01-1

Motronic system, On Board Diagnostic (OBD)

On Board Diagnostic, technical data

Equipment

The advantages of OBD can only be fully exploited by using the vehicle diagnostic, testing and information system VAS5051 or the VAG1551 scan tool, in operating mode 1 "Rapid data transfer."

The DTC memory is equipped with a permanent memory and therefore does not depend on the power supply.

The stored malfunctions will be displayed after checking the DTC memory ⇒ Page 01-15 .

After eliminating malfunctions the DTC memory must be erased ⇒ Page 01-15 .

Important note:

- Every time the DTC memory is erased and the voltage supply to the Motronic Engine Control Module (ECM) -J220 has been interrupted the readiness code must be generated ⇒ Page 01-105 .

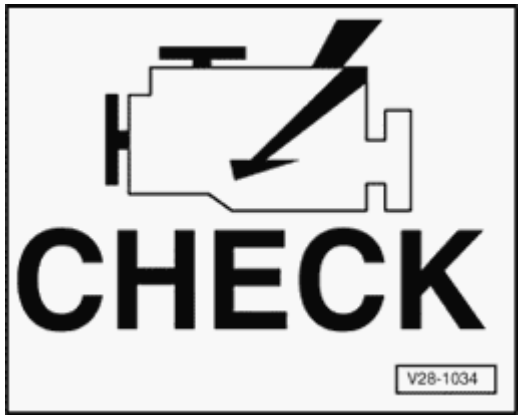
- The Exhaust Malfunction Indicator Light (MIL) in the instrument cluster will be switched on if the engine control module recognizes malfunctions which have an affect (decrease emissions) on exhaust emissions ⇒ Page 01-3 .

- Malfunctions relating to the electronic throttle are also indicated by a Electronic Power Control (EPC) warning light in the instrument cluster.

01-3

Exhaust Malfunction Indicator Light (MIL), significance

If the Engine Control Module (ECM) recognizes emission related malfunctions, this is indicates by the MIL coming on.



Component location of MIL

Note:

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

If the MIL starts to blink, there is a malfunction that can lead to damage of the Three Way Catalytic Converter (TWC). In this case driving should be only continue with reduced power until the MIL goes out or stays on continuously.

Continuos MIL

If the MIL lights continuously, there is malfunction that affects exhaust emissions. In this case the DTC memory of the ECM and Transmission Control Module (TCM) (if equipped) must be checked.

Some malfunctions may occur without causing the MIL to come on. When driveability or performance problems are reported and there is no indication from the MIL, the operation of the MIL must be checked. In addition, the DTC memory of the ECM and TCM must be checked, as there may be malfunctions stored that do not switch the MIL on immediately.

01-4

Checking function

- Switch ignition on.

  - The MIL must light up

If the MIL does not light with ignition switched:

Cause:	Corrective action:
MIL is not activated or does not light up because of an open circuit.	- Switch ignition off - Connect VAG1598/31 test box ⇒ Page 24-20 - Bridge sockets 2 and 47 on test box - Switch ignition on. The MIL should light up. If the MIL does not light up: - Switch ignition off. - Check whether lamp is burned out and test voltage supply to lamp wiring diagram. If the lamp and the voltage

	supply are OK: - Check for open circuit or short circuit in wiring between engine control module and MIL using wiring diagram. Determine and eliminate malfunction.
	If there are no malfunctions in the wiring to the MIL:
Malfunction cause:	Engine control module (ECM) faulty ⇒Replace Engine Control Module (ECM) ⇒ Page 24-24 .

01-5

If MIL remains lit for more than 3 seconds (i.e. continuously) when ignition is on, proceed with test as follows:

- Start engine and allow it to run at idling speed.

  Specification: MIL should go out.

If the MIL does not go out:

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

If no DTCs are stored:

Cause:	Corrective action:
MIL is activated via short circuit to Ground (GND).	- Switch ignition off - Connect VAG1598/31 test box . Do not connect engine control module. - Measure resistance between vehicle Ground and socket 47 on test box. Specification: infinity (because the wire should not have any direct Ground connection) If the specification is not

	reached: - Determine and eliminate short circuit to Ground in wiring between engine control module and MIL using wiring diagram.
	If there are no malfunctions in the wiring to the MIL:
Malfunction cause:	Engine control module (ECM) faulty ⇒Replace Engine Control Module (ECM) ⇒ Page 24-24 .

01-6

Available functions

The prerequisites for selecting the desired functions can be taken from the following table.

Address words and functions on VAG1551 scan tool		Ignition ON, engine not running	Engine idling	Vehicle being driven
Address words				
00	Automatic Test Sequence	yes	yes	yes
01	Engine Electronics	yes	yes	yes
Functions				
01	Check Control Module Version	yes	yes	yes
02	Check DTC Memory	yes	yes	yes
03	Output Diagnostic Test Mode (DTM)	yes	no	no
04	Basic setting	yes	yes	yes
05	Erase DTC Memory	yes	yes	yes
06	End Output	yes	yes	yes
07	Code Control Module	no	no	no
08	Read Measuring Value Block	yes	yes	yes

01-7

Mode under Address word 33:	
Mode 1: Transmit diagnostic data	Switch ignition on or let engine run at idle
Mode 2: Transmit operating conditions	Switch ignition on or let engine run at idle
Mode 3: Check DTC Memory	Switch ignition on or let engine run at idle
Mode 4: Erase diagnostic data	Switch ignition on or let engine run at idle
Mode 5: Output of oxygen sensor signals	Switch ignition on or let engine run at idle
Mode 6: Transmit measured values	Switch ignition on or let engine run at idle
Mode 7: Check DTC Memory	Switch ignition on or let engine run at idle
Mode 8: Check tank leak test	Switch ignition on or let engine run at idle
Mode 9: Read out vehicle information	Let engine run at idle

Mode 1 to 9 can be selected under address word 33.

- Individual measured values can be read out under mode 1. Mode 1 is not recommended for authorized Audi service centers, since the data can be obtained much more accurately under address word 01 function 04 or function 08.
- Mode 2 displays operating conditions, for which malfunctions are recognized.
- With mode 3 the DTC memory will be checked and with mode 4 the DTC memory will be erased.

- Mode 5 displays the static dimensions of the oxygen sensors, which are legally required. Since these dimensions are not directly relevant to oxygen sensor diagnostics, mode 5 is insignificant for the authorized Audi center.
- With mode 6 all measured values can be checked from components and systems that are not constantly monitored.
- Using mode 7, DTCs can be checked for which the Malfunction Indicator Light (MIL) is not yet lit (MIL is not on, no DTCs under mode 3).
- Under mode 8 the tank leak test will be checked.
- With mode 9 the following vehicle information can be read out: Vehicle Identification Number (VIN), Part number and program/data level of the engine control module and the check sum (this value is a internal calculated value).

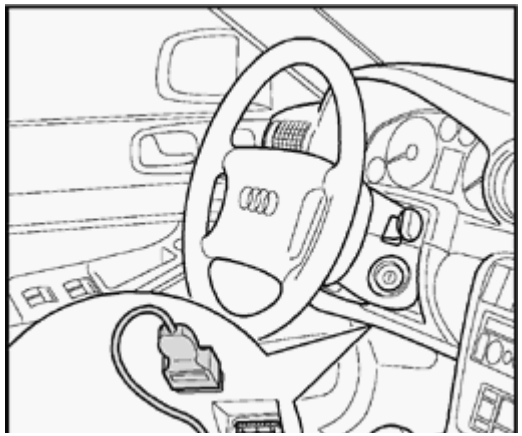
01-9

Vehicle diagnostic, testing and information system VAS5051 or VAG1551, connecting and selecting functions

Requirements

- Fuses for engine electronics OK
- Fuel pump relay OK
- Battery voltage at least 11 V
- Ground (GND) connection for engine and transmission OK

- Switch ignition off.



- Connect vehicle diagnostic, testing and information system VAS5051 with VAS5051/1 diagnostic cable. As an alternative, connect VAG1551 scan tool with VAG1551/3B diagnostic cable.

Note:

The Data Link Connector (DLC) is located below the dash, to the left of the steering column.

01-10

WARNING!

- ***When performing a road test and checks, the vehicle diagnostic, testing and information system VAS5051 as well as the VAG1551 may be secured only on rear seat, from where it is to be operated by a second technician.***

- ***Please follow safety precautions*** ⇒ ***Page 24-1***

Note:

Only the procedure for OBD VAG1551 is described below. For details of how to use the vehicle diagnostic, testing and information system VAS5051, please refer to its operating manual.

VAG - On Board Diagnostic HELP **1 - Rapid data transfer*** **2 - Blink code output***	Indicated on display * Appears alternately

01-11

- If no display appears, check diagnostic cables:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

Depending on the function required:

- Switch ignition on.

  or

  Start engine ⇒ Page 01-6 , table of available functions.

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

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

Rapid data transfer **HELP**	Indicated on display:
Insert address word XX	
Rapid data transfer **Q**	- Press buttons -0- and -1- to insert "Engine electronics" address word 01.
01 - Engine Electronics	

- Press -Q- button to confirm input.

01-12

Rapid data transfer	**HELP**
Control module does not answer	

If the display shows one of the messages reproduced here, run through the troubleshooting procedure as described in the Electrical Wiring Diagrams, Troubleshooting and Component Location binder.

⇒Electrical Wiring Diagrams, Troubleshooting and Component Locations

Rapid data transfer	**HELP**
K wire not switching to Ground	

Rapid data transfer	**HELP**
K wire not switching to B+	

01-13

Control module identification (example)



The display on VAG1551 will show the control module identification, for example:

4D0907551...	Engine Control Module (ECM) Part No.
2.7 L	Engine displacement
V6 / 5VT	Engine configuration
	(V6 5-valve Turbo[1])
♦ G or no display	"G" for vehicles with Cruise control system or not
♦ 0002	ECM Software version
♦ Coding 06711	Coding of ECM
♦ WSC 06388	Dealership code of VAG1551 with which the last coding was performed

[1)] The engine is a so called Biturbo engine, that means the engine is equipped with two turbo chargers. "Bi" (latin) stand for two.

01-14

If the coding differs from the vehicle version, then:

- Check coding of engine control module ⇒ Page 01-93 , Coding engine control module.

- Press →button.

Rapid data transfer	**HELP**
Select function XX	

Indicated on display:

Note:

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

01-15

Diagnostic Trouble Code (DTC) Memory, checking and erasing

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select "Engine Electronics" by entering address word 01 ⇒ Page 01-9 . When doing this the engine must be idling.

Only if engine does not start:

- Check engine with ignition switched on.

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

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Operate scan tool according to information on display:
- Press buttons -0- and -2- to select function "Check DTC Memory" and confirm entry with -Q- button.

01-16

No DTC recognized

➢ Indicated on display

- Press → button.

or

X DTC recognized

➢ Indicated on display

The stored malfunctions will be displayed and printed out in sequence.

- Locate and eliminate printed out malfunctions according to DTC table ⇒ Page 01-19 .

Note:

- *If no malfunction is stored in the DTC memory, do not erase memory, otherwise readiness code must be generated.*
- *If the DTC memory was erased, generate readiness code ⇒ Page 01-105 .*

- Press → button.

Rapid data transfer HELP

Select function XX

Indicated on display:

- Press buttons -0- and -5- to select function "DTC Memory" and confirm entry with -Q- button.

Notes:

Attention!

DTC memory was not checked

Indicated on display:

Test sequence has not been followed.

- Check DTC memory.

Under the following conditions the DTC memory will not be erased:

- *If Ignition was switched off after DTC memory has been checked.*
- *A static malfunction has not been eliminated.*

01-18

Rapid data transfer →

DTC Memory is erased!

Indicated on display:

- Press →button.
- After repairs, check DTC memory again.

Note:

During testing and repair work, malfunctions can be recognized from other control modules (e.g. disconnected harness connectors). Therefore on completion, the DTC memories of all control modules must be checked and erased.

End output

Rapid data transfer **HELP**

Select function XX

Indicated on display:

- Press buttons -0- and -6- to select function "End Output" and confirm entry with -Q- button.

Rapid data transfer **HELP**

Insert address word XX

Indicated on display:

- Switch ignition off and disconnect diagnostic connector.

01-19

Diagnostic Trouble Code (DTC) table

Notes:

- *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. Notes on Engine Power Control (EPC) (drive by wire)* ⇒ *Page 24-139* .
- *Malfunctions relating to the electronic throttle are also indicated by the EPC (Electronic Power Control) warning light in the instrument cluster.*
- *Malfunction which decrease exhaust emissions are indicated by an Exhaust Malfunction Indicator Light (MIL), the MIL is located in the instrument cluster. As soon as certain malfunction are recognized, the MIL is switched on immediately. There are also malfunctions, were the MIL is switched on only after the engine is started again.*
- *Sporadically occurring malfunctions (temporary malfunctions) will be indicated on the VAG1551 display as "SP."*
- *The DTC table is arranged according to the 5-digit DTC in the left-hand column.*
- *If a malfunction is stored in the DTC memory and then does not occur again during the next 40 engine warm-up phases, the DTC will be automatically erased.*
- *Components that are indicated as being faulty by the VAG1551 should not be replaced immediately. Always start by checking the wiring, connectors and Ground (GND) connections for the component using the current wiring diagram. This is particularly important in the case of sporadic malfunctions (indicated by the letters "SP"on the scan tool display).*
- *If the connector for the engine control module is disconnected or if the battery is disconnected, all the learned values (adaptation values) stored in the control module will be erased, although the contents of the DTC memory will remain intact. The next time the engine is started the idling may be rough at first. In this case let the engine run at idle for a few*

minutes until the adaptation is fully carried out.

- *After erasing the DTC memory ⇒ Page 01-15 , generate readiness code ⇒ Page 01-105 .*

01-20

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0101	16485	Mass Air Flow (MAF) sensor -G70- Implausible signal	- Check Mass Air Flow (MAF) sensor ⇒ Page 24-59
P0102	16486	Mass or Volume Air Flow Circuit Low input 2)	- Check Mass Air Flow (MAF) sensor -G70 ⇒ Page 24-59
P0103	16487	Mass or Volume Air Flow Circuit High Input 2)	
P0106	16490	Manifold Abs.Pressure or Bar. Pressure Range/Performance 2) 4)	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Repair Group 21; Turbocharger; Checking Charge Air Pressure Sensor -G31*

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

4) Absolute manifold pressure will be determined by the Charge Air Pressure Sensor -G31 (instead of displayed -G71), the air pressure is determined by the Barometric Pressure (BARO) Sensor -F96 (in Engine Control Module (ECM))

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0112	16496	Intake Air Temp. Circ. Low Input[2)]	- Check Intake Air Temperature (IAT) sensor ⇒ Page 28-17
P0113	16497	Intake Air Temp. High Input[2)]	
P0116	16500	Engine Coolant Temp. Circ. Range/Performance	- Check Engine Coolant Temperature (ECT) sensor ⇒ Page 28-25
P0117	16501	Engine Coolant Temp. Circ. Low Input [2)]	
P0118	16502	Engine Coolant Temp. Circ. High Input [2)]	

[2)] With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-22

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0130	16514	02 Sensor Circ., Bank1-Sensor1 Malfunction 2)	- Check oxygen sensor control or oxygen sensor heater and wiring ⇒ Page 24-79
P0131	16515	02 Sensor Circ., Bank1-Sensor1 Low Voltage 2)	
P0132	16516	02 Sensor Circ., Bank1-Sensor1 High Voltage 2)	
P0133	16517	02 Sensor Circ., Bank1-Sensor1 Slow Response2)	
P0134	16518	02 Sensor Circ., Bank1-Sensor1 No Activity Detected2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-23

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0136	16520	02 Sensor Circ., Bank1-Sensor2 Malfunction 2)	- Check oxygen sensor heater ⇒ Page 24-114 - Check oxygen sensor signal wire and activation ⇒ Page 24-122
P0137	16521	02 Sensor Circ., Bank1-Sensor2 Low Voltage 2)	
P0138	16522	02 Sensor Circ., Bank1-Sensor2 High Voltage2)	
P0139	16523	02 Sensor Circ., Bank1-Sensor2 Slow Response2)	- Check oxygen sensor and oxygen sensor control behind catalytic converter ⇒ Page 24-100
P0140	16524	02 Sensor Circ., Bank1-Sensor2 No Activity Detected 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-24

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0150	16534	02 Sensor Circ., Bank2-Sensor1 Malfunction 2)	- Check oxygen sensor control or oxygen sensor heater and wiring ⇒ Page 24-79
P0151	16535	02 Sensor Circ., Bank2-Sensor1 Low voltage 2)	
P0152	16536	02 Sensor Circ., Bank2-Sensor1 High Voltage 2)	
P0153	16537	02 Sensor Circ., Bank2-Sensor1 Slow Response 2)	
P0154	16538	02 Sensor Circ., Bank2-Sensor1 No Activity Detected 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-25

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0156	16540	02 Sensor Circ., Bank2-Sensor2 Malfunction 2)	- Check oxygen sensor heater ⇒ Page 24-114 - Check oxygen sensor signal wire and activation ⇒ Page 24-122
P0157	16541	02 Sensor Circ., Bank2-Sensor2 Low Voltage 2)	
P0158	16542	02 Sensor Circ., Bank2-Sensor2 High Voltage 2)	
P0159	16543	02 Sensor Circ., Bank2-Sensor2 Slow Response 2)	- Check oxygen sensor and oxygen sensor control behind catalytic converter ⇒ Page 24-100
P0160	16544	02 Sensor Circ., Bank2-Sensor2 No Activity Detected 2)	- Check oxygen sensor heater ⇒ Page 24-114

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-26

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0236	16620	Charge air pressure sensor -G31- Implausible signal	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 21; Boost pressure system with turbocharger; charge air pressure sensor -G31-, checking*
P0237	16621	Turbocharger Boost Sensor (A) Circ Low Input 2)	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Repair Group 21; Turbocharger; Checking Charge Air Pressure Sensor -G31*
P0238	16622	Turbocharger Boost Sensor (A) Circ High Input 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-27

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0300	16684	Random/Multiple Cylinder Misfire Detected[2)]	- Check cause for misfire ⇒ Page 28-52 - Check fuel tank level
P0301	16685	Cyl.1 Misfire Detected [2)]	
P0302	16686	Cyl.2 Misfire Detected [2)]	
P0303	16687	Cyl.3 Misfire Detected [2)]	
P0304	16688	Cyl.4 Misfire Detected [2)]	
P0305	16689	Cyl.5 Misfire Detected [2)]	
P0306	16690	Cyl.6 Misfire Detected [2)]	

[2)] With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

The Malfunction Indicator Light (MIL) will blink if the Engine Control Module (ECM) recognizes misfire that could damage the catalytic converters.

Notes:

- *On malfunction which could be caused by lack of fuel (e.g.: misfire) the malfunction P1250 "Fuel level too low" will be displayed in addition. That means, the misfiring was detected due to lack of fuel in the tank and not due to a technical malfunction.*

- *Depending on malfunction recognition, the MIL comes on immediately or after it has been confirmed.*

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0321	16705	Ign./Distributor Eng. Speed Inp. Circ. Range/Performance 2)	- Check Engine Speed Sensor ⇒ Page 28-21
P0322	16706	Ign./Distributor Eng. Speed Inp. Circ. No Signal 2)	
P0327	16711	Knock Sensor 1 Circ. Low Input	- Check Knock Sensor ⇒ Page 28-41
P0328	16712	Knock Sensor 1 Circ. High Input	
P0332	16716	Knock Sensor 2 Circ. Low Input	
P0333	16717	Knock Sensor 2 Circ. High Input	
P0341	16725	Camshaft Pos. Sensor Circ. Range/Performance 2)	- Check Camshaft Position Sensor ⇒ Page 28-45
P0346	16730	Camshaft Pos. Sensor Circ. 2 Range/Performance 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-29

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0421	16805	Warm Up Catalyst, Bank 1 Efficiency Below Threshold 2)	- Generate readiness code ⇒ Page 01-99 , if same DTC is displayed again, replace warm up catalytic converter bank 1 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Repair Group 26; Components of Exhaust system removing and installing, Catalytic converter removing and installing*
P0431	16815	Warm Up Catalyst, Bank 2 Efficiency Below Threshold 2)	- Generate readiness code ⇒ Page 01-99 , if same DTC is displayed again, replace warm up catalytic converter bank 1 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Repair Group 26; Components of Exhaust system removing and installing, Catalytic converter removing and installing*

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

Important note:

The warm up catalytic converters are located between the two oxygen sensors of the relevant cylinder bank. The warm up catalytic converters (little smaller than main catalytic converter) are located closer to the engine, not to be misunderstood with the main catalysts you see immediately once the vehicle is lifted.

DTC		Description of malfunction	Corrective action
P0441	16825	EVAP Emission Contr. Sys. Incorrect Purge Flow 2)	- Check EVAP canister purge regulator valve, perform output Diagnostic Test Mode (DTM) ⇒ Page 01-75
P0442	16826	EVAP Emission Contr. Sys. (Small Leak) Leak Detected 2)	- Check EVAP system and tank system for leaks ⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Components of EVAP system servicing, carry out tank leak test*
P0455	16839	EVAP Emission Contr. Sys. (Gross Leak) Leak Detected	
P0456	16840	Tank ventilation system Pin-hole leak detected	- Checking fuel supply and ventilation systems for leaks ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Repair Group 20; Fuel supply, gas engine; EVAP canister system components, servicing; tank leak diagnostic, performing.*

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-31

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0501	16885	Vehicle Speed Sensor Range/Performance 2)	- Check Vehicle Speed Signal (VSS) ⇒ Page 24-182
P0506	16890	Idle Control System RPM Lower than Expected2)	- Carry out adaptation of Throttle Valve Control Module ⇒ Page 24-146 - Check for unmetered (false) air ⇒ Page 24-76
P0507	16891	Idle Control System RPM Higher than Expected2)	
P0560	16944	System Voltage Malfunction	- Check control module voltage supply ⇒ Page 28-32
P0562	16946	System Voltage Low Voltage	
P0563	16947	System Voltage High Voltage	
P0571	16955	Cruise/Brake Switch (A) Circ. Incorrect Signal	- Check brake light switch and/or brake pedal switch ⇒ Page 24-185 ⇒ *Repair Manual, Electrical Equipment, Repair Group 01, On Board*

			Diagnostic for Cruise Control System

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-32

DTC		Description of malfunction	Corrective action
SAE	VAG		
P0601	16985	Internal Contr. Module Memory Check Sum Error[2)]	- Replace Engine Control Module (ECM) ⇒ Page 24-24
P0604	16988	Internal Contr. Module Random Access Memory (RAM) Error [2)]	
P0605	16989	Internal Contr. Module ROM Test Error [2)]	
P0606	16990	Control module faulty	- Replace Engine Control Module (ECM) ⇒ Page 24-24

[2)] With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-33

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1102	17510	O2 Sensor Heating Circ., Bank1-Sensor1 Short to B+ 2)	- Check oxygen sensor heater ⇒ Page 24-114
P1105	17513	O2 Sensor Heating Circ., Bank1-Sensor2 Short to B+ 2)	
P1107	17515	O2 Sensor Heating Circ., Bank2-Sensor1 Short to B+ 2)	
P1110	17518	O2 Sensor Heating Circ., Bank2-Sensor2 Short to B+ 2)	
P1111	17519	O2 Control (Bank 1) System too lean	- Check oxygen sensor adaptation values and oxygen sensor control ⇒ Page 24-86
P1112	17520	O2 Bank 1 System too rich	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-34

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1113	17521	Bank1-Sensor1 Internal Resistance too High 2)	- Check oxygen sensor heater ⇒ Page 24-114 - Check oxygen sensor signal wire and activation ⇒ Page 24-122
P1114	17522	Bank1-Sensor2 Internal Resistance too High 2)	
P1115	17523	O2 Sensor Heater Circ., Bank1-Sensor1 Short to Ground 2)	- Check oxygen sensor heater ⇒ Page 24-114
P1116	17524	O2 Sensor Heater Circ., Bank1-Sensor1 Open 2)	
P1117	17525	O2 Sensor Heater Circ., Bank1-Sensor2 Short to Ground 2)	
P1118	17526	O2 Sensor Heater Circ., Bank1-Sensor2 Open 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is

recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1119	17527	O2 Sensor Heater Circ., Bank2-Sensor1 Short to Ground 2)	- Check oxygen sensor heater ⇒ Page 24-114 .
P1120	17528	O2 Sensor Heater Circ., Bank2-Sensor1 Open 2)	
P1121	17529	O2 Sensor Heater Circ., Bank2-Sensor2 Short to Ground 2)	
P1122	17530	O2 Sensor Heater Circ., Bank2-Sensor2 Open 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-36

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1127	17535	Long Term Fuel Trim mult., Bank1 System too rich 2)	- Carry out road test (Fuel in engine oil) - Check fuel pressure ⇒ Page 24-33 - Check Mass Air Flow (MAF) Sensor ⇒ Page 24-59 - Check for unmetered (false) air ⇒ Page 24-76 - Check oxygen sensor before catalytic converter ⇒ Page 24-81 - Check oxygen sensor behind catalytic converter ⇒ Page 24-100 - Check fuel injectors ⇒ Page 24-43
P1128	17536	Long Term Fuel Trim mult., Bank1 System too lean 2)	
P1129	17537	Long Term Fuel Trim mult., Bank2 System too rich 2)	
P1130	17538	Long Term Fuel Trim mult., Bank2 System too lean 2)	
P1131	17539	Bank2-Sensor1 Internal Resistance too High 2)	- Check oxygen sensor heater ⇒ Page 24-114 . - Check oxygen sensor signal wire and activation ⇒ Page 24-122

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

Note:

mult. = multiplikative means that the malfunction affects the entire RPM and load range.

01-37

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1136	17544	Long Term Fuel Trim Add. Fuel, Bank1 System too Lean 2)	- Carry out road test (fuel in engine oil) - Check fuel pressure ⇒ Page 24-33 - Check Mass Air Flow (MAF) Sensor ⇒ Page 24-59 - Check oxygen sensor before catalytic converter ⇒ Page 24-81 - Check oxygen sensor behind catalytic converter ⇒ Page 24-100 - Check EVAP canister valve 1 ⇒ Page 24-134
P1137	17545	Long Term Fuel Trim Add. Fuel, Bank1 System too Rich 2)	
P1138	17546	Long Term Fuel Trim Add. Fuel, Bank2 System too Lean 2)	
P1139	17547	Long Term Fuel Trim Add. Fuel, Bank2 System too Rich 2)	
P1140	17548	Bank2-Sensor2 Internal Resistance too High 2)	- Check oxygen sensor heater ⇒ Page 24-114 . - Check oxygen sensor signal wire and activation ⇒ Page 24-122

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

Note:

add. = additive means that the malfunction in only at idle.

01-38

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1147	17555	O2 Control (Bank2) System too Lean	- Check oxygen sensor adaptation values and oxygen sensor control ⇒ Page 24-86
P1148	17556	O2 Control (Bank2) System too Rich	
P1149	17557	O2 Control (Bank1) Out of Range	- Check oxygen sensor adaptation values and oxygen sensor control ⇒ Page 24-86 - Check fuel pressure ⇒ Page 24-33 - Check for unmetered (false) air ⇒ Page 24-76
P1150	17558	O2 Control (Bank2) Out of Range	

01-39

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1171	17579	Throttle Actuation Potentiometer Signal 2 Range/Performance [1) 3)]	- Check throttle actuation potentiometer ⇒ Page 24-153 .
P1172	17580	Throttle Actuation Potentiometer Signal 2 Signal too Low [1) 3)]	
P1173	17581	Throttle Actuation Potentiometer Signal 2 Signal too High [1) 3)]	
P1176	17584	O2 Correction Behind Catalyst, B1 Limit Attained [2)]	- Check oxygen sensor aging of oxygen sensors before catalytic converters ⇒ Page 24-93
P1177	17585	O2 Correction Behind Catalyst, B2 Limit Attained [2)]	- Check oxygen sensors and oxygen sensor control behind catalytic converters ⇒ Page 24-100

[1)] With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM immediately after the malfunction has been recognized. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

[2)] With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

01-40

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1213	17621	Cyl. 1-Fuel Inj. Circ. Short to B+ 2)	- Check fuel injectors ⇒ Page 24-39
P1214	17622	Cyl. 2-Fuel Inj. Circ. Short to B+ 2)	
P1215	17623	Cyl. 3-Fuel Inj. Circ. Short to B+ 2)	
P1216	17624	Cyl. 4-Fuel Inj. Circ. Short to B+ 2)	
P1217	17625	Cyl. 5-Fuel Inj. Circ. Short to B+ 2)	
P1218	17626	Cyl. 6-Fuel Inj. Circ. Short to B+ 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-41

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1225	17633	Cyl. 1-Fuel Inj. Circ. Short to Ground 2)	- Check fuel injectors ⇒ Page 24-39
P1226	17634	Cyl. 2-Fuel Inj. Circ. Short to Ground 2)	
P1227	17635	Cyl. 3-Fuel Inj. Circ. Short to Ground 2)	
P1228	17636	Cyl. 4-Fuel Inj. Circ. Short to Ground 2)	
P1229	17637	Cyl. 5-Fuel Inj. Circ. Short to Ground 2)	
P1230	17638	Cyl. 6-Fuel Inj. Circ. Short to Ground 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-42

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1237	17645	Cyl. 1-Fuel Inj. Circ. Open Circ. 2)	- Check fuel injectors ⇒ Page 24-39
P1238	17646	Cyl. 2-Fuel Inj. Circ. Open Circ. 2)	
P1239	17647	Cyl. 3-Fuel Inj. Circ. Open Circ. 2)	
P1240	17648	Cyl. 4-Fuel Inj. Circ. Open Circ. 2)	
P1241	17649	Cyl. 5-Fuel Inj. Circ. Open Circ. 2)	
P1242	17650	Cyl. 6-Fuel Inj. Circ. Open Circ. 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-43

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1250	17658	Fuel Level Too Low [4]	- Fill fuel tank and erase DTC memory - Check DTC memory from instrument cluster. ⇒ *Repair Manual, Electrical Equipment, Repair Group 01*

[4] The malfunction "Fuel Level too Low" will be stored if the fuel level in the tank is or was too low. The malfunction remains as a static malfunction and will not be set a sporadic malfunction even if the customer fills the tank with fuel in the meantime. Therefore it is possible to recognize malfunctions which have been stored due to lack of fuel e.g.: misfiring or malfunction regarding oxygen sensor control.

01-44

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1287	17695	Turbocharger bypass valve Open	- Check recirculating valve for turbocharger -N249 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 21, checking Recirculating valve for turbocharger*
P1288	17696	Turbocharger bypass valve Short to B+	
P1289	17697	Turbocharger bypass valve Short to Ground	
P1296	17704	Cooling System Malfunction [2)]	- Check Engine Coolant Temperature (ECT) sensor ⇒ Page 28-25 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 19, Cooling, Components for cooling system, engine side*
P1297	17705	Charger/throtle-valve connection, Pressure loss	- Check hoses between turbocharger and throttle valve: ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 21; Turbocharger*

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

01-45

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1325	17733	Cyl.1-Knock Contr. Limit Attained	- Check Knock Control ⇒ Page 28-34
P1326	17734	Cyl.2-Knock Contr. Limit Attained	
P1327	17735	Cyl.3-Knock Contr. Limit Attained	
P1328	17736	Cyl.4-Knock Contr. Limit Attained	
P1329	17737	Cyl.5-Knock Contr. Limit Attained	
P1330	17738	Cyl.6-Knock Contr. Limit Attained	

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1335	17743	Engine Torque Monitoring 2 Control Limit Exceeded [1) 3)]	- Check hoses ⇒ Page 24-170 - Check Intake Air Temperature (IAT) sensor ⇒ Page 28-17 - Check Mass Air Flow (MAF) sensor ⇒ Page 24-59 - Check Engine Coolant Temperature (ECT) sensor ⇒ Page 28-25
P1336	17744	Engine Torque Monitoring Adaptation at limit	- Check hoses ⇒ Page 24-170 - Check Intake Air Temperature (IAT) sensor ⇒ Page 28-17 - Check Mass Air Flow (MAF) sensor ⇒ Page 24-59 - Check Engine Coolant Temperature (ECT) sensor ⇒ Page 28-25

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immidiately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1337	17745	Camshaft Pos. Sensor, Bank1 Short to Ground 2)	- Check Camshaft Position (CMP) sensor ⇒ Page 28-45
P1338	17746	Camshaft Pos. Sensor, Bank1 Open Circ./Short to B+ 2)	
P1340	17748	Crankshaft Pos./Engine Speed Sensor Out of Sequence 2)	- Check phase position of Camshaft Position (CMP) sensor ⇒ Page 28-45
P1347	17755	Bank2, Crankshaft-/Camshaft os.Sens.Sign. Out of Sequence 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

Note:

DTC -17748- (Crankshaft Pos./Engine Speed Sensor) indicates -G163.

01-48

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1355	17763	Cyl. 1, ignition circuit Open Circuit 2)	- Check activation of power output stages ⇒ Page 28-11
P1356	17764	Cyl. 1, ignition circuit Short to B+ 2)	
P1357	17765	Cyl. 1, ignition circuit Short to ground 2)	
P1358	17766	Cyl. 2, ignition circuit Open Circuit 2)	
P1359	17767	Cyl. 2, ignition circuit Short Circuit to B+ 2)	
P1360	17768	Cyl. 2, ignition circuit Short Circuit to ground 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1361	17769	Cyl. 3, ignition circuit Open Circuit 2)	- Check activation of power output stages ⇒ Page 28-11
P1362	17770	Cyl. 3, ignition circuit Short to B+ 2)	
P1363	17771	Cyl. 3, ignition circuit Short to ground 2)	
P1364	17772	Cyl. 4, ignition circuit Open Circuit 2)	
P1365	17773	Cyl. 4, ignition circuit Short Circuit to B+ 2)	
P1366	17774	Cyl. 4, ignition circuit Short Circuit to ground 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1367	17775	Cyl. 5, ignition circuit Open Circuit 2)	- Check activation of power output stages ⇒ Page 28-11
P1368	17776	Cyl. 5, ignition circuit Short to B+ 2)	
P1369	17777	Cyl. 5, ignition circuit Short to ground 2)	
P1370	17778	Cyl. 6, ignition circuit Open Circuit 2)	
P1371	17779	Cyl. 6, ignition circuit Short Circuit to B+ 2)	
P1372	17780	Cyl. 6, ignition circuit Short Circuit to ground 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-51

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1386	17794	Internal Control Module Knock Control Circ.Error	- Replace Engine Control Module (ECM) ⇒ Page 24-24
P1387	17795	Internal Control Module Altitude Sensor Error 2)	
P1388	17796	Internal Control Module Drive by wire error 1) 3)	

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1391	17799	Camshaft Pos. Sensor, Bank2 Short to Ground 2)	- Check Camshaft Position (CMP) sensor ⇒ Page 28-45
P1392	17800	Camshaft Pos. Sensor, Bank2 Open Circ./Short to B+ 2)	
P1410	17818	Tank Ventilation Valve Circ. Short to B+	- Check EVAP canister purge regulator valve ⇒ Page 24-134
P1411	17819	Sec. Air Inj.Sys.,Bank2 Flow too low 2)	- Check fuse for secondary air injection pump. - Check vacuum hoses - Check piping from pump to secondary air injection valve (Combi valve) ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Exhaust system, Secondary air injection system*
P1414	17822	Sec. Air Inj.Sys.,Bank2 Leak Detected 2)	- Check piping from pump to secondary air injection valve (combi valve) bank 2 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Exhaust system, Secondary air injection system*

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-53

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1420	17828	Sec. Air Inj. Valve Circ. Electrical Malfunction 2)	- Check Secondary Air Injection (AIR) Solenoid Valve -N112 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Exhaust system, Secondary air injection system, Checking Secondary Air Injection (AIR) Solenoid Valve -N112*
P1421	17829	Sec. Air Inj. Valve Circ. Short to Ground 2)	
P1422	17830	Sec. Air Inj. Valve Circ. Short to B+ 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-54

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1423	17831	Sec. Air Inj.Sys.,Bank1 Flow too low 2)	- Check fuse for secondary air injection pump - Check vacuum hoses - Check piping from pump to secondary air injection valve (Combi valve) ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Exhaust system, Secondary air injection system*
P1424	17832	Sec. Air Inj. Sys., Bank1 Leak Detected 2)	- Check piping from pump to secondary air injection valve (Combi valve) bank 1 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Exhaust system, Secondary air injection system*
P1425	17833	Tank Vent. Valve Short to Ground 2)	- Check EVAP canister valve 1 ⇒ Page 24-134
P1426	17834	Tank Vent. Valve Open 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1432	17840	Sec. Air Inj.Valve Open 2)	- Check Secondary Air Injection (AIR) Solenoid Valve -N112 ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Exhaust system, Secondary air injection system, Checking Secondary Air Injection (AIR) Solenoid Valve -N112*
P1433	17841	Sec. Air Inj. Sys. Pump Relay Circ. Open 2)	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Exhaust system, Secondary air injection system, Checking Secondary Air Injection (AIR) Pump Relay -J299*
P1434	17842	Sec. Air Inj. Sys. Pump Relay Circ. Short to B+ 2)	
P1435	17843	Sec. Air Inj. Sys. Pump Relay Circ. Short to Ground 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-56

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1453	17861	Exhaust gas temperature sensor 1 Open/short to B+	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB,Repair Group 26, Checking Sensor -1- for exhaust temperature*
P1454	17862	Exhaust gas temperature sensor 1 Short to ground	
P1455	17863	Exhaust gas temperature sensor 1 Range/performance	
P1456	17864	Exhaust gas temperature control bank 1 Limit attained	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB,Repair Group 26, Checking exhaust gas temperature control*
P1457	17865	Exhaust gas temperature sensor 2 Open/short to B+	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB,Repair Group 26, Checking Sensor -2- for exhaust temperature*
P1458	17866	Exhaust gas temperature sensor 2 Short to ground	
P1459	17867	Exhaust gas temperature	

		sensor 2 Range/performance	
P1460	17868	Exhaust gas temperature control bank 2 Limit attained	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB,Repair Group 26, Checking exhaust gas temperature control*

01-57

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1461	17869	Exhaust gas temperature control bank 1 Range/Performance	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Checking exhaust gas temperature control*
P1462	17870	Exhaust gas temperature control bank 2 Range/Performance	

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1470	17878	EVAP Emission Contr. LDP Circ Electrical Malfunction 2)	- Check Leak Detection Pump (LDP) ⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Components of EVAP system servicing, Checking Leak Detection Pump (LDP) -V144*
P1471	17879	EVAP Emission Contr. LDP Circ Short to B+ 2)	
P1472	17880	EVAP Emission Contr. LDP Circ Short to Ground 2)	
P1473	17881	EVAP Emission Contr. LDP Circ Open Circuit 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-59

DTC		Description of malfunction	Corrective
SAE	VAG		
P1475	17883	EVAP Emission Contr. LDP Circ Malfunction/Signal Circ. Open 2)	- Check hoses (pressure/vacuum) to leak detection pump - Check wiring to pump according to wiring diagram ⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Components of EVAP system servicing, Diagram of EVAP system*
P1476	17884	EVAP Emission Contr. LDP Circ Malfunction/Insufficient Vacuum 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-60

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1477	17885	EVAP Emission Contr. LDP Circ Malfunction 2)	- Check Leak Detection Pump (LDP) ⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Components of EVAP system servicing, Checking Leak Detection Pump (LDP) -V144*
P1478	17886	EVAP Emission Contr. LDP Circ Clamped Tube Detected 2)	- Check hoses (pressure/vacuum) to LDP. ⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Components of EVAP system servicing, Diagram of EVAP system*

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-61

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1500	17908	Fuel Pump Relay Circ. Electrical Malfunction 2)	- Check Fuel Pump (FP) relay ⇒ Page 24-33
P1501	17909	Fuel Pump Relay Circ. Short to ground 2)	
P1502	17910	Fuel Pump Relay Circ. Short to B+ 2)	

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-62

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1519	17927	Intake Camshaft Contr., Bank1 Malfunction 2)	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code (s): APB, Repair Group 15, Checking camshaft adjustment, Checking function of camshaft adjustment*
P1522	17930	Intake Camshaft Contr., Bank2 Malfunction 2)	
P1523	17931	Crash Signal from Airbag Control Unit Range/Performance	- Check Crash-Signal ⇒ Page 24-196

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-63

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1529	17937	Camshaft Control Circuit Short to B+ 2)	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 15, Checking camshaft adjustment, Checking solenoid valves for camshaft adjustment*
P1530	17938	Camshaft Control Circuit Short to Ground 2)	
P1531	17939	Camshaft Control Circuit Open 2)	
P1539	17947	Clutch pedal switch Range/Performance 2)	- Check Clutch Vacuum Vent Valve Switch ⇒ Page 24-191

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

01-64

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1542	17950	Throttle Actuation Potentiometer Range/Performance 1) 3)	- Check angle sensor for throttle drive ⇒ Page 24-153
P1543	17951	Throttle Actuation Potentiometer Signal too Low 1) 3)	
P1544	17952	Throttle Actuation Potentiometer Signal too High 1) 3)	- Check angle sensor for throttle drive ⇒ Page 24-153
P1545	17953	Throttle Pos. Contr. Malfunction 1) 3)	- Check throttle valve control module ⇒ Page 24-145
P1546	17954	Boost Pressure Contr.Valve Short to B+	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code (s): APB, Repair Group 21, Turbocharger system*
P1547	17955	Boost Pressure Contr.Valve Short to Ground	

P1548	17956	Boost Pressure Contr.Valve Open	

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM immediately after the malfunction has been recognized. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immidiately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

01-65

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1555	17963	Charge Pressure Upper Limit exceeded	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 21, Turbocharger system*
P1556	17964	Charge Pressure Contr. Negative Deviation	⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 21, Turbocharger system*
P1557	17965	Charge Pressure Contr. Positive Deviation	

01-66

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1558	17966	Throttle Actuator Electrical Malfunction 1)3)	- Check throttle valve control module ⇒ Page 24-145
P1559	17967	Idle Speed Contr. Throttle Pos. Adaptation Malfunction 2)	- Perform adaptation ⇒ Page 24-146
P1560	17968	Maximum Engine Speed Exceeded	- Repair mechanical damage
P1564	17972	Idle Speed Control Throttle Position Low Voltage During Adaptation	- Charge battery or repeat adaptation ⇒ Page 24-146
P1565	17973	Idle Speed Control Throttle Position Lower Limit not Attained 1) 3)	- Check throttle valve control module ⇒ Page 24-145
P1568	17976	Idle Speed Control Throttle Position Mechanical Malfunction 1) 3)	

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the

malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

01-67

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1569	17977	Cruise control switch Incorrect signal	- Check switch for Cruise Control System (CCS) ⇒ *Repair Manual, Electrical Equipment, Repair Group 01, On Board Diagnostic for CCS*
P1570	17978	Control Module Locked	- Perform adaptation for immobilizer to ECM ⇒ *Repair Manual, Electrical Equipment, Repair Group 01, On Board Diagnostic of immobilizer*
P1579	17987	Idle Speed Contr.Throttle Pos. Adaptation not started	- Perform adaptation of throttle valve control module while maintaining test requirements ⇒ Page 24-146
P1600	18008	Power Supply (B+) Terminal 15 Low Voltage	- Check voltage supply for Engine Control Module (ECM) ⇒ Page 28-32
P1602	18010	Power Supply (B+) Terminal 30 Low Voltage	

01-68

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1603	18011	Internal Control Module Malfunction 2)	- Replace Engine Control Module (ECM) ⇒ Page 24-24 .
P1604	18012	Internal Control Module Malfunction 1)3)	
P1606	18014	Rough Road Spec Engine Torque ABS-ECU Electrical Malfunction	- Check wire connection between ECM and ABS control module ⇒ Page 24-198 ⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*
P1609	18017	Crash shut-down activated	Accident with airbag triggered or a output Test Diagnostic Mode (TDM) has been carried out, therefore erase DTC Memory in ECM; Notes crash signal ⇒ Page 24-196
P1612	18020	Electronic Control Module 2) Incorrect Coding	- Check or code Engine Control Module (ECM) ⇒ Page 01-93

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

01-69

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1620	18028	Engine coolant temperature signal Open/short to B+	- Check coolant temperature signal ⇒ Page 24-181
P1621	18029	Engine coolant temperature signal Short to ground	
P1622	18030	Engine coolant temperature signal Range/Performance	

Note for malfunctions P1620, P1621 and P1622:

The Engine Control Module (ECM) receives the "Coolant temperature signal" from the instrument cluster. When the ECM receives this signal the boost pressure will be decreased.

