connect VAG 1527B voltage tester with test leads from VW 1594 to the terminals of the harness connector.
- Disconnect harness connectors from fuel injectors 2-6.
- Operate starter and check the voltage supply for no. 1 cyl. fuel injector.
  - LED must flicker
- Repeat check on fuel injectors 2-6.

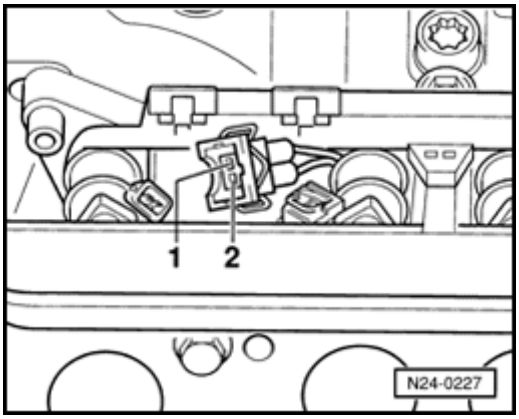
If the LED does not flicker:

- Switch ignition off.



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).

24-117



- Check wiring between test box and connector for open circuit according to wiring diagram.
  - No. 1 cyl. fuel injector: terminal 2 and test box socket 24
  - No. 2 cyl. fuel injector: terminal 2 and test box socket 25
  - No. 3 cyl. fuel injector: terminal 2 and test box socket 26
  - No. 4 cyl. fuel injector: terminal 2 and test box socket 02
  - No. 5 cyl. fuel injector: terminal 2 and test box socket 03
  - No. 6 cyl. fuel injector: terminal 2 and test box socket 04

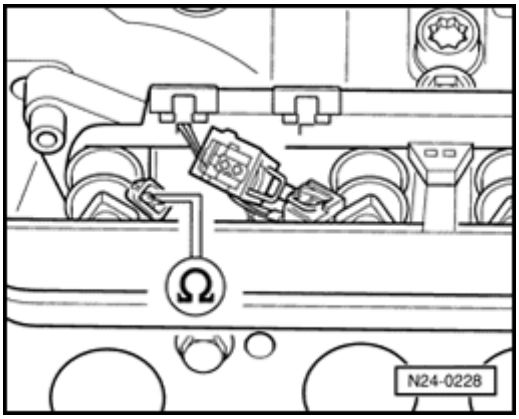
  Resistance: max.1.5 ohms (W)
- Check wiring between fuel injector connector terminal 1 and relay panel for open circuit according to wiring diagram.

  Resistance: max. 1.5 ohms (W)
- Additionally, check wires for short circuit to one another.

  Specification: ∞ ohms (W)

24-118

Checking resistance of fuel injectors



- Check resistance of fuel injectors individually.

  Specification: 15-21.5 ohms (W)

If the specification is not attained, replace fuel injector (s) as necessary.

Checking spray pattern and for leaks

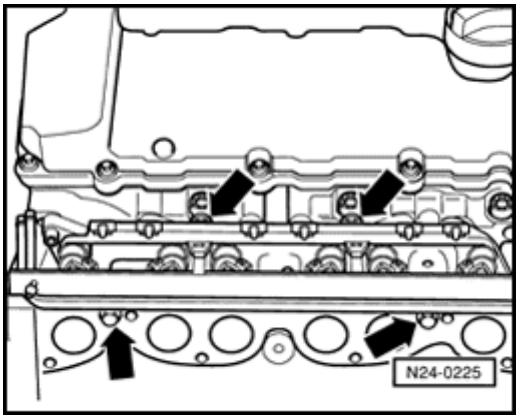
WARNING!

- ***DO NOT smoke or work near heaters or other fire hazards when working on fuel system.***
- ***The fuel system is pressurized! Before loosening hose connections or opening the test connection, wrap a cloth around the connection. Then release pressure by slowly disconnecting the hose/fitting.***

Special tools, testers and auxiliary items

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

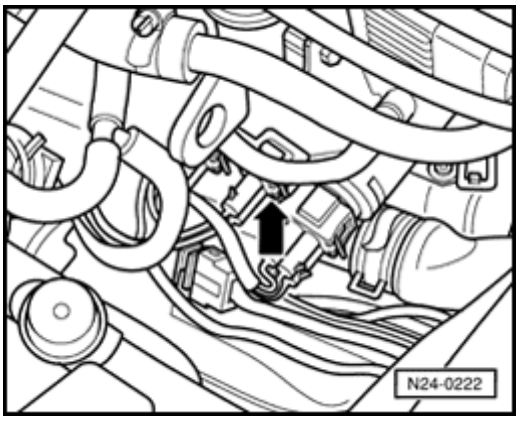
- Remove intake manifold, upper ⇒ Page 24-14 , item 1 .



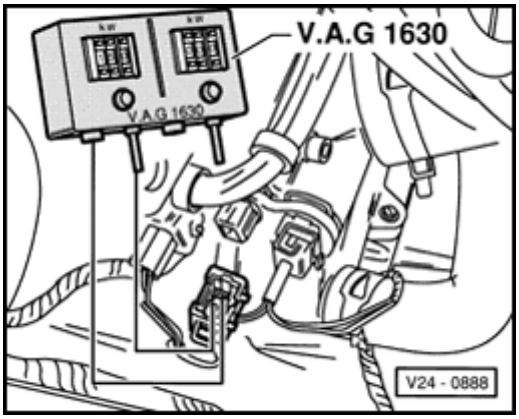
- Remove fuel rail complete with fuel injectors.

24-119

- Hold fuel injectors in VAG 1602 fuel analyzer.



- Disconnect harness connector from Engine Coolant Temperature (ECT) sensor -G62-.
- Disconnect 5-pin connector from ignition coil.



- Set VAG 1630 digital potentiometer side A to 15 KΩ and using test leads from VW 1594 connect to terminals 1 and 3 of disconnected harness connector.
- Operate starter (second technician required).
  - The fuel injectors must pulsate and spray in accordance with firing order.
- Switch ignition off and check fuel injectors for leaks.
  - No more than 2 drops/minute may leak from each fuel injector.

Note:

When installing the fuel injectors make sure that the O-rings are not damaged.

Fuel pressure regulator and residual pressure, checking

The fuel pressure regulator controls the fuel pressure dependent upon intake manifold pressure.

