Repair Manual
TT RS 2012 ➤

Generic Scan Tool			
Engine ID	CEP B	CEP A	CRR A

Edition 07.2011

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Repair Group

ST - Generic Scan Tool

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.

Contents

ST – Generic Scan Tool

1 General Information

Included in the contents of this Generic Scan Tool (GST) manual is a summary table of the vehicle specific OBD II Emission Related DTCs. The DTC table contains DTC Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination information which can be used to accurately monitor and diagnose emissions related faults and perform functions required to run Modes 01 through 0A with a hand held scan tool. For a further description of specific monitor information, an OBD strategy document is referenced throughout this manual.

This manual also contains the step by step procedures to accurately diagnose and repair a component or system once a DTC has been set. References to repair procedures and wiring diagrams can be found within the diagnostic test procedures.

1.1 Safety Precautions

Check for Technical Bulletins that may supersede any information included in this manual.

WARNING

Failure to follow these instructions may result in personal injury or possible death.

Check the Technical Bulletins for information, cautions and warnings that may supersede or supplement any information included in this manual.

When performing the drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

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

The fuel system is under pressure! Before opening the fuel system, place rags around the connection area. Then release 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 engine or fuel injection system, fuel pressure must be relieved to residual pressure before opening high pressure components. Refer to the Service Manual for the proper procedure.

If the battery has not been disconnected, the fuel pump fuse must be removed before opening the fuel supply system as the fuel pump may be activated by the driver's door contact switch.

Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and make sure the area you are working in is well ventilated.

Observe the following for all procedures, 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.*
- *Do not touch or disconnect the Ignition Coils, ignition wires, connecting parts or adapter cables when the ignition is on or the engine is running or turning at starting RPM.*
- *Only disconnect and reconnect wires for injection and ignition system, including test leads, when the ignition is turned off.*

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.*

Caution

The battery must only be disconnected and connected with the ignition switched off. Otherwise, the engine control module (ECM) can be damaged.

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 to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.

Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burnt in the engine and will damage the oxygen sensors.

Secure all hose connections with the correct hose clips (the same as original equipment).

If engine is to be cranked without starting, for example as part of a compression test, remove the fuses for the voltage supply of Ignition Coils and the fuel injector.

An electrostatic charge can lead to functional problems of electrical components of the engine, transmission and selector lever mechanism. Touch a grounded object, e.g. a water pipe or a hoist, before working on electrical components.

Do not make direct contact with electrical harness connector terminals.

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

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 of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place removed parts on a clean surface and cover. Use lint-free cloths.
- Carefully cover over opened components or seal, if repairs are not performed immediately.
- When the system is open, do not work with compressed air. Do not move vehicle unless absolutely necessary.
- 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.).
- Separated electrical connectors: Protect from dirt and moisture. Make sure connections are dry when reconnecting.

1.3 On Board Diagnostic Systems

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 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.

1.4 Malfunction Indicator Lamp Illumination

If the engine control module (ECM) recognizes a malfunction that leads to increased emission values, it indicates them by illuminating the malfunction indicator lamp (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 emission 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.

1.5 Controller Area Network Data Link

The engine control module (ECM) communicates with data bus capable control modules via a CAN Data Link.

The data bus capable control modules are connected via data bus wires, which are twisted together (CAN high and CAN low), and exchange information with the ECM. Missing or implausible information on the data bus is recognized and stored as a malfunction based on specific DTC criteria.

The malfunction indicator lamp (MIL) is illuminated as a result of a CAN message sent by the ECM. The MIL can be turned on, turned off, or blink, depending on the message received.

1.6 Electronic Power Control Warning Lamp

The engine control module (ECM) monitors electronic power control (EPC) components when the ignition is switched on.

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

2 Description and Operation

Check for technical bulletins that may supersede any information included in this manual.

Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2

View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 3

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 the manufacturer.*
- *Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.*

2.1 Fuel Supply System

For all fuel supply system component locations, removal/installation procedures and torque specifications, refer to the service manual.

2.2 Evaporative Emission System

The evaporative emission system has been designed to minimize the release of hydrocarbons from the fuel system into the atmosphere. The evaporative system components all work together with the ECM to prevent fuel vapor from escaping and route it to the intake manifold to be burned during normal combustion.

The leak detection system checks the integrity of the evaporative emission system by pressurizing system.

- When leak detection is activated, a pump pressurizes the evaporative system.
- During the leak diagnosis, the system is monitored for a specific time period. If the pressure does not drop a specific amount during the time period, the system is considered to be sealed.
- If the pressure drops greater than a specified amount during a specific time period, the system is pressurized once more. The engine control module measures the time until the pres-

sure drops again. The control module uses the measured value to determine the size of the leak.

Leak diagnosis is activated automatically shortly following every engine start. If a malfunction is determined, an entry is made to the DTC memory. The Malfunction Indicator Lamp in the instrument cluster is illuminated if the malfunction is recognized for two subsequent starts.

For all evaporative system component locations, hose routing, removal/installation procedures and torque specifications, refer to the service manual.

2.3 Electronic Engine Power Control

For EPC, the throttle valve is not operated by a cable from the accelerator pedal. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is communicated to engine control module (ECM) by the throttle position sensor / accelerator pedal position sensor 2 (variable resistances; stored in one housing) that are connected with the accelerator pedal.

The accelerator pedal position (driver's intention) is a main input unit for the ECM.

Operation of the throttle valve occurs via an electric motor, the throttle drive for in the throttle valve control module. This is true across the entire engine speed and engine load spectrum.

The throttle valve is operated by the EPC according to specifications of engine control module (ECM).

With engine off and ignition switched on, the ECM controls the throttle drive according to specifications of throttle position sensor / accelerator pedal position sensor 2. This means, if the accelerator pedal is pressed half way, the throttle drive opens the throttle valve to the same degree; i.e. throttle valve is then opened approximately half way.

With engine running under load, ECM can open or close the throttle valve independently of the throttle position sensor / accelerator pedal position sensor 2.

This means, for example, that the throttle valve could be fully opened even though the accelerator pedal has only been pressed half way. This has the advantage of preventing torque losses at the throttle valve.

In addition, it results in a significant reduction in emissions and fuel consumption under certain load conditions.

It would be incorrect to think that EPC consists of only one or two components. EPC is much more of a system containing all components that contribute to recognizing, controlling and monitoring the position of the throttle valve.

2.4 Fuel Injection System

For all fuel injection system component locations, removal/installation procedures and torque specifications, refer to the service manual.

2.5 Engine Control Module

The ECM regulates fuel injection, throttle valve control module, oxygen sensor regulation, ignition, knock control, evaporative emission purge valve, engine speed limitation through the fuel injectors or the power supply relay, as well as OBD functions.

2.6 Exhaust System Components

For all exhaust system, emission control component locations, removal/installation procedures and torque specifications, refer to the service manual.

2.7 Secondary Air Injection System

The secondary air injection system improves the secondary oxidation within the catalytic converter which are due to the rich mixture during the cold start phase where the exhaust emissions contain an increased level of unburned hydrocarbons, thereby reducing harmful emissions. The heat released by secondary oxidation shortens the startup time of the catalytic converter considerably, as well as significantly improves emissions quality during the cold-running phase.

- During a cold start, the secondary air injection system injects air behind the exhaust valves. This produces an oxygen rich exhaust gas, causes the after burning and reduces the heating-up phase of the catalytic converter.
- In addition, the secondary air injection system is switched on (after a delay) during idle after every subsequent engine start (up to a maximum coolant temperature) and is checked through on board diagnostic functions.

For all secondary air injection system component locations, removal/installation procedures and torque specifications, refer to the service manual.

2.8 Ignition System

For all ignition and glow plug system component locations, removal/installation procedures and torque specifications, refer to the service manual.

2.9 Automatic Transmission

The transmission control module receives information from transmission related components and uses this information to control shifting and operation of the transmission.

For all automatic transmission component locations, removal/installation procedures and torque specifications, refer to the service manual.

3 Diagnosis and Testing

3.1 Preliminary Check

Prior to component diagnosis, a preliminary check must be performed.

Check the technical bulletins for information that may supersede any information included in this manual.

– Connect the scan tool.

– Switch the ignition on.

– Using the scan tool, check for any stored or related DTCs.

If other DTCs are stored:

– Repair these DTCs first before performing the following procedure.

If no other DTCs are stored:

– Using the scan tool, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

– 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 ⇒ “3.2 Readiness Code”, page 8 .

3.2 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.
- Coolant temperature must be between 80° C and 110° C.
- The intake air temperature must be between 10° C and 35° C.
- Battery voltage must be a minimum of 12.5 volts.
- Fuel tank level 1/4 to 3/4 full.

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 O2 heater, misfire, secondary air injection, fuel trim, and purge system monitors.

– Drive the vehicle at 45-55 mph for a continuous 7 minute period - avoid stopping. This executes the evaporative, O2 sensor, fuel trim, and misfire monitors.

– Accelerate the vehicle to an engine speed of 5000 RPM; 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; O2 sensor, misfire, fuel trim, and purge system monitors.

– Decelerate and idle the vehicle again for 3 minutes. This executes the misfire, secondary sir injection, 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 evaporative or thermostat monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are be between 10° C and 35° C with a difference no greater than 4° C and repeat the drive cycle operation.

If the drive cycle operation fails again.

– Check the DTC memory for stored DTCs.

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.

3.3 Diagnostic Modes 01 - 0A

The information provided in Modes 01 through 0A 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.

Note

Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

3.3.1 Diagnostic Mode 01 - Read Current System Data

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

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
$00:	supported PIDS $01 thru $20
$01:	Monitoring status since erasing DTC memory
$03:	Condition of fuel system
$04:	Calculated load value
$05:	Coolant temperature
$06:	Short term air fuel ratio
$07:	Long term air fuel ratio
$0B:	Intake Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle speed
$0E:	Ignition timing advance for #1 cylinder
$0F:	Intake air temperature

PID	Component or System
$11:	Absolute throttle position
$12:	Secondary Air Injection
$13:	Oxygen Sensor Bank 1 Sensor 1
$15:	Oxygen Sensor Bank 1 Sensor 2
$1C:	OBD Requirements
$1F:	Time since engine start
$20:	supported PIDS $21 thru $40
$21:	Distance driven with MIL ON
$2E:	Commanded evap purge
$30:	Warm up counts after MIL erased
$31:	Distance driven after erasing DTC memory
$33:	Barometric pressure
$34:	Heater current Bank 1 Sensor 1
$3C:	Calculated catalyst temperature
$40:	supported PIDS $41 thru $60
$41:	Monitor status current drive cycle
$42:	Control module voltage
$43:	Absolute load value
$44:	Air/Fuel Commanded equivalence ratio
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Absolute Throttle valve position B
$49:	Accelerator pedal position D
$4A:	Accelerator pedal position E
$4C:	Specified throttle valve position
$56:	Long term secondary O2 sensor Fuel Trim Bank 1

– Switch the ignition OFF.

3.3.2 Diagnostic Mode 02 - Read Operating Conditions

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

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

Note

Depending on scan tool and protocol used, the information in diagnostic mode 02 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

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 “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
$00:	supported definition PIDs $01 thru $20
$02:	DTC which triggered Freeze Frame data
$03:	Fuel system status
$04:	Calculated load value
$05:	Engine Coolant temperature
$06:	Short term air fuel ratio
$07:	Long term air fuel ratio
$0B:	Intake Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle speed
$0E:	Ignition timing advance for #1 cylinder
$0F:	Intake air temperature
$11:	Absolute throttle valve position
$1F:	Time since engine start
$20:	supported definition PIDs $21 thru $40
$23:	Fuel rail pressure
$2E:	Commanded evap purge
$33:	Barometric pressure
$40:	supported definition PIDs $41 thru $60
$42:	Control module voltage
$43:	Absolute load value
$44:	Air/Fuel Commanded equivalence ratio
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Absolute throttle valve position B
$49:	Accelerator pedal position D
$4A:	Accelerator pedal position E
$4C:	Specified throttle valve position
$56:	Long term secondary O2 sensor Fuel Trim Bank 1

– Switch the ignition OFF.

3.3.3 Diagnostic Mode 03 - Read DTC Memory

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

When the ECM recognizes an emission related fault it turns on the malfunction indicator lamp. If an electronic throttle malfunction is recognized, the ECM turns on the electronic power control warning lamp. Both are located in the instrument cluster.

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

Note

Depending on scan tool and protocol used, diagnostic mode 03 and the information provided may be referred to by a different name.

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

Procedure

– Connect the scan tool.

– Switch the ignition to the ON position.

– Select Diagnostic Mode 03: Interrogating fault memory.

– The stored DTC or DTCs 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
Evaporative emission canister purge regulator valve	Malfunctioning wiring path or malfunctioning component
Circuit open	Malfunction type as next

– Refer to the DTC tables for the diagnostic repair procedures.

– Switch the ignition OFF.

3.3.4 Diagnostic Mode 04 - Erase DTC Memory

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

Emissions-related diagnostic data includes (as applicable):

- - MIL Status
- - Number of DTCs
- - Readiness bits
- - Confirmed DTCs
- - Pending DTCs
- - DTC that belongs to freeze frame
- - Freeze frame data
- - Test results of specific diagnostic functions
- - Distance driven with “MIL ON”
- - Number of warm-up cycles after erasing the DTC memory
- - Distance driven after erasing the DTC memory
- - Misfire counter

Note

Depending on scan tool and protocol used, diagnostic mode 04 and the information provided may be referred to by a different name.

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.

3.3.5 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.

Test requirement

Procedure

3.3.6 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

Note

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), or On-Board Diagnostic Monitor Identifier (OBDMID).

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.

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

– Select the desired “Monitor-ID” of the component or system that is to be monitored, e.g. “Monitor-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“Monitor ID's” or “Hex ID's” that may be selected.

Monitor-ID	Component or System
$01: ⇒ page 17	Oxygen Sensor Monitor Bank 1 - Sensor 1
$02: ⇒ page 18	Oxygen Sensor Monitor Bank 1 - Sensor 2
$21 ⇒ page 18	Catalytic Converter Monitoring
$35 ⇒ page 19	VVT Monitor Response Time/Target Error
$3A ⇒ page 19	Fuel Tank EVAP System Integrity/Leak Test (0.90)
$3B: ⇒ page 20	Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0 mm)
$3C: ⇒ page 20	Fuel Tank EVAP System Integrity/Leak Test (0.20/0.5 mm)
$3D: ⇒ page 21	EVAP Valve Function Check
$41: ⇒ page 21	Oxygen Sensor Heater Monitor Bank 1 - Sensor 1
$42: ⇒ page 22	Oxygen Sensor Heater Monitor Bank 1 - Sensor 2
$A2: ⇒ page 22	Misfire Cylinder 1 Data
$A3: ⇒ page 23	Misfire Cylinder 2 Data
$A4: ⇒ page 23	Misfire Cylinder 3 Data
$A5: ⇒ page 23	Misfire Cylinder 4 Data
$A6 ⇒ page 24	Misfire Cylinder 5 Data

Monitor-ID $01 (01): 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 “Monitor-ID $01 (01)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$83	P0133	Oxygen sensor signal dynamic Bank 1 Sensor 1	0.3	1.999	Refer to DTC P0133 in the DTC summary table. ⇒ page 40 .

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P2195	O2 sensor front/rear rationality Bank 1 Sensor 1.	- 0.065	0.065	Refer to DTC P2195 in the DTC summary table. ⇒ page 92

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $02 (02): Oxygen Sensor Monitor Bank 1- Sensor 2

– 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 “Monitor-ID $02 (02)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$01 (01)	no DTC	oxygen sensor behind convertor, bank 1)	0	7995 mV	
$02 (02)	no DTC	oxygen sensor behind convertor, bank 1)	0	7995 mV	
$05 (05)	no DTC	Dynamic examination LSF behind Kat bank 1 (bank 3)	0	65535 ms	
$07 (07)	no DTC	Dynamic examination LSF behind Kat bank 1 (bank 3)	0	65535 ms	
$81 (129)	P2271	Minimum voltage threshold from rich to lean.	.000 V	0.8018 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 94
$82 (130)	P2270	Maximum voltage threshold from lean to rich.	0.64 V	1.08 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 94
$86 (134)	P2271	O2 sensor transient time, Bank 1 Sensor 2.	0.0 mSec.	2.5 Sec.	Refer to DTC P2271 in the DTC summary table. ⇒ page 94

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $21 (33): Oxygen Storage Content of Catalyst

– 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 “Monitor-ID $21 (33)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84 (132)	P3298	Oxygen Storage Content value of catalyst.	1.000	65535	Refer to DTC P3298 in the DTC summary table. ⇒ page 66

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $35 (53): Variable Valve Timing Monitor

– 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 “Monitor-ID $35 (53)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$80 (128)	P0011	Target Error Intake Bank 1.	- 14.25	28.00	Refer to DTC P0011 in the DTC summary table. ⇒ page 28
$81 (129)	P000A	Slow Response Intake Bank 1.	- 14.25	28.00	Refer to DTC P000A in the DTC summary table. ⇒ page 27
$82 (130)	P0014	Target Error Intake Bank 1.	3 Kw	19 KW	Refer to DTC P0014 in the DTC summary table.
$83 (131)	P000B	Slow Response Intake Bank 1.	7 KW	19 KW	Refer to DTC P000B in the DTC summary table.

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3A (58): Fuel Tank EVAP System Integrity/Leak Test (0.90)

– 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 “Monitor-ID $3A (58)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81 (129)	P0455	Fuel Tank Leak Test: large leak.	1.95	65535	Refer to DTC P0455 in the DTC summary table. ⇒ page 72

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3B (59): Fuel Tank EVAP System Integrity/Leak Test (0.40)

– 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 “Monitor-ID $3B (59)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81 (129)	P0442	Fuel Tank Leak Test: Small leak.	1.95	65535	Refer to DTC P0442 in the DTC summary table. ⇒ page 70 .

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3C (60): Fuel Tank EVAP System Integrity/Small Leak Test (0.20)

– 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 “Monitor-ID $3C (60)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81 (129)	P0456	Fuel Tank Leak Test: Very Small leak.	4.5mSec.	65535 mSec	Refer to DTC P0456 in the DTC summary table. ⇒ page 73

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$82 (130)	---	EVAP Monitor System OK by initial Purge check.	6.4 g	6553.5 g	---

– 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
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3D (61): EVAP Purge Flow Monitor

– 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 “Monitor-ID $3D (61)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$80 (128)	P0441	Purge Flow Monitor valve open.	0.01	0.2	Refer to DTC P0441 in the DTC summary table. ⇒ page 69
$82 (130)	---	Purge Flow Monitor valve closed.	0.04	9945	---

– 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
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $41 (65): Oxygen Sensor Heater 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 “Monitor-ID $41 (65)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$85 (133)	P0135	Oxygen sensor ceramic temperature Bank 1 Sensor 1 monitoring.	720° C	1200° C	Refer to DTC P0135 in the DTC summary table. ⇒ page 41 .

– 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
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $42 (46): Oxygen Sensor Heater Monitor Bank 1 - Sensor 2

– 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 “Monitor-ID $42 (46)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0141	Oxygen sensor heating internal resistance test Bank 1 Sensor 2.	0 Ω	19.04 k Ω	Refer to DTC P0141 in the DTC summary table. ⇒ page 42 .

– 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
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A2 (162): Mis-Fire Cylinder 1 Data

– 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 “Monitor-ID $A2 (162)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B (11)	P0301	Cylinder 1 Data averaged during last 10 drive cycles.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 56
$0C (12)	P0301	Cylinder 1 Data averaged during current drive cycle.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 56

– 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
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A3 (163): Mis-Fire Cylinder 2 Data

– 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 “Monitor-ID $A3 (163):”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B (11)	P0302	Misfire cylinder 2, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 57 .
$0C (12)	P0302	Misfire cylinder 2, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 57 .

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A4 (164): Mis-Fire Cylinder 3 Data

– 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 “Monitor-ID $A4 (164)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B (11)	P0303	Misfire cylinder 3, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 58 .
$0C (12)	P0303	Misfire cylinder 3, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 58 .

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A5 (165): Mis-Fire Cylinder 4 Data

– 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 “Monitor-ID $A5 (165)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B (11)	P0304	Misfire cylinder 4, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 59 .
$0C (12)	P0304	Misfire cylinder 4, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 59 .

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A6 (166): Mis-Fire Cylinder 5 Data

– 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 “Monitor-ID $A6 (166)”.

– Select the desired “Test-ID” or “Hex-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B (11)	P0305	Misfire cylinder 5, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0305 in the DTC summary table. ⇒ page 60
$0C (12)	P0305	Misfire cylinder 5, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0305 in the DTC summary table. ⇒ page 60

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

3.3.7 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 DTC tables for the diagnostic repair procedures.
– Switch the ignition OFF.

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

Not supported on this vehicle

3.3.9 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 internal ECM related DTC's stored in 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:	Calibration verification number (check sum) e.g.
	♦ EC5AE460 the check sum is different for every control module version
$08:	In Use Performance Tracking (CBUA/SULEV only)
$0A:	ECU module acronym and text name

Service Mode $0A	SUPPORTED on CBUA/SULEV (California emissions) only. Not Supported on CBTA/Bin 5 (Federal emissions).

– Switch the ignition OFF.

3.3.10 Diagnostic Mode 0A - Check Permanent DTC Memory

Mode 0A - Check Permanent DTC Memory (Request emissions-related diagnostic trouble codes with permanent status after code clear)

Permanent Fault Codes From MY 2010 with Phase-In conforming to CCR 1968.2 (d)(2.2.5): 50% from MY 2010 / 75% from MY 2011 / 100% from MY 2012 The vehicle only participates in Phase-In if all of the OBD-relevant control modules in the vehicle meet these requirements.

Mode 0A may only be supported exclusively by OBD control modules in US vehicles. Mode 0A may not be supported in EOBD vehicles, meaning the control module may not send a response here.

Mode 0A enables the request of all OBD-relevant faults with the status “Permanent Fault Code”: - Permanent Fault Codes are Confirmed Fault Codes that are currently activating the MIL. That means faults that are still displayed in Mode 03 but no longer activate the MIL (History Fault Codes) are not Permanent Fault Codes. - Permanent Fault Codes are updated in Mode 0A at the same time as NVRAM storage immediately after switching the ignition off. A newly detected Permanent Fault Code is only visible after switching the ignition off/on in Mode 0A. - Permanent Fault Codes may only be erased in the control module after they are corrected as long as the last diagnostic result was a PASS and the MIL is no longer activated by this fault. The Permanent Fault Codes should be erased from Mode 0A at the same time the MIL switches off when the ignition is switched off/on. - Permanent Fault Codes may not be erased by clearing the DTC memory or disconnecting the power supply. Storage in NVRAM is required. - Permanent Fault Codes may only be erased after clearing the DTC memory under the following conditions: - As long as no FAIL diagnostic result was detected for a Permanent Fault Code - and

at least one PASS diagnostic result was detected - and the Minimum Trip Conditions for a General Denominator (without considering high/ambient temperature) were met in this phase in any DCY after erasing the DTC memory. - The engine control module relays the message “Minimum Trip conditions met” to all other OBD control modules via CAN: CAN message OBD_01, Byte 8, Bit 4: OBD_Minimum_Trip - Permanent Fault Codes may NOT be erased if the diagnostic result is FAIL after clearing the DTC memory. A Pending Fault Code should be stored and the DTC memory line should be overwritten with new Freeze Frame data. (Exception: If the Pending Fault Code is corrected without a Confirmed Fault Code being detected, the Permanent Fault Code may also be erased under the conditions described below.) - Permanent Fault Codes should be erased in engine control modules after Update Programming. At this time, all readiness bits (Mode 01 PID $01) must be reset to “not complete” [(g)(4.4.6)(D)]. Permanent Fault Codes should not be erased in OBD control modules with Comprehensive Components (CCM) as a single readiness bit if the identical program/data status is being programmed. If a different program/data status is being programmed, Permanent Fault Codes should be erased after Update Programming. - The procedure in Mode 01 through Mode 09 and in the service tester is NOT affected by implementation of the Permanent Fault Codes.