01-70

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1624	18032	MIL Request Sign. active	Exhaust relevant malfunction from Transmission Control Module (TCM), MIL is switched on by TCM - Check DTC Memory of TCM ⇒ *Repair Manual, Automatic Transmission, Repair Group 01, Perform On Board Diagnostic*
P1626	18034	Data-Bus Powertrain [2)] Missing message from fuel injection pump	- Check CAN-Bus ⇒ Page 24-201

[2)] With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

Note for malfunction P1624:

- *MIL stands for Malfunction Indicator Light. Once the Engine Control Module (ECM) recognizes a malfunction that decreases the exhaust emissions it switches the MIL on.*
- *The MIL is switched on only by the Engine Control Module (ECM), since the ECM has the only connection to the MIL..*
- *Malfunction that decrease the exhaust emissions can also be recognized by the Transmission Control Module (TCM), These malfunction are also indicated by the MIL.*

- *Once the TCM recognizes a malfunction that decreases the exhaust emissions it sends a message to the ECM, the ECM then switches the MIL on. Parallel to this is the malfunction P1624 stored in the ECM noting that the MIL is switched on due to a transmission problem and not because of a engine problem.*

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1630	18038	Accelera. Pedal Pos. Sensor 1 Signal too Low 1) 3)	- Check acceleration pedal position sensor ⇒ Page 24-159
P1631	18039	Accelera. Pedal Pos. Sensor 1 Signal too High 1) 3)	
P1633	18041	Accelera. Pedal Pos. Sensor 2 Signal too Low 1) 3)	
P1634	18042	Accelera. Pedal Pos. Sensor 2 Signal too High 1) 3)	

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

01-72

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1639	18047	Accelera. Pedal Pos. Sensor1+2 Range/Performance 1) 3)	- Check acceleration pedal position sensor ⇒ Page 24-159
P1640	18048	Internal Control Module (EEPROM) Error 2)	- Replace Engine Control Module (ECM) ⇒ Page 24-24 .
P1648	18056	Data Bus Powertrain Malfunction	- Check data exchange between Engine-/ABS-/Transmission control module ⇒ Page 24-201
P1649	18057	Data Bus Powertrain Missing message from ABS Control Module	- Check DTC memory of ABS control module ⇒ *Repair Manual, Brake System On Board Diagnostic (OBD), Repair Group 01, checking DTC memory of ABS control module* - Check data exchange between Engine-/ABS-/Transmission control module ⇒ Page 24-201

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

3) With this malfunction the exhaust Malfunction Indicator Light (MIL) is switched on by the ECM, immediately after the malfunction has been recognized. Significance of MIL ⇒ Page 01-3 .

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1650	18058	Powertrain CAN-bus Missing message from instrument cluster	- Check data transfer ⇒ Page 24-201
P1654	18062	Check DTC memory of the instrument cluster	- Check DTC memory of instrument cluster and repair malfunctions
P1676	18084	Drive by Wire-MIL Circ. Electrical Malfunction 1)	- Significance of Electronic Power Control (EPC) warning light ⇒ Page 24-142
P1677	18085	Drive by Wire-MIL Circ. Short to B+ 1)	
P1690	18098	Malfunction Indication Light Malfunction 2)	- Check wiring for exhaust Malfunction Indicator Light (MIL) ⇒ Page 01-4
P1693	18101	Malfunction Indication Light Short circuit to B+ 2)	

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

Note:

The malfunction light for power acceleration -K132- is also called the EPC warning lamp.

DTC		Description of malfunction	Corrective action
SAE	VAG		
P1851	18259	Data Bus Powertrain Missing Message from Brake Contr	- Check DTC memory of ABS control module ⇒ *Repair Manual, Brake System On Board Diagnostic (OBD), Repair Group 01, checking DTC memory of ABS control module* - Check data exchange between Engine-/ABS-/Transmission control module ⇒ Page 24-201
P1853	18261	Data Bus Powertrain Unplausible Message from Brake Contr.	
P1854	18262	Data Bus Powertrain Hardware Defective	
P3262	19718	Exhaust bank 1/2 oxygen sensors behind catalytic converter mixed up	- Check harness connectors for oxygen sensors and check installed position of oxygen sensors behind catalytic converter.

1) With this malfunction the EPC (Electronic Power Control) Malfunction Indicator Light (MIL) in the instrument cluster is switched on by the ECM. Significance of EPC malfunction indicator light ⇒ Page 24-142 .

2) With this malfunction the exhaust Malfunction Indicator Light (MIL) is only switched on by the ECM, if the malfunction is recognized after the engine has been restarted. Significance of MIL ⇒ Page 01-3 .

Output Diagnostic Test Mode (DTM)

Notes:

- *The DTM can only be performed with the ignition switched on and the engine not running.*
- *The DTM is terminated if the engine is started or if an engine speed pulse is detected.*
- *During the DTM, individual control elements will be activated for approx. 1 minute, or until the test program is advanced to the next control element by pressing the → button.*
- *The control elements can be tested either by listening or by touching.*
- *If the DTM is to be repeated, the engine must be started. The engine control module needs to detect an engine speed of more than 300 rpm.*
- *The electric fuel pump runs continuously throughout the DTM.*

01-76

The DTM activates the following components in the stated sequence:

Activation sequence	
1.	EVAP Canister Purge Regulator Valve -N80-
2.	Secondary Air Injection (AIR) Solenoid Valve -N112- (This display appears only on vehicles with automatic transmission)
3.	Secondary Air Injection (AIR) Pump Relay -J299- (This display appears only on vehicles with automatic transmission)
4.	Wastegate Bypass Regulator Valve -N75
5.	Camshaft adjustment
6.	Leak Detection Pump for EVAP system
7.	Recirculating valve for turbocharger -N249
8.	Cylinder 1 Fuel Injector -N30
9.	Cylinder 4 Fuel Injector -N33
10.	Cylinder 3 Fuel Injector -N32
11.	Cylinder 6 Fuel Injector -N84
12.	Cylinder 2 Fuel Injector -N31

13.	Cylinder 5 Fuel Injector -N83

01-77

Test requirements

- Fuses for engine electronics OK
- Fuel pump relay OK

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the ignition must be switched on.

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

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

Rapid data transfer **Q** **03 - Output Diagnostic Test Mode**	Indicated on display

01-78

Actuating EVAP Canister Purge Regulator Valve -N80

- Confirm input with -Q- button.

Output Diagnostic Test Mode →

EVAP canister purge regulator valve -N80

Indicated on display

This solenoid valve will continue to be actuated (i.e. will click) until the → button is pressed to advance program to next control element.

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

- Check EVAP Canister Purge Regulator Valve -N80 ⇒ Page 24-134 .

Actuating Secondary Air Injection (AIR) Solenoid Valve -N112

Note:

Only vehicles with automatic transmission are equipped with a secondary air injection system. Vehicles with manual transmission do not have a secondary air injection system. For this reason are on vehicles with manual transmission the following components Secondary Air Injection (AIR) Solenoid Valve -N112 and Secondary Air Injection (AIR) Pump Relay -J299 not displayed.

- Press →button.

Output Diagnostic Test Mode →

Secondary Air (AIR) Injection valve -N112

< Indicated on display

This solenoid valve will continue to be actuated (i.e. will click) until the → button is pressed to advance the program to the next control element.

If the secondary air injection valve does not click:

- Check Secondary Air Injection (AIR) Solenoid Valve -N112

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Checking secondary air injection valve*

01-80

Actuating Secondary Air Injection (AIR) Pump Relay -J299

Note:

Only vehicles with automatic transmission are equipped with a secondary air injection system. Vehicles with manual transmission do not have a secondary air injection system. For this reason is on vehicles with manual transmission the following component Secondary Air Injection (AIR) Pump Relay -J299 not displayed.

- Press →button.

Output Diagnostic Test Mode →

Secondary air pump relay -J299

Indicated on display

The Secondary Air Injection (AIR) Pump Relay -J299- activates the Secondary Air Injection (AIR) Pump Motor -V101-, which runs for approx: 1 minute at intervals.

If the Secondary Air Injection (AIR) Pump Motor -V101- does not run at intervals:

- Check Secondary Air Injection (AIR) Pump Relay -J299.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26, Checking Secondary Air Injection (AIR) Pump Relay -J299*

01-81

Activating Wastegate Bypass Regulator Valve -N75-

- Press →button.

Output Diagnostic Test Mode →

Wastegate bypass regulator valve -N75

Indicated on display

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

If valve is not activated (does not click):

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 21, Turbocharger, Checking Wastgate Bypass Regulator Valve -N75*

Actuating camshaft adjustment valves -N205-, -N208-

- Press →button.

Output Diagnostic Test Mode →

Camshaft Adjustment

Indicated on display

- Camshaft adjustment valves 1 and 2 (-N205 and -N208) will continue to be activated (or will click) for about 1 minute.

If camshaft adjustment valve 1 or 2 is not activated:

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 15, Camshaft adjustment, checking camshaft adjustment valves*

01-82

Actuating Leak Detection Pump (LDP) -V144-

- Press →button.

Output Diagnostic Test Mode →

EVAP system leak detection pump

➢ Indicated on display

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

Note:

The clicking can be heard by listening in the area of the left rear wheel housing.

If valve is not actuated (does not click):

⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Components of EVAP system servicing, Checking Leak Detection Pump (LDP) -V144*

01-83

Activating Recirculating valve for turbocharger -N249

- Press →button.

Output Diagnostic Test Mode →

Recirculating valve for turbocharg -N249

Indicated on display

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

If valve is not activated (does not click):

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 21, Turbocharger, Checking Recirculating valve for turbocharger -N249*

Actuating fuel injectors

Note:

The fuel injectors are activated in firing order that means Cyl.1, Cyl.4, Cyl.3, Cyl.6, Cyl.2, Cyl,5

- Press →button.

Output Diagnostic Test Mode →

Cylinder 1 fuel injectors -N30

Indicated on display

- Press →button.

After pressing → button, fuel injector must click five times.

01-84

If the fuel injector does not click:

- Check fuel injectors ⇒ Page 24-39 .

- Press →button.

Output Diagnostic Test Mode →

Cylinder 4 fuel injectors -N33

Indicated on display

- Press →button.

Output Diagnostic Test Mode →

Cylinder 4 fuel injectors -N33

Indicated on display

After pressing arrow button, fuel injector must click five times.

If the fuel injector does not click:

- Check fuel injectors ⇒ Page 24-39 .

01-85

- Press →button.

Output Diagnostic Test Mode → Cylinder 3 fuel injectors -N32	⮜	Indicated on display

- Press →button.

Output Diagnostic Test Mode → Cylinder 3 fuel injectors -N32	⮜	Indicated on display

After pressing → button, fuel injector must click five times.

If the fuel injector does not click:

- Check fuel injectors ⇒ Page 24-39 .
- Press →button.

Output Diagnostic Test Mode → Cylinder 6 fuel injectors -N84	⮜	Indicated on display

- Press →button.

Output Diagnostic Test Mode → Cylinder 6 fuel injectors -N84	⮜	Indicated on display

After pressing → button, fuel injector must click five times.

If the fuel injector does not click:

- Check fuel injectors ⇒ Page 24-39 .
- Press →button.

01-86

Output Diagnostic Test Mode → **Cylinder 2 fuel injectors -N31**	⮜	Indicated on display - Press →button.
Output Diagnostic Test Mode → **Cylinder 2 fuel injectors -N31**	⮜	Indicated on display After pressing → button, fuel injector must click five times. If the fuel injector does not click: - Check fuel injectors ⇒ Page 24-39 . - Press →button.
Output Diagnostic Test Mode → **Cylinder 5 fuel injectors -N83**	⮜	Indicated on display - Press →button. After pressing → button, fuel injector must click five times.
Output Diagnostic Test Mode → **Cylinder 5 fuel injectors -N83**	⮜	Indicated on display If the fuel injector does not click: - Check fuel injectors ⇒ Page 24-39 . - Press →button.

01-87

Output Diagnostic Test Mode →	
END	

Indicated on display

- Press →button.

Rapid data transfer **HELP**	
Select function XX	

Indicated on display (function selection):

Note:

The output Diagnostic Test Mode (DTM) cannot be re-initiated until the engine is started and ignition switched off and then on again.

01-88

Basic setting

With the ignition on and engine not running, the following operation can be performed in the "Basic setting" mode (function 04):

- Adaptation of throttle valve control module to ECM ⇒ Page 24-146
- Vehicles with automatic transmission: Adaptation of kick down function of accelerator pedal position sensor to ECM ⇒Display group 63 (⇒ Page 24-166)

With the engine running, the following operations can be performed in the basic setting mode "Function 04":

- Learning process (adaptation) for oxygen sensor control ⇒ every display group
- Troubleshooting by targeted activation and deactivation of oxygen sensor control ⇒ display group 99 (Observe note on page ⇒ Page 24-81).

01-89

Test requirements for operations with engine running

- No DTCs stored in DTC memory
- Coolant temperature at least 85 ° C
- Electrical consumers switched off (radiator fan must not run during test)
- A/C switched off

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be idling.

- Check and erase DTC memory ⇒ Page 01-15 . There should be no malfunctions stored in the DTC memory. (If necessary repair malfunctions, erase DTC memory and switch off engine. Start engine again, road test the vehicle and check DTC memory again to check).

- Continue to run engine at idle.

Rapid data transfer	**HELP**
Select function XX	

< Indicated on display

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

System in Basic Setting
04 - Basic Setting

Indicated on display

- Confirm entry by pressing -Q- button.

System in Basic Setting
Input display group number XXX

Indicated on display

- Select required display group number from the Display Group Overview in "Read Measuring Value Block" section.

Note:

Display Group 000 is used here as an example to illustrate the procedure.

- Press buttons -0- three times.

(000 is to select Display Group 000)

Note:

When the display group is selected the EVAP valve is closed and the air conditioner compressor is switched off.

System in Basic Setting	**Q**
Input display group number	**000**

Indicated on display

- Confirm entry by pressing -Q- button.

System in basic setting 0 →

Indicated on display

1 2 3 4 5 6 7 8 9 10

01-91

Display group 000 (indicated values decimal)

- Engine running at idle (Coolant Temperature not less than 80 °C)

1	2	3	4	5	6	7	8	9	10	◀ Display fields	Specification	Represents
										Adaptation value of mixture formation, bank 2	108 - 148	-4 to 4%
										Adaptation value of mixture formation, bank 1	108 - 148	-4 to 4%
										Control value of mixture formation bank 2 (If out of specification perform road test)	122 - 136	-4 to 4%
										Control value of mixture formation bank 2 (If out of specification perform road test)	122 - 136	-4 to 4%
										Adaptation value torque loss at idle	124 - 140	-3 to 5%
										Idle torque	126 - 135	-1.5 to 1.5%
										Throttle valve angle	1 - 7	0.4 to 2.75%
										Engine speed (idle speed)	77 - 83	770 - 830 RPM
										Engine load (without consumers)	21 - 34	15 - 26%
										Engine Coolant Temperature (requirement for basic setting)	177 - 203	85 - 105 °C

1) Up-to-date specifications:

- Allow engine to idle for a few minutes: Coolant temperature at least 80 ° C.

Notes:

- *When the PRINT button is pressed the current display will be printed out.*
- *Press C button before selecting further display groups.*

- If readouts in all display fields match specifications, press → button.

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

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

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

- Confirm with -Q- button.

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

01-93

Control module, coding

Notes:

- *If the correct coding for the vehicle is not displayed, or if the control module has been replaced, the control module must be coded.*

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the ignition must be switched on.



The display of VAG1551 will show the control module coding (example).

The relevant vehicle coding must be displayed, note coding table ⇒ Page 01-94 .

01-94

Coding variations of Engine Control Module (ECM)

Country/ Emission standard	Power train / Additional systems	Transmission	Type of vehicle
00 = ----------	0 = ----------	0 = ----------	0 = ----------
01 = ----------	1 = ----------	1 = 6-speed manual transmission	1 = A4
02 = ----------	2 = ----------	2 = ----------	2 = ----------
03 = ----------	3 = ----------	3 = ----------	3 = ----------
04 = ----------	4 = ----------	4 = ----------	4 = ----------
05 = ----------	5 = ----------	5 = 5-speed automatic transmission (ZF) (5HP24)	5 = ----------
06 = USA; TLEV (Exhaust emission standard) NOTE: Vehicles with Leak Detection Pump (LDP)	6 = All-wheel drive without Anti Slip Regulation (ASR)/Electronic Stability Program (ESP) (with CAN-Bus system)	6 = ----------	6 = ----------
07 = ----------	7 = All-wheel drive with Anti Slip Regulation (ASR)/Electronic Stability Program (ESP) (with CAN-Bus system)	7 = ----------	7 = ----------

Notes:

- *TLEV = Transient Low Emission Vehicles. ESP = Electronic Stability Program*
- *If the vehicle is equipped with ESP can be identified at the ESP switch in the dash panel.*

01-95

Determine the code number according to the following example:

USA; TLEV (emission standard)	06			
All-wheel drive without ASR/ESP		6		
6-Speed manual transmission			1	
Audi A4				1
Code number	06	6	1	1

01-96

If an incorrect coding is displayed:

- Press →button.

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

- Press buttons "07" for the function "Code Control Module" and press Q button to confirm input.

Code Control Module Q **Input code number XXXXX (0-32000)**	When indicated on display

- Input control module coding according to coding table and press -Q- button to confirm input ⇒ Page 01-94 .

Function unknown or → **cannot be carried out currently**	If this message appears:

Check in parts catalog if the correct control module has been installed (part number). It also possible that an incorrect code number was entered. If necessary repeat coding.

- Press →button.

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

- Press buttons -0- and -6- to select function "End Output" and confirm entry with -Q- button.

01-97

Read Measuring Value Block

Test requirements

- Coolant temperature at least 80 ° C
- Electrical consumers switched off (radiator fan must not run during the check)
- A/C switched off

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be idling.

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

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

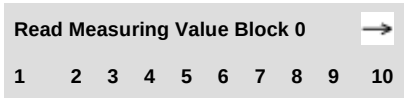
Read Measuring Value Block **Input display group number XXX**	Indicated on display

01-98

- Input relevant Display Group number (3 figures) and confirm entry by pressing -Q- button.

Note:

The display group number required is indicated in the instructions for testing functions and components given in the relevant sections of this Manual.



Indicated on display for display group 000:

Note:

To change to another display group proceed as follows:

Display group	VAG1551 scan tool	VAS5051 tester
Higher	Press button 3	Press ▲ button
Lower	Press button 1	Press ▼ button

Readiness code

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

If the function of these systems is checked via a test by On Board Diagnostic (OBD), which is successfully completed, then the position assigned to this system will be switched from "1" to "2." This occurs regardless of whether the test is indicated as "OK" or "not OK" as long as the test is successfully completed.

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

When the readiness code is generated after a successfully completed test, "00000000" will be displayed. (Measuring value block 086, display field 1).

01-100

The readiness code will be reset to "1 1 1 1 1 1 1 1 1" if:

- The DTC memory was erased
- A new Engine Control Module was installed
- If the voltage supply has been disconnected from the Engine Control Module (ECM)

In this case the readiness code must be generated ⇒ Page 01-105 .

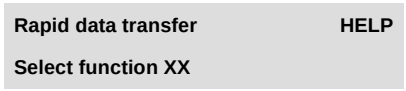
During driving operation in various load conditions, exhaust relevant tests are performed by the control module within a "short trip" and readiness code is generated on its own. In this case, however, concluding control possibilities are not available, meaning that it will not be indicated whether all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

01-101

Readiness code, checking

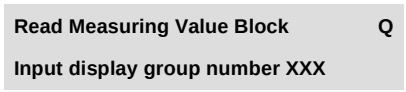
Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool to vehicle and select Control module for engine electronics "Address Word" 01 ⇒ Page 01-9 . The ignition must be switched on.



When indicated on display

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



When indicated on display

- Press buttons "086" for "display group number 086" and press -Q- button to confirm input.



When indicated on display

- Check readiness code in display field 1
  - Specified value: 0 0 0 0 0 0 0 0

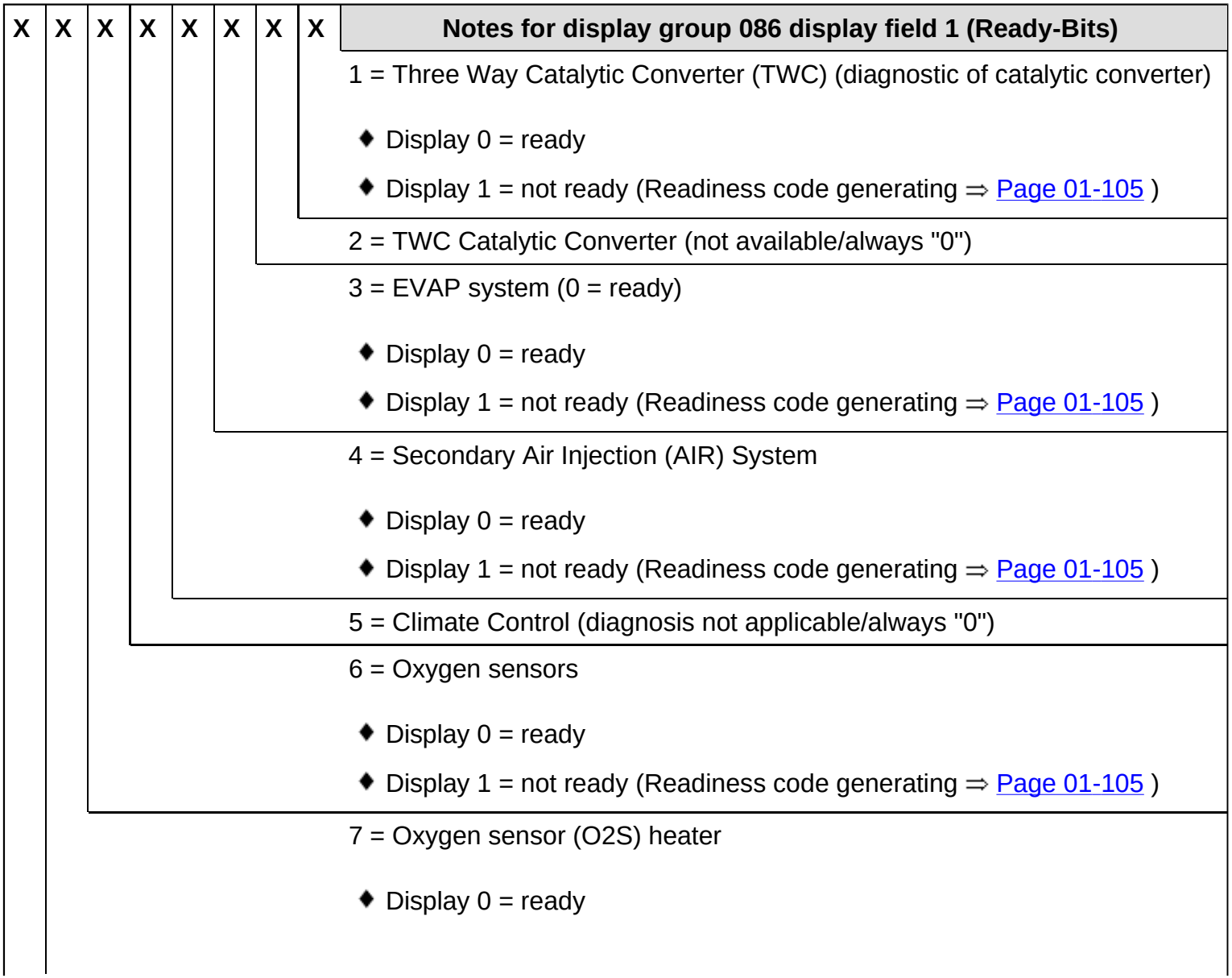
01-102

	Display fields			
	1	2	3	4
Display Group 086: Readiness code				
Display	**0 0 0 0 0 0 0 0**	X X X X X X X X	X X X X X X X X	**X X X X X X X X**
Indicated	**Ready-bits** **completed tests**	Cycle-Flags Performed cycles	Cycle-Flags Performed cycles	Cycle-Flags Performed cycles
Work area	**1 = not completed** **0 = completed**	1 = not completed 0 = completed	1 = not completed 0 = completed	1 = not completed 0 = completed
Specified value	**0 0 0 0 0 0 0 0**	X X X X X X X X	X X X X X X X X	X X X X X X X X
Note:	**Readiness code significance on next pages**			

Note for display field 1:

This display field indicates which diagnosis was checked last after the DTC memory was erased or if the control module was replaced. After erasing the DTC memory, all values that can be checked will be reset to 1, after successful testing these values will be reset to 0.

01-103


X X X X X X X X
Notes for display group 086 display field 1 (Ready-Bits)
1 = Three Way Catalytic Converter (TWC) (diagnostic of catalytic converter)
♦ Display 0 = ready
♦ Display 1 = not ready (Readiness code generating ⇒ Page 01-105)
2 = TWC Catalytic Converter (not available/always "0")
3 = EVAP system (0 = ready)
♦ Display 0 = ready
♦ Display 1 = not ready (Readiness code generating ⇒ Page 01-105)
4 = Secondary Air Injection (AIR) System
♦ Display 0 = ready
♦ Display 1 = not ready (Readiness code generating ⇒ Page 01-105)
5 = Climate Control (diagnosis not applicable/always "0")
6 = Oxygen sensors
♦ Display 0 = ready
♦ Display 1 = not ready (Readiness code generating ⇒ Page 01-105)
7 = Oxygen sensor (O2S) heater
♦ Display 0 = ready

- Display 1 = not ready

8 = Exhaust Gas Recirculation (EGR) system (not applicable/always "0")

Note:

The readiness code is only set if all position are displayed with "0."

01-104

If the specified value in display field 1:
"00000000" is obtained:

- Press →button.

Rapid data transfer **HELP**	
Select function XX	

Indicated on display (function selection)

- Check DTC memory ⇒ Page 01-15 (No malfunction should be stored in the DTC memory).

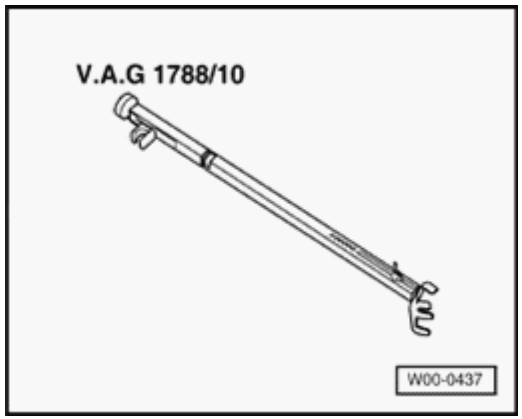
If specified value is not reached:

- Generate readiness code ⇒ Page 01-105 .

01-105

Readiness code, generating

Required special tools and test equipment



- VAG1788/10 RPM adjuster

Requirements

- Electrical consumers switched off (radiator fan must NOT run during test)
- Coolant temperature min. 80 °C (185 °F)

Work step 1: Check DTC memory

- Connect Vehicle Diagnostic, Test and Information system VAS5051 or VAG1551 scan tool to vehicle and select control module for engine electronics using "address word" 01 ⇒ Page 01-9 . The ignition is switched on.

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

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

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

If a DTC is stored:

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

If no DTC is stored:

- Press →button.

01-107

Work step 2: Erase DTC Memory

Test requirements

- Ignition switched on

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

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

Note:

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

Rapid data transfer → **DTC memory is erased**	When indicated on display

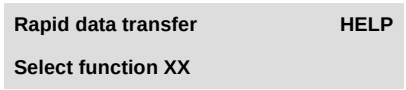
- Press →button.

01-108

Work step 3: Adaptation Throttle Valve Control Module to Engine Control Module (ECM)

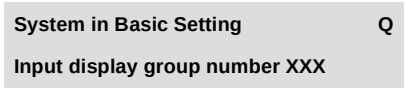
Test requirements

- Ignition switched on.



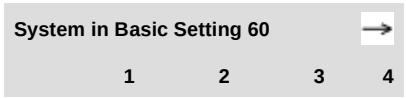
When indicated on display

- Press buttons "04" for the function "Basic Setting" and press Q button to confirm input.



When indicated on display

- Input "060" for "display group number 60" and press Q button to confirm input.



When indicated on display

- Check readiness code in display field 3 and 4:

01-109

	Display fields			
	1	2	3	4
Display group 060: Adaptation of throttle valve control module				
Display	xx %	xx %	**x**	**---**
Indicated	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Adaptation step counter**	**Adaptation condition**
Work area	0 - 100 %	0 - 100 %	**0 - 8**	**ADP. runs** **ADP. OK** **ADP. ERROR**
Specified value	3 - 93 %	97 - 3 %	**8**	**ADP. OK**
Note:			**During adaptation, adaptation step counter must reach the number 8. (Some numbers may be skipped).**	**If "ADP. ERROR." is displayed: Check DTC memory ⇒ Page 01-15 .** **If specified value is not obtained: ⇒Note, Page ⇒ Page 24-152 .**

Note for display field 3:

During adaptation different digits are displayed in display field 3, which indicate the particular adaptation condition. It is not important what the adaptation step counter (display field 3) displays during adaptation, rather that display field 4 displays the

specification value "ADP. OK.

01-110

If specified value "ADP. OK" is obtained:

- Press -C- button.

Work step 4: Diagnosis of EVAP canister purge regulator valve

- Start engine (vehicles with manual transmission depress clutch pedal)

Note:

If necessary, ECM must be re-selected with the "address word" 01 following engine start, and the function "initiate basic setting" selected with "04."

Test requirements

- Engine at idle
- Coolant temperature > 85 ° C (display group 4, display field 3)

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

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

System in Basic Setting 70 →	⮜	When indicated on display

1 2 3 4

- Check specified value in display field 4:

Note:

If test is not initiated or the display jumps from "Test ON" to "Test OFF" slightly accelerate engine briefly, test will be repeated.

01-111

	Display fields			
	1	2	3	4
Display group 070: Diagnostic of EVAP canister purge regulator valve				
Display	xx %	xx.x %	xx %	**Test ON**
Indicated	EVAP valve duty cycle during diagnosis	Oxygen sensor control deviation during diagnosis	Relative Ground via EVAP valve	**Diagnostic condition**
Work Range	min.: 0 % max.: 100 %	min.: -25.0 % max.: 25.0 %		**Test OFF** **Test ON** **EVAP OK** **EVAP n.OK** **Abort**
Specified value	xx %	-5.0 to 4.0 %	xx - xx % [1)]	**EVAP OK**
Note:				**If "EVAP n. OK" is displayed: Check DTC memory ⇒ Page 01-15 . Check EVAP canister purge regulator valve -N80 ⇒ Page 24-134**

[1)] A display appears only, if the diagnostic result occurred via deviation from the Idle Air Control (IAC) in a specified tolerance range and not from deviation from the oxygen sensor control (e.g.: oxygen sensor 1 from EVAP canister). Display field 3 is only indicated if there is a deviation.

01-112

If the specified value "EVAP OK" is reached:

- Press -C- button

Work step 5: Diagnosis of tank leak test

Note:

This diagnostic is locked the first 230 seconds after engine is started.

Test requirements

- Engine at idle
- Coolant temperature greater 85 ° C (Display group 4, display field 3)
- Intake air temperature less 95 ° C (Display group 4, display field 4)

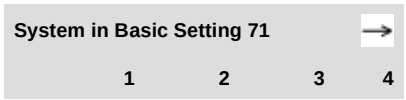
System in Basic System Q

Input display group number XXX

When indicated on display

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

01-113



When indicated on display

During test is "Test ON" displayed in display field 4. Continue to hold test conditions until a diagnostic result is displayed in display field 4.

- Check specified value in display field 4:

Note:

- *Test duration for tank leak test takes approximately 60 seconds.*
- *Should the diagnosis be repeated several times, open fuel filler cap each time to release pressure in tank.*

01-114

	Display fields			
	1	2	3	4
Display group 071: Diagnostic of tank leak test				
Display	Reed open	---	System Test	**Test ON**
Indicated	Condition Reed-contact	malfunction message	System condition	**Diagnostic condition and Diagnostic result**
Work range	Reed open Reed closed	Small leak Large leak System not OK	System Test Measurement Measurement END	**Test OFF** **Test ON** **Syst. OK** **Syst. not OK** **Abort**
Specified value	Reed open	---	Measurement END	**Syst. OK**
Note				**If "System not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

01-115

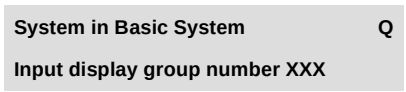
If specified value in display field "System OK" is reached:

- Press -C- button.

Work step 6: Diagnosis of fuel supply system

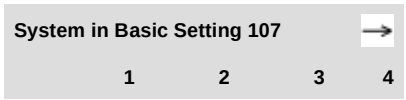
Test requirements

- Engine at idle
- Oxygen sensor control active



When indicated on display

- Press buttons -1-, -0- and -7- to select display group number 107 and confirm with -Q- button.



When indicated on display

- Check specified values in display field 4.

Note:

If display "Test ON" does not appear in the display field, switch the engine off and restart afterward and repeat work step 6. (Diagnostic of fuel supply system)

After the engine has been started it might be necessary to select "Address word 01" and initiate the function "04 Basic Setting" again.

01-116

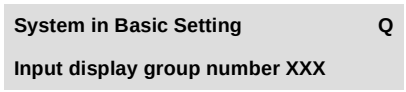
	Display fields			
	1	2	3	4
Display group 107: Diagnostic of fuel supply				
Display	xxx /RPM	x.x %	x.x %	**Test ON**
Indicated	Engine speed (actual)	Oxygen sensor control average value (Bank 1)	Oxygen sensor control average value (Bank 2)	**Diagnostic condition**
Work range	min.: 750 /RPM max.: 6800 /RPM	min.: -25.0 % max.: 25.0 %	min.: -25.0 % max.: 25.0 %	**Test OFF** **Test ON** **Syst. OK** **Syst. n OK**
Value	750 - 850/RPM	-18.0 % to 12.0 %	-18.0 % to 12.0 %	Syst. OK
Note				**If "Syst. n OK" appears, check DTC memory ⇒ Page 01-15 .**

01-117

If specified value in display "System OK" is reached:

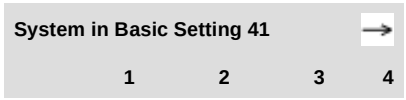
- Press -C- button.

Work step 7: Diagnosis of oxygen sensor heater



When indicated on display

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



When indicated on display

- Check specified value in display field 1 and 3:

Note:

Increasing engine speed accelerates the obtaining of specified values.

01-118

	Display fields			
	1	2	3	4
Display group 041: Oxygen sensor heater, bank 1				
Display	**xxx kOhm**	**Heater before before CAT ON**	**xxx kOhm**	**Heater before behind CAT ON**
Indicated	**Bank 1, Sensor 1**	**Condition of heater**	**Bank 1, Sensor 2**	**Condition of heater**
Work range		**Heater b. CAT ON** **Heater b. TWC OFF**		**Heater a. CAT ON** **Heater a. CAT OFF**
Specified value	**0 - 0.5 kOhm**	**Heater b. CAT ON/OFF**	**0 - 0.9 kOhm**	**Heater a. CAT ON/OFF**

Important note for display fields 1,2,3 and 4:

- *Display fields 1 and 3 will not indicate any value if the operating temperature of the oxygen sensors is not reached, that means both fields are empty. (Increase Engine Speed to reach specified value).*
- *After the operating temperature is reached, the display fields 1 and 3 must display a value of less than 0.5K Ohm*
- *Only proceed with test after value of less than 0.5K Ohm is displayed with in display fields 1 and 3.*
- *The Engine Control Module (ECM) cycles at certain operating conditions the oxygen sensor heating, that means, the heater is certain operating conditions ON or OFF. It is therefore possible that the specification in display field 2 and 4 appears periodically as "Heater b. CAT OFF" or "Heater a. CAT OFF"*

- Press -C- button.

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

01-119

	Display fields			
	1	2	3	4
Display group 042: Oxygen sensor heater, bank 1				
Display	**xxx kOhm**	**Heater before before CAT ON**	**xxx kOhm**	**Heater before behind CAT ON**
Indicated	**Bank 1, Sensor 1**	**Condition of heater**	**Bank 1, Sensor 2**	**Condition of heater**
Work range		**Heater b. CAT ON** **Heater b. TWC OFF**		**Heater a. CAT ON** **Heater a. CAT OFF**
Specified value	**0 - 0.5 kOhm**	**Heater b. CAT ON/OFF**	**0 - 0.9 kOhm**	**Heater a. CAT ON/OFF**
Note	**Observe note below**		**Observe note below**	

Important note for display fields 1,2,3 and 4:

- *Display fields 1 and 3 will not indicate any value if the operating temperature of the oxygen sensors is not reached, that means both fields are empty. (Increase Engine Speed to reach specified value).*
- *After the operating temperature is reached, the display fields 1 and 3 must display a value of less than 0.5K Ohm*
- *Only proceed with test after value of less than 0.5K Ohm is displayed with in display fields 1 and 3.*

- *The Engine Control Module (ECM) cycles at certain operating conditions the oxygen sensor heating, that means, the heater is certain operating conditions ON or OFF. It is therefore possible that the specification in display field 2 and 4 appears periodically as "Heater b. CAT OFF" or "Heater a. CAT OFF"*

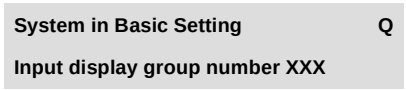
- Press -C- button.

01-120

Work step 8: Diagnosis oxygen sensor aging before catalytic converter

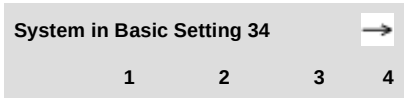
Test requirements

- Engine running at 1900 - 2200 RPM



Indicated on display

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



Indicated on display

- Check specified value in display field 4:

01-121

	Display fields			
	1	2	3	4
Display group 034: Oxygen sensor aging before catalytic converter (bank 1)				
Display	xxxx/RPM	xxx ° C	x.x seconds	**Test ON**
Indicated	Engine speed (RPM)	Exhaust temperature	Period duration of oxygen sensor before CAT	**Diagnostic condition**
Work range	0 - 6800/RPM	70 - 850 ° C	0.0 - 3.0 Seconds	**Test OFF** **Test ON** **B1-S1 OK** **B1-S1 not OK**
Specified value	1900 - 2200/RPM	Greater than 260 ° C	0.1 - 1.0 Seconds	**B1-S1 OK**
Note				**If "B1-S1 not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

If specified value of "B1-S1 OK" is reached:

- Press -C- button.

Test requirements

- Engine running at 1900 - 2200 RPM

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

01-122

	Display fields			
	1	2	3	4
Display group 035: Oxygen sensor aging before catalytic converter (Bank 2)				
Display	xxxx/RPM	xxx °C	x.x seconds	**Test ON**
Indicated	Engine speed (RPM)	Exhaust temperature	Period duration of oxygen sensor before TWC	**Diagnostic condition**
Work range	0 - 6800/RPM	70 - 850 °C	0.0 - 3.0 Seconds	**Test OFF** **Test ON** **B2-S1 OK** **B2-S1 not OK**
Specified value	1900 - 2200/RPM	greater than 260 °C	0.1 - 1.0 Seconds	**B2-S1 OK**
Note				**IF "B2-S1 not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

If specified value of "B2-S1 OK" is reached:

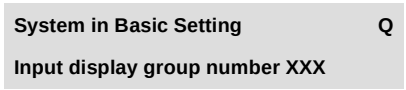
- Press -C- button.

01-123

Work step 9: Diagnosis of operational readiness of oxygen sensors behind TWC

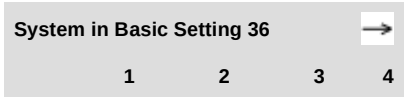
Test requirements

- Engine at idle



➢ Indicated on Display

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



➢ Indicated on display

- Check specified values in display fields 2 and 4.

01-124

	Display fields			
	1	2	3	4
Display group 036: Operational readiness of oxygen sensors behind TWC (Bank 1 and Bank 2)				
Display	x.xxx Volt	**Test ON**	x.xxx Volt	**Test ON**
Indicated	Voltage of oxygen sensor behind TWC, bank 1	**Diagnostic condition**	Voltage of oxygen sensor behind TWC, bank 2	**Diagnostic condition**
Work range	0.000V - 1.000 Volt	**Test OFF** **Test ON** **B1-S2 OK** **B1-S2 not OK**	0.000V - 1.000Volt	**Test OFF** **Test ON** **B2-S2 OK** **B2-S2 not OK**
Value	less than 0.4 Volt or greater than 0.5 Volt	**B1-S2 OK**	less than 0.4 Volt or greater than 0.5 Volt	**B2-S2 OK**
Note		**IF "B1-S2 not OK" is displayed: Check DTC Memory ⇒ Page 01-15 .**		**If "B2-S2 not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

If the specified value in display field 2 "B1-S2 OK" and in display field 4 "B2-S2 OK" is reached:

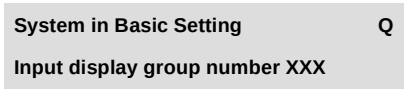
- Press -C- button.

01-125

Work step 10: Diagnosis of oxygen sensor control system

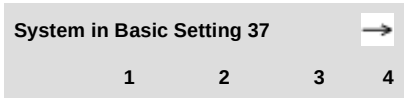
Test requirements

- Engine at idle



➢ Indicated on display

- Press buttons -0-, -3- and -7- to select "display group numbers 037" and confirm with -Q- button.



➢ Indicated on display

- Check specified value in display field 4.

01-126

	Display fields			
	1	2	3	4
Display group 037: Oxygen sensor control system (Bank 1)				
Display	xx.x %	x.xxx Volt	xxx ms	**Test ON**
Indicated	Load	Voltage of oxygen sensor behind TWC, bank 1	Correction value between oxygen sensors 1 and 2, bank 1	**Diagnostic condition**
Work range	0 - 175 %	0.000 - 1.000 Volt	---	**Test OFF** **Test ON** **Syst. OK** **Syst. not OK**
Specified value	13.5 - 25.0 %	0.000 - 1.000 Volt	-500ms to 800ms	**Syst. OK**
Note				**If "Syst. not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

If specified value of "System OK" is reached:

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

01-127

	Display fields			
	1	2	3	4
Display group 038: Oxygen sensor control system (Bank 2)				
Display	xx.x %	x.xxx Volt	xxx ms	**Test ON**
Indicated	Load	Voltage of oxygen sensor behind TWC, bank 2	Correction value between oxygen sensors 1 and 2, bank 2	**Diagnostic condition**
Work range	0 - 175 %	0.000 - 1.000 Volt	---	**Test OFF** **Test ON** **Syst. OK** **Syst. not OK**
Value	13.5 - 25.0 %	0.000 - 1.000 Volt	-500ms to 800ms	**Syst. OK**
Note				**If "Syst. not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

If specified value of "System OK" is reached:

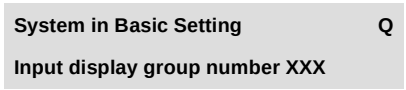
- Press -C- button.

01-128

Work step 11: Diagnosis of oxygen sensor aging behind catalytic converter

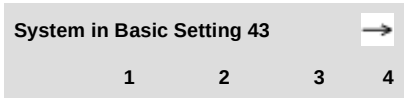
Test requirements

- Engine running at 1900 - 2200 RPM



➢ Indicated on display

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



➢ Indicated on display

- Check specified value in display field 4.

01-129

	Display fields			
	1	2	3	4
Display group 043: Oxygen sensor aging oxygen sensor behind TWC (Bank 1)				
Display	xxxx/RPM	xxx ° C	x.xxx V	**Test ON**
Indicated	Engine speed (RPM)	Catalyst temperature	Voltage of oxygen sensor behind TWC Bank 1	**Diagnostic condition**
Work range	0 - 6800/RPM	70 - 850 ° C	0.000 - 1.000 Volt	**Test OFF** **Test ON** **B1-S2 OK** **B1-S2 not OK**
Specified value	1900 - 2200/RPM	greater than 320 ° C	0.000 - 1.000 Volt	**B1-S2 OK**
Note				**If "B1-S2 not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

If specified value of "B1-S2 OK" is reached:

- Press -C- button.

