



Repair Manual Jetta, Cabrio, Golf, GTI 1999 >

Generic Scan Tool								
Engine ID	ALH	BEW						

Edition 11.2014



List of Workshop Manual Repair Groups

Repair Group

- ST - Generic Scan Tool
- 21 - Turbocharger, G-Charger
- 23 - Diesel Fuel Injection
- 26 - Exhaust system, Emission controls
- 28 - Ignition/Glow plug System
- 38 - Automatic Transmission - Gears, Hydraulic Controls

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



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ST – Generic Scan Tool

1 OBD, General Information

(Edition 11.2014)

The following table provides quick links to all chapters in this section.

⇒ "1.1 Generic Scan Tool Manual Contents", page 1 .
⇒ "1.2 OBD Systems", page 1 .
⇒ "1.3 Malfunction Indicator Lamp", page 2 .
⇒ "1.4 CAN Data Link", page 2 .
⇒ "1.5 Electronic Power Control Warning Lamp", page 2 .

1.1 Generic Scan Tool Manual Contents

"GST" is an acronym for Generic Scan Tool Manual.

Included in the contents of this GST manual is a summary table of the vehicle specific OBD II Emission Related Engine and Transmission DTCs. This table contains all necessary Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination to accurately monitor and diagnose the Engine Emissions and Transmission and perform all functions required to run Modes 01 through 09 with a hand held scan tool. For a further description of the monitor strategies, a document reference has been provided throughout this GST manual to the applicable OBD System Strategy document.

This GST manual also contains the step by step pin point test procedures to accurately diagnose the suspected component or system once a DTC has been set. All references to repair procedures and wiring diagrams will be found within the diagnostic test procedure.

1.2 OBD Systems

OBD II

"OBD" is an acronym for the On Board Diagnostic System.

California OBD II applies to all gasoline engine vehicles up to 14,000 lbs. Gross Vehicle Weight Rating (GVWR) starting in the 1996 MY and all diesel engine vehicles up to 14,000 lbs. GVWR starting in the 1997 MY.

Several states in the Northeastern United States have chosen to adopt the California emission regulations starting in the 1998 MY and are known as "Green States".

Green States receive California-certified vehicles for passenger cars and light trucks up to 6,000 lbs. GVWR. Starting in the 2004 MY, Federal vehicle over 8,500 lbs. will start phasing in OBD II.

Starting in 2004 MY, gasoline-fueled Medium Duty Passenger Vehicles (MDPVs) are required to have OBD II. Federal OBD II applies to all gasoline engine vehicles up to 8,500 lbs. GVWR starting in the 1996 MY and all diesel engine vehicles up to 8,500 lbs. GVWR starting in the 1997 MY.

OBD II system implementation and operation is described in the remainder of this document.



1.3 Malfunction Indicator Lamp

"MIL" is an acronym for the Malfunction Indicator Lamp.

If the ECM recognizes a malfunction that leads to increased emissions values, it indicates them by lighting the MIL which is located in the instrument cluster.

The ECM switches on the MIL after the ignition is switched on. Shortly after the engine is started, The MIL goes out if the ECM does not detect a malfunction that increases the emissions values.

If the ECM recognizes a malfunction that leads to increased emissions during the operation of the engine, the ECM switches on the MIL and an entry is stored in the DTC memory of the ECM.

1.4 CAN Data Link

"CAN" is an acronym for Controller Area Network.

The ECM communicates with all databus capable control modules by a CAN Data Link.

The databus capable control modules (i.e. Engine Coolant temperature Sensor) are connected by two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages) to the ECM. Missing information on the databus is then recognized and stored as a malfunction.

The ECM illuminates the MIL through the CAN data link and tells the MIL to turn on, turn off, or blink.

1.5 Electronic Power Control Warning Lamp

"EPC" is an acronym that stands for the Electronic Power Control (E-gas).

The ECM monitors all EPC components after the ignition is switched on.

If a malfunction is recognized in the EPC system during the operation of the engine, the ECM switches on the EPC which is located in the instrument cluster and an entry is stored in the DTC memory of the ECM.



2 Diagnostic Modes

The information provided in Modes 01 through 09 displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTC trouble codes, erase stored DTC trouble codes, generate readiness codes, and select the various PIDs and Test-IDs used within the modes to monitor the engine, and emission related component parameters.

The following table provides a link to all diagnostic modes that monitor all components and systems which influence the emission quality.



Note

Depending on scan tool and protocol used, the information displayed may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and be referenced by only a number.

Selectable diagnostic modes
⇒ “2.1 Diagnostic Mode 01 - Read Current System Data”, page 3 .
⇒ “2.2 Diagnostic Mode 02 - Read Operating Conditions”, page 4 .
⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5 .
⇒ “2.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions”, page 7 .
⇒ “2.6 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle”, page 13
⇒ “2.7 Diagnostic Mode 09 - Read Vehicle Information”, page 14 .

2.1 Diagnostic Mode 01 - Read Current System Data

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Depending on scan tool and protocol used, the information displayed in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and be referenced by only a number.

Test requirement

- Coolant temperature at least 80° C.

Procedure

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Diagnostic Mode 1”.
- From the following table, select the desired the “PID” that is to be monitored, e.g. “PID 05-Coolant temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
01:	System Status Information



PID	Component or System
04:	Calculated Load Value
05:	Coolant Temperature
11:	Intake Manifold Pressure
12:	Engine Speed
13:	Vehicle Speed
14:	Ignition Angle
15:	Intake Air Temperature (IAT)
16:	Air Mass
17:	Throttle Valve Position
28:	Display 3

- Switch the ignition off.

End of Procedure

2.2 Diagnostic Mode 02 - Read Operating Conditions

When an emissions-related fault (pending DTC, visible in mode 07) is first detected, operating conditions are stored. Mode 02 makes it possible to access this freeze frame data as soon as this fault is shown in mode 03. Each control module only shows freeze frame data for one fault via mode 02. Therefore, there are two priority levels. If there is a malfunction with higher priority, the freeze frame data is overwritten.

- Fault with higher priority: Misfire malfunction or fuel trim malfunction.
- Fault with normal priority: All other emissions-related faults.

Depending on scan tool and protocol used, the information displayed in diagnostic mode 02 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and be referenced by only a number.

Procedure

- Connect the scan tool.
- Start the engine and run at idle.



Note

If the engine does not start, crank the engine using starter for at least 5 seconds, do not switch the ignition off afterward under any circumstances.

- Select “Diagnostic Mode 2”.
- From the following table, select the desired the “PID”, e.g. “PID 05 Coolant temperature” that is to be monitored.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
02:	DTC that belongs to freeze frame 0
04:	Calculated Load Value
05:	Coolant Temperature



PID	Component or System
11:	Intake Manifold Pressure
12:	Engine Speed
13:	Vehicle Speed
14:	Ignition Angle
15:	Intake Air Temperature (IAT)
16:	Air Mass
17:	Throttle Valve Position

– Switch the ignition off.

End of Procedure

2.3 Diagnostic Mode 03 - Read DTC Memory

Diagnostic Mode 03 makes it possible to read emissions-related faults (confirmed DTCs: faults which have activated the MIL) in the ECM and in the TCM.

When the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) recognizes an emission related fault it turns on the Malfunction Indicator Lamp (MIL) or if a Electronic Throttle Malfunction is recognized, the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) turns on the Electronic Power Control (EPC) Warning Lamp which are both located in the instrument cluster.

The DTC's are sorted by SAE code with the DTC tables consisting of a 5-digit alpha-numeric value.

Depending on scan tool and protocol used, the information displayed in diagnostic mode 03 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and be referenced by only a number.

The following tables provide a breakdown and explanation of the DTC code.

P Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations
P	x	1	x	x	Fuel and air ratios
P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system
P	x	4	x	x	Additional exhaust system



P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission
P	x	9	x	x	Control modules, input and output signals

Procedure

- Connect the scan tool.
- Switch the ignition to the "ON" position.
- Select "Diagnostic Mode 03".
- The stored DTC or DTC's will be displayed on the scan tool screen.

The following table is an example of the DTC information that may be displayed on the scan tool screen:

Indication example	Explanation
P0444	SAE Diagnostic Trouble Code (DTC)
Evaporative Emission (EVAP) Canister Purge Regulator Valve	Malfunctioning wiring path or malfunctioning component
Circuit Open	Malfunction type as next

- Refer to the following DTC tables for the diagnostic repair procedure:

◆ ⇒ ["5.1 Engine Control Module", page 18](#) .

- Switch the ignition off.

End of Procedure

2.4 Diagnostic Mode 04 - Erase DTC Memory

Diagnostic Mode 04 makes it possible to erase the DTC memory and to reset all emissions-related diagnostic data. In that way, all faults in the DTC memory in the ECM and TCM are erased. The adaptation values may also be reset.

Emissions-related diagnostic data includes (as applicable):

- ◆ - MIL Status
- ◆ - Number of DTCs
- ◆ - Readiness Bits
- ◆ - Confirmed DTCs
- ◆ - Pending DTCs
- ◆ - DTC that belongs to freeze frame
- ◆ - Freeze frame data
- ◆ - Test results of specific diagnostic functions
- ◆ - Distance driven with "MIL ON"
- ◆ - Number of Warm-Up Cycles after erasing the DTC memory
- ◆ - Distance driven after erasing the DTC memory
- ◆ - Misfire counter



Depending on scan tool and protocol used, the information displayed in diagnostic mode 04 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and be referenced by only a number.

Procedure

- Connect the scan tool.
- Switch the ignition on.
- Select "Mode 4".

The scan tool will display: "Diagnostic data are being erased".

- Switch the ignition off.

End of Procedure

2.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the min & max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process. e.g.:

	Minimum Value
GST Manual documentation	0.3499
Aftermarket Scan Tool display	0.35

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Engine Code ALH ONLY: Test-ID (Hex-ID)	Component or System
TID 09 (\$09): ⇒ page 7 .	Dynamic plausibility of coolant temperature sensor
TID 10 (\$10): ⇒ page 8 .	Start-Stop positions test of quantity adjuster
TID 11 (\$11): ⇒ page 9 .	Dynamic plausibility of fuel temperature sensor
TID 12 (\$12): ⇒ page 9 .	Plausibility of boost pressure sensor with atmospheric pressure sensor

TID 09 (\$09): Dynamic plausibility of coolant temperature sensor

Test requirements

- No DTCs stored in the DTC memory.
- Coolant temperature 20° C.

To generate an OK result, coolant temperature must be below 20° C when starting engine and then climb 10° C or exceed 20° C.



- Connect the scan tool.
- Start the engine and run at idle.
- Select "Mode 6".

Select "Test-ID 09 (\$09)".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Time frame diagnostic cycle	---	117
02 (\$02)	Temperature change during diagnostic cycle	8	---
03 (\$03)	Temperature at end of diagnostic cycle	57	---

- If any components or systems fail to meet the specified values. Refer to
=> ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

TID 10 (\$10): Start-Stop positions test of quantity adjuster

Test requirements

- No DTCs stored in the DTC memory.

To generate an OK test result the battery voltage must be greater than 10 V, fuel temperature higher than 10° C and there cannot be any defect in the speed sensor and needle-travel sensor. After waiting 5 sec. with ignition on and engine NOT running, a diagnostic result will be available.

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Mode 6".

Select "Test-ID 10 (\$16)".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Return message of quantity adjuster in MAX position	---	242
02 (\$02)	Return message of quantity adjuster in MIN position	212	---
03 (\$03)	Return message of quantity adjuster in MIN-position.	---	49
04 (\$04)	Return message of quantity adjuster in MIN-position.	25	---

- If any components or systems fail to meet the specified values. Refer to
=> ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.



- Switch the ignition off.

End of diagnosis

TID 11 (\$11): Dynamic plausibility of fuel temperature sensor

Test requirements

- No DTCs stored in the DTC memory.

To generate an OK result, fuel temperature must increase 10° C or the integrated fuel temperature change in the last driving cycle must exceed 30° C.

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Mode 6”.

Select “Test-ID 11 (\$B) ”.

- Select the desired “Test-ID (TID)” or “Hex-ID”.
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Time frame of diagnostic cycle	---	120
02 (\$02)	Temperature change in current diagnostic cycle	100	---
03 (\$03)	Temperature integral at end of diagnostic cycle	300	---

- If any components or systems fail to meet the specified values.
 Refer to
 ⇒ [“2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.

- Switch the ignition off.

End of diagnosis

TID 12 (\$12): Plausibility of boost pressure sensor with atmospheric pressure sensor

- No DTCs stored in the DTC memory.

To generate an OK result, wait 3 sec. with ignition on and engine NOT running, a diagnostic result will be available.

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Mode 6”.

Select “Test-ID 12 (\$C) ”.

- Select the desired “Test-ID (TID)” or “Hex-ID”.
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Absolute difference of charge air pressure sensor to barometric pressure	---	150

- If any components or systems fail to meet the specified values.
 Refer to
 ⇒ [“2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) to



check for stored DTC's or the corresponding diagnostic repair procedure.

- Switch the ignition off.

End of diagnosis

Engine Code BEW ONLY: Test-ID (Hex-ID)	Component or System
TID 01 (\$01): ⇒ page 10	Oxygen Sensor Monitoring
TID 09 (\$09): ⇒ page 10 .	Dynamic plausibility of coolant temperature sensor
TID 10 (\$10): ⇒ page 11 .	Start-Stop positions test of quantity adjuster
TID 11 (\$11): ⇒ page 12 .	Dynamic plausibility of fuel temperature sensor
TID 12 (\$12): ⇒ page 12	Plausibility of boost pressure sensor with atmospheric pressure sensor
TID 31 (\$31): ⇒ page 13	Exhaust Gas Recirculation (EGR)

TID 01 (\$01): Oxygen Sensor Monitoring

Test requirements

- No DTCs stored in the DTC memory.
- Coolant temperature 20° C.

To generate an OK result, coolant temperature must be below 20° C when starting engine and then climb 10° C or exceed 20° C.

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Mode 6".

Select "TID 01 (\$01) ".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Measured Oxygen Concentration	-0.057 V	0.057 V
02 (\$02)	Measured Oxygen Concentration	630 mV	630 mV

- If any components or systems fail to meet the specified values. Refer to ⇒ ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.

- Switch the ignition off.

End of diagnosis

TID 09 (\$09): Dynamic plausibility of coolant temperature sensor

Test requirements

- No DTCs stored in the DTC memory.

To generate an OK test result the battery voltage must be greater than 10 V, fuel temperature higher than 10° C and there cannot be any defect in the speed sensor and needle-travel sensor. After waiting 5 sec. with ignition on and engine NOT running, a diagnostic result will be available.

- Connect the scan tool.



- Start the engine and run at idle.
- Select "Mode 6".

Select "TID 09 (\$09)".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Time frame diagnostic cycle.	---	117
02 (\$02)	Temperature change during diagnostic cycle.	8	---
03 (\$03)	Temperature at end of diagnostic cycle.	58	---

- If any components or systems fail to meet the specified values. Refer to ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

TID 10 (\$10): Start-Stop positions test of quantity adjuster

Test requirements

- No DTCs stored in the DTC memory.

To generate an OK test result the battery voltage must be greater than 10 V, fuel temperature higher than 10° C and there cannot be any defect in the speed sensor and needle-travel sensor. After waiting 5 sec. with ignition on and engine NOT running, a diagnostic result will be available.

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Mode 6".

Select "Test-ID 10 (\$10)".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Return message of quantity adjuster in MAX position	---	242
02 (\$02)	Return message of quantity adjuster in MIN position	212	---
03 (\$03)	Return message of quantity adjuster in MIN-position.	---	49
04 (\$04)	Return message of quantity adjuster in MIN-position.	25	---

- If any components or systems fail to meet the specified values. Refer to ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.
- Switch the ignition off.



End of diagnosis

TID 11 (\$11): Dynamic plausibility of fuel temperature sensor

Test requirements

- No DTCs stored in the DTC memory.

To generate an OK result, fuel temperature must increase 10° C or the integrated fuel temperature change in the last driving cycle must exceed 30° C.

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Mode 6".

Select "Test-ID 11 (\$11)".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Time frame of diagnostic cycle	---	120
02 (\$02)	Temperature change in current diagnostic cycle	100	---
03 (\$03)	Temperature integral at end of diagnostic cycle	300	---

- If any components or systems fail to meet the specified values. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

TID 12 (\$12): Plausibility of boost pressure sensor with atmospheric pressure sensor

- No DTCs stored in the DTC memory.

To generate an OK result, wait 3 sec. with ignition on and engine NOT running, a diagnostic result will be available.

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Mode 6".

Select "Test-ID 12 (\$12)".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Absolute difference of charge air pressure sensor to barometric pressure	---	150

- If any components or systems fail to meet the specified values. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.



- Switch the ignition off.

End of diagnosis

TID 31 (\$31): Exhaust Gas Recirculation (EGR)

- No DTCs stored in the DTC memory.

To generate an OK result, wait 3 sec. with ignition on and engine NOT running, a diagnostic result will be available.

- Connect the scan tool.
- Start the engine and run at idle.
- Select "Mode 6".

Select "Test-ID 31 (\$31)".

- Select the desired "Test-ID (TID)" or "Hex-ID".
- Check specified values at idle.

Test-ID (TID) (Hex-ID)	Component or System	Min.	Max.
01 (\$01)	Control deviation. (Specified air mass – measured air mass)	---	---

- If any components or systems fail to meet the specified values. Refer to ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) to check for stored DTC's or the corresponding diagnostic repair procedure.
- Switch the ignition off.

End of diagnosis

2.6 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle

Mode 07 makes it possible to check emissions-related faults which appeared during the current or last driving cycle (pending DTCs).

A pending DTC is saved the first time a fault is detected (output via Mode 07).

- If the fault is detected again by the end of the following driving cycle, a confirmed DTC is entered (output via Mode 03) and the MIL is activated.
- If this malfunction is not detected again by the end of the following driving cycle, the corresponding pending code will be deleted at the end of the driving cycle.

 **Note**

Depending on scan tool and protocol used, some of the information provided may be referred to by a different name.

Procedure

- Connect the scan tool.
- Start the engine and run at idle.



Note

If the engine does not start, crank the engine using starter for at least 5 seconds. Do not switch the ignition off afterward.

- Select "Mode 7: Check test results of components that are continuously monitored".

The number of pending DTCs or "0 malfunctions detected" will be displayed on the scan tool screen.

- Refer to the following DTC tables for the diagnostic repair procedure:

◆ => ["5.1 Engine Control Module", page 18](#) .

- Switch the ignition off.

2.7 Diagnostic Mode 09 - Read Vehicle Information

Diagnostic Mode 09 makes it possible to access vehicle-specific information from the ECM and the TCM (where applicable).



Note

Depending on scan tool and protocol used, Diagnostic Mode 09 and the information provided may be referred to by a different name.

Test requirement

- No DTC's stored in the DTC memory.

Procedure

- Connect the scan tool.
- Switch the ignition on.
- Select "Mode 09".
- Select the desired "Test-ID".
- The information requested will be displayed on the scan tool screen.

The following table is a numerical list of all "Test-IDs" that may be selected.

Test-ID	Diagnostic text
04:	Calibration identification e.g.
	◆ Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248-
06:	CVN (check sum) e.g.
	◆ EC5AE460 the check sum is different for every control module version
	◆ 000D105

- Switch the ignition off.

End of procedure



3 General Diagnosis

The following table provides quick links to all chapters in this section.

[⇒ "3.1 Preliminary Check", page 15](#)

3.1 Preliminary Check

Before performing any pin point test or component diagnosis, a preliminary check must be performed.

Check the Technical Bulletins for information that may supersede any information included in this manual. Refer to ⇒ EBAHN-Website .

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, check for any stored or related DTC's.

If other DTC's are stored:

- Repair these DTC's first before performing the following procedure.

If no other DTC's are stored:

- Using the scan tool, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to attempt to duplicate the customers complaint.

If the DTC returns:

- Perform the diagnostic procedure.

If the DTC does not return:

- The fault is intermittent or a sporadic condition may exist.
- Check the suspected component, electrical harness and electrical harness connectors for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.
- Perform a road test to verify the repair.

If the DTC returns:

- Perform the diagnostic procedure.

If the DTC does not return:

The fault may have been the result of a loose electrical connection.

- Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End diagnosis



4 Readiness Code

The following table provides quick links to all chapters in this section.

⇒ ["4.1 Readiness Code Description", page 16](#)

4.1 Readiness Code Description

Diagnostics are performed at regular intervals during normal vehicle operation. After repairing an emissions related system, a readiness code is generated by road testing the vehicle.

If a malfunction is recognized during the drive cycle, it will be stored in the DTC memory.

The OBD drive cycle operation will be monitored with a hand held diagnostic tool. Consult the manufacturer's instruction manual for correct tool operation.