Special tools, testers and auxiliary items

- VAG 1318 pressure tester
- VAG 1318/10 adapter
- VAG 1318/11 adapter
- VAG 1318/16 adapter

Test conditions

- Fuel pump delivery rate OK, checking:

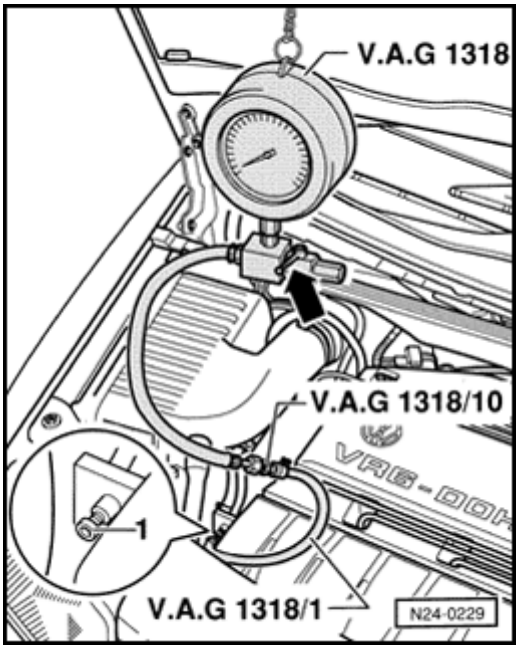
⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*

Test sequence

WARNING!

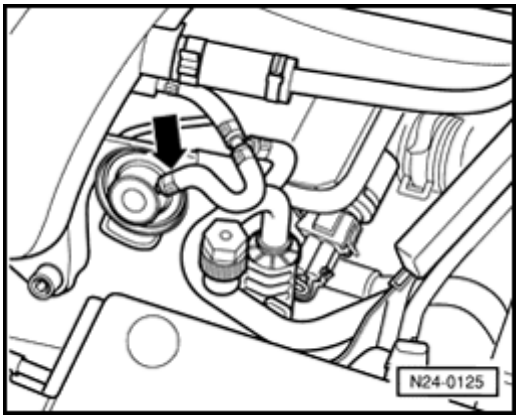
- ***DO NOT smoke or work near heaters or other fire hazards when working on fuel system.***
- ***The fuel system is pressurized! Before loosening hose connections or opening the test connection, wrap a cloth around the connection. Then release pressure by slowly disconnecting the hose/fitting.***

24-121



- Disconnect test port plug -1- from fuel rail and connect pressure gauge VAG 1318 with adapter VAG 1318/10 and hose VAG 1318/1 to fuel rail.
  - Fuel gauge valve must be closed, handle 90° to direction of flow (arrow).
- Start engine and run at idle speed.
- Check fuel pressure.

  Specification: approx. 2.5 bar (36 psi)



- Disconnect vacuum hose from intake manifold upper section at fuel pressure regulator (arrow).
  - The fuel pressure must rise to approx. 3.0 bar (44 psi)
- Switch ignition off.

- Check for leaks and residual pressure by watching pressure drop on gauge.

  - After 10 minutes there must be a residual pressure of at least 2 bar (29 psi).

If the residual pressure drops below 2 bar (29 psi):

- Start engine and run at idle speed.

- After pressure has built up switch ignition off and simultaneouslyclamp-off return line (with blue arrow) on fuel rail.

- Watch pressure drop on gauge.

If the pressure does not drop:

- Replace fuel pressure regulator.

If the pressure drops again:

- Check fuel pump check valve.

⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 20*

- Check hose connections, O-rings on fuel rail and fuel injectors for leaks.

- Check pressure gauge for leaks.

24-123

Intake air system (outside air), checking for leaks

Checking with engine leak detector spray G 001 800 A1

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- Engine leak detector spray G 001 800 A1

Notes:

- *The vacuum in the intake system will cause the leak detector spray to be drawn in with outside air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a significant increase of the CO content.*
- *Observe safety precautions listed on the container.*

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

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

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

24-124

Read Measuring Value Block HELP

Input display group number XXX

Indicated on display

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

Read Measuring Value Block 1 →

1 2 3 4

Indicated on display (1-4 = Display fields)

- Note Oxygen Sensor (O2S) control in display field 3.

	Display fields			
	1	2	3	4
Display group 001: Idle test				
Display	xxxx RPM	xxx.x °C	**xx.x%**	xx.x ∠ °
Indicated	Engine speed	Engine temperature	**O2S control**	Ignition angle
Working range	650 - 6000 RPM	-	**-25.0 to 25.0%**	0.0 - 40.0 ∠ °
Specification	650 - 750 RPM	-	**The value must fluctuate at least 2% in range - 5.0 to 5.0%**	2.0 - 15.0 ∠ °

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

If the engine speed drops or the value displayed for O2S control changes:

- Check area of intake system which has been sprayed for leaks and eliminate leaks.

Multiport fuel injection and ignition system

Ignition system, servicing

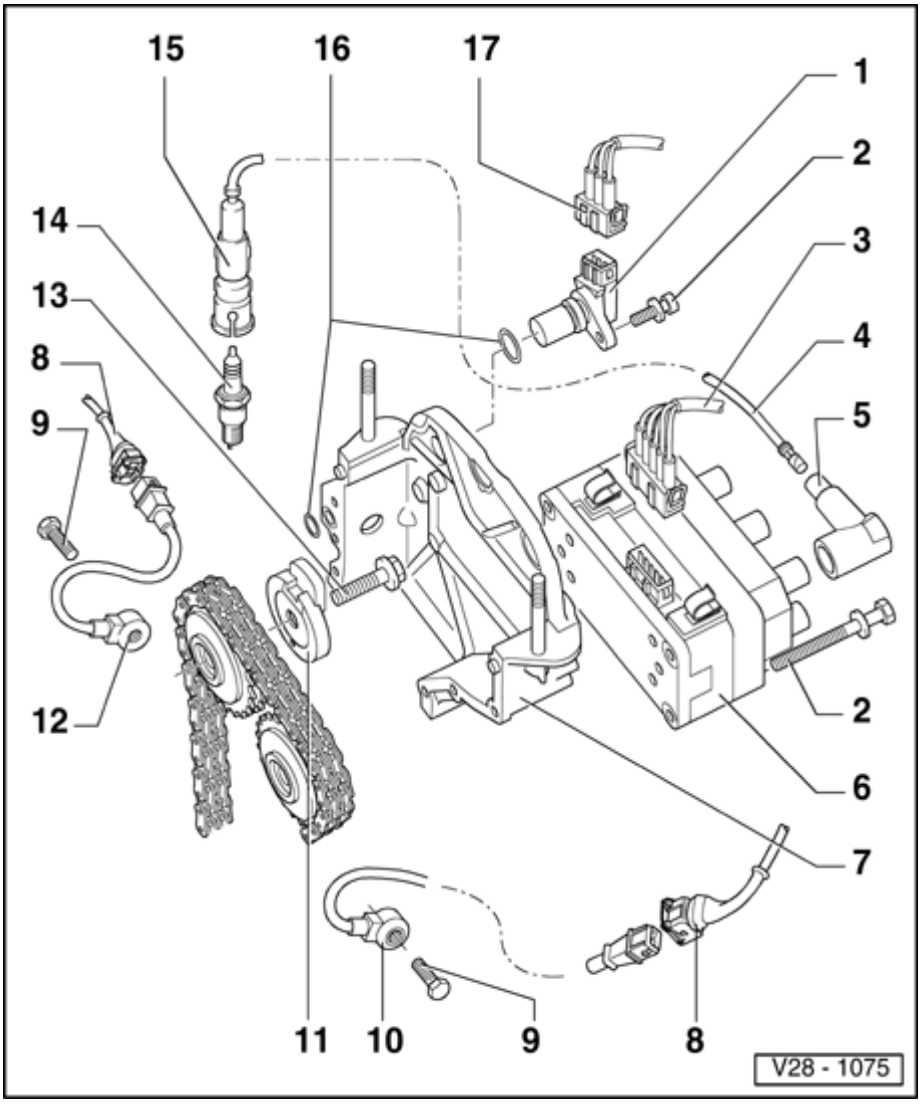
Notes:

- *Only the components which specifically relate to the ignition system are dealt with here. For the other components of the fuel injection and ignition system* ⇒ *Page 24-1* .
- *The fuel injection and ignition system control module is equipped with On Board Diagnostic (OBD).*
- *Components marked with an asterisk (*) are checked via the On Board Diagnostic (OBD) program.*
- *Check Diagnostic Trouble Code (DTC) memory before carrying out repairs and troubleshooting* ⇒ *Page 01-12* .

Safety precautions ⇒ Page 28-5 .

Spark plugs, technical data ⇒ Page 28-7 .

28-2



Ignition system, components

Note:

Engine Control Module (ECM) - J220- with connector* ⇒ *Page 24-6 , item 3 .*

1 - Camshaft Position (CMP) sensor -G40-*

- Checking ⇒ Page 28-16
- Note spacer rings

2 - 10 Nm (7 ft lb)

3 - Connector

- 5-pin
- For ignition coil -N152-

4 - Ignition wire

- Check for continuity

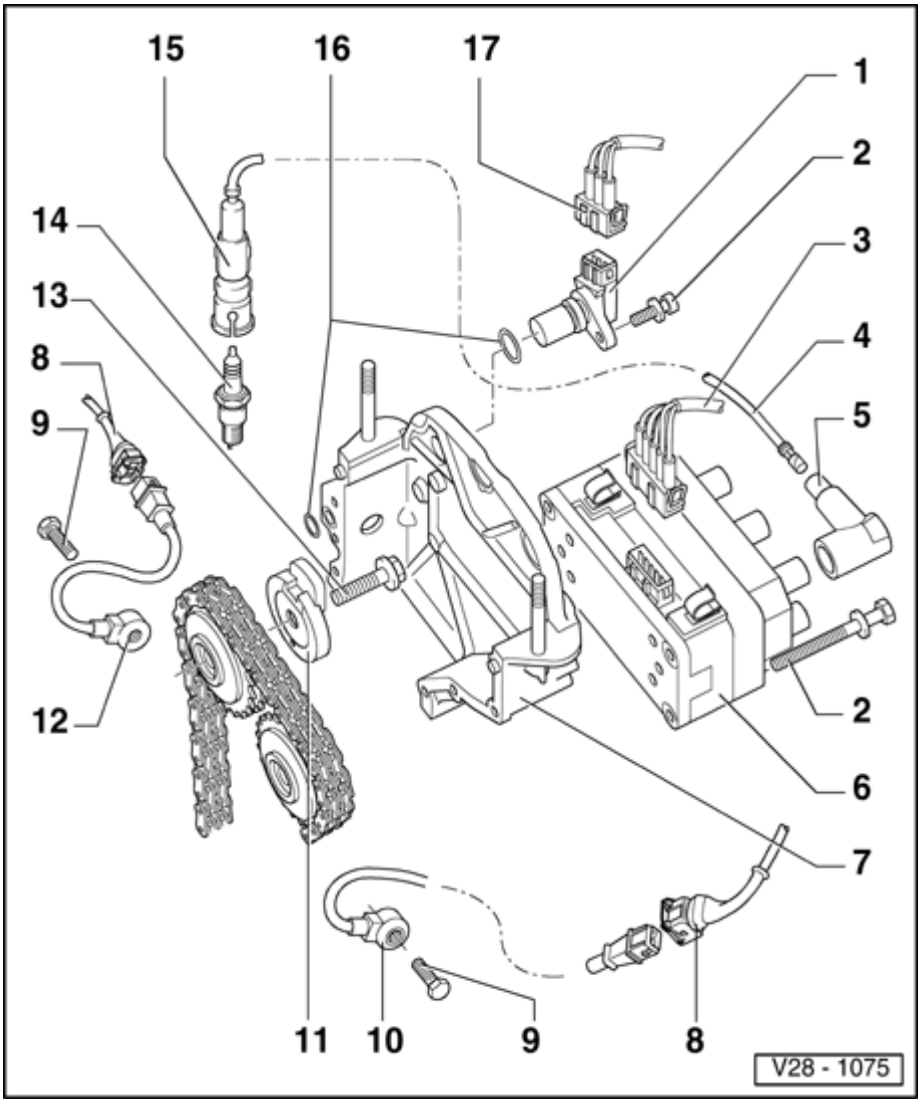
5 - Suppressor

- Resistance: 0.6-1.4 kΩ

6 - Ignition coil -N152-*

- With ignition wire identification, do not interchange
- Checking ⇒ Page 28-27

28-3



7 - Camshaft sprocket cover

- Removing and installing

⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 15, Cylinder head, removing and installing*

8 - Connector

- 3-pin

9 - 20 Nm (15 ft lb)