Test requirements

- Engine running at 1900 - 2200 RPM

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

01-130

	Display fields			
	1	2	3	4
Display group 044: Oxygen sensor aging oxygen sensor behind TWC (Bank 2)				
Display	xxxx/RPM	xxx ° C	x.xxx Volt	**Test ON**
Indicated	Engine speed (RPM)	Catalyst temperature	Voltage of oxygen sensor behind TWC Bank 2	Diagnostic condition
Work range	0 - 6800/RPM	70 - 850 ° C	0.000 - 1.000 Volt	Test OFF Test ON B2-S2 OK B2-S2 not OK
Specified value	1900 - 2200/RPM	greater than 320 ° C	0.000 - 1.000 Volt	B2-S2 OK
Note				**If "B2-S2 not OK" is displayed: Check DTC memory ⇒ Page 01-15 .**

If specified value of "B2-S2 OK" is reached:

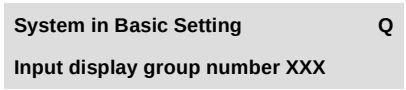
- Press -C- button.

01-131

Work step 12: Diagnosis of catalytic converter

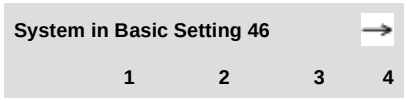
Test requirements

- Engine running at 1900 - 2200 RPM



Indicated on display

- Press buttons -0-, -4- and -6- to select "display group number 046" and confirm input with -Q- button.



Indicated on display

- Check specified value in display field 4.

Note:

The test duration for catalytic converter diagnosis takes approx.: 60 seconds.

01-132

	Display fields			
	1	2	3	4
Display group 046: Diagnostic of catalytic converter (Bank 1)				
Display	xxxx/RPM	xxx ° C	x.x s	**---**
Indicated	Engine speed (RPM)	Catalyst temperature	Catalytic converter conversion	**Diagnostic condition**
Work range	0 - 6800/RPM	70 - 850 ° C	0.0 - 0.99	**Test OFF** **Test ON** **Cat B1 OK** **Cat B1 not OK**
Specified value	1900 - 2200/RPM	greater than 350 ° C	0.0 - 0.80	**Cat B1 OK**
Note				**If "Cat B1 not OK" is displayed: Check DTC memory ⇒ Page 01-15 . If no malfunction is stored replace catalytic converter.**

If the specified value "Cat B1 OK" is reached:

- Press -C- button

- Engine running at 1900 - 2200 RPM

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

01-133

	Display fields			
	1	2	3	4
Display group 047: Diagnostic of catalytic converter (Bank 2)				
Display	xxxx/RPM	xxx ° C	x.x seconds	**---**
Indicated	Engine speed (RPM)	Catalyst temperature	Catalytic converter conversion	**Diagnostic condition**
Work range	0 - 6800/RPM	70 - 850 ° C	0.0 - 0.99	**Test OFF** **Test ON** **Cat B2 OK** **Cat B2 not OK**
Specified value	1900 - 2200/RPM	greater than 350 ° C	0.0 - 0.80	**Cat B2 OK**
Note				**If "Cat B2 not OK" is displayed: Check DTC memory ⇒ Page 01-15 . If no malfunction is stored replace catalytic converter.**

If the specified value "Cat B2 OK" is reached:

- Press -C- button

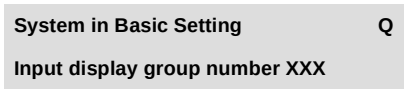
01-134

Work step 13: Diagnosis of Secondary Air Injection (AIR) system (only on vehicles with automatic transmission), on vehicles with manual transmission continue with work step 14 ⇒ **Page 01-136**

Note:

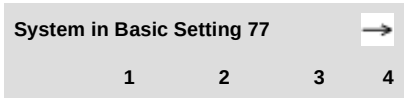
The secondary air pump runs for a few seconds during the secondary air injection system diagnosis.

- Engine at idle sped



Indicated on display

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



Indicated on display

- Check specified value in display field 4.

Note:

The test duration for the secondary air injection system takes approximately 60 seconds.

01-135

	Display fields			
	1	2	3	4
Display group 077: Diagnostic of secondary air injection system (Bank 1)				
Display	xxxx/RPM	xx.x g/s	xx %	**Test ON**
Indicated	Engine speed (RPM)	Air mass	Relative air mass secondary air injection system	**Diagnostic condition**
Work range	0 - 6800/RPM			**Test OFF** **Test ON** **Syst. OK** **Syst. not OK** **Abort**
Value	750 - 850/RPM		+10 % to -100 %	**Syst. OK**
Note				**If "Syst. not OK": Check DTC memory** ⇒ **Page 01-15** **.**

If the specified value of "Syst. OK" is reached:

- Press -C- button.
- Press buttons -0-, -7- and -8- to select "display group number 078" and confirm input with -Q- button.

01-136

	Display fields			
	1	2	3	4
Display group 078: Diagnostic of secondary air injection system (Bank 2)				
Display	xxxx/RPM	xx.x g/s	xx %	**Test ON**
Indicated	Engine speed (RPM)	Air mass	Relative air mass secondary air injection system	**Diagnostic condition**
Work range	0 - 6800/RPM			**Test OFF** **Test ON** **Syst. OK** **Syst. not OK** **Abort**
Value	750 - 850/RPM		+10 % to -100 %	**Syst. OK**
Note				**If "Syst. not OK": Check DTC memory ⇒ Page 01-15 .**

If the specified value of "Syst. OK" is reached:

- Press → button.

Work step 14: Readiness code, displaying

- Display readiness code again (measure of control) ⇒ Page 01-101 .

Motronic Multiport Fuel Injection (MFI) system, servicing

Safety precautions

Observe following precautions if test and measuring instruments are required during a road test:

WARNING!

- ***During a road test in an airbag equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.***

- ***When driving or riding in an airbag equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and and the airbag increase the risk of injury in an accident.***

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- ***Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.***

- ***Fire hazard! Do not smoke, work near heaters or open flame, or have anything nearby that could ignite fuel. The fuel system is pressurized. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully opening the connection.***

24-2

CAUTION!

- ***To operate the engine at starter speed without actually starting it (for example, in order to test compression), unplug the connectors from the output stages for the ignition coils and also the connectors on the injectors.***

- ***During some of the tests the control module may identify and record malfunctions. The DTC memory should therefore be checked and (if necessary) erased after completing the tests and any repair work that may be required. After erasing DTC memory generate new readiness code ⇒ Page 01-105 .***

- ***Always switch off the ignition before cleaning the engine.***

- ***Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control module may be damaged.***

- ***Be sure of 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.***

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

- ***Be sure the ignition is switched OFF.***
- ***Use correct adapters from the VAG1594 connector test kit.***

Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the 6 following rules for cleanliness:

- Thoroughly clean all connections and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- Carefully cover or seal opened components if the repair cannot be completed immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- Disconnected electrical connectors: Keep clean and dry. Connect only when dry.

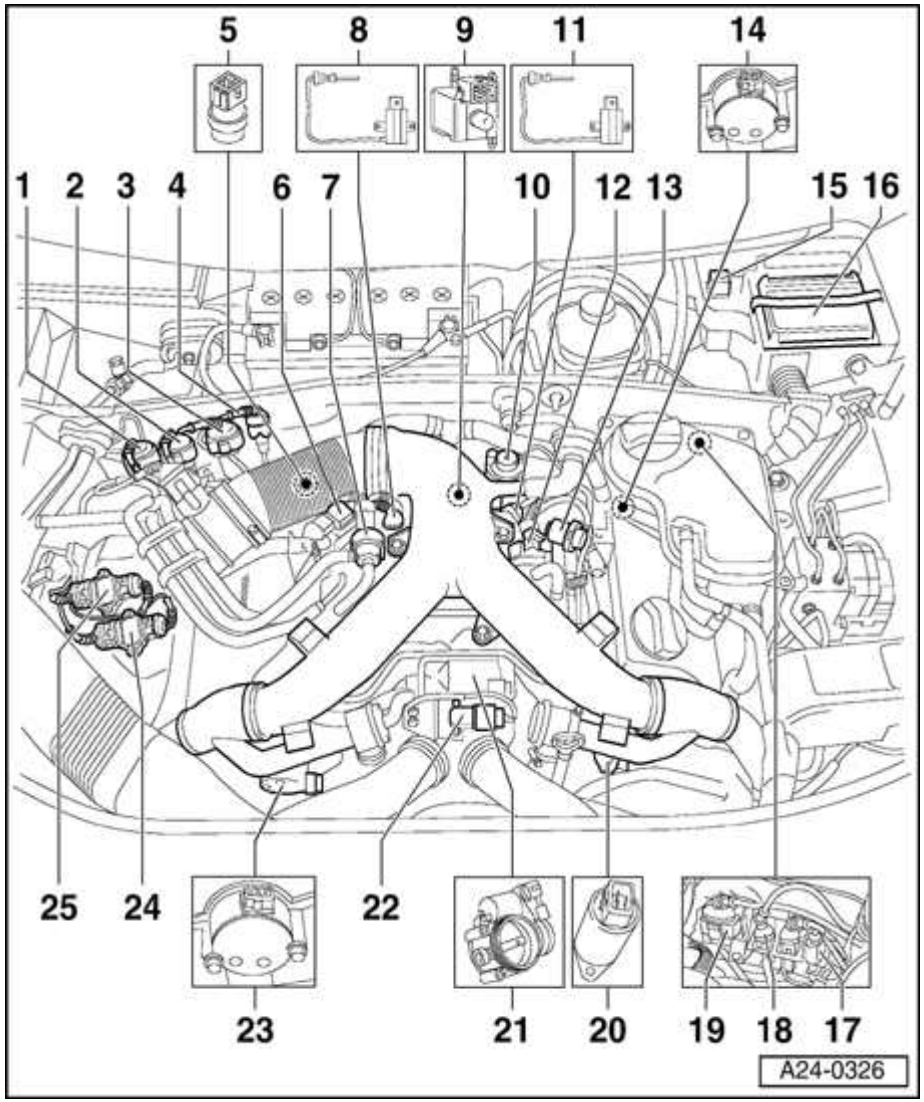
24-4

Technical data

Engine identification		APB
Idling speed Not adjustable - controlled by Idle Air Control (IAT)		750 - 850 RPM
Engine speed (RPM) limitation via fuel injector shut-off		approx: 6800 RPM
Fuel pressure at idle speed	Vacuum hose connected	approx. 3.5 bar positive pressure
	Vacuum hose disconnected	approx. 4.0 bar positive pressure
Residual pressure after 10 minutes		at least 2.5 bar positive pressure
Fuel Injectors	Spray pattern	Multi-hole nozzle (same on all injectors)
	Injection qty. (30 secs.)	135 - 165 ml
	Resistance (room temperature)[1)]	13.5 - 15.5 Ω

[1)] When the engine is at operating temperature the resistance is increased by approx. 4 - 6 Ω.

24-5



Component locations, overview

Components A to I are not shown in the exploded drawing.

A - Brake Light Switch -F- and Brake Pedal Switch -F47-

- In footwell on pedal bracket near brake pedal

B - Diagnostic connector

- In front knee protection, driver side

C - Fuel Pump (FP) relay -J17-

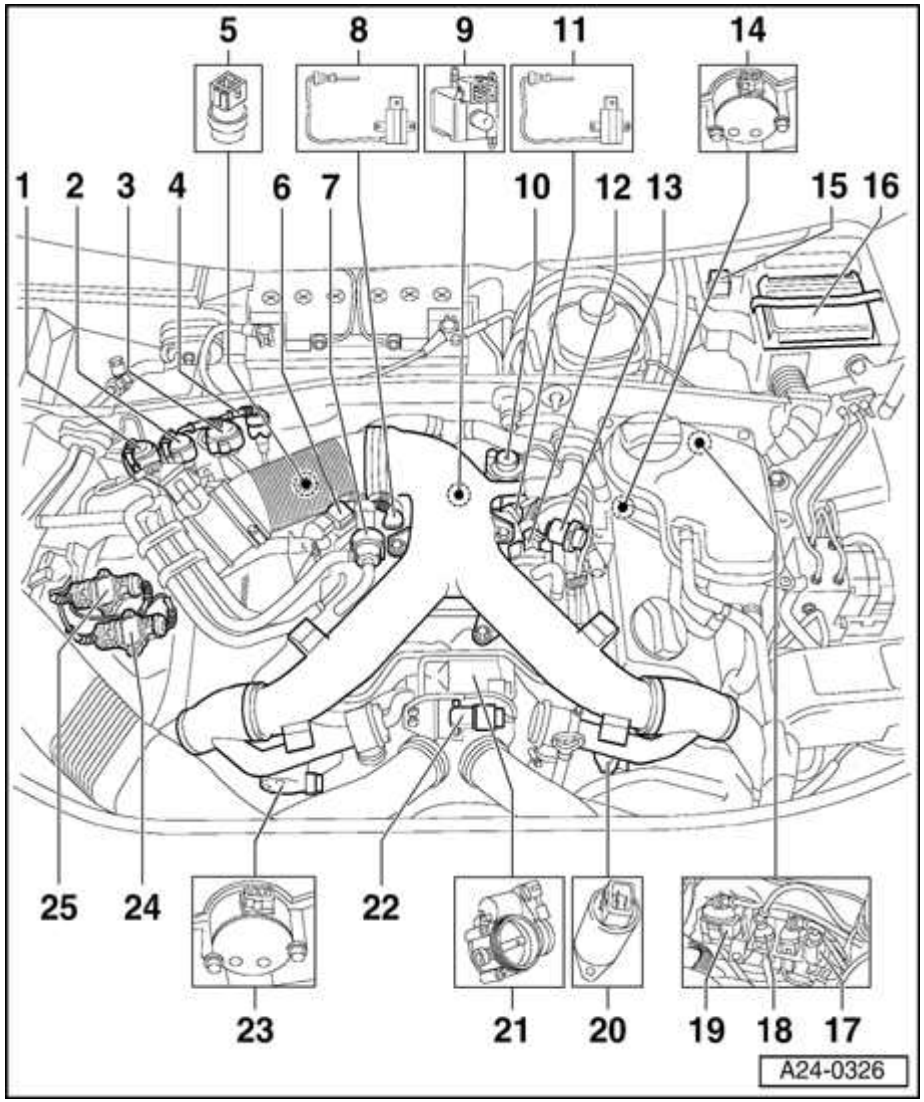
- Relay position 4 of central electrics left side under dash panel

D - Clutch Vacuum Vent Switch -F36

- In footwell on pedal frame

E - Throttle Position (TP) Sensor -G79- and Sender -2- for accelerator pedal position -G185

- In footwell on accelerator pedal (both senders are installed in one housing)



F - Electronic Power Control (EPC) warning light

- In instrument cluster (Significance of light ⇒ Page 24-139)

G - Leak Detection Pump (LDP) -V144

- Below left rear wheelhousing liner

⇒ *Repair Manual, Fuel Supply System, Repair Group 20, Components of EVAP system servicing*

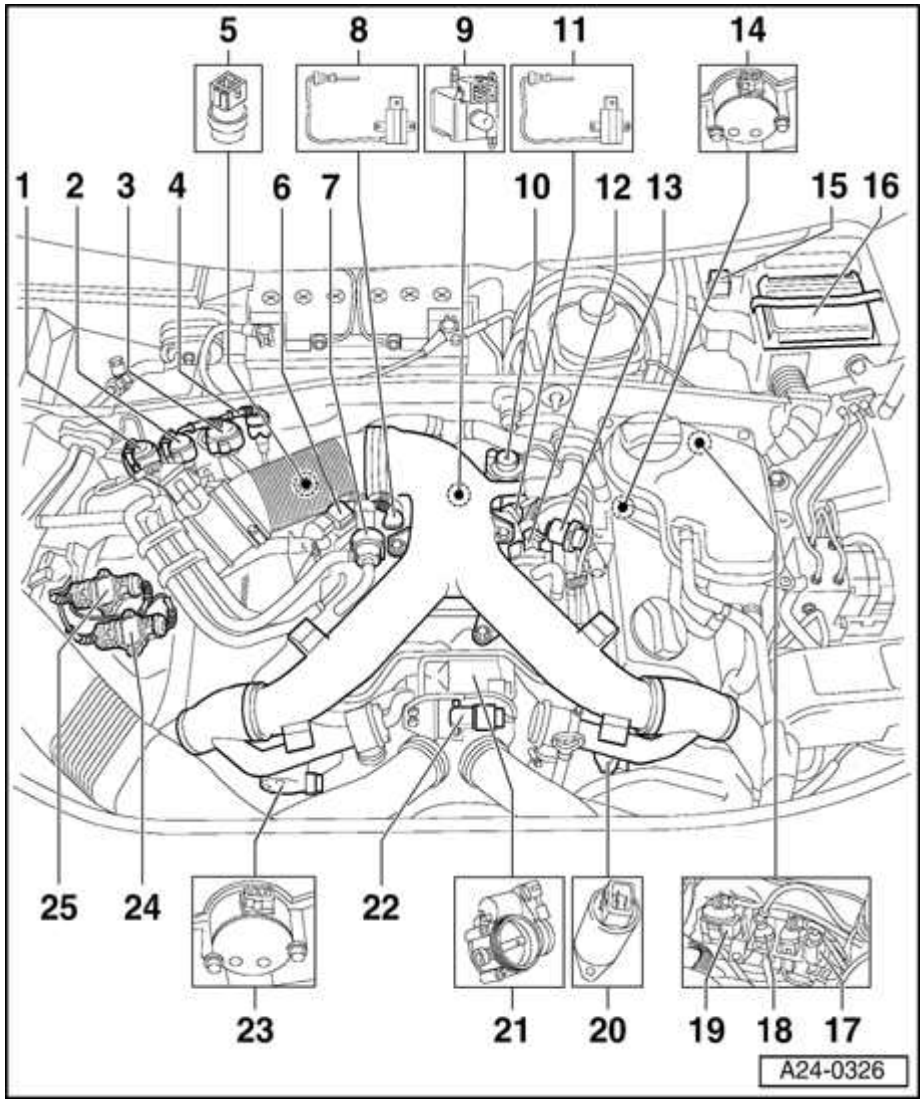
H - Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130 with Heater for Lambda-probe 1 -Z29

- This oxygen sensor is accessible from below when vehicle is lifted

I - Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131 with Heater for Lambda-probe 2 -Z30

- This oxygen sensor is accessible from below when vehicle is lifted

24-7



1 - Harness connector forOxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130 and Heater for Lambda-probe 1 -Z29

- 4-pin green

2 - Harness connector forOxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131 and Heater for Lambda-probe 2 -Z30

- 4-pin brown

3 - Harness connector for Heated Oxygen Sensor (HO2S) and Oxygen Sensor (O2S) Heater

- 4-pin black

4 - 3-pin harness connector

- For Knock sensor (KS) 1 -G61

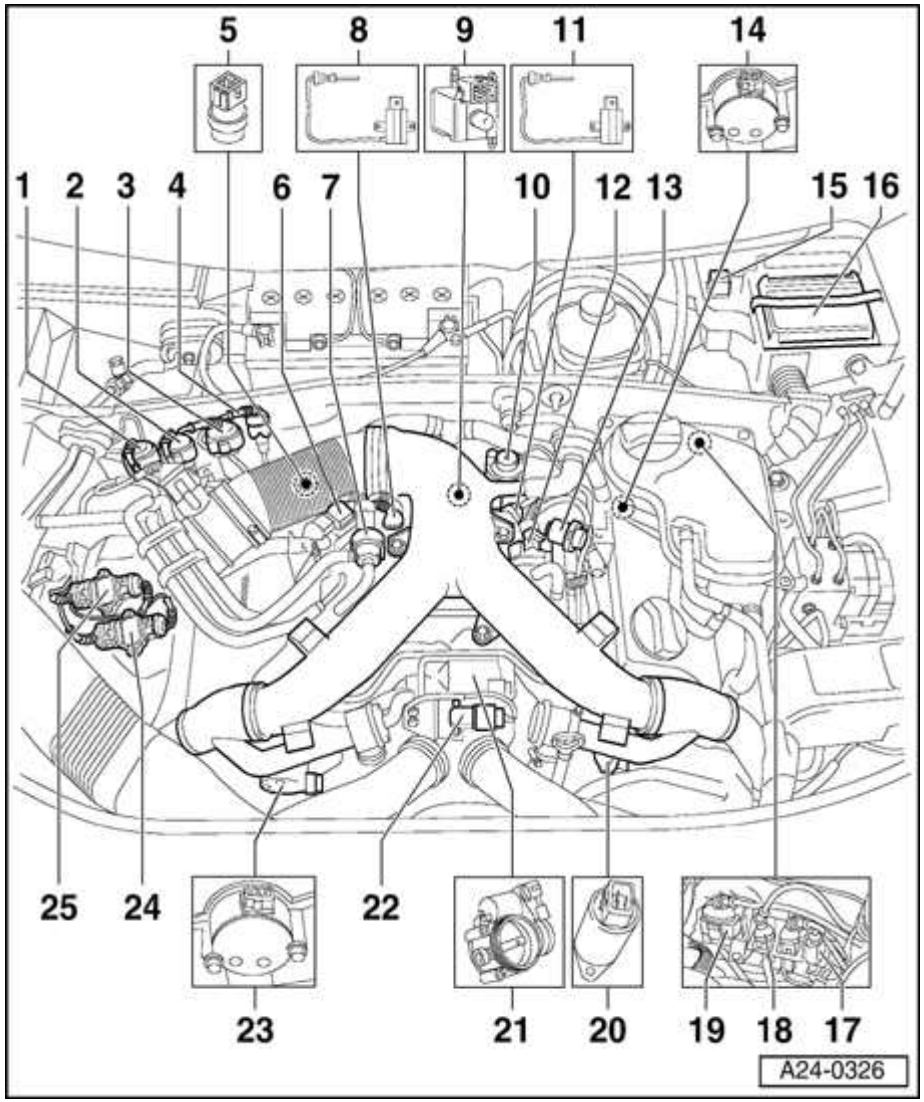
5 - Engine Coolant Temperature (ECT) Sensor -G62

- On cooling pipe behind cylinder bank 1

6 - Wastegate Bypass Regulator Valve -N75

7 - EVAP Canister Purge Regulator Valve -N80

24-8



8 - Sensor -1- for exhaust temperature -G235

- At rear of intake manifold on the left-hand side (looking from the front of the engine compartment) On vehicles with automatic transmission the Sensor -2- for exhaust temperature -G236 is located at this position see page ⇒ Page 24-14 .

9 - Secondary Air Injection (AIR) Solenoid Valve -N112

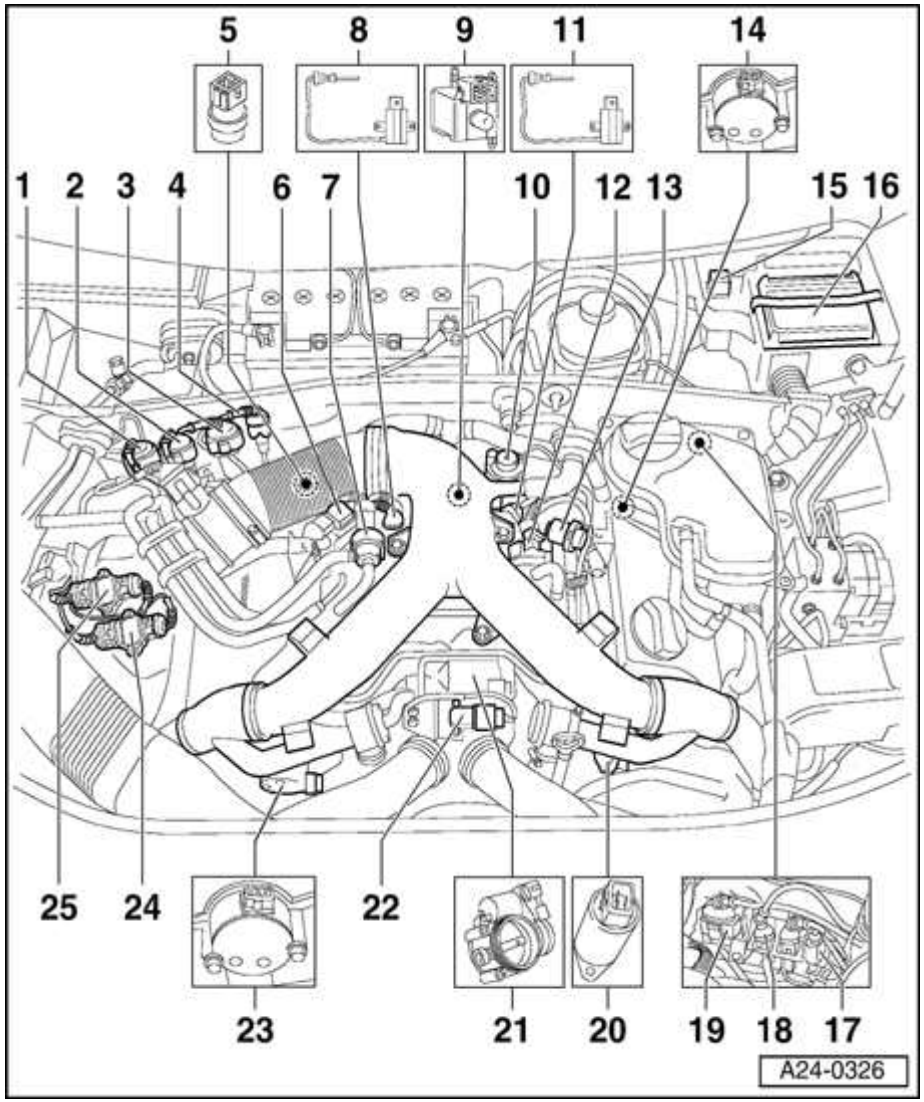
- Only on vehicles with automatic transmission

10 - Secondary Air Injection (AIR) Pump Motor -V101

- Only on vehicles with automatic transmission

11 - Sensor -2- for exhaust temperature -G236

- On vehicles with automatic transmission the sensor is located with Sensor -1- for exhaust temperature -G235 at Position -8-. Both sensors are located behind each other ⇒ Page 24-14 .



12 - Recirculating valve for turbocharger - N249

13 - Fuel pressure regulator

14 - Camshaft Position (CMP) Sensor 2 -G163

- Cylinder bank 2
- Previously identified as Camshaft Position (CMP) Sensor 2 -G40

15 - Secondary Air Injection (AIR) Pump Relay -J299

- Only on vehicles with automatic transmission

16 - Motronic Engine Control Module (ECM) - J220

17 - 3-pin harness connector

- For Engine Speed (RPM) Sensor -G28
- grey

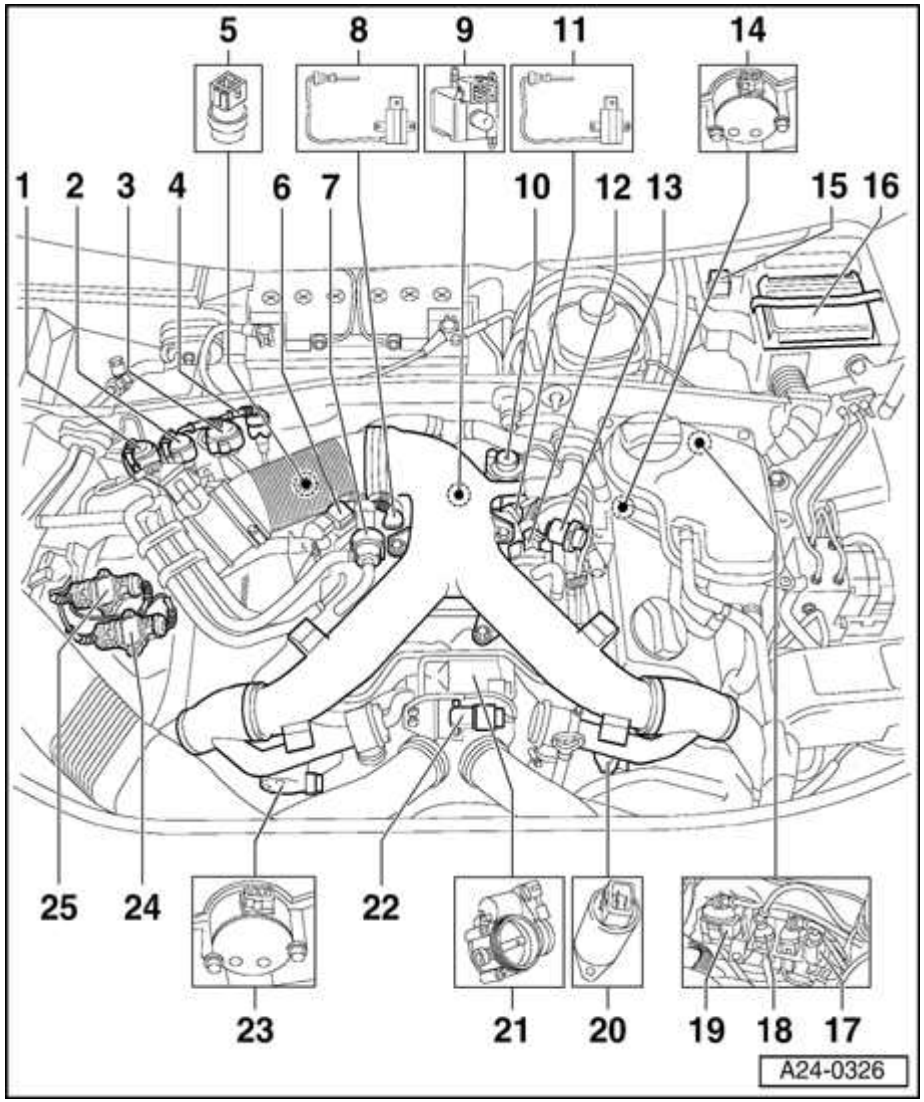
18 - 3-pin harness connector

- For Knock Sensor (KS) 2 -G66

19 - Harness connector for Heated Oxygen Sensor (HO2S) 2 -G108 and Oxygen Sensor (O2S) Heater -Z28

- 4-pin black

24-10



20 - Valve -2- for camshaft adjustment -N208

21 - Throttle Valve Control Module -J338

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

22 - Charge Air Pressure Sensor -G31

- In rubber below before Throttle Valve Control Module

23 - Camshaft Position (CMP) Sensor 1 -G40

- Cylinder bank 1
- Previously identified as Camshaft Position (CMP) Sensor 1 -G163

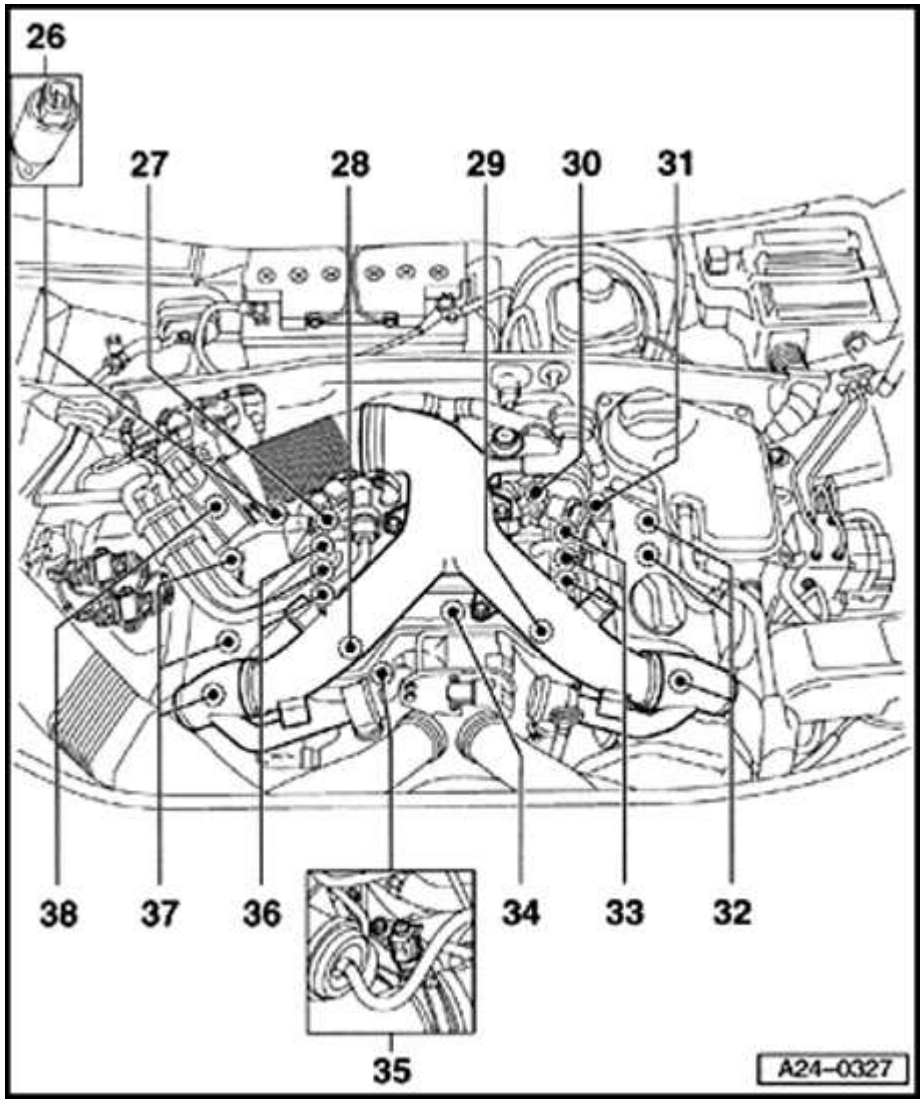
24 - Power output stage -N192

- For ignition coils cylinder bank 2

25 - Power output stage -N122

- For ignition coils cylinder bank 1

24-11



26 - Valve -1- for camshaft adjustment -N205

27 - Heated Oxygen Sensor (HO2S) -G39 with Oxygen Sensor (O2S) Heater -Z19

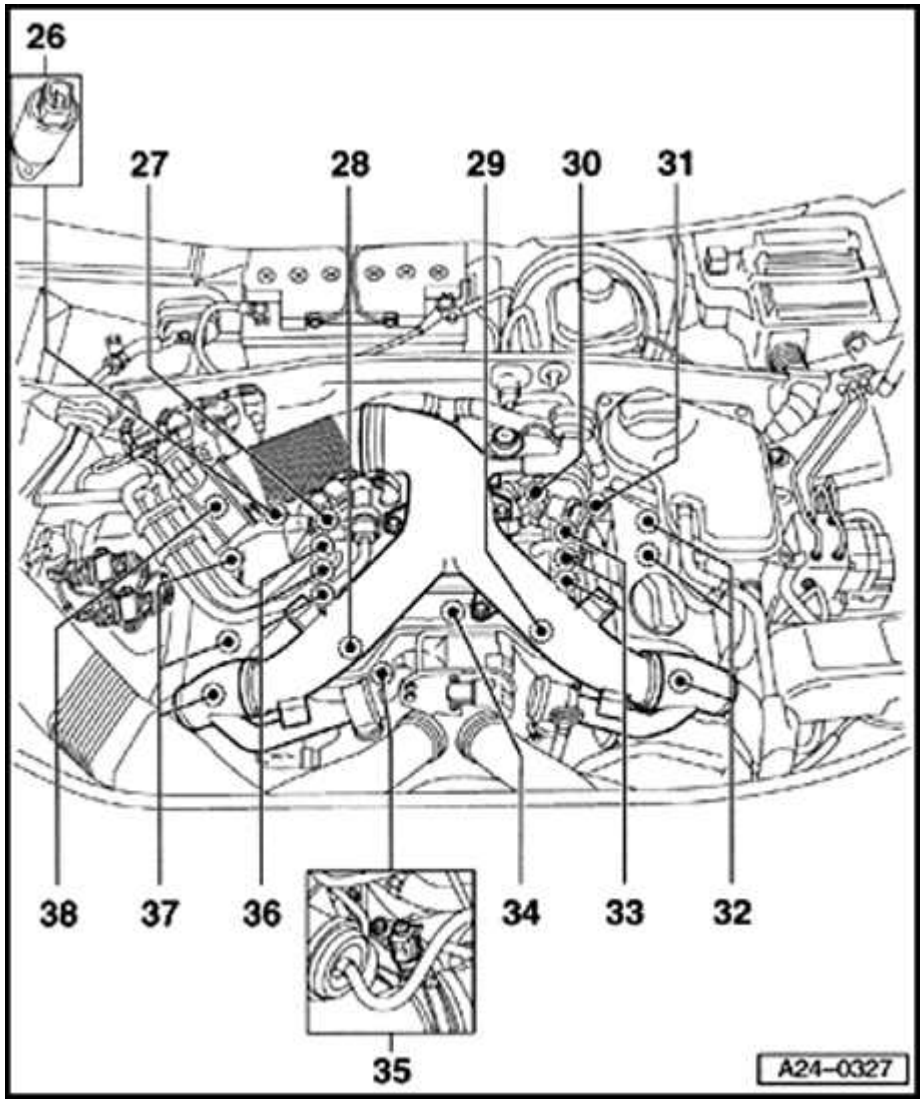
28 - Knock Sensor (KS) 1 -G61

29 - Knock Sensor (KS) 2 -G66

30 - Engine Speed (RPM) Sensor -G28

- In transmission above sensor wheel

31 - Heated Oxygen Sensor (HO2S) 2 -G108 and Oxygen Sensor (O2S) Heater -Z28



32 - Ignition coils cylinder bank 2

- Ignition Coil 4 -N163
- Ignition Coil 5 -N164
- Ignition Coil 6 -N189

33 - Fuel Injectors

- Cylinder bank 2
- Cylinder 4 Fuel Injector -N33
- Cylinder 5 Fuel Injector -N83
- Cylinder 6 Fuel Injector -N84

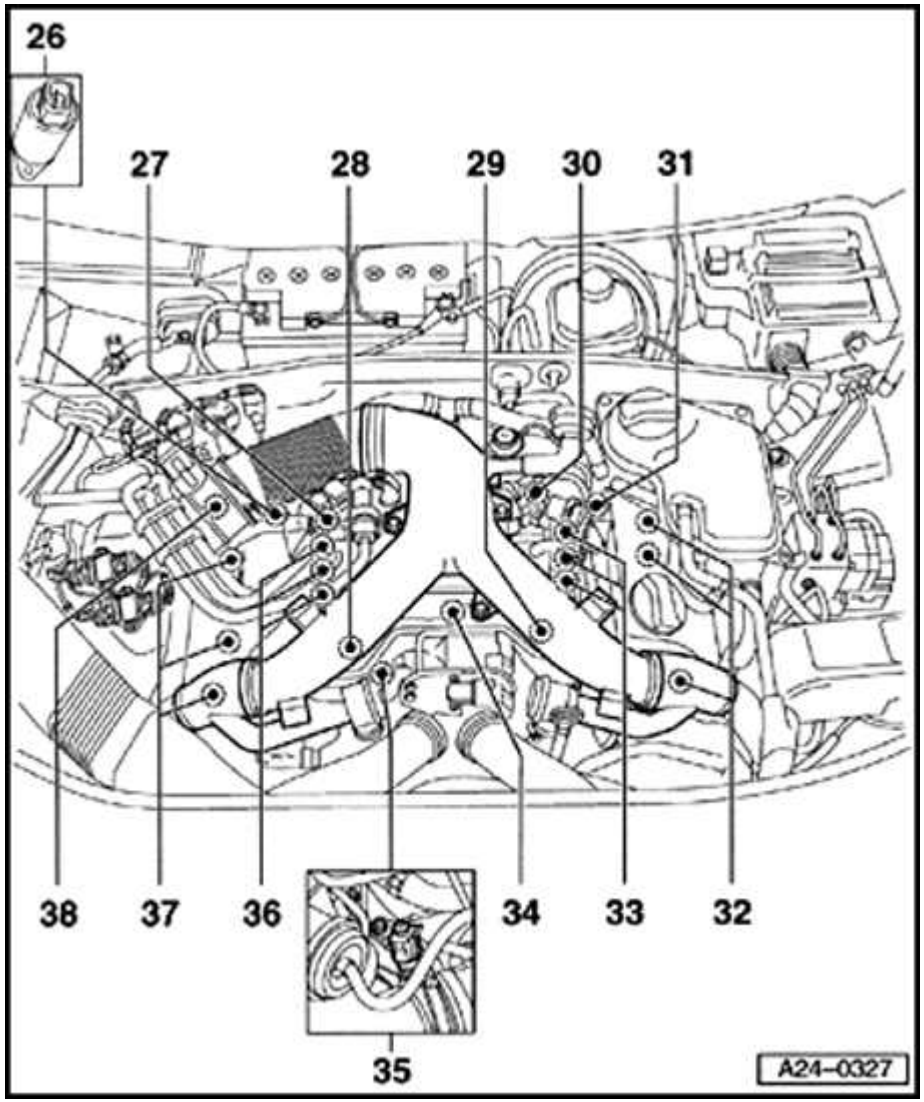
34 - Intake Air Temperature (IAT) Sensor -G42

- Under intake manifold at the front, near the throttle valve control module

35 - 2-pin harness connector

- For intake air temperature sensor (Measurements must be carried out at this connection)

24-13



36 - Fuel Injectors

- Cylinder bank 1
- Cylinder 1 Fuel Injector -N30
- Cylinder 2 Fuel Injector -N31
- Cylinder 3 Fuel Injector -N32

37 - Ignition coils cylinder bank 1

- Ignition Coil -N
- Ignition Coil 2 -N128
- Ignition Coil 3 -N158

38 - Mass Air Flow (MAF) Sensor -G70

24-14

Component location for exhaust temperature sensors on vehicle with automatic transmission:

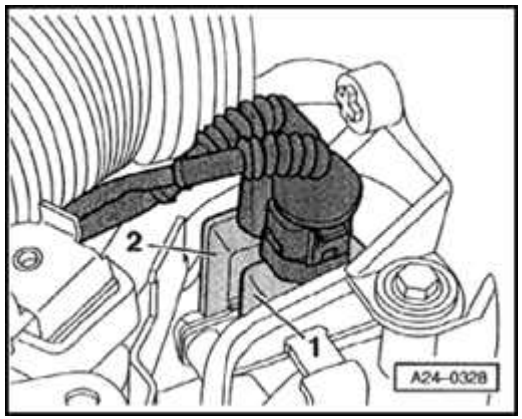
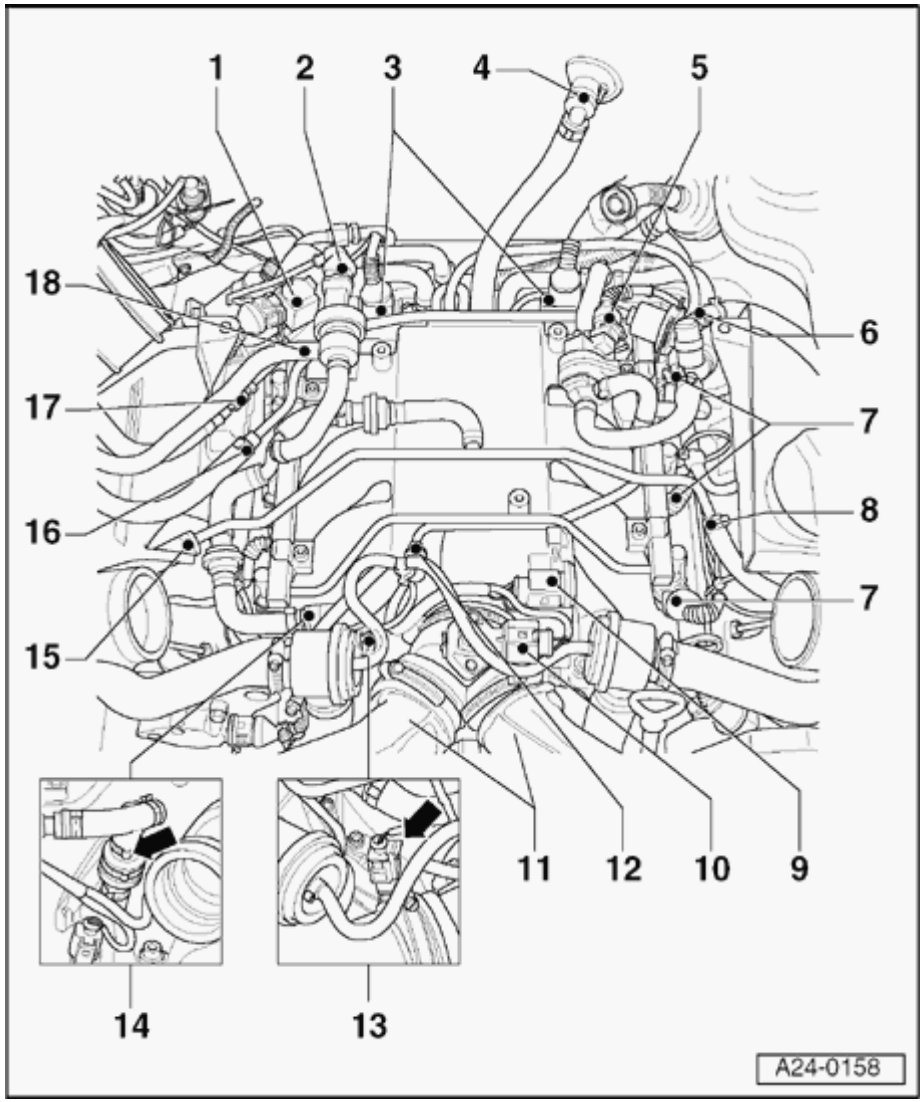


Fig. 1 Component location for exhaust temperature sensors on vehicle with automatic transmission:

1 - Sensor -1- for exhaust temperature -G235

2 - Sensor -2- for exhaust temperature -G236

24-15



Intake manifold, removing and installing

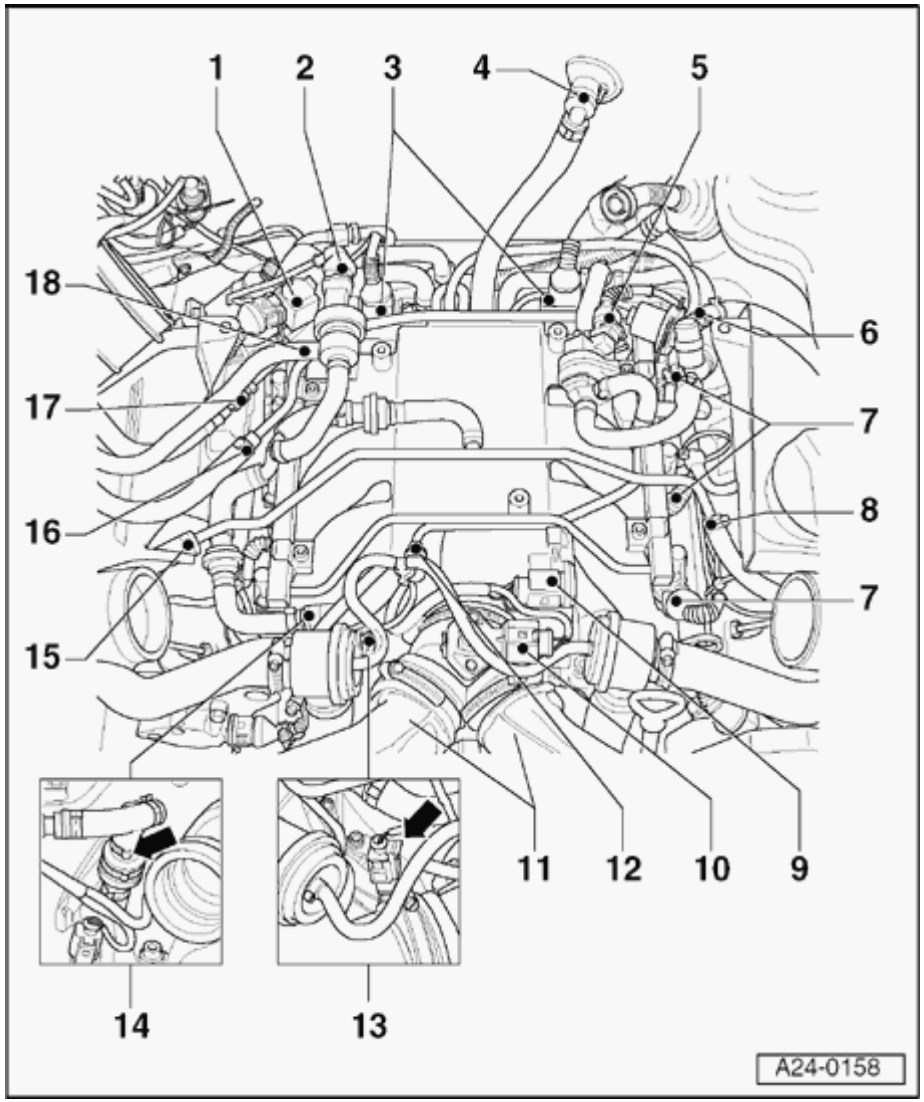
Note:

The procedure is described for vehicles with manual transmission. On vehicles with automatic transmission remove also the secondary air injection pump.

