



## Repair Manual Passat 1998–2000 ➤

Generic Scan Tool								
Engine ID	AEB							

Edition 07.07



## List of Workshop Manual Repair Groups

### Repair Group

ST - Generic Scan Tool

20 - Fuel supply

21 - Turbocharger, G-Charger

24 - Multiport Fuel Injection (MFI)

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 On Board Diagnostic

⇒ [“1.1 GST Manual Contents”, page 1](#)

⇒ [“1.2 OBD Systems”, page 1](#)

⇒ [“1.3 Malfunction Indicator Lamp Illumination”, page 1](#)

⇒ [“1.4 CAN Data Link”, page 2](#)

⇒ [“1.5 Electronic Power Control Warning Lamp”, page 2](#)

### 1.1 GST Manual Contents

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 Illumination

“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

- ⇒ [“2.1 Diagnostic Modes Description”, page 3](#)
- ⇒ [“2.2 Diagnostic Mode 01 - Read Current System Data”, page 4](#)
- ⇒ [“2.3 Diagnostic Mode 02 - Read Operating Conditions”, page 4](#)
- ⇒ [“2.4 Diagnostic Mode 03 - Read DTC Memory”, page 5](#)
- ⇒ [“2.5 Interrogating the Fault Memory”, page 6](#)
- ⇒ [“2.6 Diagnostic Mode 04 - Erase DTC Memory”, page 7](#)
- ⇒ [“2.7 Diagnostic Mode 05 - Read Oxygen Sensor Monitoring Test Results”, page 8](#)
- ⇒ [“2.8 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions”, page 9](#)
- ⇒ [“2.9 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle”, page 13](#)
- ⇒ [“2.10 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component”, page 13](#)
- ⇒ [“2.11 Diagnostic Mode 09 - Read Vehicle Information”, page 15](#)

### 2.1 Diagnostic Modes Description

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
Mode 1: Obtain data ⇒ <a href="#">page 4</a> .
Mode 2: Obtain operating conditions ⇒ <a href="#">page 4</a> .
Mode 3: Interrogating fault memory ⇒ <a href="#">page 5</a> .
Mode 4: Reset/delete diagnostic data ⇒ <a href="#">page 7</a> .
Diagnostic Mode 05: Check lambda test results ⇒ <a href="#">page 8</a> .
Mode 6: Checking test results of components that are not continuously monitored ⇒ <a href="#">page 9</a> .
Mode 7: Checking test results of components that are continuously monitored ⇒ <a href="#">page 13</a> .
Mode 8: Tank leak test ⇒ <a href="#">page 13</a> .
Mode 9: Vehicle information ⇒ <a href="#">page 15</a> .



## 2.2 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: Obtain data.”.
- 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:	Monitoring status since erasing DTC memory
03:	Condition of fuel system
04:	Calculated load condition value
05:	Coolant temperature
06:	Short term gasoline-air ratio bank 1
07:	Gasoline-air ratio bank 1
12:	Engine rotations per minute (RPM)
13:	Vehicle speed
14:	Valve timing adjustment at 1. cyl. to "advance"
15:	Intake air temperature (IAT)
16:	Air flow quantity at Mass Air Flow (MAF) sensor
17:	Throttle valve position (absolute)
18:	Availability status of secondary air
19:	Component location of oxygen sensors
21:	Bank 1 - sensor 2
28:	OBD request is designed for diagnostic of this vehicle

- Switch the ignition off.
- End of diagnosis.

## 2.3 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: Obtain operating conditions.”.
- 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
03:	Condition of fuel system
06:	Short term gasoline-air ratio bank 1
07:	Gasoline-air ratio bank 1

- Switch the ignition off.
- End of diagnosis.

## 2.4 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 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 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
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

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

## U-Codes

Component group					
U	x	x	x	x	DTC for network (CAN bus)
Norm-Code					
U	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts

## 2.5 Interrogating the Fault Memory

### Procedure

- Connect the scan tool.
- Switch the ignition to the “ON” position.
- Select “Diagnostic Mode 03: Interrogating fault memory”.
- 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)



Indication example	Explanation
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:
- ◆ SAE P0xxxDTCs ⇒ [page 19](#) .
- ◆ SAE P1xxxDTCs ⇒ [page 29](#) .
- ◆ SAE P2xxxDTCs ⇒ [page 35](#) .
- ◆ SAE P3xxxDTCs ⇒ [page 36](#) .
- Switch the ignition off.
- End of diagnosis.

## 2.6 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 “Diagnostic Mode 03: Interrogating fault memory”.
- Then select “Mode 4: Reset/delete diagnostic data”.

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

- Switch the ignition off.



- End of diagnosis.

## 2.7 Diagnostic Mode 05 - Read Oxygen Sensor Monitoring Test Results



### Note

*Mode 05 may not be supported on all systems. On systems where Diagnostic Mode 05 is not supported, refer to Diagnostic Mode 6 for Oxygen Sensor Monitoring Test Results.*

The min & max values for each individual test in Mode 05 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.

### Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80° C.

### Work 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 “Mode 5: Check lambda test results.”.
- Select the desired “Test-ID” of the component or system that is to be monitored, e.g. “Test-ID 01: Oxygen Sensor Monitor Bank 1 - Sensor 1”.
- Select the desired “Test-ID”.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all “Test-IDs” or “Hex-IDs” that may be selected.

Test-ID (Hex-ID)	Component or System
Test-ID 01 (\$01) ⇒ <a href="#">page 9</a>	Oxygen Sensor Monitor Bank 1 - Sensor 1



**Test-ID 01 (\$01): Oxygen Sensor Monitor Bank 1 - Sensor 1**

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Mode 5: Check lambda test results”.

Select “Test-ID 01 (\$01) ”.

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

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 (\$01)	—	Voltage threshold from rich to lean (fixed value). For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 33.	550 – 650 mV	—	—
02 (\$02)	—	Voltage threshold from lean to rich (fixed value). For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 33.	550 – 650 mV	—	—
07 (\$07)	—	Minimum oxygen sensor voltage value in test. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 33.	0 mV	650 mV	—
08 (\$08)	P0132	Maximum oxygen sensor voltage value in test. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 33.	550 – 650 mV	1048.4 mV	Refer to DTC P0132 in the DTC summary table. => <a href="#">page 20</a> .

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure => [page 5](#) .
- Switch the ignition off.
- End of diagnosis.

**2.8 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.

#### Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80° C.

#### Work 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 “Mode 6: Check test the results of components that are not continuously monitored”.
- Select the desired “Test-ID” of the component or system that is to be monitored, e.g. “Test-ID 01: Oxygen Sensor Monitor Bank 1 - Sensor 1”.
- Select the desired “Test-ID”.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all “Test-IDs” or “Hex-IDs” that may be selected.

Test-ID (Hex-ID)	Component or System
01 (\$01): ⇒ <a href="#">page 10</a>	O2 Sensor in front of Catalytic Converter, (Bank 1- Sensor 1)
02 (\$02): ⇒ <a href="#">page 11</a>	O2 Sensor Behind Catalytic Converter, (Bank 1, Sensor 2)
\$05 (05): ⇒ <a href="#">page 11</a>	Tank Ventilation System, Tank Vent Valve Function Check
\$05 (05): ⇒ <a href="#">page 12</a>	Tank Ventilation System, Tank Leak Test

#### Test-ID 01 (\$01): Catalytic Conversion (Bank 1)

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Test-ID 01 (\$01)”.

- Select the desired “Test-ID (TID)” or “Hex-ID”.



- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
05(\$05)	P0422	Conversion Capability (storage) Check. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 4.	—	> 0.4-0.6	Refer to DTC P0422 in the DTC summary table ⇒ <a href="#">page 24</a> .
07(\$07)	P0422	Conversion Capability (storage) Check. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 4.	—	> 0.4-0.6	Refer to DTC P0422 in the DTC summary table ⇒ <a href="#">page 24</a> .
08(\$08)	P0422	Conversion Capability (storage) Check. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 4.	—	> 0.4-0.6	Refer to DTC P0422 in the DTC summary table ⇒ <a href="#">page 24</a> .

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure ⇒ [page 5](#) .
- Switch the ignition off.
- End of diagnosis.

**Test-ID 02 (\$02): Oxygen Sensor Monitor Bank 1- Sensor 1**

- Connect the scan tool.
- Start the engine and run at idle.
- Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Test-ID 02 (\$02)”.

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

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01(\$01)	P0133	Response Check. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 33.	—	< 3.7 Sec-onds	Refer to DTC P0133 in the DTC summary table ⇒ <a href="#">page 21</a> .

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC’s or the corresponding diagnostic repair procedure ⇒ [page 5](#) .
- Switch the ignition off.
- End of diagnosis.

**Test-ID \$05 (05): Tank Ventilation System, Tank Vent Valve Function Check**

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



- Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Test-ID \$05 (05)”.

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

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
07(\$07)	P0441	Fuel Tank Leak Test. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 17.	< 5.5%	> 9.4 %	Refer to DTC P0441 in the DTC summary table ⇒ <a href="#">page 25</a> .

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ [page 5](#) .
- Switch the ignition off.

#### Test-ID \$05 (05): Tank Ventilation System, Tank Leak Test

- End of diagnosis.
- Connect the scan tool.
- Start the engine and run at idle.
- Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Test-ID \$05 (05)”.

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

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
0D (\$13)	P0442	Pressure Check. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 17.	—	< 1 Second	Refer to DTC P0442 in the DTC summary table ⇒ <a href="#">page 25</a> .
0F (\$15)	P0455	Rationality Check. For additional information, refer to the Bosch Motronic ME 5.9.2 OBD System Strategy. Page 17.	—	Signal always low	Refer to DTC P0455 in the DTC summary table ⇒ <a href="#">page 26</a> .

- If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ [page 5](#) .
- Switch the ignition off.
- End of diagnosis.





## 2.9 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:
  - ◆ SAE P0xxx DTCs ⇒ [“5.1 SAE P0xxxDTCs”, page 19](#) .
  - ◆ SAE P1xxx DTCs ⇒ [“5.2 SAE P1xxxDTCs”, page 29](#) .
  - ◆ SAE P2xxx DTCs ⇒ [“5.3 SAE P2xxxDTCs”, page 35](#) .
  - ◆ SAE P3xxx DTCs ⇒ [“5.4 SAE P3xxxDTCs”, page 36](#) .
- Switch the ignition off.

## 2.10 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component

Diagnostic Mode 08 is used to control the operation of an on-board system, test or component. A Mode 8 service can be used to turn on-board system ON or OFF, or to cycle an on-board system, test or component ON or OFF for a specific period of time. The service can also be used to request system status or to report test results.



### Diagnostic Mode 08, TID \$01

Diagnostic Mode 08, TID \$01 is used to determine if the evaporative system may be leaking.

Depending on the scan tool being used, the function test in Diagnostic Mode 08 may or may not be able to be performed.

If the scan tool being used will operate Diagnostic Mode 08, perform the test below => [page 14](#) .

If the scan tool being used will not operate Diagnostic Mode 08, refer to => [page 45](#) .



#### Note

*Always follow the manufacturers instructions for the scan tool being used.*

#### Test requirements

- No DTCs stored in the DTC memory.
- Intake Air Temperature (IAT) maximum 60° C.
- Coolant temperature 80 -110° C.
- Throttle valve angle 12.0 - 16.0%.

#### Function test



#### Note

*If the accelerator pedal is depressed during the test, the test will be aborted.*

- Connect the scan tool.
- Start the engine and run at idle for at least 15 minutes.
- Select “Mode 8: Tank Leak Test”.
- Select “ Tank Leak Test”.
- Check the specified value of the tank leak test at idle.
- The following may be displayed on the scan tool screen:

Tank leak test	Specified value
◆ Test function active	Test OK
◆ Test function is being initiated, please wait	
◆ Test off	
◆ Test aborted	

- Switch the ignition off.

If the specified result is obtained:

System OK.

If the specified result is not obtained:

- Repeat the tank leak test, switch the ignition off and start the engine again and let run for 15 minutes at idle.
- Switch the ignition off.



If the specified result is again not obtained:

- A leak may be present. Refer to ⇒ [page 45](#) .

**End diagnosis.**

## 2.11 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: Vehicle information”.
- 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
02:	Vehicle identification number e.g.
	◆ A different 17 digit number will be displayed for each vehicle
04:	Calibration identification e.g.
	◆ Engine Control Module (ECM)
	◆ Transmission Control Module (TCM)
06:	CVN (check sum) e.g.
	◆ EC5AE460 the check sum is different for every control module version
	◆ 000D105

- Switch the ignition off.
- End of diagnosis.



### 3 General Diagnosis

#### 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 ⇒ [page 5](#) .
- 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 17](#) .
- End of diagnosis.



## 4 Readiness Code

### 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.

### Operating Conditions

For the EVAP monitor test, the coolant temperature and the ambient air temperature must be between 10° C and 35° C with a difference between them no greater than 4° C. The ambient air temperature must not change more than 4° C during the drive cycle procedure (e.g. when driving out of a heated workshop in the winter).

### Test requirements

- Erase the DTC memory ⇒ [page 7](#) .
- Coolant temperature must be between 80° C - 110° C.
- The Intake Air Temperature (IAT) must be between 10° C - 35° C.
- Battery voltage must be a minimum of 12.5 volts.
- Fuel tank level 1/4 - 3/4 full.



### 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.
- Switch the ignition on and start the vehicle.
- Idle the vehicle for 2-3 minutes. This executes the O2S Heater, Misfire, Secondary AIR, Fuel Trim, and Purge system monitors.
- Drive the vehicle at 45-55 mph for a continuous 7 minute period, avoid stopping. This executes the EVAP, O2S, Fuel Trim, and Misfire monitors.
- Accelerate the vehicle to an engine speed of 5000 RPM (with automatic transmission use the tip-tronic mode); lift off the



throttle until the engine speed is around 1200 rpm. This executes the fuel cut off

- Accelerate the vehicle smoothly to 60-65 mph, cruise constantly for 5 min, this executes the Catalyst; O2S, Misfire, Fuel Trim, and Purge System monitors.
- Decelerate and idle the vehicle again for 3 minutes. This executes the Misfire, Secondary AIR, Fuel Trim, and Purge system monitors.
- 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.



**Note**

*When repeating the drive cycle operation for a failed EVAP monitor or thermostat-monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are between 10° C - 35° C with a difference between them no greater than 4° C is observed and repeat the drive cycle operation.*

If the drive cycle operation fails again.

- Check the DTC memory for stored DTC's ⇒ [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 operation.



## 5 DTC Tables

⇒ [“5.1 SAE P0xxxDTCs”, page 19](#)

⇒ [“5.2 SAE P1xxxDTCs”, page 29](#)

⇒ [“5.3 SAE P2xxxDTCs”, page 35](#)

⇒ [“5.4 SAE P3xxxDTCs”, page 36](#)

### 5.1 SAE P0xxxDTCs

For Monitor Strategy Information Refer to: ⇒ Bosch Motronic ME  
5.9.2 OBD System Strategy

Fuel and air ratios

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0102	Mass or Volume Air Flow A Circuit Low Input	– Check the Mass Air Flow (MAF) Sensor -G70- . Refer to ⇒ <a href="#">page 71</a> .	Lower threshold map (depending on engine speed and engine load)	• Air mass, < 1.5 kg/h	2 Seconds	• 2 DCY
P0103	Mass or Volume Air Flow A Circuit High Input	– Check the Mass Air Flow (MAF) Sensor -G70- . Refer to ⇒ <a href="#">page 71</a> .	Upper threshold map (depending on engine speed and engine load)	• Air mass, >128 - 730 kg/h	2 Seconds	• 2 DCY
P0107	Manifold Absolute Pressure / BARO Circuit Low	– Check the Barometric Pressure (BARO) Sensor -F96- . Refer to ⇒ <a href="#">page 58</a> .	Altitude to low – Signal <-900 m	—	2 Seconds	• 2 DCY
P0108	Manifold Absolute Pressure / BARO Circuit High	– Check the Barometric Pressure (BARO) Sensor -F96- . Refer to ⇒ <a href="#">page 58</a> .	Altitude to high – Signal >4400 m	—	2 Seconds	• 2 DCY
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	– Check the Intake Air Temperature (IAT) Sensor -G72- . Refer to ⇒ <a href="#">page 81</a> .	Short to battery positive, > 133.5° C	—	2 Seconds	• 2 DCY
P0113	Intake Air Temperature Sensor 1 Circuit High Input	– Check the Intake Air Temperature (IAT) Sensor -G72- . Refer to ⇒ <a href="#">page 81</a> .	IAT >-36° C	• Time after start, >3 min.	2 Seconds	• 2 DCY
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	– Check the Engine Coolant Temperature (ECT) Sensor -G62- . Refer to ⇒ <a href="#">page 77</a> . – Check the coolant regulator. Refer to repair group 19.	Measured temp. lower than model temp. Difference between measured and model temp. more than 20° C	—	Depends on EST	• 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
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	<ul style="list-style-type: none"> <li>– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to <a href="#">page 77</a> .</li> <li>– Check the coolant regulator. Refer to repair group 19.</li> </ul>	Short to battery + < -45° C	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• Continuous</li> <li>• 2 DCY</li> </ul>
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	<ul style="list-style-type: none"> <li>– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to <a href="#">page 77</a> .</li> <li>– Check the coolant regulator. Refer to repair group 19.</li> </ul>	Short to ground >133.5° C	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• Continuous</li> <li>• 2 DCY</li> </ul>
P0121	Throttle/Pedal Position Sensor "A" Circuit Range/Performance	<ul style="list-style-type: none"> <li>– Check the Throttle Valve Control Module -J338- . Refer to <a href="#">page 74</a></li> </ul>	<ul style="list-style-type: none"> <li>• Signal voltage – &gt;3.8 V (16°)</li> <li>• Engine speed – &gt;2390 RPM</li> <li>• Engine load &gt; 3.8 ms</li> </ul>	Coolant temp, >70° C	1 Second	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0122	Throttle/Pedal Position Sensor "A" Circuit Low	<ul style="list-style-type: none"> <li>– Check the Throttle Valve Control Module -J338- . Refer to <a href="#">page 74</a></li> </ul>	Signal low – Short to ground <157 mV	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0123	Throttle/Pedal Position Sensor "A" Circuit High	<ul style="list-style-type: none"> <li>– Check the Throttle Valve Control Module -J338- . Refer to <a href="#">page 74</a></li> </ul>	Signal high – Short to battery + >4.8 V	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0130	O2 Sensor Circuit, Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to <a href="#">page 92</a> .</li> </ul>	Short Circuit – 0.04U <0.04V	Sensor heated up, After 150 sec.	20 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0131	O2 Sensor Circuit Low Voltage (Bank 1, Sensor 1)	<ul style="list-style-type: none"> <li>– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to <a href="#">page 92</a> .</li> </ul>	Short to ground Signal < -0.15V	Sensor heated up, After 150 sec.	10 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0132	O2 Sensor Circuit High Voltage, Bank 1 Sensor 1	<ul style="list-style-type: none"> <li>– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to <a href="#">page 92</a> .</li> </ul>	Short to battery positive, > 1.08 Volts	Sensor heated up, After 150 sec.	10 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>





DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0133	O2 Circuit Slow Response (Bank 1, Sensor 1)	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ <a href="#">page 92</a> .	Threshold for signal period, length > 3.7 seconds	<ul style="list-style-type: none"> <li>• Engine load, 1.5 ms 3.6 ms</li> <li>• Engine speed, 1560 - 2600 RPM</li> <li>• Catalyst temperature, &gt;350° F</li> <li>• Fuel control, Closed loop</li> </ul>	40 Seconds	<ul style="list-style-type: none"> <li>• Once/DCY</li> <li>• 2 DCY</li> </ul>
P0134	O2 Sensor Circuit No Activity Detected, (Bank 1 Sensor 1)	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ <a href="#">page 92</a> .	Open circuit or no activity - 0.4V - 0.6V	<ul style="list-style-type: none"> <li>• Sensor heated up, After 150 seconds</li> </ul>	20 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0136	O2 Circuit (Bank 1, Sensor 2)	– Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- . Refer to ⇒ <a href="#">page 94</a> .	Short circuit - 0.4V - 0.6V	<ul style="list-style-type: none"> <li>• Sensor heated up, After 150 seconds</li> </ul>	20 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0137	O2 Sensor Circuit Low Voltage (Bank 1, Sensor 2)	– Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- . Refer to ⇒ <a href="#">page 94</a> .	Short to ground Signal < -0.15V	<ul style="list-style-type: none"> <li>• Sensor heated up, After 150.0 sec.</li> </ul>	10 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0138	O2 Circuit High Voltage (Bank 1, Sensor 2)	– Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- . Refer to ⇒ <a href="#">page 94</a> .	Short to battery +, > 1.08 V	<ul style="list-style-type: none"> <li>• Sensor heated up, After 150 seconds</li> </ul>	10 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0140	O2 Circuit No Activity Detected (Bank 1, Sensor 2)	– Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- . Refer to ⇒ <a href="#">page 94</a> .	Open circuit or no activity >0.5V	<ul style="list-style-type: none"> <li>• Sensor heated up, After 150 seconds</li> </ul>	600 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>