3.4 DTC Tables

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P000A	Intake Camshaft Position Slow Response Bank 1	– Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ “3.5.38 Camshaft Adjustment Valve, Checking”, page 186	• adjustment angle difference < 9° CA/s	• Engine speed, >550 RPM • ECT > - 7.5 °C • Time after engine start > 3.5 Sec. • number of checks@normal operation 3 • time length for more than 1.5 Sec • camshaft position change > 4° CA	5 Sec.	• Continuous • 2 DCY
P000B	Exhaust Camshaft Position Slow Response Bank 1	– Check the Camshaft Adjustment Valve 1 (exhaust) - N318- . Refer to ⇒ “3.5.39 Camshaft Adjustment Valve 1, Exhaust”, page 188	• adjustment angle difference < 7° CA/s	• engine speed > 550 rpm • ECT > 7.5° C • time after engine start > 3.5 Sec • number of checks@normal operation 3 • time length for more than 1.5 Sec • camshaft position change > 4° CA	5 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P008A	Fuel pressure out of range	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	actual pressure < 0.8 MPa	---	5 Sec	• Continuous • 2 DCY
P008B	Fuel pressure out of range	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	actual pressure > 0.8 MPa	---	5 Sec	• Continuous • 2 DCY
P0010	Intake Camshaft Position Actuator Circuit Open Bank 1	– Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ “3.5.38 Camshaft Adjustment Valve, Checking”, page 186	Signal voltage > 4.740 - 5.60 V	• Cam position actuator commanded off • Engine speed > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0011	Intake Camshaft Position Timing - Over-Advanced Bank 1	– Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ “3.5.38 Camshaft Adjustment Valve, Checking”, page 186	• adjustment angle difference > 3.2° CA	• Engine speed, >550 RPM • ECT > - 7.5 °C • Time after engine start > 3.5 Sec. • number of checks@normal operation 3 • time length for more than 1.5 Sec	5 Sec.	• Continuous • 2 DCY
P0013	Exhaust Camshaft Position Actuator Circuit Open Bank 1	– Check the Camshaft Adjustment Valve 1 (exhaust) - N318- . Refer to ⇒ “3.5.39 Camshaft Adjustment Valve 1, Exhaust”, page 188	• signal voltage > 4.4 .. 5.6 V	• Cam position actuator commanded off • Engine speed > 40 RPM	5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0014	Exhaust Camshaft Position Actuator Circuit stuck check Bank 1	– Check the Camshaft Adjustment Valve 1 (exhaust) - N318- . Refer to ⇒ “3.5.39 Camshaft Adjustment Valve 1, Exhaust”, page 188	• adjustment angle difference > 3° CA	• Engine speed, >550 RPM • ECT > - 7.5 °C • Time after engine start > 3.5 Sec. • number of checks@normal operation 3 • time length for more than 1.5 Sec	5 Sec.	• Continuous • 2 DCY
P0016	Camshaft Position Sensor Angular Offset Check	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.5.36 Camshaft Position Sensor, Checking”, page 182	adaptive vs. target values > 20° CA	---	2 Sec.	• 2 DCY
P0017	Camshaft Position Sensor Angular Offset Check	– Check the Camshaft Position (CMP) Sensor 3 - G300- . Refer to ⇒ “3.5.37 Camshaft Position Sensor 3, Checking”, page 184	adaptive vs. target values > 20° CA	---	2 Sec	• multiple • 2 DCY
P025 A	Fuel Pump Open circuit	– Check the fuel pump. Refer to ⇒ “3.5.4 Fuel Pump Electrical, Testing”, page 116 .	Signal voltage > 4.40...5.60 V	---	0.7 Sec	• Continuous • 2 DCY
P025 C	Fuel Pump Short to ground	– Check the fuel pump. Refer to ⇒ “3.5.4 Fuel Pump Electrical, Testing”, page 116 .	Signal voltage< 2.15...3.25 V	• Engine speed, > 80 RPM	0.7 Sec	• Continuous • 2 DCY
P025 D	Fuel Pump Short to B+	– Check the fuel pump. Refer to ⇒ “3.5.4 Fuel Pump Electrical, Testing”, page 116 .	Signal current > 1.10 A	• Engine speed, > 80 RPM	0.7 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	– Check the Oxygen Sensor (O2S) Heater -G39- . Refer to ⇒ “3.5.21 Oxygen Sensor Heater, Checking”, page 154 .	• heater voltage 4.4..5.6 V	• engine start completed • engine speed > 40 rpm • heater control active for 10 Sec • heater commanded off	10.7 Sec.	• Continuous • 2 DCY
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	– Check the Oxygen Sensor (O2S) Heater -G39- . Refer to ⇒ “3.5.21 Oxygen Sensor Heater, Checking”, page 154 .	• heater voltage < 2,15 ... 3,25 V	• engine start completed • engine speed > 40 rpm • heater control active for 10 Sec • heater commanded off	10.7 Sec.	• Continuous • 2 DCY
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	– Check the Oxygen Sensor (O2S) Heater -G39- . Refer to ⇒ “3.5.21 Oxygen Sensor Heater, Checking”, page 154 .	Heater current > 2.2 A	• engine start completed • engine speed > 40 rpm • heater control active for 10 Sec • heater commanded on	10.7 Sec.	• Continuous • 2 DCY
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	– Check the Oxygen Sensor (O2S) Heater -G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	Heater voltage 4.40 to 5.60 V	• Heater, ready for 10 [s] since O2S rear dewpoint exceeded • Time after engine start > 5 Sec. • heater commanded off • Engine speed > 40 RPM	10.7Sec.	• Continuous • 2 DCY
P0037	HO2S Heater Control Circuit Low (Bank 1, Sensor 2)	– Check the Oxygen Sensor (O2S) Heater -G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	heater voltage < 2.15 ..3.25 V	• Heater, ready for 10 [s] since O2S rear dewpoint exceeded • Time after engine start > 5 Sec. • heater commanded off • Engine speed > 40 RPM	10.7 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0038	HO2S Heater Control Circuit High (Bank 1, Sensor 2)	– Check the Oxygen Sensor (O2S) Heater - G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	Heater current, > 3 A	• Heater, Commanded ON • Time after engine start > 5 Sec. • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0042	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 (CBUA ONLY)	– Check the Oxygen Sensor (O2S) Heater - G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	Heater voltage 2.34 to 3.59 V	• Heater, commanded OFF. • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0043	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 Low (CBUA ONLY)	– Check the Oxygen Sensor (O2S) Heater - G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	Heater voltage < 2.34 V	• Heater, Commanded OFF • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0044	O2 Sensor Heater Control Circuit Bank 1 Sensor 3 High (CBUA ONLY)	– Check the Oxygen Sensor (O2S) Heater - G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	Heater voltage > 3.59 V	• Heater, Commanded ON • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0070	Ambient Air Temperature	– Check the Ambient Air Temperature Sensor - G17- . Refer to ⇒ „3.5.25 Ambient Air Temperature Sensor, Checking”, page 164 .	open circuit • Ambient air temp < -40.5°C	• CAN active	6 Sec. continuous	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0071	Ambient Air Temperature Sensor Range/Performance	– Check the Ambient Air Temperature Sensor - G17- . Refer to ⇒ “3.5.25 Ambient Air Temperature Sensor, Checking”, page 164 .	• ambient temperature minus engine temperature @ engine start • AND • ambient temperature minus intake air temperature @ engine start • = 40...25K	• Engine off time > 6...18 h • engine temperature @ engine start minus intake air temperature @ engine start <40…25 K • intake air temperature @ engine start engine temperature @ engine start minus engine temperature @ condition < 1.5° C • time since engine start >60 Sec • ambient temperature @ engine start minus ambient temperature @ condition: <= 5.25° C • vehicle speed > 25 mph • for time > 30 Sec • intake air temperature @ engine start minus intake air temperature @ condition: <= 5.25° C • vehicle speed > 25 mph • for time > 30 Sec	0 Sec	---
P0072	Ambient Air Temperature Sensor Circuit Low	– Check the Ambient Air Temperature Sensor - G17- . Refer to ⇒ “3.5.25 Ambient Air Temperature Sensor, Checking”, page 164 .	short to ground • Ambient air temp >78° C	• CAN active	6 Sec. continuous	• 2 DCY
P0087	Fuel Rail/ System Pressure - Too Low	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119	• pressure control activity, > 1.2 mPa • AND • fuel trim activity, 0 ... 1.3	• fuel cut off, not active • lambda control, closed loop	5 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0089	Fuel Pressure Regulator 1 Performance	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	Actual pressure Deviation • <100 kPa • >100 kPa	• Time after engine start > 60 Sec • fuel cut-off not active • time after fuel cut-off if applicable 20 Sec	• 2 Sec • 180 Sec	• Continuous • 2 DCY
P0097	Intake Air Temperature Sensor 2 Circuit high Input	– Check the Intake Air Temperature (IAT) Sensor 2 - G299- Refer to ⇒ “3.5.16 Charge Air Pressure Sensor / Intake Air Temperature Sensor 2, Checking ”, page 142	short to batt • IAT > 4.47 V	---	2 Sec.	• Continuous • 2 DCY
P0098	Intake Air Temperature Sensor 2 Circuit low Input	– Check the Intake Air Temperature (IAT) Sensor 2 - G299- Refer to ⇒ “3.5.16 Charge Air Pressure Sensor / Intake Air Temperature Sensor 2, Checking ”, page 142	short to ground • IAT < 0.15 V	---	2 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0106	Manifold Absolute Pressure to Barometric Pressure Circuit Range/Performance	NOTE: The BARO sensor is an internal part of the ECM and is not repairable. If the BARO reading is off by more than 10%, replace the ECM. Refer to the Repair Manual. – Check the ⇒ “3.5.11 Intake Air Temperature Sensor and Manifold Absolute Pressure Sensor, Checking”, page 130 .	• Difference manifold pressure - lower threshold model < 0. Model range 45 to 845 hPa • Difference manifold pressure - upper threshold model > 0. Model range 640 - 1055 • Difference. altitude sensor signal vs. manifold pressure signal at engine start > 60 hPa • boost pressure sensor signal vs. altitude sensor signal > 22 kPa - <22 kPa	• No BARO, CMP, Throttle, EVAP, or IAT codes set • Time after engine start < 25 Sec. • Engine speed < 330 RPM	• 2.5 Sec • 3.5 Sec	• multiple • 2 DCY • Continuous • 2 DCY
P0107	Manifold Absolute Pressure Circuit Low Input	– Check the Manifold Absolute Pressure (MAP) Sensor - G71- . Refer to ⇒ “3.5.11 Intake Air Temperature Sensor and Manifold Absolute Pressure Sensor, Checking”, page 130 .	• Signal voltage < 0.2V Range check: • manifold pressure signal < 100.00 hPa Cross check: • diff. manifold pressure to average value of all pressure sensors @ start < -60.00 hPa	---	1 Sec.	• Continuous • 2 DCY
P0108	Manifold Absolute Pressure Circuit High Input	– Check the Manifold Absolute Pressure (MAP) Sensor - G71- . Refer to ⇒ “3.5.11 Intake Air Temperature Sensor and Manifold Absolute Pressure Sensor, Checking”, page 130 .	• Signal voltage > 4.86 V Range check: • manifold pressure signal > 2950 hPa Cross check: • diff. manifold pressure to average value of all pressure sensors @ start > 60.00 hPa	---	1 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0111	Intake Air Temperature Circuit Range/Performance	– Check the Intake Air Temperature (IAT) Sensor -G42- . Refer to ⇒ “3.5.11 Intake Air Temperature Sensor and Manifold Absolute Pressure Sensor, Checking”, page 130 .	• IAT minus engine temperature @ engine start • AND • IAT minus ambient air temperature @ engine start • = >40…25 K	• Engine off time > 6...18 h • engine temperature @ engine start < 1.5° C • AAT at start <= 40…25 K • IAT at start <= 5.25° C • intake air temperature @ condition: vehicle speed > 25 mph	0 Sec.	• Once • 2 DCY
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	– Check the Intake Air Temperature (IAT) Sensor -G42- . Refer to ⇒ “3.5.11 Intake Air Temperature Sensor and Manifold Absolute Pressure Sensor, Checking”, page 130 .	• IAT < 0,15 V	---	2 Sec.	• Continuous • 2 DCY
P0113	Intake Air Temperature Sensor 1 Circuit High Input	– Check the Intake Air Temperature (IAT) Sensor -G42- . Refer to ⇒ “3.5.11 Intake Air Temperature Sensor and Manifold Absolute Pressure Sensor, Checking”, page 130	• IAT > 4,47 V	---	2 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	– Check the Engine Coolant Temperature (ECT) Sensor -G62 - . Refer to ⇒ “3.5.24 Engine Coolant Temperature Sensor 1 or 2, Checking”, page 160 . – Check the coolant thermostat stuck open or closed. Refer to the Repair Manual.	• delta ECT < 2.25 .. 3.75 K	Driving condition 1 • ECT at start 50 to 140 °C • driving condition 1 2 x > 10 Sec • Cold start detected • Substitute ECT > -45 °C • Vehicle speed, 0 - 2 mph • Mass air flow, > 4 - 200 kg/h and Driving condition 2 • > 32 - 52 sec. • Vehicle speed, 20 - 75 mph • Mass air flow, <20 to 304 kg/h • check after ignition off 480 Sec	65 Sec.	• Once/ DCY • 2 DCY
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	– Check the Engine Coolant Temperature (ECT) Sensor -G62 - . Refer to ⇒ “3.5.24 Engine Coolant Temperature Sensor 1 or 2, Checking”, page 160 .	• ECT < -45° C	---	2 Sec.	• Continuous • 2 DCY
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	– Check the Engine Coolant Temperature (ECT) Sensor -G62 - . Refer to ⇒ “3.5.24 Engine Coolant Temperature Sensor 1 or 2, Checking”, page 160 .	ECT > 141° C	---	2 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0121	Accelerator Pedal Position Sensor A Circuit Range/Performance	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• TPS 1 - TPS 2 > 5.10 to 6.30% • TPS 1 calc. value > 9.00%	• Engine speed > 480 RPM • TPS electrical range no failure • unthrottled regime condition not fulfilled • engine speed > 480 RPM • engine speed > 1200 RPM • (only if TPS2>TPS1)	0.3 Sec.	• multiple • 2 DCY
P0122	Accelerator Pedal Position Sensor A Circuit Low Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	Signal voltage < 0.176 V	---	0.14 Sec.	• Continuous • 2 DCY
P0123	Accelerator Pedal Position Sensor A Circuit High Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	Signal voltage > 4.83 V	---	0.14 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P013A	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	For CBTA (Fed) ONLY: – Check the Oxygen Sensor (O2S) - G130- . Refer to ⇒ "3.5.22 Oxygen Sensor after Catalytic Converter, Checking", page 156 .	EWMA filtered max differential transient time at fuel cutoff >= 0.5 Sec. and number of checks >= 3	• Time of fuel cutoff <= 90 Sec. • Time after last fuel cutoff >= 5 Sec. • Rear O2S ready • Exhaust temp at sensor deviation between actual and expected lambda signal < 8 after time since fuel cutoff at first cylinder >= 2 Sec. • Exhaust mass flow >= 12 kg/h • Exhaust mass flow dynamic within range -500 to 500 kg/h • Sensor voltage at start of measurement > 0.45 V • Target voltage end of measurement <= 0.15 V	10 Sec.	• 1 DCY
P0130	O2 Sensor Circuit Bank 1 Sensor 1	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152	• O2S ceramic temp. < 640° C • OR • internal resistance > 950°	• heater control active • Modeled exhaust temp > 330° C • Fuel cut off not active	20 Sec.	• 2 DCY
P0131	O2 Sensor Circuit, Bank 1 Sensor 1 Low Voltage	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152	• Virtual mass < 2.0 V • UN, < 1.75 V • IP < 0.3 V • IA, 0.3 V	---	2 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0132	O2 Sensor Circuit, Bank 1 Sensor 1 High Voltage	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152	• Virtual mass, > 3.25 V • UN, > 4.0 V • adjustment voltage (IP) > 1,5 V • IA, > 1.5 V	---	2Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0133	O2 Circuit Slow Response Bank 1, Sensor 1	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152	• lower value of both area ratios R2L and L2L in case of symmetric fault < 0.3 • AND • lower value of both counters for area ratio R2L and L2R >= 6	• O2S ceramic temp. front > 720 ° C and > 45 Sec. since operation readiness • Lambda control, Closed loop • Engine load, 13.99 - 45% • Engine speed, 1200 - 3000 RPM • engine load 20 ... 70% • ECT >= 60 °C • exhaust system lag time calculation (Streckenzeitkonstante) 0.2 Sec • load gradient threshold <= 3% • gradient of exhaust system lag time calculation (Streckenzeitkonstante) <=0.05 Sec • Catalyst temperature >=400° C • lambda control A/F-Ratio set-point stoichiometric prior to diagnostic fuel steps • lambda control 2. control loop deactivated • forced lambda oscillation deactivated • relative fuel amount from transient compensation (wall-applied fuel dynamics and canister purge dynamics) <= 1 • tank leakage monitor not active • Canister purge monitoring not active • injection valves no fuel cut off for any of the cylinders • Time since last measurement > 2 Sec • open circuit pump current (IP) ready, no fault	60 Sec.	• Once • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0135	O2 Heater Circuit Bank 1, Sensor 1	– Check the Oxygen Sensor (O2S) Heater -G39- . Refer to ⇒ “3.5.21 Oxygen Sensor Heater, Checking”, page 154 .	• Heater duty cycle 100% • O2S ceramic temperature, < 720 °C OR • O2S ceramic temp < 715 °C • Time after O2 heater on, 35 Sec.	• Heater control, Active • Modeled exhaust gas temp, > 330 ° C • engine speed > 25 rpm • fuel cut off inactive OR • time after engine start > 40 Sec • Engine shutoff time > 300 Sec. • ECT @ start > -9,8° C • fuel cut off inactive	• 55 Sec • 40 Sec	• continuous • 2 DCY
P0136	O2 Circuit Bank 1, Sensor 2	For CBTA (Fed) ONLY: – Check the Oxygen Sensor (O2S) -G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• Delta O2S rear signal > 2.00 V • number of heater coupling faults > 4	• engine speed > 25 rpm • O2S rear dewpoint exceeded • O2S rear fully heated up • modeled exhaust temperature >700° C for 10 Sec	2 Sec.	• continuous • 2 DCY
P0137	O2 Circuit Low Voltage Bank 1, Sensor 2	For CBTA (Fed) ONLY: – Check the Oxygen Sensor (O2S) -G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• Cold condition: Signal voltage < 0.06 V for > 3 Sec. • Cold condition: Signal voltage > 0.06 V for > 3 Sec.	• engine speed > 25 [rpm] • O2S rear dewpoint exceeded • O2S rear fully heated up • modeled exhaust temperature >700 [°C] • for > 10 Sec • engine speed > 25 [rpm] • O2S rear dewpoint exceeded • O2S rear fully heated up • modeled exhaust temperature >700 [°C]	3 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0138	O2 Circuit High Voltage Bank 1, Sensor 2	For CBTA (Fed) ONLY: – Check the Oxygen Sensor (O2S) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	Signal voltage > 1.08 V	• engine speed > 25 rpm • O2S rear dewpoint exceeded • O2S rear fully heated up • modeled exhaust temperature >700° C for 10 Sec	5 Sec.	• continuous • 2 DCY
P0139	O2 Circuit Slow Response Bank 1, Sensor 2	– Check the Oxygen Sensor (O2S) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• transient time at fuel cut off > 0.6 Sec.	• O2S rear dewpoint exceeded • modeled exhaust temperature > 400° C	• 100 Sec.	• 2 DCY
P0140	O2 Circuit No Activity Detected Bank 1, Sensor 2	– Check the Oxygen Sensor (O2S) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• Signal voltage 461 to .499 V for > 3 Sec. • exhaust gas temperature >600° C • and internal resistance >40000 Ω	• engine speed > 25 rpm • O2S rear dewpoint exceeded • O2S rear fully heated up • modeled exhaust temperature >700° C for 10 Sec	100 Sec.	• continuous • 2 DCY
P0141	O2 Heater Circuit Bank 1, Sensor 2	– Check the Oxygen Sensor (O2S) Heater - G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	• internal resistance > 0.59… 1.9 kΩ	• Heater commanded ON • Modeled exhaust gas temp, 400 - 650 °C • Engine shutoff time > 120 Sec. (during ECM keep alive time after shutoff < 500 Sec.) • Fuel cutoff not active • Number of checks = 10	6 Sec.	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0142	O2 Sensor Circuit Bank 1 Sensor 3	– Check the Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• Delta voltage 1 step at heater switching > 2.00 V • Heater coupling >= 6 times	• Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Lambda control, Not at max • Exhaust temp >= 1263 °C for > 8.8 Sec. • Heater power >= 24% for > 18 Sec.	60 Sec.	• 2 DCY
P0143	O2 Sensor Circuit Low Voltage Bank 1 Sensor 3	– Check the Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• Signal voltage . 40 to .60 V for > 3 Sec. • Voltage difference between load pulse and no load pulse >= 2.80 V • Internal resistance > 40 k and exhaust temp > 670 °C	• Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Lambda control, Not at max • Exhaust temp >= 1263 °C for > 18 Sec. • Heater power >= 24% for > 18 Sec.	3 Sec.	• 2 DCY
P0144	O2 Sensor Circuit High Voltage Bank 1 Sensor 3	– Check the Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• Signal voltage > 1.08 V for > 5 Sec.	• Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Lambda control, Not at max • Exhaust temp >= 1263 °C for > 18 Sec. • Heater power >= 24% for > 18 Sec.	5 Sec.	• 2 DCY
P0145	O2 Sensor Circuit Slow Response Bank 1 Sensor 3	– Check the Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• EWMA filtered transient time at fuel cut off > 1.5 Sec. • O2 voltage between 201 - 401 mV	• O2S rear, Fully heated up • Rich voltage enable > = 548 mV • Modeled exhaust temp: > 480 °C • No other O2 sensor faults set.	4.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0146	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 3	– Check the Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• Signal voltage . 40 to .60 V for > 3 Sec. • Voltage difference between load pulse and no load pulse >= 2.80 V • Internal resistance > 40 k and exhaust temp > 670 °C	• Sensor voltage <= 0.40 V or 0.50 to 1.08 V • Lambda control, Not at max • Exhaust temp >= 1263 °C for > 18 Sec. • Heater power >= 24% for > 18 Sec.	30 Sec.	• 2 DCY
P0147	O2 Sensor Heater Circuit Bank 1 Sensor 3	– Check the Oxygen Sensor (O2S) Heater - G130- . Refer to ⇒ “3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking ”, page 158 .	• Internal heater resistance 1200 - 32400 Ω	• Heater commanded ON • Modeled exhaust gas temp, 300 - 680 °C • Engine shutoff time > 120 Sec. (during ECM keep alive time after shutoff < 500 Sec.) • Fuel cutoff not active • Number of checks = 10	6 Sec.	• 2 DCY
P0169	Incorrect Fuel Composition	Fuel may be contaminated or contain alcohol above 15% (on non E 85 compliant vehicles) If no other codes are set, take a fuel sample and have it analyzed.	• Fuel quantity out of limit or incorrect	• Engine speed > 1200 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0171	System Too Lean (Bank 1) additive	– Check the fuel pressure . Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 . – Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 . – Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 . – Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ “3.5.20 Heated Oxygen Sensor, Checking”, page 152 . – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to	• Adaptive value > 5.0 only	• Engine speed, 560...880 RPM • Engine load, 12...34% • mass air flow, 6...25kg/h • ECT, >60.0° C • lambda control, closed loop • evap purge valve, closed	• 50 Sec	• continuous • 2 DCY
		⇒ “3.5.8 EVAP Canister Purge Regulator Valve 1, Checking”,				