The readiness code is erased every time the DTC memory is erased or any time the battery is disconnected. If the DTC memory has been erased or the battery is disconnected, a new readiness code must be generated.

Only erase the DTC memory if a DTC has been stored.

General Recommendations

Most monitors will complete easier and quicker using a "steady-foot" and "smooth" acceleration during the drive cycle operation, cruise, and acceleration modes.

Test requirements

- Engine coolant temperature 25° C (77° F) Minimum.



WARNING

When performing the drive cycle operation, pay strict attention to driving conditions and please observe and obey all posted speed limits. Failure to follow these instructions may result in personal injury or possible death.

Drive Cycle Procedure

- Connect the scan tool.
- Start engine and increase speed to 2200 RPM, by referring to tachometer.

At engine speed of at least 2200 RPM:

- Release accelerator pedal and allow engine to return to idle (approx. 900 RPM).
- Stop engine and wait approx. 10 seconds.
- Start engine and increase speed to 2200 RPM, by referring to tachometer.

At engine speed of at least 2200 RPM:

- Release accelerator pedal and allow engine to return to idle (approx. 900 RPM).
- Check the status of the readiness code.



Note

Depending on the scan tool used. The readiness code status may be displayed as complete, passed or OK.

- If any engine monitor fails the drive cycle test. Repeat the drive cycle test until all engine monitors have successfully run through and passed.

If the drive cycle operation fails again.

- Check the DTC memory for stored DTC's
⇒ [“2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .

Repair the vehicle if necessary.

- Repeat the drive cycle operation until all engine monitors have successfully run through and passed.
- Remove the scan tool and switch the ignition off.

End of Procedure.



5 Engine DTC Tables

◆ ⇒ ["5.1 Engine Control Module", page 18](#)

5.1 Engine Control Module

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1) (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	Diagnostic signal from output driver	Output driver- = OFF state	5 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0031	HO2S Heater Control Circuit (Bank 1 Sensor 1 Low (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	Diagnostic signal from output driver	Output driver- = ON state	5 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0032	HO2S Heater Control Circuit (Bank 1 Sensor 1) High (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	Diagnostic signal from output driver	Output driver- = OFF state	5 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0101	Mass or Volume Air Flow Circuit	– Check Mass Air Flow (MAF) Sensor - G70- . Refer to ⇒ "2.3 Mass Air Flow Sensor, Checking", page 68 .	Airflow-<200 mg/stroke	Engine speed, >2200 RPM	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0102	Mass or Volume Air Flow A Circuit Low Input	– Check Mass Air Flow (MAF) Sensor - G70- . Refer to ⇒ "2.3 Mass Air Flow Sensor, Checking", page 68 .	Calculated air-mass value, < -10 kg/h	Engine condition, Running	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0103	Mass or Volume Air Flow A Circuit High Input	– Check Mass Air Flow (MAF) Sensor - G70- . Refer to ⇒ "2.3 Mass Air Flow Sensor, Checking", page 68 .	Calculated air-mass value, > 700 kg/h	Engine condition, Running	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0105	Manifold Absolute Pressure/Barometric Pressure Circuit	– Check the Manifold Absolute Pressure (MAP) and Barometric Pressure (BARO) sensors . Refer to ⇒ "2.5 Manifold Absolute Pressure Sensor, Checking", page 73 .	Boost pressure sensor supply voltage 5.10 - 4.89 V	—	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY

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DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	– Check the Manifold Absolute Pressure (MAP) and Barometric Pressure (BARO) sensors . Refer to ⇒ “2.5 Manifold Absolute Pressure Sensor, Checking”, page 73 .	<ul style="list-style-type: none"> • Pressure difference, >150 hPa 	<ul style="list-style-type: none"> • Engine speed, 0 RPM • Atm. pressure sensor, Not defective • Boost pres. sensor, Not defective 	500 ms	<ul style="list-style-type: none"> • Once/DCY • 2 DCY
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	– Check the Manifold Absolute Pressure (MAP) and Barometric Pressure (BARO) sensors . Refer to ⇒ “2.5 Manifold Absolute Pressure Sensor, Checking”, page 73 .	Boost pressure sensor voltage < 0.64 V	—	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	– Check the Manifold Absolute Pressure (MAP) and Barometric Pressure (BARO) sensors . Refer to ⇒ “2.5 Manifold Absolute Pressure Sensor, Checking”, page 73 .	Boost pressure sensor voltage >4.85 V	—	2.5 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	– Check Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “2.6 Engine Coolant Temperature Sensor, Checking”, page 75 .	<ul style="list-style-type: none"> • Time for coolant temp to reach 20 °C or increase by 10 °C- >300 Sec. for start temperature <10 °C • >120 Sec. for start temp > 10 °C (2) 	<ul style="list-style-type: none"> • Start temp, < 20 °C • Coolant temperature sensor, Not defective 	See Threshold	<ul style="list-style-type: none"> • Once/DCY • 2 DCY
P0117	Engine Coolant Temperature Sensor 1 Circuit low	– Check Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “2.6 Engine Coolant Temperature Sensor, Checking”, page 75 .	Coolant temperature sensor voltage <0.41 V	—	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0118	Engine Coolant Temperature Sensor 1 Circuit High	<ul style="list-style-type: none"> Check Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ "2.6 Engine Coolant Temperature Sensor, Checking", page 75 . 	Coolant temperature sensor voltage >4.99 V	—	480 ms	<ul style="list-style-type: none"> Continuous 2 DCY
P0128	Coolant Thermostat/ Valve. Temperature below control range	<ul style="list-style-type: none"> Check Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ "2.6 Engine Coolant Temperature Sensor, Checking", page 75 . 	Measured temperature lower than model temperature <10 °C	<ul style="list-style-type: none"> ECT at engine start, <40 °C ECT, >-10 °C Coolant temp. sensor, Not defective Intake temp. sensor, Not defective 	15 Min.	<ul style="list-style-type: none"> Once/ DCY 2 DCY
P0135	O2 Sensor Heater Circuit, Bank 1- Sensor 1 Electrical Fault (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	Sensor element temperature-< 660 °C	<ul style="list-style-type: none"> Heater control-active LSU wires-no fault Heater final stage-no fault IC-no fault 	60 Sec	<ul style="list-style-type: none"> Continuous 2 DCY
P0182	Fuel Temperature Sensor A Circuit Low	<ul style="list-style-type: none"> Check Fuel Temperature Sensor - G81- . Refer to ⇒ "3.1 Fuel Temperature Sensor, Checking", page 92 . 	Fuel temperature sensor voltage <0.41 V	—	480 ms	<ul style="list-style-type: none"> Continuous Immed.
P0183	Fuel Temperature Sensor A Circuit High	<ul style="list-style-type: none"> Check Fuel Temperature Sensor - G81- . Refer to ⇒ "3.1 Fuel Temperature Sensor, Checking", page 92 . 	Fuel temperature sensor voltage > 4.99 V	—	480 ms	<ul style="list-style-type: none"> Continuous Immed.
P0216	Injector/Injection Timing Control Circuit Malfunction	<ul style="list-style-type: none"> Check Cold Start Injector - N108- . Refer to ⇒ "2.11 Cold Start Injector, Checking", page 85 . 	<ul style="list-style-type: none"> Diagnostic signal from output driver-Open circuit status Diagnostic signal from output driver-short circuit status 	<ul style="list-style-type: none"> Output driver, OFF state Output driver, ON state 	4 Sec 480 ms	<ul style="list-style-type: none"> 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0225	Throttle/Pedal Position Sensor/Switch "C" Circuit Voltage Supply	<ul style="list-style-type: none"> Check Throttle Position (TP) Sensor - G79- / Closed Throttle Position (CTP) Switch - F60- . Refer to "2.8 Throttle Position Sensor from MY 1999/ Closed Throttle Position Switch, Checking", page 79 . 	Supply voltage for accelerator pedal position sensor -4.89 - 5.10 V	—	100 ms	<ul style="list-style-type: none"> Continuous Immed.
P0226	Throttle/Pedal Position Sensor/Switch "C" Circuit Range/Performance	<ul style="list-style-type: none"> Check Throttle Position (TP) Sensor - G79- / Closed Throttle Position (CTP) Switch - F60- . Refer to "2.8 Throttle Position Sensor from MY 1999/ Closed Throttle Position Switch, Checking", page 79 . 	<ul style="list-style-type: none"> Accelerator pedal position sensor voltage >0.89 V Accelerator pedal position sensor voltage <0.48 V 	<ul style="list-style-type: none"> Idle switch, idle Idle switch, not idle 	260 ms	<ul style="list-style-type: none"> Once/DCY 2 DCY
P0228	Throttle/Pedal Position Sensor/Switch "C" Circuit High	<ul style="list-style-type: none"> Check Throttle Position (TP) Sensor - G79- / Closed Throttle Position (CTP) Switch - F60- . Refer to "2.8 Throttle Position Sensor from MY 1999/ Closed Throttle Position Switch, Checking", page 79 . 	Accelerator pedal position sensor voltage > 4.76 V	—	100 ms	<ul style="list-style-type: none"> Continuous Immed.
P0234	Turbo/Super Charger Overboost Condition limit exceeded	<ul style="list-style-type: none"> Check Wastegate Bypass Regulator Valve - N75- . Refer to "1.4 Wastegate Bypass Regulator Valve, Checking", page 57 . 	Control deviation >400 hPa	<ul style="list-style-type: none"> Control mode, Closed loop Engine speed, >2,016 rpm Fuel quantity, >18 mg/stroke 	6.5 Sec	<ul style="list-style-type: none"> Continuous 2 DCY
P0245	Turbo/Super Charger Wastegate Solenoid "A" Low Input/Short to ground	<ul style="list-style-type: none"> Check Wastegate Bypass Regulator Valve - N75- . Refer to "1.4 Wastegate Bypass Regulator Valve, Checking", page 57 . 	Diagnostic signal from output driver-Open circuit status	<ul style="list-style-type: none"> Output driver, OFF state 	480 ms	<ul style="list-style-type: none"> Continuous 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0246	Turbo/Super Charger Wastegate Solenoid "A" High Input/ Short to B+	<ul style="list-style-type: none"> - Check Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ "1.4 Wastegate Bypass Regulator Valve, Checking", page 57 . 	Diagnostic signal from output driver-Short circuit status	<ul style="list-style-type: none"> • Output driver, ON state 	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0300	Random/ Multiple Cylinder. Misfire Detected	<ul style="list-style-type: none"> - Check cylinder combustion. Refer to Fuel Mechanical, Repair Group 15. - Check electrical connection to Diesel Fuel Injection Pump. - Check Engine Speed (RPM) Sensor - G28- . Refer to ⇒ "2.7 Engine Speed Sensor, Checking", page 77 . - Check for a plugged fuel filter. Refer to Fuel Injection & Ignition System, Repair Group 23. - Check the Fuel Injector . Refer to ⇒ "2.13 Fuel Injectors, Checking", page 89 . - Check the Exhaust Gas Recirculation (EGR) Valve . Refer to ⇒ "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105 	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 80% misfire over 460 crankshaft revolutions 	<ul style="list-style-type: none"> • Engine speed, >idle -150 rpm • Engine speed, <idle +100 rpm • Fuel quantity, >2.5 mg/ stroke • Fuel quantity, <15 mg/stroke • Driving speed, <6 km/h • ECT, >10 °C • Time since start, >5 Sec. • Time since clutch status change, >1 sec. 	<= 830 Rev.	<ul style="list-style-type: none"> • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> - Check cylinder combustion. Refer to Fuel Mechanical, Repair Group 15. - Check electrical connection to Diesel Fuel Injection Pump. - Check Engine Speed (RPM) Sensor - G28- . Refer to ⇒ "2.7 Engine Speed Sensor, Checking", page 77 . - Check for a plugged fuel filter. Refer to Fuel Injection & Ignition System, Repair Group 23. - Check the Fuel Injector . Refer to ⇒ "2.13 Fuel Injectors, Checking", page 89 . - Check the Exhaust Gas Recirculation (EGR) Valve . Refer to ⇒ "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105 	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 80% misfire over 460 crankshaft revolutions 	<ul style="list-style-type: none"> • Engine speed, >idle -150 rpm • Engine speed, <idle +150 rpm • Fuel quantity, >2.5 mg/stroke • Fuel quantity, <15 mg/stroke • Driving speed, <6 km/h • ECT, >10 °C • Time since start, >5 Sec. • Time since clutch status change, >1 sec. 	<= 830 Rev.	<ul style="list-style-type: none"> • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0302	Cylinder 2 Misfire Detected	<ul style="list-style-type: none"> - Check cylinder combustion. Refer to Fuel Mechanical, Repair Group 15. - Check electrical connection to Diesel Fuel Injection Pump. - Check Engine Speed (RPM) Sensor - G28- . Refer to ⇒ "2.7 Engine Speed Sensor, Checking", page 77 . - Check for a plugged fuel filter. Refer to Fuel Injection & Ignition System, Repair Group 23. - Check the Fuel Injector . Refer to ⇒ "2.13 Fuel Injectors, Checking", page 89 . - Check the Exhaust Gas Recirculation (EGR) Valve . Refer to ⇒ "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105 	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 80% misfire over 460 crankshaft revolutions 	<ul style="list-style-type: none"> • Engine speed, >idle -150 rpm • Engine speed, <idle +150 rpm • Fuel quantity, >2.5 mg/stroke • Fuel quantity, <15 mg/stroke • Driving speed, <6 km/h • ECT, >10 °C • Time since start, >5 Sec. • Time since clutch status change, >1 sec. 	<= 830 Rev	<ul style="list-style-type: none"> • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> - Check cylinder combustion. Refer to Fuel Mechanical, Repair Group 15. - Check electrical connection to Diesel Fuel Injection Pump. - Check Engine Speed (RPM) Sensor - G28- . Refer to ⇒ "2.7 Engine Speed Sensor, Checking", page 77 . - Check for a plugged fuel filter. Refer to Fuel Injection & Ignition System, Repair Group 23. - Check the Fuel Injector . Refer to ⇒ "2.13 Fuel Injectors, Checking", page 89 . - Check the Exhaust Gas Recirculation (EGR) Valve . Refer to ⇒ "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105 	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 80% misfire over 460 crankshaft revolutions 	<ul style="list-style-type: none"> • Engine speed, >idle -150 rpm • Engine speed, <idle +150 rpm • Fuel quantity, >2.5 mg/stroke • Fuel quantity, <15 mg/stroke • Driving speed, <6 km/h • ECT, >10 °C • Time since start, >5 Sec. • Time since clutch status change, >1 sec. 	<= 830 Rev.	<ul style="list-style-type: none"> • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0304	Cylinder 4 Misfire Detected	<ul style="list-style-type: none"> - Check cylinder combustion. Refer to Fuel Mechanical, Repair Group 15. - Check electrical connection to Diesel Fuel Injection Pump. - Check Engine Speed (RPM) Sensor - G28- . Refer to "2.7 Engine Speed Sensor, Checking", page 77 . - Check for a plugged fuel filter. Refer to Fuel Injection & Ignition System, Repair Group 23. - Check the Fuel Injector . Refer to "2.13 Fuel Injectors, Checking", page 89 . - Check the Exhaust Gas Recirculation (EGR) Valve . Refer to "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105 	<ul style="list-style-type: none"> • Rise in engine speed after fuel injection Calculated based on values from last two engine revolutions • Error threshold 80% misfire over 460 crankshaft revolutions 	<ul style="list-style-type: none"> • Engine speed, >idle -150 rpm • Engine speed, <idle +150 rpm • Fuel quantity, >2.5 mg/stroke • Fuel quantity, <15 mg/stroke • Driving speed, <6 km/h • ECT, >10 °C • Time since start, >5 Sec. • Time since clutch status change, >1 sec. 	<= 830 Rev.	<ul style="list-style-type: none"> • 2 DCY
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> - Check Engine Speed (RPM) Sensor - G28- . Refer to "2.7 Engine Speed Sensor, Checking", page 77 . 	<p>New engine speed sensor interrupt period</p> <ul style="list-style-type: none"> • old period / 1.8 • old period / 0.6 	<ul style="list-style-type: none"> • Avg. engine speed, >870 rpm • Inst. engine speed, >234 rpm • Interrupts since start, >40 	3 engine revs.	<ul style="list-style-type: none"> • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> - Check Engine Speed (RPM) Sensor - G28- . Refer to ⇒ "2.7 Engine Speed Sensor, Checking", page 77 . 	Engine speed <75 rpm	<ul style="list-style-type: none"> • Engine speed from Idle lift sensor, >700 rpm • Idle lift sensor, not defective • Engine speed sens. (dyn. plaus., not defective) 	450 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	<ul style="list-style-type: none"> - Check EGR Vacuum Regulator Solenoid Valve - N18- . Refer to ⇒ "2.9 EGR Vacuum Regulator Solenoid Valve, Checking", page 82 . - Check the Exhaust Gas Recirculation (EGR) Valve . Refer to ⇒ "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105 	Control deviation < limit from map f (engine speed, desired airflow)	<ul style="list-style-type: none"> • EGR mode, closed loop • Fuel quantity, >6 mg/stroke • Fuel quantity, <22 mg/stroke • Engine speed, >1300 rpm • Engine speed, <2,000 rpm 	4 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0402	Exhaust Gas Recirculation Flow Excessive Detected	<ul style="list-style-type: none"> - Check EGR Vacuum Regulator Solenoid Valve - N18- . Refer to ⇒ "2.9 EGR Vacuum Regulator Solenoid Valve, Checking", page 82 . - Check the Exhaust Gas Recirculation (EGR) Valve . Refer to ⇒ "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105 	Control deviation >limit from map f (engine speed, desired airflow)	<ul style="list-style-type: none"> • EGR mode, closed loop • Fuel quantity, >6 mg/stroke • Fuel quantity, <22 mg/stroke • Engine speed, >1300 rpm • Engine speed, <2,000 rpm 	4 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0601	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- ⇒ "4.4 Engine Control Module, Replacing", page 100 . 	<ul style="list-style-type: none"> Read / write EEPROM-impossible Checksum-incorrect 	—	—	<ul style="list-style-type: none"> 2 DCY
P0605	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- ⇒ "4.4 Engine Control Module, Replacing", page 100 . 	<ul style="list-style-type: none"> Test result failed Comparison with stored values 	—	600 ms 10 Sec	<ul style="list-style-type: none"> Continuous 2 DCY
P0606	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- ⇒ "4.4 Engine Control Module, Replacing", page 100 . 	<ul style="list-style-type: none"> Atmospheric pressure sensor voltage 0.90 - 4.81 V 	—	480 ms	<ul style="list-style-type: none"> Continuous 2 DCY
P0614	Transmission Control Module (TCM) Incorrect software version	<ul style="list-style-type: none"> Replace the Transmission Control Module (TCM) - J217- ⇒ "2.3 Transmission Control Module, Replacing", page 127 . 	Comparison of stored value with sent value on CAN-Values not equal	CAN communication valid	1 Sec	<ul style="list-style-type: none"> Continuous 2 DCY
P0670	Glow Plug Module 1 Control Circuit electrical malfunction electrical circuit	<ul style="list-style-type: none"> Check the Glow Plug Relay - J52- . Refer to ⇒ "1.5 Glow Plug Relay, Checking", page 109 . Check the Glow Plugs . Refer to ⇒ "1.4 Glow Plugs, Checking", page 107 . 	Message from glow relay- data bit #6 = 1 (I > 75 A)	<ul style="list-style-type: none"> Engine speed, >800 rpm Fuel quantity, <14 mg/stroke 	3 Sec during glowing	<ul style="list-style-type: none"> Continuous 2 DCY
P0671	Cylinder 1 Glow Plug Circuit Q10 Electrical Fault	<ul style="list-style-type: none"> Check the Glow Plug Relay - J52- . Refer to ⇒ "1.5 Glow Plug Relay, Checking", page 109 . Check the Glow Plugs . Refer to ⇒ "1.4 Glow Plugs, Checking", page 107 . 	Message from glow relay Data bit #0 = 1 (I < 2.5 A)	<ul style="list-style-type: none"> Engine speed, >800 rpm Fuel quantity, <14 mg/stroke 	3 Sec during glowing	<ul style="list-style-type: none"> Continuous 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0672	Cylinder 2 Glow Plug Circuit Q11 Electrical Fault	<ul style="list-style-type: none"> - Check the Glow Plug Relay - J52- . Refer to ⇒ "1.5 Glow Plug Relay, Checking", page 109 . - Check the Glow Plugs . Refer to ⇒ page 107 . 	Message from glow relay Data bit #1 = 1(1 < 2.5 A)	<ul style="list-style-type: none"> • Engine speed, >800 rpm • Fuel quantity, <14 mg/stroke 	3 Sec during glowing	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0673	Cylinder 3 Glow Plug Circuit Q12 Electrical Fault	<ul style="list-style-type: none"> - Check the Glow Plug Relay - J52- . Refer to ⇒ "1.5 Glow Plug Relay, Checking", page 109 . - Check the Glow Plugs . Refer to ⇒ page 107 . 	Message from glow relay Data bit #2 = 1(1 < 2.5 A)	<ul style="list-style-type: none"> • Engine speed, >800 rpm • Fuel quantity, <14 mg/stroke 	3 Sec during glowing	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0674	Cylinder 4 Glow Plug Circuit Q13 Electrical Fault	<ul style="list-style-type: none"> - Check the Glow Plug Relay - J52- . Refer to ⇒ "1.5 Glow Plug Relay, Checking", page 109 . - Check the Glow Plugs . Refer to ⇒ "1.4 Glow Plugs, Checking", page 107 . 	Message from glow relay Data bit #3 = 1(1 < 2.5 A)	<ul style="list-style-type: none"> • Engine speed, >800 rpm • Fuel quantity, <14 mg/stroke 	3 Sec during glowing	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0684	Glow Plug Control Module to PCM Communication Circuit Range/Performance	<ul style="list-style-type: none"> - Check the Glow Plug Relay - J52- . Refer to ⇒ "1.5 Glow Plug Relay, Checking", page 109 . 	Message from glow relay-missing	<ul style="list-style-type: none"> • Engine speed, >800 rpm • Fuel quantity, <14 mg/stroke 	3 Sec during glowing	<ul style="list-style-type: none"> • Continuous • 2 DCY
P0700	Internal Control Module Memory Check Sum Error	<ul style="list-style-type: none"> - Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- ⇒ "4.4 Engine Control Module, Replacing", page 100 . 	Comparison with stored values	---	10 Sec	2 DCY
P0705	Transmission Range Sensor Circuit (PRNDL Input.) Malfunction	Check the Multi-Function Transmission Range (TR) Switch - F125- ⇒ "1.1 Multi-Function Transmission Range Switch, Checking", page 113	Combination of 4 input lines valid or not-wrong combination within 60 ms	---	300 ms	2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0715	Input Turbine/Speed Sensor (A) Circuit Malfunction	Check the Transmission Vehicle Speed Sensor (VSS) - G38- ⇒ "1.2 Transmission Vehicle Speed Sensor, Checking", page 115	Comparison with reference voltage-turbine speed = 0 and U < 2.2 V	---	0.3 Sec	2 DCY
P0722	Output Speed Sensor Circuit No Signal	Check the Transmission Vehicle Speed Sensor (VSS) - G38- ⇒ "1.2 Transmission Vehicle Speed Sensor, Checking", page 115	Comparison with reference voltage-VSS = 0 mph and U < 2.2 V	---	0.3 Sec	2 DCY
P0725	Engine Speed Input Circuit Malfunction	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison rpm and VSS-Signal-rpm >450; VSS must be > 0 mph	CAN bus okay	2 Revs	
P0730	Incorrect Gear Ratio	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison of indicated slip and actual slip with stored values-slip differences >300 rpm for more than 2 sec.	---	1 Sec	2 DCY
P0731	Gear 1 Incorrect Ratio	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison of indicated slip and actual slip with stored values-slip differences >300 rpm for more than 2 sec.	3.4 sec in new gear. Engine rpm has to be => 1,500 rpm and the car accelerates	1 Sec	2 DCY
P0732	Gear 2 Incorrect Ratio	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison of indicated slip and actual slip with stored values-slip differences >300 rpm for more than 2 sec.	3.4 sec in new gear. Engine rpm has to be => 1,500 rpm and the car accelerates	1 Sec	2 DCY
P0733	Gear 3 Incorrect Ratio	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison of indicated slip and actual slip with stored values-slip differences >300 rpm for more than 2 sec.	3.4 sec in new gear. Engine rpm has to be => 1,500 rpm and the car accelerates	1 Sec	2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0734	Gear 4 Incorrect Ratio	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison of indicated slip and actual slip with stored values-slip differences >300 rpm for more than 2 sec.	3.4 sec in new gear. Engine rpm has to be => 1,500 rpm and the car accelerates	1 Sec	2 DCY
P0740	Torque Converter Clutch Circuit Malfunction	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison slip with stored values-slip differences >200 rpm	Integrate input rpm- input rpm >1,500 rpm for integration	30 Sec	2 DCY
P0743	Torque Converter Clutch Circuit Electrical Malfunction	Refer to Auto. Transmission, Repair Group 38 ⇒ "1 Automatic Transmission Electrical Components, Checking", page 112	Comparison of stored value with active level-switch off and $U < 8.0 V < 50 \text{ mA}$. Comparison of stored value with active level-switch off and $U < 8.0 V$	---	0.3Sec	2 DCY
P0748	Pressure Control Solenoid (A) Electrical	Refer to Solenoid Valves in Valve Body ⇒ "1.5 Solenoid Valves in Valve Body, Checking", page 120	Current control and error level check- $I < 50 \text{ mA}$	---	0.3Sec	2 DCY
P0753	Pressure Control Solenoid (B) Electrical	Refer to Solenoid Valves in Valve Body ⇒ "1.5 Solenoid Valves in Valve Body, Checking", page 120	Comparison of stored value with active level-switch off and $U < 2.1 V$; switch on and $U > 1.6 V$	---	0.3Sec	2 DCY
P0758	Pressure Control Solenoid (C) Electrical	Refer to Solenoid Valves in Valve Body ⇒ "1.5 Solenoid Valves in Valve Body, Checking", page 120	Comparison of stored value with active level-switch off and $U < 2.1 V$; switch on and $U > 1.6 V$	---	0.3Sec	2 DCY
P0763	Pressure Control Solenoid (D) Electrical	Refer to Solenoid Valves in Valve Body ⇒ "1.5 Solenoid Valves in Valve Body, Checking", page 120	Comparison of stored value with active level-switch off and $U < 2.1 V$; switch on and $U > 1.6 V$	---	0.3Sec	2 DCY
P0773	Pressure Control Solenoid (E) Electrical	Refer to Solenoid Valves in Valve Body ⇒ "1.5 Solenoid Valves in Valve Body, Checking", page 120	Comparison of stored value with active level-switch off and $U < 2.1 V$; switch on and $U > 1.6 V$	---	0.3Sec	2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0785	Solenoid switching time	Refer to Solenoid Valves in Valve Body ⇒ "1.5 Solenoid Valves in Valve Body, Checking", page 120	Comparison of stored value with active level-switch off and U < 2.1 V; switch on and U > 1.6 V	---	0.3Sec	2 DCY
P0863	Communication to Transmission Control Module Electrical Malfunction	- Refer to Repair Group 38, Automatic Transmission. ⇒ "3.1 CAN-Bus Terminal Resistance, TCM to ECM, Checking", page 129	No signal-no signal within 300 ms	CAN bus okay 500 ms after ignition on	300ms	2 DCY
P0864	Communication to Transmission Control Module Range Performance	- Refer to Repair Group 38, Automatic Transmission. ⇒ "3.1 CAN-Bus Terminal Resistance, TCM to ECM, Checking", page 129		CAN bus okay 500 ms after ignition on	300ms	2 DCY
P0865	Communication to Transmission Control Module Short circuit to Ground (GND)	- Refer to Repair Group 38, Automatic Transmission. ⇒ "3.1 CAN-Bus Terminal Resistance, TCM to ECM, Checking", page 129		500 ms after ignition on	300ms	2 DCY
P1146	Air mass meter -G70 supply voltage	- Check the Mass Air Flow (MAF) Sensor - G70- . Refer to ⇒ "2.3 Mass Air Flow Sensor, Checking", page 68 .	Airflow sensor supply voltage-4.89 - 5.10 V	---	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P1160	Intake Air Temperature (IAT) Sensor -G72- Short circuit to Ground (GND)	- Check the Intake Air Temperature (IAT) Sensor - G72- . Refer to ⇒ "2.4 Intake Air Temperature Sensor, Checking", page 71 .	Intake air temperature sensor voltage-< 0.14 V	---	480 ms	2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1161	Intake Air Temperature (IAT) Sensor -G72-Open circuit/short circuit to B+	– Check the Intake Air Temperature (IAT) Sensor - G72- . Refer to ⇒ “2.4 Intake Air Temperature Sensor, Checking”, page 71 .	Intake air temperature sensor voltage-> 4.87 V	---	480 ms	2 DCY
P1164	Fuel Temperature Sensor - G81-Implausible Signal	– Check the Fuel Temperature Sensor - G81- . Refer to ⇒ “3.1 Fuel Temperature Sensor, Checking”, page 92 .	Time needed for 30°C integral change-> 600 min (1)	---	480 ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P1245	Needle Lift Sensor - G80- Short to ground	– Check the Needle Lift Sensor - G80- . Refer to ⇒ “2.10 Needle Lift Sensor, Checking”, page 83 .	Needle lift sensor voltage-< 0.30 V	Battery voltage->9 V	480ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P1246	Needle lift sender -G80 implausible signal	– Check the Needle Lift Sensor - G80- . Refer to ⇒ “2.10 Needle Lift Sensor, Checking”, page 83 .	Engine speed from needle lift sensor->6,000 rpm. Engine speed from needle lift sensor-1.5 - 0.5x eng. Spd.	<ul style="list-style-type: none"> • Battery voltage->9 V • Fuel quantity->8 mg/stroke • Engine speed- >1176 rpm • Engine speed sensor-not defective 	30.2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P1247	Needle Lift Sensor - G80- Open circuit/ short circuit to B+	– Check the Needle Lift Sensor - G80- . Refer to ⇒ “2.10 Needle Lift Sensor, Checking”, page 83 .	Needle lift sensor voltage- > 2.50 V	Battery voltage- > 9 V	480ms	<ul style="list-style-type: none"> • Continuous • 2 DCY
P1248	Injection Pump Fuel Metering Control (A) Range/ Performance	– Check the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- ⇒ “4 Engine Control Module”, page 98 .	Control deviation (absolute value)->6 ° (crankshaft angle)	Control mode-closed loop	8 Sec.	<ul style="list-style-type: none"> • Continuous • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1354	Modulating piston movement sender -G149 electrical fault in circuit	<ul style="list-style-type: none"> Check the Modulating Piston Displacement Sensor - G149- . ⇒ "3.2 Modulating Piston Displacement Sensor, Checking", page 94 	<ul style="list-style-type: none"> Control sleeve position sensor voltage- <0.43 V Control sleeve position sensor voltage- >4.95 V 	---	<ul style="list-style-type: none"> 300 ms 50 ms 	<ul style="list-style-type: none"> 2 DCY
P1402	EGR Vacuum Regulator Solenoid Valve -N18- Short circuit to B+	<ul style="list-style-type: none"> Check the EGR Vacuum Regulator Solenoid Valve - N18- . Refer to ⇒ "2.9 EGR Vacuum Regulator Solenoid Valve, Checking", page 82 . 	Short circuit status	Output driver-ON state	480 ms	<ul style="list-style-type: none"> Continuous 2 DCY
P1441	Exhaust gas Recirculation valve -N18- Open circuit/ short circuit to Ground (GND)	<ul style="list-style-type: none"> Check the EGR Vacuum Regulator Solenoid Valve - N18- . Refer to ⇒ "2.9 EGR Vacuum Regulator Solenoid Valve, Checking", page 82 . 	Diagnostic signal from output driver-open circuit status	Output driver-OFF state	480 ms	<ul style="list-style-type: none"> Continuous 2 DCY
P1556	Turbo/Super Charger Boost Sensor (A) Circuit Control limit not reached	<ul style="list-style-type: none"> Check the Turbo/Supercharger system. Refer to ⇒ "1 Turbocharger", page 55 . 	Control deviation- < -300 hPa	Control mode-closed loop. Engine speed- >2,016 rpm. Fuel quantity->18 mg/stroke	6.5 Sec	<ul style="list-style-type: none"> Continuous 2 DCY
P1562	Quantity adjuster-N146 upper limit stop value	<ul style="list-style-type: none"> Check the Quantity Adjuster - N146- . Refer to ⇒ "3.3 Quantity Adjuster, Checking", page 95 . 	Control sleeve position sensor maximum voltage-4.10 - 4.79 V	<ul style="list-style-type: none"> Engine speed- 0 rpm Battery voltage- >10 V Fuel temp.- >10 °C Eng. speed sensor-not defective Needle lift sensor-not defective 	20 ms	<ul style="list-style-type: none"> Immed.