- Remove air distributor ⇒ Page 24-43 .

1 - Unclip Wastegate Bypass Regulator Valve -N75 from fuel rail.

24-16

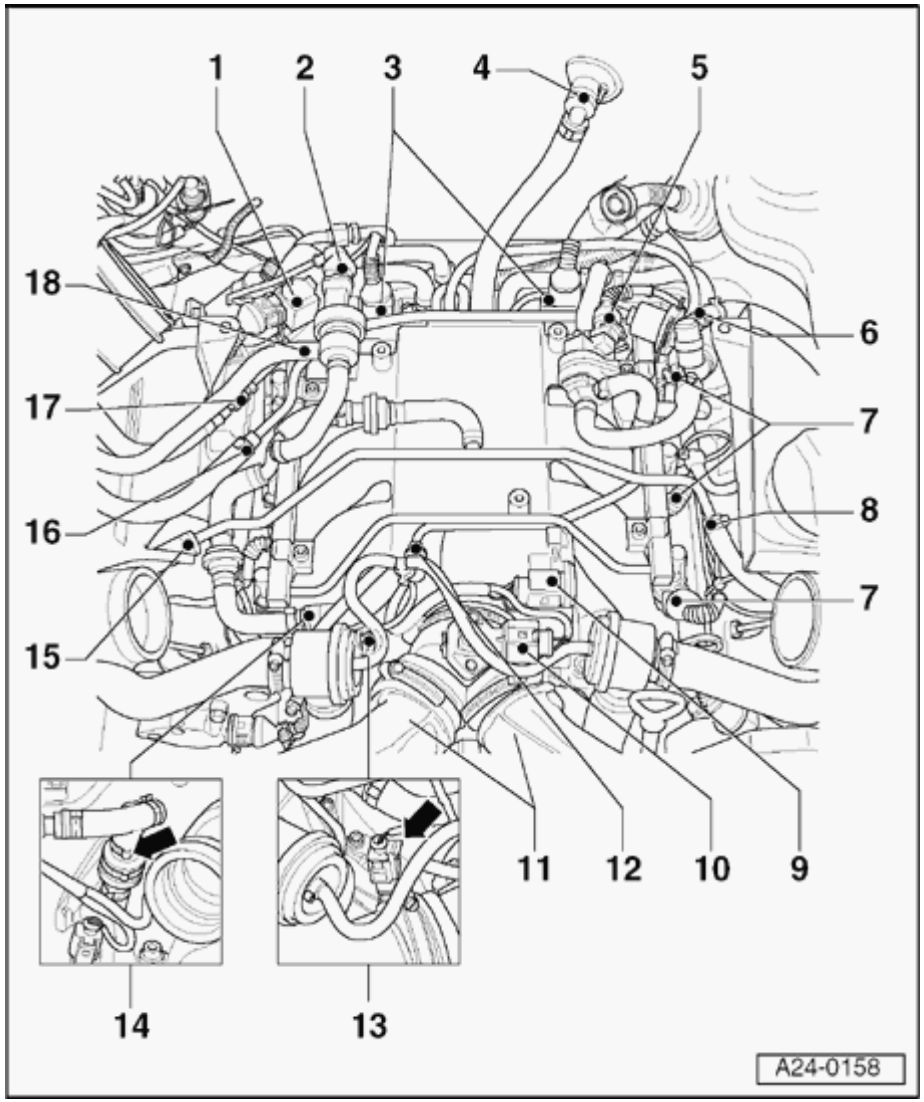


2 - Disconnect harness connector from EVAP Canister Purge Regulator Valve -N80.

3 - Loosen both exhaust temperature sensors -G235 and -G236 from intake manifold. The sensors remain connected. Ensure Ground cable is tight when installing.

4 - Loosen hose to brake booster at bulkhead.

24-17



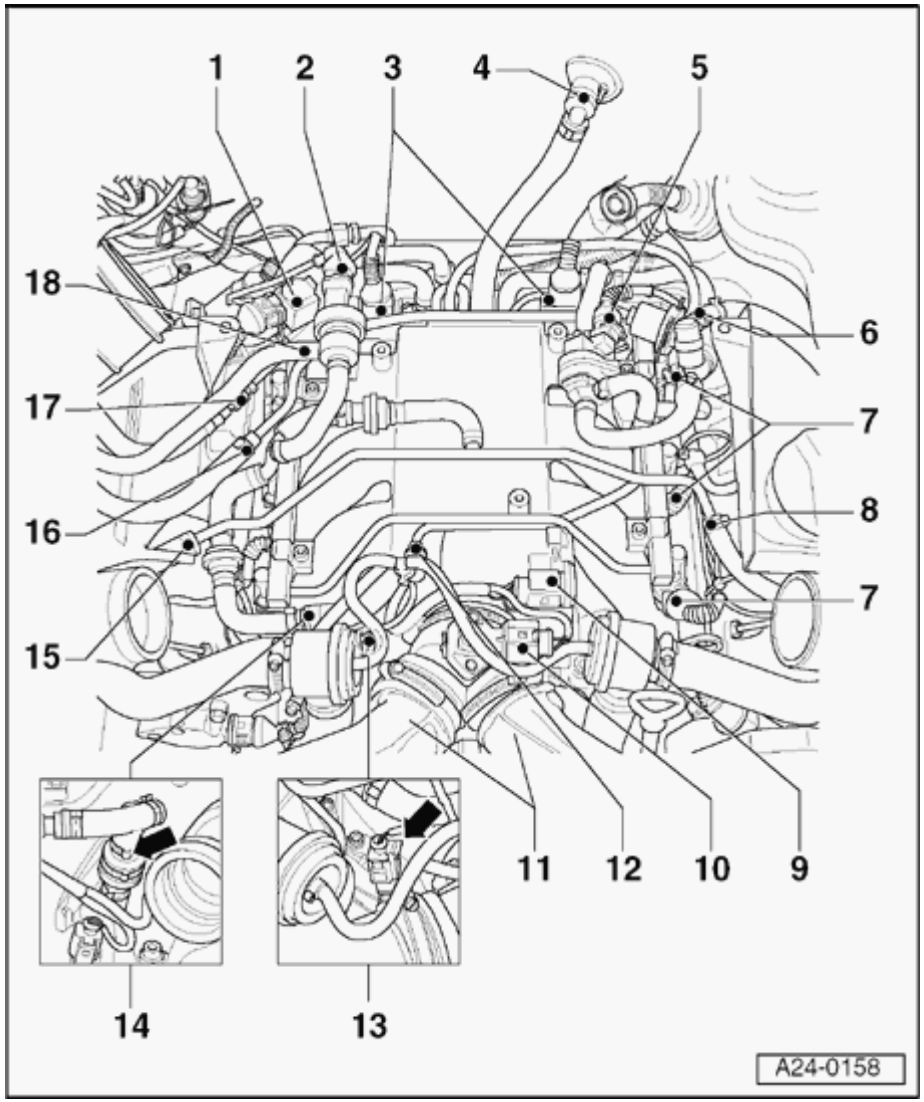
5 - Disconnect harness connector from Recirculating valve for turbocharger - N249.

6 - Loosen indicated hose. The hose leads to a vacuum reservoir.

7 - Disconnect harness connectors of fuel injectors from cylinder bank 1 and bank 2.

8 - Loosen indicated hose. This hose leads to the suction side of turbocharger bank 2.

24-18



9 - Disconnect harness connector at Throttle Valve Control Module -J338.

10 - Disconnect harness connector at Charge Air Pressure Sensor -G31.

11 - Remove indicated pressure hoses

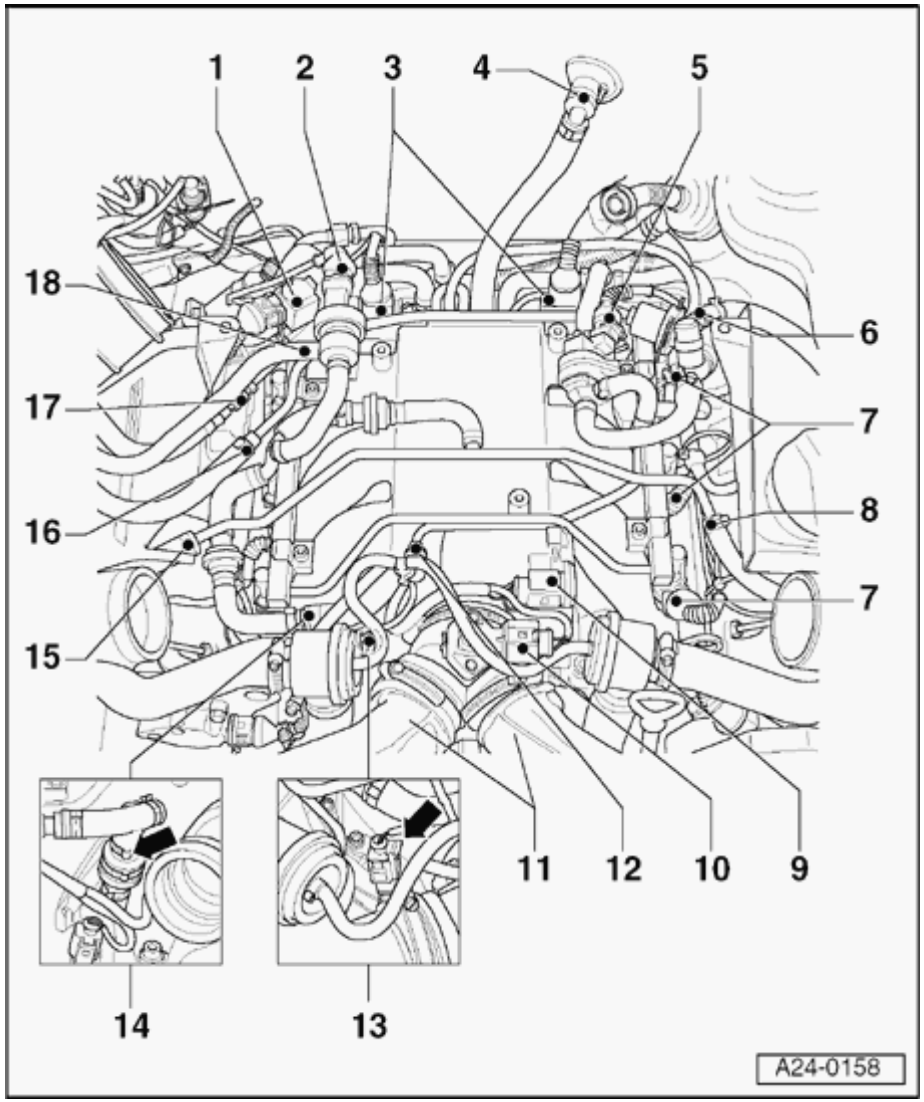
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 15*

12 - Loosen indicated hose, this hose leads to bypass valve.

13 - Disconnect harness connector at Intake Air Temperature (IAT) Sensor -G42.

14 - Loosen indicated hose, (crankcase ventilation hose).

24-19



15 - Loosen indicated hose. This hose leads to the suction side of turbocharger bank 1.

WARNING!

Fire hazard! DO NOT smoke or work near heaters of have anything in the area that can ignite fuel. The fuel system is pressurized. Before loosening hose connections or opening the test connection), place a cloth around the connection.

16 - Loosen fuel return line from fuel rail (catch escaping fuel with clean rag).

17 - Loosen fuel supply line from fuel rail.

18 - Loosen indicated hose at EVAP valve.

- Unbolt intake manifold from cylinder heads and carefuly lift intake manifold from cylinder heads.

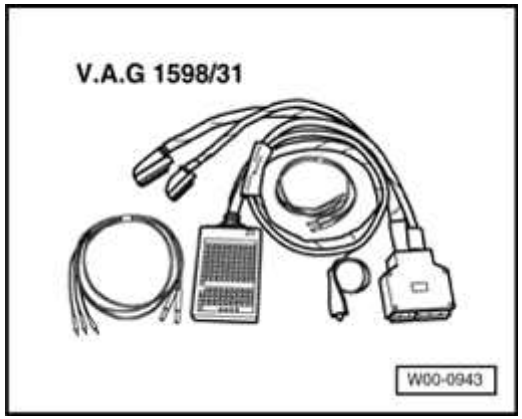
Install intake manifold in reverse order. (Tightening torque of bolts: 10 Nm)

Wiring and component check with VAG1598/31 test box

Notes:

- *The VAG1598/31 test box is designed so it can be simultaneously connected to the control module wiring harness and to the control module itself.*
- *This has the advantage of enabling the engine management system to remain fully operational even with the test box connected (for example, when testing signals while the engine is running).*
- *The instructions for performing the individual tests indicate whether or not the engine control module itself also needs to be connected to the test box.*
- *Use the hand multimeter Fluke 83 (or equivalent) or the multimeter VAG1715 and the diode test lamp VAG1527 for the checks.*
- *To connect the testers to VAG1598/31 test box, always use the adapter leads from VAG1594 A connector test kit.*

Required special tools and test equipment

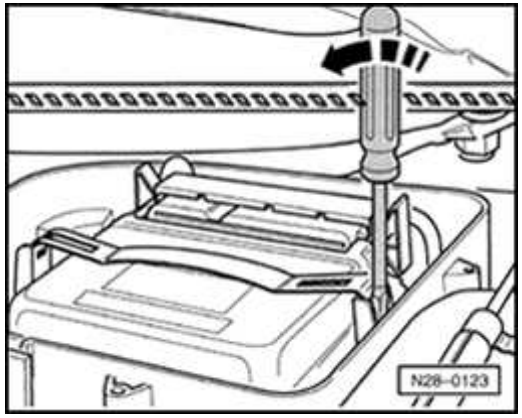


➢ VAG1598/31

24-21

Work sequence

- Switch off ignition.
- Pull rubber gasket forward.
- Remove plenum cover forward.
- Remove cover for E-box (in plenum chamber).

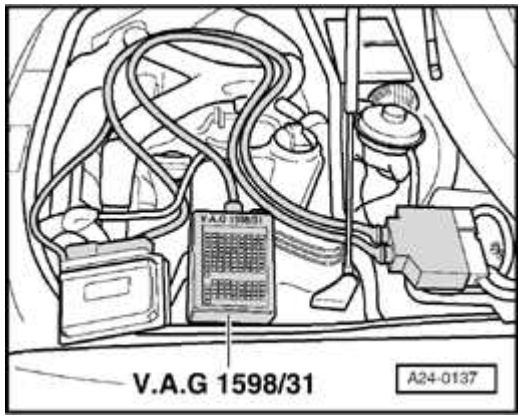


- Carefully lever off the retainer bar with a screwdriver -arrow-.
- Release connectors on engine control module and disconnect connectors.

CAUTION!

To prevent damage to the electronic components, switch to the respective measuring range before connecting the measuring cable and observe the test requirements.

24-22



- Connect VAG1598/31 test box to wiring harness connector. Also connect the Ground (GND) clamp from test box to Ground (GND). The instructions for performing the individual tests indicate whether or not the engine control module itself also needs to be connected to the test box.
- Carry out test as described in the relevant repair instructions.

After installing the engine control module, carry out the following operation

- Check DTC memory and erase if necessary ⇒ Page 01-15 .
- Generate new readiness code ⇒ Page 01-105 .

Note:

At the first learning (adaptation) phase during the "Engine-Basic Setting" the engine might run a little rough at idle and bucks/jerks a little while driving.

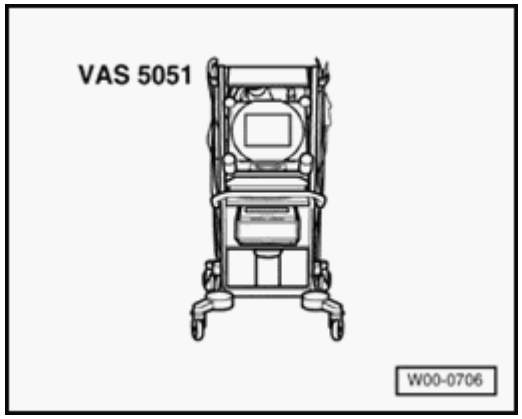
24-23

Procedure after interrupting voltage supply

Note:

At the first learning (adaptation) phase during the "Engine-Basic Setting" the engine might run a little rough at idle and bucks/jerks a little while driving.

Required special tools and test equipment



- VAS 5051 with VAS 5051/1

  or

- VAG1551 with VAG1551/3B

Work procedure

Carry out the following work after the voltage was interrupted:

- Check DTC memory and erase if necessary ⇒ Page 01-15 .
- Generate new readiness code ⇒ Page 01-105 .

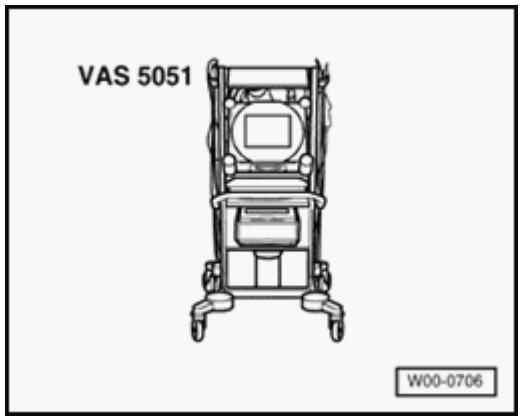
24-24

Motronic Engine Control Module (ECM) - J220, replacing

Note:

When the engine control module is disconnected the learned values are erased but the contents of the DTC memory remain intact.

Required special tools and test equipment



- VAS 5051 with VAS 5051/1

  or

- VAG1551 with VAG1551/3B

Removing

- Connect vehicle Diagnostic, Test and Information System VAS5051 or VAG1551 scan tool to vehicle and select control module for engine elcectronics "Adress word" 01 ⇒ Page 01-9 . The ignition must be switched on.

8D0907551.. 2.7L V6/5VT	G 0002 →
Coding 06711	WSC 06388

Indicated on display: e.g. ECM identification on VAG1551

- Always display control module identification and print out ⇒ Page 01-13 .

24-25

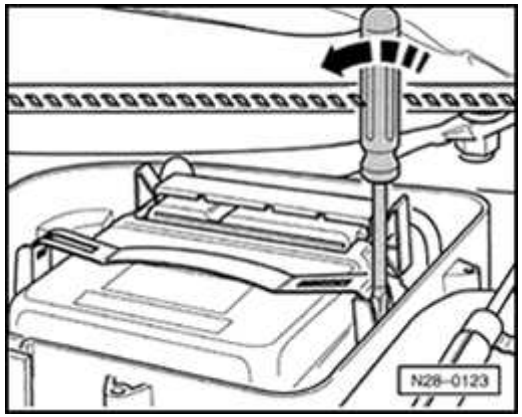
- Compare coding with coding variation table ⇒ Page 01-93 .

- Switch ignition off.

- Pull rubber gasket forward.

- Remove plenum cover forward.

- Remove cover for E-box (in plenum chamber).



- Carefully lever off the retainer bar with a screwdriver -arrow-.
- Release connectors on engine control module and disconnect connectors.
- Remove engine control module.

Installing

Installation is performed in the reverse sequence. However note the following:

Note:

At the first learning (adaptation) phase during the "Engine-Basic Setting" the engine might run a little rough at idle and bucks/jerks a little while driving.

24-26

Important Note:

After installing new engine control module, carry out the following operations:

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

- Perform adaptation of Throttle Valve Control Module -J338 ⇒ Page 24-146 .

- Observe notes for coding new engine control module ⇒ Page 01-93 .

- On vehicles with cruise control (recognizable at steering column switch), activate cruise control function in the engine control module.

⇒ Repair Manual, Electrical Equipment, Repair Group 01

- On vehicles with automatic transmission carry out adaptation for Kick-Down switch ⇒ Page 24-166 .

- Generate readiness code ⇒ Page 01-105 .

- Perform adaptation of immobilizer to engine control module

⇒ *Repair Manual, Electrical Equipment, Repair Group 01, On Board Diagnostic of Immobilizer, Adaptation after replacing engine control module*

24-27

Idle speed, checking

Test conditions

- No leaks in exhaust system
- Coolant temperature at least 80 ° C
- Electrical consumers switched off (radiator fan must not run during the check)
- A/C switched off
- Pressure gauge not connected
- Selector lever in position P or N (vehicles with automatic transmission)

Checking idle speed

Notes:

- *The idle speed cannot be adjusted.*
- *The idle speed is tested during the basic setting of the engine.*

- *During the basic setting of the engine the A/C compressor is automatically switched off and the EVAP canister purge regulator valve is closed.*

- Check DTC memory ⇒ Page 01-15 . The DTC memory must be clear. If necessary, repair any malfunctions and erase the DTC memory. Switch off the engine, then start up again. Take vehicle for a test drive and check DTC memory again to make sure it is clear.

- Run engine at idle speed.

CAUTION!

The electric radiator fan should not be running.

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

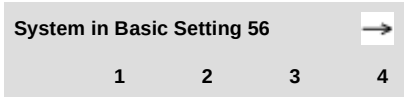
- Press buttons -0- and -4- to select function "Basic Setting" and confirm entry with -Q- button.

Basic setting **Input display group number XXX**	Indicated on display

- Press buttons -0- -5- and -6- to select "Display group number 056" and confirm entry with -Q- button.

24-29

Notes:



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

- Check whether the engine speed shown in display field 1 (actual engine speed) is within the specified tolerance range (750 - 850 RPM).

	Display fields			
	1	2	3	4
Display Group 056: Idle speed stabilization with engine idling at operating temperature				
Display	**xxx RPM**	**xxx RPM**	x.x %	xxxxxxx
Indicates	**Engine speed (actual)**	**Engine speed (specified)**	Idling speed control-torque change	Operating conditions
Specified value	**750 -850 RPM**	**800 RPM**	x.x %	0 0 0 0 0
Note	**If readout does not match Specified value ⇒ Page 24-31**			Relevance of figures ⇒ Page 24-32

- *The value shown in display field 1 is the actual engine speed.*
- *The value shown in display field 2 (specified engine speed) is a theoretical value calculated by the engine control module.*
- *See note on next page:*

24-30

- *When the engine is idling the engine control module tries constantly to adjust the actual engine speed so that it matches the specified value.*

- *This means that the actual engine speed when idling should always be approximately the same as the specified engine speed.*

- *Display fields 3 and 4 provide additional information which is not relevant when checking the idle speed.*

- Press →button.

- Press buttons -0- and -6- to select function "End Output" and confirm entry with -Q- button.

- If readout does not match Specified value, check DTC memory again.

- If DTC memory was erased, generate readiness code ⇒ Page 01-105 .

24-31

If the idle speed is too high or too low, or if the engine does not idle smoothly, and there are no malfunctions stored in the DTC memory, carry out the following tests (marked with dots):

- Check intake system for un-metered air (air leaks) ⇒ Page 24-76 .
- Check Throttle Valve Control Module ⇒ Page 24-139 .
- EVAP canister purge regulator valve constantly open, check ⇒ Page 24-134 .
- Adaptation of Throttle Valve Control Module ⇒ Page 24-146 .

24-32

Relevance of figures in 5-digit readout in Display Group 056

x	x	x	x	x	**Display field 4**
				0	A/C compressor off/on 0 = A/C compressor off 1 = A/C compressor on
			0		Gear selector lever in P or N 0 = Gear selector lever in P or N 1 = Gear selector lever in 2/3/4/R/D
		0			Climate Control readiness 0 = Minimum heating or cooling output 1 = Maximum heating or cooling output
	0				Not used
0					Not used

24-33

Fuel pressure regulator and residual fuel pressure, checking

Requirements

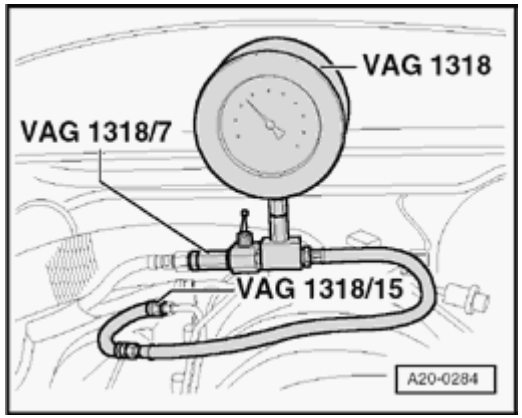
- Fuel pump relay OK
- Fuel pump OK
- Fuel filter OK
- Battery voltage at least 11 V

Note:

The fuel pressure regulator regulates the fuel pressure according to intake manifold pressure. This ensures that the drop in pressure at the injectors remains the same throughout all engine speed and engine load ranges.

WARNING!

Fire hazard! The fuel system is pressurized. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.



Testing system pressure

- Connect pressure gauge VAG 1318 to supply pipe using adapters 1318/7, 1318/8 (pressure hose) and 1318/15.
- Disconnect vacuum hose between fuel pressure regulator and intake manifold at fuel pressure regulator end; seal off end of hose.

Note:

If fuel flows out at the vacuum connection on the fuel pressure regulator during the following pressure test, fit a new fuel pressure regulator.

- Start engine and run at idling speed.
- Measure fuel pressure.

  Specified value: approx. 3.8...4.2 bar
- If fuel pressure does not match specification, install a new fuel pressure regulator for test purposes and repeat pressure test.
- If fuel pressure still does not match specification, check fuel pump and supply pipe for damage (e.g. pinching) and replace if necessary.

- If pressure is higher than specification, check return pipe for damage (e.g. pinching) and renew if necessary.

Note:

During the following test, do not allow the engine to run for too long with the vacuum hose disconnected, otherwise the increased fuel pressure will enrich the air/fuel mixture and may cause the lambda control limits to be exceeded. This would be stored as a fault in the fault memory.

- Start the engine and run at idling speed.

- Switch off electrical consumers (air conditioner etc.).

- Re-connect vacuum hose to fuel pressure regulator and observe drop in pressure on pressure gauge.

- When the vacuum hose is re-connected the fuel pressure should drop by around 0.5 bar.

  If the pressure does not change as specified, carry out the following tests:

  - Check vacuum hose for cracks and other damage.
  - Test vacuum hose for blockages at intake manifold. To do this, disconnect hose at fuel pressure regulator and blow into it.

- If there are no leaks and no blockages in the vacuum hose, install new fuel pressure regulator.
- Replace hose clamp that secures vacuum hose to the fuel pressure regulator and make sure that new clamp is properly installed.

Checking residual fuel pressure

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

  With engine cold: at least 2.2 bar

With engine at operating temperature: approx: 3.0 bar

24-37

Note:

A rise in pressure (due to fuel expansion) when the engine is at operating temperature is normal.

- Start the engine and run at idling speed.

- Switch ignition off after the pressure has built-up. At the same time close pressure gauge cut-off tap (lever at 90° to through flow direction).

If the pressure does not drop, the following faults are possible:

- Union between pressure gauge and fuel supply pipe leaking
- Supply pipe leaking at fuel tank
- Return valve in fuel pump leaking

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

Note:

When the cut-off tap is closed the pressure gauge will indicate the pressure downstream of

the cut-off tap, i.e. on the same side as the intake manifold, injectors and fuel pressure regulator. If there is then a drop in pressure upstream of the cut-off tap (same side as fuel tank), the change will not be registered by the pressure gauge. This is why the paragraph beginning "If the pressure does not drop..." has been included above.

24-38

If the pressure drops again, the following malfunctions are possible:

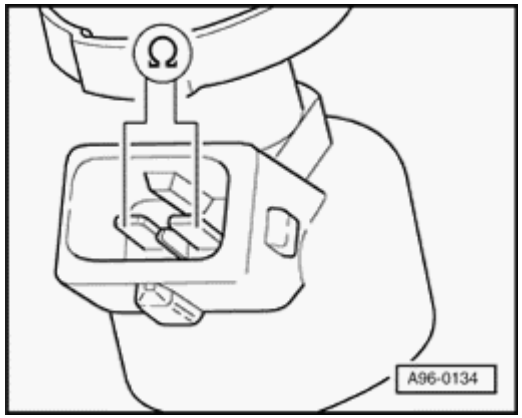
- Fuel pressure regulator faulty
- Fuel Injectors leaking
- Unions on pressure gauge downstream of cut-off valve leaking

Note:

When disconnecting the pressure gauge, close the cut-off valve, unscrew the union on adapter VAG 1318/15, then open the cut-off valve to drain off excess fuel into a suitable container.

Fuel injectors, checking

A - Electrical testing of fuel injectors



- Disconnect harness connector from injector to be tested.

- Connect hand-held multimeter to fuel injector (resistance measurement range).

  Specified value: 13.5 - 15.5 Ω

Note:

When the engine is at operating temperature the electrical resistance of the injectors will be about 4 - 6 Ω. higher.

If the specification is not obtained:

- Replace fuel injector ⇒ Page 24-53 . Also observe notes on ⇒ Page 24-51 .

24-40

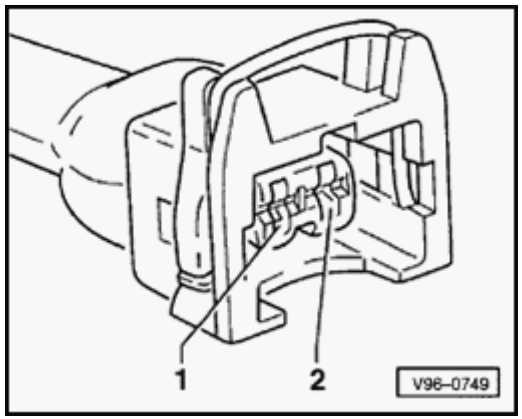
Checking voltage supply

Test conditions

- Fuse for injectors OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Disconnect harness connector from fuel injector to be tested.



- Connect diode test lamp (for measuring voltage) between Ground (GND) and socket 1 of connector.

24-41

- Switch ignition on. The diode test lamp should light up.

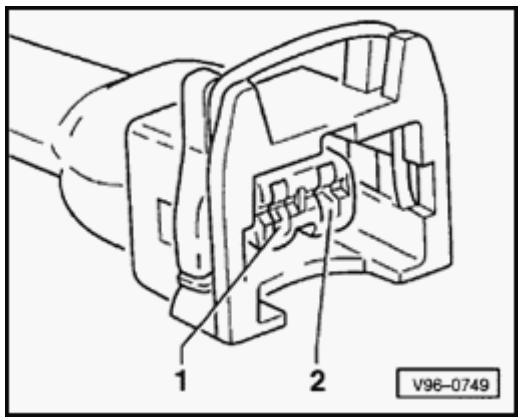
- If diode test lamp does not light up, test for open circuits in wiring between contact 1 and fuse for injectors. If necessary, rectify open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If diode test lamp lights up, test activation of injectors.

C - Testing activation of injectors

- Remove plug connector from the injector which is to be tested.



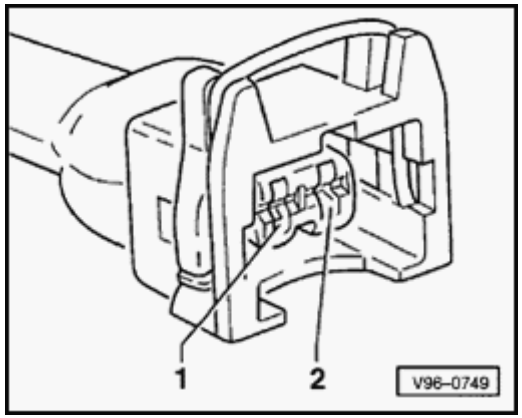
- Connect diode test lamp VAG 1527 between the battery positive terminal (+) and contact 2 on the connector.
- Operate starter for a few seconds (the engine can be allowed to start).

Specified value: the diode test lamp should start flashing.

Note:

Diode test lamps with a low current draw continue to glow faintly between

impulses from the engine control unit (rather than going out completely) and become much brighter when receiving an impulse.



If the diode test lamp does not flash:

- Connect test box VAG 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself. ⇒ Page 24-20 .

- Test for open circuit or short to B+ in wiring between engine control module and contact 2 on harness connector for fuel injector being tested.

Contact 2 on connector for injector, Cylinder No.	Test box VAG 1598/31, socket
1	96
2	112
3	88
4	97
5	113
6	89

- Rectify short circuit or open circuit if necessary.
- If wiring is OK, install a new engine control module ⇒ Page 24-24 .

Fuel injection volume, fuel injector leakage and spray pattern of injectors, checking

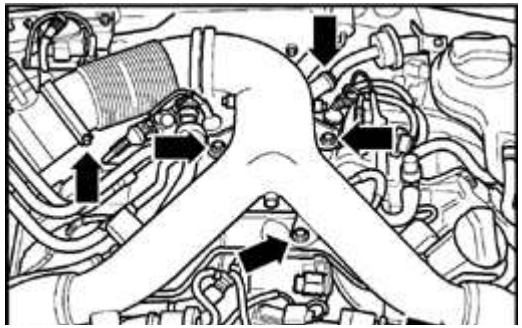
WARNING!

Fire hazard! The fuel system is pressurized. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.

Test conditions

- Fuel pressure OK; testing ⇒ Page 24-33 .

To reach the fuel rail, the following steps must be performed on vehicles with manual transmission (without secondary air injection). On vehicles with automatic transmission (with secondary air injection) are minor differences in the work procedure.



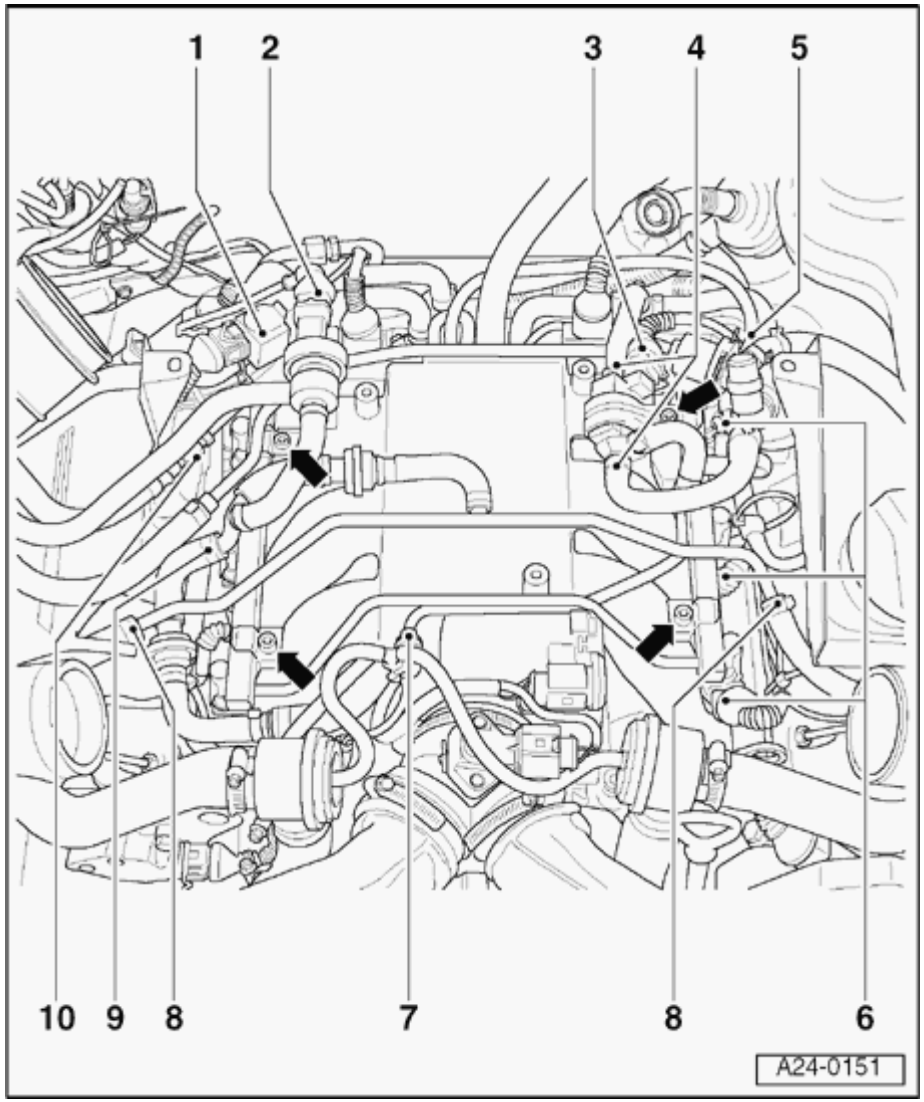
- Unscrew bolts on air duct at points indicated (arrows) and remove air duct.

Several hoses must now be disconnected:

- Absolute cleanliness must be maintained.

- After completing test, use new hose clamps and make sure they are installed properly.

24-44



1 - Detach Wastegate Bypass Regulator Valve -N75 from fuel rail. The hoses must remain connected.

2 - Disconnect harness connector from EVAP Canister Purge Regulator Valve -N80.

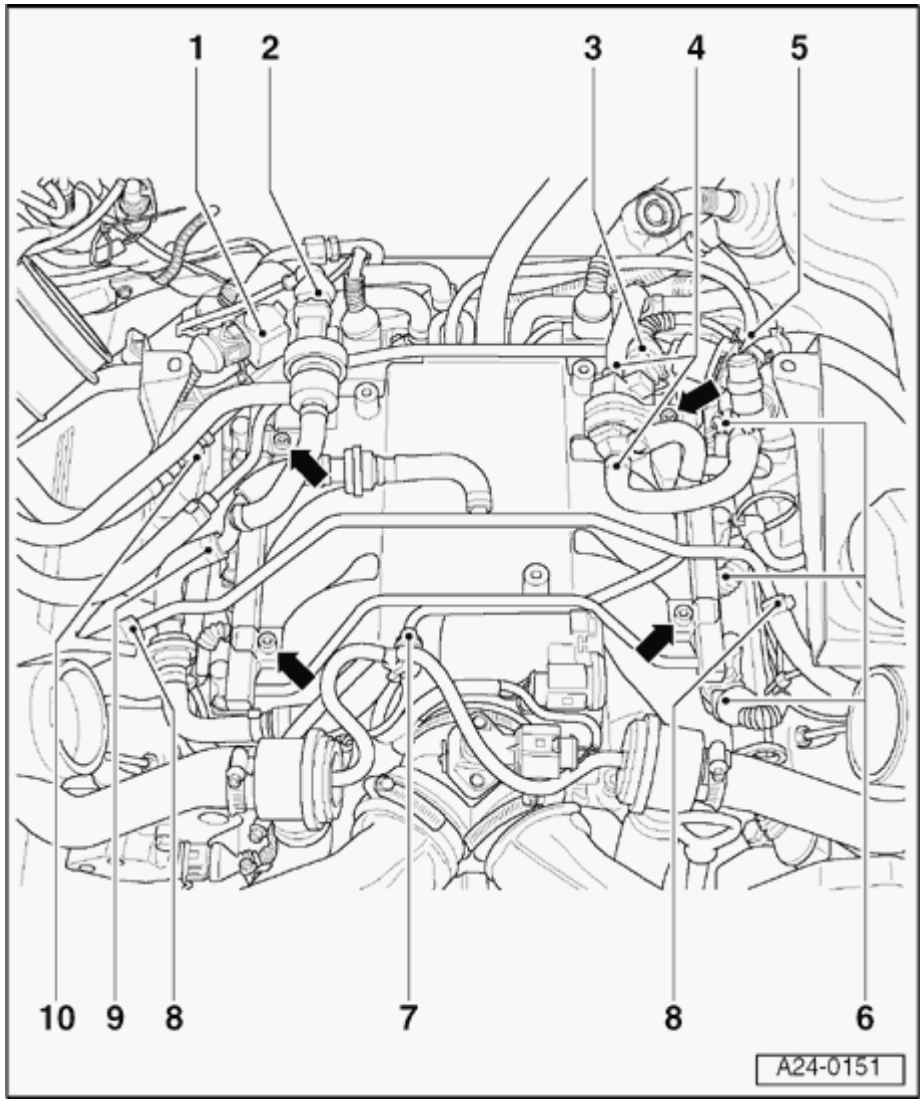
3 - Disconnect harness connector from Recirculating valve for turbocharger - N249.

4 - Open hose clamps shown in the illustration and detach hoses from air recirculating valve.

5 - Open hose clamp on fuel pressure regulator and detach hose.

6 - Disconnect harness connectors from injectors on cylinder banks 1 and 2.