Ignition system

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0300	Random Misfire Detected	<ul style="list-style-type: none"> <li>– Check the Spark plugs.</li> <li>– Check the intake system for leaks.</li> <li>– Check the fuel pressure. Refer to ⇒ <a href="#">page 40</a> .</li> <li>– Check fuel injectors -N30, N31, N32, N33, N83- .</li> <li>– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292- . Refer to ⇒ <a href="#">page 116</a> .</li> </ul>	Multiple misfire	<ul style="list-style-type: none"> <li>• Engine speed, Governed engine RPM</li> <li>• Engine torque, &gt; 0 Nm</li> <li>• Load change, &lt; 8 ms /ignition</li> <li>• Time from start-up, &lt;5 sec</li> <li>• Engine load, 1.80 ms - 6.00 ms</li> </ul>	—	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0301	Cylinder 1 Misfire Detected	<ul style="list-style-type: none"> <li>– Check the Spark plugs.</li> <li>– Check the intake system for leaks.</li> <li>– Check the fuel pressure. Refer to ⇒ <a href="#">page 40</a> .</li> <li>– Check fuel injectors -N30, N31, N32, N33, N83- .</li> <li>– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292- . Refer to ⇒ <a href="#">page 116</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• Emission threshold % misfire &gt;3%</li> <li>• Catalyst damage (T &gt; 950 °C) rate &gt; 4.5 - 9 %</li> </ul>	<ul style="list-style-type: none"> <li>• Engine speed, Governed engine RPM</li> <li>• Engine torque, &gt; 0</li> <li>• Load change, &lt; 8 ms /ignition</li> <li>• Time from start-up, &lt;5 sec</li> <li>• Engine load, 1.80 ms - 6.00 ms</li> </ul>	1000 Revs 200 Revs	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>



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"> <li>– Check the Spark plugs.</li> <li>– Check the intake system for leaks.</li> <li>– Check the fuel pressure. Refer to ⇒ <a href="#">page 40</a> .</li> <li>– Check fuel injectors -N30, N31, N32, N33, N83- .</li> <li>– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292- . Refer to ⇒ <a href="#">page 116</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• Emission threshold % misfire &gt;3%</li> <li>• Catalyst damage (T &gt; 950 °C) rate &gt; 4.5 - 9 %</li> </ul>	<ul style="list-style-type: none"> <li>• Engine speed, Governed engine RPM</li> <li>• Engine torque, &gt; 0</li> <li>• Load change, &lt; 8 ms /ignition</li> <li>• Time from start-up, &lt;5 sec</li> <li>• Engine load, 1.80 ms - 6.00 ms</li> </ul>	1000 Revs 200 Revs	• 2 DCY
P0303	Cylinder 3 Misfire Detected	<ul style="list-style-type: none"> <li>– Check the Spark plugs.</li> <li>– Check the intake system for leaks.</li> <li>– Check the fuel pressure. Refer to ⇒ <a href="#">page 40</a> .</li> <li>– Check fuel injectors -N30, N31, N32, N33, N83- .</li> <li>– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292- . Refer to ⇒ <a href="#">page 116</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• Emission threshold % misfire &gt;3%</li> <li>• Catalyst damage (T &gt; 950 °C) rate &gt; 4.5 - 9 %</li> </ul>	<ul style="list-style-type: none"> <li>• Engine speed, Governed engine RPM</li> <li>• Engine torque, &gt; 0</li> <li>• Load change, &lt; 8 ms /ignition</li> <li>• Time from start-up, &lt;5 sec</li> <li>• Engine load, 1.80 ms - 6.00 ms</li> </ul>	1000 Revs 200 Revs	• 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"> <li>– Check the Spark plugs.</li> <li>– Check the intake system for leaks.</li> <li>– Check the fuel pressure. Refer to ⇒ <a href="#">page 40</a> .</li> <li>– Check fuel injectors -N30, N31, N32, N33, N83- .</li> <li>– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292- . Refer to ⇒ <a href="#">page 116</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• Emission threshold % misfire &gt;3%</li> <li>• Catalyst damage (T &gt; 950 °C) rate &gt; 4.5 - 9 %</li> </ul>	<ul style="list-style-type: none"> <li>• Engine speed, Governed engine RPM</li> <li>• Engine torque, &gt; 0</li> <li>• Load change, &lt; 8 ms /ignition</li> <li>• Time from start-up, &lt;5 sec</li> <li>• Engine load, 1.80 ms - 6.00 ms</li> </ul>	1000 Revs 200 Revs	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance	<ul style="list-style-type: none"> <li>– Check the Engine Speed (RPM) Sensor - G28- . Refer to ⇒ <a href="#">page 85</a> .</li> </ul>	Comparison of counted teeth and number of teeth (+/-) 3 tooth	—	0.1 Second	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal	<ul style="list-style-type: none"> <li>– Check the Engine Speed (RPM) Sensor - G28- . Refer to ⇒ <a href="#">page 85</a> .</li> </ul>	Comparison with phase sensor signal- No engine speed signal	—	5 Seconds	<ul style="list-style-type: none"> <li>• Immed</li> </ul>

#### Additional exhaust regulation

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0422	Main Catalyst Efficiency Below Threshold (Bank 1)	<ul style="list-style-type: none"> <li>– Check the Three Way Catalytic Converter (TWC). Refer to ⇒ <a href="#">page 106</a> .</li> </ul>	Rear/front = AR->0.4 - 0.6	<ul style="list-style-type: none"> <li>• Catalyst temperature, &gt;352° C</li> <li>• Engine load, 20-65%</li> <li>• Engine speed, 1800 - 2200 RPM</li> <li>• Actual EVAP purge flow, &lt; 25%</li> </ul>	60 Seconds	<ul style="list-style-type: none"> <li>• Once/DCY</li> <li>• 2 DCY</li> </ul>



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0441	Evaporative Emission System Incorrect Purge Flow	<ul style="list-style-type: none"> <li>- Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to <a href="#">page 46</a> .</li> <li>- Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to <a href="#">page 47</a> .</li> <li>- Check the Leak Detection Pump (LDP) -V144- . Refer to <a href="#">page 50</a> .</li> </ul>	Lambda integrator deviation and reduction of bypass airflow – -5.5% - +9.4% of lambda deviation and -1.2 kg/h of bypass airflow reduction	<ul style="list-style-type: none"> <li>• Engine speed - Idle</li> </ul>	25 Seconds	<ul style="list-style-type: none"> <li>• Once/DCY</li> <li>• 2 DCY</li> </ul>
P0442	Evaporative Emission System Leak Detected (Small Leak)	<ul style="list-style-type: none"> <li>- Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to <a href="#">page 46</a> .</li> <li>- Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to <a href="#">page 47</a> .</li> <li>- Check the Leak Detection Pump (LDP) -V144- . Refer to <a href="#">page 50</a> .</li> </ul>	Pressure drop within predetermined time – Value <1.0	<ul style="list-style-type: none"> <li>• Purge Valve, Closed</li> <li>• LDP, Activated</li> <li>• Ambient temperature, &gt; -9.75° C</li> <li>• Altitude, &lt; 2400 m</li> <li>• Deep down hill driving time, &gt; 10 sec</li> <li>• Restart temperature difference, &gt; 40° K</li> <li>• Time after engine start, 600 sec.</li> <li>• Engine load, TL&lt;3.8 ms</li> <li>• IAT, &lt;95 ° C</li> <li>• ECT, &lt;95°C</li> <li>• Throttle angle /rpm – 720 rpm and &gt;9° to 3000 rpm and &gt; 21°</li> </ul>	1 Seconds	<ul style="list-style-type: none"> <li>• Once/DCY</li> <li>• 2 DCY</li> </ul>



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0455	Evaporative Emission System Leak Detected (gross leak/no flow)	<ul style="list-style-type: none"> <li>- Check the Evaporative Emission (EVAP) Canister System for proper seal. Refer to <a href="#">page 46</a> .</li> <li>- Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to <a href="#">page 47</a> .</li> <li>- Check the Leak Detection Pump (LDP) -V144- . Refer to <a href="#">page 50</a> .</li> </ul>	Pressure drop within predetermined time – Value <0.8	<ul style="list-style-type: none"> <li>• Purge Valve, Closed</li> <li>• LDP, Activated</li> <li>• Ambient temperature, &gt; -9.75° C</li> <li>• Altitude, &lt; 2400 m</li> <li>• Deep down hill driving time, &gt; 10 sec</li> <li>• Restart temperature difference, &gt; 40° K</li> <li>• Time after engine start, 600 sec.</li> <li>• Engine load, TL&lt;3.8 ms</li> <li>• IAT, &lt;95 ° C</li> <li>• ECT, &lt;95°C</li> <li>• Throttle angle /rpm – 720 rpm and &gt;9° to 3000 rpm and &gt; 21°</li> </ul>	1 Seconds	• 2 DCY

### Speed and idle control

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0501	Vehicle Speed Sensor A Range/Performance	<ul style="list-style-type: none"> <li>- Check vehicle speed signal. Refer to <a href="#">page 103</a> .</li> </ul>	Comparison with engine speed and fuel cut off-Speed < 1.94 mph	<ul style="list-style-type: none"> <li>• ECT, &gt; 40° C</li> </ul>	0.5 Seconds	• 2 DCY
P0505	Idle Air Control System	<ul style="list-style-type: none"> <li>- Check the Throttle Valve Control Module -J338- . Refer to <a href="#">page 74</a> .</li> </ul>	Signal high – Throttle position voltage and throttle actuator position voltage on idle position and idle switch open	<ul style="list-style-type: none"> <li>• Battery voltage, &gt;10V</li> </ul>	4 Times	• 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
P0506	Idle Air Control System RPM Lower Than Expected	– Check the Throttle Valve Control Module -J338- . Refer to <a href="#">page 74</a> .	<ul style="list-style-type: none"> <li>• Signal low – Throttle position &gt; max. idle angle and idle switch closed</li> <li>• Idle correction deviation &lt;-200 RPM</li> </ul>	<ul style="list-style-type: none"> <li>• Engine load, &gt;3.8 ms</li> <li>• ECT, &gt; 70 °C</li> <li>• Engine speed, Idle</li> </ul>	1 Seconds 15 Seconds	• 2 DCY
P0507	Idle Air Control System RPM Higher Than Expected	– Check the Throttle Valve Control Module -J338- . Refer to <a href="#">page 74</a> .	Idle speed deviation >100 RPM	<ul style="list-style-type: none"> <li>• Engine speed, idle</li> </ul>	15 Seconds	• 2 DCY

#### Control module and output signals

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0603	Internal Control Module Keep Alive Memory (KAM) Error	– Check the Transmission Control Module. Refer to Automatic Transmission, Repair Group 38.	Calculate check sum and comparison with stored value	—	0.1 Seconds	• 2 DCY
P0604	Internal Control Module Random Access Memory (RAM) Error	– Check the Engine Coolant Level (ECL) Control Module -J120- . Refer to <a href="#">page 97</a>	Calculate check sum and comparison with stored value	—	0.5 Seconds	• 2 DCY
P0605	Internal Control Module Read Only Memory (ROM) Error	– Check the Engine Coolant Level (ECL) Control Module -J120- . Refer to <a href="#">page 97</a>	Calculate check sum and comparison with stored value	—	0.5 Seconds 10 Seconds	• 2 DCY

#### 01V Transmission

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	– Refer to Automatic Transmission, Repair Group 38.	Fault code	Battery Voltage, U>10.5V	2.5 Seconds	• 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
P0717	Input/Turbine Speed Sensor "A" Circuit No Signal	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Different speed, 416 - 320 RPM</li> <li>• Vehicle speed</li> </ul>	<ul style="list-style-type: none"> <li>• Gear, 2, 3, 4, 5</li> <li>• Engine speed, &gt; 1400 RPM</li> <li>• Shift lever position, D, 4, 3, 2</li> </ul>	2.49 Seconds	• Immed.
P0722	Output Speed Sensor Circuit No Signal	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Different speed, 416 - 320 RPM</li> <li>• Vehicle speed</li> </ul>	<ul style="list-style-type: none"> <li>• Gear, 2, 3, 4, 5</li> <li>• Engine speed, &gt; 1400 RPM</li> <li>• Shift lever position, D, 4, 3, 2</li> </ul>	2.5 Seconds	• Immed.
P0727	Engine Speed Input Circuit No Signal	– Refer to Automatic Transmission, Repair Group 38.	Comparison of stored value with active level	Battery voltage, U > 10V	2.5 Seconds	• 2 DCY
P0732	Gear 2 incorrect ratio	– Refer to Automatic Transmission, Repair Group 38.	Different speed, 416 – 320 RPM	—	2.5 Seconds	• Immed.
P0733	Gear 3 incorrect ratio	– Refer to Automatic Transmission, Repair Group 38.	Different speed – 416 – 320 RPM	—	2.5 Seconds	• Immed.
P0734	Gear 4 incorrect ratio	– Refer to Automatic Transmission, Repair Group 38.	Different speed – 416 – 320 RPM	—	2.5 Seconds	• Immed.
P0735	Gear 5 incorrect ratio	– Refer to Automatic Transmission, Repair Group 38.	Different speed – 416 – 320 RPM	—	2.5 Seconds	• Immed.
P0741	Torque Converter Clutch Performance or Stuck Off	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Comparison with stored values</li> <li>• Slip differences &gt; 448 RPM</li> </ul>	—	1 Second	• 2 DCY
P0753	Shift Solenoid "A" Electrical	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Comparison of stored value with active level</li> <li>• Switch off and U &lt; 2V</li> <li>• Switch on and U &gt; 6V</li> </ul>	Battery voltage - U > 9V	0.24 Seconds 0.02 Seconds	• 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
P0758	Shift Solenoid "B" Electrical	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Comparison of stored value with active level</li> <li>• Switch off and <math>U &lt; 2V</math></li> <li>• Switch on and <math>U &gt; 6V</math></li> </ul>	Battery voltage - $U > 9V$	0.24 Seconds 0.02 Seconds	• 2 DCY
P0763	Shift Solenoid "C" Electrical	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Comparison of stored value with active level</li> <li>• Switch off and <math>U &lt; 2V</math></li> <li>• Switch on and <math>U &gt; 6V</math></li> </ul>	Battery voltage - $U > 9V$	0.24 Seconds 0.02 Seconds	• 2 DCY

## 5.2 SAE P1xxxDTCs

### Engine

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1102	HO2S Heater Control Circuit (Bank 1 Sensor 1) High	– Check the Heated Oxygen Sensor (HO2S) -G39- before catalytic converter, heater circuit. Refer to <a href="#">page 66</a> .	Short to battery + $<4.8$ Ohm	• Sensor heater on, 140 sec.	5 Seconds	• 2 DCY
P1105	HO2S Heater Control Circuit (Bank 1 Sensor 2) High	– Check the Heated Oxygen Sensor (HO2S) -G130- before catalytic converter, heater circuit. Refer to <a href="#">page 68</a> .	Short to battery + $<4.8$ Ohm	• Sensor heater, on 140 sec.	5 Seconds	• 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
P1127	Bank 1, mixture adaption (mult.) system too rich	<ul style="list-style-type: none"> <li>– Check the Fuel Injectors -N30, N31, N32, N33- . Refer to <a href="#">⇒ page 88</a> .</li> <li>– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to <a href="#">⇒ page 47</a> .</li> <li>– Check fuel pressure regulator and residual pressure. Refer to <a href="#">⇒ page 40</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• System too rich, &gt; +25%</li> <li>• System too lean, &lt; - 25% within adaptive range</li> </ul>	<ul style="list-style-type: none"> <li>• Closed loop</li> </ul>	19 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P1128	Bank 1, mixture adaption (mult.) system too lean	<ul style="list-style-type: none"> <li>– Check the Fuel Injectors -N30, N31, N32, N33- . Refer to <a href="#">⇒ page 88</a> .</li> <li>– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to <a href="#">⇒ page 47</a> .</li> <li>– Check fuel pressure regulator and residual pressure. Refer to <a href="#">⇒ page 40</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• System too rich, &gt; +25%</li> <li>• System too lean, &lt; - 25% within adaptive range</li> </ul>	<ul style="list-style-type: none"> <li>• Closed loop</li> </ul>	19 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P1136	Bank 1, mixture adaption (add.) system too lean	<ul style="list-style-type: none"> <li>– Check the Fuel Injectors -N30, N31, N32, N33- . Refer to <a href="#">⇒ page 88</a> .</li> <li>– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to <a href="#">⇒ page 47</a> .</li> <li>– Check fuel pressure regulator and residual pressure. Refer to <a href="#">⇒ page 40</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• System too rich, &gt; +26%</li> <li>• System too lean, &lt; - 26% within adaptive range</li> </ul>	<ul style="list-style-type: none"> <li>• Closed loop</li> </ul>	30 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1137	Bank 1, mixture adaption (add.) system too rich	<ul style="list-style-type: none"> <li>– Check the Fuel Injectors -N30, N31, N32, N33- . Refer to <a href="#">⇒ page 88</a> .</li> <li>– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to <a href="#">⇒ page 47</a> .</li> <li>– Check fuel pressure regulator and residual pressure. Refer to <a href="#">⇒ page 40</a> .</li> </ul>	<ul style="list-style-type: none"> <li>• System too rich, &gt; +26%</li> <li>• System to lean, &lt; - 26% within adaptive range</li> </ul>	<ul style="list-style-type: none"> <li>• Closed loop</li> </ul>	30 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P1196	O2 Sensor Heater Circuit, Bank 1- Sensor 1 Electrical Fault	<ul style="list-style-type: none"> <li>– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to <a href="#">⇒ page 66</a></li> </ul>	Malfunction >20 Ohm	Sensor heater on, 140 sec.	5 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P1198	O2 Sensor Heater Circuit, Bank 1- Sensor 2 Electrical Fault	<ul style="list-style-type: none"> <li>– Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- . Refer to <a href="#">⇒ page 68</a></li> </ul>	Malfunction >20 Ohm	Sensor heater on, 140 sec.	5 Seconds	<ul style="list-style-type: none"> <li>• 2 DCY</li> </ul>
P1213	Cylinder 1 Injector Circuit High	<ul style="list-style-type: none"> <li>– Check the Fuel Injector -N30- . Refer to <a href="#">⇒ page 88</a> .</li> </ul>	Short to battery positive, Signal high while injection valves switched on	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• Immed.</li> </ul>
P1214	Cylinder 2 Injector Circuit High	<ul style="list-style-type: none"> <li>– Check the Fuel Injector - N31- . Refer to <a href="#">⇒ page 88</a> .</li> </ul>	Short to battery positive, Signal high while injection valves switched on	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• Immed.</li> </ul>
P1215	Cylinder 3 Injector Circuit High	<ul style="list-style-type: none"> <li>– Check the Fuel Injector -N32- . Refer to <a href="#">⇒ page 88</a> .</li> </ul>	Short to battery positive, Signal high while injection valves switched on	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• Immed.</li> </ul>
P1216	Cylinder 4 Injector Circuit High	<ul style="list-style-type: none"> <li>– Check the Fuel Injector -N33- . Refer to <a href="#">⇒ page 88</a> .</li> </ul>	Short to battery positive, Signal high while injection valves switched on	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• Immed.</li> </ul>
P1225	Cylinder 1 Injector Circuit Low	<ul style="list-style-type: none"> <li>– Check the Fuel Injector -N30- . Refer to <a href="#">⇒ page 88</a> .</li> </ul>	Short to ground, Signal low while injection valves switched off	—	0.5 Seconds	<ul style="list-style-type: none"> <li>• Immed.</li> </ul>