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0172	System Too Rich (Bank 1) additive	– Check the fuel pressure . Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 . – Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 . – Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 . – Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ “3.5.20 Heated Oxygen Sensor, Checking”, page 152 . – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ “3.5.8 EVAP Canister Purge Regulator Valve 1, Checking”,	• Adaptive value < 5.0 only	• Engine speed, 560...880 RPM • Engine load, 12...34% • mass air flow, 6...25kg/h • ECT, >60.0° C • lambda control, closed loop • evap purge valve, closed	• 50 Sec	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0171	System Too Lean (Bank 1) multiplicative	– Check the fuel pressure . Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 . – Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 . – Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 . – Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ “3.5.20 Heated Oxygen Sensor, Checking”, page 152 . – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ “3.5.8 EVAP Canister Purge Regulator Valve 1, Checking”,	• Adaptive value > 20.0 only	• Engine speed, 1200...4000 RPM • Engine load, 20...95% • mass air flow, 6...25kg/h • ECT, >60.0° C • lambda control, closed loop • evap purge valve, closed • delta fuel adaptation < 10.02	• 50 Sec	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0172	System Too Rich (Bank 1) multiplicative	– Check the fuel pressure . Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 . – Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 . – Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 . – Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ “3.5.20 Heated Oxygen Sensor, Checking”, page 152 . – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ “3.5.8 EVAP Canister Purge Regulator Valve 1, Checking”,	• Adaptive value < 20.0 only	• Engine speed, 1200...4000 RPM • Engine load, 20...95% • mass air flow, 6...25 kg/h • ECT, > 60.0° C • lambda control, closed loop • evap purge valve, closed • delta fuel adaptation < 10.02	• 50 Sec	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0190	Fuel Rail Pressure Sensor A Circuit	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	Signal voltage > 4.8 V	---	.5 Sec	• Continuous • 2 DCY
P0191	Fuel Rail Control Valve, high pressure side	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	actual pressure >17.5 mPa	---	.5 Sec	• Continuous • 2 DCY
P0192	Fuel Rail Pressure Sensor A Circuit Low Input	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	Signal voltage < 0.2 V	---	.5 Sec	• Continuous • 2 DCY
P0201	Injector Circuit Open Cylinder 1	– Check the Fuel Injector - N30- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current < 2,6 A • Engine speed, > 80 RPM	0.5 Sec.	• Continuous • 2 DCY
P0202	Injector Circuit Open Cylinder 2	– Check the Fuel Injector - N31- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current < 2,6 A • Engine speed, > 80 RPM	0.5 Sec.	• Continuous • 2 DCY
P0203	Injector Circuit Open Cylinder 3	– Check the Fuel Injector - N32- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current < 2,6 A • Engine speed, > 80 RPM	0.5 Sec.	• Continuous • 2 DCY
P0204	Injector Circuit Open Cylinder 4	– Check the Fuel Injector - N33- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current < 2,6 A • Engine speed, > 80 RPM	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0205	Injector Circuit Open Cylinder 5	– Check the Fuel Injector - N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current < 2,6 A • Engine speed, > 80 RPM	0.5 Sec.	• Continuous • 2 DCY
P0221	Accelerator Pedal Position Sensor B Circuit Range/Performance	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• TPS 1 to TPS 2, > 5.10 to 6.3% • TPS 2 – calc position > 9 %	• Engine speed > 480 RPM • TPS electrical range no failure • unthrottled regime condition not fulfilled • engine speed > 480 RPM • engine speed > 1200 RPM • (only if TPS2 >TPS1)	0.5 Sec.	• multiple • 2 DCY
P0222	Accelerator Pedal Position Sensor B Circuit Low Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• Signal voltage < 0.156 V	---	0.14 Sec.	• multiple • 2 DCY
P0223	Accelerator Pedal Position Sensor B Circuit High Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• Signal voltage, > 4.84 V	• engine speed >= 0 RPM • or TPS 1 electrical range failure	0.14 Sec.	• multiple • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0234	Turbocharger/Supercharger Overboost Condition Rationality check high	– Check the Charge Air Pressure Sensor -G31- . Refer to ⇒ "3.5.16 Charge Air Pressure Sensor / Intake Air Temperature Sensor 2, Checking ", page 142 . – Check the charge air system for proper seal. Refer to Engine Mechanical, Fuel Injection and Ignition; 21; Charge Air System	• difference actual pressure - set point pressure >30….125 kPa	---	3 Sec	• Continuous • 2 DCY
P0237	Turbocharger/Supercharger Boost Sensor A Circuit Low	– Check the Charge Air Pressure Sensor -G31- . Refer to ⇒ "3.5.16 Charge Air Pressure Sensor / Intake Air Temperature Sensor 2, Checking ", page 142 . – Check the charge air system for proper seal. Refer to Engine Mechanical, Fuel Injection and Ignition; 21; Charge Air System	• signal voltage < 0.2 V Cross check: • diff. pressure in front of throttle to average value of all pressure sensors @ start < -30.00 hPa	• engine speed > 80 RPM • engine shut-off-time > 5.0 Sec • engine speed < 350 rpm	.2 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0238	Turbocharger/Supercharger Boost Sensor A Circuit High	– Check the Charge Air Pressure Sensor -G31- . Refer to ⇒ "3.5.16 Charge Air Pressure Sensor / Intake Air Temperature Sensor 2, Checking ", page 142 . – Check the charge air system for proper seal. Refer to Engine Mechanical, Fuel Injection and Ignition; 21; Charge Air System	• signal voltage > 4.80 V Cross check: • diff. pressure in front of throttle to average value of all pressure sensors @ start > -30.00 hPa	• engine speed > 80 RPM • engine shut-off-time > 5.0 Sec • engine speed < 350 rpm	0.2 Sec	• Continuous • 2 DCY
P0243	Turbocharger/Supercharger Wastegate Solenoid A	– Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ "3.5.17 Wastegate Bypass Regulator Valve, Checking", page 144 .	• signal voltage > 5.6 .. 4.4 V	---	7 Sec	• Continuous • 2 DCY
P0245	Turbocharger/Supercharger Wastegate Solenoid A Low	– Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ "3.5.17 Wastegate Bypass Regulator Valve, Checking", page 144 .	• signal voltage < 3.25 .. 2.15 V	---	7 Sec	• Continuous • 2 DCY
P0246	Turbocharger/Supercharger Wastegate Solenoid A High	– Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ "3.5.17 Wastegate Bypass Regulator Valve, Checking", page 144 .	• signal current > 2.2 A	---	7 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0261	Cylinder 1 Injector Circuit Low	– Check the Fuel Injector - N30- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current > 4.2 A • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0262	Cylinder 1 Injector Circuit High	– Check the Fuel Injector - N30- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current > 14.7 A	• Injection valve, commanded ON • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0264	Cylinder 2 Injector Circuit Low	– Check the Fuel Injector - N31- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current > 4.2 A • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0265	Cylinder 2 Injector Circuit High	– Check the Fuel Injector - N31- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current > 14.7 A	• Injection valve, commanded ON • Engine speed, > 40 RPM	0.5 Sec.	• 2 DCY
P0267	Cylinder 3 Injector Circuit Low	– Check the Fuel Injector - N32- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current > 4.2 A • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0268	Cylinder 3 Injector Circuit High	– Check the Fuel Injector - N32- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current > 14.7 A	• Injection valve, commanded ON • Engine speed, > 40 RPM	0.5 Sec.	• 2 DCY
P0270	Cylinder 4 Injector Circuit Low	– Check the Fuel Injector - N33- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current > 4.2 A • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0271	Cylinder 4 Injector Circuit High	– Check the Fuel Injector - N33- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current > 14.7 A	• Injection valve, commanded ON • Engine speed, > 40 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0273	Cylinder 5 Injector Circuit Low	– Check the Fuel Injector - N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current < 2.1 A	• Injection valve, commanded OFF • high pressure system current > 4.2 A • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0274	Cylinder 5 Injector Circuit High	– Check the Fuel Injector - N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• signal current > 14.7 A	• Injection valve, commanded ON • Engine speed, > 40 RPM	0.5 Sec.	• 2 DCY
P0299	Turbocharger/Supercharger Underboost Rationality check low	– Check the Charge Air Pressure Sensor -G31- . Refer to ⇒ “3.5.16 Charge Air Pressure Sensor / Intake Air Temperature Sensor 2, Checking ”, page 142 . – Check the charge air system for proper seal. Refer to Engine Mechanical, Fuel Injection and Ignition; 21; Charge Air System	• difference actual pressure - set point pressure >30 kPa	---	3 Sec	• multiple • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0300	Random Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check Fuel Injectors - N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• emission threshold misifre rate (MR) > 2 % • calibrated threshold misifre rate (MR) > 1.4 % • catalyst damage misifre rate (MR) > 4... 17 %	• Active after engine start, > 200 RPM and 1 cam revolution • Engine torque, > = 0 Nm • Engine speed range, idle - 6000 RPM • Fuel cutoff, Not active • ECT at start > -20° C • IAT > - 48° C • if ECT @ start < -20° C. • than wait until actual ECT > 18° C	• 1000 Rev. > (2.5% Misfire Rate) • 200 Rev. (2.5 to 24% Misfire Rate)	• Continuous • 2 DCY • immediate

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0301	Cylinder 1 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check Fuel Injectors - N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• emission threshold misifre rate (MR) > 2 % • calibrated threshold misifre rate (MR) > 1.4 % • catalyst damage misifre rate (MR) > 4... 17 %	• Active after engine start, > 200 RPM and 1 cam revolution • Engine torque, > = 0 Nm • Engine speed range, idle - 6000 RPM • Fuel cutoff, Not active • ECT at start > - 20° C • IAT > - 48° C • if ECT @ start < -20° C , • than wait until actual ECT > 18° C	• 1000 Rev. > (2.5% Misfire Rate) • 200 Rev. (2.5 to 24% Misfire Rate)	• Continuous • 2 DCY • immediate

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0302	Cylinder 2 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check Fuel Injectors - N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• emission threshold misifre rate (MR) > 2 % • calibrated threshold misifre rate (MR) > 1.4 % • catalyst damage misifre rate (MR) > 4... 17 %	• Active after engine start, > 200 RPM and 1 cam revolution • Engine torque, > = 0 Nm • Engine speed range, idle - 6000 RPM • Fuel cutoff, Not active • ECT at start > - 20° C • IAT > - 48° C • if ECT @ start < -20° C. • than wait until actual ECT > 18° C	• 1000 Rev. > (2.5% Misfire Rate) • 200 Rev. (2.5 to 24% Misfire Rate)	• Continuous • 2 DCY • immediate

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0303	Cylinder 3 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check Fuel Injectors - N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• emission threshold misifre rate (MR) > 2 % • calibrated threshold misifre rate (MR) > 1.4 % • catalyst damage misifre rate (MR) > 4... 17 %	• Active after engine start, > 200 RPM and 1 cam revolution • Engine torque, > = 0 Nm • Engine speed range, idle - 6000 RPM • Fuel cutoff, Not active • ECT at start > -20° C • IAT > - 48° C • if ECT @ start < -20° C. • than wait until actual ECT > 18° C	• 1000 Rev. > (2.5% Misfire Rate) • 200 Rev. (2.5 to 24% Misfire Rate)	• Continuous • 2 DCY • immediate

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0304	Cylinder 4 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check Fuel Injectors - N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192	• emission threshold misifre rate (MR) > 2 % • calibrated threshold misifre rate (MR) > 1.4 % • catalyst damage misifre rate (MR) > 4... 17 %	• Active after engine start, > 200 RPM and 1 cam revolution • Engine torque, > = 0 Nm • Engine speed range, idle - 6000 RPM • Fuel cutoff, Not active • ECT at start > - 20° C • IAT > - 48° C • if ECT @ start < -20° C. • than wait until actual ECT > 18° C	• 1000 Rev. > (2.5% Misfire Rate) • 200 Rev. (2.5 to 24% Misfire Rate)	• Continuous • 2 DCY • immediate