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1563	Quantity adjuster-N146 lower limit stop value	<ul style="list-style-type: none"> Check the Quantity Adjuster - N146- . Refer to ⇒ "3.3 Quantity Adjuster, Checking", page 95 . 	Control sleeve position sensor minimum voltage-0.48 - 1.02 V	<ul style="list-style-type: none"> Engine speed- 0 rpm Battery voltage- >10 V Fuel temp.- >10 °C Eng. speed sensor-not defective Needle lift sensor-not defective 	20 ms	<ul style="list-style-type: none"> Immed.
P1619	Glow Plug Relay -J52- Open circuit/short circuit to Ground (GND)	<ul style="list-style-type: none"> Check the Glow Plug Relay - J52- . Refer to ⇒ "1.5 Glow Plug Relay, Checking", page 109 . 	<ul style="list-style-type: none"> Diagnostic signal from output driver-Open circuit status Diagnostic signal from output driver-short circuit status 	Output driver-OFF state	480 ms	<ul style="list-style-type: none"> Continuous 2 DCY
P1626	Data-bus-drive train missing message from transmission control module	<ul style="list-style-type: none"> Check the Transmission Control Module (TCM) - J217- . Refer to ⇒ "3.1 CAN-Bus Terminal Resistance,TCM to ECM, Checking", page 129 . 	Message from automatic Transmission missing	<ul style="list-style-type: none"> Time since start->1 sec. Battery voltage->10.54 V 	450 ms	<ul style="list-style-type: none"> Continuous 2 DCY
P1648	Data-Bus-driving gear faulty	<ul style="list-style-type: none"> Check the Transmission Control Module (TCM) - J217- . Refer to ⇒ "3.1 CAN-Bus Terminal Resistance,TCM to ECM, Checking", page 129 . 	CAN driver status-"bus off"	Time since start->1 sec. Battery voltage->10.54 V	480 ms	<ul style="list-style-type: none"> Continuous 2 DCY
P1650	Data-bus-drive train missing message from instrument cluster	<ul style="list-style-type: none"> Check the Transmission Control Module (TCM) - J217- . Refer to ⇒ "3.1 CAN-Bus Terminal Resistance,TCM to ECM, Checking", page 129 . 	Message from instrument panel-missing	Time since start->1 sec. Battery voltage->10.54 V	420 ms	<ul style="list-style-type: none"> Continuous 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1778	Valve 7 electrical fault in circuit	– Check the ⇒ “1.5 Solenoid Valves in Valve Body, Checking”, page 120	Comparison of stored value with active level-switch off and U < 2.1 V; switch on and U > 1.6 V	---	0.3 Sec	<ul style="list-style-type: none"> • 2 DCY • Immediate
P1780	Torque withdrawal faulty	– Refer to Automatic Transmission Rep Gr. 32, torque converter.	Comparison with nominal values-switch off and U < 2.1 V; switch on and U > 1.6 V	---	1 Sec	<ul style="list-style-type: none"> • 2 DCY
P2195	Oxygen Sensor LSU (BEW Only)	Refer to ⇒ “2.1 Heated Oxygen Sensor, Engine Code BEW, Checking”, page 63	Signal range low 200mV	LSU heater control active	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P2196	Oxygen Sensor LSU (BEW Only)	Refer to ⇒ “2.1 Heated Oxygen Sensor, Engine Code BEW, Checking”, page 63	Signal range check-high (if first threshold is exceeded the sensor signal gain factor and the transformation curve is changed).	<ul style="list-style-type: none"> • 1) 4.77 V • 2) 3.2 V 	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P2237	Check Sensor wire of LSU (BEW Only)	Refer to ⇒ “2.1 Heated Oxygen Sensor, Engine Code BEW, Checking”, page 63	<ul style="list-style-type: none"> • Calculated oxygen concentration (by quantity and fuel quantity) • LSU wires • LSU heater control 	<ul style="list-style-type: none"> • > 0.067 • not defective • Active 	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P2238	LSU wire signal range check Circuit low (BEW Only)	Refer to ⇒ “2.1 Heated Oxygen Sensor, Engine Code BEW, Checking”, page 63	<ul style="list-style-type: none"> • Virtual Mass (VM) < 2 V • Nernst voltage (UN) < 1.75 V • Adjustment voltage (IP) < 0.3 V 	---	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P2239	LSU wire signal range check. Short to battery (BEW Only)	Refer to ⇒ “2.1 Heated Oxygen Sensor, Engine Code BEW, Checking”, page 63	<ul style="list-style-type: none"> • Virtual Mass (VM) > 3 V • Nernst voltage (UN) > 4 V • Adjustment voltage (IP) > 1.5 V 	---	---	<ul style="list-style-type: none"> • Continuous • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P2243	LSU wire fault (nernst voltage) (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	<ul style="list-style-type: none"> • LSU internal resistance..> 1800Ω • AND oxygen sensor raw signal.. >4.68 V <0.3 V • 	<ul style="list-style-type: none"> • LSU heater control..active, in final stage • active for 5 Sec w/ no fault 	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P2245	LSU wire signal range check Circuit low (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	<ul style="list-style-type: none"> • Virtual Mass (VM) < 2 V • Nernst voltage (UN) < 1.75 V • Adjustment voltage (IP) < 0.3 V 	---	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P2246	LSU wire signal range check. Short to battery (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	<ul style="list-style-type: none"> • Virtual Mass (VM) > 3 V • Nernst voltage (UN) > 4 V • Adjustment voltage (IP) > 1.5 V 	---	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY
P2251	LSU wire fault virtual mass (VM) open circuit (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	<ul style="list-style-type: none"> • LSU internal resistance.. > 1800 Ω • AND oxygen sensor raw signal.. >1461 mV < 1514 mV 	<ul style="list-style-type: none"> • LSU heater control..active for 5 Sec • heater final stage..no fault 	2 Sec	<ul style="list-style-type: none"> • Continuous
P2252	LSU wire signal range check Circuit low (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking", page 63	<ul style="list-style-type: none"> • Virtual Mass (VM) < 2 V • Nernst voltage (UN) < 1.75 V • Adjustment voltage (IP) < 0.3 V 	---	2 Sec	<ul style="list-style-type: none"> • Continuous • 2 DCY



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P2253	LSU wire signal range check, circuit high (BEW Only)	Refer to ⇒ "2.1 Heated Oxygen Sensor, Engine Code BEW, Checking" , page 63	<ul style="list-style-type: none"> Virtual Mass (VM) > 3 V Nernst voltage (UN) > 4 V Adjustment voltage (IP) > 1.5 V 	---	2 Sec	<ul style="list-style-type: none"> Continuous 2 DCY
P3103	Intake Flap Motor - V157- faulty	– Check the Intake Flap Motor - V157- . Refer to ⇒ "2.2 Intake Flap Motor Checking" , page 66	<ul style="list-style-type: none"> Normal closed position, unable to reach <p>or</p> <ul style="list-style-type: none"> Normal open position, unable to reach 	<ul style="list-style-type: none"> ECM keep alive time Ignition, Off Runner flaps, Commanded closed Battery voltage, >10 V tumble flap, >5%ECT, -40.5-140° C 	25 Sec	<ul style="list-style-type: none"> Once/ DCY



6 Transmission DTC Tables

6.1 Transmission Control Module , 09G

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0604	Internal Control Module Random Access Memory (RAM) Error	<ul style="list-style-type: none"> RAM area check 	<ul style="list-style-type: none"> comparison of writing data and reading data 	<ul style="list-style-type: none"> writing data is different from reading one 		<ul style="list-style-type: none"> 40 s 	<ul style="list-style-type: none"> 2 DCY
P0605	Internal Control Module Read Only Memory (ROM) Error	<ul style="list-style-type: none"> ROM area check 	<ul style="list-style-type: none"> comparison of stored checksum value and calculated checksum 	<ul style="list-style-type: none"> two checksum values are not same 		<ul style="list-style-type: none"> 40 s 	<ul style="list-style-type: none"> 2 DCY
P0613	TCM Processor	<ul style="list-style-type: none"> 2nd CPU detects miscalculation 	<ul style="list-style-type: none"> check-calculation of first CPU failed 	<ul style="list-style-type: none"> single reset does not cover problem 		<ul style="list-style-type: none"> XX s 	<ul style="list-style-type: none"> 2 DCY
P0614	ECM/TCM Incompatible	<ul style="list-style-type: none"> CAN receive data check 	<ul style="list-style-type: none"> detection of error signal 	<ul style="list-style-type: none"> transmission coding is manual transmission code (0Fh) OR <ul style="list-style-type: none"> max torque is not same as one in AT-CU 	<ul style="list-style-type: none"> CAN bus: ACTIVE ECU communication: ACTIVE ECU data update: ACTIVE 	<ul style="list-style-type: none"> 250 ms 	<ul style="list-style-type: none"> 2 DCY
P0705	Transmission Range Sensor "A" Circuit (PRNDL Input)	<ul style="list-style-type: none"> A, B, C and PA signal check in every shift lever position. 	<ul style="list-style-type: none"> detection of wrong combination of the A, B, C and PA signal 	<ul style="list-style-type: none"> wrong combination for more than 350 ms 		<ul style="list-style-type: none"> 350 ms 	<ul style="list-style-type: none"> 2 DCY