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1226	Cylinder 2 Injector Circuit Low	– Check the Fuel Injector - N31- . Refer to <a href="#">⇒ page 88</a> .	Short to ground, Signal low while injection valves switched off	—	0.5 Seconds	• Immed.
P1227	Cylinder 3 Injector Circuit Low	– Check the Fuel Injector -N32- . Refer to <a href="#">⇒ page 88</a> .	Short to ground, Signal low while injection valves switched off	—	0.5 Seconds	• Immed.
P1228	Cylinder 4 Injector Circuit Low	– Check the Fuel Injector -N33- . Refer to <a href="#">⇒ page 88</a> .	Short to ground, Signal low while injection valves switched off	—	0.5 Seconds	• Immed.
P1237	Cylinder 1 injector -N30 open circuit	– Check the Fuel Injector -N30- . Refer to <a href="#">⇒ page 88</a> .	Open circuit, Signal low while injection valves switched off	—	0.5 Seconds	• Immed.
P1238	Cylinder 2 injector -N31 open circuit	– Check the Fuel Injector - N31- . Refer to <a href="#">⇒ page 88</a> .	Open circuit, Signal low while injection valves switched off	—	0.5 Seconds	• Immed.
P1239	Cylinder 3 injector -N32 open circuit	– Check the Fuel Injector -N32- . Refer to <a href="#">⇒ page 88</a> .	Open circuit, Signal low while injection valves switched off	—	0.5 Seconds	• Immed.
P1240	Cylinder 4 injector -N33 open circuit	– Check the Fuel Injector -N33- . Refer to <a href="#">⇒ page 88</a> .	Open circuit, Signal low while injection valves switched off	—	0.5 Seconds	• Immed.
P1250	Fuel level to low	– Check the fuel gauge. Refer to Fuel Supply System, Repair Group 20.	Tank empty – < 8 Ltr (< 2 gallon)	Engine speed - > 5 sec	Continuous	---
P1337	Bank 1, Camshaft Position (CMP) Sensor -G40- Short circuit to Ground (GND)	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to <a href="#">⇒ page 110</a> .	Comparison to engine speed sensor – Signal low during 16 crankshaft turns	—	2 Seconds	• Cont. • 2 DCY
P1338	Bank 1, Camshaft Position (CMP) Sensor -G40- Open circuit/short circuit to Ground (GND)	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to <a href="#">⇒ page 110</a> .	Comparison to engine speed sensor – Signal low during 16 crankshaft turns	—	2 Seconds	• 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
P1410	Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- Short to B+	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. Refer to <a href="#">⇒ page 47</a>	Short to battery + Signal high	—	0.5 Seconds	• 2 DCY
P1425	Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- Short to Ground (GND)	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. Refer to <a href="#">⇒ page 47</a>	Short to ground < Signal low	—	0.5 Seconds	• 2 DCY
P1426	Evaporative Emission System Purge Control Valve Circuit Open	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80-. Refer to <a href="#">⇒ page 47</a>	Open circuit, No activity/no signal	—	0.5 Seconds	• 2 DCY
P1471	EVAP Emission Control LDP Circuit Short to B+	– Check the Leak Detection Pump (LDP) -V144-. Refer to <a href="#">⇒ page 50</a>	Short to battery + Signal always high	—	0.5 Seconds	• 2 DCY
P1472	EVAP Emission Control LDP Circuit Short to Ground (GND)	– Check the Leak Detection Pump (LDP) -V144-. Refer to <a href="#">⇒ page 50</a>	Short to ground, no signal after engine start	—	0.5 Seconds	• 2 DCY
P1473	Leak diagnosis pump - tank breather system open circuit	– Check the Leak Detection Pump (LDP) -V144-. Refer to <a href="#">⇒ page 50</a>	Open circuit, No activity / No signal	—	0.5 Seconds	• 2 DCY
P1475	Leak diagnosis pump - tank breather system malfunction/no signal	– Check the Leak Detection Pump (LDP) -V144-. Refer to <a href="#">⇒ page 50</a>	Open circuit, Signal high >0.5 sec.	—	0.5 Seconds	• 2 DCY
P1476	Leak diagnosis pump - tank breather system malfunction / vacuum to low	– Check the Leak Detection Pump (LDP) -V144-. Refer to <a href="#">⇒ page 50</a>	Contact unable to open-Signal always low	—	0.4 Seconds	• 2 DCY
P1477	Leak diagnosis pump - tank breather system malfunction	– Check the Leak Detection Pump (LDP) -V144-. Refer to <a href="#">⇒ page 50</a>	Short to ground, open circuit	—	0.9 Seconds	• 2 DCY
P1500	Fuel Pump Primary Circuit Fault in electrical circuit	– Check the Fuel Pump (FP) Relay -J17-. Refer to <a href="#">⇒ page 100</a>	Open circuit, Signal low	—	0.5 Seconds	• Immed.



DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P1501	Fuel Pump (FP) Relay - J17- Short circuit to Ground (GND)	– Check the Fuel Pump (FP) Relay -J17- . Refer to <a href="#">⇒ page 100</a>	Short to ground Signal low	—	0.5 Seconds	• Immed.
P1502	Fuel Pump (FP) Relay - J17- Short to B+	– Check the Fuel Pump (FP) Relay -J17- . Refer to <a href="#">⇒ page 100</a>	Short to B+	—	0.5 Seconds	• Immed.
P1543	Angle sender 1 for throttle valve drive - G187 signal too low	– Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) - G187- . Refer to <a href="#">⇒ page 74</a>	Signal low , <0.157 V	—	5 Seconds	• Cont. • 2 DCY
P1544	Angle sender 1 for throttle valve drive - G187 signal too high	– Check the Throttle Drive Angle Sensor 1 (for Electronic Power Control (EPC)) - G187- . Refer to <a href="#">⇒ page 74</a>	Signal high >4.863V	—	5 Seconds	• Cont. • 2 DCY
P1545	Throttle valve control system malfunction	– Check the Throttle Valve Control Module -J338- . Refer to <a href="#">⇒ page 74</a>	Comparison with throttle movement	—	5 Seconds	• Cont. • 2 DCY
P1558	Throttle valve drive -G186 electrical fault in circuit	– Check the Throttle Valve Control Module -J338- . Refer to <a href="#">⇒ page 74</a>	• Open circuit • Short to ground • Short to battery +	—	5 Seconds	• Cont. • 2 DCY
P1611	Request MIL on Short circuit to Ground (GND)	– Refer to Automatic Transmission, Repair Group 38.	Short to ground Signal low	—	6 Seconds	• 2 DCY
P1613	Request MIL on Open/short to B+	– Refer to Automatic Transmission, Repair Group 38.	Short to battery + Or Open circuit	During engine start	6 Seconds	• 2 DCY
P1640	Internal Control Module Read Only Memory (ROM) Error	– Refer to Automatic Transmission, Repair Group 38.	Calculate check sum and comparison with stored value	—	0.15 Seconds	• 2 DCY
P1746	Supply voltage for solenoid valves electrical fault in circuit	– Refer to Automatic Transmission, Repair Group 38.	Calculate check sum and comparison with stored value	U > 6V	0.02 Seconds	• 2 DCY
P1748	Internal Control Module Memory Check Sum Error	– Refer to Automatic Transmission, Repair Group 38.	Calculate check sum and comparison with stored value	U > 6V	0.14 Seconds	• 2 DCY
P1750	System Voltage Low Voltage	– Refer to Automatic Transmission, Repair Group 38.	Voltage – U <9V	Engine speed, >1600 RPM	0.14 Seconds	• 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
P1813	Pressure control valve 1 N215 electrical fault in circuit	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Comparison of stored value with active level</li> <li>• Switch off and <math>U &lt; 2V</math></li> <li>• Switch on and <math>U &gt; 6V</math></li> </ul>	Battery voltage - $U > 9V$	0.24 Seconds 0.02 Seconds	• 2 DCY
P1823	Pressure control valve 3 N217 electrical fault in circuit	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Comparison of stored value with active level</li> <li>• Switch off</li> <li>• Switch on</li> </ul>	Battery voltage - $U > 9V$	0.14 Seconds 0.38 Seconds	• 2 DCY
P1828	Pressure control valve 4 N218 electrical fault in circuit	– Refer to Automatic Transmission, Repair Group 38.	<ul style="list-style-type: none"> <li>• Comparison of stored value with active level</li> <li>• Switch off</li> <li>• Switch on</li> </ul>	Battery voltage - $U > 9V$	0.38 Seconds 0.91 Seconds	• 2 DCY

### 5.3 SAE P2xxxDTCs

For Monitor Strategy Information Refer to: ⇒ Bosch Motronic ME  
5.9.2 OBD System Strategy

#### Fuel and air ratios

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P2097	Bank 1, oxygen sensor correction behind cat Rich control limit exceeded	– Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- . Refer to <a href="#">page 94</a> .	<ul style="list-style-type: none"> <li>• Comparison of stored value with active level</li> <li>• Switch off and <math>U &lt; 2V</math></li> <li>• Switch on and <math>U &gt; 6V</math></li> </ul>	Battery voltage - $U > 9V$	0.24 Seconds 0.02 Seconds	• 2 DCY



## 5.4 SAE P3xxxDTCs

For Monitor Strategy Information Refer to: ⇒ Bosch Motronic ME  
5.9.2 OBD System Strategy

### Engine

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P3081	Engine Temperature Too Low	– Check the Engine Coolant Temperature (ECT) Sensor -G62- . Refer to ⇒ <a href="#">page 77</a> .	Measured temperature >9,75 K lower than model temperature measured temperature < 59.5 °C	—		<ul style="list-style-type: none"><li>• Onc/DCY</li><li>• 2 DCY</li></ul>





## 20 – Fuel supply

### 1 Fuel Supply System

⇒ [“1.1 Safety Precautions”, page 37](#)

⇒ [“1.2 Clean Working Conditions”, page 38](#)

⇒ [“1.3 Fuel Pump, Checking”, page 38](#)

⇒ [“1.4 Fuel Pressure, Checking”, page 40](#)

⇒ [“1.5 Fuel Delivery, Checking”, page 41](#)

For all fuel supply system component locations. Refer to Engine Mechanical, Repair Group 20.

For all fuel supply system removal/installation procedures and torque specifications. Refer to Engine Mechanical, Repair Group 20.

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 Safety Precautions



#### 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.*



#### WARNING

- ◆ *The fuel system is under pressure! Before opening the system, place rags around the connection area. Then release the pressure by carefully loosening the connection.*
- ◆ *The engine section of the fuel system, after the high pressure pump, is under extremely high pressure! When working on the engine or the fuel injection system, the pressure must be relieved to residual pressure before opening the high pressure components. Refer to Fuel Injection & Ignition, Repair Group 24.*
- ◆ *Place sources of flame, e.g. cigarette lighters, as well as those sources of others in the area, out of reach. These can ignite fuel vapors.*

Perform the following steps before beginning work on the fuel supply system:

- ◆ Disconnect the battery Ground (GND) cable with the ignition switched off. Refer to Electrical Equipment, Repair Group 27.
- ◆ Open the fuel filler flap briefly and then close again.

When removing and installing components from full or partially full fuel tanks, observe the following:

- ◆ The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary .
- ◆ Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m<sup>3</sup>/h can be used.
- ◆ Prevent fuel from contacting the skin! Wear fuel-resistant gloves!

## 1.2 Clean Working Conditions

When working on the fuel supply/injection system, pay careful attention to 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 them. Do not use fluffy cloths!
- ◆ Carefully cover over opened components or seal, if repairs are not performed immediately.
- ◆ Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move vehicle unless absolutely necessary.

## 1.3 Fuel Pump, Checking

### Special tools and workshop equipment required

- ◆ Hand held remote control (jumper) .
- ◆ Multimeter .
- ◆ Electrical connector test lead set .



### Test requirements

- Battery voltage at least 11.5 volts.
- Fuel Pump (FP) Fuse 28 OK.
- Fuel Pump (FP) Relay -J17- OK.

### Checking voltage supply

- Remove the luggage compartment floor cover.
- Disconnect the Transfer Fuel Pump (FP) -G6- electrical harness connector.
- Using a Multimeter , check the Transfer Fuel Pump (FP) -G6- electrical harness connector terminals 1 to 4 for voltage.

Specified value: battery (+).

If the specified value 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, lose or broken terminals.
- If necessary, repair the electrical circuit.

If the specified value was obtained:

- Connect a Hand held remote control (jumper) to terminal -1- of the fuel pump electrical harness connector and to the vehicle battery (+).
- Connect a jumper cable from a Electrical connector test lead set to terminal -4- of the fuel delivery unit and to vehicle Ground (GND).
- Press switch on the Hand held remote control (jumper) .

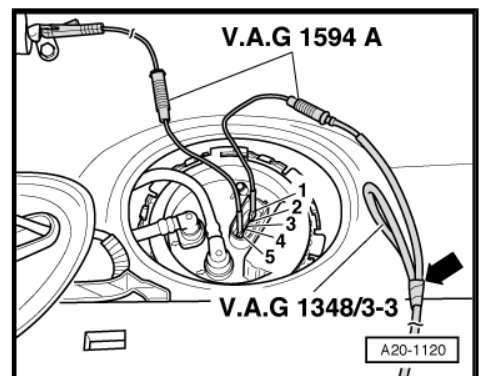
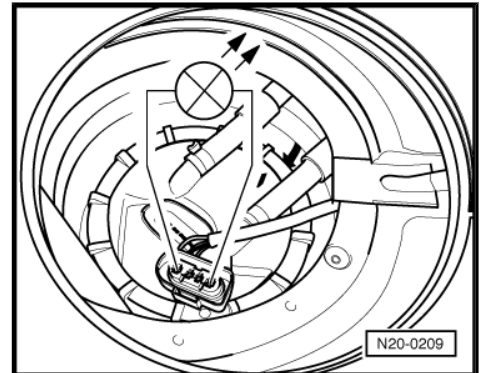
### Note

*The Fuel Pump (FP) runs quietly. Avoid surrounding noises while testing the fuel pump.*

- Listen for an operating noise from the fuel pump.

If no operating noise is heard:

- Remove the fuel delivery unit. Refer to Engine Mechanical, Repair Group 20, Fuel Supply.





- Using a Multimeter , check the electrical circuit between terminals -1- and -4- of the fuel delivery unit and the fuel pump for continuity.

Specified value: 0 ohms.

If a malfunction is detected in the electrical circuit:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- Check the electrical harness connector for damage, corrosion, lose or broken terminals.
- If necessary, repair the electrical circuit.
- If no malfunction is detected in electrical circuit, replace the fuel pump. Refer to Engine Mechanical, Repair Group 20, Fuel Supply.

#### Final procedures

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

- 1 - Check the DTC memory. Refer to [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

#### End diagnosis

## 1.4 Fuel Pressure, Checking

### Special tools and workshop equipment required

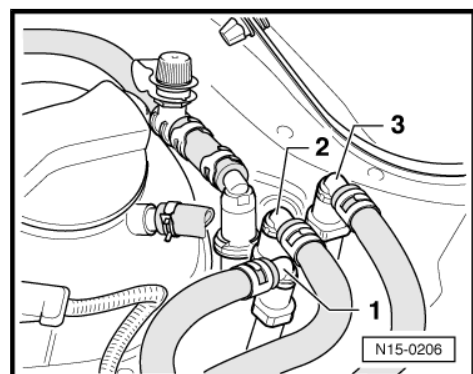
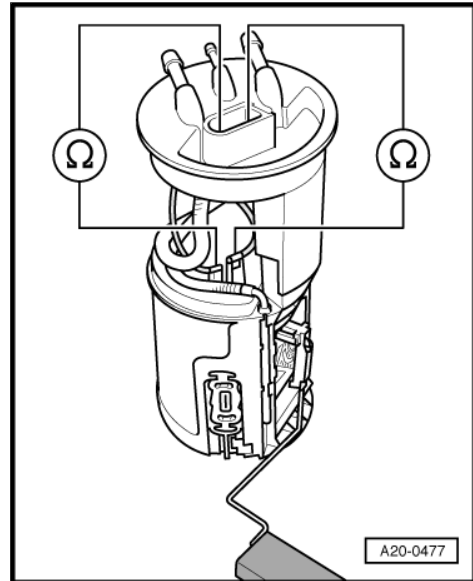
- ◆ Fuel pressure gauge



#### WARNING

*Fuel supply line is under pressure! Wear protective goggles and protective clothing to prevent injuries and contact with skin. Before loosening hose connections, place rags around the connection point. Then release pressure by carefully pulling on hose.*

- Remove the fuel supply line -3- and catch leaking fuel using a rag.





- Install a Fuel pressure gauge and hold into a measuring container.
- Open the shut-off valve of the Fuel pressure gauge .
- Switch the ignition on and off until the fuel pressure on no longer rises.
- Check the indicated fuel pressure on the Fuel pressure gauge .  
Specified value: 2.5 bar minimum.

If specified value is obtained:

- Check the return line between the fuel filter and the fuel pump for kinks and blockage.

If no malfunction is found in the return line between the fuel filter and the fuel pump:

- The pressure relief valve in the fuel filter is malfunctioning, replace the fuel filter.

If specified value is not obtained:

- Check the fuel pressure in front of the fuel filter.
- Connect a High pressure fuel gauge between the fuel filter and the fuel supply line.
- Open the shut-off valve of the Fuel pressure gauge .
- Start the engine and let it run at idle.



**Caution**

*Shut-off valve must only be closed slowly. At a fuel pressure of 8 bar, shut-off valve must be opened again immediately to prevent damage to pressure measuring device.*

- Slowly close the shut-off valve of the Fuel pressure gauge .  
Pressure must increase to min. 6.0 bar. If 6 bar is reached, open shut-off valve again immediately!

If the fuel pressure increases:

- The pressure relief valve in the fuel filter is malfunctioning, replace the fuel filter.

If the fuel pressure does not increase:

- Replace the fuel pump. Refer to Engine Mechanical, Repair Group 20, Fuel Supply.

**Final procedures**

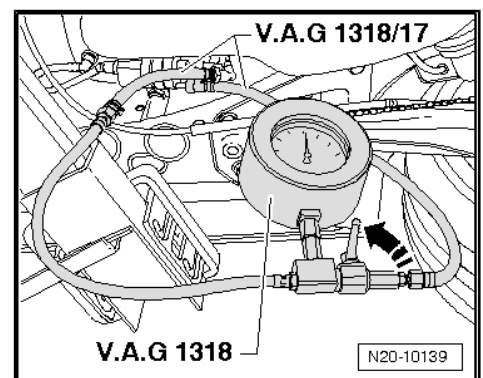
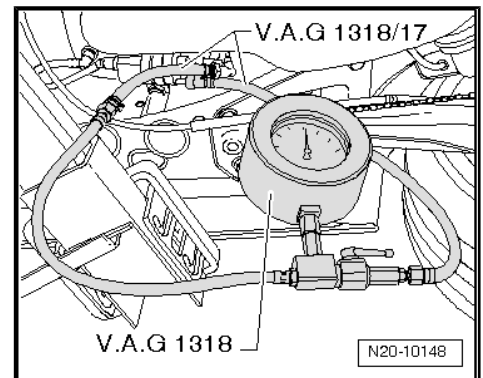
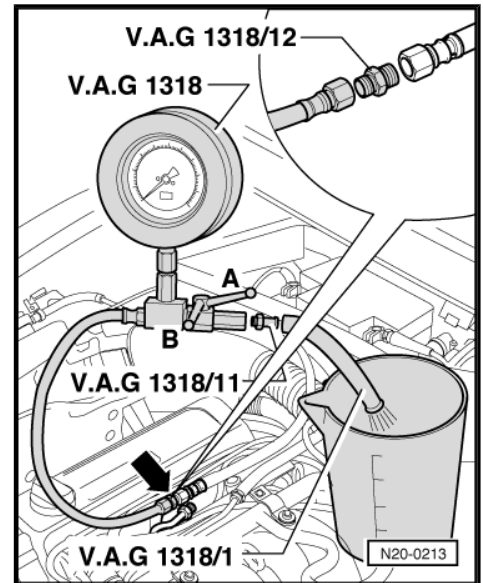
After the repair work, the following work steps must be performed in the following sequence:

- 1- Check the DTC memory. Refer to ⇒ [page 5](#) .
- 2- If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3- If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .

**End diagnosis**

**1.5 Fuel Delivery, Checking**

**Special tools and workshop equipment required**





- ◆ Hand held remote control (jumper) .
- ◆ Multimeter .
- ◆ Electrical connector test lead set .
- ◆ Fuel pressure test set .
- ◆ Measuring container, fuel-resistant .

#### Test conditions

- Battery voltage 12.5 V
- Fuel filter OK
- Fuel tank at least  $\frac{1}{4}$  filled.
- Fuel pressure regulator OK.
- Ignition switched off.