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0305	Cylinder 5 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check Fuel Injectors - N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 – Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• emission threshold misifre rate (MR) > 2 % • calibrated threshold misifre rate (MR) > 1.4 % • catalyst damage misifre rate (MR) > 4... 17 %	• Active after engine start, > 200 RPM and 1 cam revolution • Engine torque, > = 0 Nm • Engine speed range, idle - 6000 RPM • Fuel cutoff, Not active • ECT at start > - 20° C • IAT > - 48° C • if ECT @ start < -20° C. • than wait until actual ECT > 18° C	• 1000 Rev. > (2.5% Misfire Rate) • 200 Rev. (2.5 to 24% Misfire Rate)	• Continuous • 2 DCY • immediate
P0321	Engine Speed Input Circuit Range/Performance	– Check the Engine Speed (RPM) Sensor -G28- . Refer to ⇒ “3.5.26 Engine Speed Sensor, Checking ”, page 166 .	• Comparison of counted teeth and number of teeth +/- 1 tooth • Loss of reference gap during normal operation • No reference gap during engine start	---	1.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0322	Engine Speed Input Circuit No Signal	– Check the Engine Speed (RPM) Sensor -G28- . Refer to ⇒ “3.5.26 Engine Speed Sensor, Checking ”, page 166 .	• comparison with phase sensor- no signal	---	2.5 Sec.	• 2 DCY
P0324	Knock Control System Error	– Check the Knock Sensors -G61, G66- . Refer to ⇒ “3.5.40 Knock Sensor, Checking”, page 190 .	• Signal fault counter (combustion) > 30 OR Signal fault counter measuring window > 2	• Engine speed > 2000 RPM	0.5 Sec.	• 2 DCY
P0327	Knock Sensor 1 Circuit Low Input	– Check the Knock Sensors -G61, G66- . Refer to ⇒ “3.5.40 Knock Sensor, Checking”, page 190 .	• Lower threshold < - 0.70 V • Signal range check < 0.55 to 5.60 V	• Engine speed > 1000 RPM or > 2000 RPM for signal range check	0.5 to 2 Sec.	• 2 DCY
P0328	Knock Sensor 1 Circuit High Input	– Check the Knock Sensors -G61, G66- . Refer to ⇒ “3.5.40 Knock Sensor, Checking”, page 190 .	• Upper threshold > 1 V • Signal range check > 16.50 to 92 V	• Signal circuit > 1000 RPM • Signal range check > 2000 RPM • ECT > 41 °C • Engine load 30 to 37.50%	0.5 to 2 Sec.	• 2 DCY
P0332	Knock Sensor 2 Circuit Low Input	– Check the Knock Sensors -G61, G66- . Refer to ⇒ “3.5.40 Knock Sensor, Checking”, page 190 .	• Lower threshold < - 0.70 V • Signal range check < 0.55 to 5.60 V	• Engine speed > 1000 RPM or > 2000 RPM for signal range check	0.5 to 2 Sec.	• 2 DCY
P0333	Knock Sensor 2 Circuit High Input	– Check the Knock Sensors -G61, G66- . Refer to ⇒ “3.5.40 Knock Sensor, Checking”, page 190 .	• Upper threshold > 1 V • Signal range check > 16.50 to 92 V	• Signal circuit > 1000 RPM • Signal range check > 2000 RPM • ECT > 41 °C • Engine load 30 to 37.50%	0.5 to 2 Sec.	• Multiple • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0341	Camshaft Position Sensor A Circuit Range/Performance	– Check the Camshaft Position (CMP) Sensor -G40- . Refer to ⇒ "3.5.36 Camshaft Position Sensor, Checking", page 182	• signal voltage low 4	---	0.3 Sec.	• 2 DCY
P0342	Camshaft Position Sensor A Circuit Low Input	– Check the Camshaft Position (CMP) Sensor -G40- . Refer to ⇒ "3.5.36 Camshaft Position Sensor, Checking", page 182	• Signal voltage permanently low 4 Revs	---	0.3 Sec.	• 2 DCY
P0343	Camshaft Position Sensor A Circuit High Input	– Check the Camshaft Position (CMP) Sensor -G40- . Refer to ⇒ "3.5.36 Camshaft Position Sensor, Checking", page 182	• Signal voltage permanently high	---	0.3 Sec.	• 2 DCY
P0351	Ignition Coil A Primary/ Secondary Circuit	– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ "3.5.41 Ignition Coil with Power Output Stage, Checking", page 192 .	• signal current < 4.95 .. 8.82 mA	• Engine speed > 1500 RPM	0.5 Sec.	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0352	Ignition Coil B Primary/ Secondary Circuit	– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• signal current < 4.95 .. 8.82 mA	• Engine speed > 1500 RPM	0.5 Sec.	• continuous • 2 DCY
P0353	Ignition Coil C Primary/ Secondary Circuit	– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• signal current < 4.95 .. 8.82 mA	• Engine speed > 1500 RPM	0.5 Sec.	• continuous • 2 DCY
P0354	Ignition Coil D Primary/ Secondary Circuit	– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• signal current < 4.95 .. 8.82 mA	• Engine speed > 1500 RPM	0.5 Sec.	• continuous • 2 DCY
P0355	Ignition Coil E Primary/ Secondary Circuit	– Check the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• signal current < 4.95 .. 8.82 mA	• Engine speed > 1500 RPM	0.5 Sec.	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0366	Camshaft Position Sensor A Circuit Range/Performance	– Check the Camshaft Position (CMP) Sensor 3 - G300- . Refer to ⇒ "3.5.37 Camshaft Position Sensor 3, Checking", page 184	signal voltage no altering @ reference gap	---	3 Sec	• Continuous • 2 DCY
P0367	Camshaft Position Sensor A Circuit Low Input	– Check the Camshaft Position (CMP) Sensor 3 - G300- . Refer to ⇒ "3.5.37 Camshaft Position Sensor 3, Checking", page 184	signal voltage low 4 rev	---	3 Sec	• Continuous • 2 DCY
P0368	Camshaft Position Sensor A Circuit High Input	– Check the Camshaft Position (CMP) Sensor 3 - G300- . Refer to ⇒ "3.5.37 Camshaft Position Sensor 3, Checking", page 184	signal voltage high 4 rev	---	3 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0410	Secondary Air Injection System	– Check the Secondary Air Injection relay. Refer to ⇒ “3.5.33 Secondary Air Injection Pump Relay, Checking”, page 177 . Check the Secondary Air Injection pump. Refer to ⇒ “3.5.32 Secondary Air Injection Pump Motor, Checking”, page 175	• Deviation SAI pressure > 50 hPa	• Mass airflow 7 to 120 kg/h • Delta engine load -10 to 10 % • Modeled catalyst temp < 700° C • ECT 3 to 105° C • Altitude < 2700 m • IAT 4.5 to 143.3° C • SAI commanded off	0.5 Sec.	• 2 DCY
P0413	Secondary Air Injection System Switching Valve Circuit Open	– Check the Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ “3.5.34 Secondary Air Injection Solenoid Valve, Checking”, page 179 .	• Signal voltage 4.70 to 5.40 V	• Air valve commanded OFF • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0414	Secondary Air Injection System Switching Valve Circuit Shorted	– Check the Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ “3.5.34 Secondary Air Injection Solenoid Valve, Checking”, page 179 .	• Signal voltage 0 to 3.25 V OR • Signal current > 2.20 A •	• Air valve commanded OFF • Engine speed > 80 RPM OR • Air valve commanded ON • Engine speed > 80 RPM	0.5 Se • He	• 2 DCY
P0418	Secondary Air Injection System Control Circuit	– Check the Secondary Air Injection Solenoid Valve - N112- . Refer to ⇒ “3.5.34 Secondary Air Injection Solenoid Valve, Checking”, page 179 .	• Signal voltage 4.70 to 5.40 V	• Pump relay commanded OFF • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0420	Catalyst System Efficiency Below Threshold	Check Long Term Fuel Trim for out of range condition. If LT Fuel Trim is out of range, correct the condition before replacing the catalytic converter. – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ "3.5.22 Oxygen Sensor after Catalytic Converter, Checking", page 156 – Check the Three Way Catalytic Converter (TWC). Refer to ⇒ "3.5.30 Catalytic Converter, Checking", page 173 .	• Oxygen storage capacity (OSC) vs OSC value of borderline catalyst < 0.2	• ambient temperature > -10° C • Engine speed, 1200 - 3000 RPM • catalyst temperature 525 ... 700° C • mass air flow 30 ... 100 kg/h • delta mass air flow < 20 kg/h / s • delta catalyst temperature < 20 K / s	70 Sec.	• Once/ DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	For Model Year 2011 > – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• EVAP pump current during reference measurement > 40 mA	• ECT > 60° C • ECT at start < 60° C • AAT > 4 and < 35° C • Altitude <= 2700 m • Time since engine start >= 600 Sec. • Integrated EVAP purge flow since last purge stop > 2 g • Integrated EVAP purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed < 120 km/h • Fuel volume flow <= 5 ml/s • Change in battery voltage during monitoring < 1.50 V • Engine speed not at idle and above 20 RPM • O2S front ready	3 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P043F	Evaporative Emission System Leak Detection Reference Orifice High Flow	For Model Year 2011 > – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• EVAP pump current during reference measurement < 15 mA	• ECT > 60° C • ECT at start < 60° C • AAT > 4 and < 35° C • Altitude <= 2700 m • Time since engine start >= 600 Sec. • Integrated EVAP purge flow since last purge stop > 2 g • Integrated EVAP purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed < 120 km/h • Fuel volume flow <= 5 ml/s • Change in battery voltage during monitoring < 1.50 V • Engine speed not at idle and above 20 RPM • O2S front ready	3 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0441	Evaporative Emission System Incorrect Purge Flow	Check the Purge Valve for restrictions and EVAP system for damaged hoses. If OK: – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ "3.5.8 EVAP Canister Purge Regulator Valve 1, Checking", page 124 . For Model Year 2011 >: – Check the Leak Detection Pump (LDP) -V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• deviation lambda control -4 ... 4 % • AND • deviation idle control < 20%	• ignition on • Engine speed idle • Engine speed Deviation < 100 RPM • integrated mass air flow @ Purge Valve > 80 … 250 g • ECT > 59.3° C and ECT at start < 59.3° C • ambient air temperature > 3.8° C • Altitude < 2600 m • ambient air temperature @ engine start > 3.8° C	25 Sec.	• Once • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0442	Evaporative Emission System Leak Detected (Small Leak)	– Check the EVAP System, for Leaks. Refer to ⇒ "3.5.7 EVAP System, Checking for Leaks", page 123 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ "3.5.8 EVAP Canister Purge Regulator Valve 1, Checking", page 124 . For Model Year 2011 >: – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• time for pressure drop < 1.95 ... 2.15 Sec (depending on altitude and IAT)	• evap purge valve closed • ECT at start >= 4...35° C • LDP activated, Selected gear = any drive • ambient pressure > 743.5 hPa • number of diagnosis attempts <=15 • IAT > 4° C • delta ambient pressure < 300 Pa • IAT drop after engine start, < 7°K • Time after engine start > 175 - 1200 Sec. • ECT 4 .. 115° C • Vehicle speed >= 19 mph • selected gear any drive	150 Sec.	• Once • 2 DCY
P0444	Evaporative Emission System Purge Control Valve Circuit Open	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ "3.5.8 EVAP Canister Purge Regulator Valve 1, Checking", page 124 .	• Signal voltage 4.4 - 5.6 V	• EVAP purge valve, commanded OFF • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0447	Evaporative Emission System Vent Control Circuit Open	For Model Year 2011 > – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• Signal voltage > 4.70 - 5.40 V	• EVAP pump solenoid valve commanded off	0.5 Sec.	• 2 DCY
P0448	Evaporative Emission System Vent Control Circuit Shorted	For Model Year 2011 > – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• Signal current > 2.2 to 4 A OR • Signal voltage < 2.74 to 3.26 V	• EVAP pump solenoid valve commanded on OR • EVAP pump solenoid valve commanded off	0.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0455	Evaporative Emission System Leak Detected (gross leak)	– Check the EVAP System, for Leaks. Refer to ⇒ "3.5.7 EVAP System, Checking for Leaks", page 123 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ "3.5.8 EVAP Canister Purge Regulator Valve 1, Checking", page 124 . For Model Year 2011 >: – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• Time for pressure drop < 0.95 Sec. .	• evap purge valve closed • ECT at start >= 4...35° C • LDP activated, Selected gear = any drive • ambient pressure > 743,5 hPa • number of diagnosis attempts <=15 • IAT > 4° C • delta ambient pressure < 300 [Pa] • IAT drop after engine start, < 7°K • Time after engine start > 175 - 1200 Sec. • ECT 4 .. 115° C • Vehicle speed >= 19 mph • selected gear any drive	150 Sec.	• Once • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0456	Evaporative Emission System Leak Detected (very small leak)	– Check the EVAP System, for Leaks. Refer to ⇒ "3.5.7 EVAP System, Checking for Leaks", page 123 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ "3.5.8 EVAP Canister Purge Regulator Valve 1, Checking", page 124 . For Model Year 2011 >: – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• time for pressure drop 1.85...2.15 < x < 4.5...6.5 [s] (depending on altidude and IAT)	• evap purge valve closed • ECT at start >= 4...35° C • LDP activated, Selected gear = any drive • ambient pressure > 743,5 hPa • number of diagnosis attempts <=15 • IAT > 4° C • delta ambient pressure < 300 [Pa] • IAT drop after engine start, < 7°K • Time after engine start > 175 - 1200 Sec. • ECT 4 .. 115° C • Vehicle speed >= 19 mph • selected gear any drive	200 Sec.	• Once • 2 DCY
P0458	Evaporative Emission System Purge Control Valve Circuit Low	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ "3.5.8 EVAP Canister Purge Regulator Valve 1, Checking", page 124 .	• Signal voltage <3.25... 2.15 V	• EVAP purge valve, commanded OFF • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0459	Evaporative Emission System Purge Control Valve Circuit High	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ "3.5.8 EVAP Canister Purge Regulator Valve 1, Checking", page 124 .	• Signal current, > 2.2 A	• EVAP purge valve, commanded ON • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P0491	Secondary Air Injection System Insufficient Flow	– Check the Secondary Air Injection Combination Valve. Refer to ⇒ "3.5.31 Secondary Air Injection Combination Valve, Checking", page 174 .	• SAI pressure vs. modeled SAI < 50 - 72% OR • Absolute deviation of raw pressure signal from filtered signal mean value < 8.98 hPa	• Mass air flow 7 to 120 kg/h • Delta engine load -10 to 10% • ECT 3 to 105° C • IAT 4.5 to 143.3° C • Altitude < 2700 • SAI pressure sensor ready	55 Sec.	• 2 DCY
P04DB	Positive Crankcase Ventilation	Refer to appropriate repair manual, PCV system diagnosis & repair.	• signal voltage > 3.4 V	• engine speed >40 RPM	1 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0501	Vehicle Speed Sensor Range/ Performance	– Check the Vehicle Speed sensor. Refer to ⇒ "3.5.42 Speed Signal, Checking", page 194 .	• Vehicle speed < 4 km/h	• Fuel cutoff active • Engine speed 1520 to 4520 RPM • ECT > 39.8° C	4 Sec.	• multiple • 2 DCY
P0503	Vehicle Speed Sensor Intermittent/Erratic/ High	– Check the Vehicle Speed sensor. Refer to ⇒ "3.5.42 Speed Signal, Checking", page 194 .	• Vehicle speed > 325 km/h	---	.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0506	Idle Air Control System RPM Lower Than Expected	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ "3.5.19 Throttle Valve Control Module, Checking", page 149 .	• Engine speed deviation > 100 RPM • RPM controller torque value >= calculated max value.	• ECT > 40.5° C • Engine speed at idle • Vehicle speed 0 MPH • external torque request not demanded • Altitude < 2700 m • IAT > 9.8° C • Engine load < 34.50%	5 Sec.	• Continuous • 2 DCY
P0507	Idle Air Control System RPM Higher Than Expected	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ "3.5.19 Throttle Valve Control Module, Checking", page 149 .	• engine speed deviation > 80…200 rpm • idle controller at min. value 7%	• ECT > 40.5° C • Engine speed at idle • Vehicle speed 0 MPH • external torque request not demanded • Altitude < 2700 m • IAT > 9.8° C • Engine load < 34.50%	5 Sec.	• Continuous • 2 DCY
P050A	Idle Air Control System Out of Range	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ "3.5.19 Throttle Valve Control Module, Checking", page 149 .	• Engine speed deviation < 150 RPM • RPM controller value 0...8% OR • Engine speed deviation > 150 RPM • RPM controller min. value 7%	• external torque request not demanded. • Engine speed idle • Vehicle speed 0 km/h • Altitude < 2700 m • ECT at start < 4 to 40° C • IAT > 9.8° C • engine load <66…78% • Catalyst heating active	30 Sec.	• Once • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P050 B *	Cold Start Ignition Timing Performance	– Check the Engine Speed (RPM) Sensor -G28- . Refer to ⇒ “3.5.26 Engine Speed Sensor, Checking ”, page 166 . – Check the Engine Speed (RPM) Sensor -G28- . Refer to ⇒ “3.5.26 Engine Speed Sensor, Checking ”, page 166 .	Difference between commanded spark timing vs. actual value > 20%	• Time during catalyst heating > 10 Sec. • Commanded spark retard during catalyst heating < 80% • Engine at idle <= 750 RPM, vehicle speed 0 km/h • Engine load <= 100.01% and delta load < 3%	8 Sec.	• 2 DCY
P052 A	Cold Start Camshaft Position Timing Over-Advanced	– Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ “3.5.38 Camshaft Adjustment Valve, Checking”, page 186	Difference between actual and target position > 5° CRK rev.	• Time after engine start >= . 8...60 Sec. • minimal adjustment > 8° CA • for longer than (cumulative) >= 12.75 Sec • Catalyst heating active	5 Sec.	• once • 2 DCY
P054 A	Cold Start Monitoring VVT exhaust	– Check the Camshaft Adjustment Valve 1 (exhaust) - N318- . Refer to ⇒ “3.5.39 Camshaft Adjustment Valve 1, Exhaust”, page 188	• difference between target position vs. actual position > 6° CA	• Time after engine start >= . 8...60 Sec. • minimal adjustment > 6° CA • for longer than (cumulative) >= 12.75 Sec • Catalyst heating active	5 Sec	• once • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P062 B	Injection Valves Communication	– Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	• SPI communications check Identifier not active / correct	• engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0601	Internal Control Module Memory Check Sum Error	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	Internal check sum, incorrect	---	0.5 Sec	• Continuous • 2 DCY
P0604	Internal Control Module Random Access Memory (RAM) Error	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	Write ability check, failed	---	0.5 Sec	• Continuous • 2 DCY
P0605	Internal Control Module Read Only Memory (ROM) Error	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	Checksum Incorrect	---	0.5 Sec	• Continuous • 2 DCY
P0606	ECM/PCM Processor	NOTE: The BARO sensor is an internal part of the ECM and is not repairable. If the BARO reading is off by 10% or more, replace the ECM. – Replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• Internal hardware/voltage check - failed • Communication CPU - Sensor IC - failed • EEPROM Check failed	---	• .5 Sec.	• Continuous • 2 DCY
P0627	Fuel Pump Control Circuit Open/ Shorted to ground	– Check the fuel pump electrical. Refer to ⇒ “3.5.1 Fuel Pump Voltage Supply, Checking”, page 112	• Signal voltage 4.50 to 5.50 V (open circuit) • Signal voltage < 3.00 V (grounded circuit)	• Fuel pump relay commanded OFF • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P0629	Fuel Pump Control Circuit High	– Check the fuel pump electrical. Refer to ⇒ “3.5.1 Fuel Pump Voltage Supply, Checking”, page 112	• Signal current 0.60 to 1.20 A	• Fuel pump relay commanded ON • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0638	Throttle Actuator Control Range/ Performance - Bank 1	– Check the Throttle Valve Control Module -J338- . Refer to ⇒ "3.5.19 Throttle Valve Control Module, Checking", page 149 .	• time to open over reference point + 12% > 0.14 Sec • time to close below reference point + 3% > 0.56 Sec or • TPS 1 signal voltage not (0.42 .. 0.77) V • or TPS 2 signal voltage not (4.26 .. 4.58) V	• engine speed <= 300 rpm • IAT, > 5.3° C • ECT > 5.3° C • Vehicle speed, 0 km/h	5 Sec.	• 2 DCY
P0641	Sensor Reference Voltage "A" Circuit/Open	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• internal communication failure	---	0.5 Sec.	• continuous • 2 DCY
P0642	Sensor Reference Voltage A Circuit Low	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	• signal voltage < 4.6 .. 5 V	---	0.5 Sec.	• continuous • 2 DCY
P0643	Sensor Reference Voltage A Circuit High	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	• signal voltage > 5 .. 5.4 V	---	0.5 Sec.	• continuous • 2 DCY
P0651	Sensor Reference Voltage "B" Circuit/Open	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• internal communication failure	---	0.5 Sec.	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0652	Sensor Reference Voltage A Circuit Low	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	• signal voltage < 4.6 .. 5 V	---	0.5 Sec.	• Continuous • 2 DCY
P0653	Sensor Reference Voltage A Circuit High	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	• signal voltage > 5 .. 5.4 V	---	0.5 Sec.	• Continuous • 2 DCY
P0657	Actuator Supply Voltage A Circuit / Open	– Check the Engine Control Module (ECM) Power Supply Relay -J271- . Refer to ⇒ "3.5.28 ECM Voltage Supply, Checking", page 170 .	• signal voltage > 4.4 .. 5.6 V	• Engine Relay commanded off • engine speed > 40 rpm	0.5 Sec.	• Continuous • 2 DCY
P0658	Actuator Supply Voltage A Circuit Low	– Check the Engine Control Module (ECM) Power Supply Relay -J271- . Refer to ⇒ "3.5.28 ECM Voltage Supply, Checking", page 170 .	• signal voltage < 2.15 .. 3.25 V	• Engine Relay commanded off • engine speed > 40 rpm	0.5 Sec.	• Continuous • 2 DCY
P0659	Actuator Supply Voltage "A" Circuit High	– Check the Engine Control Module (ECM) Power Supply Relay -J271- . Refer to ⇒ "3.5.28 ECM Voltage Supply, Checking", page 170 .	• signal current > 1.1 A	• Engine Relay commanded on • engine speed > 40 rpm	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0685	ECM/PCM Power Relay Control Circuit/ Open	– Check the Engine Control Module (ECM) Power Supply Relay -J271- . Refer to ⇒ “3.5.28 ECM Voltage Supply, Checking”, page 170 .	• control voltage 2.6 .. 3.7 V • sense circuit voltage < 6.0 V	• ECM keep alive time 0.5 Sec • main relay commanded on	0.5 Sec.	• Continuous • 2 DCY
P0686	ECM/PCM Power Relay Control Circuit Low	– Check the Engine Control Module (ECM) Power Supply Relay -J271- . Refer to ⇒ “3.5.28 ECM Voltage Supply, Checking”, page 170 .	• control voltage 2.6 .. 3.7 V • sense circuit voltage > 6.0 V	• ECM keep alive time 0.5 Sec • main relay commanded on	0.5 Sec.	• Continuous • 2 DCY
P0687	ECM/PCM Power Relay Control Circuit High	– Check the Engine Control Module (ECM) Power Supply Relay -J271- . Refer to ⇒ “3.5.28 ECM Voltage Supply, Checking”, page 170 .	• signal current > 0.7 ...1.4 A • sense circuit voltage < 6.0 V	• ECM keep alive time 0.5 Sec • main relay commanded on	0.5 Sec.	• Continuous • 2 DCY
P0697	Sensor Reference Voltage “C” Circuit/Open	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.	• internal communication failure	---	0.5 Sec.	• Continuous • 2 DCY
P0698	Sensor Reference Voltage A Circuit Low	– Replace the Engine Control Module (ECM) -J623- . Refer to the appropriate service manual.	• signal voltage < 4.6 .. 5 V	---	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0699	Sensor Reference Voltage A Circuit High	– Replace the Engine Control Module (ECM) - J623- . Refer to the appropriate service manual.	• signal voltage > 5 .. 5.4 V	---	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P117A	Fuel System out of range	– Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156	• I - portion of 3rd lambda control loop > 0.03	• Engine speed 1400 to 3600 RPM • Modeled exhaust gas temp 350 - 1000° C • Engine load 20.3 to 54.8% • All O2 sensors in closed loop - no faults.	1800 Sec.	• 2 DCY
P12A1	Fuel Rail Pressure Sensor Inappropriately Low	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 ..	• pressure control activity, >2.50 mPa • AND • fuel trim activity, <0.80	• engine speed 600...900 RPM • evap purge adaptation < 20 kg/m • engine load > 10...30% • lambda control closed loop • fuel cut off not active	• 5 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P12A2	Fuel Rail Pressure Sensor Inappropriately High	– Check the Fuel Pressure Sensor - G247- . Refer to Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 ..	• pressure control activity, <0.14 mPa • AND • fuel trim activity, >1.5	• engine speed 600...900 RPM • evap purge adaptation < 20 • lambda control closed loop • engine load > 10...30% • fuel cut off not active	• 5 Sec	• Continuous • 2 DCY
P12A4	Fuel Rail Pump Control Valve Stuck Closed	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	• pressure control activity, <6.00 mPa • AND • fuel trim activity, >0.9 \0...1.15	• lambda control closed loop • fuel cut off not active	5 Sec	• Continuous • 2 DCY
P150A	Comparing engine off time from instrument cluster control unit with engine after run time	Check the ECM battery voltage inputs. The ECM must have voltage input with key off. Refer to wiring diagrams for pin locations. If key off voltage supply is present at the ECM, replace the ECM. Refer to the Repair Manual	• difference between engine-off-time and ECM after run-time < 12 • difference between engine-off-time and ECM after run-time > 12 Sec	• Key ON during ECM after run timer - active • CAN active	0 Sec.	• once • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2004	Intake Manifold Runner Control Stuck Open Bank 1	– Check the Intake Flap Motor -V157- / Intake Manifold Runner Position Sensor -G336- . Refer to ⇒ “3.5.12 Intake Manifold Runner Position Sensor, Checking”, page 134 .	signal range check @ upper mechanical stop • normal closed position unable to reach • signal voltage < 2.62 or > 4.65 V signal range check @ lower mechanical stop • normal closed position unable to reach • signal voltage< 0.35 or > 2.38 V	---	25 Sec	• Once • 2 DCY
P2008	Intake Manifold Runner Control Circuit/Open Bank 1	– Check the Intake Flap Motor -V157- / Intake Manifold Runner Position Sensor -G336- . Refer to ⇒ “3.5.12 Intake Manifold Runner Position Sensor, Checking”, page 134 .	• signal duty cycle > 80% • ECM power stage failure	---		• Continuous • 2 DCY
P2014	Intake Manifold Runner Position Sensor/Switch Circuit Bank 1	– Check the Intake Flap Motor -V157- / Intake Manifold Runner Position Sensor -G336- . Refer to ⇒ “3.5.12 Intake Manifold Runner Position Sensor, Checking”, page 134 .	signal voltage < 0.2 V	---	.2 Sec	• Continuous • 2 DCY
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance Bank 1	– Check the Intake Flap Motor -V157- / Intake Manifold Runner Position Sensor -G336- . Refer to ⇒ “3.5.12 Intake Manifold Runner Position Sensor, Checking”, page 134 .	• signal duty cycle > 80% • deviation vs. calculated value > 5%	• Engine speed >400 rpm • ECT > 10° C	• 5 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2017	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance Bank 1	– Check the Intake Flap Motor -V157- / Intake Manifold Runner Position Sensor -G336- . Refer to ⇒ “3.5.12 Intake Manifold Runner Position Sensor, Checking”, page 134 .	• signal voltage > 4.8 V	---	.2 Sec	• Continuous • 2 DCY
P2088	Camshaft Position Actuator Control Circuit Low Bank 1	– Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ “3.5.38 Camshaft Adjustment Valve, Checking”, page 186 .	• signal voltage < 2.15 .. 3.25 V	• Camshaft solenoid commanded OFF • Engine speed, > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P2089	Camshaft Position Actuator Control Circuit High Bank 1	– Check the Camshaft Adjustment Valve 1 - N205- . Refer to ⇒ “3.5.38 Camshaft Adjustment Valve, Checking”, page 186 .	• Signal current, > 2.2 A	• Camshaft solenoid commanded ON • Engine speed > 40 RPM	0.5 Sec.	• Continuous • 2 DCY
P2090	Exhaust Camshaft Position Actuator Circuit short to ground Bank 1	– Check the Camshaft Adjustment Valve 1 (exhaust) - N318- . Refer to ⇒ “3.5.39 Camshaft Adjustment Valve 1, Exhaust”, page 188	• signal voltage < 2.15 .. 3.25 V	• Camshaft solenoid commanded OFF • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2091	Exhaust Camshaft Position Actuator Circuit short to Batt+ Bank 1	– Check the Camshaft Adjustment Valve 1 (exhaust) - N318- . Refer to ⇒ "3.5.39 Camshaft Adjustment Valve 1, Exhaust", page 188	• signal current > 2.2 A	• Camshaft solenoid commanded ON • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	– Check the fuel pressure. Refer to ⇒ "3.5.2 Fuel Pump Pressure, Checking", page 113 – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ "3.5.22 Oxygen Sensor after Catalytic Converter, Checking", page 156	• Deviation lambda control < -3%	• Lambda control, active • lambda set point 1 • engine load 16….100% • Engine speed, 1120-4000 RPM • Fuel cutoff and catalyst heating not active • ECT > 50° C • engine load changes < 7% • O2S front, ready and heater active • O2S rear, ready and heater active • catalyst gas temperature 350 to 8500° C • mass flow 25 to 150 kg/h • 2nd lambda control loop active	100 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	– Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 – Check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 – Check the Three Way Catalytic Converter (TWC). Refer to ⇒ “3.5.30 Catalytic Converter, Checking”, page 173 .	• Deviation lambda control > 3%	• Lambda control, active • lambda set point 1 • engine load 16….100% • Engine speed, 1120-4000 RPM • Fuel cutoff and catalyst heating not active • ECT > 50° C • engine load changes < 7% • O2S front, ready and heater active • O2S rear, ready and heater active • catalyst gas temperature 350 to 8500° C • mass flow 25 to 150 kg/h • 2nd lambda control loop active	140 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2101	Throttle Actuator Control Motor Circuit Range/Performance	– Check the Throttle Valve Control Module -J338- . Refer to ⇒ “3.5.19 Throttle Valve Control Module, Checking”, page 149 .	signal range check • Duty cycle > 80% • ECM power stage no failure rationality check • deviation throttle valve angles vs. calculated value > 4 .. 50 %	---	0.6 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2106	Throttle Actuator Control System - Forced Limited Power	– Check the Throttle Valve Control Module -J338- . Refer to ⇒ “3.5.19 Throttle Valve Control Module, Checking”, page 149 .	• duty cycle > 80 % • ECM power stage failure	---	5 Sec.	• Continuous • 2 DCY
P2122	Accelerator Pedal Position Sensor D Circuit Low Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• Signal voltage < 0.63 V	---	0.2 Sec.	• Continuous • 2 DCY
P2123	Accelerator Pedal Position Sensor D Circuit High Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• Signal voltage > 4.8 V	---	0.2 Sec.	• Continuous • 2 DCY
P2127	Accelerator Pedal Position Sensor E Circuit Low Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• Signal voltage < 0.29 V	---	0.2 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2128	Accelerator Pedal Position Sensor E Circuit High Input	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• Signal voltage > 2.5 V	---	0.2 Sec.	• Continuous • 2 DCY
P2138	Accelerator Pedal Position Sensor D / E Voltage Correlation	– Check the Accelerator Pedal Position Sensor 1 - G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to ⇒ “3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking”, page 147 .	• Signal voltage sensor 1 vs. 2 > 0.12 to 0.70 V	---	0.24 Sec.	• Continuous • 2 DCY
P2146	Fuel Injector Group A Supply Voltage Circuit / short to ground	– Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	short to battery plus • signal current < 2.6 A short to ground • signal current > 14.9 A	• injection valve commanded off • engine speed > 40 rpm	0.5 Sec	• Continuous • 2 DCY
P2149	Fuel Injector Group B Supply Voltage Circuit / Short to ground	– Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	short to battery plus • signal current < 2.6 A short to ground • signal current > 14.9 A	• injection valve commanded off • engine speed > 40 rpm	0.5 Sec	• Continuous • 2 DCY
P2152		– Check the Fuel injectors -N30, N31, N32, N33, N83- . Refer to ⇒ “3.5.27 Fuel Injectors, Checking”, page 167 .	short to battery plus • signal current < 2.6 A short to ground • signal current > 14.9 A	• injection valve commanded off • engine speed > 40 rpm	0.5 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2177	System Too Lean Off Idle	• Check O2 sensor operation. If any O2 codes are set, diagnose them first. • Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 • Check for a vacuum leak or poor engine gasket seal. • Check the Secondary Air Injection Combination Valve. Refer to ⇒ “3.5.31 Secondary Air Injection Combination Valve, Checking”, page 174 .	• Adaptive value > 28%	• Number of injections after engine start > 1500 • Engine speed < 860 RPM • Mass air flow < 35 kg/h • ECT > 59 °C • IAT < 85 °C • Ratio manifold pressure to ambient pressure > 0.20 • Delta part load adaptation ready • Lambda control - closed loop • EVAP purge valve closed • Valve overlap < 40 °CRK	25 Sec.	• 2 DCY
P2178	System Too Rich Off Idle	• Check O2 sensor operation. If any O2 codes are set, diagnose them first. • Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 • Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ “3.5.8 EVAP Canister Purge Regulator Valve 1, Checking”, page 124 .	• Adaptive value < -20%	• Number of injections after engine start > 1500 • Engine speed < 860 RPM • Mass air flow < 35 kg/h • ECT > 59 °C • IAT < 85 °C • Ratio manifold pressure to ambient pressure > 0.20 • Delta part load adaptation ready • Lambda control - closed loop • EVAP purge valve closed • Valve overlap < 40 °CRK	25 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2181	Cooling System Performance	– Check the Cooling system thermostat. Refer to the Repair Manual . – Check Engine Coolant Temperature (ECT) Sensor -G62 or G83- . Refer to ⇒ “3.5.24 Engine Coolant Temperature Sensor 1 or 2, Checking”, page 160 .	• ECT too low after sufficient mass air flow interval = 76.5° C • AND • mass air integral 4.0 .. 17.0 kg	• ECT at start -7 to 60° C • ECT > 35° C • IAT > -7° C • accum. fuel cut off < 40...220 Sec • delta ambient pressure < 1.2 kPa • vehicle speed > 22 mph • vehicle speed < 75 mph • mass air flow > (33 .. 89) kg/h • mass air flow < (96 .. 220) kg/h	< 1000 Sec	• Once • 2 DCY
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	– Check Engine Coolant Temperature (ECT) Sensor - G83- . Refer to ⇒ “3.5.24 Engine Coolant Temperature Sensor 1 or 2, Checking”, page 160 .	• ECT outlet > 140° C	---	2 Sec.	• 2 DCY
P2185	Engine Coolant Temperature Sensor 2 Circuit High	– Check Engine Coolant Temperature (ECT) Sensor -G83- . Refer to ⇒ “3.5.24 Engine Coolant Temperature Sensor 1 or 2, Checking”, page 160 .	• ECT outlet < -40° C	---	2 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2187	System Too Lean at Idle Bank 1	• Check for a vacuum leak or poor engine gasket seal. • Check O2 sensor operation. If any O2 codes are set, diagnose them first. • Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 • Check the Secondary Air Injection Combination Valve. Refer to ⇒ “3.5.31 Secondary Air Injection Combination Valve, Checking”, page 174 .	• Adaptive value > 5.02%	• Number of injections after engine start > 1500 • Engine speed < 860 RPM • Mass air flow < 35 kg/h • ECT > 59° C • IAT < 85° C • Ratio manifold pressure to ambient pressure > 0.20 • Delta part load adaptation ready • Lambda control - closed loop • EVAP purge valve closed • Valve overlap < 40° CRK	40 Sec.	• 2 DCY
P2188	System Too Rich at Idle Bank 1	• Check O2 sensor operation. If any O2 codes are set, diagnose them first. • Check the fuel pressure. Refer to ⇒ “3.5.2 Fuel Pump Pressure, Checking”, page 113 • Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . Refer to ⇒ “3.5.8 EVAP Canister Purge Regulator Valve 1, Checking”, page 124 .	• Adaptive value < -5.02%	• Number of injections after engine start > 1500 • Engine speed < 860 RPM • Mass air flow < 35 kg/h • ECT > 59° C • IAT < 85° C • Ratio manifold pressure to ambient pressure > 0.20 • Delta part load adaptation ready • Lambda control - closed loop • EVAP purge valve closed • Valve overlap < 40° CRK	40 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2195	O2 Sensor Signal Biased/ Stuck Lean - Bank 1, Sensor 1	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152 .	• trim control post catalyst < -6 %	• Catalyst temp 350 to 850° C • engine load changes < 7% • engine speed 1120 ... 4000 RPM • engine load 16….100 % • mass air flow 25 to 150 kg/h • ECT > 50° C • lambda set point 1 • Lambda control - active • O2 heaters ready, no DTCs • second control loop active • Fuel cutoff, catalyst heating, SAI not active	200 Seconds	• Continuous • 2 DCY
P2196	O2 Sensor Signal Biased/ Stuck Rich - Bank 1, Sensor 1	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152 .	• trim control post catalyst < -6 %	• Catalyst temp 350 to 850° C • engine load changes < 7% • engine speed 1120 ... 4000 RPM • engine load 16….100 % • mass air flow 25 to 150 kg/h • ECT > 50° C • lambda set point 1 • Lambda control - active • O2 heaters ready, no DTCs • second control loop active • Fuel cutoff, catalyst heating, SAI not active	200 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2237	O2 Sensor Positive Current Control Circuit Open Bank 1, Sensor 1	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152 .	• O2S signal front 1.49 to 1.51 V • Fuel cutoff > 3 Sec. • Delta lambda controller > 0.10	• O2S ceramic temp > 720° C • engine start completed • Lambda control active • Heater active • engine speed > 25 rpm • mass air integral > 0.2 kg • Lambda modulation > 0.02	30 Sec.	• 2 DCY
P2243	O2 Sensor Reference Voltage Circuit Open Bank 1, Sensor 1	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152 .	• O2S signal front > 4.70 V and Internal resistance > 950 Ω • O2S signal front < 0.20 V And Internal resistance > 950 Ω	• Heater control active • engine start completed • engine speed > 25 RPM • O2S ceramic temperature > 720° C	10 Sec.	• 2 DCY
P2251	O2 Sensor Negative Current Control Circuit Open	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152 .	• O2S signal front 1.47 to 1.53 V and > 950 Ω	• Modeled exhaust gas temp < 750 Ω • No fuel cutoff > 2 Sec. • Heater control active	30.5 Sec.	• 2 DCY
P2257	Secondary Air Injection System Control Circuit Low	• Check the Secondary Air Injection (AIR) Pump Relay - J299- . Refer to ⇒ "3.5.33 Secondary Air Injection Pump Relay, Checking", page 177	• Signal voltage 0 to 3.26 V	• Pump relay commanded OFF • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2258	Secondary Air Injection System Control Circuit High	• Check the Secondary Air Injection (AIR) Pump Relay - J299- . Refer to ⇒ “3.5.33 Secondary Air Injection Pump Relay, Checking”, page 177	• Signal current . 60 to 2.40 A	• Pump relay commanded ON • Engine speed > 80 RPM	0.5 Sec.	• 2 DCY
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	– Check the Oxygen Sensor (O2S) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 . For CBUA (Cali) ONLY:	• O2S signal rear not oscillating at reference < <0.649d enrichment after stuck lean 20% • enrichment after stuck lean 1%	• Mass air flow > 30 kg/h • Modeled exhaust gas temp > 700° C • O2S rear readiness > 10 Sec. • 2nd lambda control - closed loop	100c.	• Continuous • 2 DCY
P2271	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	– Check the Oxygen Sensor (O2S) - G130- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156 .	• O2S signal rear not oscillating at reference > . 0649 mV and enrichment after stuck rich 15% • enrichment after stuck rich 1% response time check • response time > 2.5 Sec	• Mass air flow 22 to 120 kg/h • Modeled exhaust gas temp > 300 °C • O2S rear readiness > 10 Sec. • 2nd lambda control - closed loop • mass air flow > 10 kg/h • O2S rear no DTC • O2S rear sensor voltage > 0,57 V • fuel cut off active	100 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2274	O2 Sensor Signal Stuck Lean Bank 1 Sensor 3	• Check the Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) - G465- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156	• O2S rear not oscillating at reference < 0.64 to 0.65 V and enrichment after stuck lean 20%	• Mass air flow 22 to 120 kg/h • Modeled exhaust gas temp > 300 °C • O2S rear readiness > 10 Sec. • 2nd lambda control - closed loop	100 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2275	O2 Sensor Signal Stuck Rich Bank 1 Sensor 3	• Check the Oxygen Sensor (O2S) 2 Behind Three Way Catalytic Converter (TWC) - G465- . Refer to ⇒ “3.5.22 Oxygen Sensor after Catalytic Converter, Checking”, page 156	• O2S rear not oscillating at reference > 0.64 to 0.65 V and enrichment after stuck rich 15% OR • Sensor voltage of >= 0.15 V after oxygen mass flow (after fuel cutoff) > 1500 to 3000 mg with >= 1 check	• Mass air flow 22 to 120 kg/h • Modeled exhaust gas temp > 300 °C • Fuel cutoff > 3 Sec. • O2S rear readiness > 10 Sec. • 2nd lambda control - closed loop OR • Time of fuel cutoff <= 90 Sec. • Time after last fuel cutoff >= 5 Sec. • Rear O2S ready • Exhaust temp at sensor deviation between actual and expected lambda signal < 8 after time since fuel cutoff at first cylinder >= 2 Sec. • Exhaust mass flow >= 12 kg/h • Exhaust mass flow dynamic within range -500 to 500 kg/h • Sensor voltage at start of measurement > 0.45 V • Target voltage end of measurement <= 0.15 V	10 to 215 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2279	Intake Air System Leak	• Check the intake system for leaks. Check oil cap for proper seal along with engine cover gaskets or oil dipstick not seated in tube, that may allow additional air into crankcase. The PCV system is not metered (no valve) so any additional air entering through an engine gasket will cause an increase in PCV volume drawn into the intake manifold.	• Offset value throttle mass flow > 19 kg/h • correction factor > 0.95	• Desired mass flow 5 to 21 kg/h • ECT >-42.8° C • EVAP purge valve closed	2 Sec.	• 2 DCY
P2293	Fuel Rail	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 ..	difference between MPa actual pressure - target pressure = > 1.3 <-3 MPa	fuel cut off not active	3.5 Sec	• Continuous • 2 DCY
P2294	Fuel Rail	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 ..	signal voltage 2.3 ... 2.7 V	• valve commanded off • engine relay commanded on	1 Sec	• Continuous • 2 DCY
P2295	Fuel Rail	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 ..	signal voltage 1.8 .. 2.2 V	• valve commanded off • engine relay commanded on	1 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2296	Fuel Rail	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 ..	signal voltage > 3.9 V	• valve commanded on • engine relay commanded on	1 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2300	Ignition Coil A Primary Control Circuit Low	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• short to ground signal voltage < 0.5 .. 1.0 V	• Engine speed, > 1500 RPM	0.5 V	• Continuous • 2 DCY
P2301	Ignition Coil A Primary Control Circuit High	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal voltage > 5.2 .. 6.0 V	• Engine speed > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY
P2303	Ignition Coil B Primary Control Circuit Low	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• short to ground signal voltage < 0.5 .. 1.0 V	• Engine speed, > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2304	Ignition Coil B Primary Control Circuit High	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal voltage > 5.2 .. 6.0 V	• Engine speed > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY
P2306	Ignition Coil C Primary Control Circuit Low	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal current > 24 mA	• short to ground signal voltage < 0.5 .. 1.0 V	0.5 Sec.	• Continuous • 2 DCY
P2307	Ignition Coil C Primary Control Circuit High	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal voltage > 5.2 .. 6.0 V	• Engine speed > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY
P2309	Ignition Coil D Primary Control Circuit Low	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal current > 24 mA	• Engine speed, > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2310	Ignition Coil D Primary Control Circuit High	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal voltage > 5.2 .. 6.0 V	• Engine speed > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY
P2312	Ignition Coil “E” Primary Control Circuit Low	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal current > 24 mA	• Engine speed, > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY
P2313	Ignition Coil “E” Primary Control Circuit High	– Check the Ignition Coils with Power Output Stage . Refer to ⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192 .	• Signal voltage > 5.2 .. 6.0 V	• Engine speed > 1500 RPM	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P240A	Evaporative Emission System Leak Detection Pump Heater Control Circuit Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.5.13 Leak Detection Pump, Checking ”, page 136	• Signal voltage > 4.7 to 5.4 V	• EVAP pump electric drive commanded off	0.5 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P240B	Evaporative Emission System Leak Detection Pump Heater Control Circuit Low	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• Signal voltage < 2.74 to 3.26 V	• EVAP pump electric drive commanded off	0.5 Sec.	• 2 DCY
P240C	Evaporative Emission System Leak Detection Pump Heater Control Circuit High	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• Signal current > 2.2 to 4 A	• EVAP pump electric drive commanded on	0.5 Sec.	• 2 DCY
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• Signal voltage > 4.40 to 5.60 V	• LDP commanded OFF • engine speed >40 RPM	0.5 Sec.	• Continuous • 2 DCY
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	For Model Year 2011 >: – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• Signal voltage < 2.74 to 3.26 V	• LDP commanded OFF • engine speed >40 RPM	0.5 Sec.	• Continuous • 2 DCY
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	For Model Year 2011 >: – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136	• signal current > 3 A	• LDP commanded ON • engine speed >40 RPM	0.5 Sec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136 .	• Low signal voltage >1 Sec.	• LDP commanded OFF • evap purge valve closed • ECT at start >= 4...35° C • LDP activated, Selected gear = any drive • ambient pressure > 743,5 hPa • number of diagnosis attempts <=15 • IAT > 4° C • delta ambient pressure < 300 [Pa] • IAT drop after engine start, < 7°K • Time after engine start > 175 - 1200 Sec. • ECT 4 .. 115° C • Vehicle speed >= 19 mph • selected gear any drive	10 Sec.	• Once/ DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2404	Evaporative Emission System Leak Detection Pump Sense Range/Performance	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136 .	• High signal voltage > 0.36 Sec.	• LDP commanded ON • evap purge valve closed • ECT at start >= 4...35° C • LDP activated, Selected gear = any drive • ambient pressure > 743,5 hPa • number of diagnosis attempts <=15 • IAT > 4° C • delta ambient pressure < 300 [Pa] • IAT drop after engine start, < 7°K • Time after engine start > 175 - 1200 Sec. • ECT 4 .. 115° C • Vehicle speed >= 19 mph • selected gear any drive	10 Sec.	• Once/ DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ "3.5.13 Leak Detection Pump, Checking ", page 136 .	• Fluctuation of EVAP pump current during reference measurement > 1 mA • Drop of EVAP pump current during pump phase > 6 mA for >= 3 Sec.	• ECT > 60 °C • ECT at start < 60 ° C • AAT > 4 and < 35 ° C • Altitude <= 2700 m • Time since engine start >= 600 Sec. • Integrated EVAP purge flow since last purge stop > 2 g • Integrated EVAP purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed < 120 km/h • Fuel volume flow <= 5 ml/s • Change in battery voltage during monitoring < 1.50 V • Engine speed not at idle and above 20 RPM • O2S front ready	21.5 Sec.	• 2 DCY
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	– Check the Heated Oxygen Sensor (HO2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152 .	• Signal Voltage 2.5 to 3.06 V	• desired Lambda value < 1.6 • Fuel cut off, Not active • Heater control - closed loop • engine speed > 25 rpm • O2S no DTC • O2S ceramic temp, >715° C • low fuel signal on than wait > 600 [s]	10 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2431	Secondary Air Injection System Air Flow Pressure Sensor Circuit Range/Performance	– Check the Secondary Air Injection Sensor 1 - G609- . Refer to ⇒ "3.5.35 Secondary Air Injection Sensor 1, Checking", page 180 .	• Difference between SAI pressure and ambient pressure NOT -60 to 60 hPa	• Secondary Air Injection - done	0.5 Sec.	• Once/ DCY • 2 DCY
P2432	Secondary Air Injection System Air Flow/Pressure Sensor Circuit Low	– Check the Secondary Air Injection Sensor 1 - G609- . Refer to ⇒ "3.5.35 Secondary Air Injection Sensor 1, Checking", page 180 .	• Signal voltage < 0.5 V	---	0.5 Sec.	• 2 DCY
P2433	Secondary Air Injection System Air Flow/Pressure Sensor Circuit High	– Check the Secondary Air Injection Sensor 1 - G609- . Refer to ⇒ "3.5.35 Secondary Air Injection Sensor 1, Checking", page 180 .	• Signal voltage > 4.5 V	---	0.5 Sec.	• 2 DCY
P2440	Secondary Air Injection System Switching Valve Stuck Open	– Check the Combination Valve . Refer to ⇒ "3.5.31 Secondary Air Injection Combination Valve, Checking", page 174 . – Check the Secondary Air Injection Sensor 1 - G609- . Refer to ⇒ "3.5.35 Secondary Air Injection Sensor 1, Checking", page 180 .	• SAI pressure sensor measured with SAI pressure vs. modeled while SAI valve closed < 64.8%	• ECT 3 to 105 °C • IAT 4.5 to 143.3 °C • Altitude < 2700 m • SAI pressure sensor - ready	55.5 Sec.	• Once/ DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.5.13 Leak Detection Pump, Checking ”, page 136	• EVAP pump current difference between reference measurement to idle < 3 mA	• ECT > 60 °C • ECT at start < 60 ° C • AAT > 4 and < 35 ° C • Altitude <= 2700 m • Time since engine start >= 600 Sec. • Integrated EVAP purge flow since last purge stop > 2 g • Integrated EVAP purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed < 120 km/h • Fuel volume flow <= 5 ml/s • Change in battery voltage during monitoring < 1.50 V • Engine speed not at idle and above 20 RPM • O2S front ready	21.5 Sec.	• 2 DCY
P2539	Fuel System	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	• "signal range check out of range high" signal voltage "> 4.9 >4,8" V	---	1 Sec	• Continuous • 2 DCY
P2541	Fuel System	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.5 Fuel Pressure Sensor, Checking”, page 119 .	• "signal range check out of range low" signal voltage "< 0.2 <0,2" V	---	1 Sec	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2626	O2 Sensor Pumping Current Trim Circuit Open Bank 1 Sensor 1	– Check the Oxygen Sensor (O2S) - G39- . Refer to ⇒ "3.5.20 Heated Oxygen Sensor, Checking", page 152 .	• O2S signal front > 3.1 V (lean)	• engine start completed • engine speed > 25 rpm • O2S ceramic temp > 720° C • Modeled exhaust temp, < 750° C • Fuel cut off, Active • Heater control - closed loop	4 Sec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P3081	Engine Temperature Too Low	– Check the coolant thermostat. Refer to the Repair Manual – Check the Engine Coolant Temperature (ECT) Sensor -G62 or G83- . Refer to ⇒ "3.5.24 Engine Coolant Temperature Sensor 1 or 2, Checking", page 160 .	• Difference between ECT and modeled ECT > 10 K	ECT < 48° C	2 Sec.	• Once • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0001	High Speed CAN Communication Bus	– Check the CAN-Bus terminal resistance. Refer to ⇒ "3.5.43 CAN Bus Terminal Resistance, Checking", page 195 .	• CAN message = no feedback	Time after ignition on = 500 mSec.	250 mSec.	• Continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0002	High Speed CAN Communication Bus Performance	– Check the CAN-Bus terminal resistance. Refer to ⇒ "3.5.43 CAN Bus Terminal Resistance, Checking", page 195 .	• Global time out, no messages received	Time after ignition on = 500 mSec.	500 mSec.	• Continuous • 2 DCY
U0101	Lost Communication with TCM	– Check the CAN-Bus terminal resistance, Transmission Control Module - J217- to Engine Control Module (ECM) - J623- . Refer to ⇒ "3.5.44 CAN-Bus Terminal Resistance, Transmission Control Module to Engine Control Module, Checking", page 197 .	• Time out, no message received	Time after ignition on = 500 mSec.	5000 mSec.	• 2 DCY
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Check for ABS module communication with scan tool. If no communication with scan tool, check power supply and ground to ABS module. If power and ground are present, perform diagnosis on the ABS module. Refer to the Repair Manual.	• No CAN messages received	Time after ignition on = 500 mSec.	500 mSec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0146	Lost Communication With Gateway "A"	Check for Data Bus On Board Diagnostic Interface communication with scan tool. If no communication with scan tool, check power and ground to Data Bus On Board Diagnostic Interface. If no other communication faults are set, the ECM may be at fault.	• No CAN messages received	Time after ignition on = 500 mSec.	500 mSec.	• 2 DCY
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Check TSB's for software update. Check for IPC communication with scan tool. If IPC has no communication with scan tool check power and ground to cluster. If present, replace the cluster	• No CAN messages received	Time after ignition on = 500 mSec.	2000 mSec.	• 2 DCY
U0302	Software Incompatibility with Transmission Control Module	Check ECM calibration. Fault will set if ECM was programmed for a manual trans in an automatic transmission vehicle.	• Manual transmission coded ECM and messages received from TCM	Time after ignition on = 500 mSec.	100 mSec.	• 2 DCY
U0323	CAN: Instrument cluster Audi only	– Check the CAN-Bus terminal resistance. Refer to ⇒ "3.5.43 CAN Bus Terminal Resistance, Checking", page 195 .	receiving fault value = -50° C	• CAN active • time after ignition on >2 Sec	6 Sec	• Continuous • 2 DCY
U0402	Invalid Data Received From Transmission Control Module	Check TSB's for software update. Check for correct software. Check to see if any other modules have set an invalid data code from TCM (ABS, Cluster etc.). If so and the software is correct, replace the TCM.	• Implausible data message received	Time after ignition on = 500 mSec.	60 mSec.	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0415	Invalid Data Received From Anti-Lock Brake System Control Module	Check ABS for any sensor faults. Check ABS module with scan tool for correct calibration software, veh info and correct VIN.	• Sensor signal failure • None, or implausible information • CAN 1 VSS signal incorrect > 206 MPH	Time after ignition on = 500 mSec.	500 mSec.	• Continuous • 2 DCY
U0422	Invalid Data Received From Body Control Module	– Check the Ambient Air Temperature Sensor - G17- . Refer to ⇒ "3.5.25 Ambient Air Temperature Sensor, Checking", page 164 .	• Ambient temperature value initialization = 00h	• Key ON • Status ambient temperature from instrument cluster - no fault • Ambient temp sensor - no fault	3 Sec.	• 2 DCY
U0423	Invalid Data Received From Instrument Panel Control (IPC) Module	– Check the CAN-Bus terminal resistance. Refer to ⇒ "3.5.43 CAN Bus Terminal Resistance, Checking", page 195 .	• Temperature received from CAN = 49.5° C	CAN active	2 Sec.	• Continuous • 2 DCY
U0447	Invalid Data Received From Gateway Module	Check TSB's for software update. Check other modules on bus for similar message. If only 1 module has this DTC set, that module may not be reading the information and require replacement.	• CAN message incorrect	Time after ignition on = 500 mSec.	300 mSec.	• 2 DCY