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0715	Input Turbine/Speed Sensor "A" Circ	<ul style="list-style-type: none"> Electrical check 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> voltage < 0.2 volt (AD value < 45) for more than 100 ms <p>OR</p> <ul style="list-style-type: none"> (AD value > 545) voltage > 3.8 volt for more than 100 ms 	<ul style="list-style-type: none"> input sensor: no failure decision for input sensor no pulse failure 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
P0716	Input/Turbine Shaft Speed Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> No pulse check 	<ul style="list-style-type: none"> comparison pulse of input revolution and output revolution 	<ul style="list-style-type: none"> no pulse of input sensor more than 125 ms 	<ul style="list-style-type: none"> engine speed > 400 rpm output sensor: ACTIVE output speed >= 300 rpm input sensor: no during failure detection or after failure decision for input sensor electrical failure 	<ul style="list-style-type: none"> 125 ms 4 times 	<ul style="list-style-type: none"> 2 DCY
P0720	output Shaft Speed Sensor Circuit	<ul style="list-style-type: none"> Electrical check 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> voltage < 0.2 volt (AD value < 45) for more than 100 ms <p>OR</p> <ul style="list-style-type: none"> (AD value > 545) voltage > 3.8 volt for more than 100 ms 	<ul style="list-style-type: none"> output sensor: no failure decision for output sensor no pulse 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0721	Output Shaft Speed Sensor Circuit Range/Performance	<ul style="list-style-type: none"> No pulse check 	<ul style="list-style-type: none"> comparison pulse of input revolution and output revolution 	<ul style="list-style-type: none"> no pulse of output sensor more than 250 ms 	<ul style="list-style-type: none"> engine speed: > 400 rpm input sensor: ACTIVE calculated output speed by input speed: >= 300 rpm main solenoid switch: ON gear condition: Engage Range: D,S Inhibitor switch: no fault output sensor: no during failure detection or after failure decision for output sensor electrical failure solenoid: no fault (except S2) linear solenoid: no fault 	<ul style="list-style-type: none"> 250 ms 2 times 	<ul style="list-style-type: none"> 2 DCY
P0725	Engine Speed Input Circuit	<ul style="list-style-type: none"> CAN receive data check 	<ul style="list-style-type: none"> detection of error signal 		<ul style="list-style-type: none"> CAN bus: ACTIVE ECU communication: ACTIVE ECU data update: ACTIVE 	<ul style="list-style-type: none"> 250 ms 	<ul style="list-style-type: none"> 2 DCY



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0729	Gear 6 Incorrect Ratio	<ul style="list-style-type: none"> Input and output rpm signal check. Separate error memory for each gear. 	<ul style="list-style-type: none"> comparison of indicated slip and actual slip with stored values 	<ul style="list-style-type: none"> 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s 	<ul style="list-style-type: none"> engine speed > 400 rpm output revolutions > 250 rpm shift lever D or S brake: OFF slip difference of output speed (In case ABS valid) difference < 10% revolution sensor, no back up condition model oil temperature $\geq 0^{\circ} \text{C}$ common parameter, common condition (see footnote ⇒ page 54) 	<ul style="list-style-type: none"> 1 s 12 times 	<ul style="list-style-type: none"> 2 DCY cumulative



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	<ul style="list-style-type: none"> Input and output rpm signal check. Separate error memory for each gear. 	<ul style="list-style-type: none"> comparison of indicated slip and actual slip with stored values 	<ul style="list-style-type: none"> ABS (input rev – output rev x other gear ratio) < (0.04 x other gear ratio x output rev) for more than 1 s 	<ul style="list-style-type: none"> engine speed > 400 rpm output revolutions > 250 rpm estimated engine torque > 100 Nm at 1st gear > 80 Nm at 1st EB gear shift lever D or S brake: OFF slip difference of output speed and ABS difference < 10% (in case of ABS failure, this condition isn't activated) engaged gear, 1st gear revolution sensor, no back up condition model oil temperature $\geq 20^{\circ}\text{C}$ common parameter, common condition (see footnote => page 54) 	<ul style="list-style-type: none"> 1 s 12 times 	<ul style="list-style-type: none"> 2 DCY cumulative



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> Neutral condition check 	<ul style="list-style-type: none"> detection of slip condition 	<ul style="list-style-type: none"> input revolutions > output revolutions x 1st gear ratio + 400 rpm for more than 3.3 s 	<ul style="list-style-type: none"> engine speed > 400 rpm shift lever D or S output revolutions <= 500 rpm output revolutions which <= 500 rpm calculated from ABS (In case of ABS failure, this condition isn't activated) L-up condition: OFF input sensor, no back up condition output sensor, active or back up by ABS model oil temperature >= 0° C common parameter, common condition (see footnote => page 54) 	<ul style="list-style-type: none"> 2 times 	<ul style="list-style-type: none"> 2 DCY cumulative but, in case of changing the shift lever position, counter = 0



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0732	Gear 2 Incorrect Ratio	<ul style="list-style-type: none"> Neutral condition check 	<ul style="list-style-type: none"> detection of slip condition 	<ul style="list-style-type: none"> input revolutions > output revolutions x 1st gear ratio + 400 rpm for more than 3.3 s 	<ul style="list-style-type: none"> engine speed > 400 rpm shift lever D or S output revolutions <= 500 rpm output revolutions which <= 500 rpm calculated from ABS (In case of ABS failure, this condition isn't activated) L-up condition: OFF input sensor, no back up condition output sensor, active or back up by ABS model oil temperature >= 0° C common parameter, common condition (see footnote => page 54) 	<ul style="list-style-type: none"> 2 times 	<ul style="list-style-type: none"> 2 DCY cumulative but, in case of changing the shift lever position, counter = 0



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		<ul style="list-style-type: none"> Input and output rpm signal check. Separate error memory for each gear. 	<ul style="list-style-type: none"> comparison of indicated slip and actual slip with stored values 	<ul style="list-style-type: none"> 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s 	<ul style="list-style-type: none"> engine speed > 400 rpm output revolutions > 250 rpm shift lever D or S brake: OFF slip difference of output speed (In case ABS valid) difference < 10% revolution sensor, no back up condition model oil temperature $\geq 0^{\circ} \text{C}$ common parameter, common condition (see footnote ⇒ page 54) 	<ul style="list-style-type: none"> 1 s 12 times 	<ul style="list-style-type: none"> 2 DCY cumulative



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0733	Gear 3 Incorrect Ratio	<ul style="list-style-type: none"> Input and output rpm signal check. Separate error memory for each gear. 	<ul style="list-style-type: none"> comparison of indicated slip and actual slip with stored values 	<ul style="list-style-type: none"> 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s 	<ul style="list-style-type: none"> engine speed > 400 rpm output revolutions > 250 rpm shift lever D or S brake: OFF slip difference of output speed (In case ABS valid) difference < 10% revolution sensor, no back up condition model oil temperature $\geq 0^{\circ} \text{C}$ common parameter, common condition (see footnote ⇒ page 54) 	<ul style="list-style-type: none"> 1 s 12 times 	<ul style="list-style-type: none"> 2 DCY cumulative



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0734	Gear 4 Incorrect Ratio	<ul style="list-style-type: none"> Input and output rpm signal check. Separate error memory for each gear. 	<ul style="list-style-type: none"> comparison of indicated slip and actual slip with stored values 	<ul style="list-style-type: none"> 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s 	<ul style="list-style-type: none"> engine speed > 400 rpm output revolutions > 250 rpm shift lever D or S brake: OFF slip difference of output speed (In case ABS valid) difference < 10% revolution sensor, no back up condition model oil temperature $\geq 0^{\circ} \text{C}$ common parameter, common condition (see footnote ⇒ page 54) 	<ul style="list-style-type: none"> 1 s 12 times 	<ul style="list-style-type: none"> 2 DCY cumulative



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0735	Gear 5 Incorrect Ratio	<ul style="list-style-type: none"> Input and output rpm signal check. Separate error memory for each gear. 	<ul style="list-style-type: none"> comparison of indicated slip and actual slip with stored values 	<ul style="list-style-type: none"> 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s 	<ul style="list-style-type: none"> engine speed > 400 rpm output revolutions > 250 rpm shift lever D or S brake: OFF slip difference of output speed (In case ABS valid) difference < 10% revolution sensor, no back up condition model oil temperature $\geq 0^{\circ}$ C common parameter, common condition (see footnote => page 54) 	<ul style="list-style-type: none"> 1 s 12 times 	<ul style="list-style-type: none"> 2 DCY cumulative
P0743	Torque Converter Clutch Circuit Electrical	<ul style="list-style-type: none"> Input AD value check in every Linear solenoid. 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> feedback current > 1333 mA (AD value > 1000) for more than 100 ms 	<ul style="list-style-type: none"> main solenoid switch: ON 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> feedback current < 23 mA (AD value < 15) for more than 100 ms 			
		<ul style="list-style-type: none"> Linear solenoid feedback current check 	<ul style="list-style-type: none"> comparison of target current and feedback current 	<ul style="list-style-type: none"> sum of difference of two current > 20000 Ω 			

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0748	Pressure Control Solenoid "A" Electrical	<ul style="list-style-type: none"> Input AD value check in every Linear solenoid. 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> feedback current > 1333 mA (AD value > 1000) for more than 100 ms 	<ul style="list-style-type: none"> main solenoid switch: ON 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> feedback current < 23 mA (AD value < 15) for more than 100 ms 			
P0753	Shift Solenoid "A" Electrical	<ul style="list-style-type: none"> Conduction check in ON/OFF solenoid. 	<ul style="list-style-type: none"> Comparison of the signal of solenoid monitor and solenoid driver output 	<ul style="list-style-type: none"> wrong output signal for more than 100 ms 		<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
P0798	Pressure Control Solenoid "C" Electrical	<ul style="list-style-type: none"> Input AD value check in every Linear solenoid. 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> feedback current > 1333 mA (AD value > 1000) for more than 100 ms 	<ul style="list-style-type: none"> main solenoid switch: ON 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> feedback current < 23 mA (AD value < 15) for more than 100 ms 			



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0811	Excessive Clutch "A" Slippage	<ul style="list-style-type: none"> OFF stuck check. 	<ul style="list-style-type: none"> comparison of engine rpm and input rpm 	<ul style="list-style-type: none"> Engine rpm – input rpm > 100 rpm for 2 s 	<ul style="list-style-type: none"> engine speed > 400 rpm shift lever D or S engine speed < 4000 rpm estimated engine torque >= 0 Nm revolution sensor, no back up condition SLU target current > 1000 mA model oil temperature >= 20° C common parameter, common condition (see footnote => page 54) 	<ul style="list-style-type: none"> 2 s 6 times 	<ul style="list-style-type: none"> 2 DCY continuously
P0864	TCM Communication Circuit Range/Performance	<ul style="list-style-type: none"> CAN communication check 	<ul style="list-style-type: none"> detection of communication error (all frames which are entered in ATCU) 	<ul style="list-style-type: none"> ECU no communication for more than 50 ms (In case of repeat rate is over 25 ms, double value of repeat rate is used) 	<ul style="list-style-type: none"> CAN bus: ACTIVE time: 500 ms after ignition: ON 	<ul style="list-style-type: none"> 500 ms (In case of repeat rate is over 50 ms, 10 times value of repeat rate is used) 	<ul style="list-style-type: none"> 2 DCY



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			<ul style="list-style-type: none"> detection of communication error (one frame which is entered in ATCU) 	<ul style="list-style-type: none"> ECU no communication for more than 50 ms (In case of repeat rate is over 25 ms, double value of repeat rate is used) 	<ul style="list-style-type: none"> CAN bus: ACTIVE time: 500 ms after ignition: ON ECU communication: not in no communication failure 	<ul style="list-style-type: none"> 1000 ms (In case of repeat rate is over 50 ms, 20 times value of repeat rate is used) 	
		<ul style="list-style-type: none"> CAN receive data check 	<ul style="list-style-type: none"> ECU signal data freeze (data counter (ID488, Byte8, Bit7...4) not updated) 		<ul style="list-style-type: none"> CAN bus: ACTIVE CAN data repeat rate: the space of time between two received messages has not exceeded double the transmission cycle time 	<ul style="list-style-type: none"> no update in five message 	
		<ul style="list-style-type: none"> CAN communication check 	<ul style="list-style-type: none"> detection of communication error 	<ul style="list-style-type: none"> no acknowledge condition for more than 300 ms 	<ul style="list-style-type: none"> CAN bus: ACTIVE time: 500 ms after ignition: ON 	<ul style="list-style-type: none"> 300 ms 	
P0865	TCM Communication Circuit Low	<ul style="list-style-type: none"> CAN communication check 	<ul style="list-style-type: none"> detection of communication error 	<ul style="list-style-type: none"> CAN BUS off condition for more than 250 ms 	<ul style="list-style-type: none"> time 500 ms after ignition: ON 	<ul style="list-style-type: none"> 250 ms 	<ul style="list-style-type: none"> 2 DCY
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low	<ul style="list-style-type: none"> CAN communication check 	<ul style="list-style-type: none"> detection of error signal 		<ul style="list-style-type: none"> CAN bus: ACTIVE ECU communication: ACTIVE ECU data update: ACTIVE 	<ul style="list-style-type: none"> 250 ms 	<ul style="list-style-type: none"> 2 DCY



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2637	Torque Management Feedback Signal "A"	<ul style="list-style-type: none"> CAN receive data check for "signal invalid" 	<ul style="list-style-type: none"> detection of error signal (0xFF) 		<ul style="list-style-type: none"> CAN bus: ACTIVE ECU communication: ACTIVE ECU data update: ACTIVE 	<ul style="list-style-type: none"> 250 ms 	<ul style="list-style-type: none"> 2 DCY
P2716	Pressure Control Solenoid "D" Electrical	<ul style="list-style-type: none"> Input AD value check in every Linear solenoid. 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> feedback current > 1333 mA (AD value > 1000) for more than 100 ms 		<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> feedback current < 23 mA (AD value < 15) for more than 100 ms 	<ul style="list-style-type: none"> main solenoid switch: ON 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> Linear solenoid feedback current check 	<ul style="list-style-type: none"> comparison of target current and feedback current 	<ul style="list-style-type: none"> sum of difference of two current > 20000 Ω 	<ul style="list-style-type: none"> linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)
P2725	Pressure Control Solenoid "E" Electrical	<ul style="list-style-type: none"> Input AD value check in every Linear solenoid. 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> feedback current > 1333 mA (AD value > 1000) for more than 100 ms 		<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> feedback current < 23 mA (AD value < 15) for more than 100 ms 	<ul style="list-style-type: none"> main solenoid switch: ON 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> Linear solenoid feedback current check 	<ul style="list-style-type: none"> comparison of target current and feedback current 	<ul style="list-style-type: none"> sum of difference of two current > 20000 Ω 	<ul style="list-style-type: none"> linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)



AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2734	Pressure Control Solenoid "F" Electrical	<ul style="list-style-type: none"> Input AD value check in every Linear solenoid. 	<ul style="list-style-type: none"> detection of wrong input AD value 	<ul style="list-style-type: none"> feedback current > 1333 mA (AD value > 1000) for more than 100 ms 		<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
				<ul style="list-style-type: none"> feedback current < 23 mA (AD value < 15) for more than 100 ms 	<ul style="list-style-type: none"> main solenoid switch: ON 	<ul style="list-style-type: none"> 100 ms 5 times 	<ul style="list-style-type: none"> 2 DCY
		<ul style="list-style-type: none"> Linear solenoid feedback current check 	<ul style="list-style-type: none"> comparison of target current and feedback current 	<ul style="list-style-type: none"> sum of difference of two current > 20000 Ω 	<ul style="list-style-type: none"> linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000) 	<ul style="list-style-type: none"> 2 times 	<ul style="list-style-type: none"> 2 DCY continuously

Footnote:

Common parameter for enabling gear ratio or lock up errors:

- ◆ main solenoid switch ON
- ◆ gear condition engaged
- ◆ S1 solenoid No fault
- ◆ linear solenoid no fault
- ◆ inhibitor switch no fault
- ◆ CAN communication no fault
- ◆ ECU data update no fault
- ◆ estimated engine torque no fault
- ◆ engine speed no fault
- ◆ accelerator pedal no fault
- ◆ T/M coding and MDI max info no fault
- ◆ ROM no fault
- ◆ RAM no fault
- ◆ safety processor no fault



21 – Turbocharger, G-Charger

1 Turbocharger

The following table provides quick links to all chapters in this section.

⇒ "1.1 General Information", page 55
⇒ "1.2 Safety Precautions", page 56
⇒ "1.3 Clean Working Conditions", page 56
⇒ "1.4 Wastegate Bypass Regulator Valve, Checking", page 57

For all Turbocharger, G-Charger component locations, refer to ⇒ Charge Air System with Turbocharger; Rep. Gr. 21 ; Engine, Mechanical .

For all Turbocharger, G-Charger system removal/installation procedures and torque specifications, refer to ⇒ Charge Air System with Turbocharger; Rep. Gr. 21 ; Engine, Mechanical .

Check the Technical Bulletins for information that may supersede any information included in this manual. Refer to ⇒ EBAHN-Website .



Note

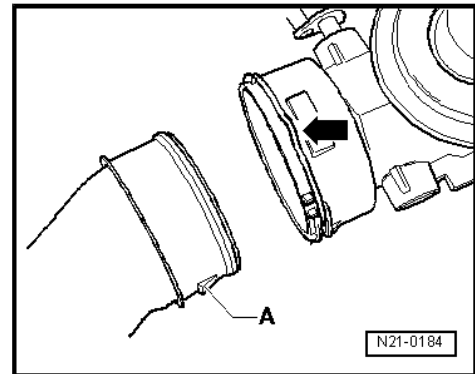
- ◆ *All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through VW. Refer to ⇒ Tool catalog .*
- ◆ *Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.*

1.1 General Information

- ◆ Charge air system must be properly sealed.
- ◆ Always replace self-locking nuts.
- ◆ Charge air hoses and pipes as well as their connections must be free of oil and grease before reinstalling.
- ◆ Do not assemble charge air hoses and lines with lubricants containing oils, only coat with water (without additives) if necessary.
- ◆ Note installation marks on hoses and components.
- ◆ All hose connections for charge air system are secured by spring-type clamps or by connector couplings.
- ◆ Install only approved clamps for securing hose connections ⇒ Electronic Parts Catalog "ETKA" .
- ◆ Spring clamp pliers or Hose clamp pliers are recommended for installing spring clamps.
- ◆ For connector couplings, always note the following points:



- Disengage connector coupling by pulling securing clip -arrow-.
- Disconnect hose and pipe without the assistance of tools.
- When assembling, make sure the retaining tabs -A- are engaged securely.
- ◆ Before screwing on oil supply line, fill turbocharger with engine oil at filler tube.
- ◆ After installing turbocharger, let engine idle for approx. 1 minute without increasing engine speed. This ensures adequate oil supply to the turbocharger.



1.2 Safety Precautions



Caution

Observe the following for all installations, especially in engine compartment due to lack of room:

- ◆ *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *Watch for sufficient clearance to all moving or hot components.*

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



WARNING

- ◆ *Test equipment must always be secured to the rear seat and operated from there by a second person.*
- ◆ *If test and measuring equipment is operated from the passenger seat, the person seated there could be injured in the event of an accident involving deployment of the passenger-side airbag.*



WARNING

The use of nails, paper clips, or another unauthorized materials to back-probe electrical harness connectors is strictly prohibited and may cause damage to the electrical harness connectors, terminal ends or damage to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.

1.3 Clean Working Conditions

When working on turbocharger, carefully observe the following Rules of Cleanliness:

- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.



- ◆ Place parts that have been removed on a clean surface and cover. Use lint-free cloths only!
- ◆ Carefully cover over opened components or seal, if repairs are not carried out immediately.
- ◆ Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (in tool boxes etc.)
- ◆ Transport and protective packaging and sealing caps are to be removed only immediately prior to installation.
- ◆ During repairs, clean oil from connections and hose ends.
- ◆ When the system is open: Avoid working with compressed air if possible. Do not move vehicle unless absolutely necessary.

1.4 Wastegate Bypass Regulator Valve, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- On vehicles with automatic transmission, selector lever in position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Disconnect the Wastegate Bypass Regulator Valve - N75- electrical harness connector.

Checking internal resistance

- Using a multimeter , check the Wastegate Bypass Regulator Valve - N75- -1- terminals 1 to 2 for resistance.