#### WARNING

*Fuel supply line is under pressure! Wear protective goggles and protective clothing to prevent injuries and contact with skin. Before loosening hose connections, place rags around the connection point. Then release pressure by carefully pulling on hose.*

#### Procedure

- Remove fuel filler cap from fuel filler tube.
- Remove the rear seat bench. Refer to Body Interior, Repair Group 72.
- Connect a Hand held remote control (jumper) to terminal -1- of the fuel delivery unit and to vehicle battery (+).
- Connect a jumper cable from a Electrical connector test lead set to terminal 4 of the fuel delivery unit and to vehicle Ground (GND).



#### WARNING

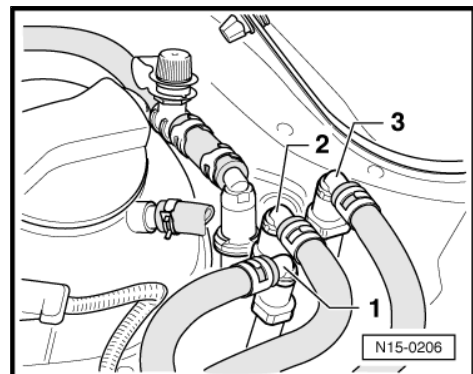
*Fuel supply line is under pressure! Wear protective goggles and protective clothing to prevent injuries and contact with skin. Before loosening hose connections, place rags around the connection point. Then release pressure by carefully pulling on hose.*

- Disconnect the fuel supply line -3- and catch escaping fuel using a rag.



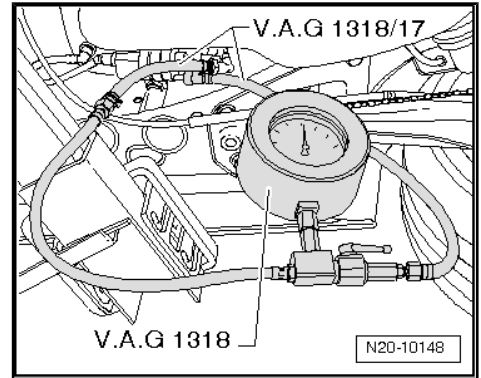
#### Note

*Press in securing ring to disengage the fuel lines.*





- Connect a Fuel pressure gauge between the fuel filter and fuel supply line.

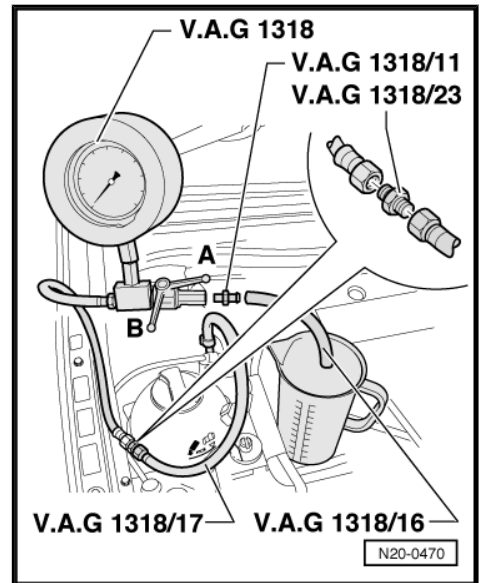


- Connect a fuel line from the Fuel pressure gauge to the disconnected fuel return line and hold it in the measuring container .

**⚠ WARNING**

*Danger of spraying when opening shut-off valve; wear protective goggles and protective clothing to prevent injuries and contact with skin. Hold container in front of open connection of pressure measuring device.*

- Close the shut-off valve of Fuel pressure gauge .
- Press switch on the Hand held remote control (jumper) while opening the shut-off valve slowly until 4 bar positive pressure is indicated on pressure gauge. Do not change position of the shut-off valve.
- Empty into the measuring container.



Delivery rate of the fuel pump is dependent on the battery voltage.

- Operate the remote control for 30 seconds.
- Using a Multimeter , check battery voltage while the fuel pump is running.
- Compare the fuel quantity pumped with the specified value.

\*) Minimum delivery rate  $\text{cm}^3/30 \text{ s}$

\*\*\*) Voltage at the fuel pump with the engine off and the fuel pump running (approx. 2 Volts less than battery voltage).

Read-out example:

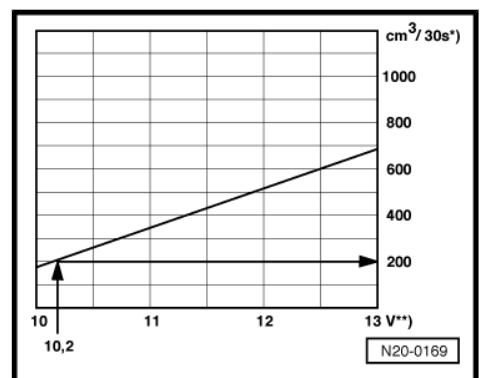
During test, a voltage of 12.5 Volts is measured at battery. Since voltage at the pump is approx. 2 Volts less than battery voltage, there is a minimum delivery rate of approx.  $580 \text{ cm}^3/30 \text{ s}$ .

If the minimum delivery rate is not obtained:

- Check fuel lines for restrictions (kinks) or clogging.

If no malfunction can be found:

- Disconnect the supply hose from the fuel filter input.





- Connect a Fuel pressure gauge between the fuel filter and fuel supply line.
- Repeat the delivery rate test.

If the minimum delivery rate is obtained:

- Replace the fuel filter.

If the minimum delivery rate is not obtained:

- Remove the fuel pump and check the strainer filter for dirt.

If no malfunctions have been found:

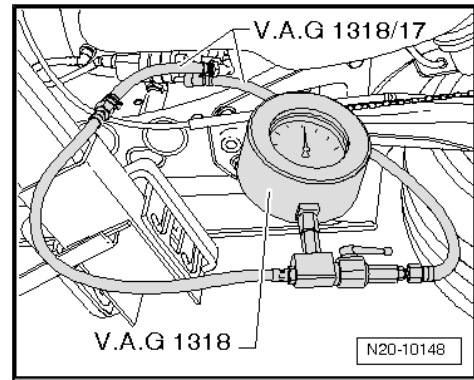
- Replace the fuel pump. Refer to Engine Mechanical, Repair Group 20, Fuel Supply.

### Final procedures

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

- 1 - Check the DTC memory. Refer to ⇒ [page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .

### End diagnosis







## 2 EVAP System

⇒ [“2.1 EVAP System, Leak Detection”, page 45](#)

⇒ [“2.2 EVAP Canister System, Checking for Proper Seal”, page 46](#)

⇒ [“2.3 EVAP Canister Purge Regulator Valve N80, Checking”, page 47](#)

⇒ [“2.4 Leak Detection Pump V144, Checking”, page 50](#)

For all EVAP system component locations and hose routing. Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 20.

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.*
- ◆ *The manufacturers test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- is available for purchase or rental. Refer to the ⇒ Tool catalog .*

## 2.1 EVAP System, Leak Detection

### Function

The leak detection system recognizes leaks in the complete fuel system, including the fuel tank, EVAP canister and the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- .

On the mechanical side, the leak detection system consists mainly of a vacuum-driven diaphragm pump equipped with a reed contact on the actuation rod of the pump diaphragm. The pump is supplied with vacuum by the engine intake stroke.

- ◆ When leak detection is activated, the diaphragm pump pumps the fuel system up to 20 - 30 mbar. The pump diaphragm is then moved out so that the reed contact at the operating rod remains in the “open” position.
- ◆ During the leak diagnosis, the reed contact is monitored to check if it remains open within 10 seconds. This indicates the system is sealed.
- ◆ If the pressure falls (indicating a leak), the diaphragm moves back and the reed contact closes.
- ◆ If the reed contact closes within 10 seconds of leak detection time, a further test is performed: In this case the diaphragm pump pumps four times again. The Motronic Engine Control Module (ECM) -J220- measures the time for each of the four pumps until the reed contact is closed again. From that, the control module can recognize a “small leak” (greater than 1 mm in diameter) or a “large leak”.



Leak diagnosis is activated automatically shortly following every engine start. If a malfunction is determined, an entry is made to the Diagnostic Trouble Code (DTC) memory. The Malfunction Indicator Lamp (MIL) -K83- in the instrument cluster lights up if the malfunction is recognized for two subsequent starts.

## 2.2 EVAP Canister System, Checking for Proper Seal

### Special tools and workshop equipment required

- ◆ Smoke tester .
- ◆ EVAP and Fuel Supply System Vacuum hose and line routing diagram.



#### Note

- ◆ *Secure all hose connections using hose clamps appropriate for the model type ⇒ Parts catalog .*
- ◆ *Replace seals and gaskets when performing repair work.*

### Leak checking

- Using a Smoke tester , check the Evaporative Emission (EVAP) canister system for leaks.



#### Note

*Always follow the manufacturers directions for the proper installation and operation of the Smoke tester being used.*

If a leak is detected:

- Check the fuel filler cap seal for damage and for proper installation. Replace if necessary.
- Check the seals under the locking flanges and the union nuts are properly tightened on the fuel tank.
- Check all hose connections of the fuel supply system and replace or repair any leaking lines.
- Check all hose connections of the EVAP system and replace or repair any leaking lines.
- Repair or replace any damaged component.

If no leaks are found in the EVAP and Fuel Supply System:

- Erase the DTC memory if a DTC was set. Refer to ⇒ [page 7](#) .
- Perform a road test to verify repair.

If a DTC was set and does not return:

Repair complete, Generate readiness code. Refer to ⇒ [page 17](#) .

- End diagnosis.

If the DTC does return and no leaks are found in the EVAP and Fuel Supply System:

- Check the DTC memory for any DTC codes pertaining to the EVAP and Fuel Supply Systems. If a DTC is stored, perform the diagnostic test procedure for the suspected component. Refer to ⇒ [page 5](#) .



## 2.3 EVAP Canister Purge Regulator Valve N80, Checking

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

### Test requirements

- The Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- fuse OK.
- The Fuel Pump (FP) Relay -J17- OK.
- The ignition switched off.

### Note

*Voltage for the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- is supplied by the Fuel Pump (FP) Relay -J17- .*

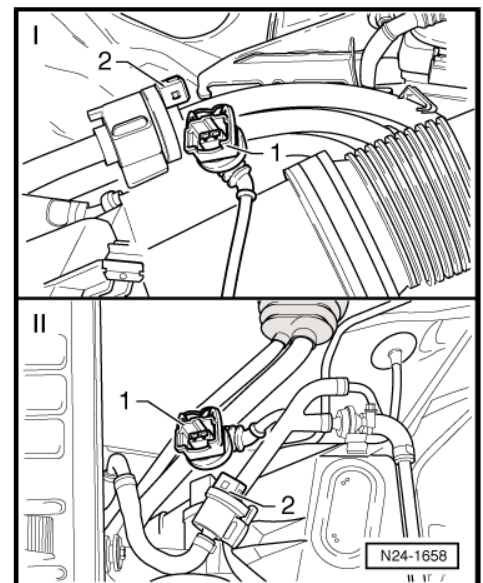
### Test procedure

- Perform a preliminary check to verify the customers complaint.  
Refer to [⇒ page 99](#)

### Start diagnosis

- Remove the engine cover with air filter. Refer to Fuel Injection & Ignition, Repair Group 24.
- Disconnect the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- electrical harness connector -Top Graphic 2-.

### Checking internal resistance





- Using a Multimeter , check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- terminals 1 and 2 for resistance.

Specified value: 22,0 to 30,0 Ω.

If the specified value is not obtained:

- Replace the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- .

If the specification is obtained:

#### Checking voltage supply

- Using a Multimeter , check the electrical harness connector terminal 1 to 2 for voltage.
- Operate the starter briefly.

Specified value: battery voltage.

If the specified value was not obtained:

- Using a Multimeter , check the electrical harness connector terminal 1 for voltage.

Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- electrical harness connector terminal	Measure to
1	Engine Ground (GND)

- Operate the starter briefly.

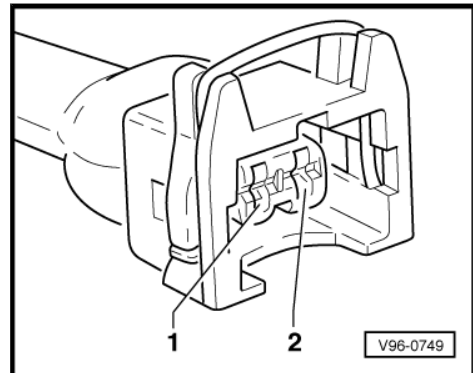
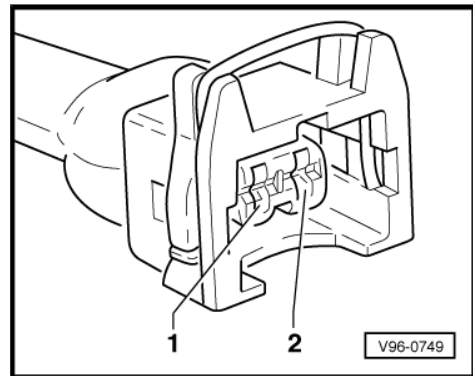
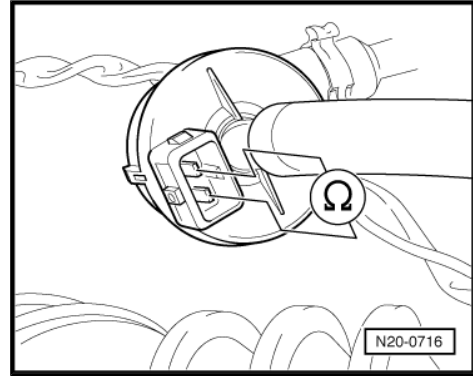
Specified value: battery voltage.

If the specified value is not obtained:

- Check the wiring connection from the electrical harness connector terminal 1 to the Fuel Pump (FP) Relay -J17- terminal 23/87 for an open circuit.
- Check the electrical harness connector for damage, corrosion, lose or broken terminals.
- If necessary, repair the wiring connection.

If the specified value was obtained:

#### Check Ground (GND) activation





- Using a Multimeter , check the electrical harness connector for voltage.

Evaporative Emission (EVAP) Can- ister Purge Regulator Valve -N80- electrical harness connector terminal	Measure to
2	Battery positive (+)

- Operate the starter briefly.
- Specified value: battery voltage.
- Switch the ignition off.

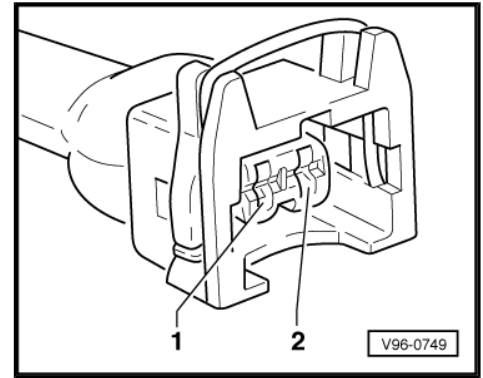
If the specified value was not obtained:

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .





- Using a Multimeter , check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- electrical connector terminal 2 to Motronic Engine Control Module (ECM) -J220- electrical connector T80 terminal 15 for an open circuit.

Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- electrical harness connector terminal	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal test box socket
2	15

Specified value: 1.5 Ω max.

If the specification is not obtained:

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

If the specification was obtained:

- Erase the DTC memory. Refer to ⇒ [page 7](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ [page 17](#) .

- End diagnosis.

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

- Replace the Motronic Engine Control Module (ECM) -J220- . Refer to Fuel Injection & Ignition, Repair Group 24.
- 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 ⇒ [page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .

## 2.4 Leak Detection Pump V144, Checking

### Special tools and workshop equipment required

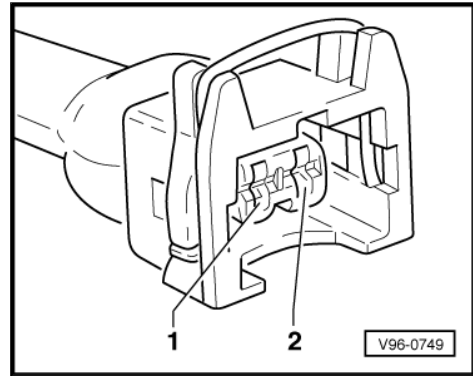
- ◆ Multimeter .
- ◆ Wiring diagram.

### Test requirements

- The Leak Detection Pump (LDP) -V144- fuse OK.
- The Fuel Pump (FP) Relay -J17- OK.
- The ignition switched off.

### Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [page 99](#) .





### Start diagnosis

- Remove the right rear wheel housing liner. Refer to Body Exterior, Repair Group 66.
- Disconnect the Leak Detection Pump (LDP) -V144- electrical harness connector -arrow-.

### Checking internal resistance

- Using a Multimeter , check the Leak Detection Pump (LDP) -V144- for resistance as follows:

Leak Detection Pump (LDP) -V144- electrical harness connector terminals	Specified values
-1- + -3-	640 to 720 Ω
-2- + -3-	17.5 to 27.5 Ω

If any of the specifications are not obtained:

- Replace the Leak Detection Pump (LDP) --V144-- . Refer to Engine Mechanical, Repair Group 20, Fuel Supply.

If the specified values are obtained:

### Checking voltage supply



#### Note

*The voltage for the Leak Detection Pump (LDP) --V144-- is supplied by the Fuel Pump (FP) Relay -J17- .*

- Check the Leak Detection Pump (LDP) --V144-- for voltage.
- Using a Multimeter , check the Leak Detection Pump (LDP) --V144-- electrical harness connector terminal 3 for voltage.

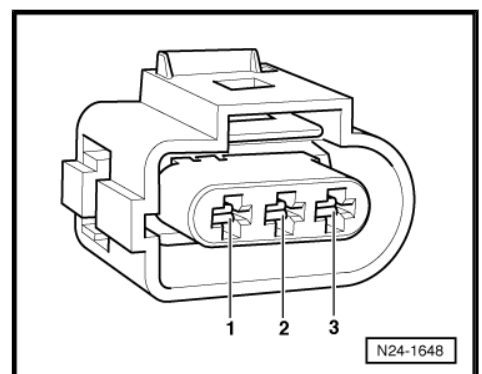
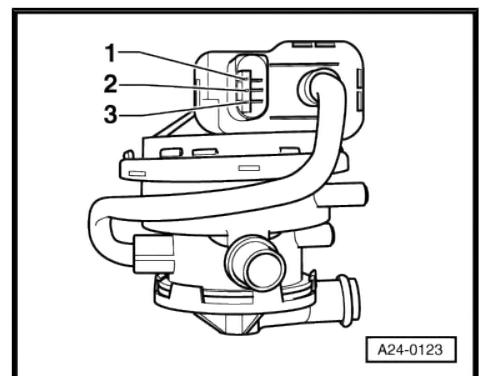
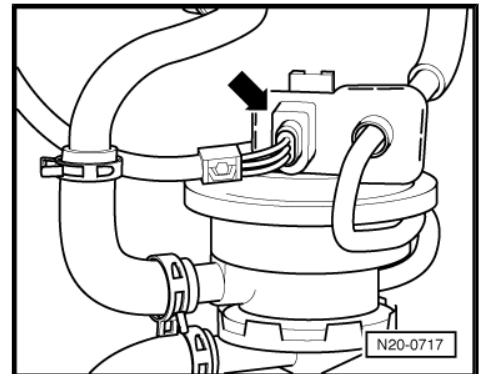
Leak Detection Pump (LDP) --V144-- electrical harness connector terminal	Measure to
-3-	Engine Ground (GND)

- Operate the starter briefly.

Specified value: battery voltage.

- Switch the ignition off.

If the specified value was not obtained:





- Using a Multimeter , check the Leak Detection Pump (LDP) -- V144-- electrical harness connector terminal 3 to the Fuel Pump (FP) Relay -J17- terminal 23/87 for an open circuit.

Specified value: Wire resistance max 1.5  $\Omega$ .

If the specification is not obtained:

- Check the wiring for a short circuit to Battery positive (+) or an open circuit.
- Check the electrical harness connector for damage, corrosion, lose 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:

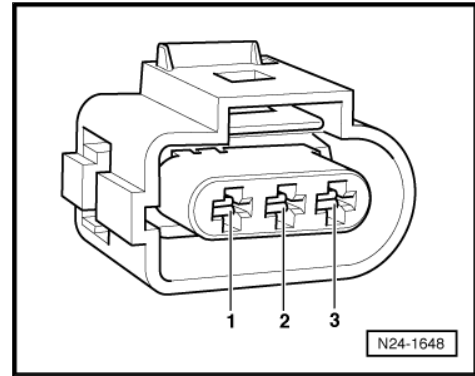
### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- Using a Multimeter , check the Leak Detection Pump (LDP) -- V144-- electrical connector terminal 1 to Motronic Engine Control Module (ECM) -J220- electrical connector T80 terminal 40 for an open circuit.