3.5 Diagnostic Procedures

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⇒ “3.5.34 Secondary Air Injection Solenoid Valve, Checking”, page 179

⇒ “3.5.35 Secondary Air Injection Sensor 1, Checking”, page 180

⇒ “3.5.36 Camshaft Position Sensor, Checking”, page 182

⇒ “3.5.37 Camshaft Position Sensor 3, Checking”, page 184

⇒ “3.5.38 Camshaft Adjustment Valve, Checking”, page 186

⇒ “3.5.39 Camshaft Adjustment Valve 1, Exhaust”, page 188

⇒ “3.5.40 Knock Sensor, Checking”, page 190

⇒ “3.5.41 Ignition Coil with Power Output Stage, Checking”, page 192

⇒ “3.5.42 Speed Signal, Checking”, page 194

⇒ “3.5.43 CAN Bus Terminal Resistance, Checking”, page 195

⇒ “3.5.44 CAN-Bus Terminal Resistance, Transmission Control Module to Engine Control Module, Checking”, page 197

3.5.1 Fuel Pump Voltage Supply, Checking

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Electrical connector test lead set.

Test conditions

- Battery voltage 12.5 V.
- Fuse 47 in Fuse Panel C is OK.
- Fuel filter OK.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove rear seat bench. Refer to the Repair Manual .

Test procedure for Fuel Delivery Unit

– Remove the floor sealing cover to access the Fuel Delivery Unit (fuel pump).

– Disconnect the harness connector from the Fuel Delivery Unit.

– Connect the multimeter positive lead to terminal 1 of the Fuel Delivery Unit harness connector.

– Connect the multimeter ground to the Battery Negative terminal.

–

– Crank the engine and note voltage displayed on multimeter during crank. Voltage should be within 2.5 volts of battery voltage.

Turn the ignition switch OFF.

If voltage is below specification:

– Check voltage supply from the Fuel Pump relay (J17).

If voltage is within specification :

– Connect the multimeter ground lead to terminal 5 of the Fuel Delivery Unit harness connector.

– Connect the multimeter positive lead to terminal 1

– Crank the engine and note voltage displayed on multimeter during crank. Voltage should be within 2.0 volts of battery voltage.

Turn the ignition switch OFF.

If voltage is below specification:

– Check for open ground circuit or poor ground connection. Repair as necessary. Refer to Wiring Diagrams for pin locations.

If voltage is within specification :

– Replace the Fuel Delivery Unit (Fuel Pump). Refer to the Repair Manual

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.2 Fuel Pump Pressure, Checking

Special tools and workshop equipment required

- Multimeter.
- fuel line adapter set -V.A.G. 1318/17A- These tools may be substituted with an equivalent aftermarket tool and are also available for rental or purchase through the local dealer.
- In line Fuel pressure gauge with shutoff. (high pressure).

Test conditions

- Battery voltage 12.5 V
- Function and voltage supply for the Fuel Pump is OK.
- Fuel tank at least $^1/_4$ filled.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

WARNING

Fuel system is under pressure! Before opening the system, place rags around the connection area. Then release the pressure by carefully loosening the connection.

Start diagnosis

– Disconnect fuel supply line and catch any fuel coming out with a shop towel. Refer to the Repair Manual for location.

Note

Pull circlip upward to unlock fuel line

– Install a fuel pressure gauge with appropriate adapters.
– Open shut off valve on fuel gauge.
– Switch ignition on and off repeatedly until fuel pressure stops increasing pressure.
– Read fuel pressure on the gauge.

♦ Specified value: 3.5 to 4.3 bar
♦ Turn the ignition switch OFF.

If specification is exceeded:

– Check return line between fuel filter and fuel pump for kinks or blockage.

If no malfunction in fuel return line is found:

– Pressure relief valve in fuel filter is malfunctioning.
– Replace the fuel filter. Refer to the Repair Manual .

If specified value was Not obtained:

– Check fuel pressure at the fuel filter between fuel pump and fuel filter using appropriate adapters
– Open shut off valve on gauge and start the engine. Allow to idle.
– Slowly close the pressure gauge shut off and note the fuel pressure.

♦ Pressure must increase to 4 bar.

When 4 bar is reached: Open shut off tap immediately!

Turn the ignition switch OFF.

If pressure has increased during test:

– Fuel pump is OK. Pressure relief valve in fuel filter is malfunctioning.
– Replace the fuel filter. Refer to the Repair Manual .

If pressure did not increase:

– Fuel pump is faulty
– Replace the fuel pump. Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.3 Fuel Pump Delivery Rate, 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 $^1/_4$ filled.
- Fuel pressure regulator OK.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the fuel filler cap from fuel filler tube.

– Remove rear seat bench. Refer to the Repair Manual .

– Remove the floor sealing cover.

– Disconnect the electrical harness connector from the fuel delivery unit.

– Connect a hand held remote control (jumper) to terminal 1 of the fuel delivery unit and to vehicle battery (+).

– Connect a jumper wire from terminal 5 of the fuel delivery unit to vehicle Ground.

WARNING

Fuel system is under pressure! Before opening the system, place rags around the connection area. Then release the pressure by carefully loosening the connection.

– Disconnect the fuel return line by pressing release buttons.

– Connect a fuel line from the fuel pressure test set to the disconnected fuel return line and hold it in the measuring container.

– Press the switch on the hand held remote control (jumper) and operate the fuel pump for 15 seconds.

– Compare quantity of fuel delivered with minimum delivery rate in the diagram (cm^3/30s).

Note

Voltage at the fuel pump with engine stopped and fuel pump running is approx. 2 volts less than battery voltage.

If minimum delivery quantity is not obtained, the following malfunctions may be present:

If specified value was Not obtained:

Check the following components;

- Fuel lines pinched.
- Fuel filter restriction.
- Fuel pump faulty.

– Repair or replace the above components as necessary.

– To replace the fuel filter refer to the Repair Manual .

– To replace the fuel pump refer to the Repair Manual .

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

– Install the rear seat bench. Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.4 Fuel Pump Electrical, Testing

Special tools and workshop equipment required

- multimeter.
- Electrical connector test lead set.

Test conditions

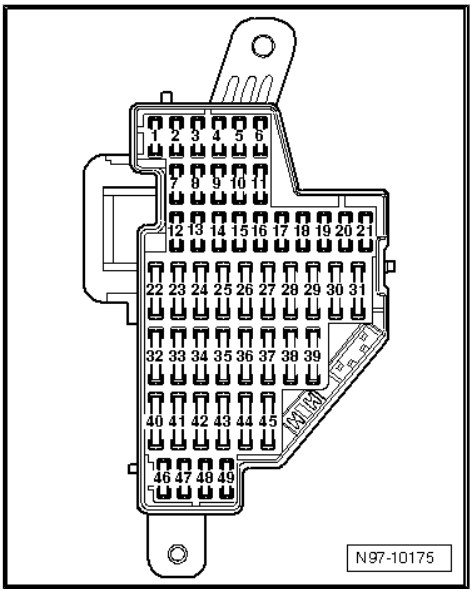
- Battery voltage 12.5 V.
- Fuse -27- in Fuse Panel C is OK.
- Fuel filter OK.
- Ignition switched off.

Test procedure

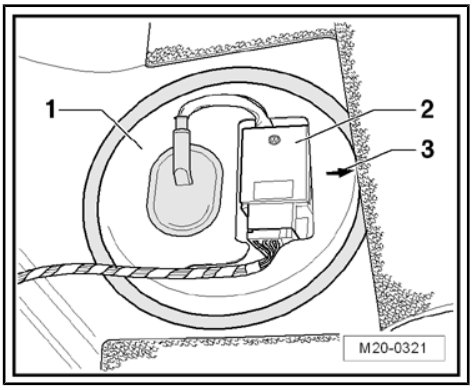
– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove rear seat bench. Refer to appropriate service manual.

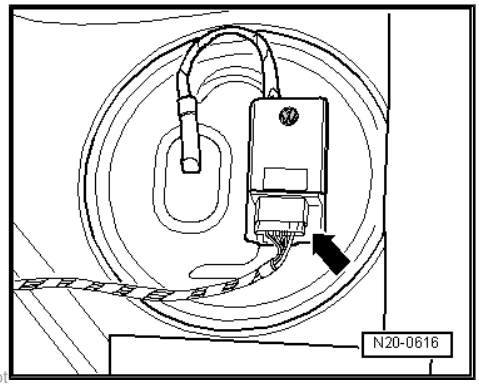


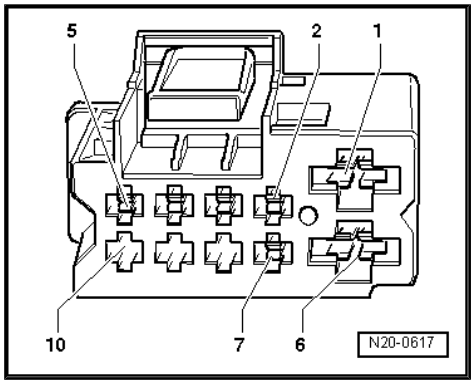
– Remove the Fuel Pump Control Module from the retaining clips on the floor sealing cover.