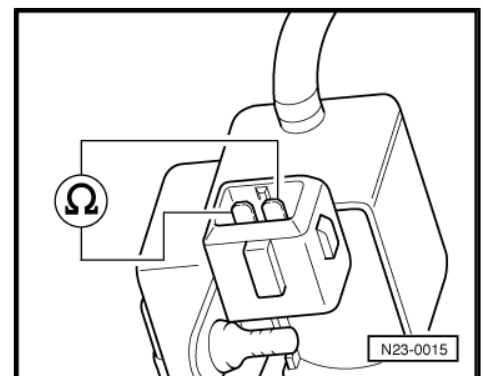
Specified value: 20 to 30 Ω (at approx. 20° C)

If the specification was not obtained:

- Replace the Wastegate Bypass Regulator Valve - N75- .

If the specification is obtained:

Checking Voltage supply





- Using a multimeter , check the Wastegate Bypass Regulator Valve - N75- electrical harness connector terminal 1 to Ground (GND).

Wastegate Bypass Regulator Valve - N75- electrical harness connector terminal	Measure to
1	Engine Ground (GND)

- Operate the starter briefly.
- Specified value: battery voltage.

- Switch the ignition off.

If the specification was not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunction is found in the wiring:

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ["4.4 Engine Control Module, Replacing", page 100](#) .
- Using a multimeter , check the Wastegate Bypass Regulator Valve - N75- electrical harness connector terminal 2 to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminal 62 for an open circuit.

Wastegate Bypass Regulator Valve - N75- electrical harness connector terminal	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical connector T121 terminal
2	62

Specified value: 1.5 Ω max.

If the specification is not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

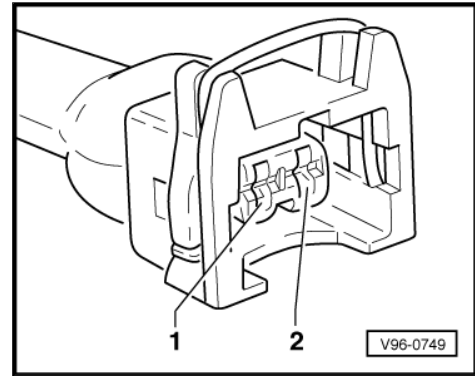
If no malfunction is detected in the wiring and if the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ["4.4 Engine Control Module, Replacing", page 100](#) .

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ["2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .





- 3 - If the DTC memory was erased, generate readiness code.
Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis.



23 – Diesel Fuel Injection

1 Fuel Injection System, Servicing

The following table provides quick links to all chapters in this section.

⇒ "1.1 Safety Precautions", page 60
⇒ "1.2 Clean Working Conditions", page 62
⇒ "1.3 Technical Data", page 62

For all Diesel fuel injection system component locations, refer to ⇒ Diesel Fuel Injection; Rep. Gr. 23 ; Diesel Direct Fuel Injection System, Servicing .

For all Diesel fuel injection system removal/installation procedures and torque specifications, refer to ⇒ Diesel Fuel Injection; Rep. Gr. 23 ; Diesel Direct Fuel Injection System, Servicing .

Check the Technical Bulletins for information that may supersede any information included in this manual. Refer to ⇒ EBahn-Website .



Note

- ◆ *All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through VW. Refer to the ⇒ Tool catalog .*
- ◆ *Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.*

1.1 Safety Precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system. Note the following:



WARNING

Fire hazard! To prevent personal injury, and damage to vehicle components. Remove all objects from the repair area that can ignite Diesel fuel .



Caution

Be sure the ignition is switched OFF, when:

- ◆ *Disconnecting or connecting Diesel fuel injection and glow plug system wiring or test equipment.*
- ◆ *Be sure the ignition is switched OFF. Failure to do so may damage the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM).*
- ◆ *Observe procedures for disconnecting battery. Refer to Electrical Equipment, Repair Group 27.*

BEFORE cranking the engine at starting RPM (such as for compression testing)

- ◆ *Disconnect the Fuel Cut-Off Valve - N109- electrical harness connector on the Diesel injection pump.*
- ◆ *After all repair work is completed, check and erase Diagnostic Trouble Code (DTC) memory.*

Observe the following if test and measuring instruments are required during a test drive:



Caution

- ◆ *Test and measuring equipment must always be secured to the rear seat and be operated from there by a second person.*
- ◆ *If test and measuring instruments are operated from the front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is deployed.*



WARNING

The use of nails, paper clips, or another unauthorized materials to back-probe electrical harness connectors is strictly prohibited and may cause damage to the electrical harness connectors, terminal ends or damage to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.



1.2 Clean Working Conditions



Caution

When working on the fuel supply or Diesel injection system, always observe the following rules of cleanliness.

- ◆ *Thoroughly clean fuel system line and hose connections and the surrounding area before disconnecting.*
- ◆ *Place removed components on a clean surface and cover. Use plastic sheet or paper. Do not use fluffy rags that leave lint!*
- ◆ *Carefully cover over or seal any components that have been opened if repairs are not carried out immediately.*
- ◆ *Install only clean parts. Do not remove replacement parts from the packaging until immediately before they are to be installed or use parts that have been stored without packaging (e.g. in toolboxes, etc.).*
- ◆ *When the fuel system has been opened, avoid working with compressed air whenever possible, and also avoid moving the vehicle if possible*
- ◆ *Do not let Diesel fuel come in contact with engine coolant hoses and, if necessary, immediately clean any hose that has been contaminated by fuel. Replace hoses if Diesel fuel has had time to soak into the hose material.*

1.3 Technical Data

Engine Code	ALH, BEW (1.9L / 66 kW DFI engine)
Idle speed (not adjustable)	680 RPM
Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM)	
Terminals at Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM)	121
Replacement part number	⇒ ETKA (electronic parts catalog)
Engine speed (RPM) limitation	starting at approx. 4000 RPM



2 Components, Checking

The following table provides quick links to all chapters in this section.

⇒ “2.1 Heated Oxygen Sensor, Engine Code BEW, Checking”, page 63
⇒ “2.2 Intake Flap Motor Checking”, page 66
⇒ “2.3 Mass Air Flow Sensor, Checking”, page 68
⇒ “2.4 Intake Air Temperature Sensor, Checking”, page 71
⇒ “2.5 Manifold Absolute Pressure Sensor, Checking”, page 73
⇒ “2.6 Engine Coolant Temperature Sensor, Checking”, page 75
⇒ “2.7 Engine Speed Sensor, Checking”, page 77
⇒ “2.8 Throttle Position Sensor from MY 1999/Closed Throttle Position Switch, Checking”, page 79
⇒ “2.9 EGR Vacuum Regulator Solenoid Valve, Checking”, page 82
⇒ “2.10 Needle Lift Sensor, Checking”, page 83
⇒ “2.11 Cold Start Injector, Checking”, page 85
⇒ “2.12 Fuel Cut-Off Valve, Checking”, page 87
⇒ “2.13 Fuel Injectors, Checking”, page 89
⇒ “2.14 Positive Crankcase Ventilation Heating Element, Checking”, page 90

2.1 Heated Oxygen Sensor, Engine Code BEW, Checking



Note

- ◆ *Applies to Engine Code (BEW) only*
- ◆ *Oxygen Sensor (O2S) Heater - Z19- is part of Heated Oxygen Sensor (HO2S) - G39- and cannot be serviced separately.*
- ◆ *When servicing terminals in the electrical harness connector of Heated Oxygen Sensor (HO2S) - G39- , use only gold-plated terminals.*

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- Fuse - S13- OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.



Test procedure

- Perform a preliminary check to verify the customers complaint.
Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Vehicle must be raised to access Heated Oxygen Sensor (HO2S) - G39-
- Access to Heated Oxygen Sensor is beneath synthetic cover at vehicle floor.
- Disconnect the Heated Oxygen Sensor (HO2S) - G39- electrical harness connector .

Checking internal resistance

- Using a multimeter , check the Heated Oxygen Sensor (HO2S) - G39- terminals 3 to 4 for resistance.

Specified value: 2.5 to 10.0 Ω (at approx. 20° C)

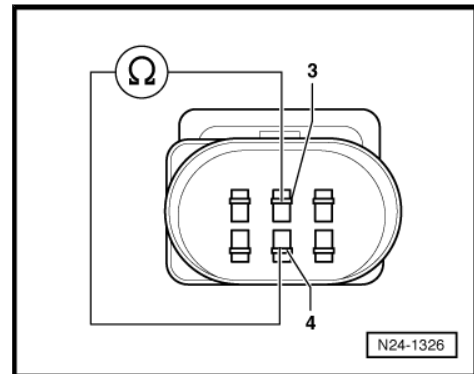
If the specification was not obtained:

- Replace Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ Fuel Injection and Ignition; Rep. Gr. 23 ; Diesel fuel Injection .

If the specification was obtained:

Checking voltage supply

Crank the engine.





- Using a multimeter , check the Heated Oxygen Sensor (HO2S)
 - G39- electrical harness connector terminal 4 to Ground (GND) for voltage.

Heated Oxygen Sensor (HO2S) - G39- electrical harness connector terminal	Measure to
4	Ground (GND)

Specified value: Battery voltage.

Switch the ignition off.

If the specification was not obtained:

- Check the wiring from the Heated Oxygen Sensor (HO2S) - G39- electrical harness connector terminal 4 to the Power Supply Relay (terminal 30, B+) - J317- socket 2/30 for an open circuit, a short circuit to Battery (+), or Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specification was obtained:

Checking Ground (GND) activation

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Using a multimeter , check the Heated Oxygen Sensor (HO2S) - G39- electrical harness connector to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T94 for resistance.

Heated Oxygen Sensor (HO2S) - G39- electrical harness connector terminal	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical connector T94 terminal
1	32
2	10
3	51
5	54
6	77

Specified value: 1.5 Ω.

If the specification was not obtained:

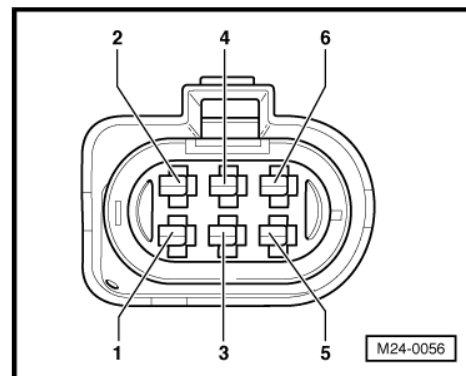
- Check the wiring for an open circuit, a short circuit to Battery positive (+) or Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If the specification was obtained:

- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .





- End diagnosis.

If the DTC returns and no malfunction is found in the wiring and voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .

Assembly is performed in the reverse order of the removal, note the following:

Final procedures

After repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of Diagnosis

2.2 Intake Flap Motor Checking

Observe all safety precautions:

View clean working conditions:

Use only gold-plated terminals when servicing any component with gold-plated electrical harness connector terminals.

For wiring diagrams, component locations, and connector views, Refer to the applicable wiring diagram.

Special tools and workshop equipment required

- ◆ multimeter
- ◆ Wiring diagram.

Test requirements

- The Motronic Engine Control Module (ECM) - J623- fuses OK .
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to

Start diagnosis

- Remove the engine cover with air filter. Refer to appropriate service manual.
- Disconnect the Intake Flap Motor - V157- electrical harness connector.



- Switch the ignition on.
- Using a multimeter, check the Intake Flap Motor - V157- electrical harness connector terminals 1 to 2 for voltage.

Specified value: about 12 V

- Switch ignition off.

If the specified value was not obtained:

- Check and/or repair wiring as required.

If the specified value was obtained:

- Using a multimeter, check the Intake Flap Motor - V157- electrical harness connector terminals 3 to 4 for voltage.

Specified value: 4.5V

If the specified value was not obtained:

- Check and/or repair wiring as required.

If the specified value was obtained:

Checking internal resistance

- Using a multimeter, check the Intake Flap Motor - V157- electrical terminals 1 to 2 for resistance.

Specified value: 244 [+/- 40] Ω (at approx. 20° C)

If the specified values were not obtained:

- Replace the Intake Flap Motor - V157- . Refer to appropriate service manual.

If the specified value was obtained:

Checking wiring

- Remove the Motronic Engine Control Module (ECM) - J623- . Refer to appropriate service manual.
- Using a multimeter, check the Intake Flap Motor - V157- electrical harness connector terminals to the Motor für Saugrohrklappe (01238) - V157- Motronic Engine Control Module (ECM) - J623- electrical harness connector T60 terminals for an open circuit.

Intake Flap Motor - V157- electrical harness connector terminals	Motronic Engine Control Module (ECM) - J623- electrical connector terminals T60, T94
1	T94-4
2	The appropriate fuse in the fuse panel
3	T60-60
4	T60-25

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to Battery (+), or an open circuit.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:



- Replace the Motronic Engine Control Module (ECM) - J623- . Refer to appropriate service manual.
- Install the engine cover with air filter. Refer to appropriate service manual.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

2.3 Mass Air Flow Sensor, Checking



Note

Use only gold-plated terminals when servicing terminals in harness connector of Mass Air Flow (MAF) Sensor - G70- .

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring diagram.

Test requirements

- The Mass Air Flow (MAF) Sensor - G70- fuse OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Coolant Temperature at least 80° C.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to [⇒ "3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Connect the scan tool.
- Start engine and let it run at idle.
- Using the scan tool, Check the air flow quantity of the Mass Air Flow (MAF) Sensor - G70- at idle:

Diagnostic text	Specified value
Air flow quantity at Mass Air Flow (MAF) sensor	
• Engine running at idle	2.00 to 5.00 g/sec.



- End diagnosis and switch ignition off.

If specified value was not obtained:

Checking voltage supply

- Disconnect the Mass Air Flow (MAF) Sensor - G70- electrical harness connector -1-.
- Start the engine and let it run at idle.
- Using a multimeter, check the Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminal 2 to engine Ground (GND).

Specified value: battery voltage.

- Switch the ignition off.

If specified value was not obtained:

- Check the Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminal 2 to the Power Supply Relay (terminal 30, B+) - J317- terminal 6/87 for an open circuit.

Specified value: 1.5 Ω max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+) and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

Checking 5 volt reference

- Start the engine and let it run at idle.
- Using a multimeter, check the Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminal 3 to engine Ground (GND).

Specified value: 5V

- Switch the ignition off.

If specified value was not obtained:

- Check the Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminal 3 to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T80/4 for an open circuit.

Specified value: 1.5 Ω max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+) and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and if the voltage supply was OK:

Checking Ground (GND)

- Using a multimeter, check the Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminal 5 to engine Ground (GND) for resistance.

Specified value: 1.5 Ω max.



If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+) and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and if the voltage supply was OK:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Using a multimeter, check the Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T80 for an open circuit.

Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
3	49
4	30
5	68

Specified value: 1.5 Ω max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+) and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and if the voltage supply was OK:

- Replace Mass Air Flow (MAF) Sensor - G70- .
- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .



- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

2.4 Intake Air Temperature Sensor, Checking



Note

Use only gold-plated terminals when servicing terminals in the electrical harness connector of the Intake Air Temperature (IAT) Sensor - G72- .



Note

Intake Air Temperature (IAT) Sensor - G72- and Manifold Absolute Pressure (MAP) Sensor - G71- are contained in the same housing. Replacing one or the other replaces both. ALH Engine only.

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to [⇒ "3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, check the intake air temperature:

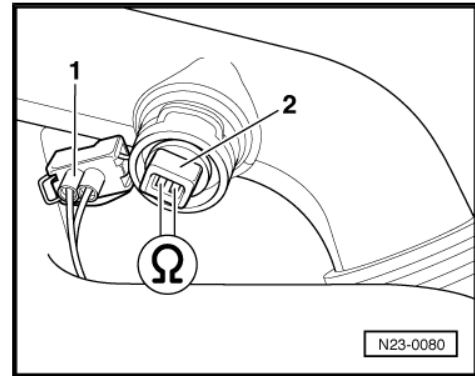
Diagnostic text	Specified value
Intake Air Temperature (IAT)	approx. ambient air temperature

If the specified value is not obtained:



Checking internal resistance

- Disconnect the Intake Air Temperature (IAT) Sensor - G72- electrical harness connector -1-.
- Using a multimeter , check the Intake Air Temperature (IAT) Sensor - G72- -2- terminals 1 to 2 for resistance.



Use the chart below for the specified values:

- ◆ Area A: Resistance values 0 to 50° C (32° - 122° F).
- ◆ Area B: Resistance values 50 to 100° C (122° - 212° F).

Examples:

- ◆ Range A, 30° C (86° F) equals a resistance of 1500 to 2000 Ω
- ◆ Range B, 80° C (176° F) equals a resistance of 275 to 375 Ω

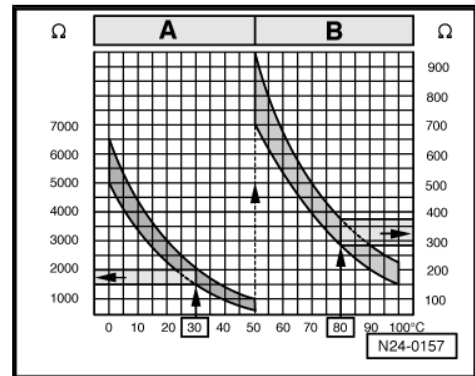
If any of the specified values are not obtained:

- Replace the Intake Air Temperature (IAT) Sensor - G72- .

If the specified values were obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .





- Using a Multimeter , check the Intake Air Temperature (IAT) Sensor - G72- electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for resistance.

Intake Air Temperature (IAT) Sensor - G72- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
1	52
2	73

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ “4.4 Engine Control Module, Replacing”, page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

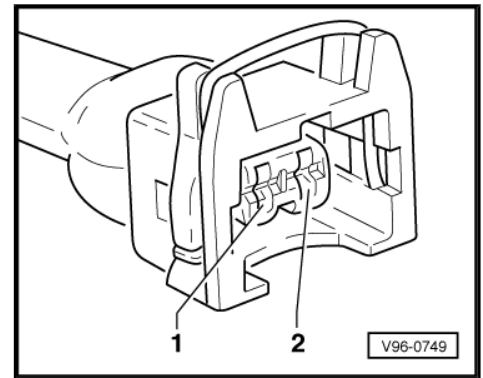
- 1 - Check the DTC memory. Refer to [⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

End of diagnosis

2.5 Manifold Absolute Pressure Sensor, Checking

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.





- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.
- Engine cold.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Perform the function test in diagnostic mode 06. Refer to ⇒ ["2.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions", page 7](#) .

If the specified values were not obtained:

- Check the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector for damage, corrosion, loose or broken terminals.

Manifold Absolute Pressure (MAP) Sensor - G71-	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
3	31
4	71

If no malfunction is detected with the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ ["4.4 Engine Control Module, Replacing", page 100](#) .
- Erase the DTC memory. Refer to ⇒ ["2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to ⇒ ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ ["2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ ["4 Readiness Code", page 16](#) .



End of diagnosis

2.6 Engine Coolant Temperature Sensor, Checking



WARNING

- ◆ *Cooling system is under pressure.*
- ◆ *Danger of scalding when opening!*



Note

Use only gold-plated terminals when servicing terminals in the electrical harness connector of Engine Coolant Temperature (ECT) Sensor - G62- .

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ jumper wire .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.
- Engine cold.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

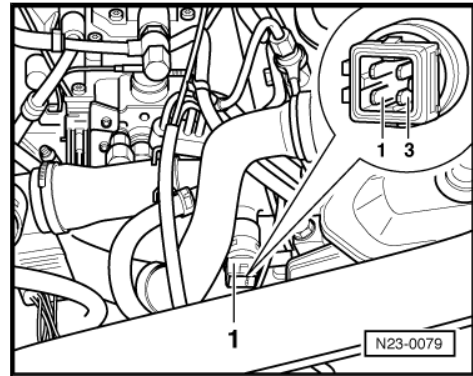
- Perform the function test in diagnostic mode 06. Refer to ⇒ ["2.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions", page 7](#) .

If the specified values were not obtained:



Checking internal resistance

- Disconnect the Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector -1-.
- Using a multimeter , check the Engine Coolant Temperature (ECT) Sensor - G62- terminals 1 to 3 for resistance.



Use the chart below for the specified values:

- ◆ Area A: Resistance values 0 to 50° C (32° - 122° F).
- ◆ Area B: Resistance values 50 to 100° C (122° - 212° F).

Examples:

- ◆ Range A, 30° C (86° F) equals a resistance of 1500 to 2000 Ω
- ◆ Range B, 80° C (176° F) equals a resistance of 275 to 375 Ω

If any of the specified values were not obtained:

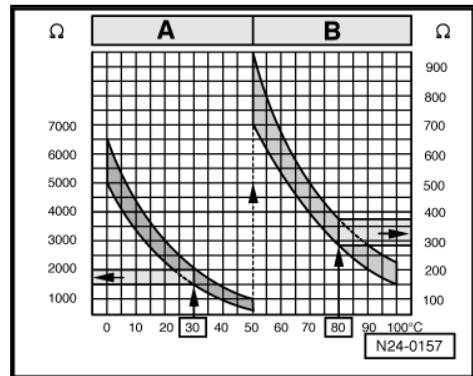
- Replace the Engine Coolant Temperature (ECT) Sensor - G62- .