- Tightening torque influences function of Knock Sensor

10 - Knock Sensor (KS) 2 - G66-*

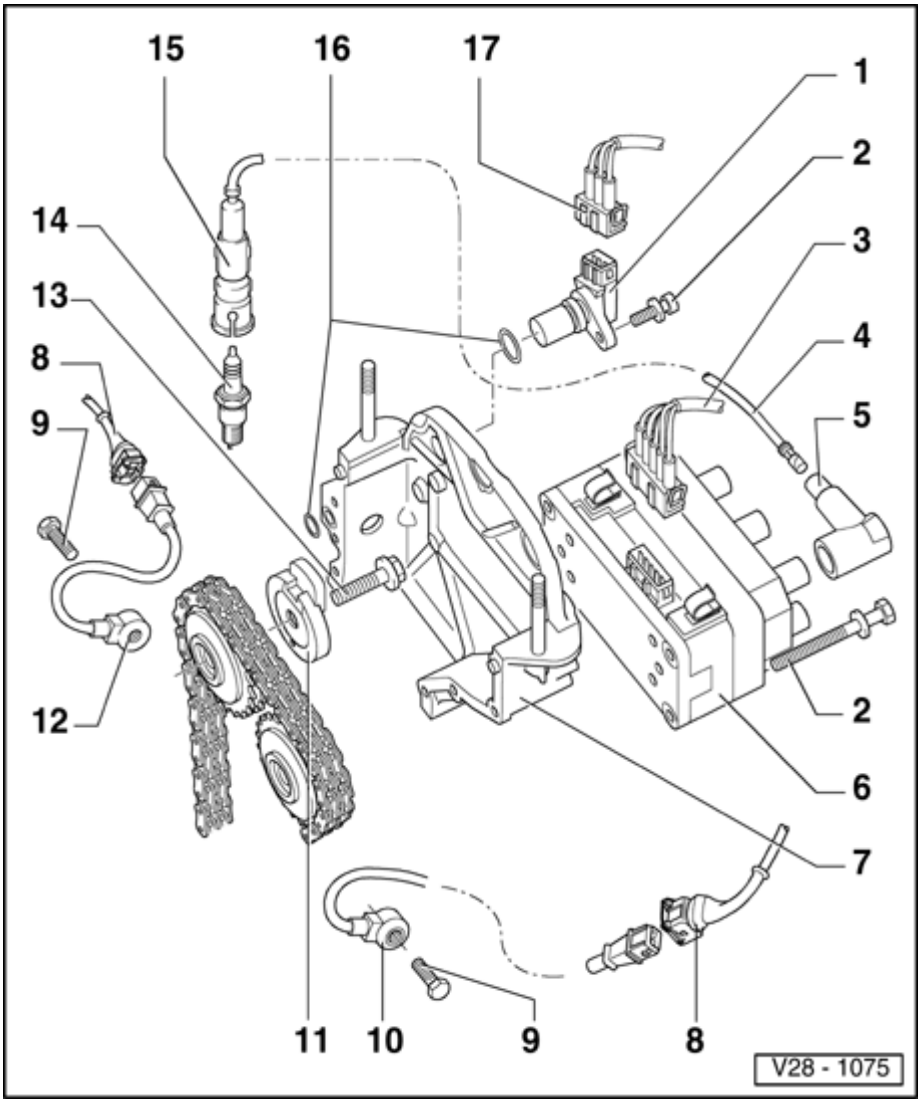
- Installation position: cylinder block intake side

11 - Sensor wheel

- For Camshaft Position (CMP) sensor -G40-
- Contact surface on camshaft sprocket must be dry
- If the sensor wheel has been removed, check timing after installing:

⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 13*

28-4



12 - Knock Sensor (KS) 1 - G61-*

- Installation position: cylinder block exhaust side

13 - 100 Nm (74 ft lb)

- To remove and install counter-hold with 24 mm OJ wrench on camshaft
- Oil bolt head contact surface

14 - Spark plug

- 25 Nm (18 ft lb)
- Remove and install with tool 3122B
- Type and electrode gap ⇒ Page 28-7 , spark plugs, technical data

15 - Spark plug connector

- Use 3277 to disconnect and connect
- Resistance: 4-6 kΩ

16 - O-ring

- Replace if damaged

17 - Connector

- 3-pin
- Camshaft Position (CMP) sensor -G40-

28-5

Safety precautions

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 5-pin connector to ignition coil (arrow).***
- ***Disconnect harness connectors from all fuel injectors.***
- ***After the work is completed, erase Diagnostic Trouble Code (DTC) memory.***

28-6

CAUTION!

BEFORE disconnecting the battery:

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

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

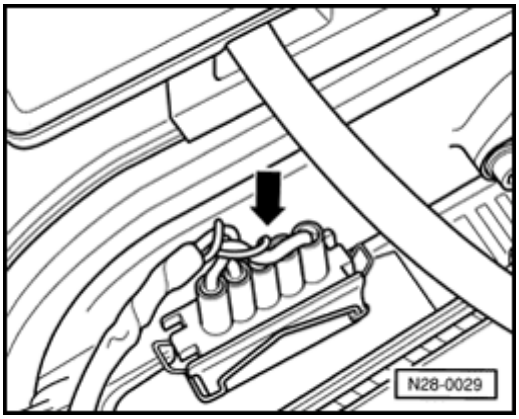
- ***Working on the electrical system***
- ***Resistance (spot) welding or electric arc welding anywhere on the vehicle.***

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

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



Technical data, spark plugs

Engine code	AAA
Ignition timing [1]	
Checking	⇒ Page 28-8
Firing order	1-5-3-6-2-4
Spark plugs [2]	
VW/Audi	101 000 035 AB
Manufacturer's designation	BKR 5 EKU
Electrode gap	0.7 mm (0.028 in.) [3]
Tightening torque	25 Nm (18 ft lb)

1) Not adjustable

2) Use tool 3277 to disconnect and connect spark plug connector. Remove and install spark plugs with tool 3122B

3) Gap between Ground (GND) electrode and center electrode

28-8

Ignition timing, checking

Special tools, testers and auxiliary items

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

Test conditions

- Electrical consumers switched off (radiator coolant fan must not run during the check)
- Air conditioner switched off

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -0-, -1- and -0- to input display group 010 and press -Q- button to confirm input.

Read Measuring Value Block **10** →

1 2 3 4

Indicated on display (1-4 = display fields)

28-9

- Check the ignition specifications (display fields 3 and 4).

	Display fields			
	1	2	3	4
Display group 010: Ignition 1				
Display	xxx RPM	xx.x ms	**xx.x ∠ °**	**xx.x ∠ °**
Indicated	Engine speed	Engine load	**Ignition angle (mapped value)**	**Ignition angle**
Working range	650 - 6000 RPM	0.0 - 25.0 ms	**0.0 - 50.0 ∠ ° BTDC**	**0.0 - 40.0 ∠ ° BTDC**
Specification	650 - 750 RPM	1.5 - 2.5 ms	**11.0 - 13.0 ∠ ° BTDC**	**Max. ±2.0 ∠ ° deviation from display field 3**
	-	-	**Test conditions:** ♦ Intake air temperature max. 50 ° C **If the specification is not attained ⇒ Page 24-68 , checking throttle valve control module**	

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

- Press → button.