– Disconnect the electrical harness connector -arrow- from the Fuel Pump Control Module.

– Connect the multimeter ground lead to terminal -6- of the Fuel Pump Control Module harness connector.

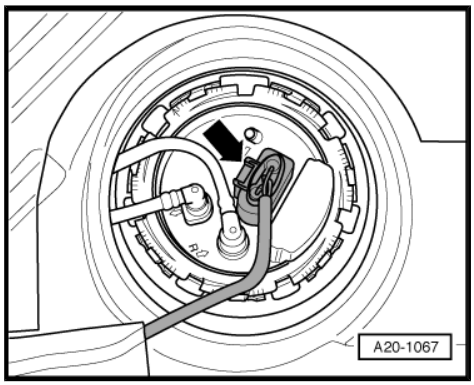




- Connect the multimeter positive lead to terminal -1- of the Fuel Pump Control Module harness connector.
- Turn the Ignition key to the ON position.
- The meter should read within 1 V of battery voltage.
- If voltage is below specification, locate wiring fault in ground or power circuit. Refer to wiring diagram for location.
- If voltage is OK, connect multimeter positive lead to terminal -3- of the Fuel Pump Control Module harness connector. The ground lead remains on terminal -6-
- Crank the engine and note voltage displayed on multimeter during crank. Voltage should be within 2.5 volts of battery voltage.
- If voltage is below specification, locate wiring fault in the power circuit. Refer to wiring diagram for location.
- If voltage is OK, connect multimeter positive lead to terminal -2- of the Fuel Pump Control Module harness connector. The ground lead remains on terminal -6-
- Crank the engine and note voltage displayed on multimeter during crank. Voltage should be 3.2 volts (+/- .4)
- If voltage is below specification, check circuit from Fuel Pump Control Module to ECM for open, short or high resistance and repair as necessary. If no circuit fault is found, replace ECM.
- If voltage is OK, reconnect the wiring harness to the Fuel Pump control Module.

Test procedure for Fuel Pump Control Module

- Remove the floor sealing cover to access the Fuel Delivery Unit (fuel pump).
- Disconnect the harness connector from the Fuel Delivery Unit.
- Connect the multimeter positive lead to terminal -1- of the Fuel Delivery Unit harness connector.



- Connect the multimeter ground lead to terminal -5- of the Fuel Delivery Unit harness connector.
- Crank the engine and note voltage displayed on multimeter during crank. Voltage should be within 2.5 volts of battery voltage.
- If voltage is below specification, replace the Fuel Pump Control Module (J538).
- If voltage is within specification, replace the Fuel Pump (G6). Refer to appropriate service manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.5 Fuel Pressure Sensor, Checking

Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2

View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 3

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

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

Special tools and workshop equipment required

- multimeter
- Wiring diagram.

Test requirements

- The Fuel Pump (FP) Control Module -J538- OK.
- The Engine Control Module (ECM) - J623- fuses OK.
- The fuel filter OK.
- The battery voltage at least 12.5 V.
- All electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- The fuel tank at least $^1/_4$ filled.
- The ignition switched off.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to appropriate service manual.

Checking voltage

– Disconnect the Fuel Pressure Sensor -G247- electrical harness connector.

– Switch the ignition on.

– Using a multimeter, check the Fuel Pressure Sensor -G247- electrical harness connector terminals for voltage.

Fuel Pressure Sensor -G247- electrical harness connector terminals	Specified value
1 to Battery positive (+)	Battery voltage
3 to Ground (GND)	about 5 V

– Switch the ignition off.

If the specified value was obtained:

– Replace the Fuel Pressure Sensor -G247- . Refer to appropriate service manual.

If the specified value was not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

– Using a multimeter, check the Fuel Pressure Sensor -G247- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminals for an open circuit according to the wiring diagram.

Fuel Pressure Sensor - G247- electrical harness connector terminals	Engine Control Module (ECM) - J623- electrical connector T60 terminals or test box socket
1	14
2	25
3	26

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:

– Replace the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

– Install the engine cover with air filter. Refer to appropriate service manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.6 Fuel Metering Valve, Checking

The following procedure is used to diagnose the Fuel Metering Valve -N290- which is controlled by Engine Control Module -J623- .

Special tools and workshop equipment required

- multimeter.
- Wiring diagram.

Test requirements

- The Engine Component Power Supply Relay -J757- OK.
- The Fuse -SA5- OK.
- The fuel filter OK.
- The parking brake engaged.
- The battery voltage at least 12.5 V.
- The selector lever of automatic transmission in position “P” or “N”.
- All electrical consumers switched off.
- A/C switched off.
- The fuel tank at least $^1/_4$ filled.
- The ignition switched off.

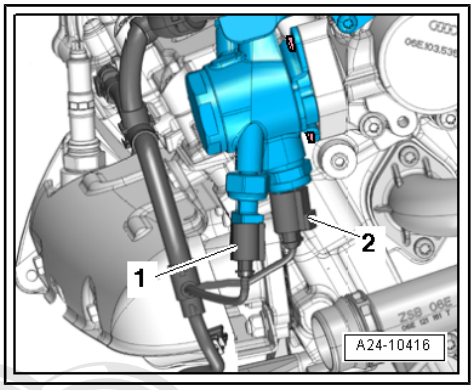
Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Start diagnosis

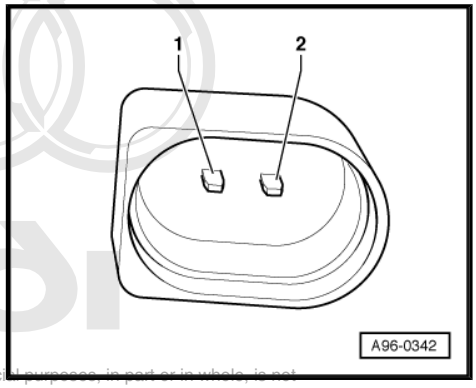
– Located on the high pressure pump, right side of cylinder head.

– Disconnect the Fuel Metering Valve -N290- electrical harness connector -2-.



Checking internal resistance

– Using a multimeter , check the Fuel Metering Valve -N290- terminals 1 to 2 for resistance



Specified value: 450 to 1000 Ω.

If the specified value was not obtained:

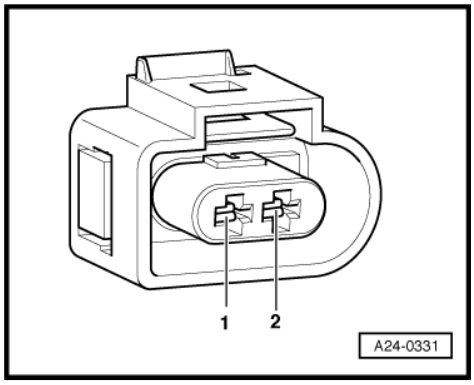
– Replace the Fuel Metering Valve -N290- . Refer to the appropriate service manual

If the specified value was obtained:

Checking voltage

Crank the engine.

– Using a multimeter, check the Fuel Metering Valve -N290- electrical harness connector terminal 1 to Ground (GND) for voltage.



Specified value: battery voltage.

– Switch the ignition off.

If the specified value was not obtained:

– Check the wiring from the Fuel Metering Valve -N290- electrical harness connector terminal 1 to the Engine Component Power Supply Relay -J757- socket 8/87 for an open circuit or a short circuit to Ground (GND).
– Check the electrical harness connector for damage, corrosion, loose or broken terminals.
– If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking wiring connections

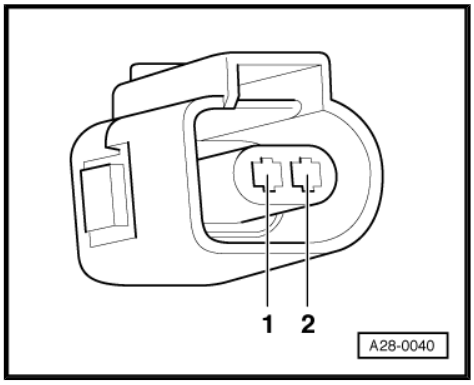
If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

– Using a multimeter, check the Fuel Metering Valve -N290- electrical harness connector terminal 2 to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminal 60 for resistance.



Fuel Metering Valve -N290- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical connector T60 terminal or test box socket
2	60

Specified value: 1.5 Ω Max.

If the specification was not obtained:

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

– If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

– Erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

– Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

– End diagnosis.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

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

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.7 EVAP System, Checking for Leaks

Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2

View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 3

Perform a preliminary check to verify the condition:
⇒ “3.1 Preliminary Check”, page 8 .

Special tools and workshop equipment required

♦ Smoke tester.

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

Note

- *A connection to access the EVAP system can be found in the EVAP hose just below the EVAP purge solenoid.*
- *Replace seals and gaskets when performing repair work.*
- *Secure all hose connections using hose clamps appropriate for the model type.*

Leak checking

– Using a Smoke tester, check the Evaporative Emission (EVAP) 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 all hose connections of the EVAP system and replace or repair any leaking lines.

– Check all hose connections of the Fuel Supply system and replace or repair any leaking lines.

– Remove the rear seat bench. Refer to the Repair Manual .

– Remove the floor cover seal.

– Inspect the seal under the Fuel Delivery Unit (fuel pump) locking flange for proper sealing. Also check the fuel line connections.

– Repair or replace any damaged component.

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

– Erase the DTC memory if a code was set. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

– Perform a road test to verify repair.

Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.8 EVAP Canister Purge Regulator Valve 1, Checking

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- The Evaporative Emission (EVAP) Canister Purge Regulator Valve 1 -N80- fuse OK.
- The ignition switched OFF.

Note

Voltage for the Evaporative Emission (EVAP) Canister Purge Regulator Valve 1 -N80- is supplied via the Engine Component Power Supply Relay -J757- .

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

etc.)

– Remove the engine cover with air filter. Refer to the Repair Manual .

– Disconnect the Evaporative Emission (EVAP) Canister Purge Regulator Valve 1 -N80- electrical harness connector.

Checking internal resistance

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

Specified value: 15.0 to 22.0 Ω.

If the specified value was Not obtained:

– Replace the Evaporative Emission (EVAP) Canister Purge Regulator Valve 1 -N80- .

If the specification is obtained:

Checking voltage supply

– Using a multimeter, check the purge valve electrical harness connector terminal 1 to 2 for voltage.

– Turn ignition switch ON.

Specified value: 8.60 volts +/- 2 volts.

Turn the ignition switch OFF.

If the specified value was Not obtained:

– Leave the multimeter positive lead on terminal 1 and connect the multimeter negative lead to engine ground.

– Ignition switch ON.

Specified value: Near battery voltage.

Turn the ignition switch OFF.

If the specified value was Not obtained:

– Check the circuit from the Fuel Pump relay (J17) to EVAP solenoid terminal 1for open or high resistance. Refer to Wiring Diagrams for circuit.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

If the specified value was obtained:

Check Ground activation

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

– Using a multimeter, check the Evaporative Emission (EVAP) Canister Purge Regulator Valve 1 -N80- electrical connector terminal 2 to Engine Control Module (ECM) -J623- electrical connector T94 terminal 9 for an open circuit. Refer to Wiring Diagrams for pin locations.

Specified value: 1.5 Ω max.

If the specified value was Not obtained:

– Check the wiring for a short to voltage, high resistance or an open circuit.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

If the specified value was obtained:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

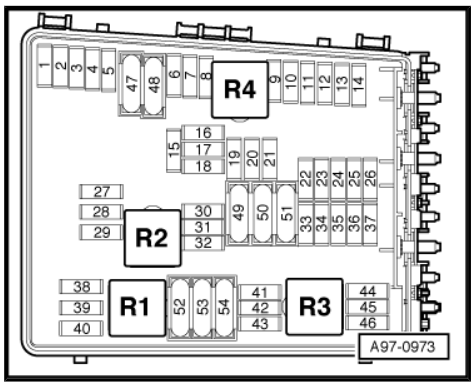
3.5.9 Exhaust Flap Valve 1, Checking

Special tools and workshop equipment required

- multimeter.
- Wiring diagram.

Test requirements

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



Test procedure

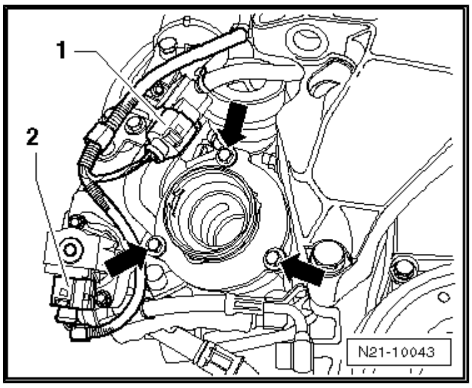
– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

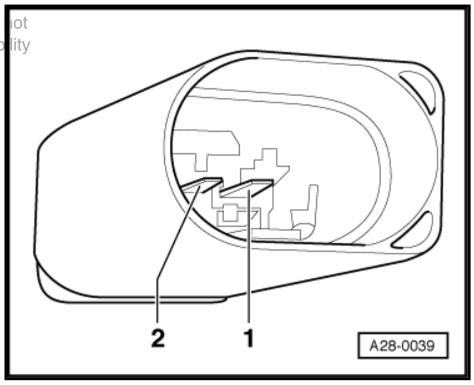
– Remove the engine cover with air filter. Refer to the appropriate service manual.

Checking internal resistance

– Disconnect the Exhaust Flap Valve 1 -N321- electrical harness connector-2-.



– Using a multimeter, check the Exhaust Flap Valve 1 -N321- terminals 1 to 2 for resistance.



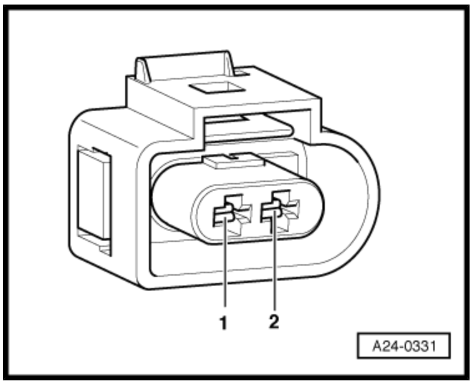
Specified value: 13.6 +/- 5 Ω (at room temp.)

If the specification was not obtained:

– Replace the Exhaust Flap Valve 1 -N321- . Refer to the appropriate service manual.

If the specification was obtained:

Checking Voltage supply



– Using a multimeter, check the Exhaust Flap Valve 1 -N321- electrical harness connector terminal 1 to Ground (GND).

Exhaust Flap Valve 1 -N321- electrical harness connector terminal	Measure to
1	Engine Ground (GND)

– Operate the engine briefly.

Specified value: battery voltage.

– Switch the ignition off.

If the specified value was not obtained:

– Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking wiring

If the manufacturers test box is being used, perform the following step.

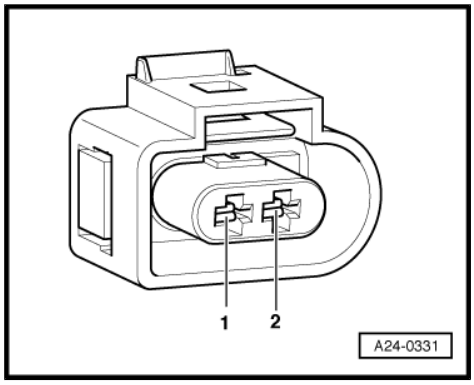
– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the appropriate service manual.

– Using a multimeter, check the Exhaust Flap Valve 1 -N321- electrical harness connector terminal 2 to Engine Control Module (ECM) -J623- electrical harness connector T94 terminal 28 for an open circuit.

Exhaust Flap Valve 1 -N321- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical connector T94 terminal or test box socket
2	28



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 Engine Control Module (ECM) -J623- . Refer to the appropriate service manual.

– Install the engine cover with air filter. Refer to the appropriate service manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.10 Exhaust Gas Temperature Sensor 1, Checking

Note

Use only gold-plated terminals when servicing terminals in the electrical harness connector of Exhaust Gas Temperature (EGT) Sensor 1 -G235- .

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- The Engine Control Module (ECM) - J623- fuses OK.
- The Fuel Pump (FP) Relay -J17- must be 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 ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

Checking internal resistance

– Disconnect the Exhaust Gas Temperature (EGT) Sensor 1 -G235- electrical harness connector.

– Using a multimeter, check the Exhaust Gas Temperature (EGT) Sensor 1 -G235- terminals 1 to 2 for resistance.

Specified value: ∞ Ω (INFINITE)

If the specification was not obtained:

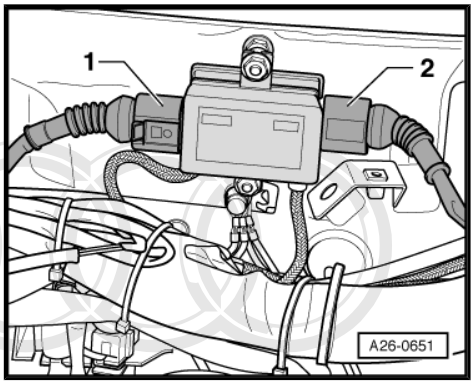
– Replace the Exhaust Gas Temperature (EGT) Sensor 1 -G235- .

If the specification was obtained:

Checking Voltage supply

– Disconnect the Exhaust Gas Temperature (EGT) Sensor 1 -G235- electrical harness connector -1-.

– Switch the ignition on.

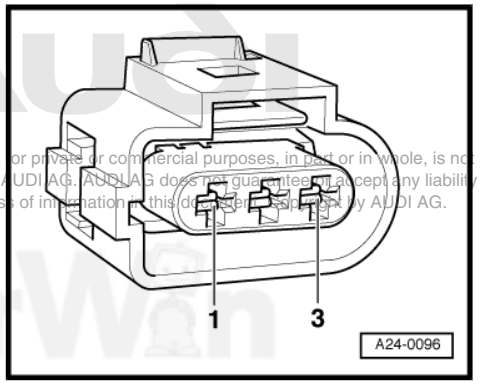


– Using a multimeter, check the Exhaust Gas Temperature (EGT) Sensor 1 -G235- electrical harness connector terminals 1 to 2 for voltage.

Specified value: 0.400 to 0.500 V.

– Switch the ignition off.

If any of the specified values was not obtained:



Checking wiring

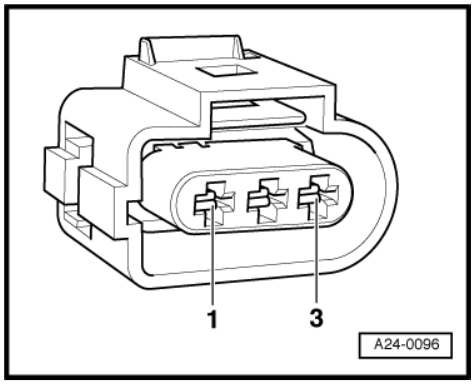
If the manufacturers test box is being used, perform the following step.

– Install the Test Box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate Repair manual.

– Using a multimeter, check the Exhaust Gas Temperature (EGT) Sensor 1 -G235- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector terminals for an open circuit.



Exhaust Gas Temperature (EGT) Sensor 1 -G235- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector terminals or test box socket
1	T94/20
2	T94/1
3	pin 30 of J496

Specified value: 1.5 Ω Max.

If the specification was not obtained:

– Check the wiring for a short circuit to each other, Battery (+), or Ground (GND).

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, Repair the faulty wiring connection.

If no malfunction is detected in the wiring:

– Erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15

– Perform a road test to verify Repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

– End diagnosis.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to appropriate Repair manual.

– 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.11 Intake Air Temperature Sensor and Manifold Absolute Pressure Sensor, Checking

The following procedure is used to diagnose the Manifold Absolute Pressure (MAP) Sensor -G71- and Intake Air Temperature (IAT) Sensor -G42- which is controlled by Engine Control Module -J623- .

Note

- *The Intake Air Temperature (IAT) Sensor -G42- is part of the Manifold Absolute Pressure (MAP) Sensor -G71- and cannot be replaced separately*
- *Use only gold-plated terminals when servicing terminals in harness connector of Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- .*

Special tools and workshop equipment required

- multimeter.
- Wiring diagram.

Test requirements

- The Engine Control Module (ECM) -J623- fuse OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground (GND) connections between engine/transmission/chassis OK.
- Coolant Temperature at least 80° C.
- Ignition switched off.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Start diagnosis

– Connect the scan tool.

– Start engine and let it run at idle.

– Using the scan tool, Check the temperature of the Manifold Absolute Pressure (MAP) Sensor -G71- and Intake Air Temperature (IAT) Sensor -G42- at idle:

Diagnostic text	Specified value
Intake air temperature sensor • Engine running at idle	approx. ambient temperature

– End diagnosis and switch ignition off.

If the specified value was obtained, but the DTC memory has a DTC indicating a Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- fault:

– Check the voltage supply of the Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- ⇒ page 132 .

If specified value was not obtained:

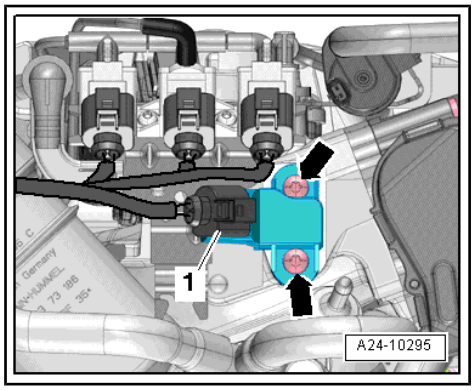
– Check the wiring of the Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- ⇒ page 132 .

Checking voltage supply

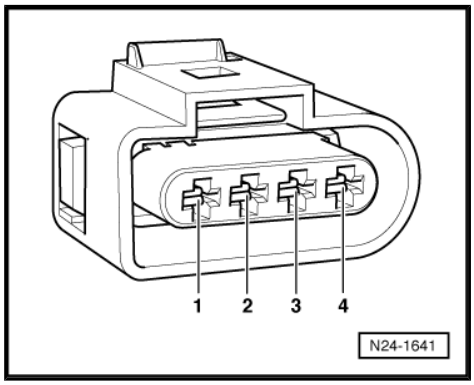
– Remove the engine cover . Refer to appropriate service manual.

– Disconnect the Manifold Absolute Pressure (MAP) Sensor -G71- and Intake Air Temperature (IAT) Sensor -G42- electrical harness connector -1-.

– Crank the engine.



– Using a multimeter, check the Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- electrical harness connector terminal 3 to engine Ground (GND) for voltage.



Specified value: approx 5 V.

– Switch the ignition off.

If specified value was not obtained:

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

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

Checking electrical circuit

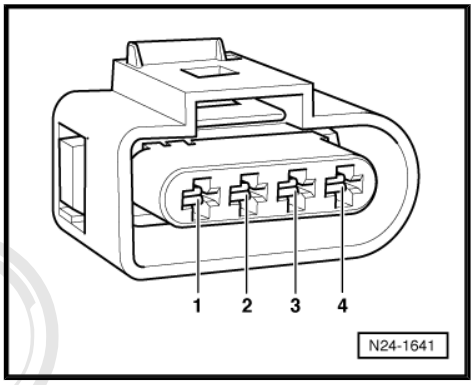
If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module -J623- . Refer to appropriate service manual.

– Using a multimeter, check the Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- electrical harness connector terminals to the Engine Control Module -J623- electrical harness connector T60 terminals for resistance.



Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- electrical harness connector terminals	Engine Control Module -J623- electrical connector T60 terminals or test box socket
1	14
2	7
3	26
4	11

Specified value: 1.5 Ω max.

If any of the specified values were not obtained:

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

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

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

– Replace the Manifold Absolute Pressure (MAP) Sensor -G71- / Intake Air Temperature (IAT) Sensor -G42- .

– Erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

– Perform a road test to verify repair.

If the DTC does not return:

Repair complete, Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

– End diagnosis.

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

– Replace the Engine Control Module -J623- . Refer to the service manual for removal and installation procedures.

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

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.12 Intake Manifold Runner Position Sensor, Checking

Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2

View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 3

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

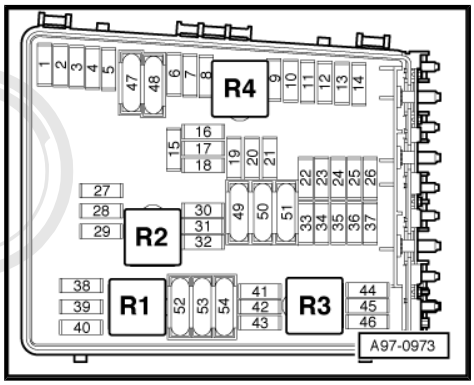
For wiring diagrams, component locations, and connector views, Refer to the applicable wiring diagram.