24-45

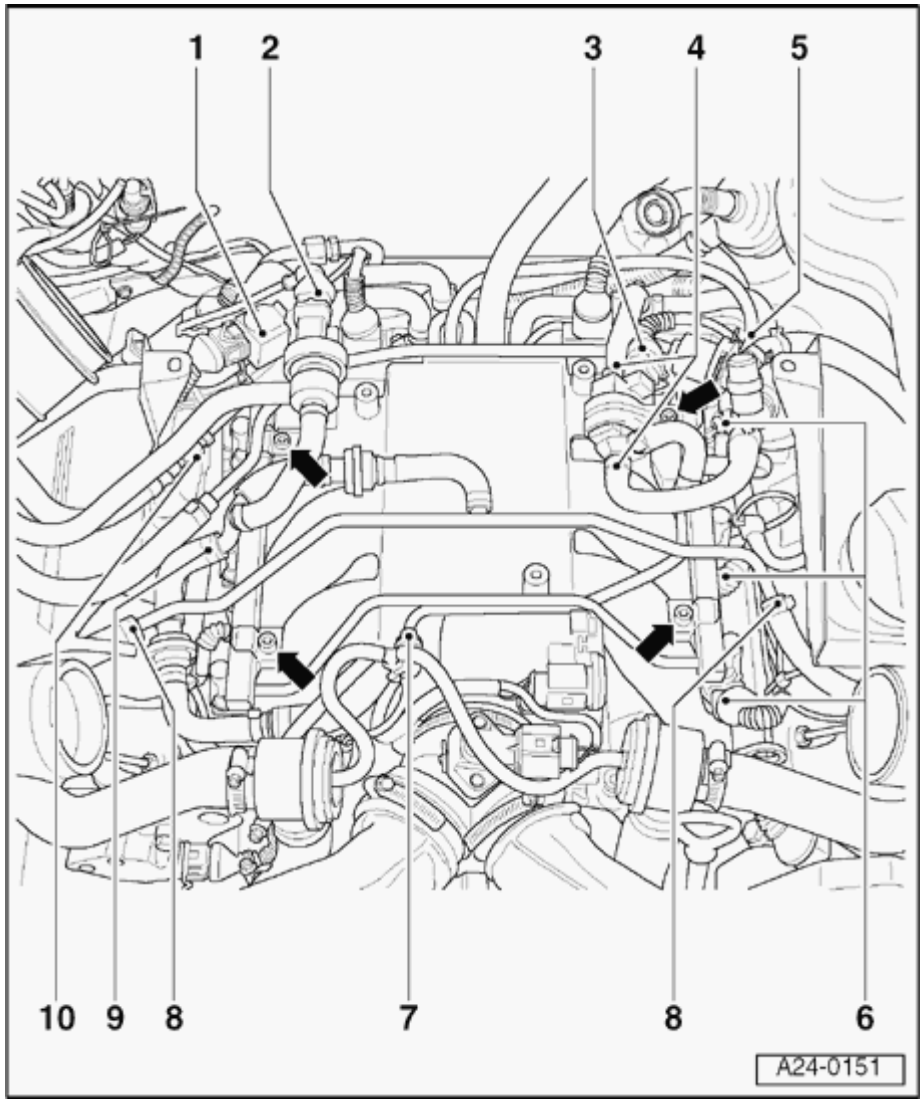


7 - Open hose clamp and detach hose (vacuum hose for applying vacuum to the mechanical air recirculating (Bypass) valves when required).

8 - Open hose clamps shown in the illustration and detach hoses. (The hoses lead to the intake (suction) sides of the turbochargers for cylinder banks 1 and 2).

9 - Open hose clamp shown in the illustration and detach hose. (The hose supplies fuel vapor to the intake manifold).

24-46



10 - Briefly open screw connection on fuel rail (supply hose) to release pressure. Use clean cloth to catch any fuel that leaks out. Then tighten screw connection again.

WARNING!

Fire hazard! The fuel system is pressurized. Before loosening hose connections or opening the test connection, place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.

11 - Unbolt fuel rail from intake manifold at the points indicated (see arrows).

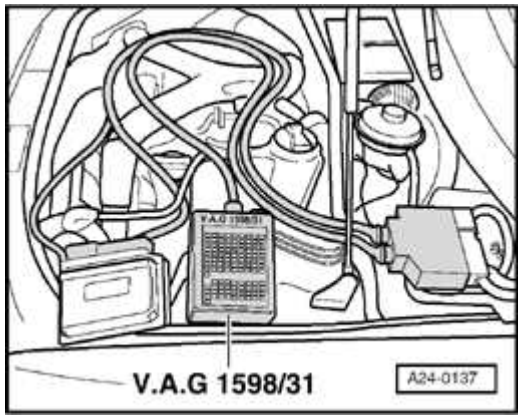
- Tightening torque bolts: 10 Nm

- Lift fuel rail off intake manifold together with fuel injectors and support the fuel rail.

Note:

- *After lifting off the fuel rail, check to make sure that the injectors are properly secured to the fuel rail.*

- *It is possible that some of the fuel injectors will become detached from the fuel rail and remain in the intake manifold when the fuel rail is removed. If this happens, install the fuel injectors back onto the fuel rail* ⇒ *Page 24-53* .



- Connect test box VAG 1598/31 to wiring harness for engine control unit. Do not connect to the engine control module itself ⇒ Page 24-20 .

WARNING!

Make sure test box is inside of passenger compartment.

Checking for leaks

- Bridge sockets 1 and 65 on the test box using test leads from VAG1594 A connector test kit. (This creates an Ground (GND) connection to one side of the fuel pump relay coil.)

Note:

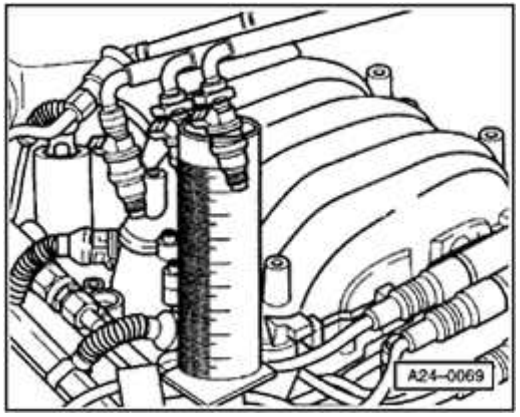
Once the socket are bridged the fuel pump runs continuously, even if the engine is not running. This is because the fuel pump relay receives its positive voltage supply via the central electrics. The negative voltage supply for the fuel pump relay comes via the cable bridge on the test box.

WARNING!

Fire hazard. DO NOT smoke or work near heaters or have anything in the area that can ignite fuel!

- Check injectors fuel for leaks (visual check). When fuel pump is running, only 1 or 2 drops should escape per minute from each injector.

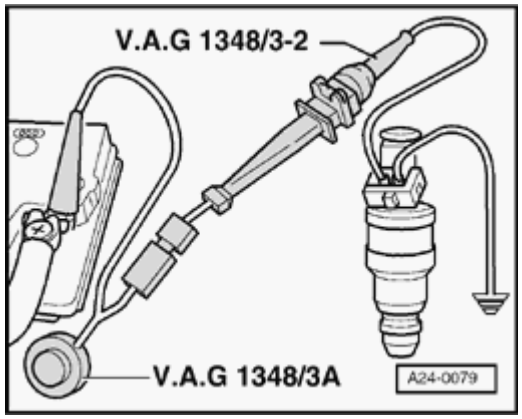
- If fuel loss is greater, switch off fuel pump (remove bridge) and replace faulty injector ⇒ Page 24-53 , also observe notes on ⇒ Page 24-53 .



Checking injection quantity

- Place fuel injector which is to be tested into measuring glass from injection quantity tester VAG1602.

24-49



- Connect one fuel injector terminal to engine Ground (GND) using test cable and crocodile clamp from VAG1594 connector test kit.
- Connect second fuel injector terminal to B+ using remote control VAG1348/3 A, adapter cable VAG1348/3-2 and auxiliary cable.

WARNING!

Make sure test box is inside of passenger compartment.

- Bridge sockets 1 and 65 on the test box using test leads from VAG1594 A connector test kit. (This creates an Ground (GND) connection to one side of the fuel pump relay coil.)

The fuel pump should run.

24-50

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

- When all three fuel injectors from the first bank of cylinders have been activated, place the three measuring glasses on a level surface.

  Specified value for each fuel injector: 135 ... 165 ml

- If measured value for one or more of fuel injectors is outside tolerance range, switch off fuel pump (switch ignition off) and replace faulty fuel injector ⇒ Page 24-53 , also observe notes on ⇒ Page 24-53 .

- Repeat test for fuel injectors from second bank of cylinders.

- If measured values for all fuel injectors are outside tolerance range (specification), check fuel pressure ⇒ Page 24-33 .

Note:

When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

Installation of the fuel rail together with injectors is performed in the reverse sequence. The following points should be noted when installing:

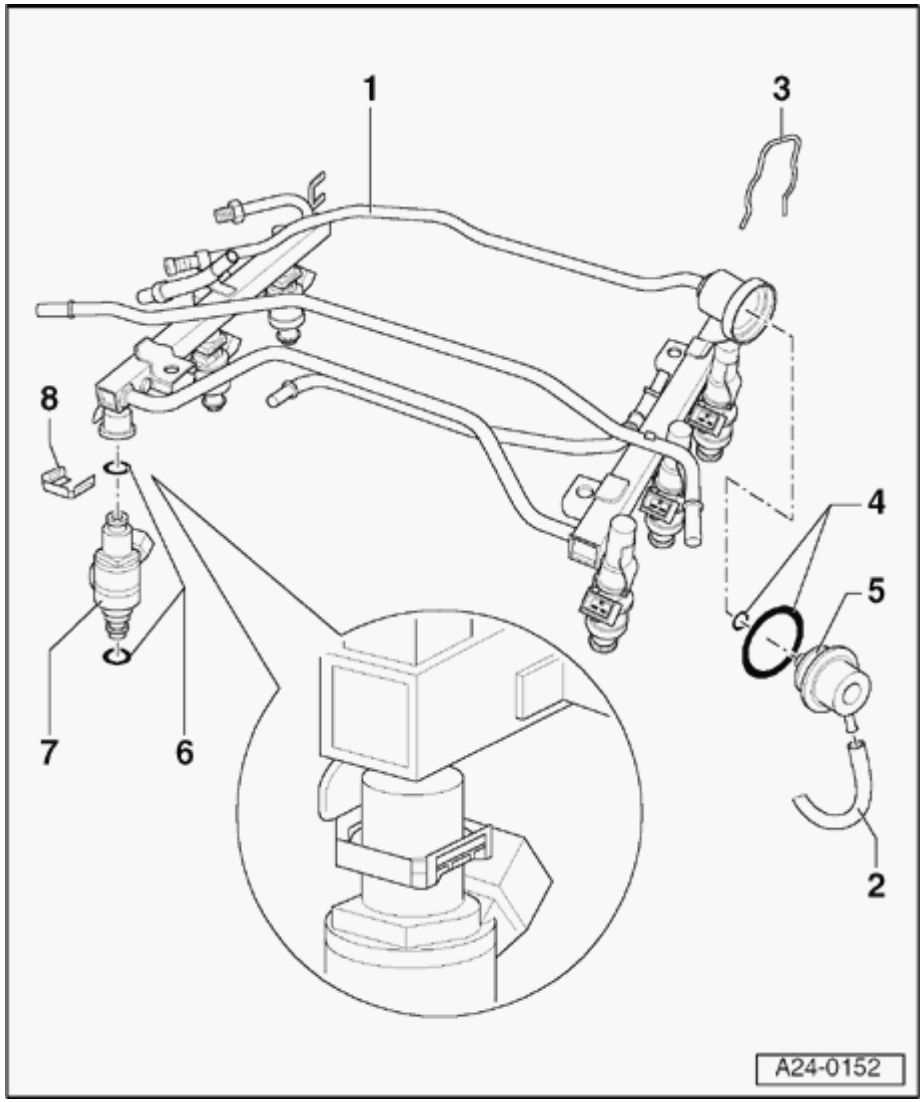
- Replace O-rings at all opened connections. (When replacing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)

- Moisten O-rings with clean engine oil.

24-52

- Make sure fuel injectors are correctly positioned, insert vertically into fuel rail and secure with retainer clips.
- Position fuel rail together with injectors (properly secured) against intake manifold and press into place evenly all round.
- Replace hose clamps and make sure that they are securely installed.

24-53



Fuel rail with fuel injectors, dismantling and assembling

1 - Fuel rail

2 - To intake manifold

3 - Retaining clip

4 - O ring

- Replace

5 - Fuel pressure regulator

6 - O ring

- Replace

7 - Injector (N30...N32, N33...N84)

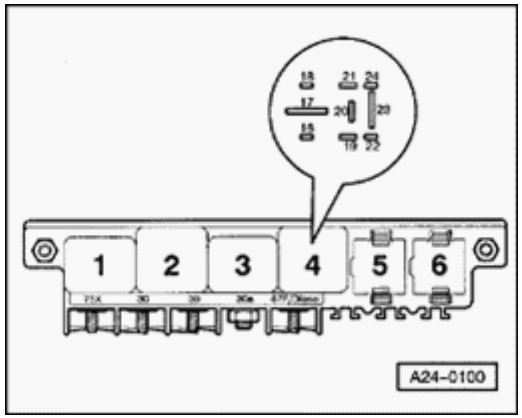
8 - Retaining clip

- Must be seated correctly at fuel injector and fuel rail

24-54

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

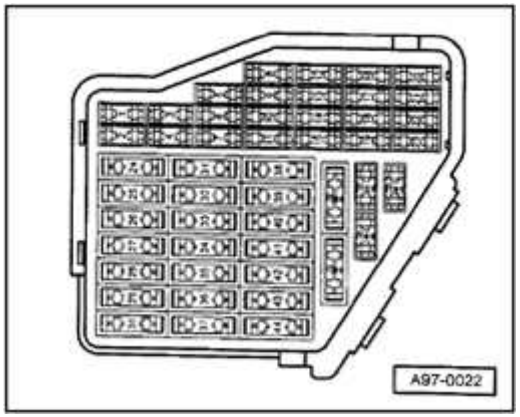
Note:



The fuel pump relay is located in the central electrics in the left-hand footwell, relay position 4.

A - Checking Fuel Pump (FP) relay -J17

- Remove storage bin in front left-hand footwell.



- Remove fuel pump fuse from fuse holder and connect diode test lamp VAG1527 between Ground and one of the two contacts for the fuel pump fuse.

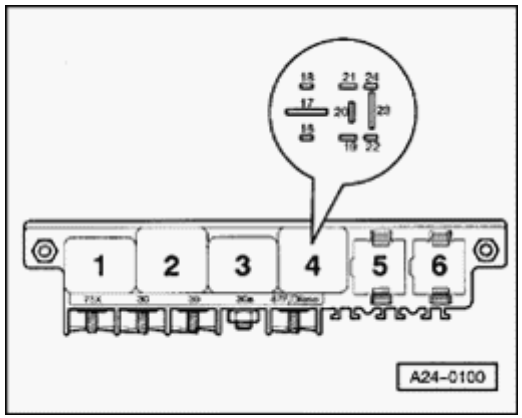
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Operate starter briefly.

The fuel pump relay should pick up (can be felt and heard) and the diode test lamp should light up.

- If fuel pump relay does not pick up, check activation ⇒ Page 24-56 .

24-55



- If fuel pump relay picks up but diode test lamp does not light up, repeat test on other terminal.

- If diode test lamp still does not light up, test for open circuit in wiring between fuel pump fuse and terminal 23 in relay position 4. If necessary, rectify open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If voltage supply, activation and wiring for fuel pump relay are OK, install new fuel pump relay.

B - Checking voltage supply and activation of fuel pump relay

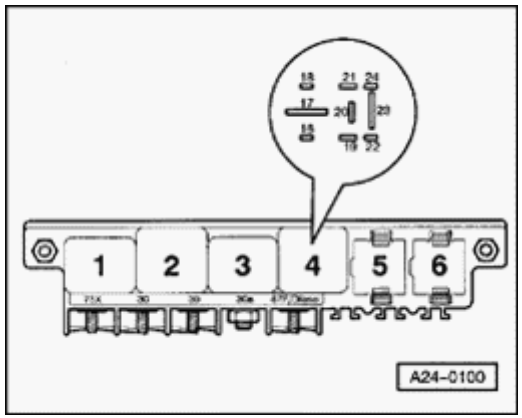
Note:

Activation of the fuel pump relay can also be tested using the final control diagnosis ⇒ Page 01-75 .

- Remove fuel pump relay -J17 from central electrics, relay position 4.

Checking voltage supply

- Switch ignition on.

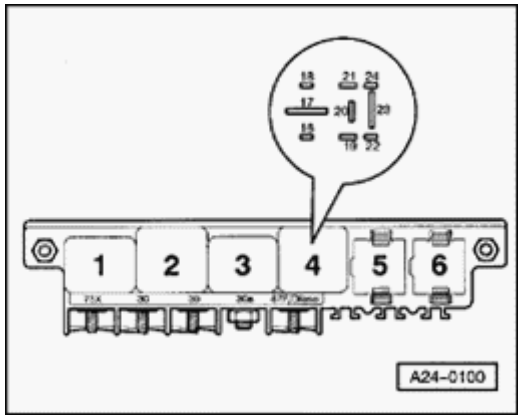


- Connect hand-held multimeter VAG1526 between Ground (GND) and relay panel contact 19 (B+; terminal 15 from ignition switch). Disconnect, then re-connect between Ground (GND) and relay panel contact 17 (permanent B+; terminal 30 from battery).

Specification: approx. battery voltage in each case

- If values are not as specified, rectify open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*



Checking activation

- Connect diode test lamp VAG1527 between B+ and contact 16 on relay panel (Ground connection via engine control module).
- Operate starter briefly.
- The diode test lamp should light up and remain lit when the starter is operated.

Note:

Diode test lamps with a low current draw do not go out completely but continue to glow faintly until the starter is operated.

- If activation, wiring and power supply for fuel pump relay are OK but fuel pump relay still does not pick up, replace fuel pump relay.

If the diode test lamp does not light up, test the wiring as follows:

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

24-58

- Connect hand-held multimeter between contact 16 on relay panel and socket 65 on the test box, then test wiring for open circuits.

- Rectify open circuit if necessary.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If there is no open circuit and the diode test lamp still does not light up:

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

- Reinstall fuel pump fuse.

24-59

Mass Air FLow (MAF) sensor -G70, checking

Requirements

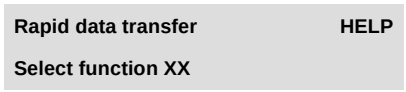
- Coolant temperature at least 80 ° C (175 ° F)
- Electrical consumers switched off (radiator fan must not run during test)
- A/C switched off
- Fuse for mass air flow sensor OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

Checking function

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.

24-60

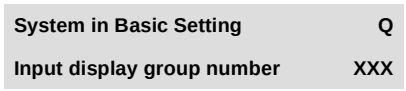


Indicated on display

- Press buttons -0- and -4- to select function "Basic Setting" and confirm entry with -Q- button.

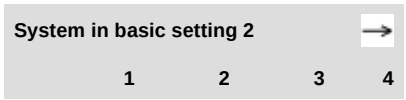
Note:

During the basic setting the engine control module closes the EVAP canister purge regulator valve -N80 and switches off the A/C compressor.



Indicated on display

- Press buttons -0-, -0- and -2- to select Display Group 002 and confirm entry with -Q- button.



Indicated on display

- Check displayed specified values for engine load.

24-61

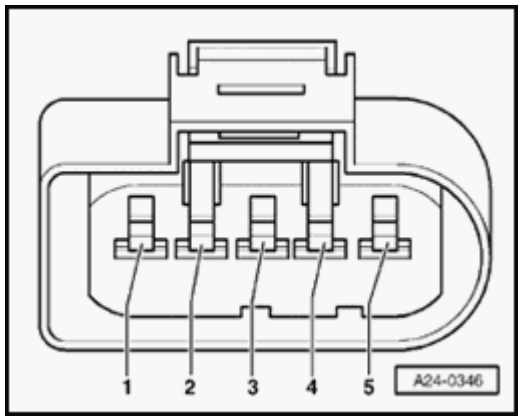
Note:

Read measuring value block display group 2 as described in repair manual and evaluate it ⇒ Page 24-69 . If the suggested repair steps refer to the voltage supply test for the Mass Air Flow (MAF) sensor or the wiring connections from the Mass Air Flow (MAF) sensor to the Engine Control Module (ECM), proceed to the following pages.

Please note the distinction between sensors made by Bosch and those made by Hitachi (recognizable via the writing on the sensor).

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

Note: For Bosch Mass Air Flow (MAF) sensors see page ⇒ Page 24-65 .



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

- Connect multimeter to terminal 2 of connector and engine Ground (GND) for voltage measurement.

- Operate starter briefly.

  Specification: approx. battery voltage

Note:

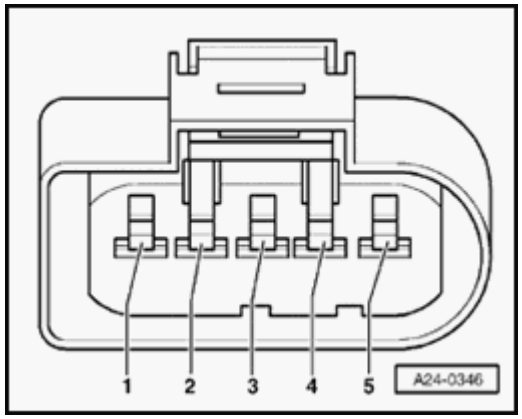
Voltage is supplied to Mass Air Flow (MAF) sensor from Fuel Pump (FP) relay.

If there is no battery voltage.

- Check wire connection from terminal 2 of connector to Fuel Pump (FP) relay via fuse for open circuit and short circuit to Ground (GND), repair if necessary.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-63



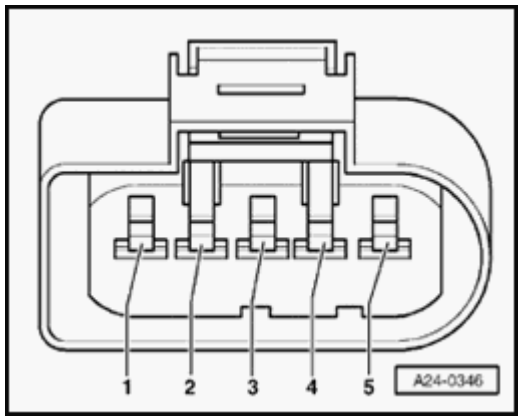
- Connect multimeter to terminal 2 and terminal 3 of connector for voltage measurement.
- Operate starter briefly.

  Specification: approx. battery voltage

Note:

Ground (GND) from the ECM is present at terminal 3 of connector.

If specified value is not obtained, check wire connections ⇒ Page 24-74 .



- Connect multimeter to terminal 3 and terminal 1 of connector for voltage measurement.
- Switch ignition on.

  Specification: approx. 5 volts.

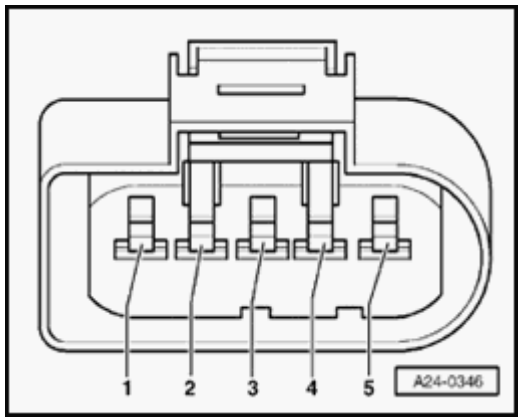
If specified value is not obtained, check wire connections ⇒ Page 24-74 .

Wire connections for Mass Air Flow (MAF) sensor, checking (Hitachi MAF sensor)

Note:

Signal wire is also checked during wire test.

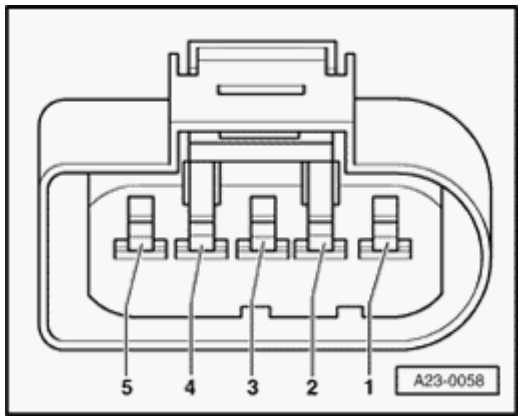
- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-20 .



➢ The following wire connections must be checked for short circuit to B+, Ground (GND) and for open circuit

Connector for Mass Air Flow (MAF) sensor -G70-	VAG1598/31 test box terminal
1	53
3	27
4	29

24-65



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

- Disconnect connector from Mass Air Flow (MAF) sensor.
- Connect multimeter to terminal 2 of connector and engine Ground (GND) for voltage measurement.
- Operate starter briefly.

  Specification: approx. battery voltage

Note:

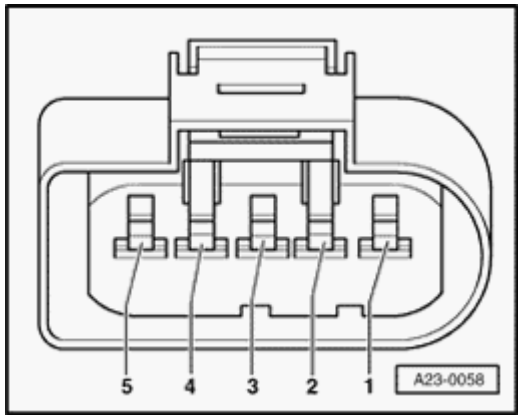
Voltage is supplied to Mass Air Flow (MAF) sensor from Fuel Pump (FP) relay.

If there is no battery voltage.

- Check wire connection from terminal 2 of connector to Fuel Pump (FP) relay via fuse for open circuit and short circuit to Ground (GND), repair if necessary.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-66



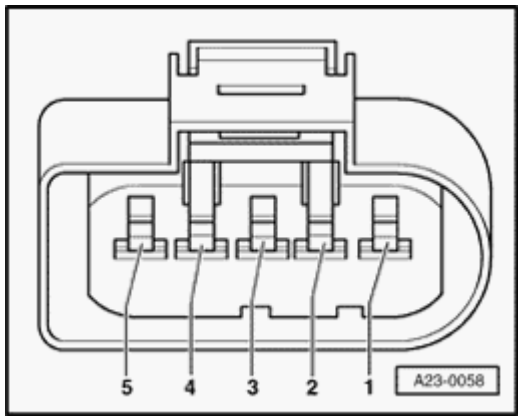
- Connect multimeter to terminal 2 and terminal 3 of connector for voltage measurement.
- Operate starter briefly.

  Specification: approx. battery voltage

Note:

Ground (GND) from the ECM is present at terminal 3 of connector.

If specified value is not obtained, check wire connections ⇒ Page 24-74 .



- Connect multimeter to terminal 3 and terminal 4 of connector for voltage measurement.
- Switch ignition on.

  Specification: approx. 5 volts.

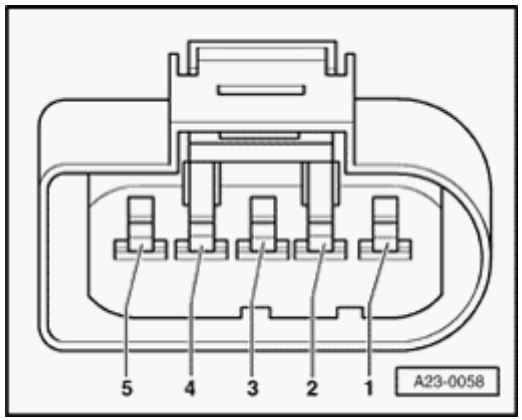
If specified value is not obtained, check wire connections ⇒ Page 24-74 .

Wire connections for Mass Air Flow (MAF) sensor, checking (Bosch MAF sensor)

Note:

Signal wire is also checked during wire test.

- Connect VAG1598/31 test box at wiring harness to ECM, do not connect ECM ⇒ Page 24-20 .



➢ The following wire connections must be checked for short circuit to B+, Ground (GND) and for open circuit

Connector for Mass Air Flow (MAF) sensor -G70-	VAG1598/31 test box terminal
3	27
4	53
5	29

Wire resistance: max: 1.5 Ohm

- Also check all wires for short circuit to each other.

Specification: infinite Ohms (no continuity)

- If the voltage supply and the wire connection are OK, replace Mass Air Flow (MAF) sensor -G70-.

24-69

	Display fields			
	1	2	3	4
Display Group 002: Intake air mass at idling speed with engine at operating temperature				
Display	xxx RPM	xx.x %	**x.x ms**	**xxx.x g/s**
Indicates	Engine speed (in steps of 40 RPM)	Load	**Average injection period**	**Air mass**
Work range	min.: 750 rpm max.: 6800 rpm	min.: 15 % max.: 175 %	**min.: 2.0 ms** **max.: 19.0 ms**	**min.: 3.0 g/s** **max.: approx: 225g/s**
Specification	750 - 850 rpm	15.0 - 25.0 %	**2.0 - 4.0 ms1.**	**3.0 - 4.5 g/s**
Note	---	---	**If readout does not match specification, see table for display field 3 ⇒ Page 24-70**	**If readout does not match specification, see table for display field 4 ⇒ Page 24-71**

If the specification is obtained:

- Press →button.

- Press buttons -0- and -6- to select function "End Output" and confirm entry with -Q- button.

- Switch ignition off.

Reading Display Group 002

Display field 3	Possible cause of malfunction	Corrective action
Less than 2.0 ms	♦ Lower values can only occur when vehicle is on fuel-shut off (overrun)	
More than 4.0 ms	♦ Load on engine due to ancillaries	- Eliminate load (air conditioner, power steering, alternator)
	♦ Rough idle (engine not running on all cylinders)	- Check spark plugs - Check fuel injectors ⇒ Page 24-39
	♦ Throttle Valve Control Module -J338 faulty	- Check Throttle Valve Control Module ⇒ Page 24-139

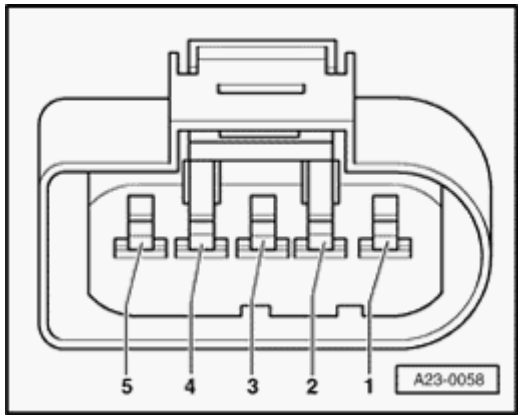
24-71

Reading Display Group 002

Display field 4	Possible cause of malfunction	Corrective action
Less than 3.0 g/s	♦ Large quantity of un-metered air between intake manifold and Mass Air Flow (MAF) sensor ♦ Voltage supply to Mass Air Flow (MAF) sensor or wiring to Engine Control Module (ECM)	- Check intake system for leaks (un-metered air) ⇒ Page 24-76 - Check voltage supply and wiring ⇒ Page 24-72
More than 4.5 g/s	♦ Load on engine due to accessories	- Eliminate load (A/C, power steering, generator)
	♦ Voltage supply to Mass Air Flow (MAF) sensor or wiring to Engine Control Module (ECM)	- Check voltage supply and wiring ⇒ Page 24-72

Checking voltage supply to Mass Air Flow (MAF) sensor

- Disconnect harness connector from air mass meter.



- Connect hand-held multimeter (voltage measurement range) between engine Ground (GND) and socket 2 of connector.
- Operate starter briefly.

  Specification: approx. battery voltage

Note:

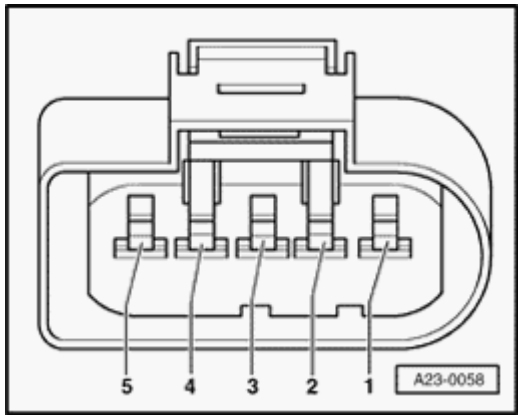
The mass air flow sensor receives its voltage supply via the fuel pump relay.

If the reading does not match the battery voltage:

- Check for open circuit or short to Ground (GND) in wiring between fuel pump relay and socket 2 on connector via fuse. Repair if necessary.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-73



- Connect hand-held multimeter (voltage measurement range) between sockets 2 and 3 of connector.
- Operate starter briefly.

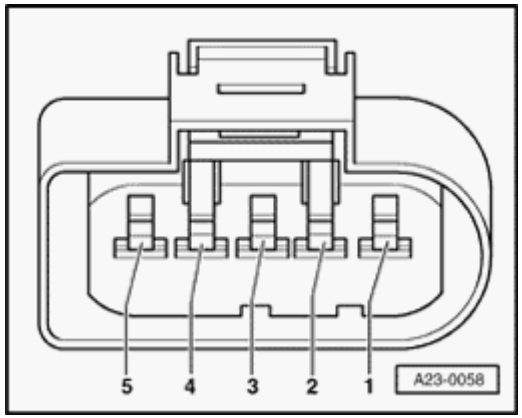
  Specification: approx. battery voltage

Note:

Socket 3 on the connector is the Ground (GND) connection from the engine control module.

If the specification is not attained:

- Check wiring ⇒ Page 24-74 .



- Connect hand-held multimeter (voltage measurement range) between sockets 3 and 4 of connector.
- Switch ignition on.

  Specification: approx. 5 V

If the specification is not attained:

- Check wiring ⇒ Page 24-74 .

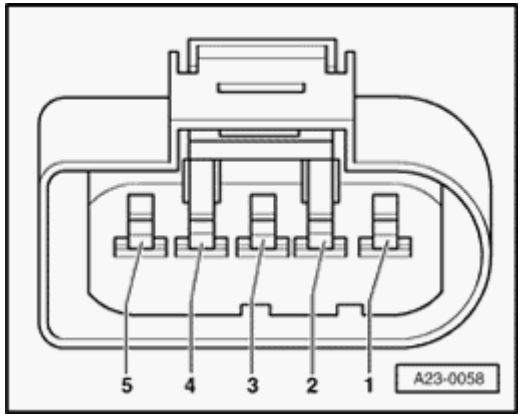
24-74

Checking wiring for mass air flow sensor

Note:

The wiring test includes also testing the signal wire.

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .



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

Connector for MAF sensor -G70, socket	VAG1598/31 test box, socket
3	27
4	53
5	29

24-75

Resistance in wiring: max. 1.5 Ω

- Repair short circuit or open circuit if necessary.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

Specification: infinity Ω (open circuit)

- If wiring and voltage supply are OK, replace Mass Air Flow (MAF) sensor -G70.

Air system for leaks (un-metered air), checking

Check with engine leak detector spray G 001 800 A1

CAUTION!

Part numbers are for reference only, always check with your parts department for latest information.

Notes:

- *The vacuum in the intake system will cause the leak detector spray to be drawn in with the 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.*

- *The safety precautions listed on the container must be adhered to.*

- Connect VAG1551 (or VAS 5051) and select engine electronics control module with the "Address word" 01. When doing this the engine must be running at idling speed. (Connect scan tool and selecting engine electronics control module ⇒ Page 01-9 .)

Rapid data transmission **HELP**

Select function XX

➢ Indicated on display:

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block

Enter display group number XXX

➢ Indicated on display:

24-77

- Press buttons -0-, -0- and -1- to select "Display Group 01" and confirm entry by pressing -Q- button.



Indicated on display: (1...4 = Display fields)

- Note engine speed in display field 1.
- Systematically spray parts of intake system with engine leak detection spray.

If the engine speed does not change:

- Press →button.
- Press buttons -0- and -6- to select function "End Output" and confirm entry with -Q- button.

24-78

If the engine speed drops:

- Press →button.
- Press buttons -0- and -6- to select function "End Output" and confirm entry with -Q- button.
- Check sprayed areas of intake system for leaks and rectify if necessary.

Oxygen sensor control, checking

Function of oxygen sensor control

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

The voltage signal for "Mixture too rich" (low residual oxygen) is between about 0.5 and 1.0 V (relative to reference Ground (GND)).

The voltage signal for "Mixture too lean" (high residual oxygen) is between about 0 and 0.5 V (relative to reference Ground (GND)).

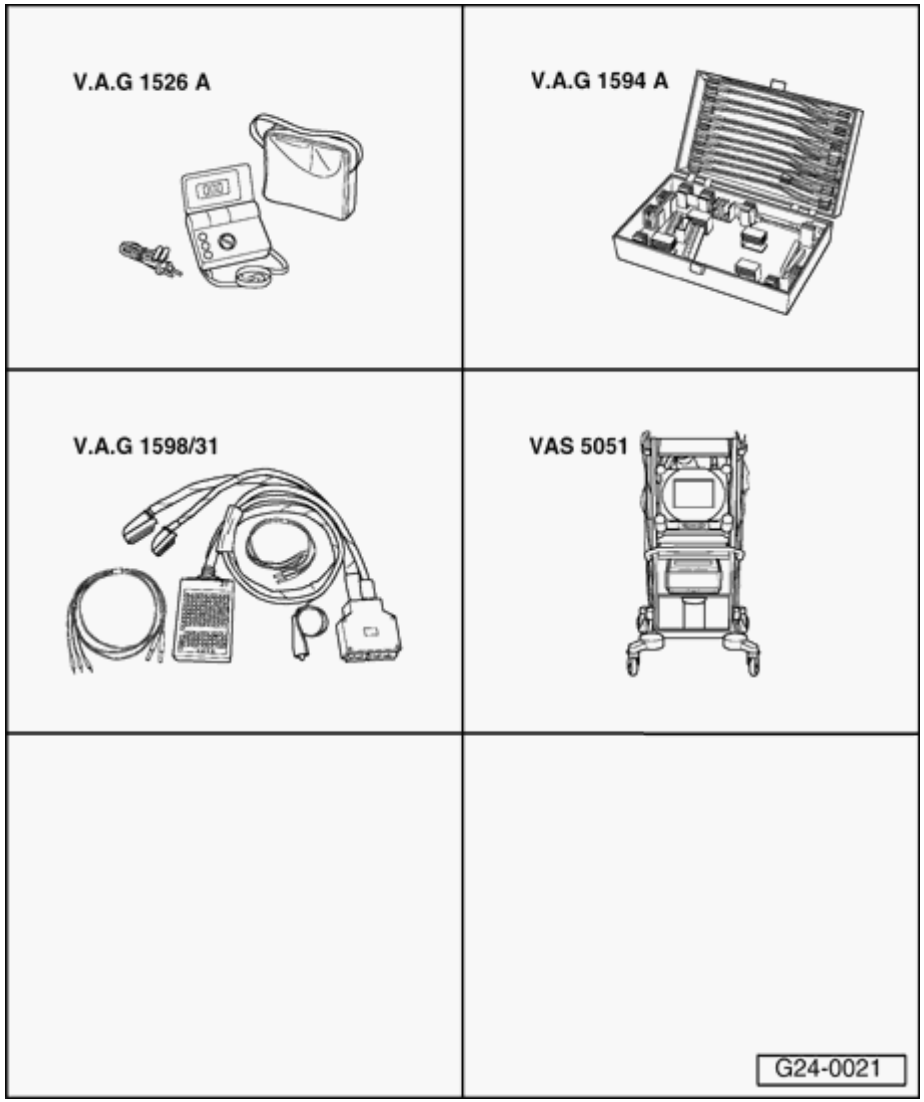
The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.5 and 1.0 V to between 0 and 0.5 V (relative to reference Ground (GND)), and vice versa (λ = 1.0).

Because of the sharp voltage jump the oxygen sensor control cannot maintain a constant ideal mixture composition of λ = 1.0. The system fluctuates continuously between "slightly too lean" and "slightly too rich".

24-80

If the voltage does not change or only changes slowly the following malfunctions are possible:

- Slits or holes in probe head are blocked.
- Oxygen sensor has been subjected to excessive thermal stress.
- Contact resistance in signal wire or Ground (GND) wire.
- Oxygen sensor too cold; sensor heater not working.
- Oxygen sensor damaged by contact spray or similar product. (The contact spray is drawn through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effect.)
- Oxygen sensor damaged by silicone vapors. (The engine draws in traces of any silicone-based sealants that may have been used. The silicone does not burn and damages the oxygen sensor.)



Oxygen sensor and oxygen sensor control before Three Way Catalytic Converter (TWC), checking

Special tools and shop equipment

- Fluke 83 (or equivalent) A
- VAG1594 A
- VAG1598/31
- VAS5051 with VAS5051/1

- or

- VAG1551 with VAG1551/3B

24-82

Notes:

- *For the defined troubleshooting procedure, it is possible to switch off the oxygen sensor control by selecting Display Group 99 in "Basic Setting" mode and to switch it on again by selecting Display Group 99 in "Read Measuring Value Block" mode.*

- *After selecting Display Group 99 (either in "Basic Setting" mode or in "Read Measuring Value Block" mode) it is possible to switch back and forth between function 04 ("Basic Setting") and function 08 "Read Measuring Value Block") by pressing buttons 4 and 8 on VAG1551 scan tool.*

- *When exiting the "Basic Setting" mode (function 04) the oxygen sensor control is automatically switched on again.*

Test conditions

- Perform road test and do not erase DTC memory.

- Coolant temperature at least 85 ° C (Display group 004, display field 3)

Checking function

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.

Rapid data transfer HELP

Select function XX

Indicated on display

- Press buttons -0- and -4- to select function "Basic Setting" and confirm entry with -Q- button.

Note:

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

Basic Setting

Input display group number XXX

Indicated on display

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

System in Basic Setting 30 →

1 2 3 4

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

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

24-84

Note:

The "Oxygen sensor status" display indicates the status of the oxygen sensor control and oxygen sensors.

	Display fields			
	1	2	3	4
Display Group 030: Oxygen sensor status at idle speed (coolant temperature at least 85 °C)				
Display	**0 0 0**	0 0 0	**0 0 0**	0 0 0
Indicates	**Oxygen sensor status bank 1, sensor 1**	Oxygen sensor status bank 1, sensor 2	**Oxygen sensor status bank 2, sensor 1**	Oxygen sensor status bank 2, sensor 2
Work range	**0 = off** **1 = on**	0 = off 1 = on	**0 = off** **1 = on**	0 = off 1 = on
Specification	**1 1 1**	0 1 0	**1 1 1**	0 1 0
Note	**Significance of display ⇒ Page 24-85** **If specification is obtained, but a malfunction is stored in the DTC memory: Check oxygen sensor adaptation values and oxygen sensor control ⇒ Page 24-86** **If specification is not obtained: Check oxygen sensor signal wire and activation ⇒ Page 24-122**			

24-85

Significance of 3 digit indication in Display Group 30

1	1	1	**Display fields 1 through 3**
		X	Oxygen sensor control 0= inactive 1= active
	X		Operational readiness of oxygen sensor 0= inactive 1= active
X			Condition of oxygen sensor heater 0= inactive 1= active

Note:

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

- *The first position of the 3 digit display (Heater) fluctuate at certain operating conditions between 0 and 1.*

Checking oxygen sensor adaptation and oxygen sensor control

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be idling.

Rapid data transfer HELP
Select function XX

➢ Indicated on display

- Press buttons -0- and -4- to select function "Basic Setting" and confirm entry with -Q- button.

Note:

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

Basic Setting
Input display group number XXX

➢ Indicated on display

- Press buttons -0-, -3- and -3- to select Display Group 33 and confirm entry with -Q- button.

System in Basic Setting 33			→
1	**2**	**3**	**4**

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

24-87

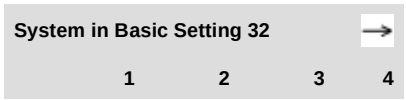
- Check oxygen sensor control in display fields 1 to 4:

	Display fields			
	1	2	3	4
Display Group 33: Oxygen sensor control at idle speed				
Display	**xx.x %**	**xx.x V**	**xx.x %**	**xx.x V**
Indicates	**Oxygen sensor control, bank 1**	**Oxygen sensor voltage, bank 1**	**Oxygen sensor control, bank 2**	Oxygen sensor voltage, bank 2
Work range	**min.: -25.0 %** **max.: 25.0 %**	**min.: 0.000 Volt** **max.: 1.000 Volt**	**min.: -25.0 %** **max.: 25.0 %**	**min.: 0.000 Volt** **max.: 1.000 Volt**
Specification	**-4.0 to 4.0 %** **(The value must fluctuate by 2 %)**	**Between 0.000 and 1.000 V the voltage should fluctuate**	**-4.0 to 4.0 %** **(The value must fluctuate by 2 %)**	**Between 0.000 and 1.000 V the voltage should fluctuate**
Note	**If readout does not match specification ⇒ Page 24-89**	**If readout does not match specification ⇒ Page 24-92**	**If readout does not match specification ⇒ Page 24-89**	**If readout does not match specification ⇒ Page 24-92**

- Press button -C-.