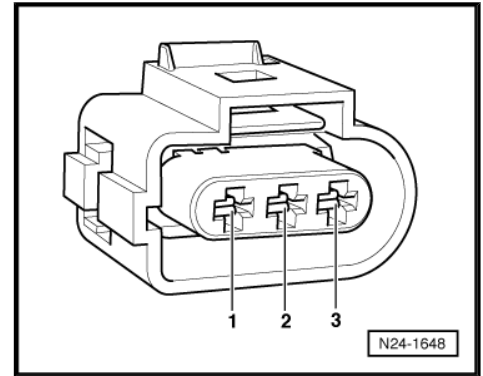






- Using a Multimeter , check the Leak Detection Pump (LDP) -- V144-- electrical connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical connector T80 terminals for an open circuit.

Leak Detection Pump (LDP) -- V144-- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box socket
-1-	37
-2-	16



Specified value: 1.5 Ω max.

If the specification is not obtained:

- Erase the DTC memory. Refer to ⇒ [page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ [page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- Assembly is performed in the reverse of the removal.

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

- Install the right rear wheel housing liner. Refer to Body Exterior, Repair Group 66.

### Final procedures

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

- 1 - Check the DTC memory. Refer to ⇒ [page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .



## 21 – Turbocharger, G-Charger

### 1 Turbocharger

⇒ [“1.1 Safety Precautions”, page 54](#)

⇒ [“1.2 Clean Working Conditions”, page 55](#)

⇒ [“1.3 General Information”, page 55](#)

⇒ [“1.4 Wastegate Bypass Regulator Valve N75, Checking”, page 56](#)

⇒ [“1.5 Barometric Pressure Sensor F96, Checking”, page 58](#)

For all Turbocharger, G-Charger component locations. Refer to Engine Mechanical, Repair Group 21.

For all Turbocharger, G-Charger system removal/installation procedures and torque specifications. Refer to Engine Mechanical, Repair Group 21.

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.*
- ◆ *The manufacturers test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- is available for purchase or rental. Refer to the ⇒ Tool catalog .*

### 1.1 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.*

## 1.2 Clean Working Conditions

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

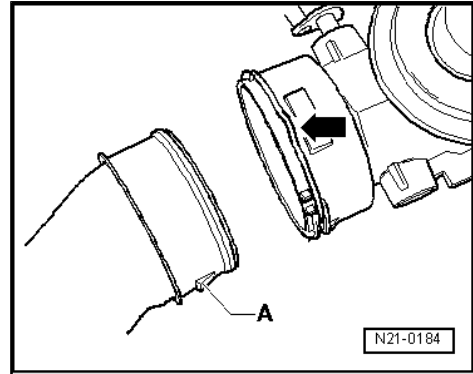
- ◆ Thoroughly clean all connections and the surrounding area before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover. Use lint-free cloths only!
- ◆ Carefully cover over opened components or seal, if repairs are not carried out immediately.
- ◆ Only install clean components: 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.

## 1.3 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 re-installing.
- ◆ 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" .
- ◆ Pliers for spring clamps -VAS 5024 A- or Hose clamp pliers - V.A.G 1921- 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.



## 1.4 Wastegate Bypass Regulator Valve N75, Checking

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

### Test requirements

- Fuse -S229- OK.
- The ignition switched off.



### Note

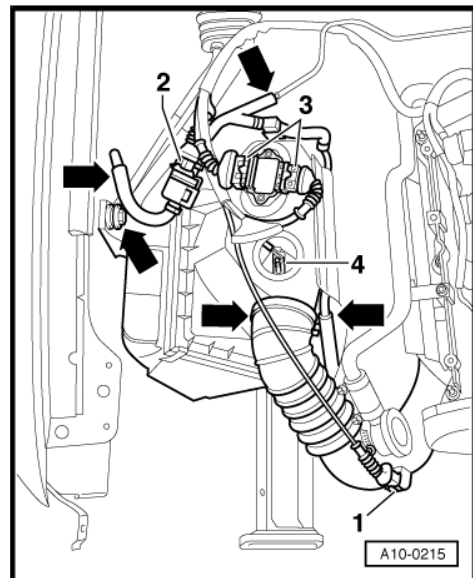
*The voltage for the Wastegate Bypass Regulator Valve -N75- is supplied by the Fuel Pump Relay -J17- .*

### Procedure

- Remove the engine cover.

### Checking internal resistance

- Disconnect the Wastegate Bypass Regulator Valve -N75- electrical harness connector-1-.





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

Specified value: 25 to 35 Ω (at approx. 20° C)

If the specification was not obtained:

- Replace the Wastegate Bypass Regulator Valve -N75- . Refer to Engine Mechanical, Repair Group 21.

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 between the Fuel Pump Relay -J17- socket 20/87a and the Wastegate Bypass Regulator Valve -N75- electrical harness connector terminal 1 for a short circuit to Battery positive (+) or an open circuit.
- Check the electrical harness connector for damage, corrosion, lose or broken terminals.
- If necessary, repair the wiring connection.

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

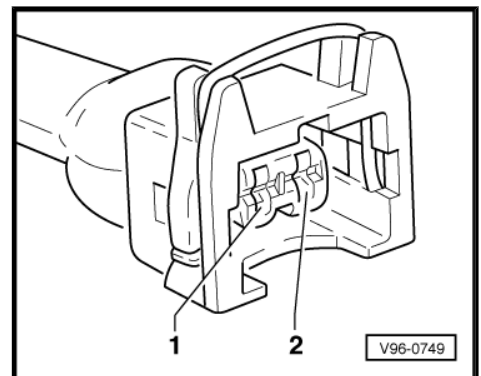
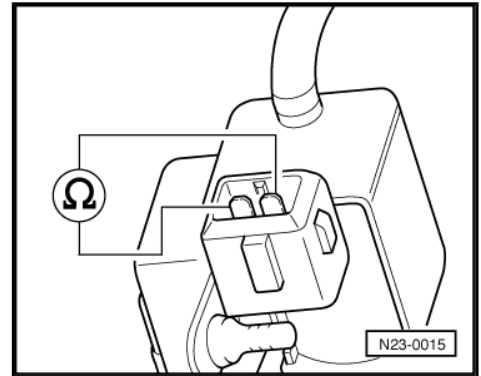
### Checking Wiring

If the manufacturers test box is being used. Perform the following step.

- Install the Adapter F/VAG1598 (68 Pin) -VAG1598/22- . Refer to Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to chapter [⇒ page 99](#)





- Using a multimeter , check the Wastegate Bypass Regulator Valve -N75- electrical harness connector terminal 2 to the Motronic Engine Control Module (ECM) -J220- electrical harness connector 64 for an open circuit.

Wastegate Bypass Regulator Valve. -N75- electrical harness connector terminal	Motronic Engine Control Module (ECM) -J220- electrical harness connector test box socket
2	64

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, lose 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 Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- Install the engine cover.

#### Final procedures

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

- 1 - Check the DTC memory. Refer to ⇒ [page 5](#) .
  - 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
  - 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .
- End of diagnosis.

## 1.5 Barometric Pressure Sensor F96, Checking

#### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

#### Test requirements

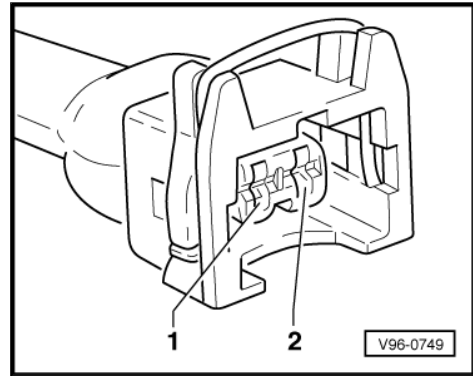
- Fuse -S229- OK.
- The ignition switched off.

#### Procedure

- Remove the engine cover.

#### Checking voltage

- Disconnect the Barometric Pressure (BARO) Sensor -F96- electrical harness connector.
- Switch the ignition on.





- Using a multimeter , check the Barometric Pressure (BARO) Sensor -F96- electrical harness connector terminals for voltage.

Barometric Pressure (BARO) Sensor -F96- electrical harness connector terminals	Specified value
1 to 3	4.5 to 5.5 V
2 to 3	4.5 to 5.5 V

- Switch the ignition off.

If the specified values were not obtained:

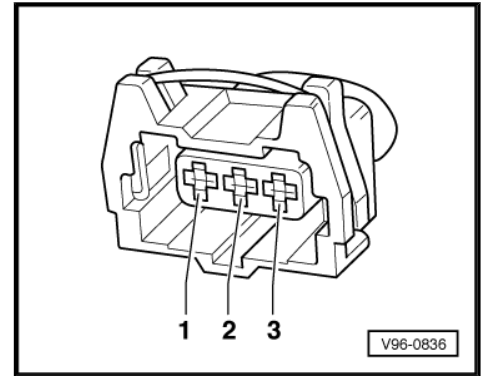
### Checking Wiring

If the manufacturers test box is being used. Perform the following step.

- Install the Adapter F/VAG1598 (68 Pin) -VAG1598/22- . Refer to Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to chapter [⇒ page 99](#)





- Using a multimeter, check the Barometric Pressure (BARO) Sensor -F96- electrical harness connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical harness connector terminals for an open circuit.

Barometric Pressure (BARO) Sensor -F96- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector test box sockets
1	61
2	62
3	67

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 Barometric Pressure (BARO) Sensor -F96-. Refer to Engine Mechanical, Repair Group 21.

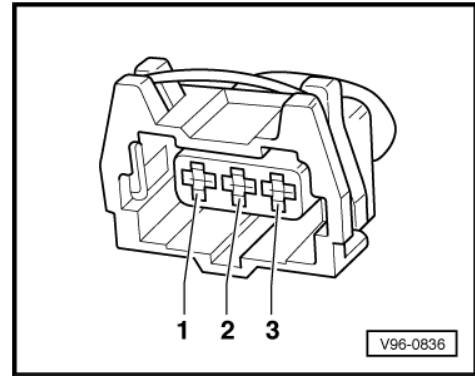
If no malfunction is detected in the wiring and if the voltage supply was not OK:

- Replace the Motronic Engine Control Module (ECM) -J220-. Refer to [⇒ page 99](#).
- Install the engine cover.

### Final procedures

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

- 1 - Check the DTC memory. Refer to [⇒ page 5](#).
  - 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#).
  - 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#).
- End of diagnosis.







## 2 Charge Air System

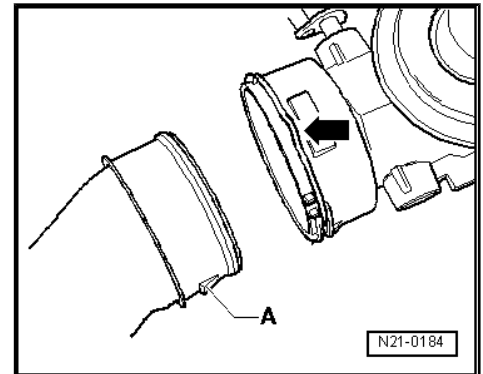
⇒ [“2.1 General Information”, page 61](#)

⇒ [“2.2 Safety Precautions”, page 61](#)

⇒ [“2.3 Clean Working Conditions”, page 62](#)

### 2.1 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 re-installation.
- ◆ Do not assemble charge air hoses and pipes 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 Type Clip Pliers or Hose clamp pliers are recommended for installing spring clamps.
- ◆ For connector couplings, always note the following points:
  - Release connector coupling by pulling securing clip -arrow-.
  - Disconnect the hose and line without the assistance of tools.
  - When assembling, make sure the retaining tabs -A- are engaged Securely.



### 2.2 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.*

## 2.3 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.



## 24 – Multiport Fuel Injection (MFI)

### 1 Motronic Fuel Injection System, Servicing

⇒ [“1.1 Safety Precautions”, page 63](#)

⇒ [“1.2 Clean Working Conditions”, page 64](#)

⇒ [“1.3 Technical Data”, page 64](#)

For all Motronic fuel injection system component locations. Refer to Fuel Injection & Ignition, Repair Group 24.

For all Motronic fuel injection system removal/installation procedures and torque specifications. Refer to Fuel Injection & Ignition, Repair Group 24.

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.*
- ◆ *The manufacturers test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- is available for purchase or rental. Refer to the ⇒ Tool catalog .*

### 1.1 Safety Precautions

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



#### Caution

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

- ◆ Always switch off ignition before disconnecting or connecting lines of the fuel injection and ignition system, including test leads.
- ◆ During some of the tests, a Diagnostic Trouble Code (DTC) may be recognized and stored by the control module. At the end of all tests and repairs, the DTC memory should be checked and, if necessary, erased. After erasing the DTC memory, a readiness code must be generated for the engine control module.
- ◆ Always switch ignition off before cleaning engine.



**Caution**

- ◆ *The battery must only be disconnected and connected with the ignition switched off, since the Engine Control Module (ECM) can otherwise be damaged.*
- ◆ *Observe procedures for disconnecting battery. Refer to Electrical Equipment, Repair Group 27.*

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

Even minor contaminations can lead to malfunctions in the fuel injection system. When working on the fuel supply/injection system, pay careful attention to the following rules for cleanliness:

- ◆ Thoroughly clean all unions and adjacent areas with engine or brake cleaner and dry before disconnecting.
- ◆ Plug open lines and connections immediately with appropriate protective caps.
- ◆ Place removed parts on a clean surface and cover. Use lint-free cloths.
- ◆ Install clean components: Remove replacement parts immediately prior to installation. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move vehicle unless absolutely necessary.
- ◆ Separated electrical connectors: Protect from dirt and moisture. Make sure connections are dry when reconnecting.

## 1.3 Technical Data

Engine Code	AEB
Idle speed (not adjustable)	820–920 RPM
Engine Control Module (ECM) System identification	Motronic ME 5.9.2



<b>Engine Code</b>	<b>AEB</b>
Terminals at Engine Control Module (ECM) Replacement part number Engine speed (RPM) limitation	80 ⇒ ETKA (electronic parts catalog) starting at approx. 6500 RPM



## 2 Components, Checking

⇒ [“2.1 Heated Oxygen Sensor before Catalytic Converter, Checking Heater Circuit”, page 66](#)

⇒ [“2.2 Oxygen Sensor after Catalytic Converter, Checking Heater Circuit”, page 68](#)

⇒ [“2.3 Mass Air Flow Sensor, Checking”, page 71](#)

⇒ [“2.4 Throttle Valve Control Module, Checking”, page 74](#)

⇒ [“2.5 Engine Coolant Temperature Sensor, Checking”, page 77](#)

⇒ [“2.6 Intake Air Temperature Sensor, Checking”, page 81](#)

⇒ [“2.7 Engine Speed Sensor, Checking”, page 85](#)

⇒ [“2.8 Fuel Injectors N30, N31, N32, N33, Checking”, page 88](#)

### 2.1 Heated Oxygen Sensor before Catalytic Converter, Checking Heater Circuit



#### Note

*When servicing terminals in harness connector of Heated Oxygen Sensor (HO2S) -G39-, use only gold-plated terminals.*

#### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

#### Test requirements

- The Heated Oxygen Sensor (HO2S) -G39- fuse OK.
- The Fuel Pump (FP) Relay -J17- 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 [⇒ page 99](#)

#### Start diagnosis

- Remove the engine cover with air filter. Refer to Fuel Injection & Ignition, Repair Group 24.

#### Checking internal resistance

- Disconnect the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector .



- Using a multimeter , check the Heated Oxygen Sensor (HO2S) -G39- terminals 1+2 for an open circuit.

Specified value: 2.5 to 19.9  $\Omega$  (at approx. 20° C)

If the specification was not obtained:

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

If the specification is obtained:

#### Checking voltage supply

- Using a multimeter , check the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminal 1 to ground (GND) for voltage.

Specified value: Battery voltage.

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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specification was obtained:

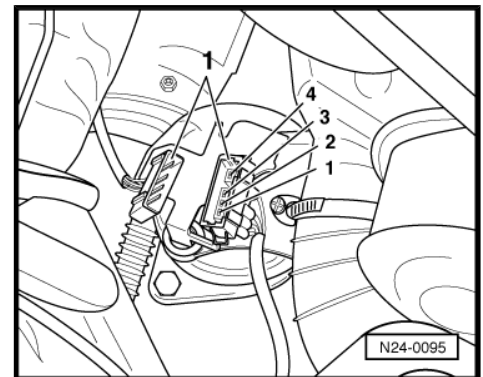
#### Checking Ground (GND) activation

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .





- Using a multimeter , check the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminal 2 to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal 27 for an open circuit.

Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminal	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal or test box socket
2	27

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, lose 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:

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

### End diagnosis

## 2.2 Oxygen Sensor after Catalytic Converter, Checking Heater Circuit

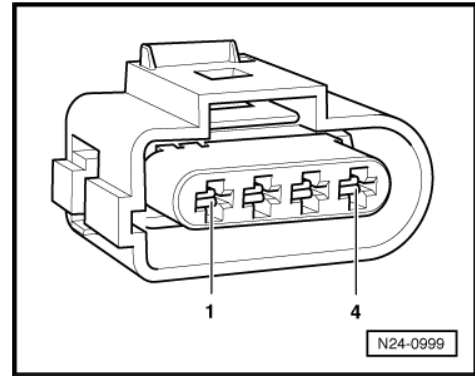


### Note

*When servicing terminals in harness connector of Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- , use only gold-plated terminals.*

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.







### Test requirements

- The Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- fuse OK.
- The Fuel Pump (FP) Relay -J17- 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.

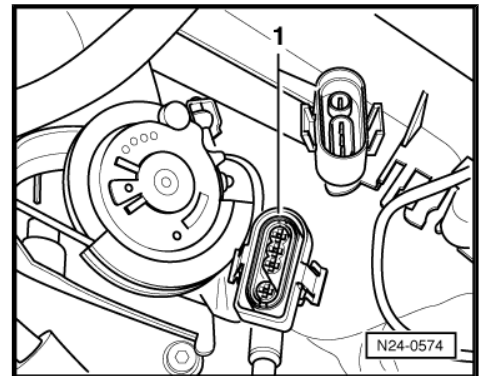
### Test procedure

- Perform a preliminary check to verify the customers complaint.  
Refer to ⇒ [page 99](#)

### Start diagnosis

#### Checking internal resistance

- Disconnect the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- electrical harness connector -1-.





- Using a multimeter , check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- electrical harness connector terminals 1 to 2 for resistance.

Specified value: 1.0 to 20.0  $\Omega$  (at approx. 20° C)

If the specification was not obtained:

- Replace the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- .

If the specification was obtained:

#### Checking voltage supply

- Using a multimeter , check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- electrical harness connector terminal 1 to ground (GND).

Specified value: Battery voltage.

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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specification was obtained:

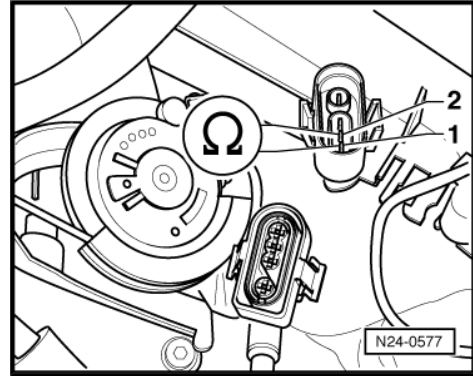
#### Checking Ground (GND) activation

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .





- Using a multimeter , check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- electrical harness connector terminal 2 to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal 28 for an open circuit according to the wiring diagram.

Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- electrical harness connector terminal	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal or test box socket
2	28

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, lose 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:

- Erase the DTC memory. Refer to ⇒ [page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ [page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- 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 ⇒ [page 5](#) .
- 2- If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3- If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .

### End diagnosis

## 2.3 Mass Air Flow Sensor, Checking

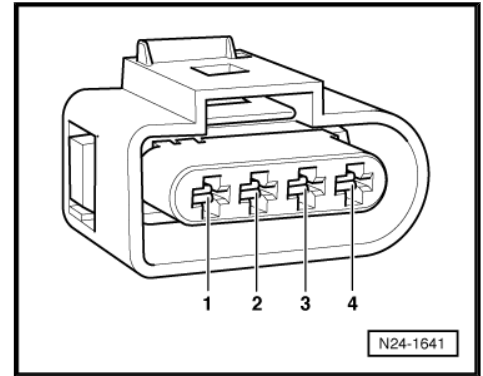


### Note

*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.
- The Fuel Pump (FP) Relay -J17- 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 ⇒ [page 99](#)

### Start diagnosis

#### Function test

- 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 <ul style="list-style-type: none"><li>• Engine running at idle</li></ul>	2.00 to 5.00 g/sec

- End diagnosis and switch ignition off.

If specified value is obtained, but DTC memory has a DTC concerning Mass Air Flow (MAF) Sensor -G70- :

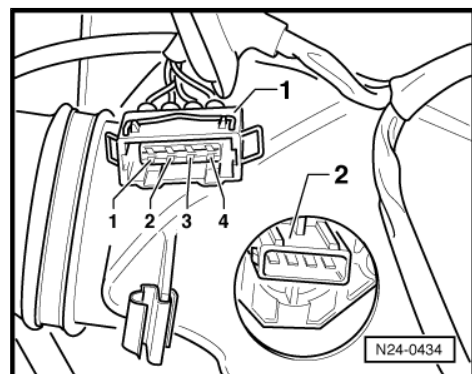
- Check voltage supply of Mass Air Flow (MAF) Sensor -G70- ⇒ [page 72](#) .

If specified value was not obtained:

- Check the Mass Air Flow (MAF) Sensor -G70- electrical circuit ⇒ [page 73](#) .

#### 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 3 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 3 to the Fuel Pump (FP) Relay -J17- terminal 23/87 for an open circuit.

Specified value: 1.5  $\Omega$  max.

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 2 to engine Ground (GND) for resistance.

Specified value: 1.5  $\Omega$  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, lose 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:

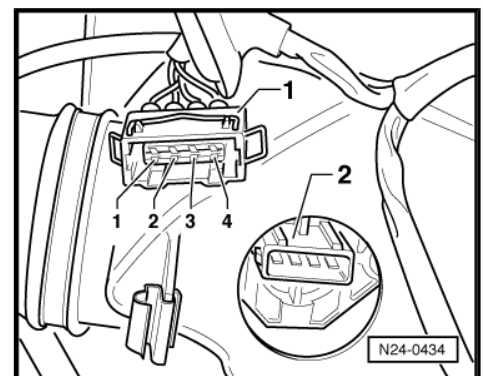
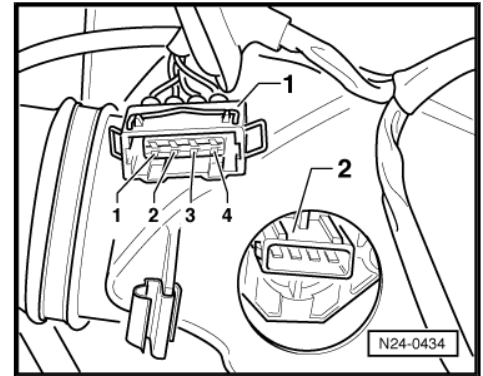
### Checking electrical circuit

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .





- Using a multimeter , check the Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 for an open circuit.

Mass Air Flow (MAF) Sensor - G70- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box socket
2	12
4	13

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, lose 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 ⇒ [page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ [page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- 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 ⇒ [page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .

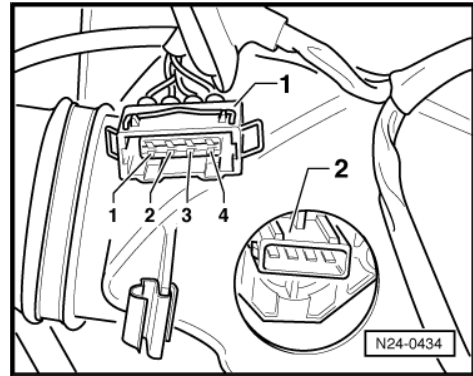
### End diagnosis

## 2.4 Throttle Valve Control Module, Checking



### Note

*Use only gold-plated terminals when servicing terminals in harness connector of Throttle Valve Control Module -J338- .*





## Components

The Throttle Valve Control Module -J338- is made up of the following components:

- ◆ Throttle Position (TP) Actuator -V60-
- ◆ Throttle Position (TP) Sensor -G88-
- ◆ Throttle Position (TP) Sensor -G69-
- ◆ Closed Throttle Position (CTP) Switch -F60-

The Throttle Valve Control Module -J338- cannot be serviced separately and must be serviced as a unit.

## Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

## Test requirements

- The Motronic Engine Control Module (ECM) - J220- 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".
- Ground (GND) connections between engine/transmission/ chassis OK.
- Throttle valve must not be damaged or dirty.
- Throttle valve must be in the Closed Throttle Position (CTP).
- Accelerator pedal cable and adjustment must be OK.

## Procedure

- Disconnect the Throttle Valve Control Module -J338- electrical harness connector -2-.

## Checking internal resistance

- Using a multimeter , check the Throttle Valve Control Module -J338- electrical terminals 1 to 2 for resistance.

Specified value: 1.0 to 5.0  $\Omega$  (at 20° C)

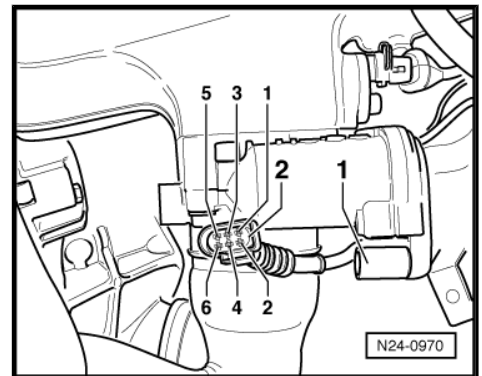
If the specification was not obtained:

- Replace the Throttle Valve Control Module - J338- .

If the specification was obtained:

## Checking voltage supply

- Switch the ignition on.





- Using a Multimeter , check the Throttle Valve Control Module -J338- electrical harness connector terminals 4 to 7 for voltage.

Specified value: at least 4.5 V

- Using a Multimeter , check the Throttle Valve Control Module -J338- electrical harness connector terminals 3 to 7 for voltage.

Specified value: at least 9 V

If the either of the specifications was obtained:

- Replace the Throttle Valve Control Module - J338- .
- Switch the ignition off.

If the either of the specifications was not obtained:

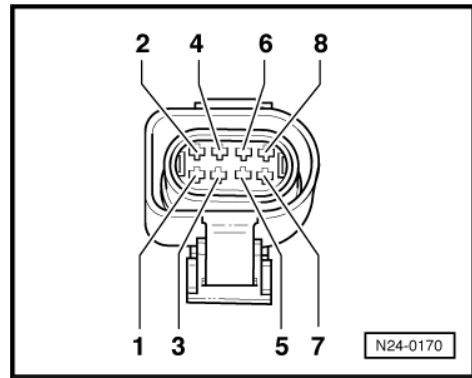
### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the Adapter F/VAG1598 (68 Pin) -VAG1598/22- . Refer to Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .

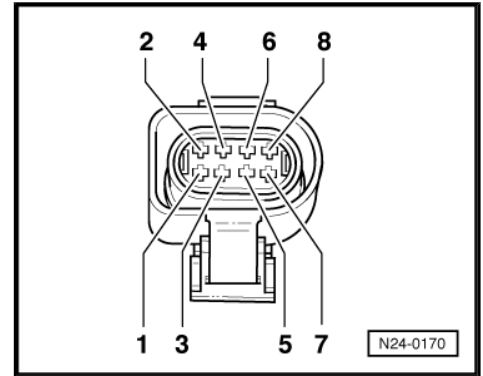






- Using a Multimeter , check the Throttle Drive (for Electronic Power Control (EPC)) -G186- at Throttle Valve Control Module -J338- electrical harness connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical harness connector terminals for an open circuit according to the wiring diagram.

Throttle Valve Control Module -J338- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connectors test box sockets
1	66
2	59
3	69
4	62
5	75
8	74



Specified value: 1.5  $\Omega$  max.

- 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, lose or broken terminals.
- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2- If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3- If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

End diagnosis

## 2.5 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 Motronic Engine Control Module (ECM) - J220- 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 ⇒ [page 99](#)

**Start diagnosis**

**Function test**

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

Diagnostic text	Specified value
Coolant temperature	Approx. coolant temperature

If the specified value is not obtained:

- Continue test according to the following table:

Indicated	Cause	Test
approx. - 40.0° C	Open circuit or short circuit to (B+)	⇒ <a href="#">page 79</a>
approx. 143.0° C	Short circuit to Ground (GND)	⇒ <a href="#">page 80</a>

If the specified value was obtained:

- Start the engine and let it run at idle.

The temperature value must increase uniformly in increments of 1.0° C.

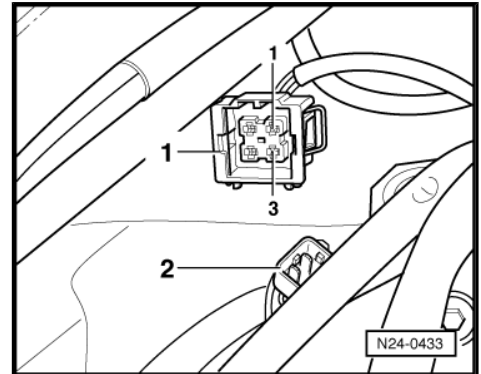


If the engine shows problems in certain temperature ranges and if the temperature does not climb uniformly, the temperature signal is intermittent.

- Replace the the Engine Coolant Temperature (ECT) Sensor - G62- Refer to Engine Mechanical, Repair Group 19, Engine Cooling System.

**Checking internal resistance**

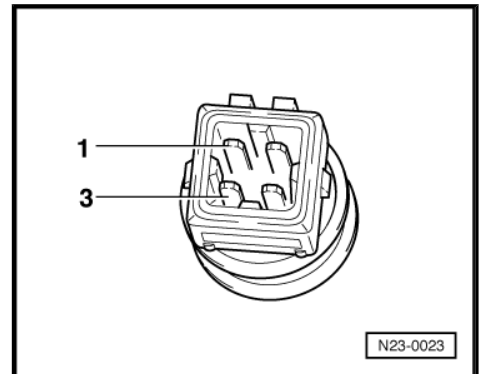
- Disconnect the Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector -1-.



- 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.
- ◆ Area B: Resistance values 50 to 100° C.



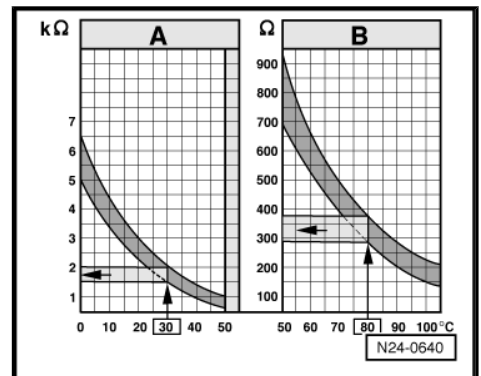
Specified values:

- ◆ Range A, 30° C equals a resistance of 1.5 to 2.0 kΩ
- ◆ Range B, 80° C equals a resistance of 275 to 375Ω

If any of the specified values was not obtained:

- Replace the Engine Coolant Temperature (ECT) Sensor - G62- Refer to Engine Mechanical, Repair Group 19, Engine Cooling System.

**Testing if display is approx. - 40.0° C**





- Disconnect the Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector -1-.
- Using a jumper wire , connect the Engine Coolant Temperature (ECT) Sensor -G62- electrical harness connector terminals 3 to 4.
- Check the value indicated on the scan tool display.

If the value jumps to approx. 140.0° C

- End diagnosis and switch the ignition off.
- Replace the Engine Coolant Temperature (ECT) Sensor - G62- Refer to Engine Mechanical, Repair Group 19, Engine Cooling System.

If indication remains at approx. -40.0° C:

#### Testing if display approx. 140.0° C

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

If indication jumps to approx. -40.0° C:

- End diagnosis and switch ignition off.
- Replace the Engine Coolant Temperature (ECT) Sensor - G62- .

If indication remains at approx. 140.0° C:

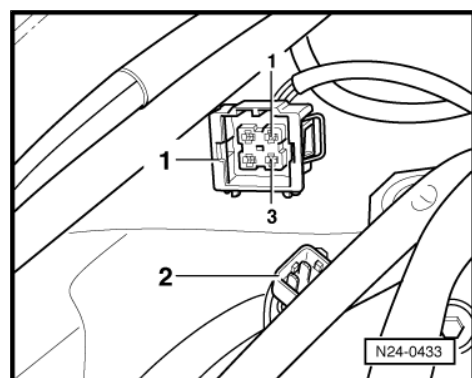
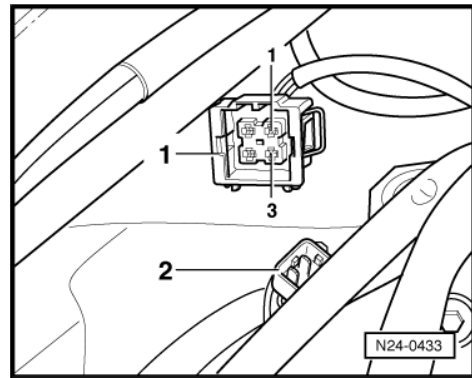
#### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .





- Using a Multimeter , check the Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector terminal 1 to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal 53 for an open circuit according to the wiring diagram.

Engine Coolant Temperature (ECT) Sensor - G62- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box socket
1	53

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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

### End diagnosis

## 2.6 Intake Air Temperature Sensor, Checking

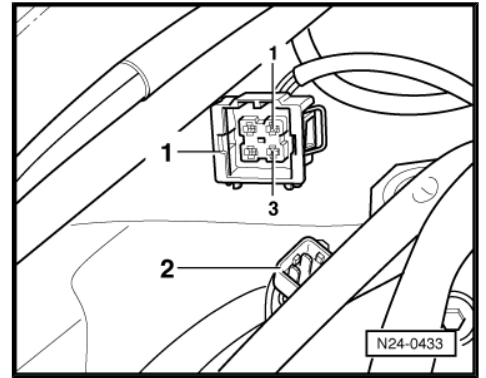


### Note

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

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.





- ◆ Cool spray (commercially available).

#### Test requirements

- The Motronic Engine Control Module (ECM) - J220- 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 ⇒ [page 99](#)

#### Start diagnosis

#### Function test

- 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:

- Continue the test according to the following table:

Indicated	Cause	Test
approx. -40° C	Open circuit or short circuit to (B+)	⇒ <a href="#">page 83</a>
approx. 143° C	Short circuit to Ground (GND)	⇒ <a href="#">page 83</a>

If the specified values are obtained:

- Remove the Intake Air Temperature (IAT) Sensor -G72- .
- Spray the Intake Air Temperature (IAT) Sensor -G72- with a commercially available cool spray while observing the temperature value on the scan tool.

The temperature value must decrease.

- End diagnosis and switch the ignition off.

If the intake air temperature does not decrease:

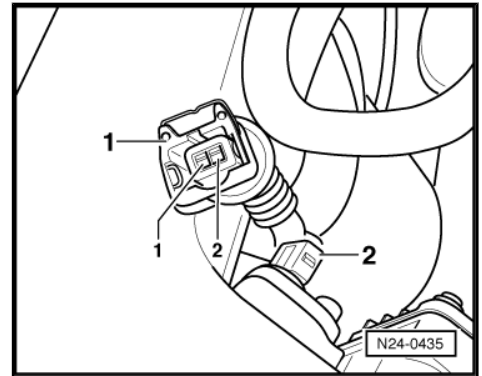
- Replace the Intake Air Temperature (IAT) Sensor -G72- .

If the intake air temperature does decrease:



### Checking internal resistance

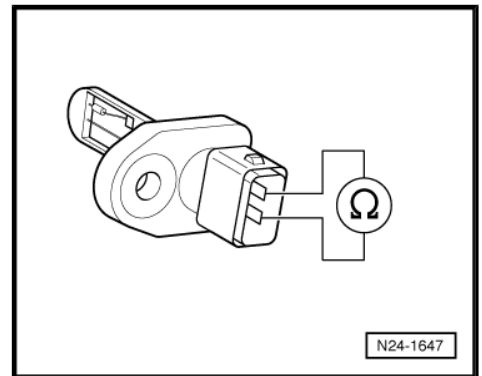
- Disconnect the Intake Air Temperature (IAT) Sensor -G72- electrical harness connector -1-.



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

Use the chart below for the specified values:

- ◆ Area A: Resistance values 0 to 50° C.
- ◆ Area B: Resistance values 50 to 100° C.



Specified values:

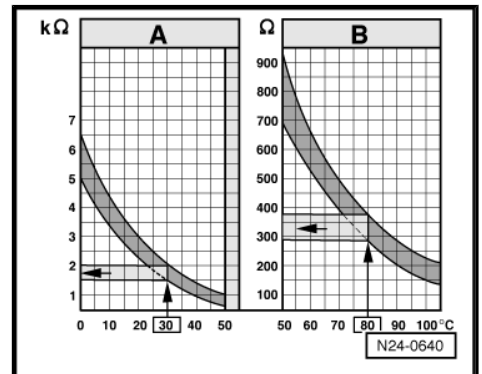
Read-out examples:

- ◆ Range A, 30° C equals a resistance of 1.5 to 2.0 kΩ
- ◆ Range B, 80° C equals a resistance of 275 to 375Ω

If any of the specified values are not obtained:

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

**Testing if display approx. -40° C or approx. -46° C:**



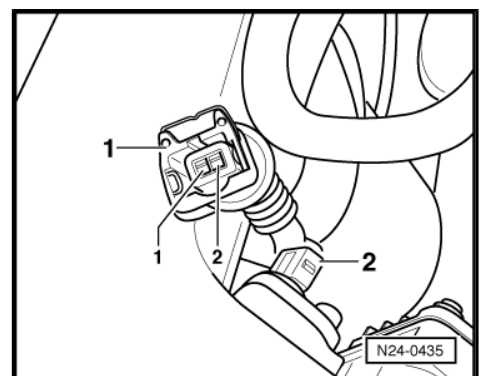
- Disconnect the Intake Air Temperature (IAT) Sensor -G72- electrical harness connector -1-.
- Using a jumper wire , connect the Intake Air Temperature (IAT) Sensor -G72- electrical harness connector terminals 1 to 2.
- Check the value indicated on the scan tool display.

If indication jumps to approx. 140° C:

- End diagnosis and switch ignition off.
- Replace the Intake Air Temperature (IAT) Sensor -G72- .

If indication remains at approx. -40° C or -46° C:

**Testing if display approx. 140° C:**





- Disconnect the Intake Air Temperature (IAT) Sensor -G72- electrical harness connector -arrow-.

If indication jumps to approx.  $-40^{\circ}\text{C}$  or  $-46^{\circ}\text{C}$ :

- End diagnosis and switch ignition off.
- Replace the Intake Air Temperature (IAT) Sensor -G72- .

If the indication remains at approx.  $140^{\circ}\text{C}$ :

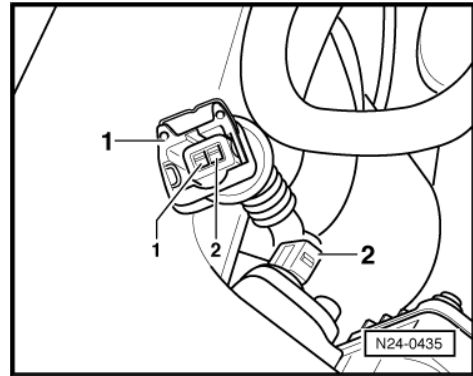
#### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to [page 99](#) .







- Using a Multimeter , check the Intake Air Temperature (IAT) Sensor -G72- electrical harness connector terminal 1 to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal 54 for an open circuit according to the wiring diagram.

Intake Air Temperature (IAT) Sensor -G72- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box socket
1	54

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, lose or broken terminals.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

### End diagnosis

## 2.7 Engine Speed Sensor, Checking

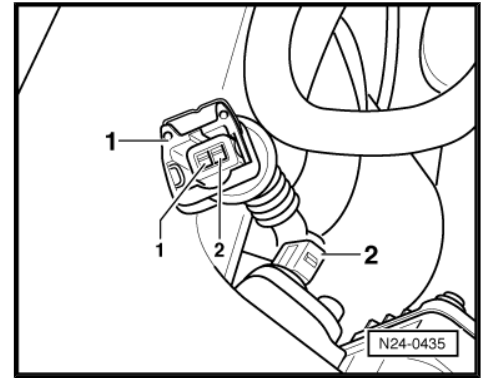


### Note

*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 Motronic Engine Control Module (ECM) - J220- 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.