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

28-10

Misfire recognition, checking

Special tools, testers and auxiliary items

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

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" address word 01 ⇒ Page 01-7 .

Rapid data transfer **HELP**

Select function XX

Indicated on display

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

Read Measuring Value Block **HELP**

Input display group number XXX

Indicated on display

- Press buttons -1-, -1- and -0- to input display group 110 and press -Q- button to confirm input.

Read Measuring Value Block **110** →

1 2 3 4

Indicated on display (1-4 = display fields)

- Check the specification for misfire recognition (display fields 2-4):

28-11

	Display fields			
	1	2	3	4
Display group 110: Misfire recognition 1				
Display	x.xx ms	**xxx**	**xxx**	**xxxxxxxx**
Indicated	Engine load	**Misfire adversely affecting exhaust gas (total)**	**Misfire adversely affecting three way catalytic converter (total)**	**Misfire recognition status**
Working range	0.00 - 25.00 ms	**-**	**-**	**-**
Specification	1.00 - 3.00 ms	**0**	**0**	**00000000**
	-	**If specification is not attained ⇒ Page 28-12 , evaluating display group 110**		

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

- Press → button.

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

28-12

Evaluating display group 110

Display group: 110		
Display field: 2 + 3	**Possible malfunction cause**	**Malfunction elimination**
More than 25	♦ Ignition coil faulty ♦ Ignition wire faulty ♦ Spark plug faulty	- Check ignition coil ⇒ Page 28-27 - Check ignition system components ⇒ Page 28-1
	♦ Fuel injector faulty ♦ Fuel shortage	- Check fuel injectors ⇒ Page 24-115 - Check amount of fuel in tank

28-13

Ignition timing control, checking

Special tools, testers and auxiliary items

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

Test conditions

- Electrical consumers switched off (radiator coolant fan must not run during the check)
- Air conditioner switched off
- Engine oil temperature at least 80 °C (176 °F)

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" with address word 01 ⇒ Page 01-7 .

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

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

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

- Press buttons -0-, -1- and -0- to input display group 010 and press -Q- button to confirm input.

28-14

Read Measuring Value Block 10 →

1 2 3 4

Indicated on display (1-4 = display fields)

- Check the ignition timing control specifications (display fields 1-4).

	Display fields			
	1	2	3	4
Display group 010: Ignition 1				
Display	**xxx RPM**	**xx.x ms**	**xx.x ∠°**	**xx.x ∠°**
Indicated	**Engine speed**	**Engine load**	**Ignition angle (mapped value)**	**Ignition angle**
Working range	**650 - 6000 RPM**	**0.0 - 25.0 ms**	**0.0 - 40.0 ∠° BTDC**	**0.0 - 40.0 ∠° BTDC**
Specification	**650 - 750 RPM**	**1.9 - 2.1 ms**	**11.0 - 13.0 ∠° BTDC**	**Max. ±2.0 ∠° deviation from display field 3**
	2480 - 2520 RPM	**1.7 - 1.9 ms**	**23.0 - 25.0 ∠° BTDC**	**Max. ±2.0 ∠° deviation from display field 3**
	-	**-**	**Test condition:** ♦ Intake air temperature max. 50° C **If the specification is not attained ⇒ Page 28-15 , continuation**	

28-15

Continuation

- Checking operating modes ⇒ Page 24-60 .
- Checking throttle valve control module ⇒ Page 24-68 .
- Checking Knock Sensor (KS) and knock control ⇒ Page 28-19 .

If the specification is still not attained:

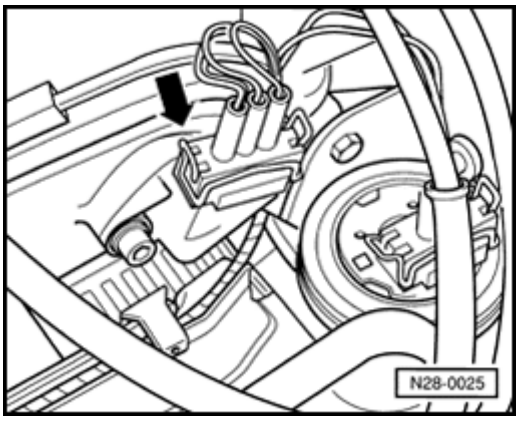
- Replace Engine Control Module (ECM) -J220- ⇒ Page 24-6 , item 3 .
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

Camshaft Position (CMP) sensor, checking

Special tools, testers and auxiliary items

- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test sequence

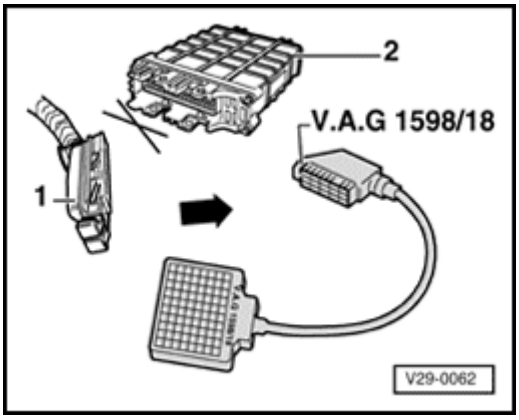


- Disconnect 3-pin connector from camshaft position sensor.
- Connect multimeter using test leads from VW 1594 to measure voltage at terminals 1 and 3.
- Switch ignition on.
- Measure voltage between terminals 1 and 3:

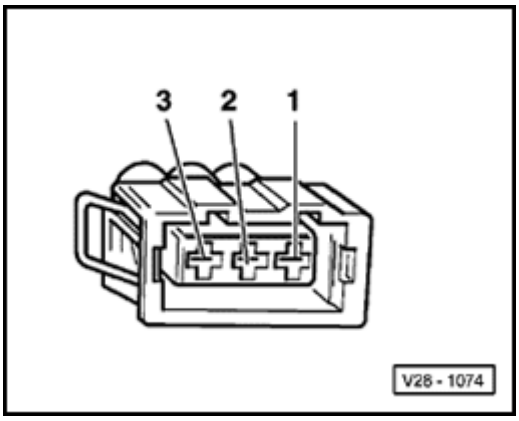
  Specification: 9-14.5 volts
- Switch ignition off.