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

24-88



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

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

	Display fields			
	1	2	3	4
Display Group 32: Oxygen sensor adaptation at idle speed				
Display	**xx.x %**	**x.xxx %**	**xx.x %**	**x.xxx %**
Indicates	**Oxygen sensor adaptation value, bank 1, sensor 1 at idle (additive)**	**Oxygen sensor adaptation value, bank 1, sensor 1 at partial throttle (multiple)**	**Oxygen sensor adaptation value, bank 2, sensor 1 at idle (additive)**	Oxygen sensor adaptation value, bank 2, sensor 1 at partial throttle (multiple)
Range	**min.: -25.0 %** **max.: 25.0 %**	**min.: -25.0 %** **max.: 25.0 %**	**min.: -25.0 %** **max.: 25.0 %**	**min.: -25.0 %** **max.: 25.0 %**
Specification	**-4.0 and 4.0 %** **can fluctuate slightly**	**-4.0 and 4.0 %** **can fluctuate slightly**	-4.0 and 4.0 % **can fluctuate slightly**	-4.0 and 4.0 % **can fluctuate slightly**
Note	**If readout does not match specification ⇒ Page 24-90 and ⇒ Page 24-91**	**If readout does not match specification ⇒ Page 24-90 and ⇒ Page 24-91**	**If readout does not match specification ⇒ Page 24-90 and ⇒ Page 24-91**	**If readout does not match specification ⇒ Page 24-90 and ⇒ Page 24-91**

If the specified values in display fields 1 and/or 3 do not match the specifications, or if the readout does not fluctuate by at least 2 %:

- Check oxygen sensor heater ⇒ Page 24-114 .
- Check oxygen sensor signal wire and activation ⇒ Page 24-122 .
- Check intake system for leaks and eliminate false air ⇒ Page 24-76 .
- Check fuel pressure regulator ⇒ Page 24-33 .
- Fuel return line kinked or plugged.
- Press → button.
- Press button -0- and -6- to select function "End Output" and confirm with -Q- button.
- Switch ignition off.

Evaluation display group 032

Display group 32 **Display fields: 1/3**	**Possible cause**	**Corrective action**
Oxygen sensor adaptation values in range: -4.0 to -25.0 %	♦ Oil thinning	- Carry out oil change or carry out road test on highway
Display fields: 2/4	♦ High oil consumption	
Oxygen sensor adaptation values in range: -4.0 to -25.0 %	♦ Mass Air Flow (MAF) Sensor faulty	- Check Mass Air Flow (MAF) Sensor ⇒ Page 24-59
	♦ EVAP canister purge regulator valve remains in stuck in open position	- Check EVAP canister purge regulator valve ⇒ Page 24-134
	♦ Fuel pressure too high ♦ Fuel return line kinked or pluged	- Check fuel pressure regulator ⇒ Page 24-33 - Check fuel return line
	♦ Fuel injector leaking	- Check fuel injectors ⇒ Page 24-39

Evaluation display group 032

Display Group 32 Display fields: 1/3	Possible cause	Corrective action
Oxygen sensor adaptation values in range: 4.0 and 25.0 %	♦ Un-metered air in intake area	- Check intake system for un-metered air and eliminate leaks
Display field: 2/4	♦ Fuel pressure too low	- Check fuel pressure regulator ⇒ Page 24-33
Oxygen sensor adaptation values in range: 4.0 - 25.0 %	♦ Oxygen sensor heater faulty	- Check oxygen sensor heater ⇒ Page 24-114
	♦ Injector not opening or only opening partially	- Check injectors ⇒ Page 24-39
	♦ EVAP canister purge regulator valve remains in stuck in open position	- Check EVAP canister purge regulator valve ⇒ Page 24-134

Evaluation display group 33

Display Group 33 Display field: 2/4	Possible cause	Corrective action
Approx. 0.450 V	♦ Open circuit in wire 4 between oxygen sensor and control module ♦ Open circuit in wire 3 between oxygen sensor and control module	- Check signal wire and activation ⇒ Page 24-122
	♦ Oxygen sensor heater faulty	- Check oxygen sensor heater ⇒ Page 24-114 - Replace oxygen sensor
	♦ Oxygen sensor faulty	
More than 1.100 V	♦ Short to B+ in wire 4 between oxygen sensor and control module	- Check oxygen sensor wiring, bank 1, sensor 1 ⇒ Page 24-123
Less than 0.100 V	♦ Short to Ground (GND) in wire 4 between oxygen sensor and control module	- Check oxygen sensor wiring, bank 2, sensor 1 ⇒ Page 24-127

24-93

Oxygen sensors aging, oxygen sensor before catalytic converter, checking

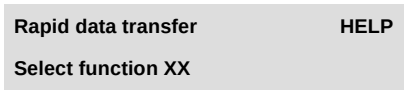
Test requirements

- Coolant temperature min. 85 ° C (185 ° F) (Display group 004, display field 3)

Test sequence for oxygen sensor 1 before catalytic converter bank 1

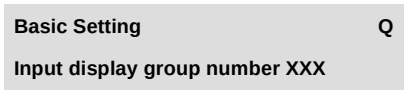
- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.

24-94



Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" and confirm with -Q- button.

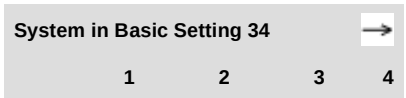


Indicated on display

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

Test requirements

- Engine runs at 1900 - 2200 RPM



Indicated on display

- Continue test as soon as display field 4 indicates "Test ON".

24-95

Note:

This procedure can take a few minutes

	Display fields			
	1	2	3	4
Display field 034: Diagnostic oxygen sensor aging (Bank 1)				
Display	xxxx/RPM	xxx °C	x.x s	**Test ON**
Indicated	Engine speed (RPM)	Exhaust temperature	Period duration oxygen sensor before catalytic converter	**Diagnostic condition**
Working range	0 - 6800	70 - 850 °C	0 - 3.0 Seconds	**Test OFF** **Test ON** **B1-S1 OK** **B1-S1 not OK**
Specification	1900 - 2200/RPM	greater than 260 °C	0.1 - 1.0 s	**B1-S1 OK**
Note			**If specified value is not obtained ⇒Continuation Page ⇒ Page 24-96**	

Note for display field 2:

Calculated value from engine speed and engine load.

Note for display fields 3 and 4:

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

24-96

Continuation

If specified value in display field 3 or 4 is not obtained:

- Replace Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter Bank 1 -G39.

Test sequence for oxygen sensor 1 before catalytic converter bank 2

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.

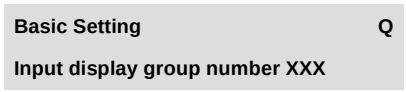
Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" and confirm with -Q- button.

24-97

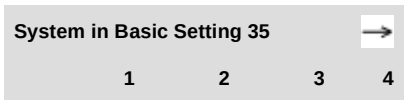


➢ Indicated on display

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

Test requirements

- Engine runs at 1900 - 2200 RPM



➢ Indicated on display

- Continue test as soon as display field 4 indicates "Test ON".

Note:

This procedure can take a few minutes

24-98

	Display fields			
	1	2	3	4
Display field 035: Diagnostic oxygen sensor aging (Bank 2)				
Display	xxxx/RPM	xxx °C	x.x s	**Test ON**
Indicated	Engine speed (RPM)	Exhaust temperature	Period duration oxygen sensor before catalytic converter	**Diagnostic condition**
Working range	0 - 6800	70 - 850 °C	0 - 3.0 Seconds	**Test OFF** **Test ON** **B1-S1 OK** **B1-S1 not OK**
Specification	1900 - 2200/RPM	greater than 260 °C	0.1 - 1.0 s	**B1-S1 OK**
Note			**If specified value is not obtained ⇒Continuation Page ⇒ Page 24-99**	

Note for display field 2:

Calculated value from engine speed and engine load.

Note for display fields 3 and 4:

Period duration is the time between two voltage jumps (e.g. rich - lean - rich) and is therefore a measurement of the aging condition of the oxygen sensor. If the specified time is exceeded, display field 4 will indicate =B2-S1 not OK.

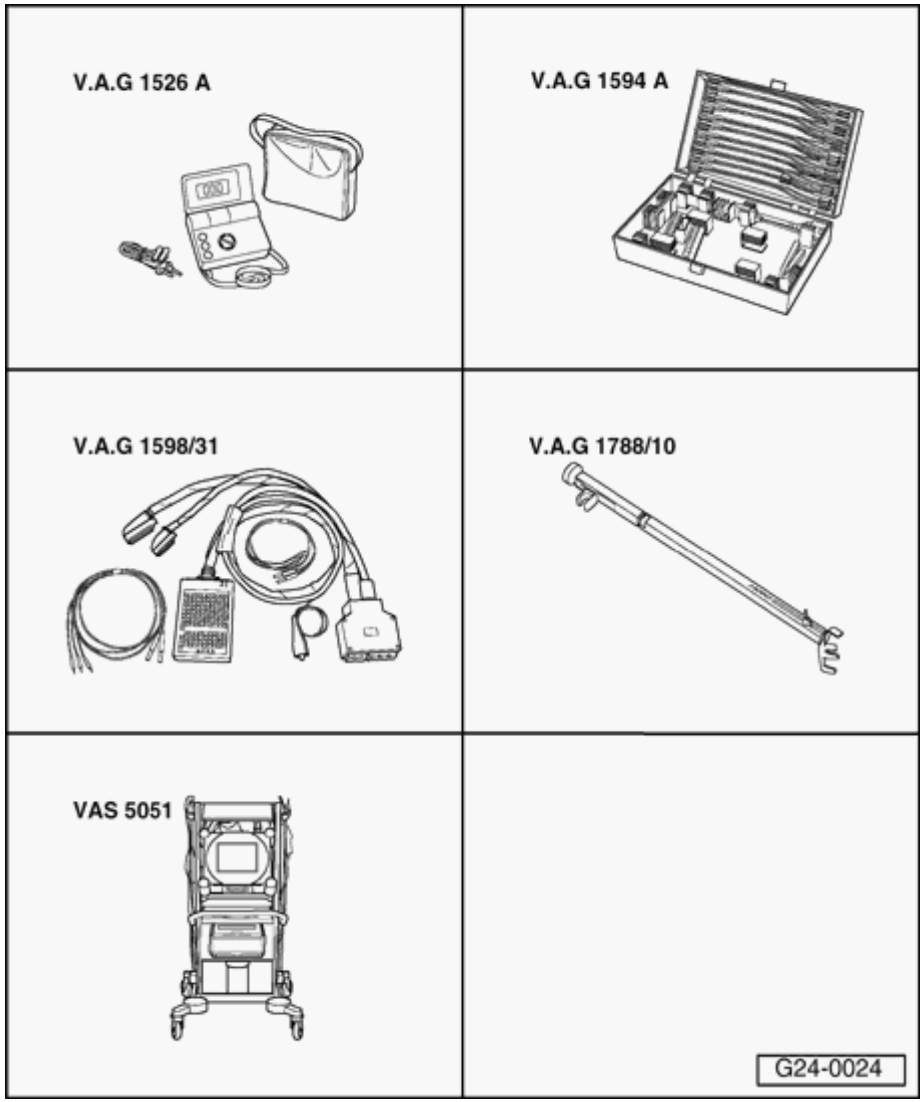
24-99

Continuation

If specified value in display field 3 or 4 is not obtained:

- Replace Heated Oxygen Sensor (HO2S) before Three Way Catalytic Converter Bank 2 -G108.

24-100



Oxygen sensor and oxygen sensor control behind catalytic converter, checking

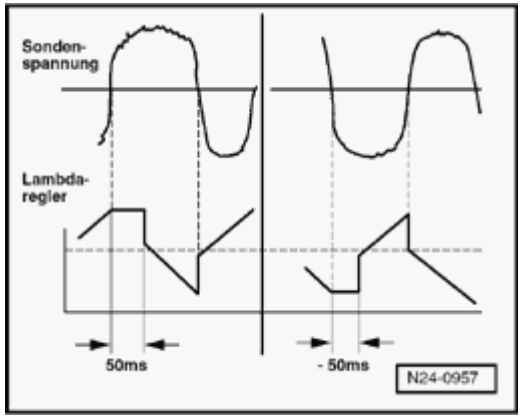
Test equipment and shop tools

- Fluke 83 (or equivalent)
- VAG1594 A
- VAG1598/31
- VAG1788/10
- VAS5051 with VAS5051/1

- or

- VAG1551 with VAG1551/3B

24-101



Notes:

- *Oxygen sensor control behind the catalytic converter is responsible for final control correction. It is the primary sensor and can override the signal from the oxygen sensor control before the catalytic converter..*

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

Component location of harness connectors ⇒ **Page 24-5**

24-102

Test conditions

- Perform road test and do not erase DTC memory.
- Coolant temperature at least 85 °C (185 °F) (Display group 004, display field 3)

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.

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

- Press buttons -0- and -4- to select function "Basic Setting" and confirm entry with -Q- button.

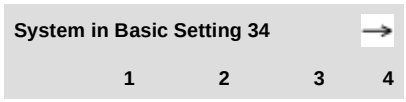
Note:

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

Basic Setting **Input display group number XXX**	➢	Indicated on display

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

24-103



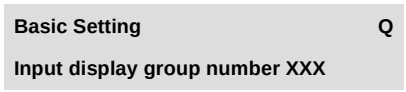
When indicated on display:

- Adjust engine speed using VAG1788/10 to 2800 - 3200 RPM.
- Continue test as soon as display field 2 indicates an exhaust temperature of more than 320 ° C.

Note:

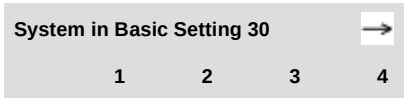
This process can take a few minutes.

- Press -C- button.
- Adjust engine speed using VAG1788/10 to 1900 - 2200 RPM.



When indicated on display:

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



When indicated on display:

- Check oxygen sensor status for oxygen sensor behind catalytic converter in display field 2.

Note:

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

24-104

	Display fields			
	1	2	3	4
Display group 030: Oxygen sensor status with engine at idle				
Display	X X X	**X X X**	X X X	**X X X**
Indicated	Oxygen sensor status, bank 1, sensor 1	**Oxygen sensor status bank 1, sensor 2**	**Oxygen sensor status, bank 2, sensor 1**	Oxygen sensor status bank 2, sensor 2
Working area	0 = off 1 = on	**0 = off** **1 = on**	0 = off 1 = on	**0 = off** **1 = on**
Specified value:	1 1 1	**1 1 1**	1 1 1	**1 1 1**
Note:	**Significance of display ⇒ Page 24-105** **If specified value is not obtained:** **Check oxygen sensor signal wire and activation ⇒ Page 24-122** **Check oxygen sensor heater ⇒ Page 24-114**			

Notes:

- *Oxygen sensor control of oxygen sensor behind catalytic converter (Bank 1-Sensor 2 and Bank 2 -Sensor 2) is not active without engine load.*
- *The first position of the 3 digit indication (heater) fluctuates between 0 and 1.*

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

24-105

Significance of 3 digit indication in Display Group 030

1	1	1	**Display fields 1 to 4**
		X	Oxygen sensor control 0= inactive 1= active
	X		Operational readiness of oxygen sensor 0= inactive 1= active
X			Condition of oxygen sensor heater 0= inactive 1= active

- Press -C- button.

Basic Setting **Q**

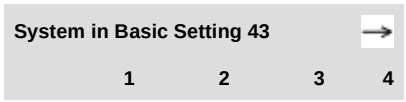
Input display group number XXX

When indicated on display

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

Test requirements

- Engine runs at 1900 - 2200 RPM



When indicated on display

- Check specified value in display field 4.

24-106

	Display fields			
	1	2	3	4
Display group 043: Oxygen sensor aging oxygen sensor behind catalytic converter (Bank 1)				
Display	xxxx/RPM	xxx °C	x.xxx V	**Test ON**
Indicated	Engine speed (RPM)	Exhaust temperature	Voltage of oxygen sensor behind CAT, Bank 1	**Diagnostic condition**
Work range	0 - 6800/RPM	70 - 850 °C	0.000 - 1.000 Volt	**Test OFF** **Test ON** **B1-S2 OK** **B1-S2 not OK**
Specified value	1900 - 2200/RPM	greater than 320 °C	0.000 - 1.000 Volt	**B1-S2 OK**
Note				**If specified value is not reached. Check oxygen sensor heater ⇒ Page 24-114**

If the specified value of "B1-S2 OK" is reached:

- Press -C- button.

Test requirements

- Engine runs at 1900 - 2200 RPM

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

24-107

	Display fields			
	1	2	3	4
Display group 044: Oxygen sensor aging oxygen sensor behind catalytic converter (Bank 2)				
Display	xxxx/RPM	xxx ° C	x.xxx V	**Test ON**
Indicated	Engine speed (RPM)	Exhaust temperature	Voltage of oxygen sensor behind CAT, Bank 1	**Diagnostic condition**
Work range	0 - 6800/RPM	70 - 850 ° C	0.000 - 1.000 Volt	**Test OFF** **Test ON** **B2-S2 OK** **B2-S2 not OK**
Specified value	1900 - 2200/RPM	greater than 320 ° C	0.000 - 1.000 Volt	**B1-S2 OK**
Note				**If specified value is not reached. Check oxygen sensor heater ⇒ Page 24-114**

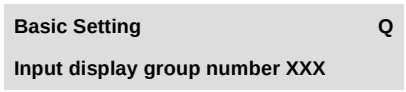
If the specified value of "B2-S2 OK" is reached:

- Press -C- button.

24-108

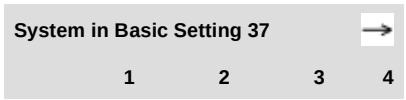
Checking oxygen sensor control behind catalytic converter

- Carry out road test for approx.: 10 minutes.



Indicated on display

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



Indicated on display

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

24-109

	Display fields			
	1	2	3	4
Display group 037: Diagnostic oxygen sensor control (Bank 1)				
Display	xxx %	x.xxx Volt	xxx ms	**Test ON**
Indicated	Engine load	Oxygen sensor voltage behind catalytic converter, Bank 1	Correction value between oxygen sensor 1 and sensor 2, bank 1	**Diagnostic condition**
Work range	15.0 - 175.0 %	0.000 - 1.000 V	-1200 - 1200 ms	**Test OFF** **Test ON** **SYST. OK** **SYST. not OK**
Specified value	15.0 - 25.0 %	0.000 - 1.000 V	-500 - 500 ms	**SYST. OK**
Note		**If specified value is not obtained: Evaluation display field 2 ⇒ Page 24-112**	**If specified value is obtained: Continuation ⇒ Page 24-113**	**If "SYST. not OK" is displayed: Check DTC memory ⇒ Page 01-15** **or Continue ⇒ Page 24-113**

Note for display field 3:

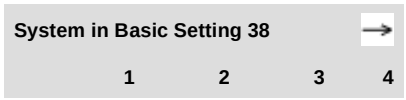
Oxygen sensor control behind catalytic converter is superior to oxygen sensor control before catalytic converter and is the primary control. It corrects slight changes in the mixture (i.e. enrichment or thinning) by holding the oxygen sensor control before catalytic converter at its higher or lower point for a specific time (duration). If this time is in the positive range (i.e. 50 ms), mixture is shifted in the -enrich- direction. If this time is in the negative range (i.e. 50 ms), mixture is shifted in the -lean-

direction.

24-110

- Press -C- button.

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



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

24-111

	Display fields			
	1	2	3	4
Display group 038: Diagnostic oxygen sensor control (Bank 2)				
Display	xxx %	x.xxx Volt	xxx ms	**Test ON**
Indicated	Engine load	Oxygen sensor voltage behind catalytic converter, Bank 2	Correction value between oxygen sensor 1 and sensor 2, bank 2	**Diagnostic condition**
Work range	15.0 - 175.0 %	0.000 - 1.000 V	-1200 - 1200 ms	**Test OFF** **Test ON** **SYST. OK** **SYST. not OK**
Specified value	15.0 - 25.0 %	0.000 - 1.000 V	-500 - 500 ms	**SYST. OK**
Note		If specified value is not obtained: Evaluation display field 2 ⇒ Page 24-112	If specified value is obtained: Continuation ⇒ Page 24-113	**If "SYST. not OK" is displayed: Check DTC memory ⇒ Page 01-15** **or Continue ⇒ Page 24-113**

Note for display field 3:

Oxygen sensor control behind catalytic converter is superior to oxygen sensor control before catalytic converter and is the primary control. It corrects slight changes in the mixture (i.e. enrichment or thinning) by holding the oxygen sensor control before catalytic converter at its higher or lower point for a specific time (duration). If this time is in the positive range (i.e. 50 ms), mixture is shifted in the -enrich- direction. If this time is in the negative range (i.e. 50 ms), mixture is shifted in the -lean-

direction.

24-112

Evaluation display group 037 and 038

Display Group: 037/038 Display field: 2	Possible cause	Corrective action
approx.: 0.450 V	♦ Open circuit in wire 4 between oxygen sensor and control module ♦ Open circuit in wire 3 between oxygen sensor and control module ♦ Oxygen sensor heater faulty ♦ Oxygen sensor faulty	- Check signal wire and activation ⇒ Page 24-122 - Check oxygen sensor heater ⇒ Page 24-114 - Replace oxygen sensor
greater than 1.100 V	♦ Short circuit to B+ in wire 4 between oxygen sensor and control module	- Check oxygen sensor wiring bank 1 sensor 2 (behind converter) ⇒ Page 24-125
smaller than 0.100 V	♦ Short circuit to Ground (GND) in wire 4 between oxygen sensor and control module ♦ Short circuit between wire 3 and 4	- Check oxygen sensor wiring bank 2 sensor 2 (behind converter) ⇒ Page 24-129

24-113

Continuation

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

- Check exhaust system and catalytic converter for leaks (check clamps and exhaust for damage)

- If the difference of the values in measuring blocks, display fields 3 (oxygen sensor correction value) is to large (e.g.:+500 ms, -500 ms), it is possible that the oxygen sensor are interchanged (mixed up).

If none of the causes are identified:

- Replace particular oxygen sensor "before" catalytic converter.

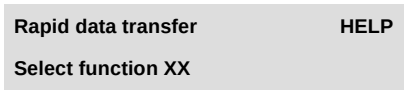
24-114

Oxygen sensor heater for oxygen sensor, checking

Note:

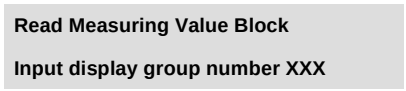
The oxygen sensor heating circuit is monitored by the On Board Diagnostic (OBD). Check DTC memory ⇒ *Page 01-15* .

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.



Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.



Indicated on display

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



Indicated on display

24-115

- Adjust engine speed to approx: 3000 RPM

- Check resistance of oxygen sensor heater.

	Display fields			
	1	2	3	4
Display Group 041: Oxygen sensor heater, Bank 1 (at idle speed)				
Display	**xxx kOhm**	**Htg.bC.ON**	**xxx kOhm**	**Htg.aC.ON**
Indicates	**Bank 1, Sensor 1**	**Status of heater**	**Bank 1, Sensor 2**	**Status of heater**
Range		**Htg.bC.ON** **Htg.bC.OFF**		**Htg.aC.ON** **Htg.aC.OFF**
Specified value	**0 - 0.5 kOhm**	**Htg.bC.ON/OFF**	**0 - 0.5 kOhm**	**Htg.aC.ON/OFF**
Note	**It can take a few minutes until specification are obtained**		**It can take a few minutes until specified values are obtained**	

- Press -C- button.

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

24-116

	Display fields			
	1	2	3	4
Display Group 042: Oxygen sensor heater, Bank 2 (at idle speed)				
Display	**xxx kOhm**	**Htg.bC.ON**	**xxx kOhm**	**Htg.aC.ON**
Indicates	**Bank 2, Sensor 1**	**Status of heater**	**Bank 2, Sensor 2**	**Status of heater**
Range		**Htg.bC.ON** **Htg.bC.OFF**		**Htg.aC.ON** **Htg.aC.OFF**
Specified value	**0 - 0.5 kOhm**	**Htg.bC.ON/OFF**	**0 - 0.5 kOhm**	**Htg.aC.ON/OFF**
Note	**It can take a few minutes until specifications are obtained**		**It can take a few minutes until specifications are obtained**	

If the specification is not attained:

- Check voltage supply for oxygen sensor heater
  ⇒ Page 24-117 .

- Check oxygen sensor signal wire and activation
  ⇒ Page 24-122 .

24-117

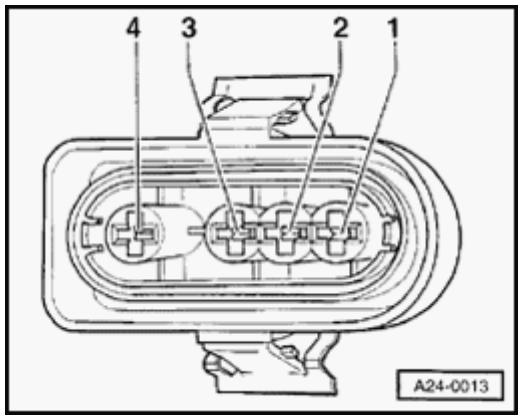
Checking voltage supply for oxygen sensor heater

Component location of 4-pin harness connector of oxygen sensors ⇒ Page 24-5 .

- Check fuse for oxygen sensor heater

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Disconnect 4-pin harness connector of particular oxygen sensor.



- Connect hand-held multimeter (voltage measurement range) between sockets 1 (B+) and 2 (Ground (GND)) using test leads from VAG1594 connector test kit.
- Operate starter briefly.

  Specified value: approx. battery voltage

If there is no voltage reading:

- Connect hand-held multimeter (voltage measurement range) between socket 1 (B+) and vehicle Ground (GND) using test leads from VAG1594 connector test kit.

24-118

- Operate starter briefly.

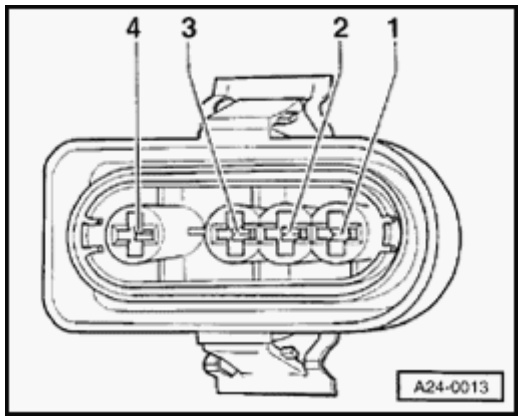
  Specified value: approx. battery voltage

If there is still no voltage reading:

- Check for open circuit and/or short circuit in wiring between fuel pump relay and socket 1 on the relevant oxygen sensor connector (on wiring harness) via fuse.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If the voltage supply is OK:



- Connect hand-held multimeter (voltage measurement range) between socket 2 (switched Ground (GND) connection from engine control module) and B+ terminal using test leads from VAG1594 connector test kit.

24-119

- Start engine.

  Specified value: approx. battery voltage (fluctuating)

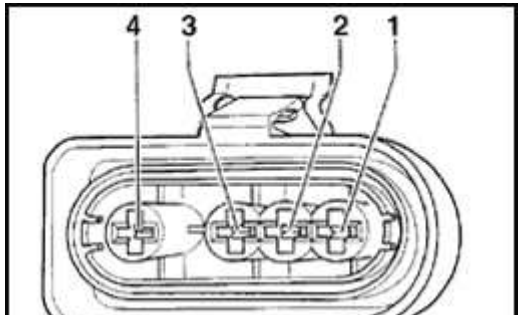
Note:

At certain points in the operating range the engine control module continuously "switches" the Ground (GND) connection to the oxygen sensor heater. That means, it repeatedly connects and disconnects the Ground (GND) connection at these points. For this reason the voltage reading on the tester may fluctuate.

- Switch ignition off.

If there is no voltage reading:

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .



- Check for open circuits in the following wiring connection:

Heated Oxygen Sensor (HO2S) -G39	
Connector on wiring harness, socket	**VAG1598/31 test box, socket**
2	5 (Ground)
Heated Oxygen Sensor (HO2S) 2 -G108	
Connector on wiring harness, socket	**VAG1598/31 test box, socket**
2	4 (Ground)
Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130	
Connector on wiring harness, socket	**VAG1598/31 test box, socket**
2	63 (Ground)
Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131	
Connector on wiring harness, socket	**VAG1598/31 test box, socket**
2	6 (Ground)

Resistance in wiring: max. 1.5 Ohm

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-121

If the wiring is OK but the oxygen sensor heater still has no Ground (GND) connection:

- Replace particular oxygen sensor.

- Display readiness code ⇒ Page 01-101 . The readiness code must be generated if the DTC memory was erased ⇒ Page 01-105 .

24-122

Oxygen sensor signal wire and activation, checking

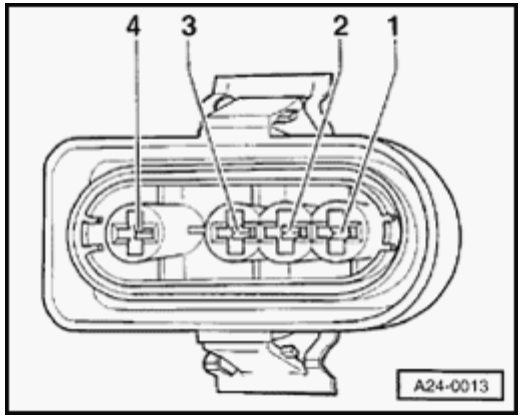
Note:

The oxygen sensor signal is monitored by the OBD system.

- Check DTC memory ⇒ Page 01-15 .

- If a oxygen sensor malfunction is displayed and the oxygen sensor heater is OK, disconnect harness connector for relevant oxygen sensor.

Component location of 4-pin harness connector of oxygen sensor ⇒ Page 24-5 .



- Test voltage by connecting hand-held multimeter Fluke 83 (or equivalent) (measuring range 2 V) between sockets 3 and 4 of connector on wiring harness.
- Switch ignition on. Specified value: 450 ± 50 mV.

If the Specified value is not obtained, check oxygen sensor wiring:

Bank 1, Sensor 1 ⇒ Page 24-123 .

Bank 1, Sensor 2 ⇒ Page 24-125 .

Bank 2, Sensor 1 ⇒ Page 24-127 .

Bank 2, Sensor 2 ⇒ Page 24-129 .

If Specified value is obtained:

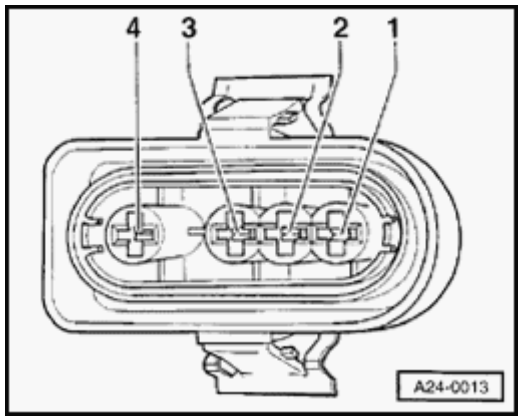
- Replace relevant oxygen sensor.

Checking oxygen sensor wiring for Heated Oxygen Sensor (HO2S) -G39

Component location of 4-pin harness connector of oxygen sensor ⇒ Page 24-5 .

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

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to engine control module itself ⇒ Page 24-20 .

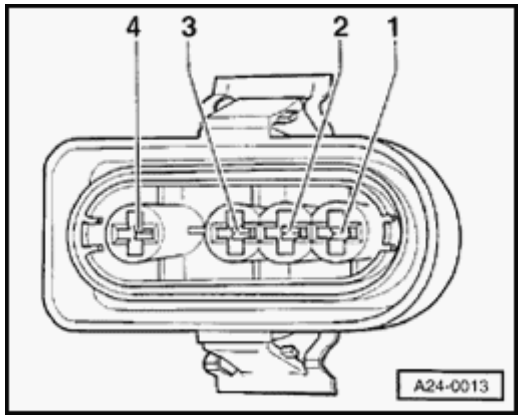


- Check following wiring connections for open circuits:

Connector on wiring harness, socket	VAG1598/31 test box socket
3	51
4	70

Resistance in wiring: max. 1.5 Ohm

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*



- Check wiring also on 4-pin harness connector for short circuits to each other.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	51

Specified value: infinite ohms (open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check shielded wire for short circuit to sensor wiring.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	32
3	32

Specified value: infinite ohms(open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If no malfunction is identified in the wiring:

- Replace Motronic Engine Control Module (ECM) -J220 ⇒ Page 24-24 .

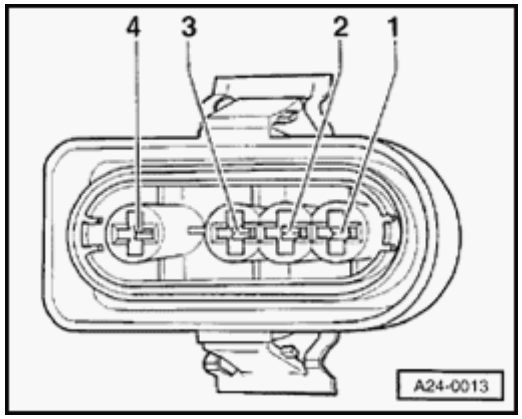
24-125

Checking wiring for Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130

Component location of 4-pin harness connector of oxygen sensor ⇒ Page 24-5 .

- Disconnect 4-pin connector (black) for Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130.

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

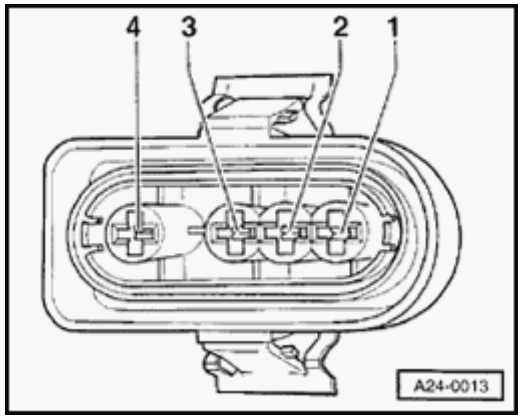


- Check following wiring connections for open circuits:

Connector on wiring harness, socket	VAG1598/31 test box socket
3	68
4	69

Resistance in wiring: max. 1.5 ohm

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*



- Check wiring also on 4-pin harness connector for short circuits to each other.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	68

Specified value: infinite ohms (open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check shielded wire for short circuit to sensor wiring.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	32
3	32

Specified value: infinite ohms (open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If no malfunction is identified in the wiring:

- Replace Motronic Engine Control Module (ECM) -J220 ⇒ Page 24-24 .

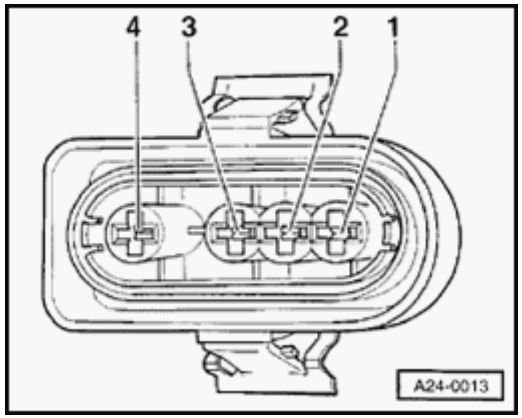
24-127

Checking wiring for Heated Oxygen Sensor (HO2S) 2 -G108

Component location of 4-pin harness connector of oxygen sensor ⇒ Page 24-5 .

- Disconnect 4-pin connector (black) for Heated Oxygen Sensor (HO2S) 2 -G108.

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

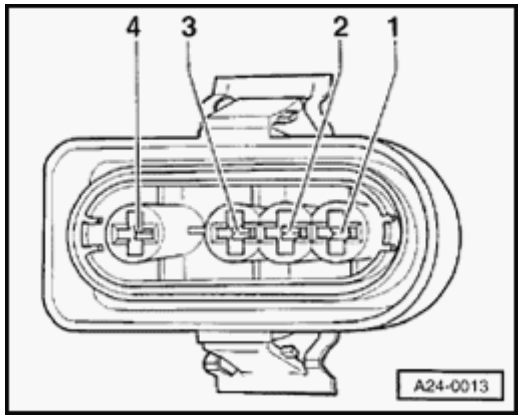


- Check following wiring connections for open circuits:

Connector on wiring harness, socket	VAG1598/31 test box socket
3	12
4	13

Resistance in wiring: max. 1.5 ohm

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*



- Check wiring also on 4-pin harness connector for short circuits to each other.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	12

Specified value: infinite ohms (open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check shielded wire for short circuit to sensor wiring.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	32
3	32

Specified value: infinite ohms (open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If no malfunction is identified in the wiring:

- Replace Motronic Engine Control Module (ECM) -J220 ⇒ Page 24-24 .

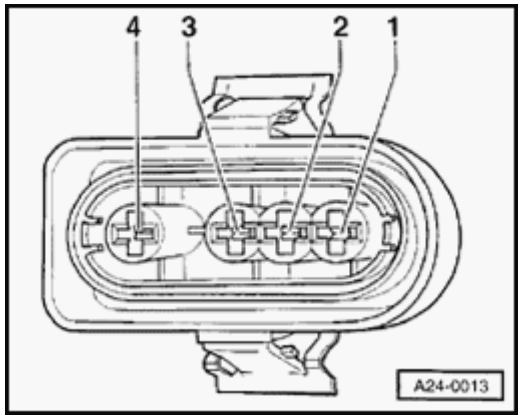
24-129

Checking wiring for Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131

Component location of 4-pin harness connector of oxygen sensor ⇒ Page 24-5 .

- Disconnect 4-pin connector for Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) -G131

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

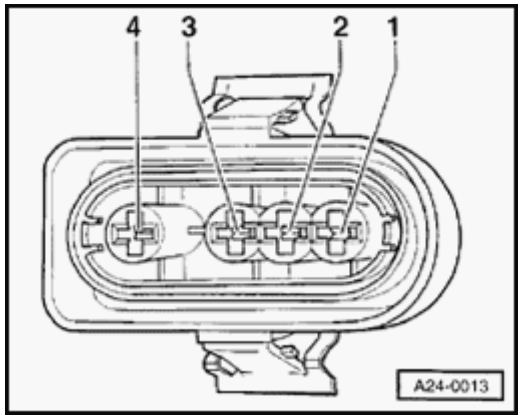


- Check following wiring connections for open circuits:

Connector on wiring harness, socket	VAG1598/31 test box socket
3	10
4	11

Resistance in wiring: max. 1.5 ohm

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*



- Check wiring also on 4-pin harness connector for short circuits to each other.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	10

Specified value: infinite ohms (open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check shielded wire for short circuit to sensor wiring.

Connector on wiring harness, socket	VAG1598/31 test box socket
4	32
3	32

Specified value: infinite ohms (open circuit)

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If no malfunctions are identified in the wiring:

- Replace Motronic Engine Control Module (ECM) -J220 ⇒ Page 24-24 .

24-131

If no malfunction can be identified in the wiring:

- Replace Motronic Engine Control Module (ECM) -J220 ⇒ Page 24-24 .

- Display readiness code ⇒ Page 01-101 . The readiness code must be generated if the DTC memory was erased ⇒ Page 01-105 .

Oxygen sensors, removing and installing

Removing

- Disconnect harness connector of particular oxygen sensor before catalytic converter for bank 1 and bank 2 (component location ⇒ Page 24-5).

- Disconnect harness connector of particular oxygen sensor behind catalytic converter for bank 1 and bank 2 (component location ⇒ Page 24-5).

- Remove particular oxygen sensor with 3337/7 special tool.

- Lower transmission, in order to remove oxygen sensors behind catalytic converter.

⇒ *Repair Manual, 6 Spd. Manual Transmission 01E, Repair Group 34, Transmission removing and installing.*

24-133

When installing observe the following:

Note:

- *The wiring from the oxygen sensor must be fastened at the exact location as previously installed, to avoid contact with exhaust pipe.*
- *The oxygen sensor threads are coated with a tread sealing compound that must not come in contact with the slits in the sensor tip.*
- *Tightening torque: 55 Nm (41 ft lb)*

Evaporative Emission (EVAP) system, checking

Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80, checking

Checking for leaks

If there is no electrical signal (not activated) the solenoid valve remains closed.

- Disconnect hoses from Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80.

- Start output Diagnostic Test Mode and select Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80 ⇒ Page 01-75 .

Output Diagnostic Test Mode →

EVAP canister purge regulator valve -N80

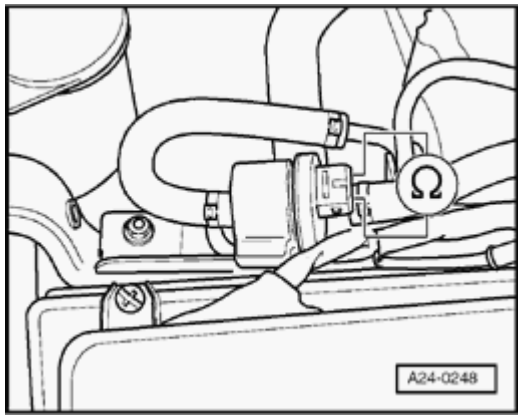
Indicated on display

The valve should click and should open and close (test by blowing into auxiliary hose).

- If valve does not click, carry out electrical test of Evaporative Emission (EVAP) Canister Purge Regulator Valve ⇒ Page 24-135 .
- If valve does not open and close properly, replace Evaporative Emission (EVAP) Canister Purge Regulator Valve.

Electrical testing of Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80

- Disconnect connector from Evaporative Emission (EVAP) Canister Purge Regulator Valve-N80.



- Measure resistance between contacts on valve using hand-held multimeter Fluke 83 (or equivalent).

  Specified value: 22 - 30 ohm

If the specification is not obtained:

- Replace Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80.

If the specification is obtained:

- Check voltage supply ⇒ Page 24-136 .

24-136

Checking voltage supply to Evaporative Emission (EVAP) Canister Purge Regulator Valve (solenoid valve)

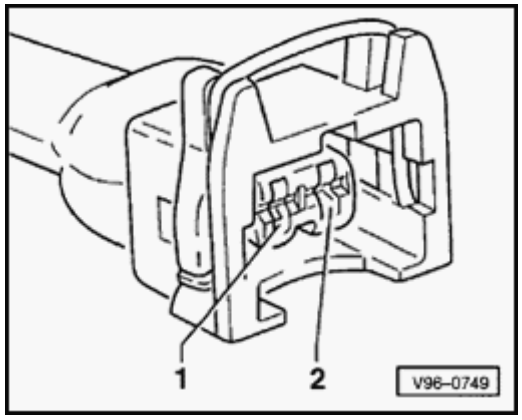
Note:

The Evaporative Emission (EVAP) Canister Purge Regulator Valve receives its power supply via the fuel pump relay.

Test requirements

- Fuse for EVAP valve OK

- Disconnect harness connector on Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80.



- Connect VAG1527 diode test lamp between engine Ground (GND) and socket 1 on connector.
- Operate starter.

The diode test lamp should light up.

If diode test lamp does not light up:

- Check continuity of wiring from socket 1 to fuel pump relay via fuse. Repair open circuit if necessary.

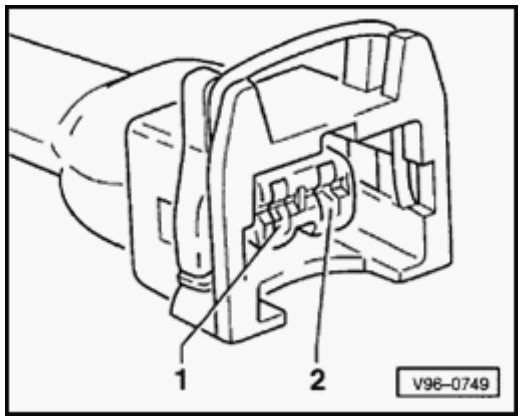
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If wiring is OK, check fuel pump relay ⇒ Page 24-54 .