### Function

The Engine Speed (RPM) Sensor -G28- detects RPM and reference marks. Without an engine speed signal, the engine will not start. If the engine speed signal fails while the engine is running, the engine will stop immediately.

### Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ➤ [page 99](#)

### Start diagnosis

#### Function test

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, check the engine speed:

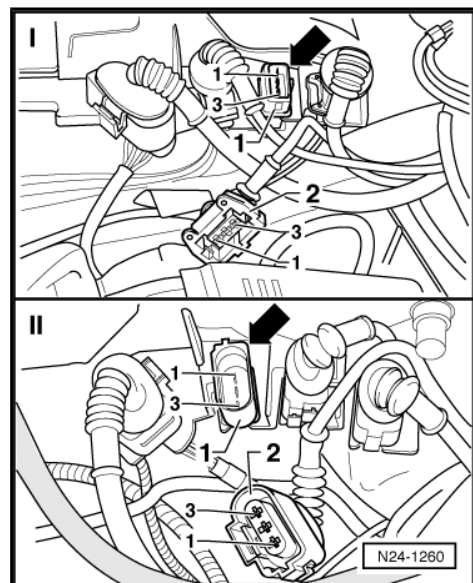
Diagnostic text	Specified value
Engine rotations per minute (RPM)	Idle speed

- End diagnosis and switch ignition off.

If the specified value was not obtained:

#### Checking internal resistance

- Disconnect the gray Engine Speed (RPM) Sensor -G28- electrical harness connector -1 Arrow-.





- Using a multimeter , check the Engine Speed (RPM) Sensor - G28- terminals 2 to 3 for resistance.

Specified value: 0.7 to 1000 kOhm

- Check Engine Speed (RPM) Sensor -G28- terminals 1 to 2 and 1 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:

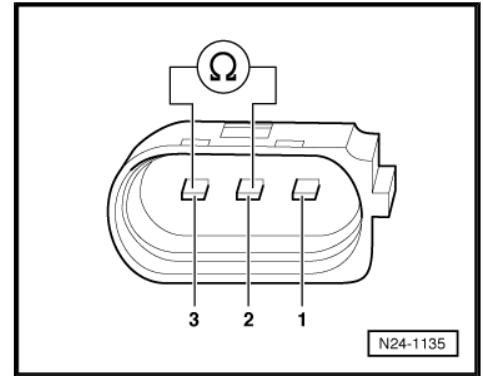
### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .





- Using a Multimeter , check the Engine Speed (RPM) Sensor - G28- electrical harness connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals for an open circuit.

Engine Speed (RPM) Sensor - G28- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box socket
1	56
2	63

Specified value: 1.5  $\Omega$  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, lose 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:

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

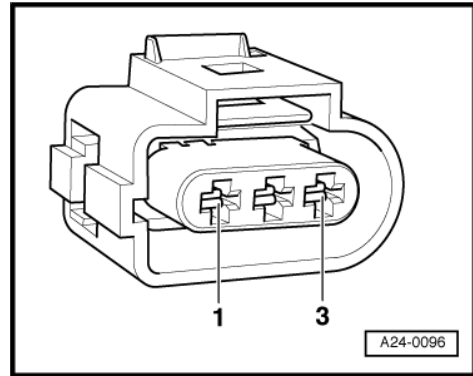
End diagnosis

## 2.8 Fuel Injectors N30, N31, N32, N33, Checking

The following test procedure is used to diagnose all fuel injectors.

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Diode test lamp (12V) .





- ◆ Wiring diagram.

### Test requirements

- The Fuel Injectors -N30, N31, N32, N33- fuses OK.
- The Engine Speed (RPM) Sensor -G28- OK, checking [⇒ page 85](#).
- 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.
- Observe safety precautions.
- Observe rules for cleanliness.

### Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to [⇒ page 99](#)

### Start diagnosis

- Disconnect the Fuel Injector electrical harness connectors from Fuel Injectors -N30, N31, N32, N33- -1-.

### Checking internal resistance

- Using a multimeter , check the Fuel Injector electrical terminals 1 to 2 for resistance.

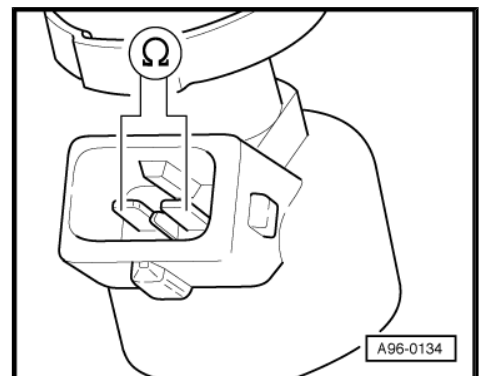
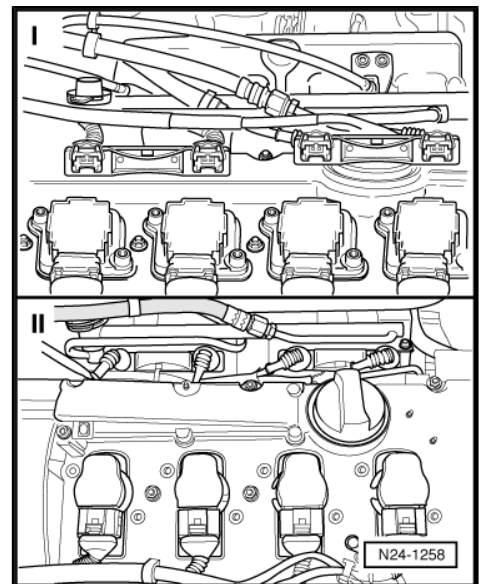
Specified value: 12.0 to 20.0  $\Omega$  (at approx. 20° C)

If the specified value was not obtained:

- Replace the malfunctioning Fuel Injector Refer to Fuel Injection & Ignition, Repair Group 24.

If the specified value was obtained:

### Checking activation





- Connect a diode test lamp (12V) to the electrical harness connector terminals 1 and 2 of the Fuel Injector to be tested.
- Operate the starter and test the activation of the Fuel Injector .

LED should flicker.

- Switch the ignition off.

If LED does not flicker:

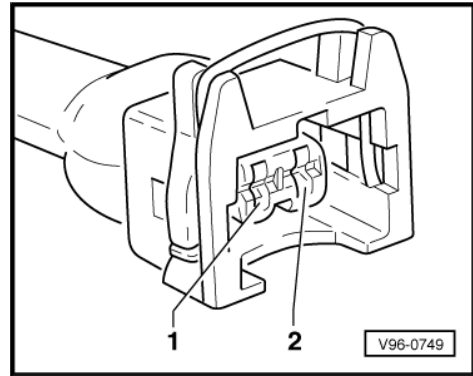
### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

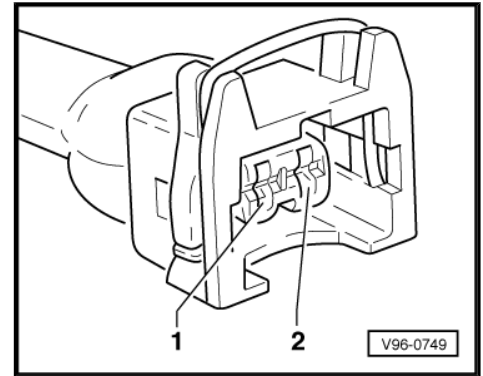
- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to => [page 99](#) .





- Using a Multimeter , check the Fuel Injector electrical harness connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals for an open circuit.

Component	Fuel Injector electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box sockets
Cylinder 1 Fuel Injector -N30-	2	73
Cylinder 2 Fuel Injector -N31-	2	80
Cylinder 3 Fuel Injector -N32-	2	58
Cylinder 4 Fuel Injector -N33-	2	65



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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

- Erase the DTC memory. Refer to ⇒ [page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ [page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- 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 ⇒ [page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .



## 3 Function Tests

### 3.1 Heated Oxygen Sensor and Oxygen Sensor Regulation before Catalytic Converter, Checking



#### Note

*Use only gold-plated terminals when servicing terminals in the electrical harness connector of the Heated Oxygen Sensor (HO2S) -G39- .*

#### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

#### Test requirements

- The Heated Oxygen Sensor (HO2S) -G39- fuse OK.
- The Heated Oxygen Sensor (HO2S) -G39- heater circuit before catalytic converter OK. Refer to [⇒ page 66](#) .
- 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.
- Exhaust system between catalytic converter and cylinder head properly sealed.
- Coolant Temperature at least 80° C.

#### Function test

- Perform the function test in Diagnostic Mode 05 [⇒ page 8](#) and Diagnostic Mode 06. Refer to [⇒ page 9](#) .

#### Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to [⇒ page 99](#)

#### Start diagnosis

##### Checking primary voltage

- Remove the protective cover -arrows- and disconnect the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector.
- Using a multimeter , check the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminals 1 to 5 for voltage.

Specified value: 0.400 to 0.500 Volts

- Switch the ignition off.

If the specified value was obtained:

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

If the specified value is obtained:





### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- Using a Multimeter , check the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals for an open circuit.

Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box sockets
3	25
4	26

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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .



## End diagnosis

### 3.2 Oxygen Sensor after Catalytic Converter, Checking



#### Note

*When servicing terminals in the electrical harness connector of the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130-, use only gold-plated terminals.*

#### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

#### Test requirements

- The Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- fuse Ok.
- Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- heater circuit OK. Refer to ⇒ [page 68](#) .
- 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.
- Exhaust system between catalytic converter and cylinder head properly sealed.
- Coolant Temperature at least 80° C.

#### Function test

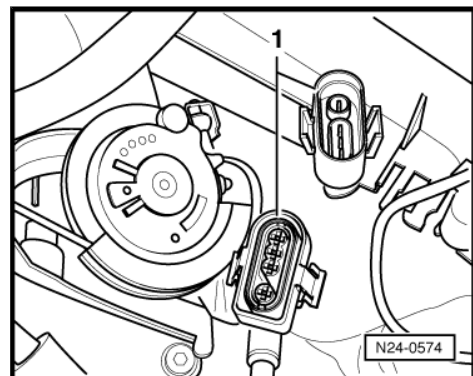
- Perform the function test in Diagnostic Mode 05 ⇒ [page 8](#) and Diagnostic Mode 06. Refer to ⇒ [page 9](#) .

#### Test procedure

- Perform a preliminary check to verify the customers complaint. Refer to ⇒ [page 99](#)

#### Start diagnosis

- Disconnect the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector -1-.
- Switch the ignition on.





- Using a multimeter , check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- electrical harness connector terminals 3 to 4 for voltage.

Specified value: 0.400 to 0.500 Volts

- Switch the ignition off.

If the specified value was obtained:

- Replace the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- .

If the specified value was not obtained:

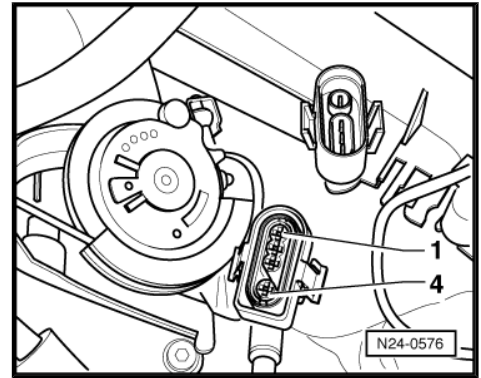
### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

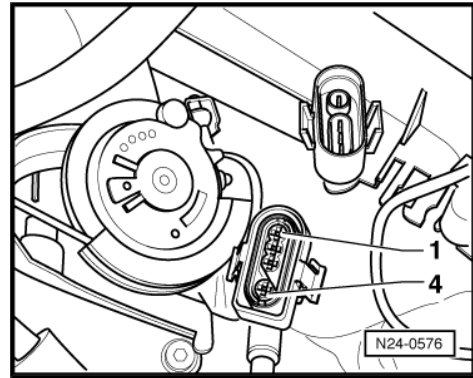
- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .





- Using a Multimeter , check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- electrical harness connector terminals to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals for an open circuit according to the wiring diagram.

Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- electrical harness connector terminals	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box sockets
3	51
4	52



Specified value: 1.5  $\Omega$  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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

### End diagnosis



## 4 Motronic Engine Control Module

Motronic Engine Control Module (ECM) -J220- regulates fuel injection, Throttle Valve Control Module -J338- , oxygen sensor regulation, ignition, knock control, Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- , engine speed limitation through fuel injectors or Fuel Pump (FP) Relay -J17- as well as On Board Diagnostic (OBD).

⇒ [“4.1 Voltage Supply, Checking”, page 97](#)

⇒ [“4.2 Motronic Engine Control Module, Replacing”, page 99](#)

⇒ [“4.3 Fuel Pump Relay, Checking”, page 100](#)

### 4.1 Voltage Supply, Checking

#### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

#### Test requirements

- The Motronic Engine Control Module (ECM) - J220- 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 procedure

- Perform a preliminary check to verify the customers complaint.  
Refer to ⇒ [page 99](#)

#### Start diagnosis

- Remove the Motronic Engine Control Module (ECM) Power Supply Relay -J271- .

#### Checking voltage

- Using a Multimeter , check the Fuel Pump (FP) Relay -J17- socket 16/MOT to Ground (GND).

Specified value: battery voltage.

If the specified value was not obtained:

- Check the wiring connections from the Battery to the Fuel Pump (FP) Relay -J17- socket 17/30 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 Fuel Pump (FP) Relay -J17- socket 19/15 to Ground (GND).



Specified value: battery voltage.

If the specified value was obtained:

### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- Using a Multimeter , check the Fuel Pump (FP) Relay -J17- sockets to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal 4 for resistance.

Fuel Pump (FP) Relay -J17- socket terminal	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal or test box socket
16/S	4

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, lose 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 Fuel Pump (FP) Relay -J17- socket 16/S to the Motronic Engine Control Module (ECM) - J220- electrical harness connector T80 terminal 4 for voltage.

Fuel Pump (FP) Relay -J17- socket terminal	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal or test box socket
16/S	4

- Switch the ignition off.

Specified value: 0.5 V Max.

If the specified value was obtained:

- Replace the Motronic Engine Control Module (ECM) Power Supply Relay -J271- . Refer to Fuel Injection & Ignition, Repair Group 24.

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, lose or broken terminals.



- If necessary, repair the faulty wiring connection.

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

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

### End diagnosis

## 4.2 Motronic Engine Control Module, Replacing

### Removing



#### Note

*When the Motronic Engine Control Module (ECM) -J220- electrical harness connectors are disconnected, the adaptation values are erased and the DTC memory content remains intact.*

### Work procedure

Check the identification of the previous Motronic Engine Control Module (ECM) -J220- as follows:

- Connect the scan tool.
- Switch the ignition on.
- Using the scan tool, select “Vehicle information”.
- Select “ Calibration Identification” in vehicle information.

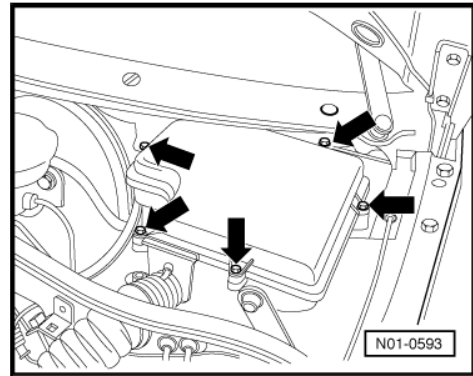
The electronic control module identification number will be displayed, e.g.: 06A906032NA 4983

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



## Procedure

- Remove the screws -arrows- from the cover of the protective housing.



Using a screwdriver, carefully pry off retaining bracket -arrow-.

- Disconnect electrical harness connector from control module.
- Remove the control module.

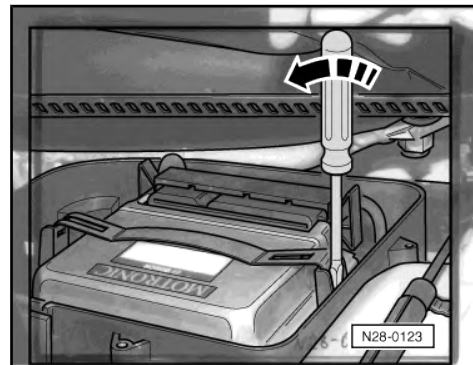
## Installation

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

The Motronic Engine Control Module (ECM) -J220- must be installed with the protective housing.

### Motronic Engine Control Module (ECM) -J220- reprogramming

- The new Engine Control Module (ECM) -J220- 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 ⇒ [page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .

## 4.3 Fuel Pump Relay, Checking

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

### Test requirements

- The Fuel Pump (FP) Relay -J17- 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 procedure

- Perform a preliminary check to verify the customers complaint.  
Refer to ⇒ [page 99](#)

### Start diagnosis

- Remove the Fuel Pump (FP) Relay -J17- .

### Checking voltage

- Using a Multimeter , check the Fuel Pump (FP) Relay -J17- socket 17/30 to Ground (GND).

Specified value: battery voltage.

If the specified value was not obtained:

- Check the wiring connections from the Battery to the Fuel Pump (FP) Relay -J17- socket 17/30 for an open circuit or a short circuit.
- Check the wiring connections for damage, corrosion, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

### Checking activation

- Install the Fuel Pump (FP) Relay -J17- .
- Switch the ignition on.
- Using a Multimeter , check the Fuel Pump (FP) Relay -J17- socket 16/85 to Ground (GND)
- Switch the ignition off.

Specified value: battery voltage.

If the specified value was not obtained:

- Check or replace the Fuel Pump (FP) Relay -J17- .
- Check the wiring connections for damage, corrosion, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If the specified value was obtained:

### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- Using a Multimeter , check the Fuel Pump (FP) Relay -J17- socket 16/S to the Motronic Engine Control Module (ECM) - J220- electrical harness connector T80 terminal 4 for resistance.



<b>Fuel Pump (FP) Relay -J17- socket terminal</b>	<b>Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminal or test box socket</b>
16/S	4

Specified value: 2.0  $\Omega$  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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

### End diagnosis



## 5 Additional Engine Signals, Checking

⇒ [“5.1 Speed Signal, Checking”, page 103](#)

⇒ [“5.2 ECM to Instrument Cluster Control Module K Line, Checking”, page 104](#)

### 5.1 Speed Signal, Checking

The following procedure requires a test drive. Observe all safety precautions. Refer to ⇒ [page 64](#) .

#### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

#### Test requirements

- The Speedometer -G21- OK.
- The Motronic Engine Control Module (ECM) -J220- 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 Motronic Engine Control Module (ECM) -J220- 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, lose 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 ⇒ [page 5](#) .
  - 2 - If necessary, erase the DTC memory. Refer to ⇒ [page 7](#) .
  - 3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ [page 17](#) .
- End of diagnosis.



## 5.2 ECM to Instrument Cluster Control Module K Line, Checking

If the Engine Control Module (ECM) or the Instrument Cluster Control Module -J285- recognizes a malfunction that leads to increased emissions values, it indicates them by lighting the Malfunction Indicator Lamp (MIL) which is located in the instrument cluster .

If the Instrument Cluster Control Module -J285- recognizes a malfunction that leads to increased emissions during the operation of the engine, the Engine Control Module (ECM) switches on the Malfunction Indicator Lamp (MIL) and an entry is stored in the DTC memory of the Engine Control Module (ECM) .

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

### Test requirements

- The Motronic Engine Control Module (ECM) -J220- fuses OK.
- Fuse -S30- 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 ⇒ [page 99](#)

### Start diagnosis

- Remove the Fuel Pump (FP) Relay -J17- .
- Disconnect the Motronic Engine Control Module (ECM) -J220- electrical harness connector.
- Switch the ignition on.
- Using a Multimeter , check the Motronic Engine Control Module (ECM) -J220- electrical harness connector terminal 67 to Ground (GND) for voltage.

Specified value: Battery Voltage:

- Switch the ignition off.

If the specified value was not obtained:

- Check the Motronic Engine Control Module (ECM) -J220- electrical harness connector terminal T80/19 to the Instrument Cluster Control Module -J285- electrical harness connector terminal 25 for an open circuit or a short to Battery (+).
- 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 wiring

- Disconnect the Instrument Cluster Control Module -J285- electrical harness connector.

If the manufacturers test box is being used. Perform the following step.