28-17

If the specification is not attained:



- Connect VAG 1598/18 test box to Engine Control Module (ECM) wiring harness (arrow).



- Check wiring between test box and 3-pin connector for open circuit according to wiring diagram.
  - Terminal 2 and test box socket 44
  - Terminal 3 and test box socket 56

  Resistance: max. 1.5 ohms (Ω)
- Check wiring between 3-pin connector and relay panel for open circuit according to wiring diagram.
  - Terminal 1 and relay panel

  Resistance: max. 1.5 ohms (Ω)

28-18

- Additionally, check wires for short to one another:

  - Terminal 3 and test box socket 44
  - Terminal 2 and test box socket 56

  Specification: ∞ ohms (Ω)

If no wiring malfunction is detected and voltage was present between terminals 1 and 3:

- Replace distributor with Camshaft Position (CMP) sensor -G40- ⇒ Page 24-6 , item 3 .

If no wiring malfunction is detected and no voltage was present between terminals 1 and 3:

- Replace ECM -J220- ⇒ Page 24-6 , item 3 .
- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

28-19

Knock Sensor (KS) and knock control, checking

Special tools, testers and auxiliary items

- VAG 1551/1552 scan tool with VAG 1551/3 adapter cable
- VAG 1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- Connector test kit VW 1594
- Wiring diagram

Test sequence

- Engine running at idle

- Connect VAG 1551/1552 scan tool and select "Engine Electronics" with address word 01 ⇒ Page 01-7 .

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

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

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

- Press buttons -0-, -4- and -5- to input display group 045 (cylinders 1-4), or press buttons -0-, -4- and -6- to input display group 046 (cylinders 5 and 6), and press -Q- button to confirm input.

Read Measuring Value Block 45 →

1 2 3 4

Indicated on display (1-4 = display fields)

Note:

The check must be carried out during a test drive as the knock control is only active with an engine load exceeding 3 ms.

- Carry out a test drive and observe the knock control specifications on display (second technician necessary).

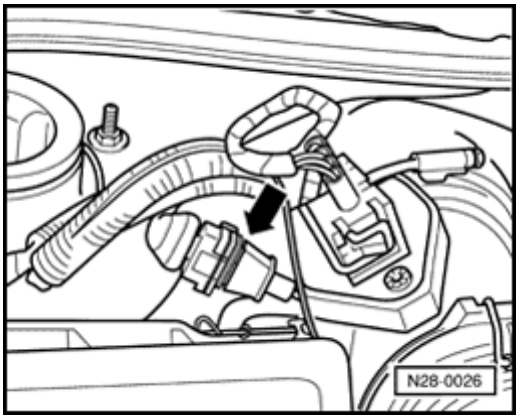
	Display fields			
	1	2	3	4
Display group 045: Knock control				
Display	**xx.xx ∠ °**	**xx.xx ∠ °**	**xx.xx ∠ °**	**xx.xx ∠ °**
Indicated	**Ignition angle correction cylinder 1**	**Ignition angle correction cylinder 2**	**Ignition angle correction cylinder 3**	**Ignition angle correction cylinder 4**
Working range	**0.0 - 15.0∠ °**	**0.0 - 15.0∠ °**	**0.0 - 15.0∠ °**	**0.0 - 15.0∠ °**
Specification	**0.0 - 12.0∠ °**	**0.0 - 12.0∠ °**	**0.0 - 12.0∠ °**	**0.0 - 12.0∠ °**
	If specification is not attained ⇒ Page 28-21 , evaluating display group 045 and 046			

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.
- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06 and press -Q- button to confirm input.

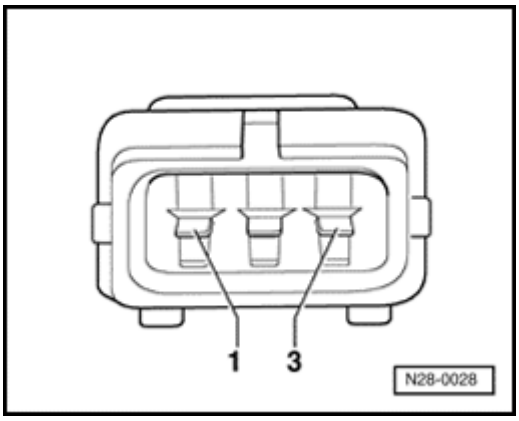
Evaluating display group 045 and 046

Display group: 045 **Display field: 1-4**	**Possible malfunction cause**	**Malfunction elimination**
Display group: 046 **Display field: 1-2**		
All cylinders more than 12 ∠ °	♦ Knock Sensor (KS) faulty	- Continuation ⇒ Page 28-22
	♦ Connector corroded	
	♦ Knock sensor not correctly torqued	- Loosen knock sensor and torqued to 20 Nm (15 ft lb)
	♦ Attached components on engine loose	- Tighten attached components
	♦ Poor fuel quality	- Change type of fuel
One cylinder deviates greatly from the others	♦ Connector corroded	- Continued ⇒ Page 28-22
	♦ Engine damage	- Check compression pressure: ⇒ *Repair Manual, 2.8 Liter VR6 2V Engine Mechanical, Engine Code(s): AAA, Repair Group 13*
	♦ Attached components on engine loose	- Tighten attached components

Continuation



- Separate white 3-pin connector to Knock Sensor (KS) 1 -G61- (arrow).



- Measure resistance between terminals 1 and 2, 1 and 3 and 2 and 3 on KS connector.

  Specification: ∞ ohms (Ω)

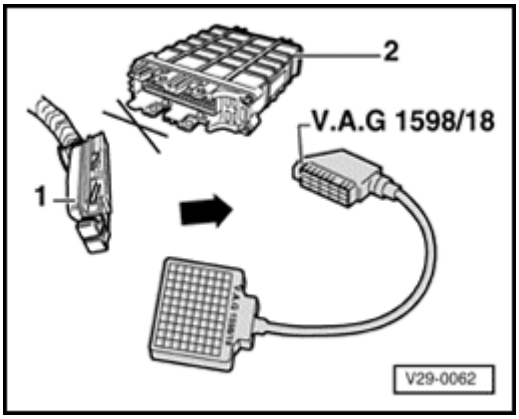
28-23

Additionally, check wires for short to one another.