If the specified values were obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ["4.4 Engine Control Module, Replacing", page 100](#) .

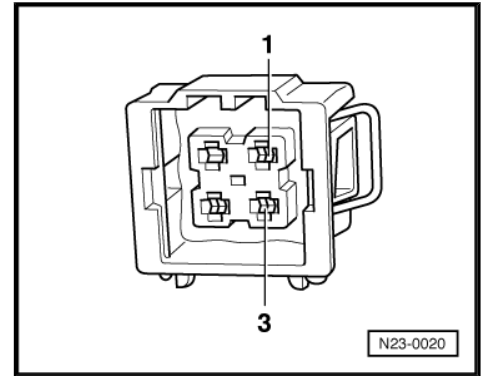
Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>





- Using a Multimeter , check the Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for resistance.

Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
4	104
3	112
2	GND



Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis

2.7 Engine Speed Sensor, Checking

The Engine Speed (RPM) Sensor - G28- provides the engine speed signal. If the Engine Speed (RPM) Sensor - G28- fails, the engine continues to run using a back up signal from the Needle Lift Sensor - G80- .



Note

Use only gold-plated terminals when servicing terminals in the electrical harness connector of the Engine Speed (RPM) Sensor - G28- .

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Function

The Engine Speed (RPM) Sensor - G28- detects RPM and reference marks. Without an engine speed signal, the engine will not start.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [“3.1 Preliminary Check”, page 15](#) .

Start diagnosis

- Disconnect the Engine Speed (RPM) Sensor - G28- electrical harness connector.

Checking internal resistance

- Using a multimeter , check the Engine Speed (RPM) Sensor - G28- terminals 1 to 2 for resistance.

Specified value: 0.7 to 1000k Ω .

- Check Engine Speed (RPM) Sensor - G28- terminals 1 to 3 and 2 to 3 for short circuits.

Specified value: ∞ (infinity)

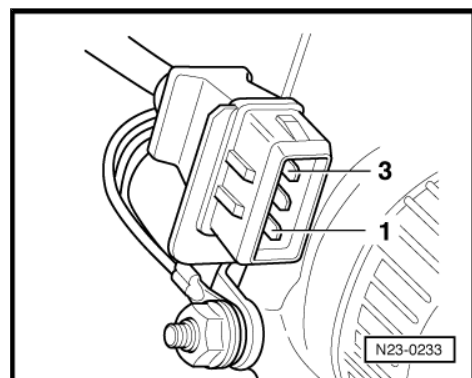
If any of the specified values are not obtained:

- Replace the Engine Speed (RPM) Sensor - G28- .

If the specified values are obtained:

Checking wiring

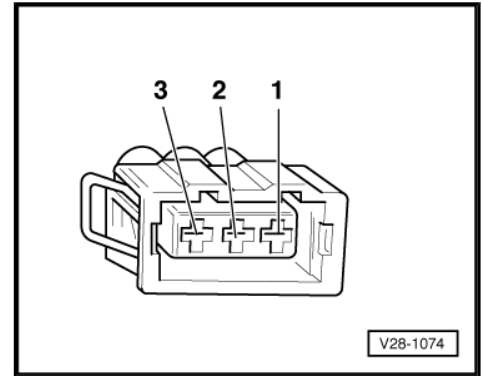
- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ [“4.4 Engine Control Module, Replacing”, page 100](#) .





- Using a Multimeter , check the Engine Speed (RPM) Sensor - G28- electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for an open circuit.

Engine Speed (RPM) Sensor - G28- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
1	102
2	110
3	Ground (GND)



Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

- Remove the Engine Speed (RPM) Sensor - G28- and check the sensor wheel for proper seating, damage and run-out.

If the sensor wheel is OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis

2.8 Throttle Position Sensor from MY 1999/ Closed Throttle Position Switch, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram

Test requirement

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.



- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.



Note

Use only gold-plated terminals when servicing the electrical harness connector terminals in Throttle Position (TP) Sensor - G79-.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Remove the engine cover.

Checking internal resistance

- Disconnect the Throttle Position (TP) Sensor - G79- electrical harness connector.
- Using a multimeter , check the Throttle Position (TP) Sensor - G79- / Closed Throttle Position (CTP) Switch - F60- terminals 1 to 3 for resistance.

Specified value: 1000 to 1500 Ω

- Depress the accelerator pedal.

Specified value: 1000 to 2500 Ω

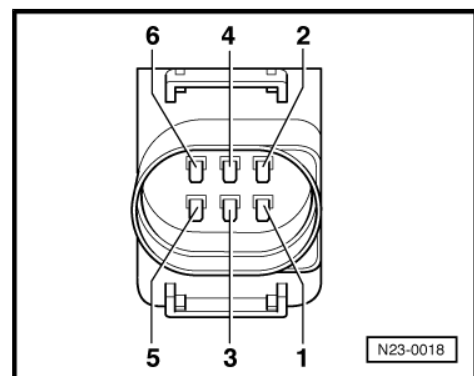
If either specification was not obtained:

- Replace the Throttle Position (TP) Sensor - G79- .

If the specifications were obtained:

Checking wiring

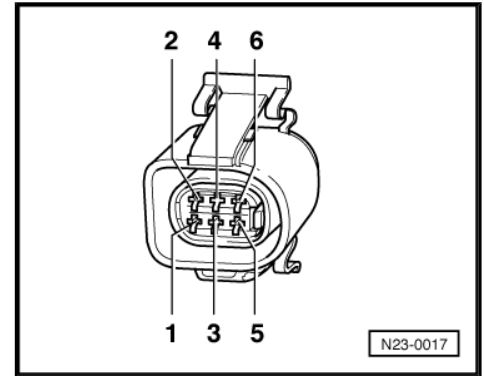
- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ ["4.4 Engine Control Module, Replacing", page 100](#) .





- Using a Multimeter , check the Throttle Position (TP) Sensor - G79- electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical connector for an open circuit.

Throttle Position (TP) Sensor - G79- / Closed Throttle Position (CTP) Switch - F60- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121
1	63
2	12
3	50
4	69
5	70
6	51



Specified value: 1 Ω max.

If the specification is not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and if the voltage supply was OK:

- Replace the Throttle Position (TP) Sensor - G79- / Closed Throttle Position (CTP) Switch - F60- . Refer to Fuel Injection & Ignition System, Repair Group 23.
- Erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ “4.4 Engine Control Module, Replacing”, page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

End diagnosis.



2.9 EGR Vacuum Regulator Solenoid Valve, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- Fuse (on fuse panel) - S234- OK.
- The ignition switched off.



Note

Voltage for the EGR Vacuum Regulator Solenoid Valve - N18- is supplied by the Power Supply Relay (terminal 30, B+) - J317- .

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Disconnect the EGR Vacuum Regulator Solenoid Valve - N18- electrical harness connector .

Checking internal resistance

- Using a Multimeter , check the EGR Vacuum Regulator Solenoid Valve - N18- terminals 1 and 2 for resistance.

Specified value: 14 to 18 Ω .

If the specified value is not obtained:

- Replace the EGR Vacuum Regulator Solenoid Valve - N18- .

If the specification is obtained:

Checking voltage

- Switch the ignition on.
- Using a Multimeter , check the EGR Vacuum Regulator Solenoid Valve - N18- electrical harness connector terminal 1 to Ground (GND) for voltage.

Specified value: Battery (+).

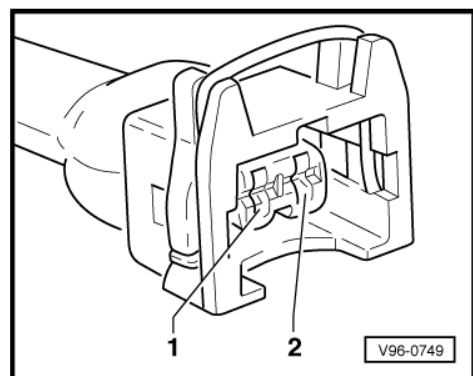
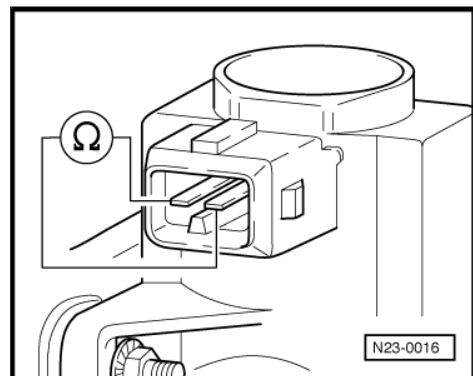
If the specified value was not obtained:

- Check the EGR Vacuum Regulator Solenoid Valve - N18- electrical harness connector terminal 1 to the Power Supply Relay (terminal 30, B+) - J317- socket 6/87 for an for an open circuit or a short circuit.
- Check the wiring connections for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ ["4.4 Engine Control Module, Replacing", page 100](#) .





- Using a Multimeter , check the EGR Vacuum Regulator Solenoid Valve - N18- electrical harness connector terminal to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminal for resistance.

EGR Vacuum Regulator Solenoid Valve - N18- electrical harness connector terminal	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
2	61

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ “4.4 Engine Control Module, Replacing”, page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

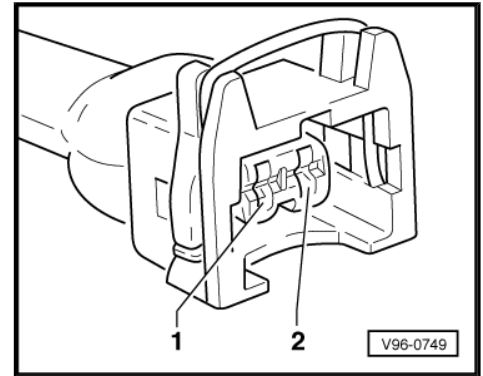
End of diagnosis

2.10 Needle Lift Sensor, Checking

The needle lift sensor signal determines the start of injection during normal operation by closed-loop control based on RPM, load and temperature. If the sensor malfunctions, control switches to open-loop, based on RPM and load.

The Needle Lift Sensor - G80- is part of the cylinder 3 Fuel Injector and cannot be serviced separately.

Special tools and workshop equipment required





- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Disconnect the Needle Lift Sensor - G80- electrical harness connector -1-

Checking internal resistance

- Using a multimeter , check the Needle Lift Sensor - G80- terminals 1 to 2 for resistance.

Specified value: 80 to 120 Ω

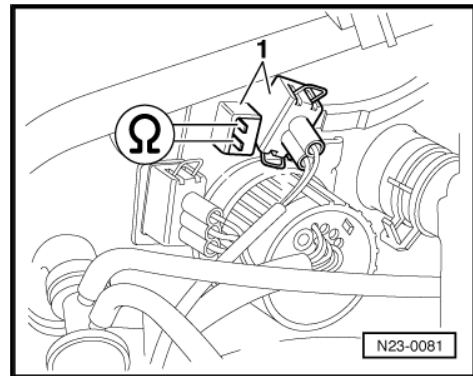
If the specified value was not obtained:

- Replace cylinder 3 Fuel Injector . Refer to Diesel Fuel Injection, Repair Group 23.

If the specified value was obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ ["4.4 Engine Control Module, Replacing", page 100](#) .





- Using a Multimeter , check the Needle Lift Sensor - G80- electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for resistance.

Needle Lift Sensor - G80- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
1	109
2	101

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ “4.4 Engine Control Module, Replacing”, page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

End of diagnosis

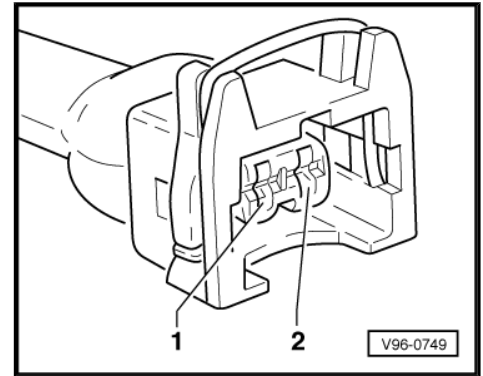
2.11 Cold Start Injector, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.





- The Power Supply Relay (terminal 30, B+) - J317- OK.
- The Fuse (on fuse panel) - S234- OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Disconnect the Cold Start Injector - N108- electrical harness connector.

Checking internal resistance

- Using a multimeter , check the Cold Start Injector - N108- terminals 1 to 2 for resistance.

Specified value: 12 to 20 Ω

If the specified value was not obtained:

- Replace the Cold Start Injector - N108- . Refer to Diesel Fuel Injection, Repair Group 23.

If the specified value was obtained:

Checking voltage

- Switch the ignition on.
- Using a Multimeter , check the Cold Start Injector - N108- electrical harness connector terminal 2 to Ground (GND) for voltage.

Specified value: Battery (+).

If the specified value was not obtained:

- Check the Cold Start Injector - N108- electrical harness connector terminal 2 to the Power Supply Relay (terminal 30, B+) - J317- socket 6/87 for an for an open circuit or a short circuit.
- Check the wiring connections for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ ["4.4 Engine Control Module, Replacing", page 100](#) .
- Using a Multimeter , check the Cold Start Injector - N108- electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for resistance.



Cold Start Injector - N108- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
1	114

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis

2.12 Fuel Cut-Off Valve, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.



- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [“3.1 Preliminary Check”, page 15](#) .

Start diagnosis

- Disconnect the Fuel Cut-Off Valve - N109- electrical harness connector.

Checking voltage

- Switch the ignition on.
- Using a Multimeter , check the Fuel Cut-Off Valve - N109- electrical harness connector terminal 1 to Ground (GND) for voltage.
- Switch the ignition off.

Specified value: Battery (+).

If the specified value was obtained:

- Replace the Fuel Cut-Off Valve - N109- . Refer to Fuel Injection & Ignition System, Repair Group 23.

If the specified value was not obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ [“4.4 Engine Control Module, Replacing”, page 100](#) .
- Using a Multimeter , check the Fuel Cut-Off Valve - N109- electrical harness connector terminal to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminal for resistance.

Fuel Cut-Off Valve - N109- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
1	120

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to ⇒ [“2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ [“4 Readiness Code”, page 16](#) .

- End diagnosis.



If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ “4.4 Engine Control Module, Replacing”, page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

End of diagnosis

2.13 Fuel Injectors, Checking

Special tools and workshop equipment required

- ◆ Fuel Injector Test Stand with pressure gauge .

Test requirements

- ◆ Diesel Fuel Injection Pump OK.
- ◆ Fuel injector removed.

Procedure

- Remove the Fuel Injectors . Refer to Diesel Fuel Injection, Repair Group 23.
- Connect the Fuel Injector to the Fuel Injector Test Stand with pressure gauge .



Note

- ◆ *Always follow the manufacturers instructions for connecting the fuel injector.*
- ◆ *Always follow the manufacturers operating instructions.*
- Using the Fuel Injector Test Stand with pressure gauge , check the Fuel Injector for pressure and leaks.

Specified value: 150 bar (2175 PSI) for 10 seconds.

- Fuel should not leak from the Fuel Injector nozzle.

If the Fuel Injector leaks or does not hold pressure:

- Replace the faulty Fuel Injector . Refer to Diesel Fuel Injection System, Repair Group 23.
- Assembly is performed in the reverse of the removal.



2.14 Positive Crankcase Ventilation Heating Element, Checking



Note

Use only gold-plated terminals when servicing terminals in the electrical harness connector of Positive Crankcase Ventilation (PCV) Heating Element - N79- .

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [“3.1 Preliminary Check”, page 15](#)

Start diagnosis

- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.
- Engine warm.

Checking internal resistance

- Disconnect the Positive Crankcase Ventilation (PCV) Heating Element - N79- electrical harness connector .
- Using a multimeter , check the Positive Crankcase Ventilation (PCV) Heating Element - N79- terminals 1 to 2 for resistance.
Specified value: 25 to 35 Ω (at approx. 20° C)

If the specified value was not obtained:

- Replace the Positive Crankcase Ventilation (PCV) Heating Element - N79- .

If the specified value was obtained:

Checking voltage

Switch the ignition on.

- Using a multimeter , check the Positive Crankcase Ventilation (PCV) Heating Element - N79- electrical connector terminal 1 to Ground (GND) for voltage.

Specified value: battery voltage.

Switch the ignition off.

If the specified value was not obtained:



- Check the wiring from the Positive Crankcase Ventilation (PCV) Heating Element - N79- electrical connector terminal 1 to the Power Supply Relay (terminal 30, B+) - J317- for a short circuit to Ground (GND), or an open circuit.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking Ground (GND)

- Using a multimeter , check the Positive Crankcase Ventilation (PCV) Heating Element - N79- electrical connector terminal 2 to Ground (GND) for resistance.

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

- Replace the Positive Crankcase Ventilation (PCV) Heating Element - N79- . Refer to Repair Manual, repair group 26, Exhaust System, Emission Controls.
- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .

Final procedures

After repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis



3 Diesel Injection Pump, Servicing

The following table provides quick links to all chapters in this section.

⇒ "3.1 Fuel Temperature Sensor, Checking", page 92
⇒ "3.2 Modulating Piston Displacement Sensor, Checking", page 94
⇒ "3.3 Quantity Adjuster, Checking", page 95

The Fuel Temperature Sensor - G81- , Modulating Piston Displacement Sensor - G149- , and the Quantity Adjuster - N146- are part of the Diesel Fuel Injection Pump and cannot be serviced separately.

3.1 Fuel Temperature Sensor, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Perform the function test in diagnostic mode 06. Refer to ⇒ ["2.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions", page 7](#) .

If the specified value was not obtained:

- Disconnect the Diesel Fuel Injection Pump electrical harness connector.

Checking internal resistance

- Using a multimeter , check the Diesel Fuel Injection Pump terminals 4 to 7 for resistance.

Use the chart below for the specified values:

- ◆ Area A: Resistance values 0 to 50° C (32° - 122° F).
- ◆ Area B: Resistance values 50 to 100° C (122° - 212° F).

Examples:

- ◆ Range A, 30° C (86° F) equals a resistance of 1500 to 2000 Ω



- ◆ Range B, 80° C (176° F) equals a resistance of 275 to 375Ω

If any of the specified values are not obtained:

- Replace the Diesel Fuel Injection Pump . Refer to Diesel Fuel Injection, Repair Group 23.

If the specified values were obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Using a Multimeter , check the Diesel Fuel Injection Pump electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for resistance.

Diesel Fuel Injection Pump electrical harness connector T10 terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
4	103
7	111

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .



End of diagnosis

3.2 Modulating Piston Displacement Sensor, Checking

The modulating piston displacement sensor provides the ECM with information on quantity adjuster position, and the ECM then calculates the required amount of fuel for injection.

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .

Start diagnosis

- Disconnect the Diesel Fuel Injection Pump electrical harness connector.

Checking internal resistance

- Using a multimeter , check the Diesel Fuel Injection Pump terminals 1 to 2 and 2 to 3 for resistance.

Specified value: 5 to 7 Ω

If the specified value was not obtained:

- Replace the Diesel Fuel Injection Pump . Refer to Diesel Fuel Injection, Repair Group 23.

If the specified value was obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ ["4.4 Engine Control Module, Replacing", page 100](#) .
- Using a Multimeter , check the Diesel Fuel Injection Pump electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for resistance.

Modulating Piston Displacement Sensor G149, Checking. T10 terminals:	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
1	108
2	106



Modulating Piston Displacement Sensor G149, Checking. T10 terminals:	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
3	99

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis

3.3 Quantity Adjuster, Checking

The Quantity Adjuster - N146- is controlled by the Diesel Direct Fuel Injection (DFI) ECM duty cycle (on-off ratio). The eccentric shaft on the quantity adjuster moves the modulating piston (on the high-pressure piston), regulating the amount of fuel injected.

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- The Power Supply Relay (terminal 30, B+) - J317- OK.



- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [“3.1 Preliminary Check”, page 15](#) .

Start diagnosis

- Perform the function test in diagnostic mode 06. Refer to ⇒ [“2.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions”, page 7](#) .
- Disconnect the Diesel Fuel Injection Pump electrical harness connector.

Checking internal resistance

- Using a multimeter , check the Diesel Fuel Injection Pump terminals 6 to 5 for resistance.

Specified value: 0.5 to 2.5 Ω

If the specified value was not obtained:

- Replace the Diesel Fuel Injection Pump . Refer to Diesel Fuel Injection, Repair Group 23.