- Install the Adapter F/VAG1598 (68 Pin) -VAG1598/22- . Refer to Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- Using a Multimeter , check the wiring from the Motronic Engine Control Module (ECM) -J220- electrical harness connector terminal 19 to the Instrument Cluster Control Module -J285- electrical harness connector terminal 25 for resistance.

Specified value: 1.5 Ω.

If the specified value was not obtained:

- Check the Motronic Engine Control Module (ECM) -J220- electrical harness connector terminal 19 to the Instrument Cluster Control Module -J285- electrical harness connector terminal 25 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 malfunction is detected in the wiring and the voltage supply was not OK:

- Replace the Motronic Engine Control Module (ECM) -J220- .
- Erase the DTC memory. Refer to [⇒ page 7](#) .
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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

- Replace the Motronic Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- Assembly is performed in the reverse of the removal.

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

- 1 - Check the DTC memory. Refer to [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .

### End diagnosis



## 26 – Exhaust system, Emission controls

### 1 Exhaust System Components, Removing and Installing

⇒ [“1.1 Three Way Catalytic Converter, Checking”, page 106](#)

For all Exhaust System, Emission control component locations. Refer to ⇒ Engine Mechanical, Fuel Injection and Ignition; Rep. Gr. 26 ; Exhaust System Components

For all Exhaust System, Emission control removal/installation procedures and torque specifications. Refer to ⇒ Engine Mechanical, Fuel Injection and Ignition; Rep. Gr. 26 ; Exhaust System Components

Check the Technical Bulletins for information that may supersede any information included in this manual. Refer to ⇒ EBAAH-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 Three Way Catalytic Converter, Checking

#### Test requirements

- Battery voltage at least 12.5 volts.
- Oxygen Sensors OK.
- No leaks or damage to exhaust system.

#### Function test

- Perform the function test in Diagnostic Mode 06. Refer to [⇒ page 9](#) .
- End diagnosis and switch the ignition off.

If the specified values are exceeded:

- Check the exhaust system for leaks.
- If necessary, repair the leak in the exhaust system.
- Erase the DTC memory. Refer to [⇒ page 7](#) .
- Perform a road test to verify Repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

If no leaks are found in the exhaust system:



- Replace the catalytic converter including front exhaust pipe.  
Refer to Engine Mechanical, Repair. Group. 26.

#### Final procedures

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

- 1 - Check the DTC memory. Refer to [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code.  
Refer to [⇒ page 17](#) .



## 28 – Ignition/Glow plug System

### 1 Ignition, Servicing

⇒ [“1.1 Ignition System General Information”, page 108](#)

⇒ [“1.2 Safety Precautions”, page 109](#)

⇒ [“1.3 Test Data, Spark Plugs”, page 109](#)

⇒ [“1.4 Camshaft Position Sensor, Checking”, page 110](#)

⇒ [“1.5 Knock Sensors, Checking”, page 112](#)

⇒ [“1.6 Power Output Stage and Ignition Coil, Checking”, page 116](#)

#### 1.1 Ignition System General Information

For all Ignition/Glow plug system component locations. Refer to Fuel Injection & Ignition, Repair Group 28.

For all Ignition/Glow plug system removal/installation procedures and torque specifications. Refer to Fuel Injection & Ignition, Repair Group 28.

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.*
- ◆ *The manufacturers test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- is available for purchase or rental. Refer to the ⇒ Tool catalog .*






## 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.*

If engine is to be cranked at starting RPM without starting, e.g. for a compression test:

- Remove Fuse 6 (on fuse panel B) SB6 and Fuse 29 (on fuse panel B) SB29 from the fuse holder, E-box, plenum chamber.

By removing Fuse 6 (on fuse panel B) SB6, voltage supply of Ignition Coils with Power Output Stage -N70, N127, N291, N292- is interrupted, that of Fuel Injectors -N30, N31, N32, N33- by removing Fuse 29 (on fuse panel B) SB29.

## 1.3 Test Data, Spark Plugs

Engine code	AEB (1.8L / 110 kW 5V-Turbo engine)
Engine Control Module (ECM) System identification	Motronic ME 5.9.2
Engine idle speed	640 to 800 RPM (not adjustable)
Engine speed (RPM) limitation	Starting at approx. 6500 RPM
Ignition sequence	1-3-4-2
Ignition timing	Not adjustable, regulated by Electronic control module
Ignition system	Single coil ignition system with 6 ignition coils (output stages integrated) that are connected directly to spark plugs by the ignition cables.
Spark plugs	101 000 0051



<b>Engine code</b>	<b>AEB (1.8L / 110 kW 5V-Turbo engine)</b>
Manufacturer code	F 7 LTCR
Spark plug gap	0.8 to 1.1 mm
Tightening torque	30 Nm

## 1.4 Camshaft Position Sensor, Checking



### Note

Use only gold-plated terminals when servicing terminals in harness connector of Camshaft Position (CMP) Sensor -G40- .

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.

### Test requirements

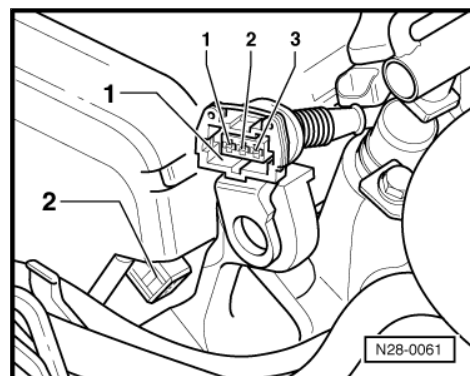
- The Motronic Engine Control Module (ECM) - J220- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position "P" or "N".
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.

### Test procedure

- Perform a preliminary check to verify the customers complaint.  
Refer to ⇒ [page 99](#)

### Start diagnosis

- Disconnect the Camshaft Position (CMP) Sensor -G40- -1-.
- Switch the ignition on.





- Using a Multimeter , Check the Camshaft Position (CMP) Sensor -G40- electrical harness connector terminals 1 to 3 for voltage.

Specified value: about 5.0 V

- Switch the ignition off.

If the specification was not obtained:

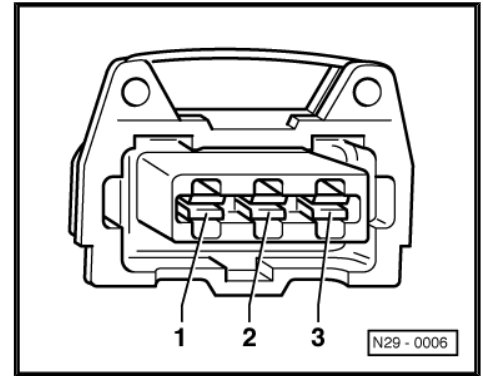
#### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) - VAG1598/22- . Refer to Engine Mechanical, Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

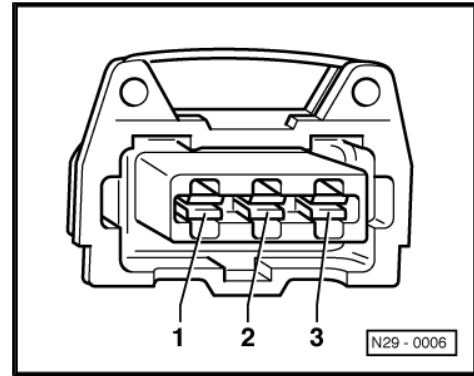
- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .





- Using a Multimeter , Check the Camshaft Position (CMP) Sensor -G40- electrical harness connector to the Motronic Engine Control Module (ECM) - J220- electrical harness connector T80 for an open circuit.

Camshaft Position (CMP) Sensor -G40- electrical harness connector terminals	Motronic Engine Control Module (ECM) - J220- electrical harness connector T80 terminals or test box sockets
1	11
2	76
3	Ground (GND)



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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

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

- Replace the Camshaft Position (CMP) Sensor -G40- .
- Erase the DTC memory. Refer to ⇒ [page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ [page 17](#) .

- End diagnosis.

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

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- 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 ⇒ [page 5](#) .
- 2 - If necessary, erase the DTC memory ⇒ [page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code ⇒ [page 17](#) .

### End diagnosis

## 1.5 Knock Sensors, Checking

The following procedure is used to diagnose all Knock Sensors .

### Special tools and workshop equipment required

- ◆ Multimeter .
- ◆ Wiring diagram.



### Test requirements

- The mounting bolt of Knock Sensor (KS) 1 -G61- / Knock Sensor (KS) 2 -G66- tightened to 20 Nm.
- The Motronic Engine Control Module (ECM) - J220- 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 ⇒ [page 99](#)

### Start diagnosis

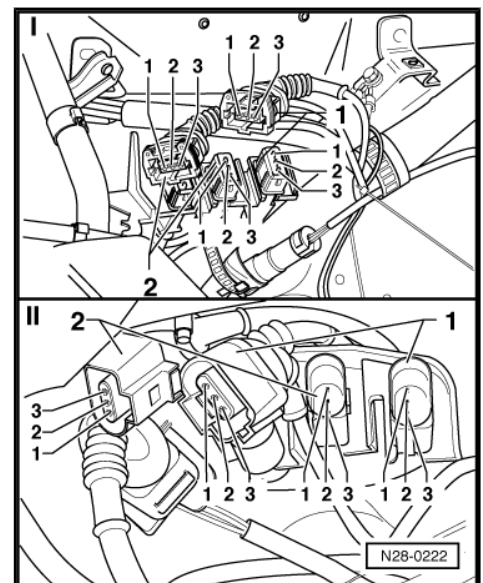


#### Note

*Before disconnecting the Knock Sensor electrical harness connectors, mark the component location.*

- Disconnect the green Knock Sensor (KS) 1 -G61- electrical harness connector-upper graphic -1- or the blue Knock Sensor (KS) 2 -G66- electrical harness connector -upper graphic - 2-.

### Checking internal resistance





- Using a Multimeter , check the Knock Sensor  
-upper graphic- terminals 1 to 2 for an internal short.

Specified value:  $\infty$  (Infinity).

If the specified value was not obtained:

- Replace the faulty Knock Sensor (KS) 1 -G61- / Knock Sensor  
(KS) 2 -G66- .

If the specified value was obtained:

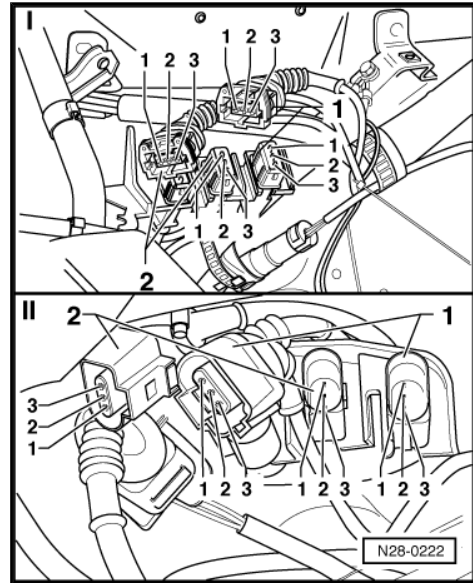
### Checking wiring

If the manufacturers test box is being used. Perform the following step.

- Install the test box Adapter F/VAG1598 (68 Pin) -  
VAG1598/22- . Refer to Engine Mechanical, Fuel Injection &  
Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- .  
Refer to ⇒ [page 99](#) .





- Using a Multimeter , Check the Knock Sensor electrical harness connector to the Motronic Engine Control Module (ECM)
  - J220- electrical harness connector T80 for an open circuit.

<b>Knock Sensor (KS) 1 -G61- electrical harness connector terminals</b>	<b>Motronic Engine Control Module (ECM) - J220- electrical harness connector T80 terminals or test box sockets</b>
1	68
2	67
<b>Knock Sensor (KS) 2 -G66- electrical harness connector terminals</b>	<b>Motronic Engine Control Module (ECM) - J220- electrical harness connector T80 terminals or test box sockets</b>
1	60
2	67

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, lose or broken terminals.
- If necessary, repair the faulty wiring connection.

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

- Replace the faulty Knock Sensor (KS) 1 -G61- / Knock Sensor (KS) 2 -G66- .

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

- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

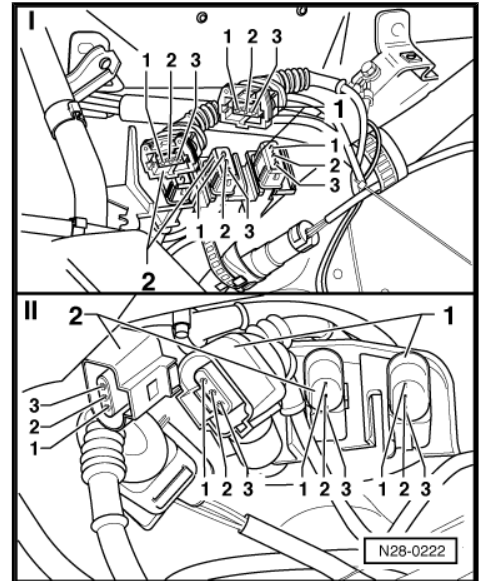
If the DTC does return and no malfunction is detected in the wiring and the voltage supply was OK:

- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
  - 2- If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
  - 3- If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .
- End of diagnosis.





## 1.6 Power Output Stage and Ignition Coil, Checking

The following procedure is used to diagnose Power Output Stage -N122- and Ignition Coils -N, N128, N158, N163- .

### Special tools and workshop equipment required

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

### Test requirements

- The Motronic Engine Control Module (ECM) -J220- fuses OK.
- Fuse (on fuse panel) -S232- 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.

### Test procedure

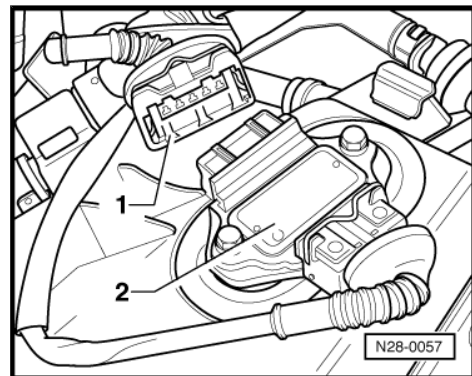
- Perform a preliminary check to verify the customers complaint.  
Refer to ⇒ [page 99](#)

### Start diagnosis

- Remove the Fuel Pump (FP) Relay -J17- .
- Disconnect the Power Output Stage -N122- electrical harness connector -1-.

### Checking Power Output Stage -N122- voltage supply

- Using a Diode test lamp , check the Power Output Stage -N122- electrical harness connector terminals for voltage.







- Crank the engine.

Power Output Stage -N122- electrical harness connector terminals
1 to G
2 to G
3 to G
4 to G

The LED should light up.

- Switch the ignition off.

If the LED does not light up:

- Using a Multimeter , check the Power Output Stage -N122- electrical harness connector terminal G to Ground connection on intake manifold for an open circuit.

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).
- If necessary, repair the faulty wiring connection.

If the Ground (GND) connection is OK:

#### Checking Power Output Stage -N122- wiring

If the manufacturers test box is being used. Perform the following step.

- Install the Adapter F/VAG1598 (68 Pin) -VAG1598/22- . Refer to Fuel Injection & Ignition, Repair Group 24.

If the manufacturers test box is not being used. Perform the following step.

- Remove the Motronic Engine Control Module (ECM) -J220- . Refer to ⇒ [page 99](#) .
- Using a Multimeter , Check the Power Output Stage -N122- electrical harness connector to the Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 for an open circuit.

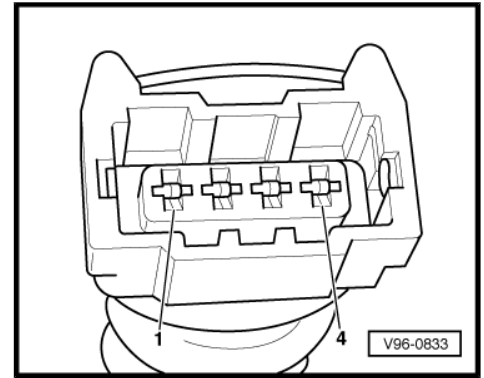
Power Output Stage - N122- electrical harness connector terminal	Motronic Engine Control Module (ECM) -J220- electrical harness connector T80 terminals or test box sockets
1	70
2	78
4	77
5	71

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 the wiring was OK and the LED did not light up:





- Replace the MFI Engine Control Module (ECM) -J192- . Refer to [⇒ page 99](#) .

If the LED lights up:

### Checking Power Output Stages

- Connect the Power Output Stage -N122- electrical harness connector.
- Disconnect the Power Output Stage -N122- electrical harness connector.
- Using a Diode test lamp , check the Power Output Stage - N122- terminals to Battery (+) for voltage.

Power Output Stage -N122- Terminals	Measure to
T4a/1	Battery (+)
T4a/2	Battery (+)
T4a/3	Battery (+)
T4a/4	Battery (+)

- Crank the engine.

The LED should light up.

- Switch the ignition off.

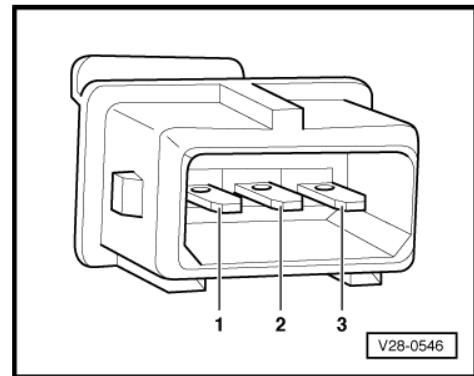
If the LED does not light up:

- Replace the Power Output Stage -N122- .

If the LED does light up:

### Checking Ignition Coil

- Connect the Power Output Stage -N122- electrical harness connector.
- Disconnect the Ignition Coil electrical harness connector.





- Using a Diode test lamp , check the Ignition Coil electrical harness connector terminal to Battery (+) for voltage.

Ignition Coil	Electrical Harness Connector Terminal	Measure to
N	1	Battery (+)
N128	1	Battery (+)
N158	1	Battery (+)
N163	1	Battery (+)

- Crank the engine.
- The LED should light up.
- Switch the ignition off.

If the LED does not light up:

- Check the Ignition Coil electrical harness connector terminal 1 to Battery (+) wiring connection for an open circuit, short circuit to Battery (+) or Ground (GND).
- If necessary, repair the faulty wiring connection.

If the wiring connection is OK:

- Using a Multimeter , check the Ignition Coil electrical harness connector terminal 15 to the Ground (GND).

Ignition Coil	Ignition Coil Electrical Harness Connector Terminal
N	15
N128	15
N158	15
N163	15

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).
- If necessary, repair the faulty wiring connection.

If the wiring connection is OK:

- Replace the faulty Ignition Coil .

If the wiring connection is not OK:

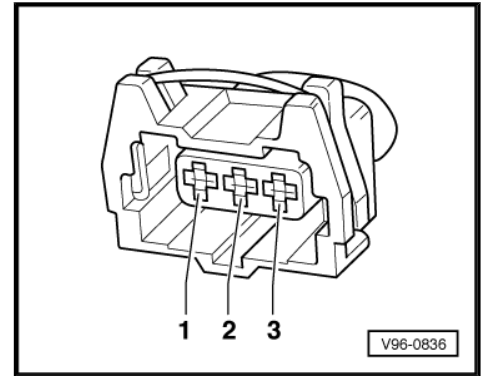
- Check the wiring connection from the Ignition Coil electrical harness connector terminal 15 to the MFI Engine Control Module (ECM) -J220- electrical harness connector terminal D10 for an open circuit or short circuit to Battery (+).
- If necessary, repair the faulty wiring connection.
- Install Fuse -S234- .
- Erase the DTC memory. Refer to [⇒ page 7](#)
- Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to [⇒ page 17](#) .

- End diagnosis.

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





- Replace the MFI Engine Control Module (ECM) -J220- . Refer to [⇒ page 99](#) .
- 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 [⇒ page 5](#) .
- 2 - If necessary, erase the DTC memory. Refer to [⇒ page 7](#) .
- 3 - If the DTC memory was erased, generate readiness code. Refer to [⇒ page 17](#) .



## 38 – Automatic Transmission - Gears, Hydraulic Controls

### 1 Electrical Components, Checking

For all Automatic Transmission- Gears, Hydraulic controls component locations. Refer to repair group 38.

For all Automatic Transmission- Gears, Hydraulic controls removal/installation procedures and torque specifications. Refer to Refer to repair group 38.

For all Automatic Transmission- Diagnostic procedures. Refer to Automatic Transmission

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