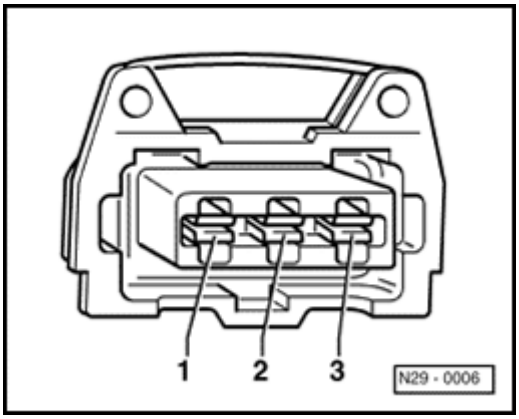
Terminal 3 and test box socket 34

Terminal 3 and test box socket 33

Terminal 2 and test box socket 34



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).



- Check wiring between test box and white 3-pin connector for open circuit according to wiring diagram.

Terminal 1 and test box socket 34

Terminal 2 and test box socket 33

Terminal 3 and test box socket 56

Resistance: max. 1.5 ohms (Ω)

Specification: ∞ ohms (Ω)

28-24

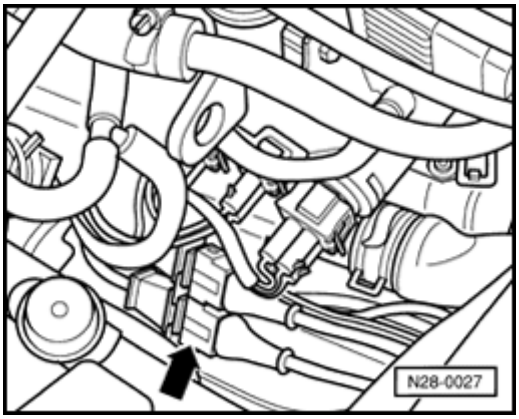
If no wiring malfunction is detected:

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

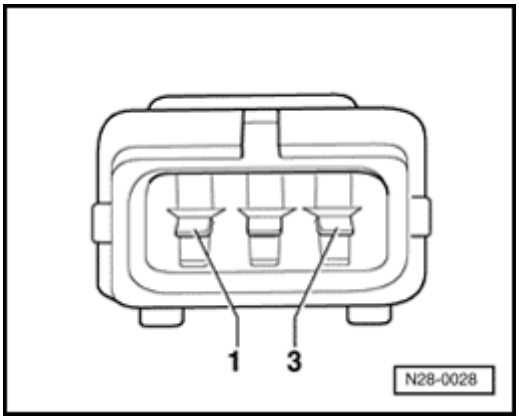
If the malfunction is still present (malfunction again in DTC memory):

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

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.



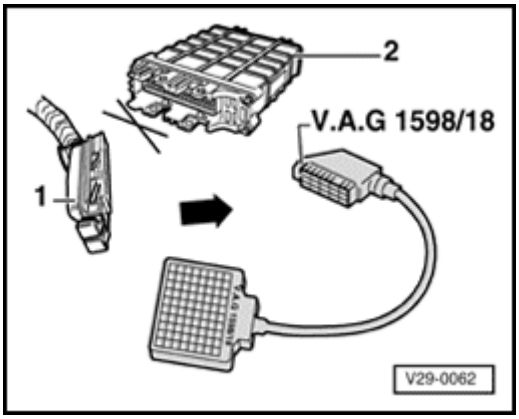
- Separate black 3-pin connector to Knock Sensor (KS) 2 -G66- (arrow).



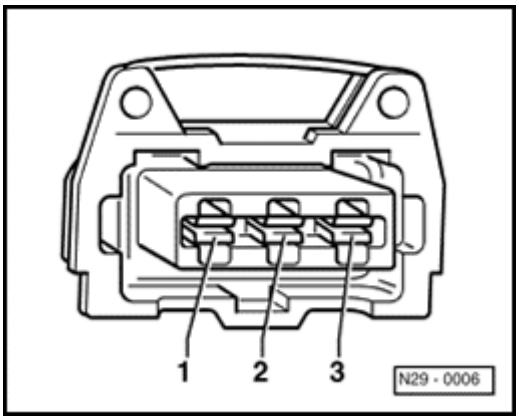
- Measure resistance between terminals 1 and 2, 1 and 3 and 2 and 3 on KS connector.

  Specification: ∞ ohms (Ω)

28-25



- Connect VAG 1598/18 test box to ECM wiring harness (arrow).



- Check wiring between test box and black 3-pin connector for open circuit according to wiring diagram.

Terminal 1 and test box socket 57

- Terminal 2 and test box socket 33
- Terminal 3 and test box socket 56

Resistance: max. 1.5 ohms (Ω)

- Additionally, check wires for short to one another.

Terminal 3 and test box socket 57

- Terminal 3 and test box socket 33
- Terminal 2 and test box socket 57

Specification: ∞ ohms (Ω)

If no wiring malfunction is detected:

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

If the malfunction is still present (malfunction again in DTC memory):

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

- Read the readiness code ⇒ Page 01-31 . If DTC memory has been erased, verify repair via appropriate display group ⇒ Page 01-33 , Readiness code, creating.

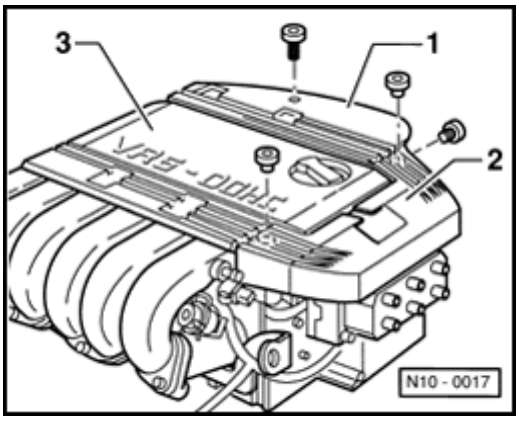
28-27

Ignition coil, checking

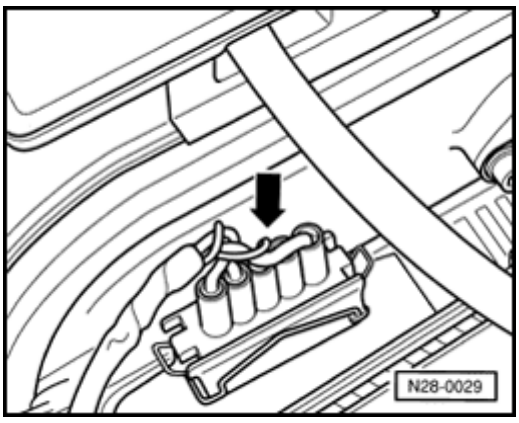
Special tools, testers and auxiliary items

- Multimeter (Fluke 83 or equivalent)
- VAG 1527B voltage tester
- Connector test kit VW 1594

Test sequence



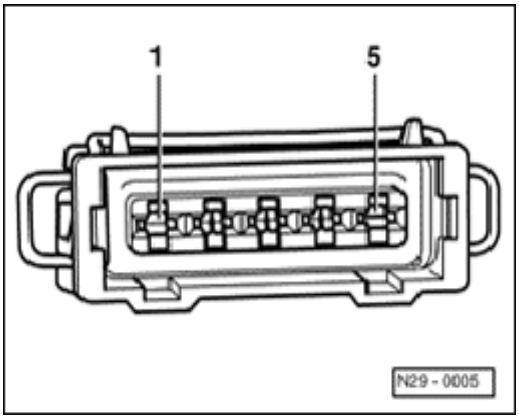
- Disconnect ignition wires at ignition coil and remove wire guide -2-.