Special tools and workshop equipment required

- multimeter
-
- Wiring diagram.

Test requirements

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



Test procedure

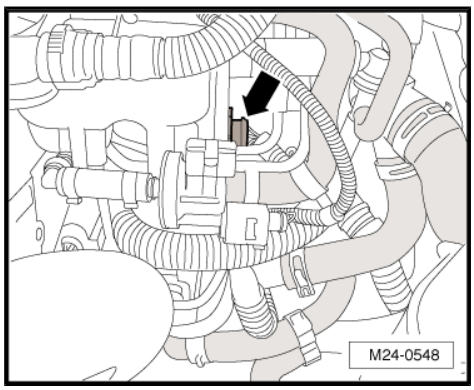
– Perform a preliminary check to verify the customers complaint. Refer to Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to appropriate service manual.

– Disconnect the Intake Manifold Runner Position Sensor - G336- electrical harness connector -arrow-.

– Switch the ignition on.



– Using a multimeter, check the Intake Manifold Runner Position Sensor -G336- electrical harness connector terminals 1 to 3 for voltage.

  Specified value: about 5 V

– Switch ignition off.

If the specified value was not obtained:

– Check and/or repair wiring as required.

If the specified value was obtained:

Checking internal resistance

– Using a multimeter, check the Intake Manifold Runner Position Sensor -G336- electrical terminals 2 to 3 for resistance.

Specified value: 7-25 Ω (at approx. 20° C)

– Using a multimeter, check the Intake Manifold Runner Position Sensor -G336- electrical terminals 1 to 3 for resistance.

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

If the specified values were not obtained:

– Replace the Intake Manifold Runner Position Sensor -G336- . Refer to appropriate service manual.

If the specified value was obtained:

Checking wiring

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

– Using a multimeter, check the Intake Manifold Runner Position Sensor -G336- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminals for an open circuit.

Intake Manifold Runner Position Sensor -G336- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T60 terminals or test box socket
1	26
2	22
3	14

Specified value: 1.5 Ω Max.

If the specification was not obtained:

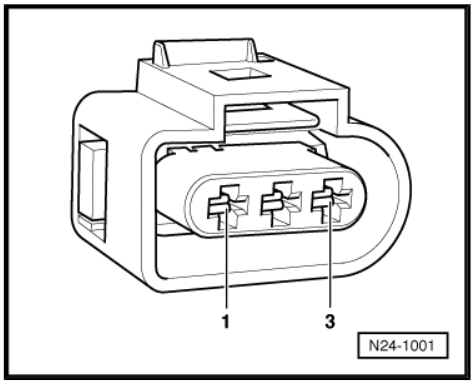
– Check the wiring for a short circuit to Battery (+), or an open circuit.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

– Replace the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.



– Install the engine cover with air filter. Refer to appropriate service manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.13 Leak Detection Pump, Checking

Special tools and workshop equipment required

- Multimeter.
- EVAP Smoke Machine
- Wiring diagram.

Test requirements

- The ignition switched Off.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the right rear wheel housing liner. Refer to the Repair Manual.

– Disconnect the Leak Detection Pump (LDP) -V144- electrical harness connector .

Checking internal resistance

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

Leak Detection Pump (LDP) -V144- electrical connector terminals	Specified values
1 to 2	134 to 153 Ω
1 to 3	134 to 153 Ω

If any of the specified values were Not obtained:

– Replace the Leak Detection Pump (LDP) --V144-- . Refer to the Repair Manual.

If the specified values were obtained:

Checking voltage supply

Note

The voltage for the Leak Detection Pump (LDP) --V144-- is supplied via the Fuse SB7.

– Using a multimeter, check the Leak Detection Pump (LDP) -- V144-- electrical harness connector terminal 3 for voltage. Connect the negative lead to engine ground.

– Start the engine.

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-- wiring from terminal 3 to Fuse SB7. Refer to Wiring Diagrams for pin locations.

Specified value: 1.0 Ω max.

If the specified value was Not obtained:

– Check the wiring for high resistance, short to ground or an open circuit.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If the specified voltage was obtained:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Leak Detection Pump (LDP) -- V144-- electrical connector terminals to Engine Control Module (ECM) -J623- electrical connector terminals for an open circuit or high resistance. Refer to Wiring Diagrams for pin locations.

Leak Detection Pump (LDP) --V144-- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical connector T94 terminal or test box socket
1	40
2	10

Specified value: 1.0 Ω max.

If the specified value was Not obtained:

– Check the wiring for high resistance or an open circuit.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

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

– Install the right rear wheel housing liner. Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.14 Low Fuel Pressure Sensor, Checking

Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2

View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 3

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

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

Special tools and workshop equipment required

- multimeter.
- Wiring diagram.

Test requirements

- The Fuel Pump (FP) Control Module -J538- OK.
- The Engine Control Module (ECM) - J623- fuses OK.
- The fuel filter OK.
- The battery voltage at least 12.5 V.
- All electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- The fuel tank at least $^{1}/_{4}$ filled.
- The ignition switched off.

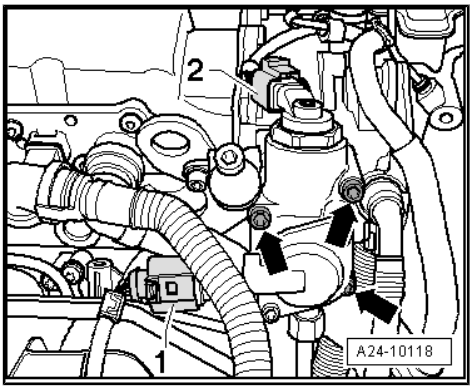
Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to appropriate service manual.

Checking voltage



– Disconnect the Low Fuel Pressure Sensor -G410- electrical harness connector -2-.
– Switch the ignition on.
– Using a multimeter, check the Low Fuel Pressure Sensor -G410- electrical harness connector for voltage.

Low Fuel Pressure Sensor -G410- electrical harness connector terminals	Specified value
1 to Battery positive (+)	Battery voltage
2 to Ground (GND)	Near 0 volts
3 to Ground (GND)	5 V

– Switch the ignition off.

If the specified value was obtained:

– Replace the Low Fuel Pressure Sensor -G410- . Refer to appropriate service manual.

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.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.
– Using a multimeter, check the Low Fuel Pressure Sensor -G410- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T94 terminals for an open circuit according to the wiring diagram.

Low Fuel Pressure Sensor -G410- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T94 terminals or test box socket
1	53
2	35
3	19

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance, short to Battery (+) or Ground (GND).
– Check the electrical harness connector for damage, corrosion, loose or broken terminals.
– If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

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

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

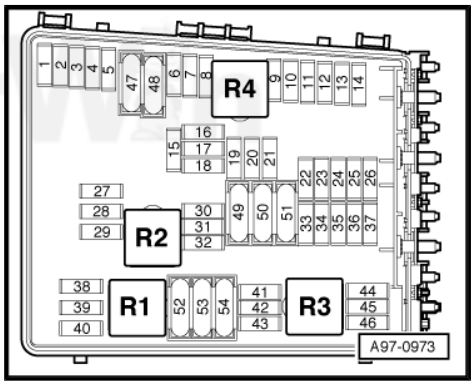
3.5.15 Turbocharger Recirculating Valve, Checking

Special tools and workshop equipment required

- multimeter.
- Wiring diagram.

Test requirements

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



Test procedure

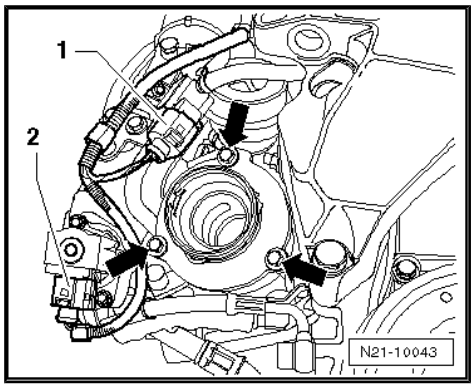
– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

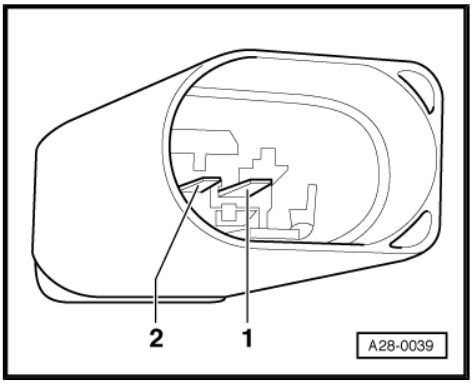
– Remove the engine cover with air filter. Refer to the appropriate service manual.

Checking internal resistance

– Disconnect the Turbocharger Recirculating Valve -N249- electrical harness connector-2-.



– Using a multimeter, check the Turbocharger Recirculating Valve -N249- terminals 1 to 2 for resistance.



Specified value: 13.6 +/- 5 Ω (at room temp.)

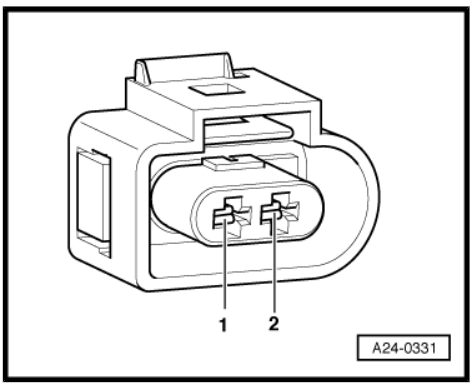
If the specification was not obtained:

– Replace the Turbocharger Recirculating Valve -N249- . Refer to the appropriate service manual.

If the specification was obtained:

Checking Voltage supply

– Using a multimeter, check the Turbocharger Recirculating Valve -N249- electrical harness connector terminal 1 to Ground (GND).



Turbocharger Recirculating Valve -N249- electrical harness connector terminal	Measure to
1	Engine Ground (GND)

– Operate the engine briefly.

Specified value: battery voltage.

– Switch the ignition off.

If the specified value was not obtained:

– Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking wiring

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the appropriate service manual.

– Using a multimeter, check the Turbocharger Recirculating Valve -N249- electrical harness connector terminal 2 to Engine Control Module (ECM) -J623- electrical harness connector T60 terminal 31 for an open circuit.

Turbocharger Recirculating Valve -N249- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical connector T60 terminal or test box socket
2	31

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 Engine Control Module (ECM) -J623- . Refer to the appropriate service manual.

– Install the engine cover with air filter. Refer to the appropriate service manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.16 Charge Air Pressure Sensor / Intake Air Temperature Sensor 2, Checking

Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2

View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 3

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

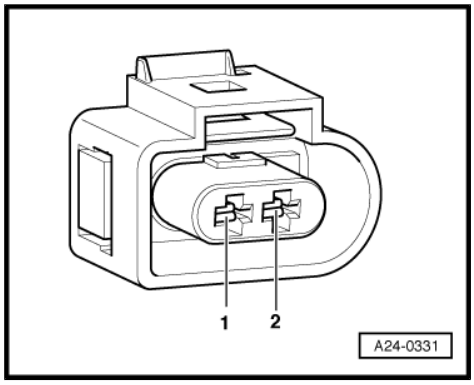
Note

The Charge Air Pressure Sensor -G31- / Intake Air Temperature (IAT) Sensor 2 -G299- shares the same housing. Replacing either component replaces the other at the same time.

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

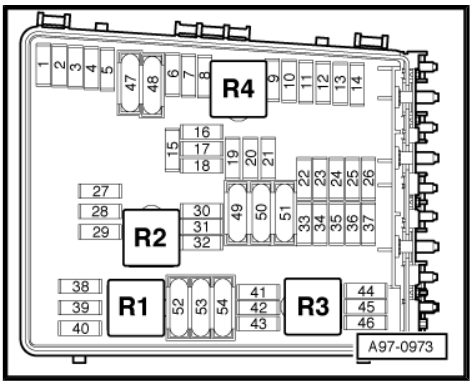
Special tools and workshop equipment required

- Multimeter



♦ Wiring diagram

Test requirements



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

Test procedure

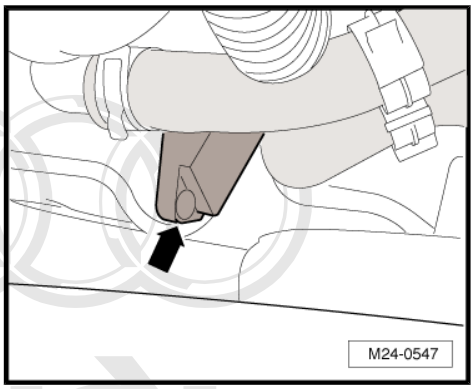
– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to appropriate service manual.

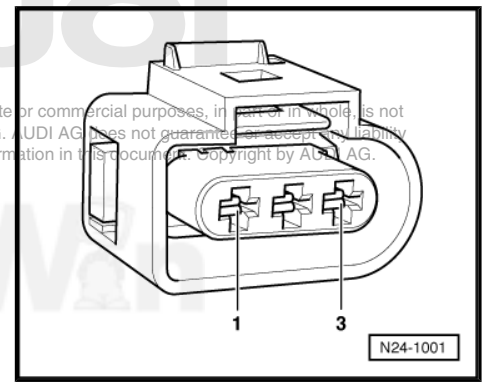
Test sequence

– Disconnect the Charge Air Pressure Sensor -G31- / Intake Air Temperature (IAT) Sensor 2 -G299- electrical harness connector -arrow-.



– Start engine and let it run at idle.

– Using a multimeter, check the Charge Air Pressure Sensor -G31- / Intake Air Temperature (IAT) Sensor 2 -G299- electrical harness connector terminals 1 to 3 for voltage.



Specified value: min. 4.5 V

– Switch the ignition off.

If the specification was obtained:

– Replace the Charge Air Pressure Sensor -G31- / Intake Air Temperature (IAT) Sensor 2 -G299- .

If the specification was not obtained:

Checking wiring

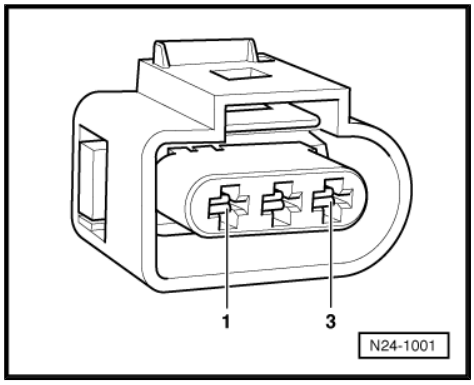
If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

– Using a multimeter, check the Charge Air Pressure Sensor -G31- / Intake Air Temperature (IAT) Sensor 2 -G299- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T94 terminals for an open circuit according to wiring diagram.



Charge Air Pressure Sensor -G31- / Intake Air Temperature (IAT) Sensor 2 -G299- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T94 terminals or test box sockets
1	53
2	13
3	19
4	38

Specified value: 1.5 Ω max.

If the specification was not obtained:

– Check the wiring for a short circuit to each other, Battery (+), and Ground (GND).

– If necessary, repair the faulty wiring connection.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

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

– Replace the Charge Air Pressure Sensor -G31- / Intake Air Temperature (IAT) Sensor 2 -G299- .Refer to appropriate service manual.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

– Install the engine cover with air filter. Refer to appropriate service manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

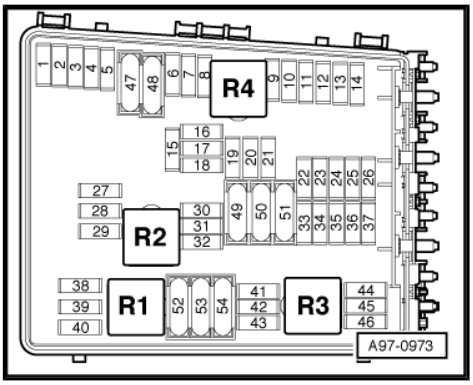
3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.17 Wastegate Bypass Regulator Valve, Checking

Special tools and workshop equipment required

- multimeter.
- Wiring diagram.

Test requirements



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

Test procedure

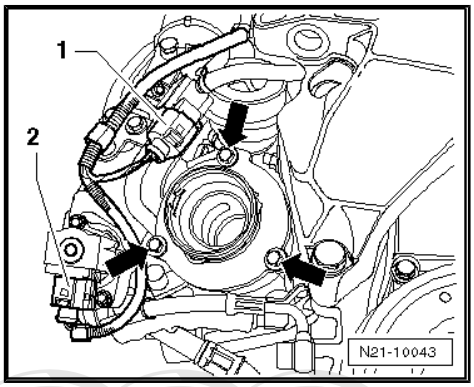
– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to the appropriate service manual.

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.

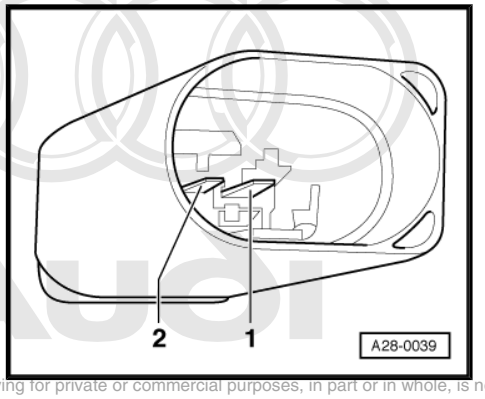
Specified value: 20 to 30 Ω (at room temp.)

If the specification was not obtained:

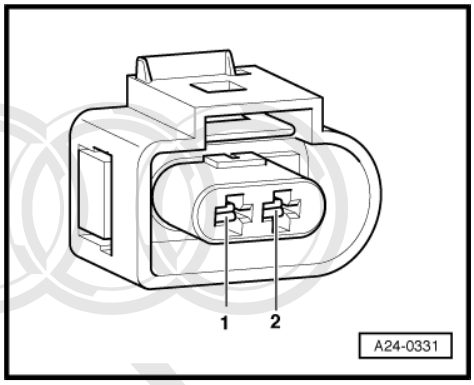
– Replace the Wastegate Bypass Regulator Valve -N75- . Refer to the appropriate service manual.

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 engine briefly.

Specified value: battery voltage.

– Switch the ignition off.

If the specification was not obtained:

– Check the wiring for a short circuit to Battery positive (+) or an open circuit.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

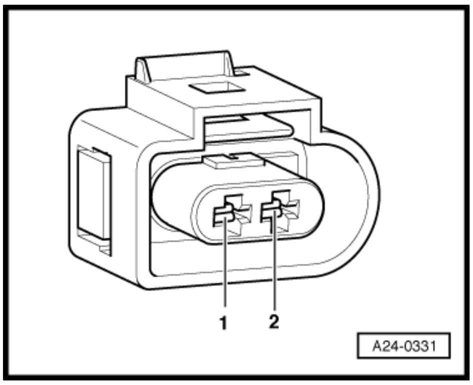
If no malfunction is found in the wiring:

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the appropriate service manual.



– Using a multimeter, check the Wastegate Bypass Regulator Valve -N75- electrical harness connector terminal 2 to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminal 50 for an open circuit.

Wastegate Bypass Regulator Valve -N75- electrical harness connector terminal	Engine Control Module (ECM) - J623- electrical connector T60 terminal or test box socket
2	50

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 Engine Control Module (ECM) -J623- . Refer to the appropriate service manual.

– Install the engine cover with air filter. Refer to the appropriate service manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.18 Accelerator Pedal Position Sensor / Accelerator Pedal Position Sensor 2, Checking

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring diagram

Test requirement

• The Engine Control Module (ECM) - J623- fuses OK.

• Battery voltage at least 12.5 volts.

• All electrical consumers such as, lights and rear window defroster, switched off.

• Vehicles with automatic transmission, shift selector lever into position “P” or “N”.

• A/C switched off.

• Ground connections between engine/transmission/chassis OK.

Note

Use only gold-plated terminals when servicing the electrical harness connector terminals in Accelerator Pedal Position Sensor -G79- / Accelerator Pedal Position Sensor 2 -G185- .

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the drivers side storage compartment. Refer to the Repair Manual

– Disconnect the Accelerator Pedal Position Sensor -G79- / Accelerator Pedal Position Sensor 2 -G185- 6 pin electrical harness connector.

Checking voltage supply and wiring

– Switch the ignition On.

– Using a multimeter, check the following wiring connections for voltage.

Accelerator Pedal Position Sensor 1 -G79- / Accelerator Pedal Position Sensor 2 -G185- electrical harness connector terminals	Specified value
1 to Ground	near 5 V
1 to 5	near 5 V
2 to Ground	near 5 V
2 to 3	near 5 V

– Switch the ignition OFF.

If the specified value was Not obtained:

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

– Using a multimeter, check the Accelerator Pedal Position Sensor -G79- / Accelerator Pedal Position Sensor 2 -G185- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical connector T94 for an open circuit. Refer to Wiring Diagrams for pin locations.

Accelerator Pedal Position Sensor -G79- / Accelerator Pedal Position Sensor 2 -G185- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T94 terminals or test box sockets
1	58
2	80
3	78
4	79
5	56
6	57

Specified value: 1.5 Ω max.

If the specified value was Not obtained:

– Check the wiring for high resistance, a short circuit to each other, Battery (+) or Ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

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

– Replace the Accelerator Pedal Position Sensor -G79- / Accelerator Pedal Position Sensor 2 -G185- . Refer to the Repair Manual .

If no fault is detected in the wiring and if the voltage supply was Not OK:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

– Install the drivers side storage compartment.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.19 Throttle Valve Control Module, Checking

Note

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

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring diagram.

Test requirements

- The Engine Control Module (ECM) - J623- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground connections between engine/transmission/chassis OK.
- Throttle valve must not be damaged or dirty.

- Coolant Temperature at least 80° C.

Function

Throttle valve operation occurs by an electric motor Throttle Drive for Electronic Power Control (EPC) -G186- in the Throttle Valve Control Module - J338- . It is operated by the Engine Control Module (ECM) -J623- and the Accelerator Pedal Position Sensor 1 -G79- / Accelerator Pedal Position Sensor 2 -G185- .

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

- Throttle Drive for Electronic Power Control (EPC) -G186-
- Throttle Drive Angle Sensor 1 for Electronic Power Control (EPC) -G187-
- Throttle Drive Angle Sensor 2 for Electronic Power Control (EPC) -G188-

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

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Connect the scan tool.

– Switch ignition ON.

– Using the scan tool, check the throttle valve position (absolute) at idle stop:

Diagnostic text	Specified value
Throttle valve position (absolute) • Idle stop	3.0 to 25.0%

– Slowly depress the accelerator pedal to Wide Open Throttle (WOT) stop while observing the percentage display. The percentage display must increase uniformly.

– Using the scan tool, check the throttle valve position (absolute) at Wide Open Throttle (WOT) stop:

Diagnostic text	Specified value
Throttle valve position (absolute) • Wide Open Throttle (WOT) stop	84.0 to 97.0%

– Switch ignition OFF.

If the specified values are not obtained:

– Remove the Throttle Valve Control Module -J338 - far enough so that the electrical connector terminals are reached.

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

Checking resistance

– Using a multimeter, check the Throttle Drive for Electronic Power Control (EPC) -G186- at the Throttle Valve Control Module -J338- terminals 3 to 5 for resistance.

Specified value: 3.0 to 7.0 Ω (at 20° C)

If the specified value was Not obtained:

– Replace the Throttle Valve Control Module - J338- . Refer to the Repair Manual .

If the specified value was obtained:

– Check the voltage supply of the Throttle Valve Control Module -J338- from the Engine Control Module (ECM) -J623- as instructed below.

Checking voltage supply and wiring

– Switch the ignition ON.

– Using a multimeter, check the Throttle Valve Control Module -J338- electrical harness connector, terminals 2 to 6 for voltage from the ECM.

Specified value: 4.5 to 5.2 V

– Switch the ignition OFF.

If the specified value was Not obtained:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Throttle Valve Control Module -J338- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminals for an open circuit according to the wiring diagram. Refer to Wiring Diagrams for pin locations.

Throttle Valve Control Module -J338- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T60 terminals or test box socket
1	27
2	28
3	15
4	12
5	30
6	29

Specified value: 1.5 Ω max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance or short to ground.

– If necessary, repair the faulty wiring connection.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

If no fault is detected in the wiring and the voltage supply was Not OK:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.20 Heated Oxygen Sensor, Checking

Note

Use only gold-plated terminals when servicing terminals in the electrical harness connector of the Heated Oxygen Sensor (HO2S) -G39/Z19- .

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- The Heated Oxygen Sensor (HO2S) -G39- fuse OK.
- The Oxygen Sensor (O2S) Heater -Z19- before catalytic converter OK. (No heater code set).
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- A/C switched off.
- Ground connections between engine/transmission/chassis OK.
- Exhaust system between catalytic converter and cylinder head properly sealed.
- Coolant Temperature at least 80° C.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Connect scan tool.

– Start the engine and let it run at idle.

– Select “Diagnostic mode 6: Check test results of components that are not continuously monitored”.