If the diode test lamp lights up, check activation ⇒ Page 24-137 .

24-137

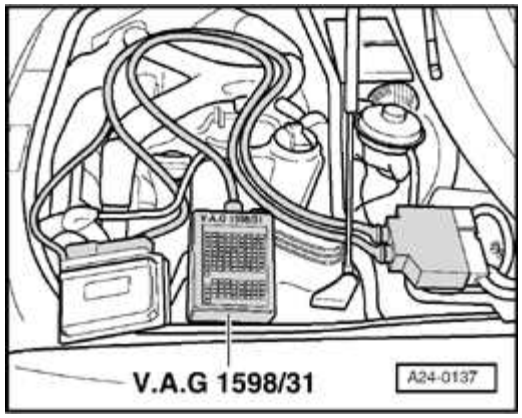
Testing activation of Evaporative Emission (EVAP) Canister Purge Regulator Valve



- Connect VAG1527 between diode test lamp sockets 1 (B+) and 2 of harness connector.
- Start output Diagnostic Test Mode (DTM) and select Evaporative Emission (EVAP) Canister Purge Regulator Valves -N80 ⇒ Page 01-75 . (To initiate DTM a second time, the engine must be started and switched off)

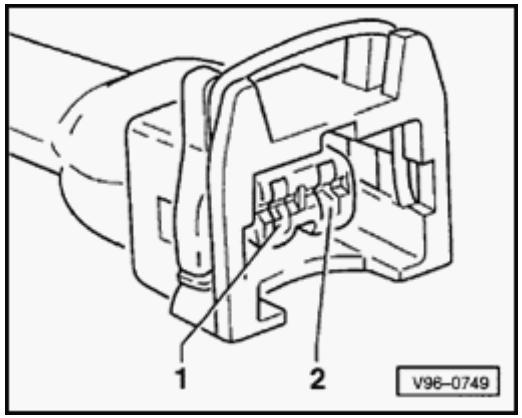
The diode test lamp should blink.

If the diode test lamp does not blink or lights up continuously:



- Connect VAG1598/31 test box to multi-pin harness connector for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

24-138



If the diode test lamp lights up continuously:

- Check for short circuit to Ground (GND) in wiring between contact 2 on EVAP valve harness connector and socket 64 on test box.

If the diode test lamp does not flash:

- Check for open circuit as well as short circuit to B+ in wiring between contact 2 on EVAP valve harness connector and socket 64 on test box.

  Resistance in wiring: max. 1.5 ohm

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If necessary, repair short circuit to Ground (GND) or open circuit.

If no short circuit or open circuit is found

- Replace Motronic Engine Control Module (ECM) -J220 ⇒ Page 24-24 .

Electronic Engine Power Control (EPC), checking

Function of Engine Power Control (EPC)

With the electronic throttle, the throttle valve is not operated by a cable connected to the accelerator pedal. There is no mechanical link between the accelerator pedal and the throttle valve.

The throttle valve is actuated by a servomotor (throttle valve positioner) in the throttle valve control module over the full range of engine speeds and load conditions.

The throttle valve positioner actuates the throttle valve according to the commands it receives from the Engine Control Module (ECM).

The position of the accelerator pedal is communicated to the Engine Control Module (ECM) by two accelerator position sensors (variable resistors, both installed in a single housing) which are connected to the accelerator pedal.

The accelerator pedal position (as determined by the driver) is one of the main input values for the Engine Control Module (ECM).

24-140

With the engine is not running and the ignition switched on, the ECM operates the throttle valve positioner in exact accordance with the signals from the accelerator position sensors. For example, when the accelerator pedal is pressed down half way, the throttle valve positioner opens the throttle valve by an equivalent amount, i.e. about half way.

When the engine is running (i.e. under load) the ECM can open and close the throttle valve freely, independently of the signals being sent by the accelerator position sensors.

For example, the throttle valve might already be fully open even though the accelerator pedal is only pressed down half way. This has the advantage of preventing throttling losses at the throttle valve.

Under certain engine load conditions there is also a significant reduction in harmful emissions and noticeably improved fuel consumption.

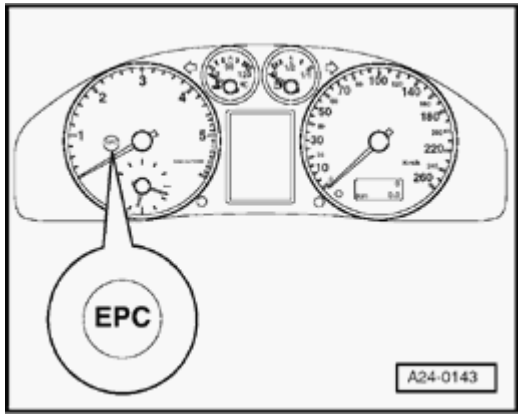
The Engine Control Module (ECM) can provide the optimum combination of throttle valve opening and charge pressure in order to create the required torque.

The electronic throttle is not simply a combination of two or three components, but rather a complete system comprising all the elements that together determine the position of the throttle valve and also control and monitor it. For example, the Accelerator Pedal Position Sensor, Throttle Valve Control Module, EPC warning lamp, Engine Control Module (ECM) etc.

24-142

Significance of electronic Engine Power Control (EPC) warning light in instrument cluster

"EPC" stands for Electronic Power Control and refers to the electronic throttle control system (Drive by wire).



Component location of EPC warning light

The Engine Control Module (ECM) checks after the ignition has been switched on all important parts of the electronic throttle control system for functionality.

After the ignition is switched on the ECM turns on the EPC warning light. Shortly after the engine has been started the EPC warning light goes out if, no malfunctions regarding the electronic throttle control system are stored in the ECM and if the activation for the EPC warning light is OK.

If a malfunction is detected in the electronic throttle system while the engine is running, the ECM will activate the EPC warning lamp. At the same time a Diagnostic Trouble Code (DTC) is stored in the DTC memory of the Engine Control Module (ECM).

Checking function of warning light

- Switch ignition on.

24-143

Specified value: The EPC warning light should light up.

If the EPC warning light does not light up:

- Check wire from Engine Control Module (ECM) to EPC warning light in instrument cluster as follows:

Cause:	Corrective action:
EPC warning light is not activated or does not light up because of an open circuit.	- Switch ignition off - Connect VAG1598/31 test box . Do not connect engine control module. - Bridge sockets 1 and 48 on test box - Switch ignition on. The EPC warning lamp should light up. If the EPC warning lamp does not light up: - Switch ignition off. - Check whether lamp is burned out and test voltage supply to lamp wiring diagram. If the warning lamp and the voltage supply are OK: - Check for open circuit or short circuit in wiring between engine control module and EPC warning lamp using wiring diagram. Determine and eliminate

	malfunction.
	If there are no malfunctions in the wiring to the EPC warning lamp:
Malfunction cause:	Engine control module (ECM) faulty ⇒Replace Engine Control Module (ECM) ⇒ Page 24-24 .

24-144

If EPC warning lamp remains lit for more than 3 seconds (i.e. continuously) when ignition is on, proceed with test as follows:

- Start engine and allow it to run at idling speed.

  Specified value: EPC warning lamp should go out.

If the EPC warning lamp does not go out:

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

If no DTCs are stored:

Cause:	Corrective action:
EPC warning light is activated via short circuit to Ground (GND).	- Switch ignition off - Connect VAG1598/31 test box . Do not connect engine control module. - Measure resistance between vehicle Ground and socket 48 on test box. Specified value: infinity (because the wire should not have any direct Ground connection) If the specification is not reached: - Determine and eliminate short circuit to Ground in wiring between engine control module and EPC warning lamp using wiring diagram.
	If there are no malfunctions in the wiring to the EPC warning lamp:

Malfunction cause:	Engine control module (ECM) faulty ⇒Replace Engine Control Module (ECM) ⇒ Page 24-24 .

24-145

Throttle Valve Control Module -J338, checking

The throttle valve control module housing contains the following components:

CAUTION!

The housing should NOT be opened.

- Throttle drive -G186 (power accelerator actuation) (This is an electric motor activated by the engine control module. The motor opens the throttle valve by applying force to overcome the spring pressure.)

- Angle sensor -1- for throttle drive (power accelerator actuation) -G187

- Angle sensor -2- for throttle drive (power accelerator actuation) -G188

Notes:

- *The angle sensors are in the form of potentiometers (variable resistors). Each sends its own separate signal to inform the engine control module of the position of the throttle valve (i.e. one of the signals is redundant).*

- *The potentiometers cannot be adjusted mechanically. Settings are made using the "Basic Setting" function (function 04) with VAG1551 scan tool or VAG1552.*

Throttle valve control module, adaptation

The adaptation process enables the Engine Control Module (ECM) to learn the different positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the control module. The feedback signal indicating the position of the throttle valve comes from the two angle sensors for throttle valve drive.

If the Throttle Valve Control Module -J338 or the ECM is removed and installed or replaced, or if the voltage (power) supply to the ECM is interrupted, an adaptation must be carried out.

24-147

The learning process (adaptation process) is carried out:

- By selecting "Basic Setting" (function 04), Display Group 060 with the ignition switched on.

- Automatically if the ignition is switched on for at least 6 seconds without operating the starter or depressing the accelerator, and if the Engine Control Module (ECM) registers a "learning requirement." (In this case, however, there is no way of knowing whether the adaptation process was successful or not.) The engine control module will register a learning requirement if the previously stored voltage readings from the angle sensors do not correspond (within a certain tolerance range) to the new voltage readings.

Note:

The engine will not start during automatic adaptation.

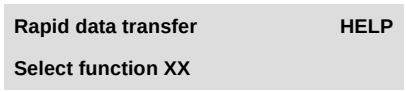
24-148

Test conditions for adaptation of throttle valve control module

- No malfunctions stored in DTC memory ⇒ Page 01-15 , check DTC memory
- Engine not running, ignition switched on
- Accelerator pedal not depressed
- Coolant temperature between 5 ° C and 100 ° C (Display group 004, display field 3)
- Intake air temperature less than 100 ° C
- Voltage supply to engine control module greater than 11Volt, Checking ⇒ Page 28-32

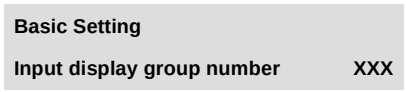
- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the ignition must be switched on.

24-149



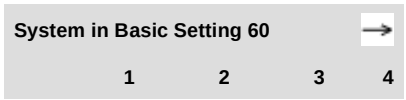
Indicated on display

- Press buttons -0- and -4- to select function "Basic Setting" and confirm entry with -Q- button.



Indicated on display

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



Indicated on display

- Check specification for throttle valve control module in display field 4 ⇒ Page 24-151

24-150

When the -Q- button is pressed the throttle valve positioner will be switched mechanically.

In this condition the throttle valve is pulled into an "emergency running" or default position by a mechanical spring in the throttle valve control module. The values supplied by the two angle sensors for this emergency running position are stored in the Engine Control Module (ECM).

The throttle valve is then opened by a predetermined amount. As soon as it reaches this position the current supply to the throttle valve positioner is again disconnected. The spring should then close the throttle valve mechanically to the previously learned default position within a specified period of time (spring test).

The throttle valve positioner then closes the throttle valve and the values supplied by the angle sensors in the throttle valve control module are stored in the Engine Control Module (ECM).

If the ECM disconnects the current supply to the throttle valve positioner while the vehicle is being driven, the result will be an increase in idling speed with fluctuating engine RPM (hunting) and very slow throttle response.

24-151

- Check specification for throttle valve control module (display fields 4).

	Display fields			
	1	2	3	4
Display Group 060: Adaptation of throttle valve control module with ignition on				
Display	xx %	xx %	**---**	**---**
Indicates	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Learning stage counter**	**Adaptation status**
Work Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	**0 to 8**	**ADP. runs** **ADP. O.K.** **ADP. ERROR**
Specified value	3 - 20 %	80 - 97 %	**8**	**ADP. OK**
Note			**Learning stage counter must run from 0 to 8 during adaptation process (some digits may also skip).**	**If specification is not met: Notes ⇒ Page 24-152 .**

Note:

- *It is not important how the learning stage counter reacts during adaptation, rather the specification "ADP" is reached after the adaptation in display field 4.*

- *The Abbreviation "ADP" stands for adaptation.*

24-152

Note:

If the adaptation process is interrupted by the control unit, the cause could be one of the following:

- *The throttle valve is unable to close completely (e.g. because of dirt).*
- *The harness connectors (e.g.: at throttle valve control module) are loose, not properly connected or the contacts at the connector are corroded or bent.*
- *Battery voltage too low.*
- *Throttle valve control module or wiring is faulty.*
- *The engine was started or the accelerator pedal was depressed during the adaptation process.*
- *Distortion of throttle valve housing (check bolts: 10 Nm)*

When the adaptation process is interrupted the message "Function is unknown or cannot be carried out at the moment" will appear on the fault reader display. The adaptation process will

start again automatically the next time the ignition is switched on (for several seconds).

- End engine basic setting by pressing the→ button.

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

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

The angle sensor -1- for throttle drive (power accelerator actuation) -G187 and angle sensor -2- for throttle drive (power accelerator actuation) -G188 inform the engine control module of the position of the throttle valve. Both angle sensors are located in the throttle valve control module.

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the ignition must be switched on.

Rapid data transfer	**HELP**
Select function XX	

Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block	**Q**
Input display group number	**XXX**

Indicated on display

- Press buttons -0-, -6- and -2- to select "display group number 062" and confirm entry with -Q- button.

24-154

Note:

The engine control module converts the voltage readings from the angle sensors into percentages of 5 V and displays them as percentages. (A signal wire voltage of 5 V is equivalent to 100%.)



Indicated on display

- Check specified display values for electronic throttle potentiometer voltages.

	Display fields			
	1	2	3	4
Display Group 062: Electronic throttle potentiometer voltages				
Display	**xx %**	**xx %**	xx %	xx %
Indicates	**Throttle valve angle (angle sensor 1)**	**Throttle valve angle (angle sensor 2)**	Accelerator position sensor 1	Accelerator position sensor 2
Work Range	**min.: 0 % max.: 100 %**	**min.: 0 % max.: 100 %**	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %
Specified value	**3 - 93 % (Idle value: 8 - 18%)**	**97 - 3 % (Idle value: 80 - 90%)**	12 - 97 %	4 - 49 %

- Observe display fields 1 and 2.
- Slowly depress accelerator pedal to full throttle position.

24-155

The percentage value in display field 1 should rise steadily, but without covering the full tolerance range between 3 - 93 %.

The percentage value in display field 2 should also rise steadily but without covering the full range of values (in this case 4 - 49 %).

If the display values do not appear as described:

- Check voltage supply and wiring to accelerator position senders ⇒ Page 24-163 .

Observe harness connectors for the following: Loose connectors, not properly engaged or corroded.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check accelerator position sensors ⇒ Page 24-159 .

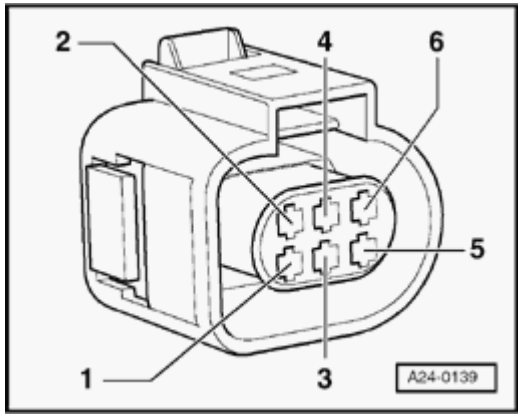
24-156

Notes:

- *The reason why the value in display field 1 rises and the value in display field 2 falls is because the potentiometers (angle senders) in the throttle valve control module work in opposite directions.*
- *The percentage value for the first potentiometer increases as the voltage rises towards 5 V because the voltage at this potentiometer increases as the throttle valve opens.*
- *The percentage value for the second potentiometer decreases as the voltage drops away from 5 V and towards 0 V because the voltage at this potentiometer decreases as the throttle valve opens.*

24-157

Checking voltage supply to throttle valve control module



- Disconnect harness connector from throttle valve control module.

- Switch ignition on.

- Connect hand-held multimeter (voltage range) between the following sockets on connector:

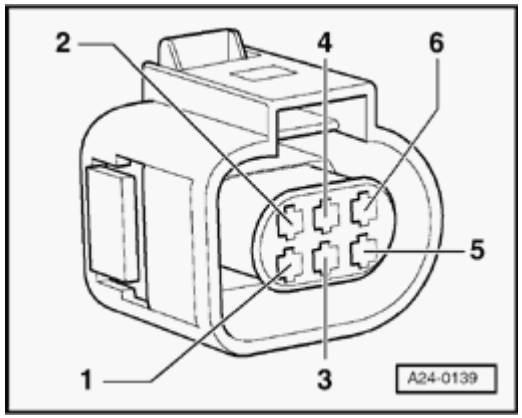
6-pin connector on wiring harness, socket	Specification
2 + Ground (GND)	approx. 5 V
2 + 6	approx. 5 V

If the specifications are not obtained, test wiring connections from engine control module to throttle valve control module ⇒ Page 24-158 .

If the readouts match the specifications, test also the signal wires and activation wires for the throttle valve positioner ⇒ Page 24-158 .

Checking wiring for voltage, signal and activation

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .



Test the following wiring connections for open circuits and short to B+ or Ground (GND).

6-pin connector on wiring harness, socket	VAG1598/31 test box, socket
1	92
2	83
3	117
4	84
5	118
6	91

Resistance in wiring: max. 1.5 ohm

- Repair any open/short circuit as necessary.

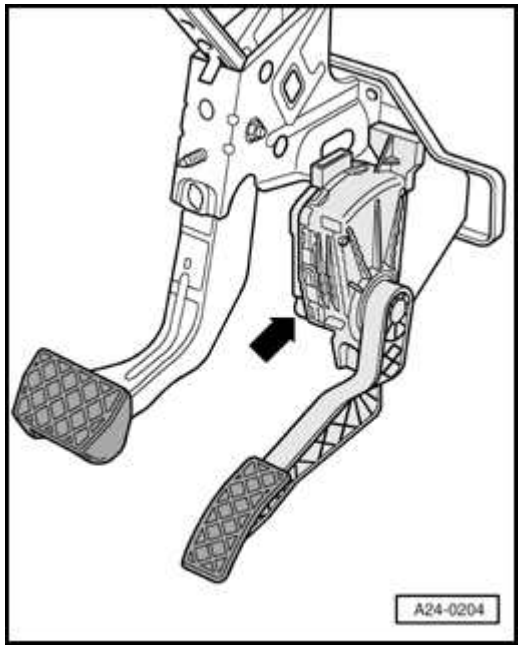
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If no wiring malfunction is detected:

- Replace throttle valve control module.

24-159

Throttle Position (TP) sensor -G79 and Sender -2- for accelerator pedal position -G185, checking



Component location of Throttle Position (TP) sensor -G79 and Sender -2- accelerator pedal position

The Throttle Position (TP) Sensor -G79 and Sender -2- for accelerator pedal position -G185 are located at the accelerator pedal. Both sensors inform (completely independently of the other) the engine control module of the driver's throttle requirement (pedal position). Both sensors are located in a single housing.

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the ignition must be switched on.

24-160

Rapid data transfer	**HELP**
Select function XX	

Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block	**Q**
Input display group number	**XXX**

Indicated on display

- Press buttons -0-, -6- and -2- to select "display group number 062" and confirm entry with -Q- button.

Read Measuring Value Block 62			→
1	**2**	**3**	**4**

Indicated on display

- Observe specification for electronic throttle potentiometer voltages.

24-161

	Display fields			
	1	2	3	4
Display Group 062: Electronic throttle potentiometer voltages				
Display	xx %	xx %	**xx %**	**xx %**
Indicates	Throttle valve angle (angle sensor 1)	Throttle valve angle (angle sensor 2)	**Accelerator position sensor 1**	**Accelerator position sensor 2**
Work Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	**min.: 0 % max.: 100 %**	**min.: 0 % max.: 100 %**
Specified value	3 - 93 %	97 - 3 %	**12 - 97 % (Idle value: 12 - 18%)**	**4 - 49 % (Idle value: 4 - 13%)**

Note:

The engine control module converts the voltage readings from the angle sensors into percentages of 5 V and displays them as percentages. (A signal wire voltage of 5 V is equivalent to 100%.)

- Observe display fields 3 and 4.

- Slowly depress accelerator pedal to full throttle position.

The percentage value in display field 3 should rise steadily, but without covering the full tolerance range between 3 - 93 %.

The percentage value in display field 4 should also rise steadily but without covering the full range of values (in this case 4 - 49 %).

24-162

Note:

The value shown in display field 3 should always be about the double of the value shown in display field 4.

If the display values do not appear as described:

- Check voltage supply and wiring to accelerator position sensors ⇒ Page 24-163 .

24-163

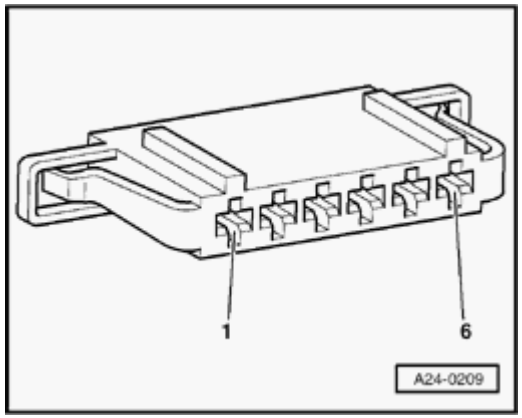
Checking voltage supply of accelerator position sensors

- Remove storage compartment on driver's side.

⇒ *Repair Manual, Body Interior, Repair Group 68*

- Disconnect harness connector for accelerator position sensor.

- Switch ignition on.



- Connect hand-held multimeter (voltage range) between the following sockets on the connector:

6-pin connector on wiring harness, socket	Specification
2 + Ground (GND)	approx. 5 V
1 + 3	approx. 5 V
5 + Ground (GND)	approx. 5 V
5 + 4	approx. 5 V

If the specifications are obtained:

- Check signal wiring ⇒ Page 24-164 .

If the specifications are not obtained:

- Check wiring between Engine Control Module (ECM) and accelerator position sensors.

Checking wiring

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

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

Connector socket	VAG1598/31 test box Socket
1	72
2	73
3	36
4	35
5	33

6	34

- Repair any open/short circuit as necessary.

If no wiring malfunction is detected:

- Replace accelerator position sensors.

Note:

After replacing accelerator position sensor, on vehicles with automatic/stepless transmission carry out adaptation of Kick-Down switch ⇒ *Page 24-166* .

Kick-Down function, adaptation

On vehicles with automatic/inifinitely variable transmission, when the accelerator position sensor or the Engine Control Module (ECM) was replaced, the Kick-Down function from ECM must be adapted.

Test conditions

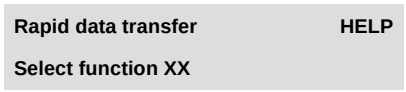
- No malfunctions stored in DTC memory ⇒ Page 01-15 , check DTC memory

- Engine not running, ignition switched on

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 .

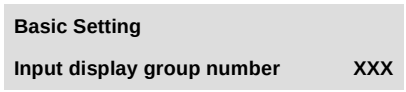
  When doing this the ignition must be switched on.

24-167



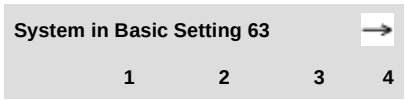
Indicated on display

- Press buttons -0- and -4- to select function "Basic Setting" and confirm entry with -Q- button.



Indicated on display

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



Indicated on display

Note:

You are prompt to: "Activate Kick-Down"

- Depress accelerator pedal fully pass the Kick-Down point and hold accelerator pedal at this position.

Note:

During the Kick-Down point adaptation the VAG1551 displays "Kick-Down ADP. runs". After the Kick-Down point adaptation was successfully carried out the VAG1551 displays "Kick-Down ADP. OK", now you can release the accelerator pedal.

- Check specification in display field 4.

24-168

	Display fields			
	1	2	3	4
Display Group 063: Kick-down function adaptation				
Display	xx %	xx %		**---**
Indicated	accelerator position sensor 1	accelerator position sensor 2		**Adaptation condition**
Work range	0...100 %	0...100 %	**Kick Down**	**Activate** **ADP. runs** **ADP. OK** **ADP. ERROR**
Specified value	12...97 %	4...49 %	**Kick Down**	**ADP. OK**
Note			**IF "ADP. ERROR" is displayed: Check DTC memory ⇒ Page 01-15 .**	

Note:

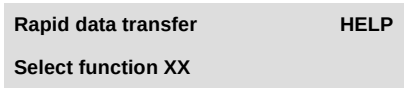
- *The Abbreviation "ADP." stands for adaptation.*
- *The "ERROR" display could appear, if the accelerator pedal was not immediately depressed after you have been prompted or the accelerator pedal was released during the adaptation although the adaptation was not completely carried out. In both cases the "Basic Setting" mode must be abandoned and the adaptation must be started again ⇒ Page 24-*

166 .

24-169

If the specification "ADP. OK" is obtained:

- Press →button.



Indicated on display (Select function)

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

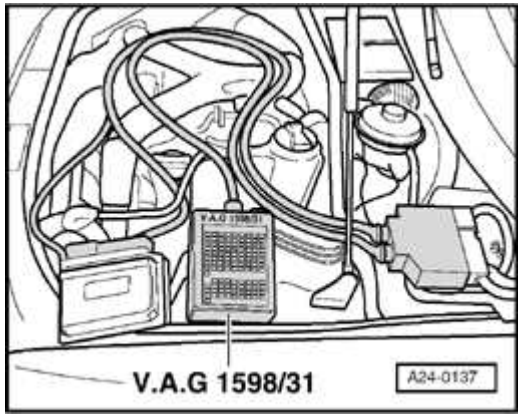
24-179

Additional signals, checking

Engine speed (RPM) signal, checking

Note:

The engine speed signal is taken from terminal 37 on the Engine Control Module (ECM). The signal is used for various functions including the RPM display in the instrument cluster.



- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .
- Check wiring from test box socket 37 to instrument cluster according to wiring diagram for an open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-180

Fuel consumption signal for on-board computer, checking

Notes:

- *The fuel consumption signal is calculated by the engine control module (on the basis of the injection period) and passed on to the on-board computer. The fuel consumption signal is taken from terminal 81 on the Engine Control Module (ECM).*

- *Checking fuel consumption signal*

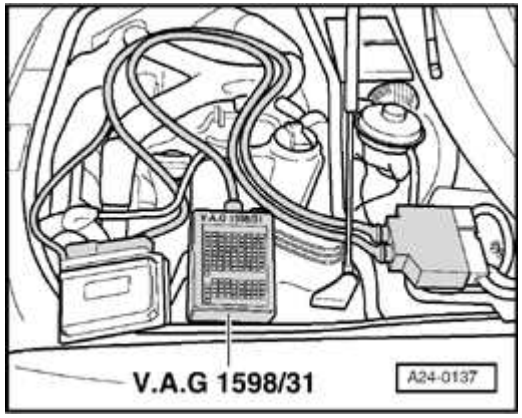
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-181

Coolant temperature signal, checking

Notes:

- *The engine control module receives the coolant temperature signal from the instrument cluster. When the signal is received, the charge pressure is reduced to prevent the engine from overheating.*



- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .
- Check wiring from test box socket 19 to instrument cluster according to wiring diagram for an open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-182

Vehicle Speed Signal (VSS), checking

Notes:

- *The vehicle speed signal is generated by the Vehicle Speed Sensor (VSS) -G68 (on the transmission) and is processed in the instrument cluster.*

- *The processed signal goes to terminal 54 on the engine control module and is used for Idle Air Control (IAC) and for the damping of load change jolts when changing gear.*

- Start engine.

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 .

- Select "Read measured value block" (function 08) and Display Group 5.



Indicated on display:

Warning!

- ***During a road test in an airbag equipped vehicle, VAG1551 must***

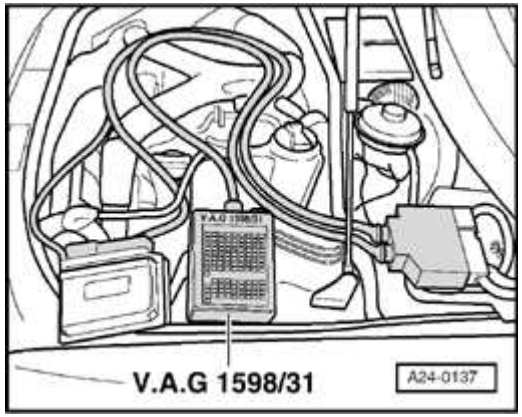
always be fastened to and operated from the rear seat by a second technician.

- ***When driving or riding in an airbag equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and and the airbag increase the risk of injury in an accident.***

24-183

- Take vehicle for a test drive and check whether vehicle speed appears in display field 3.

- If vehicle speed does not appear, raise the vehicle (preferably using a lift) until front left wheel is clear of the ground.



- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .
- Connect diode test lamp between socket 3 (B+) and socket 54 (vehicle speed signal).
- Switch ignition on and turn front left wheel by hand.

  The diode test lamp should flash (very brief flashes).
- If diode test lamp does not flash, check for open circuit or short to B+ or Ground (GND) in wiring between instrument panel and terminal 54 on engine control module connector.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

Fuel tank level signal, checking

Note:

- *The Engine Control Module (ECM) receives the fuel tank level signal from the instrument cluster.*
- *The processed signal enters on terminal 30 the Engine Control Module (ECM) and is used to determine certain malfunctions (e.g.: misfire)*

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

- Check wiring from test box socket 30 to instrument cluster according to wiring diagram for an open circuit and short circuit to B+/Ground (GND).

24-185

Brake light switch -F and brake pedal switch -F47, checking

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 .

When doing this the ignition must be switched on.

Rapid data transfer **HELP**

Select function XX

Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block

Input display group number XXX

Indicated on display

- Press buttons -0-, -6- and -6- to select "display group number 066" and confirm entry with -Q- button.

24-186



➢ Indicated on display

- Observe brake light/brake pedal switch in display field 2.

	Display fields			
	1	2	3	4
Display Group 066: Signals to engine control module				
Display	xxx km/h	**X X X X**	xxx km/h	0 0 0 0
Indicates	Actual speed	**Switch positions**	Specified speed	Switch positions
Work range		**XX00** **XX11**		
Specified value		**XX00** **Brake pedal not depressed** **XX11** **Brake pedal depressed**		
Note		**Value:** **X = insignificant** **The switch points are offset**		

24-187

If display does not appear as described:

Check switch

- Remove storage compartment on driver's side.

⇒ *Repair Manual, Body Interior, Repair Group 68*

- Disconnect harness connector on brake light/brake pedal switch.

- Connect hand-held multimeter for resistance measurement between terminals 1 and 2.

Note:

The connector slots are marked on the back side of the connector.

24-188

- Specified value: ∞ Ω (no continuity)

- Depress brake pedal.

- Specified value: approx.: 0 Ω

- Connect hand-held multimeter for resistance measurement between terminals 3 and 4.

- Specified value: approx.: 0 Ω

- Depress brake pedal.

- Specified value: ∞ Ω (no continuity)

If specifications are not obtained:

- Check adjustment or replace brake light/brake pedal switch.

24-189

If specifications are not met:

Check voltage supply

- Connect VAG1527 B between following sockets on harness connector:

Harness connector terminal	Measure against
1	Ground (GND)

- ♦ The LED must come on

Harness connector terminal	Measure against
3	Ground (GND)

- Switch ignition on.

- ♦ The LED must come on

If LED does not come on:

- Check wiring connection from terminal 1 or 3 of connector for open circuit (fuse) or short circuit to Ground (GND).

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If necessary eliminate open circuit or short circuit to Ground (GND)

If LED comes on:

Check activation

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

Test the following wiring connections for open circuits and short to B+ or Ground (GND):

Harness connector terminal	VAG1598/31 test box, socket
2	56
4	55

- Repair any open/short circuit as necessary.

24-191

Clutch Vacuum Vent Valve Switch -F36, checking

Note:

This signal is used to avoid RPM over-oscillation and load change impacts when changing gears and is also used for the cruise control system.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 .

When doing this the ignition must be switched on.

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

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

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

- Press buttons -0-, -6- and -6- to select "display group number 066" and confirm entry with -Q- button.

Read Measuring Value Block 66 →	⮜	Indicated on display

1	2	3	4

- Observe clutch vacuum vent switch switch in display field 2.

	Display fields			
	1	2	3	4
Display Group 066: Signals to engine control module				
Display	xxx km/h	**X X X X**	xxx km/h	0 0 0 0
Indicates	Actual speed	**Switch positions**	Specified speed	Switch positions
Work range		**X0XX** **X1XX**		
Specified value		**X0XX** **Clutch pedal not depressed** **X1XX** **Clutch pedal depressed**		
Note		**Value:** **X = insignificant**		

24-193

If display does not appear as described:

Check switch

- Remove storage compartment on driver's side.

⇒ *Repair Manual, Body Interior, Repair Group 68*

- Disconnect harness connector on clutch switch.

- Connect hand-held multimeter for resistance measurement between terminals 1 and 2.

Note:

The connector slots are marked on the back side of the connector.

  - ♦ Specified value: approx.: 0 Ω

- Depress clutch pedal.

  - ♦ Specified value: ∞ Ω (no continuity)

If specifications are not obtained:

- Replace clutch vacuum vent valve switch.

If specification is obtained:

Check voltage supply

- Connect VAG1527 B between following sockets on harness connector:

Harness connector terminal	Measure against
2	Ground (GND)

- Switch ignition on.

  - The LED must come on

If LED does not come on:

- Check wire connection from terminal 2 of connector for open circuit (fuse) or short circuit to Ground (GND).

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If necessary eliminate open circuit or short circuit to Ground (GND)

If LED comes on:

Check activation

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

Test the following wiring connections for open circuits and short to B+ or Ground (GND):

Harness connector terminal	VAG1598/31 test box, socket
1	39

- Repair any open/short circuit as necessary.

Crash signal, checking

The Engine Control Module (ECM) receives the crash signal ("Crash shut-down activated") from the airbag control module.

If the airbag control module sends the crash signal to the ECM (if an accident occurred or if a output Diagnostic Test Mode (DTM) was carried out), the ECM shuts off the fuel pump, that means the engine stalls, however, afterwards the engine can be started again (e.g. when removing the vehicle from the accident area)

The ECM cannot switch off the fuel pump during an accident if the malfunction "Crash Signal from Airbag Control Unit/Range Performance" from the airbag control module is sent to ECM. The engine control module cannot recognize the crash signal from the airbag control module; e.g.: if the wiring between the ECM and the airbag control module is faulty.

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

24-197

Test the following wiring connections for open circuit and/or short to B+ or Ground (GND) and open circuit.

VAG1598/31 test box, socket	Airbag control module, contact
67	⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

Resistance in wiring: max. 1.5 ohm

Eliminate open circuit or short circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If no malfunctions are found in wiring: Check DTC memory of airbag control module.

24-198

Signal for rough road recognition from ABS/EDL control module, checking

Note:

- *The ABS/EDL control module generates the rough road signal if it recognizes wheel spin on a wheel. The Engine Control Module (ECM) switches off the misfire recognition once the rough road signal is recognized by the ECM.*
- *The rough road signal should only be checked if the malfunction (P1606) 18014 "Rough Road Spec Engine Torque ABS-ECU/Electrical Malfunction" is stored in the DTC memory. It is possible that the malfunction "Misfiring" is also stored in DTC memory, however this is then a sequence error and should be ignored.*
- *The wiring and the rough road signal is monitored by the ECM.*

24-199

Test conditions

- Control module coding OK ⇒ Page 01-93 .

Test sequence

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

- Check wire from test box socket 74 to ABS Control Module according to wiring diagram for short circuit or open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-200

If no malfunction is detected:

- Replace ABS control module.

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

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

24-201

Data exchange between Engine/ABS/ Transmission control module, checking

Notes:

- *The data exchange between the various control modules is carried out via a bus system.*
- *The term "Bus" refers to a system for transmitting and distributing data.*
- *The wires which connect the control modules and convey the data between them are called data wires.*
- *Data is transmitted via data wires in serial, i.e. in a specific order to the connected control modules.*

24-202

Checking bus system

The principle of the test is independent of the number of control modules/systems connected to the CAN-bus.

The DTC table suggested checking the data exchange between the Engine Control Module (ECM) and CAN capable control modules.

- Start engine (if engine will not start, switch ignition on).

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

Rapid data transfer	**HELP**
Select function XX	

When indicated on display:

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

Read measuring value block	**Q**
Enter display group number XXX	

When indicated on display:

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

24-203

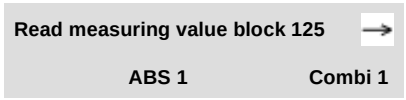


When indicated on display:

- Check indications in display fields 1 through 4.

  CAN capable control modules connected to the Engine Control Module (ECM) are indicated:

  - No indication (display field empty): Control module not CAN-capable
  - Indication 1: CAN capable control module is connected to databus
  - Indication 0: CAN capable control module is not connected to databus (e.g. in case of malfunction)



Example:

Note:

Display group 125 indicates all systems that communicate with the Engine Control Module (ECM) via the CAN-bus. (In this example, the ABS control module and the instrument cluster). If these systems are not installed, the display fields in display group 125 that are intended for them will be empty. Display field 1 will indicate "Transmission 1" and display field 4 will indicate "A/C 1" if these systems are communicated with the Engine Control Module (ECM) via the CAN-bus.

24-204



- Check under display group 126 in the same manner.

Note:

Display group 126 indicates all other systems that communicate with the Engine Control Module (ECM) via the CAN-bus. If these systems are not installed, the display fields that are intended for them will be empty.

The following systems will be indicated in display group 126, assuming they are communicating with the Engine Control Module (ECM) via the CAN-bus:

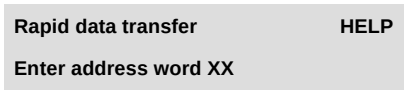
Display field 1: automatic distance control; indication: "Distance 1".

Display field 2: Steering angle sensor; indication: "Steering angle 1"

Display field 3: Airbag; indication: "Airbag 1".

Display field 4: System voltage; indication: "cnt. ELEC 1".

- Press → button.



When indicated on display:

24-205

- Press button 0- twice to select "Automatic test sequence", address word 00. Press -Q- button to confirm input.

  - DTC memory of all OBD capable systems in the vehicle will be checked.

When a control module responds with its identification, the display indicates the number of stored errors or indicates "no malfunctions recognized".

DTCs stored in the system are indicated in sequence and printed out. Then the VAG1551 scan tool sends the next address word.

VAG - On Board Diagnostic (OBD) HELP

1- Rapid data transfer*

2- Blink code output*

The automatic test sequence is over when the following indication appears on the display:

If a malfunction related to the"powertrain databus" or the "CAN-bus" is indicated:

- Check whether the Engine Control Module (ECM) and other CAN capable control modules installed are appropriate for this vehicle (part no. and coding).

24-206

If the correct control modules are installed:

- Check to be sure the multi-pin connectors of the control modules are securely connected.

If multi-pin connectors are properly secured:

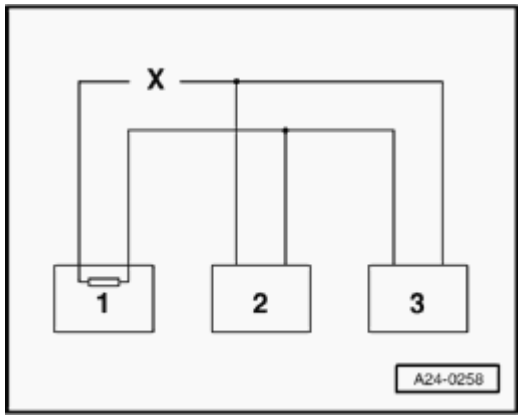
- Check CAN-bus system as described in repair manual ⇒ Page 24-202 .

The following trouble shooting procedure is recommended if three or more control modules communicate via a "two-wire bus system".

- Read out malfunctions stored in the control modules.

  This will help to identify a malfunction in the wiring.

24-207



Example 1

From the malfunctions present in the DTC memories, you can see that control module 1 has no connection to control modules 2 or 3.

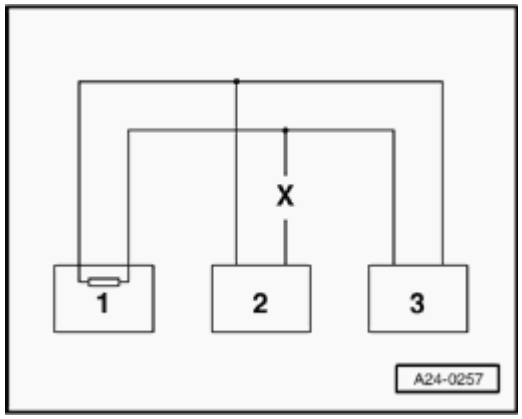
Control module	Stored malfunctions in DTC memory:
1	♦ No message from control module 2 ♦ No message from control module 3
2	♦ No message from control module 1
3	♦ No message from control module 1

- Switch ignition off.
- Disconnect control modules that are linked by bus wires and check whether there is an open circuit in one of the bus wires

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If no malfunction can be identified in the bus wires replace control module 1.

24-208



Example 2

From the malfunctions present in the DTC memories, you can see that control module 2 has no connection to control modules 1 or 3.

Control module	Stored malfunctions in DTC memory:
1	♦ No message from control module 2
2	♦ No message from control module 1 ♦ No message from control module 3
3	♦ No message from control module 2

- Switch ignition off.
- Disconnect control modules that are linked by bus wires and check whether there is an open circuit in one of the bus wires

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- If no malfunction can be identified in the bus wires replace control module 2.

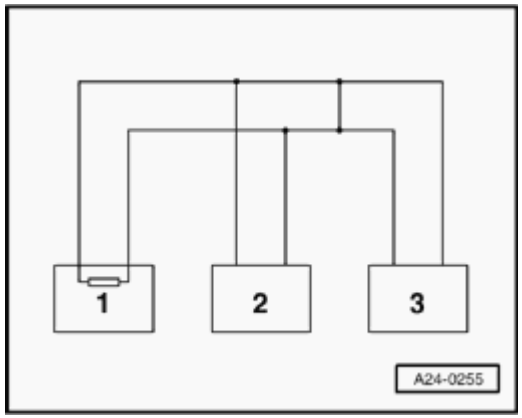
24-209

Example 3

From the malfunctions present in the DTC memories, you can see that none of the control modules are able to transmit or receive signals.

Control module	Stored malfunctions in DTC memory:
1	♦ Data Bus Powertrain Malfunction
2	♦ Data Bus Powertrain Malfunction
3	♦ Data Bus Powertrain Malfunction

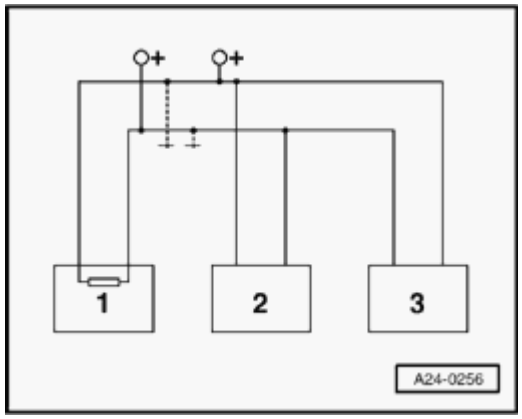
- Switch ignition off.



- Disconnect the control modules which are linked by the bus wires and check for a short circuit between the bus wires

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

24-210



- Check bus wires for short to B+ and short to Ground (GND).

If the cause of the malfunction "Data Bus Powertrain Malfunction" cannot be found in the data bus wires, check whether one of the control modules is causing the malfunction.

At this stage all the control modules which communicate via the CAN data bus are disconnected. The ignition is switched off.

24-211

- Connect one of the control modules.

- Connect VAG1551 scan tool. Switch ignition on and erase the DTC memory of the control module which has just been connected. End output from scan tool with function 06 "End Output."

- Switch ignition off and then on again.

- Leave ignition switched on for 10 seconds. Then check DTC memory of the control module that has just been connected, using the scan tool.

- If the malfunction "Data Bus Powertrain Malfunction" is now indicated, replace the control module which has just been connected.

- If malfunction "Data Bus Powertrain Malfunction" is not indicated, connect next control module, and repeat above procedure.