If the specified value was obtained:

Checking voltage

- Switch the ignition on.
- Using a Multimeter , check the Diesel Fuel Injection Pump electrical harness connector terminal 5 to Ground (GND) for voltage.
- Switch the ignition off.

Specified value: Battery (+)

If the specified value was not obtained:

- Check the Diesel Fuel Injection Pump electrical harness connector terminal 5 to the Power Supply Relay (terminal 30, B+) - J317- socket 6/87 for an for an open circuit or a short circuit.
- Check the wiring connections for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to ⇒ [“4.4 Engine Control Module, Replacing”, page 100](#) .
- Using a Multimeter , check the Diesel Fuel Injection Pump electrical harness connector terminals to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals for resistance.



Quantity Adjuster N146, Checking	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminals
6	116, 121

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis



4 Engine Control Module

The following table provides quick links to all chapters in this section.

⇒ "4.1 68 Pin Test Box Adapter VAG 1598/19, Installing", page 98
⇒ "4.2 Function", page 98
⇒ "4.3 Voltage Supply, Checking", page 98
⇒ "4.4 Engine Control Module, Replacing", page 100

4.1 68 Pin Test Box Adapter VAG 1598/19, Installing

Test requirements

- Ignition switched off.

Work procedure

When the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector is disconnected, the adaptation values are erased and the DTC memory content remains intact.

Procedure

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to .
- Disconnect the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector.
- Connect the Adapter - 68 Pin - VAG1598/18- to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector.

4.2 Function

Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- regulates fuel injection, Throttle Valve Control Module - J338- , engine speed limitation through fuel injectors as well as On Board Diagnostic (OBD).

4.3 Voltage Supply, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, selector lever in position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.



Test sequence

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- .

Checking voltage

- Using a Multimeter , check the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- socket 2/30 to Ground (GND).

Specified value: battery voltage.

If the specified value was not obtained:

- Check the wiring connections from the Battery to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- socket 2/30 for an open circuit or a short circuit.
- Check the wiring connections for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

- Switch the ignition on.
- Using a Multimeter , check the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- socket 6/87 to Ground (GND).

Specified value: battery voltage.

If the specified value was obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Using a Multimeter , check the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- socket 9/85 to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminal 18 for resistance.

Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- socket terminal	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminal
9/85	18

Specified value: 2.0 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

Checking activation

- Switch the ignition on.
- Using a Multimeter , check the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- socket 6/87 to the Diesel Direct Fuel Injection (DFI)



Engine Control Module (ECM) - J248- electrical harness connector T121 terminal 18 for voltage.

Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- socket terminal	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 terminal
6/87	18

– Switch the ignition off.

Specified value: 0.5 V Max.

If the specified value was obtained:

– Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) Power Supply Relay - J317- .

If the specified value was not obtained:

– Check the wiring connection for an open circuit, short circuit to Battery (+) or Ground (GND).

– Check the wiring connection for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring and voltage supply was not OK:

– Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ “4.4 Engine Control Module, Replacing”, page 100](#) .

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

End of diagnosis

4.4 Engine Control Module, Replacing

Removing



Note

When the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector is disconnected, the adaptation values are erased and the DTC memory content remains intact.

Work procedure

Check the identification of the previous Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- as follows:

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, select “Vehicle information”.



- Select " Calibration Identification" in vehicle information.

The electronic control module identification number will be displayed, e.g. 06A906032NA 4983

- Record the electronic control module identification number.
- End diagnosis and switch the ignition off.

Procedure

- Remove the wiper arms.
- Remove cowl panel. Refer to Rep. Gp 92.
- Disconnect the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector.
- Press securing tab - arrow- to the left and pull Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) out.
- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- .

Installation

Installation is performed in reverse order of removal. Note the following:

Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- reprogramming

- The new Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- and immobilizer must be activated. Refer to the ⇒ Ebahn website for ECM and immobilizer activation instructions.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to ⇒ ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ ["2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ ["4 Readiness Code", page 16](#) .



5 Additional Signals, Checking

The following table provides quick links to all chapters in this section.

⇒ ["5.1 Speed Signal, Checking", page 102](#)

5.1 Speed Signal, Checking

The following procedure requires a test drive. Observe all safety precautions. Refer to ⇒ [page 61](#) .

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirements

- The Speedometer - G21- OK.
- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Function test

- Connect the scan tool.
- Perform a road test with a vehicle speed greater than 5 Km/h.
- Using the scan tool, Check the vehicle speed:

Diagnostic text	Specified value
Vehicle Speed	Approx. Vehicle Speed

- Compare the vehicle speed on the scan tool to the Speedometer - G21- .

Specified value: a difference of no greater than 10%.

If the specified value was not obtained or no speed was displayed:

- Check the wiring from the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121/16 to the Instrument Cluster Control Module - J285- for an open circuit, Short to Battery (+), or to Ground (GND).
- Check the wiring connection for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to ⇒ ["2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .



- 2 - If necessary, erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

End of diagnosis



26 – Exhaust system, Emission controls

1 Exhaust System

For all Exhaust System, Emission control component locations, refer to ⇒ Exhaust System, Emission Controls; Rep. Gr. 26 ; Exhaust System Components, Removing and Installing .

For all Exhaust System, Emission control removal/installation procedures and torque specifications, refer to ⇒ Exhaust System, Emission Controls; Rep. Gr. 26 ; Exhaust System Components, Removing and Installing .

Check the Technical Bulletins for information that may supersede any information included in this manual. Refer to ⇒ EBAHN-Website .



Note

- ◆ *All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through VW. Refer to ⇒ Tool catalog .*
- ◆ *Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.*



2 Exhaust Gas Recirculation System, Servicing

The following table provides quick links to all chapters in this section.

[⇒ "2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking", page 105](#)

2.1 Exhaust Gas Recirculation Valve, Engine Code ALH, Checking

Special tools and workshop equipment required

- ◆ Hand operated Vacuum Pump .

Test requirements

- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ ["3.1 Preliminary Check", page 15](#) .
- Disconnect EGR valve vacuum hose.
- Connect Hand operated Vacuum Pump to the EGR valve vacuum port.
- Using the Hand operated Vacuum Pump , open the EGR valve.
- The diaphragm must move towards the EGR valve vacuum port.
- Disconnect the Hand operated Vacuum Pump from the EGR valve vacuum port opening the EGR valve.
- The diaphragm must move away from the EGR valve vacuum port closing the EGR valve.

If the diaphragm does not move or moves in one direction only:

- Replace the EGR valve. Refer to Engine Mechanical, Repair Group 26.



28 – Ignition/Glow plug System

1 Ignition System, Servicing

The following table provides quick links to all chapters in this section.

⇒ "1.1 General Information", page 106
⇒ "1.2 Safety Precautions", page 107
⇒ "1.3 Glow Plug System, Checking", page 107
⇒ "1.4 Glow Plugs, Checking", page 107
⇒ "1.5 Glow Plug Relay, Checking", page 109

1.1 General Information

For all Ignition/Glow plug system component locations, refer to ⇒ Ignition/Glow Plug System; Rep. Gr. 28 ; Glow Plug System, Checking .

For all Ignition/Glow plug system removal/installation procedures and torque specifications, refer to ⇒ Ignition/Glow Plug System; Rep. Gr. 28 ; Glow Plug System, Checking .

Check the Technical Bulletins for information that may supersede any information included in this manual. Refer to ⇒ EBAHN-Website .



Note

- ◆ *All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through VW. Refer to ⇒ Tool catalog .*
- ◆ *Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.*



1.2 Safety Precautions



WARNING

Observe the following for all installations, especially in the engine compartment due to lack of room:

- ◆ *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *Watch for sufficient clearance to all moving or hot components.*
- ◆ *Fuel system is under pressure! Before opening system, place rags around the connection point. Then release pressure by carefully loosening connection.*
- ◆ *Test equipment must always be secured to the rear seat and operated by a second person.*
- ◆ *Test and measuring equipment that is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.*
- ◆ *Do not touch or disconnect ignition wires when engine is running or turning at starting RPM.*
- ◆ *Only disconnect and reconnect wires for injection and ignition system, including test leads, if the ignition is turned off.*



WARNING

The use of nails, paper clips, or another unauthorized materials to back-probe electrical harness connectors is strictly prohibited and may cause damage to the electrical harness connectors, terminal ends or damage to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.

1.3 Glow Plug System, Checking

Engine code	ALH, BEW (1.9L / 66 kW DFI engine)
Engine idle speed	680 RPM
Engine speed (RPM) limitation	Starting at approx. 4000 RPM
Ignition sequence	1-3-4-2

1.4 Glow Plugs, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Diode test lamp .
- ◆ Wiring diagram.

Test requirements

- Fuse - S39- OK.
- The Glow Plug Relay - J52- OK.



- Battery voltage at least 12.5 volts.
- Ground (GND) connections between engine/transmission/chassis OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [“3.1 Preliminary Check”, page 15](#) .

Start diagnosis

- Disconnect the Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector -1-.



Note

A “cold engine” condition is simulated when the ECT electrical harness connector is disconnected and the ignition is switched on for the appropriate glow period.

Checking voltage supply

- Disconnect the Glow Plug electrical connectors.
- Using a Multimeter , check each Glow Plug electrical connector, in sequence, from 1 to 4, to Ground (GND) for voltage.

Specified value: Battery voltage for 20 seconds.

If the specified value is not obtained:

- Using a Multimeter , check each Glow Plug electrical harness to the Glow Plug Relay - J52- socket 4 & 6 for resistance.

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring from the Glow Plug electrical harness to the Glow Plug Relay - J52- socket 4 & 6 for an open circuit, short circuit to each other or to Battery (+) or Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring and the voltage supply was not OK:

- Check the Glow Plug Relay - J52- . Refer to ⇒ [“1.5 Glow Plug Relay, Checking”, page 109](#) .

If no malfunction is detected in the wiring and the voltage supply was OK:



Checking Glow Plug

- Using a Diode test lamp , check the Glow Plug from Battery (+) to each individual Glow Plug .

The Diode test lamp must light up.

If the Diode test lamp does not light up:

- Replace the faulty Glow Plug .
- Perform a road test to verify repair.

If the fault does not return:

Repair complete, Generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

- End diagnosis.

If the fault does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Recheck the voltage supply.
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

End diagnosis.

1.5 Glow Plug Relay, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ wiring diagrams.

Test requirements

- The fuse for the engine electronics OK.
- The Ground (GND) connections at the engine and transmission OK.
- The battery voltage at least 12.5 V.
- The generator OK.

Test procedure

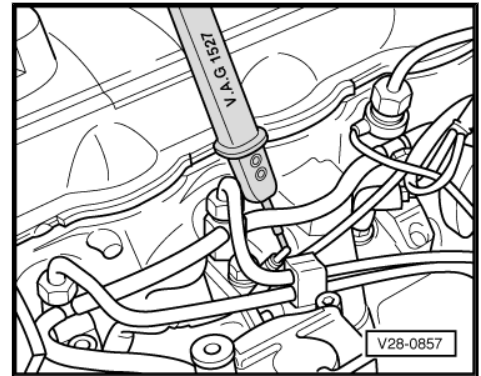
- Perform a preliminary check to verify the customers complaint. Refer to [⇒ “3.1 Preliminary Check”, page 15](#)

Start diagnosis

- Using a Multimeter , check the following wiring connection for voltage.

Glow Plug Relay - J52-socket	Measure to
2	Engine Ground (GND)

Specified value: 12.5 V





If the specified value was not obtained:

- Using a Multimeter , check the Glow Plug Relay - J52- socket 2 to the Battery (+) for an open circuit or short to Ground (GND).
- Check the electrical harness connectors for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking relay activation

- Switch the ignition on.
- Using a Multimeter , check the following wiring connection for voltage.

Glow Plug Relay - J52-socket	Measure to
4	Engine Ground (GND)

Specified value: 12.5. battery voltage.

- Switch the ignition off.

If the specified value was not obtained:

- Using a Multimeter , check the Glow Plug Relay - J52- socket 2/86 to the Ignition/Starter Switch - D- electrical harness connector terminal for an open circuit.

Specified value: 1.5 Ω.

If the specified value was not obtained:

- Check the Glow Plug Relay - J52- socket 28/15 to the Ignition/Starter Switch - D- electrical harness connector terminal for an open circuit or a short to Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking Ground (GND)

- Using a Multimeter , check the Glow Plug Relay - J52- socket 3/85 to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector terminal T80/50 for an open circuit.

Specified value: 1.5 Ω.

If the specified value was not obtained:

- Check the Glow Plug Relay - J52- socket 3/85 to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector terminal T80/50 for an open circuit or a short to Ground (GND).
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the wiring connection.

If no malfunctions are found in the wiring and the voltage supply was OK:

- Replace the Glow Plug Relay - J52- .
- Perform a road test to verify repair.



If the fault does not return:

Repair complete, Generate readiness code. Refer to
⇒ [“4 Readiness Code”, page 16](#) .

– End diagnosis.

If the fault does return and no malfunction is detected in the wiring
and the voltage supply was OK:

– Replace the Diesel Direct Fuel Injection (DFI) Engine Control
Module (ECM) - J248- . Refer to
⇒ [“4.4 Engine Control Module, Replacing”, page 100](#) .

– Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed
in the following sequence:

- 1 - Check the DTC memory. Refer to
⇒ [“2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to
⇒ [“2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - If the DTC memory was erased, generate readiness code.
Refer to ⇒ [“4 Readiness Code”, page 16](#) .

End diagnosis.



38 – Automatic Transmission - Gears, Hydraulic Controls

1 Automatic Transmission Electrical Components, Checking

The following table provides quick links to all chapters in this section.

⇒ "1.1 Multi-Function Transmission Range Switch, Checking", page 113
⇒ "1.2 Transmission Vehicle Speed Sensor, Checking", page 115
⇒ "1.3 Vehicle Speed Sensor, Checking", page 117
⇒ "1.4 Transmission Fluid Temperature Sensor, Checking", page 119
⇒ "1.5 Solenoid Valves in Valve Body, Checking", page 120

For all Automatic Transmission component locations, refer to ⇒ Automatic Transmission-Controls-Housing; Rep. Gr. 37 ; Automatic Transmission 01M, Checking Electrical Components .

For all Automatic Transmission system removal/installation procedures and torque specifications, refer to ⇒ Automatic Transmission-Controls-Housing; Rep. Gr. 37 ; Automatic Transmission 01M, Checking Electrical Components .

Check the Technical Bulletins for information that may supersede any information included in this manual. Refer to ⇒ EBAHN-Website .



Note

- ◆ *All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through VW. Refer to ⇒ Tool catalog .*
- ◆ *Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.*
- ◆ *Certainly you have received an electrical shock once before when touching something made out of metal. The reason for this is the electrostatic charge of the human body. This charge can lead to functional problems by touching the electrical components of the transmission and selector lever mechanism. Touch a grounded object, e.g. a water pipe or a hoist, before working on the electrical components!*
- ◆ *Do not make direct contact on electrical harness connector terminals!*
- ◆ *If special testing equipment is required during road test, note the following:*



Safety precautions



WARNING

Observe the following for all installations, especially in engine compartment due to lack of room:

- ◆ *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- ◆ *Watch for sufficient clearance to all moving or hot components.*
- ◆ *Shift selector lever into position -P- and engage parking brake before working with the engine running.*



WARNING

- ◆ *Test equipment must always be secured to the rear seat and operated by a second person.*

If test and measuring equipment is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.

The use of nails, paper clips, or another unauthorized materials to back-probe electrical harness connectors is strictly prohibited and may cause damage to the electrical harness connectors, terminal ends or damage to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.

1.1 Multi-Function Transmission Range Switch, Checking

Special tools and workshop equipment required

- ◆ Multimeter
- ◆ Wiring diagram

Requirements

- Fuse - SC39- OK.
- The Control Module with indicator unit in the Instrument Cluster Control Module - J285- must be OK.
- The selector lever cable adjustment OK.
- The battery voltage must be at least 12.5 Volts.
- All electrical consumers must be switched off.
- The parking brake must be engaged.
- The selector lever must be in the "P" position.
- The Ground (GND) connections to transmission must be OK.
- Ignition switched off

Test procedure

- Perform a preliminary check to verify the customers complaint.
Refer to ⇒ ["3.1 Preliminary Check", page 15](#)



Start diagnosis

- Switch the ignition on.
- Depress the brake pedal and maintain depressed.
- Shift the selector lever into all positions.

The selector lever position must correspond to the display of the Control Module with the indicator unit in the Instrument Cluster Control Module - J285- .

- Switch the ignition off.

If the selector lever position does not correspond to the display of the Control Module with indicator unit in the Instrument Cluster Control Module - J285- :

- Disconnect the Multi-Function Transmission Range (TR) Switch - F125- electrical harness connector -2-.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- Repair any damage found to the electrical harness connector.

If the electrical harness connector is not OK:

- Repair the malfunction.

If the electrical harness connector is OK:

Checking voltage

- Switch the ignition on.
- Using a multimeter , check the Multi-Function Transmission Range (TR) Switch - F125- electrical harness connector terminal 2 to Ground (GND) for voltage.

Specified value, Battery voltage.

- Switch the ignition off.

If the specified value was not obtained:

- Check the wiring from the Multi-Function Transmission Range (TR) Switch - F125- electrical harness connector terminal 2 to the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminal 40 for an open circuit, short to ground (GND) or a short to Battery (+).
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Checking wiring

- Remove the Transmission Control Module (TCM) - J217- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..
- Using a multimeter , check the Multi-Function Transmission Range (TR) Switch - F125- electrical harness connector terminals to the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminals for an open circuit.

Multi-Function Transmission Range (TR) Switch - F125- electrical harness connector terminals	Transmission Control Module (TCM) - J217- electrical connector T68 terminals
1	63
2	40
3	1



Multi-Function Transmission Range (TR) Switch - F125- electrical harness connector terminals	Transmission Control Module (TCM) - J217- electrical connector T68 terminals
4	empty
5	18
6	62

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.

If no malfunction was found in the wiring and the resistance was not OK:

- Replace the Multi-Function Transmission Range (TR) Switch - F125- . For all Automatic Transmission system removal/installation procedures and torque specifications. Refer to Automatic Transmissions, Repair Group 38

If no malfunction is found in the wiring and the resistance was OK:

- Replace the Transmission Control Module (TCM) - J217- . For all Automatic Transmission system removal/installation procedures and torque specifications. Refer to Automatic Transmissions, Repair Group 38.
- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

- 1- Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2- If necessary, erase DTC memory of the Transmission Control Module (TCM) - J217- . [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3- Generate readiness code. [⇒ "4 Readiness Code", page 16](#) .

End diagnosis.

1.2 Transmission Vehicle Speed Sensor, Checking

Special tools and workshop equipment required

- ◆ Multimeter



◆ Wiring diagram

Requirements

- The Transmission Vehicle Speed Sensor (VSS) - G38- fuse OK.
- The battery voltage must be at least 12.5 Volts.
- All electrical consumers must be switched off.
- The parking brake must be engaged.
- The selector lever must be in the “P” position.
- The Ground (GND) connections to transmission must be OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [“3.1 Preliminary Check”, page 15](#)

Start diagnosis

- Disconnect the Transmission Vehicle Speed Sensor (VSS) - G38- electrical harness connector -arrow-.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- Repair any damage found to the electrical harness connector.

If the electrical harness connector is not OK:

- Repair the malfunction.

If the electrical harness connector is OK:

Checking wiring

- Remove the Transmission Control Module (TCM) - J217- . ⇒ [“2.3 Transmission Control Module, Replacing”, page 127](#) .
- Using a multimeter , check the Transmission Vehicle Speed Sensor (VSS) - G38- electrical harness connector terminals to the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminals for an open circuit.

Transmission Vehicle Speed Sensor (VSS) - G38- electrical harness connector terminal	Transmission Control Module (TCM) - J217- electrical connector T68 terminals
1	66
2	21

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring and the resistance was not OK:

- Replace the Transmission Vehicle Speed Sensor (VSS) - G38- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..

If no malfunction is found in the wiring and the resistance was OK:



- Replace the Transmission Control Module (TCM) - J217- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..
- Erase the DTC memory. Refer to [⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ “4 Readiness Code”, page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ “4.4 Engine Control Module, Replacing”, page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

- 1 - Check the DTC memory.
[⇒ “2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase DTC memory of the Transmission Control Module (TCM) - J217- .
[⇒ “2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - Generate readiness code.
[⇒ “4 Readiness Code”, page 16](#) .

1.3 Vehicle Speed Sensor, Checking

Special tools and workshop equipment required

- ◆ Multimeter
- ◆ Wiring diagram

Requirements

- The Vehicle Speed Sensor (VSS) - G68- fuse OK.
- The battery voltage must be at least 12.5 Volts.
- All electrical consumers must be switched off.
- The parking brake must be engaged.
- The selector lever must be in the “P” position.
- The Ground (GND) connections to transmission must be OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to [⇒ “3.1 Preliminary Check”, page 15](#)

Start diagnosis

- Disconnect the Vehicle Speed Sensor (VSS) - G68- electrical harness connector -1-.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- Repair any damage found to the electrical harness connector.