Checking voltage supply

- Disconnect 5-pin connector at ignition coil -N152- (arrow).

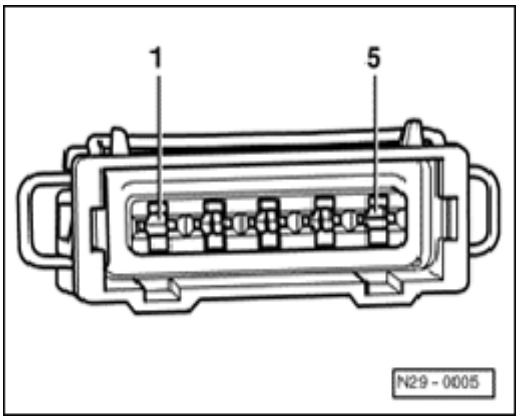
28-28



- Connect multimeter using test leads from VW 1594 to measure voltage at connector terminals 1 and 5.
- Switch ignition on.
- Measure voltage between terminals1 and 5.

  Specification: 9-14.5 volts
- Switch ignition off.

If the specification is not attained:

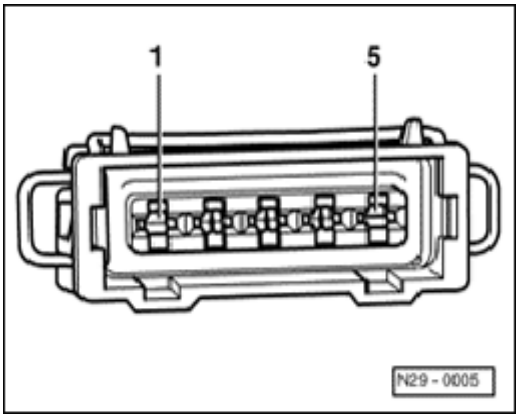


- Check wiring between 5-pin connector terminal 1 and Ground (GND) according to wiring diagram.

  Resistance max. 1.5 ohms (Ω)
- Check wiring between 5-pin connector terminal 5 and relay panel for open circuit according to wiring diagram.

  Resistance: max. 1.5 ohms (Ω)

28-29



Checking activation

- Remove fuse 18.

WARNING!

During the following test do not touch the terminals of the ignition coil or test leads.

- Switch ignition off.

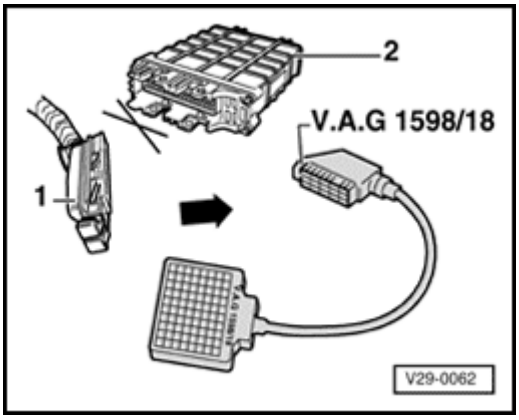
- Connect VAG 1527B voltage tester with test leads from VW 1594 to terminals of disconnected 5-pin connector.
  - Terminals 5 and 2 (ignition output 1)
  - Terminals 5 and 3 (ignition output 3)
  - Terminals 5 and 4 (ignition output 2)
- Operate starter and check ignition signal from Engine Control Module (ECM).
  - LED must flicker
- Switch ignition off.

If the LED does NOT flicker:

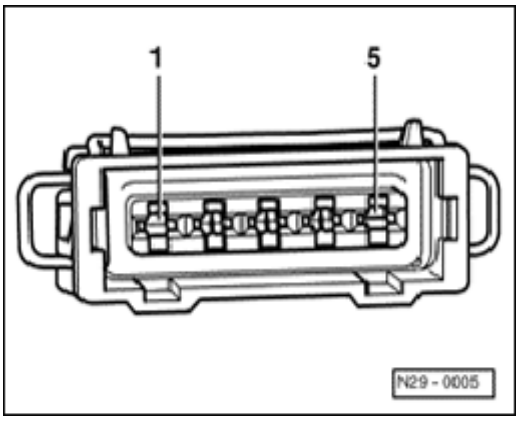
- Replace ECM -J220- ⇒ Page 24-6 .

28-30

If LED flickers:



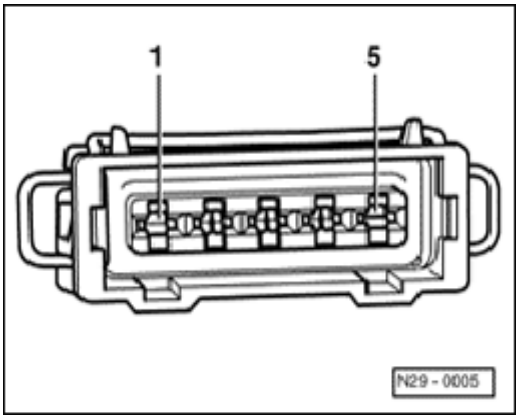
- Connect VAG 1598/18 test box to ECM wiring harness (arrow).



- Check wiring between test box and 5-pin connector for open circuit according to wiring diagram.
  - Terminal 2 and test box test box socket 8
  - Terminal 3 and test box test box socket 60
  - Terminal 4 and test box test box socket 52

  Resistance: max. 1.5 ohms (Ω)

28-31



- Additionally check wiring for short to one another.
  - Terminal 2 and test box test box socket 60
  - Terminal 2 and test box test box socket 52
  - Terminal 3 and test box test box socket 52

  Specification: ∞ ohms (Ω)

If no wiring malfunction is detected and voltage was present between terminals 1 and 5:

- Replace ignition coil -N152-.