28-1

Ignition system, checking

General notes on ignition system

- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control module may be damaged.
- The engine control module is equipped with On Board Diagnostic (OBD).
- For trouble-free operation of the electrical components a voltage of at least 11.5 V is necessary.
- During some of the tests it is possible that the control module will detect and record a malfunction. The DTC memory must therefore be checked and if necessary erased when all tests and repair work have been completed.
- After completing troubleshooting, repairs or component tests, it is possible that the engine will start, run for a short period and then cut out. If this happens it may be that the immobilizer is blocking the engine control module. In such cases the DTC memory must be checked and if necessary the control module must be adapted.

28-2

Safety precautions

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

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 wiring when the engine is running or being turned at starter speed.***
- ***DO NOT operate the starter if fuel injectors are removed.***
- ***Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control module may be damaged.***
- ***The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.***
- ***In order to run the engine at starting speed***

without actually starting it (e.g. to test compression), disconnect the connectors from the output stages of the ignition coils and from all the fuel injectors. After completing the work, check and erase the DTC memory.

- ***The ignition must always be switched off when cleaning the engine.***

28-3

CAUTION!

Before disconnecting the battery:

- ***Stop the engine.***
- ***Be sure of proper radio code (for vehicles equipped with coded anti-theft radio).***

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

- ***Be sure the ignition is switched OFF.***
- ***Use correct adapters from VAG1594 connector test kit***

28-4

Technical data, ignition system

Engine code	APB
Engine idle RPM Not adjustable - controlled by Idle Air Control (IAC)	750 - 850 RPM
RPM limit ♦ Operates by closing throttle valve ♦ Operates by shutting off fuel injectors	approx. 6800 RPM
Ignition timing is determined by the control module. Ignition timing cannot be adjusted.	
Ignition system	Single-coil system with 6 ignition coils located above spark plug connectors and installed directly on spark plugs. The power output stages are located as separate components in air cleaner housing.
Spark plugs connectors	Resistance approx.: 2K Ohm
Firing order	1-4-3-6-2-5

28-5

Ignition coils, checking

Note:

Misfiring is recognized by the On Board Diagnostic (OBD). This means a non working cylinder is stored with the cylinder number in the DTC memory. This has an advantage in case of a malfunction the trouble shooting procedure can be started at a certain cylinder. Check the DTC memory of the Engine Control Module (ECM) before commencing trouble shooting.

Test conditions

- No DTCs stored relating to any of the fuel injectors

Determine a non working or misfiring cylinder as follows:

- With the engine running disconnect harness connectors in sequence from fuel injectors, and observe the engine performance.

or

- Compare spark plugs of all cylinders with each other and check for soot on the electrodes.

When the faulty cylinder has been identified:

- Connect hand-held multimeter (resistance measurement) to spark plug connector:

Note:

The spark plug connector can be disconnected from the ignition coil.

Specified value: approx.: 2K Ohm.

28-7

If specification is not obtained:

- Replace spark plug connector.

If specification is obtained:

- Exchange spark plug from faulty (misfiring) cylinder with one from another cylinder. Visually check spark plug for damage e.g.: cracks on ceramic body of spark plug.

- If malfunction (misfire) occurs now on other cylinder, replace spark plug.

If the malfunction remains at the same cylinder:

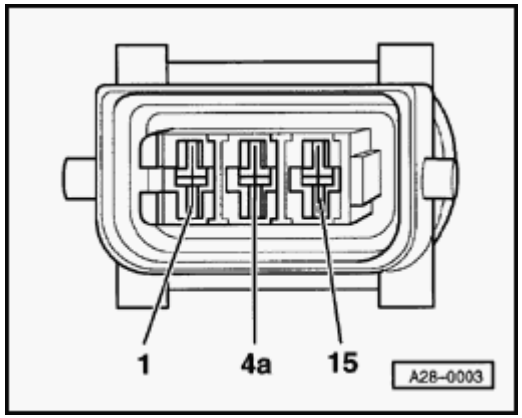
- Exchange ignition coil from faulty (misfiring) cylinder with one from another cylinder. Visually check ignition coil for damage (ignition coil could be cracked or bursted)

- If malfunction occurs now on other cylinder, replace ignition coil.

28-8

If malfunction remains at the same cylinder.

- Disconnect harness connector from ignition coil.



- Check Ground (GND) connection between socket 4a and engine Ground (GND) for open circuit and short circuit to B+.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Repair any open/short circuit as necessary.

If the Ground (GND) connection is OK.

- Connect hand-held multimeter (voltage range) to terminal 15 of harness connector and Ground (GND).
- Disconnect harness connector from fuel injector of cylinder to be tested.
- Operate starter.

  Specified value: approx. battery voltage

28-9

If the specification is not obtained:

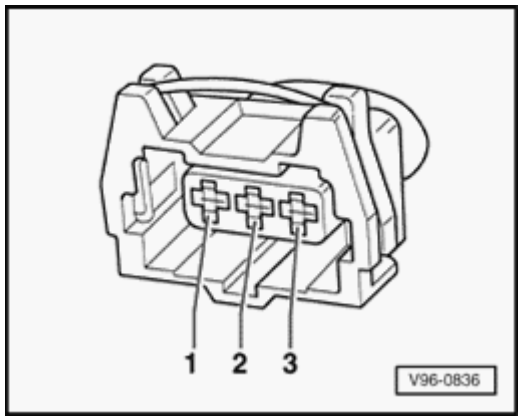
- Check wiring.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If the specification is obtained:

- Disconnect 3-pin harness connectors on power output stages for ignition coils; component locations overview ⇒ Page 24-5 .

- Then connect diode test lamp to 3-pin connectors for both output stages.



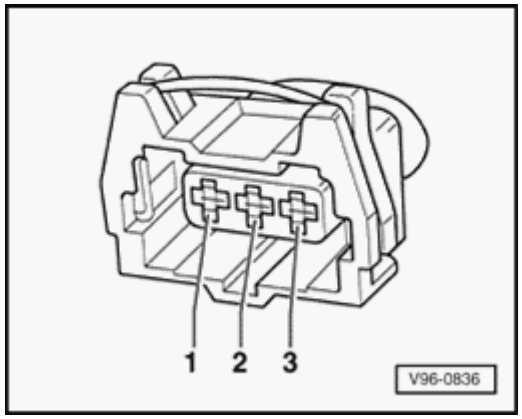
- Connect diode test lamp VAG1527 to following contacts on connectors for power output stages:

3-pin harness connector terminal	Specification (with starter activated)
1 + Ground (GND)	Diode test lamp should light up
2 + Ground (GND)	
3 + Ground (GND)	

If the specifications are not obtained:

- Switch ignition off.

28-10



➢ Check the following wiring connections for open circuits and/or short to B+ or Ground (GND).

Black 3-pin connector on power output stage, terminal	3-pin connector on ignition coil, terminal
1	1 (cylinder 1)
2	1 (cylinder 2)
3	1 (cylinder 3)
Brown 3-pin connector on power output stage, terminal	**3-pin connector on ignition coil, terminal**
1	1 (cylinder 4)
2	1 (cylinder 5)
3	1 (cylinder 6)

- Eliminate any open/short circuit as necessary.

28-11

Power output stages for ignition coils, checking

Note:

- *Power Output Stage -N122 (black connector) activates the ignition coils for cylinder bank 1 (cylinders 1 to 3).*

- *Power Output Stage 2 -N192 (brown connector) activates the ignition coils for cylinder bank 2 (cylinders 4 to 6).*

Checking activation of power output stages

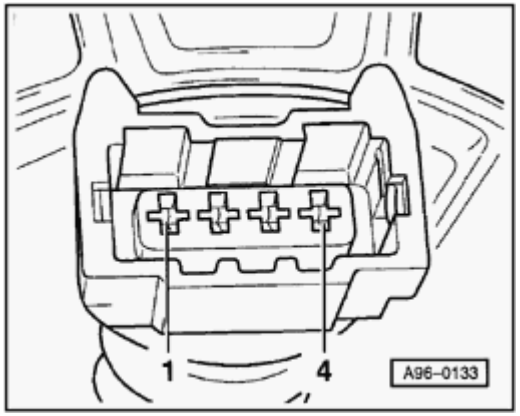
- Disconnect harness connectors from all six fuel injectors.

Note:

It is important to ensure that no fuel is injected during the test as this would damage the catalytic converter. The harness connectors on the fuel injectors must therefore be disconnected.

28-12

- Disconnect 4-pin harness connectors on power output stages Component locations overview, ⇒ Page 24-5 .



- Connect diode test lamp VAG1527 in turn to the following contacts on the two 4-pin connectors for the power output stages.
- Then, operate starter for a few seconds.

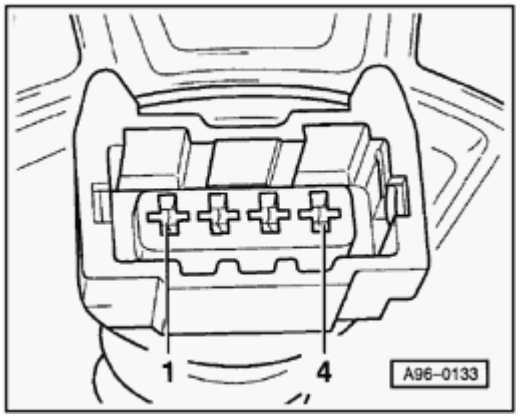
6-pin connector on wiring harness, terminal	Specification
1 + Ground (GND)	Diode test lamp should flash (brief impulse)
3 + Ground (GND)	
4 + Ground (GND)	

28-13

If the specifications are not obtained:

- Switch ignition off.

- Connect test box VAG 1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .



➢ The following wiring connections are to be checked for open circuits and/or short to B+ or Ground (GND).

Black 4-pin connector on wiring harness, terminal	VAG1598/31 test box, socket
1	94
3	110
4	102
Brown 4-pin connector on wiring harness, terminal	**VAG1598/31 test box, socket**
1	95
3	111
4	103

- Rectify any open/short circuit as necessary.

If no wiring malfunction is detected:

- Connect 4-pin connectors to power output stages.

- Disconnect 3-pin connectors from power output stages.

- Connect diode test lamp VAG1527 to battery (B+) and to one of the 3 terminals on power output stage.

- Operate starter for few seconds.

  The diode test lamp should flash.

- Carry out test with all 3 terminals on each of the 3-pin connectors for the power output stages.

  The diode test lamp should flash each time.

28-15

If the diode test lamp does not flash when testing one or more of the contacts:

Check the Ground (GND) connections for the power output stages as follows:

- Disconnect 4-pin harness connectors from power output stages.

- Connect diode test lamp VAG1527 to battery (B+) and terminal 2 of each of the 4-pin connectors in turn.

  The diode test lamp should light up.

- If diode test lamp does not light up, test for open circuit in wiring using wiring diagram.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If the diode test lamp lights up:

- Replace power output stage.

Note:

Before installing new power output stage coat metal side with heat paste (part no. G 052 170 A1). The heat paste is used to prevent corrosion between the power output stage and the fastening point, it is also used to transfer heat from the power output stage.

CAUTION!

Part numbers are only for reference, always check with your parts department for latest information.

28-17

Intake Air Temperature (IAT) sensor - G42, checking

Location of sensor and connector ⇒ Page 24-5 .

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the ignition must be switched on.

Rapid data transfer HELP

Select Function XX

Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block HELP

Input Display Group Number XXX

Indicated on display

- Press buttons -0-, -0- and -4- to select Display Group 4 and confirm entry with -Q- button.

Read Measuring Value Block 4 →

1 2 3 4

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

- Check display value for intake air temperature sensor (display field 4):

28-18

	Display fields			
	1	2	3	4
Display Group 004: Intake air temperature with engine idling				
Display	xxxx rpm	xx.xxx V	xxx.x °C	**xxx.x °C**
Indicates	Engine speed	Battery voltage	Coolant temperature	**Intake air temperature**
Work range	min.: 750 RPM max.: 6800 RPM	min.:10.000 V max.: 15.000 V	min.: -48.0 °C max.: 143.0 °C	**min.: -48.0 °C** **max.: 143.0 °C**
Specified value	xxxx RPM	12.000...15.000 V	80.0...110.0 °C	**Between ambient temp. and 120 °C** [1)]

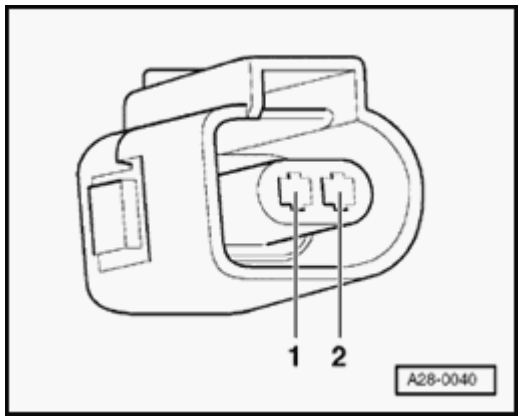
1) If there is a large difference between the temperature displayed and the ambient temperature at the sensor, check the sensor and sensor wiring for contact resistance and open circuit.

28-19

Checking wiring:

- Switch ignition off.

- Connect test box VAG1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .

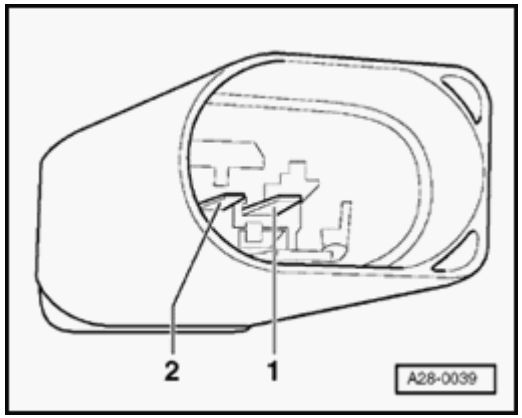


- Check for open circuit in wiring between test box and 2 pin harness connector using wiring diagram.

  Specified value: max. 1.5 Ω

Terminal on 2-pin harness connector	Contact on control module connector or test box
1	85
2	108

- Check wiring for short circuits to each other between contacts 1 and 2 on 2-pin connector. Also test for short circuits to B+ or Ground (GND).



If no malfunction in wire is detected:

Checking sender

- Measure resistance between contacts 1 (signal) and 2 (Ground GND)) on connector for Intake Air Temperature (IAT) sensor -G42.

Temperature °C	Resistance kΩ
-20	approx. 13.8
0	approx. 5.5
20	approx. 2.4
40	approx. 1.1
60	approx. 0.6

- If value does not match the specification, replace intake air temperature sensor.
- In order to install a new sensor, the intake manifold must first be removed ⇒ Page 24-15 .

28-21

Engine Speed (RPM) sensor -G28, checking

Note:

- *The engine speed sender is a combined speed sender and reference mark sender. Without a signal from the Engine Speed (RPM) sensor -G28 the engine cannot be started. If the signal from the Engine Speed (RPM) sensor -G28 fails while the engine is running, the engine will cut out immediately.*

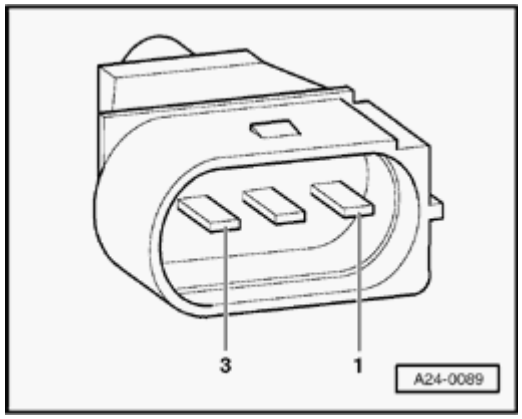
Checking Engine Speed (RPM) sensor

Component location of sensor and connector ⇒ Page 24-5 .

- Before carrying out test, make sure that sensor is correctly installed and firmly seated.

- Disconnect harness connector for Engine Speed (RPM) sensor (grey connector).

28-22



- Connect multimeter (Fluke 83 or equivalent) (resistance test range) to terminals 2 and 3 on connector for engine speed sensor using test lead from VAG1594 connector test kit.

  Specified value: approx. 730 - 1000 ohm

Notes:

- *The resistance value for the engine speed sensor is based on a temperature of 20° C.*
- *The resistance increases as the temperature rises.*

If the specification is not attained:

- Replace engine speed sensor.

If the specification is attained:

- Connect multimeter (Fluke 83 or equivalent) (resistance test range) between terminals 2 and 1 (Ground (GND)) and between terminals 3 and 1 (Ground (GND)).

  Specified value: R Ω (infinite Ohms / open circuit) in each test

If the specification is not attained:

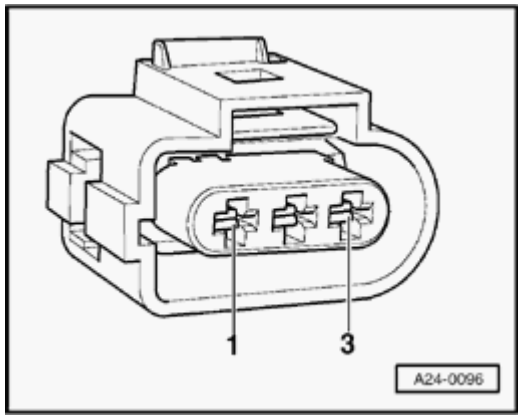
- Replace Engine Speed (RPM) sensor.

If the specification is attained:

- Check wiring between sensor connector and engine control module as

follows:

28-23



- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

- Test continuity of screening (shielded wire) between contact 1 on engine speed sender connector and socket 108 on test box.

Specified value: max. 1 Ω.

- Test continuity of negative wire from contact 2 on sender connector to socket 90 on test box.

Specified value: max. 1 Ω.

- Test continuity of signal wire from contact 3 on sender connector to socket 82 on test box.

Specified value: max. 1 Ω.

28-24

If the values are not as specified:

- Rectify short or open circuit in wiring between sender connector and control module connector.

Terminal on sensor connector	Terminal on control module connector
1	108
2	90
3	82

- If no open circuits or short circuits are identified, replace Engine Control Module (ECM) ⇒ Page 24-24 .

28-25

Engine Coolant Temperature (ECT) sensor -G62, checking

Note:

Component location of coolant temperature sensor ⇒ Page 24-5 .

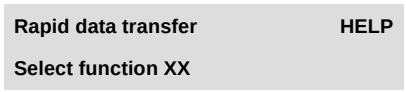
Test conditions

- Engine cold

- Connect vehicle diagnostic, testing and information system VAS 5051 or VAG1551 scan tool to vehicle and select engine electronics control module by entering address word "01" ⇒ Page 01-9 .

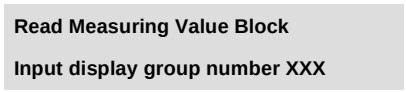
  When doing this the engine must be at idle.

28-26



Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.



Indicated on display

- Press buttons -0-, -0- and -4- to select Display Group 4 and confirm entry with -Q- button.



Indicated on display

- Check readout for coolant temperature sender in display field 3.

28-27

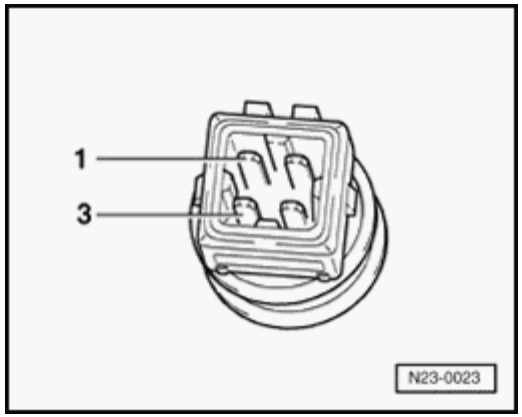
	Display fields			
	1	2	3	4
Display Group 004: Coolant temperature with engine idle				
Display	xxxx RPM	xx.xxx V	**xxx.x °C**	xxx.x °C
Indicates	Engine speed RPM	Battery voltage	**Coolant temperature**	Intake air temperature
Specified value	XXXX RPM	12.000...14.500 V	**Temperature must increase evenly**	Ambient temperature until 120 °C

28-28

If display field 3 does not display a realistic value:

- Disconnect harness connector from coolant temperature sensor.

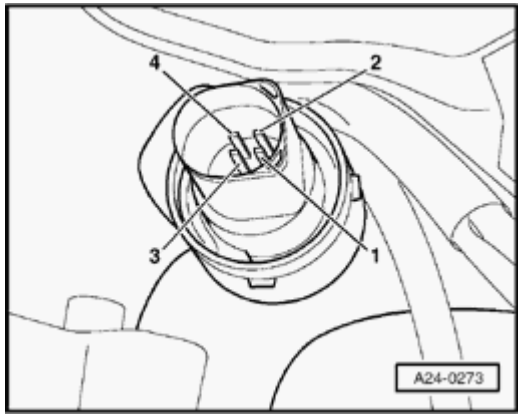
Coolant temperature sensor with square connector:



- Connect multi-meter (resistance measurement) between terminals 1 and 3 of sensor.

28-29

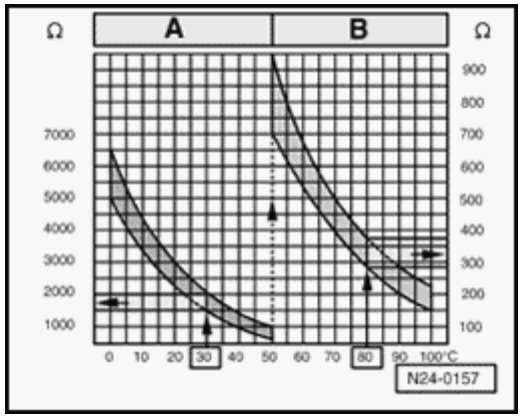
Coolant temperature sensor with oval connector:



- Connect multi-meter (resistance measurement) between terminals 3 and 4 of sensor.

All:

Scale A shows resistance values for temperature range 0 - 50 ° C and scale B the values for temperature range 50 - 100 ° C.



Examples:

- 30 ° C corresponds to a resistance from 1500...2000 Ω
- 80 ° C corresponds to a resistance from 275...375 Ω

If value does not match the specification:

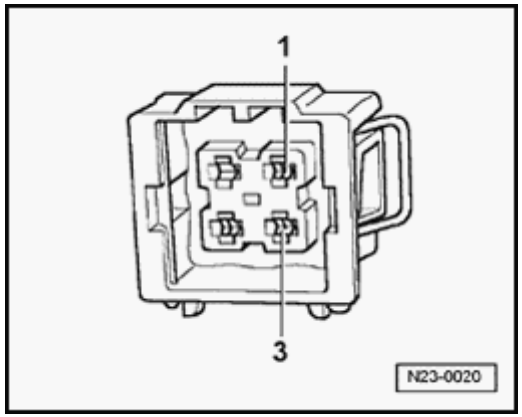
- Replace coolant temperature sensor.

28-30

If the value does match the specification:

- Connect test box VAG1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .

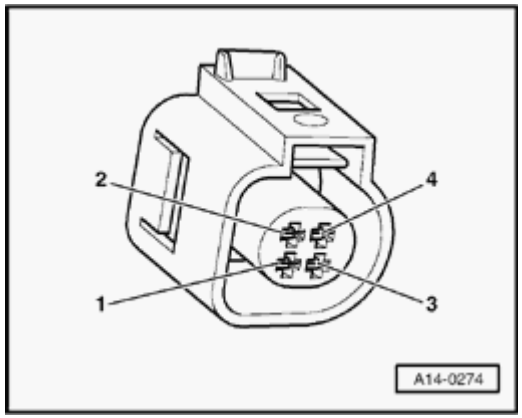
Coolant temperature sensor with square connector:



- Check following wiring connections for open circuits and short circuits to B+ or Ground (GND)

Harness connector Terminal	VAG1598/31 test box Socket
1 (Signal)	93
3	108

Coolant temperature sensor with oval connector:



- Check following wiring connections for open circuits and short circuits to B+ or Ground (GND)

Harness connector Terminal	VAG1598/31 test box Socket
3	108
4 (Signal)	93

28-31

All:

- Check wiring for short circuit to each other.
- If necessary eliminate open circuit or short circuit.

If no malfunction is identified in the wiring:

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

28-32

Control module voltage supply, checking

Test requirements:

- Fuse for Engine Control Module (ECM) OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Battery voltage at least 11 V

- Generator OK

- Connect test box VAG1598/31 to wiring harness for engine control module. Do not connect to the engine control module itself. ⇒ Page 24-20 .

- Switch ignition on.

Note:

- *The B+ voltage supply for the engine control module comes via terminal 3 (terminal 15) and terminal 62 (terminal 30).*

- *The Ground (GND) connection for the engine control module is via terminals 1 and 2.*

28-33

- Connect hand-held multimeter VAG1526 (voltage measurement range) to the following contacts on the test box:

Contact	Specification
3 + 2	approx. battery voltage
3 + 1	approx. battery voltage
62 + 2	approx. battery voltage

If the specifications are not obtained:

- Check wiring.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

28-34

Knock sensor control limit, checking

If the malfunction message "Knock control regulation reached" is recorded in the DTC memory the following tests must be carried out. See also measuring value blocks 20, 21, 22, 23 and 24 ⇒ Page 28-35

	Possible cause of malfunction	Corrective action
Malfunction message relating to all cylinders or malfunction message relating to all cylinders in one bank	♦ Poor fuel quality	- Change to higher quality fuel (see Owner's Manual)
	♦ Incorrect tightening torque on knock sensor	- Loosen knock sensor, then tighten to 20 Nm (15 ft lb)
	♦ Knock sensor faulty	- Check knock sensor ⇒ Page 28-41 .
	♦ Corrosion on connector	
	♦ Loose components on engine	- Secure loose components
Malfunction message relating to one cylinder	♦ Mechanical engine damage	- Check compression pressure
	♦ Loose components on engine	- Secure loose components

28-35

Measuring value blocks for ignition timing angle retard

Display Group 20 -Ignition- Knock control						
• Driving mode						
Read measuring value block 20 →				◀ Indicated on display		
xx.x ° KW	xx.x ° KW	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 4	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 3	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 2	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 1	0...12 ° KW (crankshaft angle)	⇒ Page 28-40

Note:

The displayed digit values in display fields 1 to 4 reflects the actual "ignition timing retard" via knock control from the individual cylinders. The ignition timing retard occurs via ° KW (crankshaft angle).

28-36

Display Group 21 -Ignition- Knock control						
• Driving mode						
Read measuring value block 21 → xx.x° KW xx.x° KW				◀ Indicated on display		
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 6	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 5	0...12 ° KW (crankshaft angle)	⇒ Page 28-40

Note:

The displayed digit values in display fields 1 and 2 reflects the actual "ignition timing retard" via knock control from the individual cylinders. The ignition timing retard occurs via ° KW (crankshaft angle).

28-37

Display Group 22 -Ignition- Knock control						
• Driving mode						
Read measuring value block 22 →				◀ Indicated on display		
xx.x RPM	x.x %	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 2	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 1	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
		Engine load			15 - 175 %	
	Engine speed RPM				750 - 6800 RPM	

Note:

The displayed digit values in display fields 3 and 4 reflects the actual "ignition timing retard" via knock control from cylinders 1 and 2. The ignition timing retard occurs via ° KW (crankshaft angle).

28-38

Display Group 23 -Ignition- Knock control						
• Driving mode						
Read measuring value block 23 →				◀ Indicated on display		
xx.x RPM	x.x %	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 4	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 3	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
		Engine load			15 - 175 %	
	Engine speed RPM				750 - 6800 RPM	

Note:

The displayed digit values in display fields 3 and 4 reflects the actual "ignition timing retard" via knock control from cylinders 3 and 4. The ignition timing retard occurs via ° KW (crankshaft angle).

28-39

Display Group 24 -Ignition- Knock control						
• Driving mode						
Read measuring value block 24 →				◀ Indicated on display		
xx.x RPM	x.x %	xx.x ° KW	xx.x ° KW			
1	2	3	4	◀ Display fields	**Specified value**	**Evaluation**
				Ignition timing retard via knock control: cylinder 6	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
				Ignition timing retard via knock control: cylinder 5	0...12 ° KW (crankshaft angle)	⇒ Page 28-40
		Engine load			15 - 175 %	
	Engine speed RPM				750 - 6800 RPM	

Note:

The displayed digit values in display fields 3 and 4 reflects the actual "ignition timing retard" via knock control from cylinders 5 and 6. The ignition timing retard occurs via ° KW (crankshaft angle).

28-40

Evaluation display groups 20/21/22/23/24, - Ignition timing angle retard

Indicated on display	Malfunction cause	Corrective action
All cylinders greater than 12 ° KW	♦ Knock sensor faulty	- Check knock sensor ⇒ Page 28-41 .
	♦ Corroded connection	
	♦ Knock sensor incorrect tightening torque	- Loosen and tighten knock sensor with 20 Nm (15 ft lb)
	♦ Components on engine loose	- Tighten components
	♦ Low fuel grade	- Change fuel grade
One cylinder deviates clearly from others	♦ Corroded connection	- Check knock sensor ⇒ Page 28-41 .
	♦ Engine damage	- Check compression pressure: ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 15, Cylinder head removing, check compression pressure*
	♦ Components on engine loose	- Tighten components

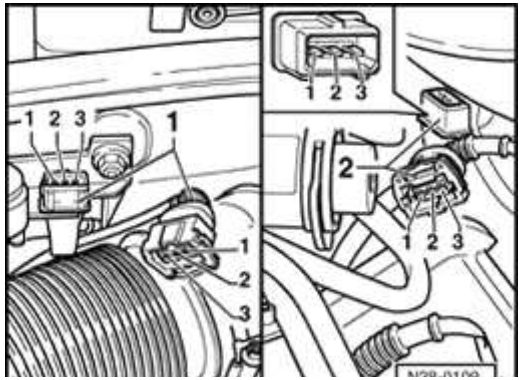
28-41

Knock Sensor (KS) 1 -G61 and Knock Sensor (KS) 2 -G66, checking

Notes:

- *It is not possible to carry out an electrical test of the knock sensors themselves.*
- *To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm (15 ft lb)*
- *Use only gold-plated terminals when repairing the terminals in the plug connectors for the knock sensors.*
- *Check for corrosion in connection between knock sensor and wiring harness.*

Checking knock sensors



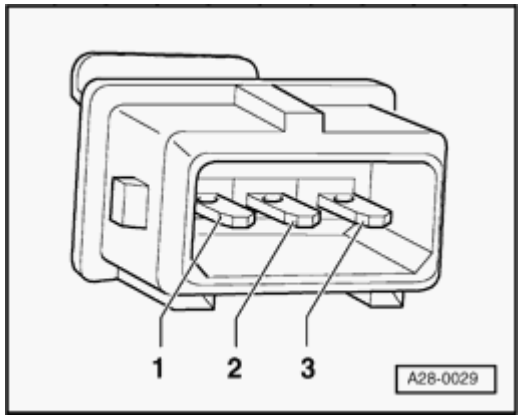
- Disconnect harness connector for relevant knock sensor in engine compartment.

Note:

- *Component location overview* ⇒ *Page 24-5* .
- *In order to reach the connector for the knock sensor for cylinder bank 2, first remove the bolts securing the coolant reservoir and move the*

coolant reservoir to one side. Coolant hoses remain attached.

28-42



- Check for short circuits between all three terminals in knock sensor connector (terminals 1 + 2, 1 + 3 and 2 + 3).

  Specified value: There must be no contact between the wires (infinite Ω).

If there is a connection between the terminals.

- Replace knock sensor.

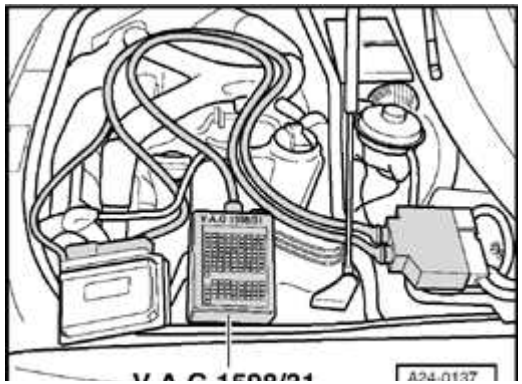
Notes:

- *In order to reach the knock sensors, first remove the air duct* ⇒ *Page 24-43* .
- *Use special tool 3247 to remove the knock sensors.*

If there is no short circuit

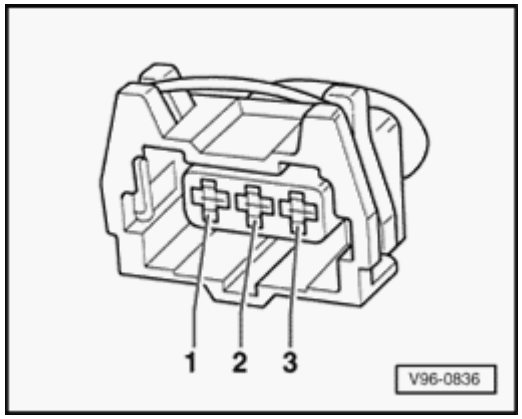
- Check wiring for knock sensors.

Checking wiring between knock sensors and engine control module

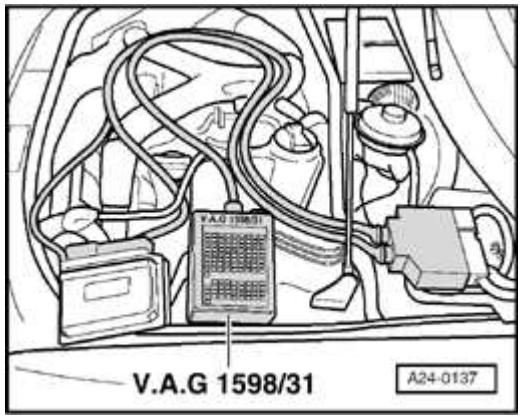


- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .

28-43



- Check wiring connection from relevant sensor connector to...



- ....Engine Control Module (ECM) for open circuit and/or short to B+ or Ground (GND).

28-44

Knock Sensor (KS) 1 -G61 (Bank 1)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (Ground (GND))	99
2 (signal)	106
3 (shielded)	108
Knock sensor (KS) 2 -G66 (Bank 2)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (Ground (GND))	99
2 (signal)	107
3 (shielded)	108

Resistance in wiring: max. 1.5 ohm

- Repair any open/short circuit as necessary.

28-45

Camshaft Position (CMP) sensor 1 -G40 and Camshaft Position (CMP) sensor 2 - G163, checking

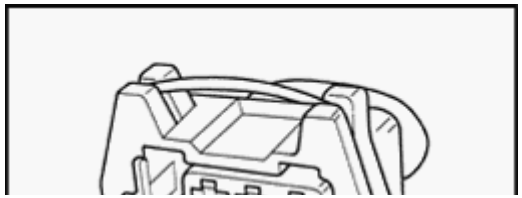
Notes:

- *Component locations of Hall sensors ⇒ Page 24-5 .*
- *The Camshaft Position (CMP) Sensor 1 -G40 is located at the rear of the right-hand cylinder head (Bank 1).*
- *The Camshaft Position (CMP) Sensor 2 -G163 is located at the front of the left-hand cylinder head (Bank 2).*

Checking activation of Hall sensor (camshaft position sensor)

Use test leads VAG1594 connector test kit when carrying out the following tests.

- Push back rubber grommet on relevant Hall sensor connector.



- Connect VAG1527 diode test lamp to terminals 1 and 2 of hall sensor connector from behind (without disconnecting connector from hall sensor).

Note:

The connector terminals are numbered on the back of the connector.

- Operate starter for few seconds.

The diode test lamp should blink briefly once every two engine revolutions.

Note:

Diode test lamps with a low current draw continue to glow faintly between impulses from the engine control module (rather than going out completely) and become much brighter when receiving an impulse.

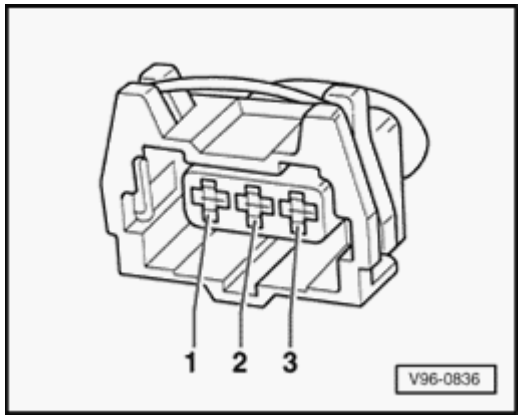
If the diode test lamp does not flash, test the voltage supply.

Checking voltage supply for Hall sensor

- Disconnect harness connector from relevant Hall sensor.

- Switch ignition on.

28-47



- Connect multimeter (Fluke 83 or equivalent) (voltage measurement range) between engine Ground (GND) and socket 1 of connector.

  Specified value: approx. 5 V

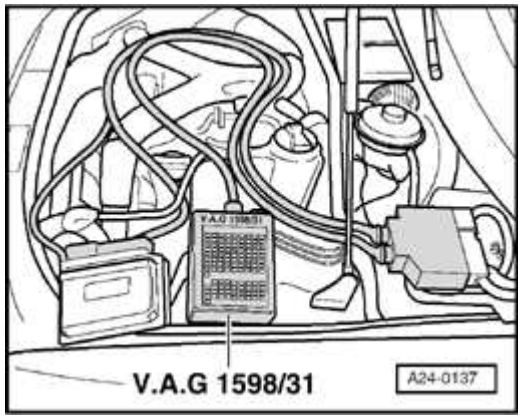
Checking signal wire for Hall sensor

- Connect multimeter (Fluke 83 or equivalent) (voltage measurement range) between engine Ground (GND) and socket 2 of relevant connector.

  Specified value: approx. battery voltage

Checking Ground (GND) wire for Hall sensor:

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .



- Connect multimeter (Fluke 83 or equivalent) (resistance measurement range) between socket 3 on connector and engine Ground (GND).

  Specified value: Continuity

  Resistance in wiring: max. 1.5 Ohms

28-48

If all specifications are reached but the diode test lamp does not flash (measurement taken between terminals 1 and 2 without unplugging connector and while operating starter):

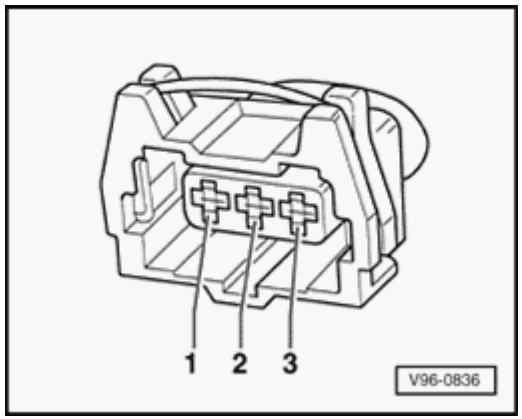
- Replace relevant Hall sensor.

If specifications are obtained:

- Check wiring.

Checking wiring between hall sensor and engine control module

- Connect VAG1598/31 test box to wiring harness for engine control module. Do not connect to the engine control module itself ⇒ Page 24-20 .



- Check wiring connection from Hall sensor to engine control module for open circuit and/or short circuit to B+ or Ground (GND).

28-49

Camshaft Position (CMP) Sensor 2 -G163 (Bank 2)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (B+)	98
2 (signal)	86
3 (Ground (GND))	108
Camshaft Position (CMP) Sensor 1 -G40 (Bank 1)	
3-pin connector on wiring harness, socket	**VAG1598/31 test box, socket**
1 (positive)	98
2 (signal)	87
3 (Ground (GND))	108

Resistance in wiring: max. 1.5 ohm

- Repair any open/short circuit as necessary.

28-50

If all the test results so far have been OK but a malfunction related to the camshaft position sensor (Hall sensor) is displayed again after erasing the DTC memory as a test measure, the following might be the cause:

- Rotor ring (trigger wheel) for camshaft position sensor (Hall sensor) misaligned; test phase position.

Checking phase position of Hall sensor

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be idling.

Rapid data transfer HELP
Select function XX

Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.

Read Measuring Value Block
Input display group number XXX

Indicated on display:

- Press buttons -0-, -9- and -3- to select "Display Group 093" and confirm entry with -Q- button.

28-51



Indicated on display

- Check specified display values for Hall sensors.

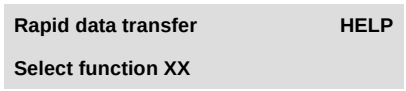
	Display fields			
	1	2	3	4
Display Group 093: Phase positions of Hall sensors (Bank 1 and Bank 2) with engine idling				
Display	xxx RPM	xx %	**0 ± 6 ° KW**	**0 ± 6 ° KW**
Indicates	Engine speed (RPM)	Engine load	**Phase position** **Bank 1**	**Phase position** **Bank 2**
Work range	min.: 750 RPM max.: 6800 RPM	min.: 15 % max.: 175 %	**-20.3 to 14.8 ° KW**	**-20.3 to 14.8 ° KW**
Specified value	750 - 850 RPM		**0 ± 6 ° KW**	**0 ± 6 ° KW**
Note			**If readouts do not match specifications, unbolt Hall sensor and check whether rotor ring is properly mounted on camshaft. If it is incorrectly mounted, the locating lug will be flattened when the securing bolt is tightened. Also check valve timing.** ⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 13, Crankcase ventilation, Ribbed belt removing and installing, Timing belt removing and installing*	

28-52

Misfire recognition, checking

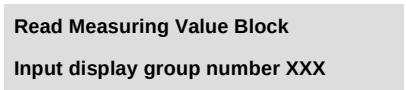
Test sequence

- Connect vehicle diagnostic, testing and information system VAS5051 or VAG1551 scan tool and select engine electronics control module by entering address word "01" ⇒ Page 01-9 . When doing this the engine must be at idle.



Indicated on display

- Press buttons -0- and -8- to select function "Read Measuring Value Block" and confirm entry with -Q- button.



Indicated on display

- Press buttons -0-, -1- and -4- to select "Display Group 014" and confirm entry with -Q- button.



Indicated on display

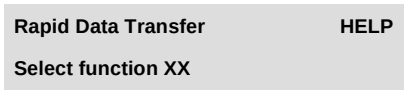
- Check misfire recognition.

28-53

	Display fields			
	1	2	3	4
Display Group 014: Misfire recognition				
Display	xxx / RPM	xxx %	**xxx**	**---**
Indicated	Engine speed (RPM)	Load	**Sum of misfire**	**Misfire recognition**
Work range	min.: 750 / RPM max.: 6800 /RPM	min.: 0 max.: 100		**activated** **locked**
Specified value	650 - 720 / RPM	15.0 - 22.0 %	**0 - 15**	**activated**
Note	---	---	**If specified value is not reached: Evaluation display field 3 ⇒ Page 28-54 see also page ⇒ Page 28-55**	**---**

If specified value is reached:

- Press →button.



Indicated on display (select function)

28-54

Evaluation display group 014, display field 3

Display field: 3	Possible cause	Corrective action
greater 15	♦ Spark plug faulty ♦ Spark plug connector faulty ♦ Ignition coil or power output stage faulty	- Check spark plug and ignition cable with connector - Check ignition coil ⇒ Page 28-5 . - Check power output stages ⇒ Page 28-11
	♦ Fuel injector faulty ♦ Check compression of one or more cylinder weak	- Check fuel injectors ⇒ Page 24-39 - Check compression pressure

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The following measuring value blocks display misfiring of individual cylinders:

	Display fields			
	1	2	3	4
Display Group 015: Misfire recognition from cylinder 1, 2 and 3				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicates	**Amount of misfires cylinder 1**	**Amount of misfires cylinder 2**	**Amount of misfires cylinder 3**	Misfire recognition
Work range				activated locked
Specified value	**0...15**	**0...15**	**0...15**	activated
Note			**If specification is obtained: Evaluation ⇒ Page 28-57 .**	**---**

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	Display fields			
	1	2	3	4
Display Group 015: Misfire recognition from cylinder 4, 5 and 6				
Display	**xxx**	**xxx**	**xxx**	**---**
Indicates	**Amount of misfires cylinder 4**	**Amount of misfires cylinder 5**	**Amount of misfires cylinder 6**	Misfire recognition
Work range				activated locked
Specified value	**0...15**	**0...15**	**0...15**	activated
Note			**If specification is obtained: Evaluation ⇒ Page 28-57 .**	**---**

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Evaluation display groups 015 and 016

Display field: 1,2 and 3 from measuring value block 15 and 16	Possible cause	Corrective action
greater 15	♦ Spark plug faulty ♦ Spark plug connector faulty ♦ Ignition coil or power output stage faulty	- Check spark plug and ignition cable with connector - Check ignition coil ⇒ Page 28-5 . - Check power output stages ⇒ Page 28-11
	♦ Fuel injector faulty ♦ Check compression of one or more cylinder weak	- Check fuel injectors ⇒ Page 24-39 - Check compression pressure