If the electrical harness connector is not OK:



- Repair the malfunction.

If the electrical harness connector is OK:

Checking wiring

- Remove the Transmission Control Module (TCM) - J217- .
⇒ [“2.3 Transmission Control Module, Replacing”, page 127](#) .
- Using a multimeter , check the Vehicle Speed Sensor (VSS) - G68- electrical harness connector terminals to the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminals for an open circuit.

Vehicle Speed Sensor (VSS) - G68- electrical harness connector terminal	Transmission Control Module (TCM) - J217- electrical connector T68 terminals
1	65
2	20
3	43

Specified value: 1.5 Ω Max.

If the specification was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring and the resistance was not OK:

- Replace the Vehicle Speed Sensor (VSS) - G68- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..

If no malfunction is found in the wiring and the resistance was OK:

- Replace the Transmission Control Module (TCM) - J217- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..
- Erase the DTC memory. Refer to
⇒ [“2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to
⇒ [“4 Readiness Code”, page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to
⇒ [“4.4 Engine Control Module, Replacing”, page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

- 1 - Check the DTC memory. Refer to
⇒ [“2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase DTC memory of the Transmission Control Module (TCM) - J217- .
⇒ [“2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .



- 3 - Generate readiness code.
⇒ [“4 Readiness Code”, page 16](#) .

1.4 Transmission Fluid Temperature Sensor, Checking

Special tools and workshop equipment required

- ◆ Multimeter
- ◆ Wiring diagram

Requirements

- The Transmission Fluid Temperature Sensor - G93- fuse OK.
- The battery voltage must be at least 12.5 Volts.
- All electrical consumers must be switched off.
- The parking brake must be engaged.
- The selector lever must be in the “P” position.
- The Ground (GND) connections to transmission must be OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint.
Refer to ⇒ [“3.1 Preliminary Check”, page 15](#)

Start diagnosis

- Disconnect the Transmission Fluid Temperature Sensor - G93- electrical harness connector -1-.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- Repair any damage found to the electrical harness connector.

If the electrical harness connector is not OK:

- Repair the malfunction.

If the electrical harness connector is OK:

Checking resistance

- Using a multimeter , check the Transmission Fluid Temperature Sensor - G93- terminals 1 to 12 for resistance.

ATF Temperature	Specified Values
Approx. - 30° C	37.0 - 51.0 KΩ
Approx. 10° C	5 - 8 KΩ
Approx. 25° C	3.0 - 5.0 KΩ
Approx. 110° C	230.0 - 265.0 KΩ
Approx. 145° C	100.0 - 120.0 KΩ

If any of the specified values are not obtained:

- Replace the Transmission Fluid Temperature Sensor - G93- .
For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..

If the specified values are obtained:

Checking wiring

- Remove the Transmission Control Module (TCM) - J217- .
⇒ [“2.3 Transmission Control Module, Replacing”, page 127](#) .



- Using a multimeter , check the Transmission Fluid Temperature Sensor - G93- electrical harness connector terminals to the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminals for an open circuit.

Transmission Fluid Temperature Sensor - G93- electrical harness connector terminal	Transmission Control Module (TCM) - J217- electrical connector T68 terminals
12	6
1	67

Specified value: 1.5 Ω Max.

If the specified value was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring and the resistance was not OK:

- Replace the Transmission Fluid Temperature Sensor - G93- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..

If no malfunction is found in the wiring and the resistance was OK:

- Replace the Transmission Control Module (TCM) - J217- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..
- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase DTC memory of the Transmission Control Module (TCM) - J217- . [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - Generate readiness code. [⇒ "4 Readiness Code", page 16](#) .

1.5 Solenoid Valves in Valve Body, Checking

This procedure is used to diagnose all Solenoid Valves in the valve body.



Special tools and workshop equipment required

- ◆ Multimeter
- ◆
- ◆ Wiring diagram

Requirements

- The Solenoid Valve fuses OK.
- The battery voltage must be at least 12.5 Volts.
- All electrical consumers must be switched off.
- The parking brake must be engaged.
- The selector lever must be in the "P" position.
- The Ground (GND) connections to transmission must be OK.
- Ignition switched off.

Test procedure

- Perform a preliminary check to verify the customers complaint.
 Refer to ⇒ ["3.1 Preliminary Check", page 15](#)

Start diagnosis

- Disconnect the Solenoid Valve electrical harness connector -2-.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- Repair any damage found to the electrical harness connector.

If the electrical harness connector is not OK:

- Repair the malfunction.

If the electrical harness connector is OK:

Checking resistance

- Using a multimeter , check the Solenoid Valve terminals 1 to 2 at the Solenoid Valve electrical harness connector for resistance.

Solenoid Valve	Electrical Harness Connector Terminal	Specified Value (Approx. 20° C)
Solenoid Valve 1 - N88-	1 to Ground (GND)	10.0 - 16.0 Ω
Solenoid Valve 2 - N89-	2 to Ground (GND)	10.0 - 16.0 Ω
Solenoid Valve 3 - N90-	7 to 8	4.0 - 8.0 Ω
Solenoid Valve 4 - N91-	11 to 12	4.0 - 8.0 Ω
Solenoid Valve 5 - N92-	3 to 4	4.0 - 8.0 Ω
Solenoid Valve 6 - N93-	13 to 14	4.0 - 8.0 Ω
Solenoid Valve 7 - N94-	5 to 6	4.0 - 8.0 Ω

If any of the specified values are not obtained:

- Replace the faulty Solenoid Valve . For all Automatic Transmission system removal/installation procedures and torque

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specifications, refer to Automatic Transmissions, Repair Group 38..

If the specified values are obtained:

Checking wiring

- Remove the Transmission Control Module (TCM) - J217- .
⇒ ["2.3 Transmission Control Module, Replacing", page 127](#) .
- Using a multimeter , check the Solenoid Valve electrical harness connector terminals to the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminals for an open circuit.

Solenoid Valve	Electrical Har- ness Connector Terminal	Transmission Control Module (TCM) - J217- electrical connector T80 terminals
Solenoid Valve 1 - N88-	1	67
	3	55
Solenoid Valve 2 - N89-	4	54
Solenoid Valve 3 - N90-	5	9
Solenoid Valve 4 - N91-	6	47
Solenoid Valve 5 - N92-	7	56
Solenoid Valve 6 - N93-	2	22
	8	58
Solenoid Valve 7 - N94-	10	10

Specified value: 1.5 Ω Max.

If the specified value was not obtained:

- Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring and the resistance was not OK:

- Replace the faulty Solenoid Valve . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..

If no malfunction is found in the wiring and the resistance was OK:

- Replace the Transmission Control Module (TCM) - J217- . For all Automatic Transmission system removal/installation procedures and torque specifications, refer to Automatic Transmissions, Repair Group 38..
- Erase the DTC memory. Refer to
⇒ ["2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to
⇒ ["4 Readiness Code", page 16](#) .

- End diagnosis.



If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

- Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .If necessary, erase DTC memory of the Transmission Control Module (TCM) - J217- .
[⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Generate readiness code. [⇒ "4 Readiness Code", page 16](#)



2 Transmission Control Module

The following table provides quick links to all chapters in this section.

⇒ "2.1 Function", page 124
⇒ "2.2 Transmission Control Module Voltage Supply, Checking", page 124
⇒ "2.3 Transmission Control Module, Replacing", page 127

2.1 Function

The Transmission Control Module (TCM) - J217- receives information from the components that affect the shifts and forwards this information to the pressure regulator valves of the valve body, which control the slide valves in the valve body.

2.2 Transmission Control Module Voltage Supply, Checking

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Requirements

- Fuse - S15- OK.
- The battery voltage must be at least 12.5 volts.
- The Ground (GND) connections at the transmission OK.
- The parking brake engaged.
- The selector lever of automatic transmission in position "P".
- All electrical consumers switched off.
- The ignition switched off.

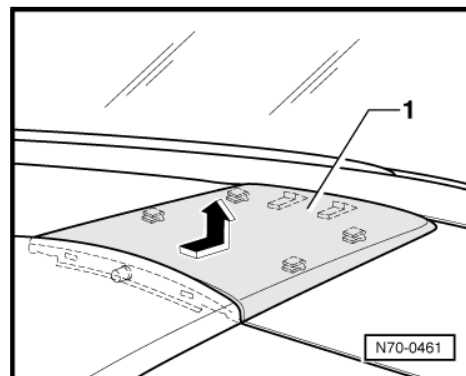
Test procedure

- Perform a preliminary check to verify the customers complaint.
Refer to ⇒ ["3.1 Preliminary Check", page 15](#)

Start diagnosis

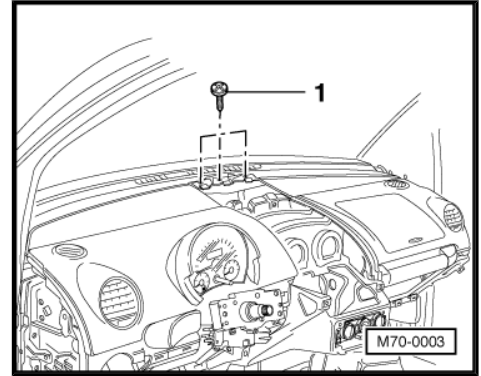
Removal

- Remove the center dash panel -1- in the direction of the -arrow-.
- Remove the right upper dashboard panel.

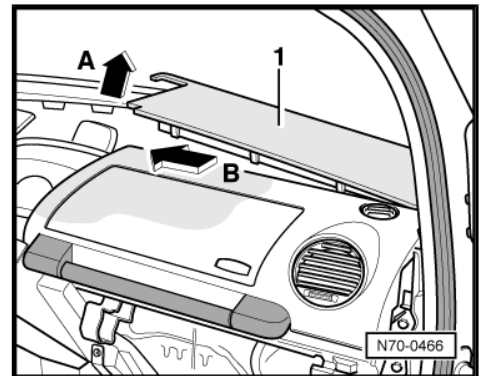




- Remove the three center screws -1-



- Remove the right upper dashboard panel -1- in the direction of -arrow A- and -arrow B-.
- Pull the Transmission Control Module (TCM) - J217- electrical harness electrical connector -1- retaining tab in the direction of the -arrow- and remove from the Transmission Control Module (TCM) - J217- -2-.





- Remove the retaining nuts -3- and the Transmission Control Module (TCM) - J217- -2- in the direction of the -arrow-.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- Repair any damage found to the electrical harness connector.

If the electrical harness connector is not OK:

- Repair the malfunction.

If the electrical harness connector is OK:

Checking voltage

- Switch the ignition on.
- Using a Multimeter , check the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminal 45 to Ground (GND) for voltage.

Specified value: battery voltage.

- Switch the ignition off.

If the specified value was not obtained:

- Check the wiring from the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminal 45 to the fuse S15 for an open circuit or a short circuit.
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Checking Ground (GND)

- Ensure key is off.
- Using a Multimeter , check the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminals 1 to Ground (GND) for resistance.

Specified value: 1.5 Ω

If the specification was not obtained:

- Check the wiring for a an open circuit.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

- Replace the Transmission Control Module (TCM) - J217- . Refer to [⇒ "2.3 Transmission Control Module, Replacing", page 127](#) .
- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Perform a road test to verify repair.

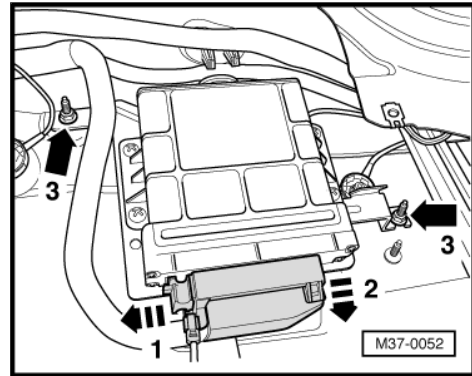
If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.





- Installation is performed in the reverse order of removal. note the following:

Final procedures

- 1 - Check the DTC memory. Refer to
⇒ [“2.3 Diagnostic Mode 03 - Read DTC Memory”, page 5](#) .
- 2 - If necessary, erase DTC memory of the Transmission Control Module (TCM) - J217- .
⇒ [“2.4 Diagnostic Mode 04 - Erase DTC Memory”, page 6](#) .
- 3 - Generate readiness code.
⇒ [“4 Readiness Code”, page 16](#) .

2.3 Transmission Control Module, Replacing



Note

- ◆ *To achieve optimal anti-theft protection for the vehicle, an anti-theft immobilizer was installed. The anti-theft immobilizer is a system for enabling/locking the Transmission Control Module (TCM) - J217- .*
- ◆ *To perform adaptation of the anti-theft immobilizer. Refer to the Ebahn website.*

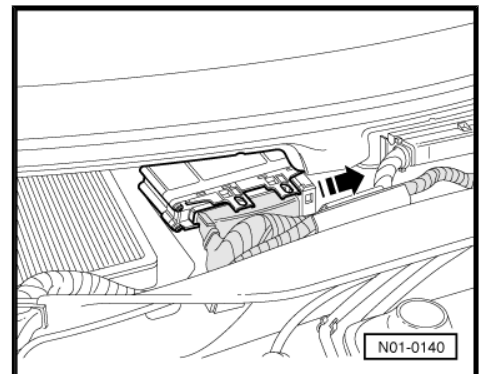
Procedure

Check the identification of the previous Transmission Control Module (TCM) - J217- as follows:

- Connect the scan tool.
- Switch the ignition on.
- Select “Diagnostic mode 9: Vehicle information.”
- Select the “Test-ID 04: Calibration identification”.
- The Transmission Control Module (TCM) - J217- identification will be displayed, e.g.: 09G27750 L 0301
- End diagnosis and switch the ignition off.

Removal

- Remove wiper arms and windshield cowl. Refer to Repair Manual, Electrical Equipment, Repair Gp. 92.
- Open locking mechanism of connector in direction of arrow and disconnect connector from the Transmission Control Module.





- Remove mounting bolts (arrows)
- Remove old Transmission Control Module.

Installation

- Installation is performed in the reverse order of removal. note the following:
- Check the identification of the new Transmission Control Module (TCM) - J217- to ensure it matches the old Transmission Control Module (TCM) - J217- .
- Code the Transmission Control Module (TCM) - J217- .
- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16](#) .

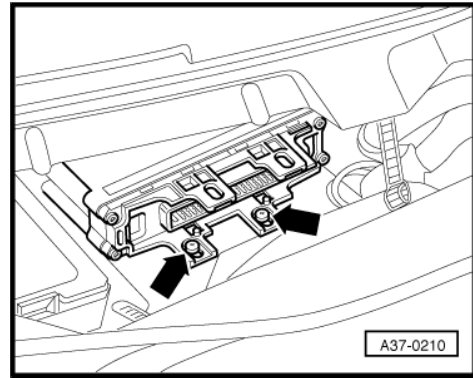
- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
- 2 - If necessary, erase DTC memory of the Transmission Control Module (TCM) - J217- .
[⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
- 3 - Generate readiness code.
[⇒ "4 Readiness Code", page 16](#) .





3 Automatic Transmission, Checking Additional Signals

The following table provides quick links to all chapters in this section.

⇒ [“3.1 CAN-Bus Terminal Resistance,TCM to ECM, Checking”, page 129](#)

3.1 CAN-Bus Terminal Resistance,TCM to ECM, Checking

The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- communicates with all databus capable control modules via a CAN databus.

These databus capable control modules are connected via two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the databus is recognized as a malfunction and stored.

Trouble-free operation of the CAN-bus requires that it have a terminal resistance. The central terminal resistor is located in the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- .

Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

Test requirement

- A CAN-Bus malfunction was recognized.
- The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- fuses OK.
- Battery voltage at least 12.5 V.
- Ignition switched off.

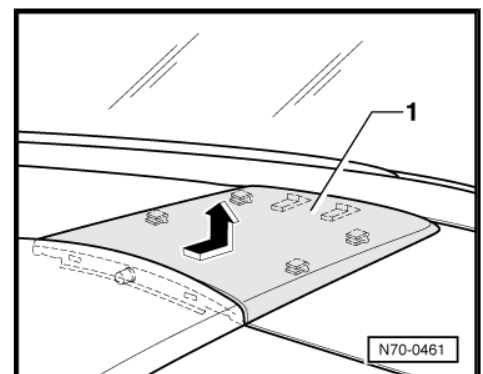
Test procedure

- Perform a preliminary check to verify the customers complaint.
Refer to ⇒ [“3.1 Preliminary Check”, page 15](#)

Start diagnosis

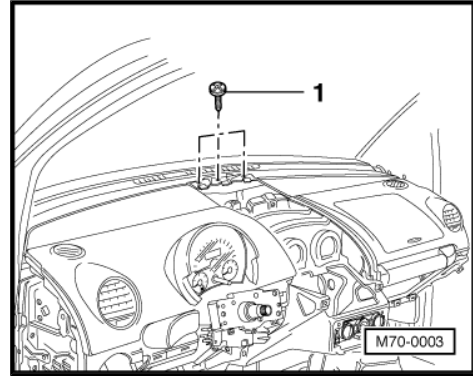
Removal

- Remove the center dash panel -1- in the direction of the -arrow-.
- Remove the right upper dashboard panel.

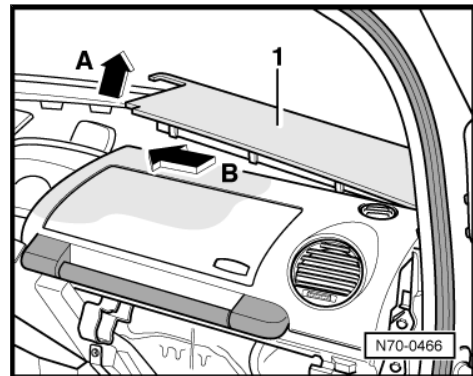




- Remove the three center screws -1-



- Remove the right upper dashboard panel -1- in the direction of -arrow A- and -arrow B-.
- Pull the Transmission Control Module (TCM) - J217- electrical harness electrical connector -1- retaining tab in the direction of the -arrow- and remove from the Transmission Control Module (TCM) - J217- -2-.





- Remove the retaining nuts -3- and the Transmission Control Module (TCM) - J217- -2- in the direction of the -arrow-.

i Note

The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- must remain connected for the following step.

- Using a Multimeter , check the Transmission Control Module (TCM) - J217- electrical harness connector T68 terminals 3 to 25 for resistance.

Specified value: 60 to 72 Ω (at approx. 20° C)

If the specified value was not obtained:

- Check the wiring connection for an open circuit, short circuit to Battery (+) or Ground (GND).
- Check the wiring connection for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

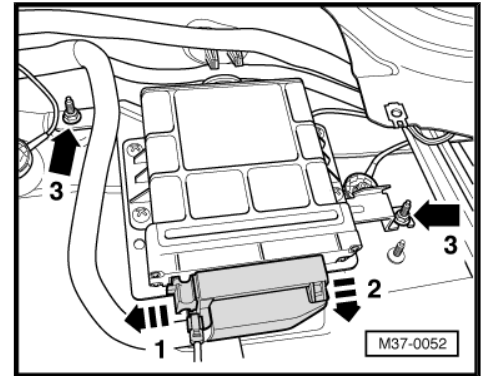
If no malfunction is found in the wiring:

- Replace the Transmission Control Module (TCM) - J217- . Refer to [⇒ "2.3 Transmission Control Module, Replacing", page 127 .](#)

If the specified value was obtained:

Checking wiring

- Remove the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100 .](#)
- Using a Multimeter , check the Transmission Control Module (TCM) - J217- electrical harness connector T68 to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical harness connector T121 for resistance.



Transmission Control Module (TCM) - J217- electrical harness connector terminals	Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- electrical connector T121 terminals
3 (Can_Bus Low)	6
25 (Can_Bus High)	7

Specified value: 1.5 Ω Max.

If the specified value was not obtained:

- Check the wiring connection for an open circuit, short circuit to Battery (+) or Ground (GND).
- Check the wiring connection for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

- Erase the DTC memory. Refer to [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ "4 Readiness Code", page 16 .](#)



- End diagnosis.

If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) - J248- . Refer to [⇒ "4.4 Engine Control Module, Replacing", page 100](#) .
- Assembly is performed in the reverse of the removal.

Final procedures

After the repair work, the following work steps must be performed in the following sequence:

- 1 - Check the DTC memory. Refer to [⇒ "2.3 Diagnostic Mode 03 - Read DTC Memory", page 5](#) .
 - 2 - If necessary, erase the DTC memory. [⇒ "2.4 Diagnostic Mode 04 - Erase DTC Memory", page 6](#) .
 - 3 - If the DTC memory was erased, generate readiness code. [⇒ "4 Readiness Code", page 16](#) .
- End of diagnosis.