– Select “Monitor-ID $01: Oxygen sensor monitoring before catalytic converter”.

– Select “Test-ID $83: Dynamic test” .

– Check the specified values at idle.

Dynamic test	Specified value	
	min.	**max.**
Normal operation	0.350 V	---

Dynamic test	Specified value	
	min.	max.
Reduced threshold upon suspicion of malfunction in catalytic converter	0.399 V	---

If the specified value was obtained:

– Switch the ignition OFF. Generate the readiness code.

If the specified value was Not obtained:

Checking primary voltage

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

– Using a multimeter, connect the negative lead to engine ground. Check the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminals 1,2,5, and 6 for voltage.

Specified value: 2.40 V - 3.10 V

– Switch the ignition OFF.

If the specified value was obtained:

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

If the specified value was Not obtained:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T94 terminals for an open circuit. Refer to Wiring Diagrams for pin locations.

Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T94 terminals or test box sockets
1	60
2	61
5	81
6	82

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance, short circuit to each other, Battery (+) or Ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.21 Oxygen Sensor Heater, Checking

Note

When servicing terminals in harness connector of Oxygen Sensor (O2S) Heater -Z19- , use only gold-plated terminals.

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- The Heated Oxygen Sensor (HO2S) -G39- fuse is 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 connections between engine/transmission/chassis OK.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to the Repair Manual .

Checking internal resistance

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

– Using a multimeter, check the Oxygen Sensor (O2S) Heater -Z19- terminals 3 and 4 for correct resistance.

Specified value: 2.5 to 16.0 Ω (at approx. 20° C)

If the specified value was Not obtained:

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

If the specified value was obtained:

Checking voltage supply

– Turn the ignition switch ON

– Using a multimeter, check the Oxygen Sensor (O2S) Heater -Z19- electrical harness connector terminal 4 to engine ground for voltage.

Specified value: Battery voltage.

– Switch the ignition OFF.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance or short to Ground and replace any open fuse.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Checking Ground activation

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

– Using a multimeter, check the Oxygen Sensor (O2S) Heater -Z19- electrical harness connector terminal 3 to the Engine Control Module (ECM) -J623- electrical harness connector T94 terminal 51 for an open circuit. Refer to Wiring Diagrams for pin locations.

Heated Oxygen Sensor (HO2S) -G39- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical connector T94 terminal or test box socket
3	51

Specified value: 1.5 Ω max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance, short circuit to each other, Battery (+) or Ground.

– 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 Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.22 Oxygen Sensor after Catalytic Converter, Checking

Note

Use only gold-plated terminals when servicing terminals in the electrical harness connectors of the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- .

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- Fuse -SB6- OK.
- Engine Control Module (ECM) -J623- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground connections between engine/transmission/chassis OK.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Start diagnosis

– Perform the function test in Diagnostic Mode 06.

If specified Mode 6 values are obtained:

– Switch the ignition Off. Generate the readiness code.

If the specified value was Not obtained:

– Remove the retaining screws and the cover.

Checking primary voltage

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

– 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.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T94 terminals for resistance. Refer to Wiring Diagrams for pin locations.

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Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T94 terminals or test box sockets
3	76
4	77

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance, short circuit to each other, Battery (+) or Ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

– Assembly is performed in the reverse of the removal.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.23 Oxygen Sensor 1 after Catalytic Converter Heater, Checking

Note

- *Vehicle must be raised before electrical harness connector for the Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) -G130- is accessible.*
- *When servicing terminals in harness connector of Oxygen Sensor 02S) 1 (behind Three Way Catalytic Converter (TWC)) Heater -Z29- , 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 SB6 in Fuse box B is 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 connections between engine/transmission/chassis OK.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the right vehicle floor cover.

Checking internal resistance

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

– Using a multimeter, check the Oxygen Sensor 02S) 1 (behind Three Way Catalytic Converter (TWC)) Heater -Z29- electrical harness connector terminals 1 to 2 for resistance.

Specified value: 2.5 to 14.0 Ω (at approx. 20° C)

If the specified value was Not obtained:

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

If the specified value was obtained:

Checking voltage supply

– Turn the ignition switch ON

– Using a multimeter, check the Oxygen Sensor 02S) 1 (behind Three Way Catalytic Converter (TWC)) Heater -Z29- electrical harness connector terminal 1 to engine ground.

Specified value: Battery voltage.

– Switch the ignition OFF.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance, short circuit to each other, or Ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Checking Ground activation

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Oxygen Sensor 02S) 1 (behind Three Way Catalytic Converter (TWC)) Heater -Z29- electrical harness connector terminal 2 to the Engine Control Module (ECM) -J623- electrical harness connector T94 terminal for an open circuit. Refer to Wiring Diagrams for pin locations.

Oxygen Sensor 02S) 1 (behind Three Way Catalytic Converter (TWC)) Heater -Z29- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical connector T94 terminal or test box socket
2	7

Specified value: 1.5 Ω max.

If the specified value was Not obtained:

– Check the wiring for an open or high resistance.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

– Install the right vehicle floor 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 ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.24 Engine Coolant Temperature Sensor 1 or 2, 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 or G83- .

Special tools and workshop equipment required

- Multimeter.
- jumper wire.
- Wiring diagram.

Test requirements

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

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Connect the scan tool.

– Switch the ignition On.

– Using the scan tool, check the coolant temperature:

Diagnostic text	Specified value
Coolant temperature	near Ambient temperature (veh. completely cooled down)

– Switch the ignition Off.

If the specified value was Not obtained:

– Continue test according to the following table:

Indicated	Cause	Test
approx. -40.0° C	Open circuit or short circuit to (B+)	⇒ page 162
approx. 140.0° C	Short circuit to Ground	⇒ page 163

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, if the temperature does not climb uniformly or the temperature signal is intermittent.

– Switch the ignition OFF.

– Replace the the Engine Coolant Temperature (ECT) Sensor - G62 or G83- .

Checking internal resistance

– Disconnect the Engine Coolant Temperature (ECT) Sensor - G62 or G83- electrical harness connector.

– Using a multimeter, check the Engine Coolant Temperature (ECT) Sensor -G62 or G83- terminals 1 to 2 for resistance.

Use the chart below for the specified values:

ECT Temperature vs Resistance		
Temp (C)	min. value ohms	max value ohms
- 40	36816	43714
- 35	28840	33978
- 25	17680	20530
- 15	10940	12534
- 5	6897	7804
0	5535	6226
5	4443	4970
15	2923	3235
25	1978	2167
35	1369	1486
45	965	1039
55	692	738
65	503	533
75	372	392
85	279	292
95	213	223
105	164	172
115	127	134
125	99	106
135	78	84

If the specified value was Not obtained:

– Replace the Engine Coolant Temperature (ECT) Sensor -G62 or G83- .

Testing if display is approx. - 40.0° C

– Disconnect the Engine Coolant Temperature (ECT) Sensor -G62 or G83- electrical harness connector .

– Using a jumper wire, connect the Engine Coolant Temperature (ECT) Sensor -G62 or G83- electrical harness connector terminals 1 to 2.

– Check the value indicated on the scan tool display.

If the value jumps to approx. 140.0° C:

– Switch the ignition OFF.

– Replace the Engine Coolant Temperature (ECT) Sensor -G62 or G83- .

If indication remains at approx. -40.0° C:

Checking wiring

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Engine Coolant Temperature (ECT) Sensor -G62 or G83- electrical harness connector terminal 1 to the Engine Control Module (ECM) -J623- electrical harness connector for an open circuit or a short to voltage, refer to the chart below for the appropriate sensor. Refer to Wiring Diagrams for pin locations.

ECT 1

Engine Coolant Temperature (ECT) Sensor -G62 - electrical harness connector terminals	Engine Control Module (ECM) - J623- electrical connector T60 terminals or test box socket
1	14
2	10

ECT 2

Engine Coolant Temperature (ECT) Sensor -2 G83- electrical harness connector terminals	Engine Control Module (ECM) - J623- electrical connector T94 terminals or test box socket
1	18
2	12

Specified values: 1.5 Ω Max. and 0 volts disconnected from ECM.

If the specified value was Not obtained:

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

– 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 signal circuit:

– Using a multimeter, check terminal 2 of the ECT sensor to engine ground.

Specified value: 1.5 Ω Max

If the specified value was Not obtained:

– Check the wiring for an open circuit or high resistance.

– 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 ground circuit:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

Testing if display approx. 140.0° C

– Disconnect the Engine Coolant Temperature (ECT) Sensor -G62 or G83- electrical harness connector .

– Turn the ignition switch ON.

If indication jumps to approx. -40.0° C:

– Switch ignition OFF.

– Replace the Engine Coolant Temperature (ECT) Sensor -G62 or G83- .

If indication remains at approx. 140.0° C:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Disconnect the ECT harness connector at the sensor.

– Using a multimeter, check the signal circuit of the Engine Coolant Temperature (ECT) Sensor -G62 or G83- electrical harness connector terminal 1 to engine ground. Refer to Wiring Diagrams for pin locations.

Specified value: OL or no continuity.

If the specified value was Not obtained:

– Check the wiring for a short circuit to Ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.25 Ambient Air Temperature Sensor, Checking

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Connect the scan tool.

– Engine MUST be at room temperature.

– Turn the ignition switch On.

– Using the scan tool, check the ambient air temperature:

Diagnostic text	Specified value
Ambient Air Temperature (AAT) Sensor	approx. ambient air temperature

– Turn the ignition switch OFF.

If the specified value was obtained:

– Fault may be intermittent. Check for proper connection, damaged wiring or loose terminals.

Note

On some models the display in the cluster will default to 419° F if the circuit is open or shorted to ground. The display on the cluster may show 3 dashes on other models when signal is out of range.

If the specified value was Not obtained:

Checking internal resistance

– Disconnect the Ambient Air Temperature Sensor -G17- electrical harness connector.

– Using a multimeter, check the Ambient Air Temperature Sensor -G17- terminals 1 to 2 for resistance.

Use the chart below for the specified values:

Specified values:

AAT Temperature vs Resistance		
Temp (C)	min. value ohms	max. value ohms
- 40	31811	37560
- 35	22941	26863
- 25	12415	14289
- 15	6958	7880
- 5	4036	4495
0	3120	3442
5	2422	2655
15	1519	1623
25	968	1031

35	629	676
45	419	455
55	286	314
65	195	217
75	136	155

If the specified value was Not obtained:

– Replace the Ambient Air Temperature Sensor -G17- . Refer to the Repair Manual.

If the specified values are obtained, continue the test according to the following table:

Checking wiring

– Turn the ignition switch ON.

– Connect a multimeter to terminals 1 and 2 of the Ambient Air Temperature Sensor -G17- electrical harness connector.

Specified value: near 5.02 V

– Turn the ignition switch OFF.

If the specified value was Not obtained:

– Remove the Instrument Cluster. Refer to the Repair Manual.

– Disconnect the Instrument Cluster harness.

– Using a multimeter, check the Ambient Air Temperature Sensor -G17- electrical harness connector terminals 1 and 2 to the Instrument Cluster electrical harness connector for an open circuit or a short, refer to the wiring diagram. Refer to Wiring Diagrams for pin locations.

Ambient Air Temperature Sensor -G17- electrical harness connector terminals	Instrument Cluster -J285- electrical connector T32 terminals
1	20
2	19

Specified value: 1.5 Ω max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance or short circuit to Battery (+) or ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If the specified value was obtained:

Replace the Instrument Cluster. Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.26 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 Engine Control Module (ECM) - J623- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground 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 stall.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– 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

– Switch ignition OFF.

If the specified value was Not obtained:

Checking internal resistance

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

– Using a multimeter, connect the RED meter lead to terminal 1 of the Engine Speed (RPM) Sensor -G28- and the BLACK meter lead to terminal 2 for resistance.

Specified value: 11.4 MΩ (+/- 1.4 M)

– Multimeter RED lead still connected to terminal 1 of the Engine Speed (RPM) Sensor -G28- and the BLACK meter lead to terminal 3 for resistance.

Specified value: 11.4 MΩ (+/- 1.4 M)

If any of the specified values are not obtained:

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

If the specified value was obtained:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Engine Speed (RPM) Sensor -G28- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminals for an open circuit. Refer to Wiring Diagrams for pin locations.

Engine Speed (RPM) Sensor -G28- electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T60 terminals or test box socket
1	28
2	36
3	51

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance or short to ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

– Remove the Engine Speed (RPM) Sensor -G28- and check the sensor wheel for proper seating, damage and runout Refer to the Repair Manual .

If the sensor wheel is OK:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.27 Fuel Injectors, Checking

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

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Diode test lamp (12 V).
- ♦ Wiring diagram.

Test requirements

- The Fuel Pump relay is operational.
- The Engine Speed (RPM) Sensor -G28- OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window de-froster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground 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 ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to the Repair Manual.

– Disconnect the Fuel Injector electrical harness connectors from Fuel Injectors -N30, N31, N32, N33, N83- .

Checking internal resistance

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

Specified value: 10.0 to 18.5 Ω (at approx. 20° C)

If the specified value was Not obtained:

– Replace the malfunctioning Fuel Injector Refer to the Repair Manual.

If the specified value was obtained:

Checking activation and wiring

– Connect a Diode test lamp (12 V) 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:

– Remove the Fuel Pump Relay -J17- .

– Connect a jumper between the Fuel pump relay terminals 30 and 87

– Turn the ignition switch ON.

– Using a test lamp connected to ground, check terminal 1 of the Fuel Injector to be tested. The lamp should be ON.

– If the test lamp did not turn on, locate the open or high resistance in the voltage supply circuit.

If the voltage supply was OK:

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Fuel Injector electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminals for an open circuit. Refer to Wiring Diagrams for pin locations.

Component	Fuel Injector electrical harness connector terminals	Engine Control Module (ECM) -J623- electrical connector T60 terminals or test box sockets
Cylinder 1 Fuel Injector -N30-	2	2
Cylinder 2 Fuel Injector -N31-	2	3
Cylinder 3 Fuel Injector -N32-	2	18
Cylinder 4 Fuel Injector -N33-	2	19
Cylinder 5 Fuel Injector -N83-	2	17

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance or short to voltage or ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Install the engine cover with air filter. Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.28 ECM Voltage Supply, Checking

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

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

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

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

Checking voltage

– Using a multimeter, check the Engine Control Module (ECM) Power Supply Relay Box socket 8 (relay terminal 87) to Ground.

Specified value: Battery voltage.

If the specified value was Not obtained:

– Check the wiring connections from the Battery to the Engine Control Module (ECM) Power Supply Relay -J271- socket 8 for an open 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 Engine Control Module (ECM) Power Supply Relay Box socket 4, (relay terminal 86) to Ground.

Specified value: Battery voltage.

If the specified value was Not obtained:

– Remove Fuse SD3 (2011 >) in Fuse Panel D and check resistance of circuit between fuse and relay terminal socket 1. Refer to Wiring Diagrams for pin locations.

Specified value: 1.5 ohm or less.

– If fuse is blown, locate short to ground in circuit, refer to wiring diagram.

– Repair as necessary.

If the specified value was obtained:

Checking activation

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

– Using a diode test lamp (12 V) connected to Battery + check the Engine Control Module (ECM) Power Supply Relay Box socket 6 (relay terminal 85) while cranking the engine.

The test lamp should be ON.

– Switch the ignition OFF.

If the test lamp was ON:

– Replace the Engine Control Module (ECM) Power Supply Relay -J271- : .

If the test lamp was not ON:

– Using a multimeter, check the Engine Control Module (ECM) Power Supply Relay socket 4 (relay terminal 85), to the Engine Control Module (ECM) -J623- electrical harness connector T94 terminal 69 for resistance.

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

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

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

– If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring and ground was not present from the ECM during crank:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.29 Engine Component Power Supply Relay, Checking

Special tools and workshop equipment required

♦ Multimeter .

♦ wiring diagrams.

Test requirements

• Fuse -SB 1- OK.

• The Engine Control Module (ECM) Power Supply Relay -J271- OK.

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

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Start diagnosis

– Turn key on:

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

Engine Component Power Supply Relay -J757- socket	Measure to
2/30	Engine Ground (GND)

Specified value: 12.5 V

If the specified value was not obtained:

– Turn key off.

– Check the Engine Component Power Supply Relay -J757- socket 8/87 to the Battery -(+)- positive terminal for an open circuit or short to Ground (GND).

– Check the electrical harness connectors for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

– Switch the engine on.

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

Engine Component Power Supply Relay -J757- socket	Measure to Engine Control Module (ECM) Power Supply Relay -J271-
8/87	8/87

Specified value: 12.5 V

– Switch the engine off.

If the specified value was not obtained:

– Check the electrical harness connectors for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

If no malfunctions are found in the wiring:

Checking Ground (GND)

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to appropriate service manual..

– Using a Multimeter , check the following wiring connection for resistance.

Engine Component Power Supply Relay - J757- socket	Engine Control Module (ECM) electrical harness connector T94 or test box socket
6/85	32

Specified value: 1.5 Ω.

If the specified value was not obtained:

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the wiring connection.

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

– Replace the Engine Component Power Supply Relay -J757 - Refer to appropriate service manual.

– Perform a road test to verify repair.

If the fault does not return:

Repair complete, Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

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

– Replace the Engine Control Module (ECM) -J623- . Refer to appropriate service manual.

– Assembly is performed in the reverse of the removal.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 ..

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.30 Catalytic Converter, Checking

Test requirements

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

Note

If ANY Fuel Trim, misfire, or sensor faults are set, repair those faults BEFORE replacing the Catalytic Converter. Failure to do so will damage the replacement converter.

Function test

– Perform the function test in Diagnostic Mode 06. Refer to ⇒ “3.3.6 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions ”, page 16 .

– 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 ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

– Perform a road test to verify Repair.

If the DTC does not return:

Erase the DTC memory. Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

If no leaks are found in the exhaust system:

– Replace the catalytic converter with front exhaust pipe. Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.31 Secondary Air Injection Combination Valve, Checking

The following procedure is used to test all combination valves.

Special tools and workshop equipment required

♦ Hand vacuum pump.

Test conditions

- Vacuum lines and hose connections free of leaks.
- Vacuum lines not plugged.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Start procedure

– Remove the vacuum hose from the Secondary Air Injection Combination Valve .

– Connect hand vacuum pump to combination valve vacuum connection.

– Remove the air duct hose from the Throttle Valve Control Module -J338- and position aside.

– Disconnect the Secondary Air Injection hose .

– Inject a light air pressure into the in Secondary Air Injection hose to close the combination valve. (do not use compressed air).

The Secondary Air Injection Combination Valve should close and seal. Air should not be able to pass through the valve.

– Operate the hand vacuum pump.

The Secondary Air Injection Combination Valve should open. Air should be able to pass through the valve.

If combination valve does not open:

Replace the Secondary Air Injection Combination Valve

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.32 Secondary Air Injection Pump Motor, Checking

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- The Secondary Air Injection (SAI) Pump Relay --J299-- fuse is OK.
- The Engine Control Module (ECM) Power Supply Relay -J271- and the Fuel Pump Relay -J17- fuse OK.
- Battery voltage at least 12.5 V.
- All electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- The ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Start diagnosis

– Disconnect the secondary air injection hose .

– Disconnect the Secondary Air Injection (SAI) Pump Motor -V101-- electrical harness connector.

Checking voltage

Note

The engine MUST be at ambient temperature and have at least 8 hours off time for the ECM to operate the Secondary Air Injection (SAI) system. The SAI system may operate for as little as 10 seconds, up to 55 seconds depending on ambient temperature.

– Ignition switch Off.
– Using a multimeter, check the Secondary Air Injection (SAI) Pump Motor --V101-- electrical harness connector terminal 2 to ground for voltage. When ready, start the engine while monitoring the reading.
– Start the engine.

Specified value: Battery voltage.

– Switch the ignition OFF.

If the specified value was Not obtained:

– Check the wiring connection from the Secondary Air Injection (SAI) Pump Relay --J299-- socket 2 (relay terminal 87) to the Secondary Air Injection (SAI) Pump Motor --V101-- electrical harness connector terminal 2 for an open circuit or a short circuit.
– Check the wiring connections for damage, corrosion, loose or broken terminals or an open fuse. Refer to the wiring diagram.
– If necessary, repair the faulty wiring connection, replace fuse if needed.

If the wiring has no fault, the fuse is not open and voltage is Not present at the pump:

– Perform the Secondary Air Injection (SAI) Pump Relay --J299-- test.

If the specified value was obtained:

Checking Ground

– Using a multimeter, check the Secondary Air Injection (SAI) Pump Motor --V101-- electrical harness connector terminal 1 to Ground for resistance.

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring for an open or high resistance.
– Check the electrical harness connector for damage, corrosion, loose or broken terminals.
– If necessary, repair the faulty wiring connection.

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

– Replace Secondary Air Injection (SAI) Pump Motor --V101-- .
– Erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .
– Perform a road test to verify repair.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.33 Secondary Air Injection Pump Relay, Checking

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring diagram.

Test requirements

- Secondary Air Injection (SAI) Pump Relay --J299-- fuses OK.
- Engine Control Module (ECM) Power Supply Relay -J271- and the Fuel Pump Relay -J17- fuse OK.
- Battery voltage at least 12.5 V.
- All electrical consumers switched off.
- A/C switched off.
- The ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Checking voltage

– Remove the Secondary Air Injection (SAI) Pump Relay -J299- .

– Using a multimeter, check the Secondary Air Injection (SAI) Pump Relay -J299- socket 1 (relay terminal 30) to Ground.

Specified value: Battery voltage.

If the specified value was Not obtained:

– Check the wiring connection from the Secondary Air Injection (SAI) Pump Relay -J299- socket 1 (relay terminal 30) to the Battery positive cable for an open circuit or high resistance. Refer to Wiring Diagrams for pin locations.

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

– If necessary, repair the faulty wiring connection.

If the specified value was obtained:

– Using a multimeter, check the resistance of the Secondary Air Injection (SAI) Pump Relay -J299- socket 2 (relay terminal 87) to Secondary Air Injection (SAI) Pump Motor -V101- harness connector, terminal 2 .

Specified value: 1.5 Ω Max.

– Switch the ignition OFF.

If the specified value was Not obtained:

- Check the circuit from the Secondary Air Injection (SAI) Pump Relay -J299- socket 2 (relay terminal 87) through fuse 27 (for 2009 - 2010) or fuse 21 (for 2011 >) in Fuse Box B, out to the Secondary Air Injection (SAI) Pump Motor -V101- connector, terminal 2 for an open circuit or a short circuit to Ground. Refer to Wiring Diagrams for pin locations.
- Check the wiring for an open circuit, high resistance or a short to Battery (+) or Ground.
- Check the electrical connections for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection and replace fuse if blown.

If the specified value was obtained:

Checking wiring

- Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.
- Using a multimeter, check the Secondary Air Injection (SAI) Pump Relay -J299- socket 4 (relay terminal 85) to the Engine Control Module (ECM) -J623- electrical harness connector T94 for resistance. Refer to Wiring Diagrams for pin locations.

Secondary Air Injection (SAI) Pump Relay -J299- socket/ terminal	Engine Control Module (ECM) -J623- electrical connector T94 terminal or test box socket
4/85	94

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

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

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

- Replace the Secondary Air Injection (SAI) Pump Relay -J299- .
- Erase the DTC memory.
- Perform a road test to verify repair.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.34 Secondary Air Injection Solenoid Valve, Checking

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- The Secondary Air Injection (SAI) Solenoid Valve --N112-- fuse OK.
- The Engine Control Module (ECM) Power Supply Relay -J271- and the Fuel Pump Relay -J17- fuse OK.
- Battery voltage at least 12.5 V.
- All electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- The ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

Start diagnosis

Note

Voltage is supplied to the Secondary Air Injection (SAI) Solenoid Valve --N112-- from the Engine Control Module (ECM) Power Supply Relay -J271- on early models, or the Fuel Pump Relay -J17- on later models. Refer to Wiring Diagrams for circuit/pin locations.

Procedure

– Disconnect the Secondary Air Injection (SAI) Solenoid Valve --N112-- electrical harness connector.

Checking internal resistance

– Using a multimeter, check the Secondary Air Injection (SAI) Solenoid Valve --N112-- terminals 1 to 2 for resistance.

Specified value: 3.5 - 8.5 Ω (at approx. 20° C)

If the specified value was Not obtained:

– Replace the Secondary Air Injection (SAI) Solenoid Valve --N112-- .

If the specified value was obtained:

Checking voltage supply

Start the engine.

– Using a multimeter, check the Secondary Air Injection (SAI) Solenoid Valve --N112-- electrical connector terminal 1 to Ground for voltage.

Specified value: Battery voltage.

Switch the ignition OFF.

If the specified value was Not obtained:

- Check the wiring from the Secondary Air Injection (SAI) Solenoid Valve --N112-- electrical connector terminal 1 to the Secondary Air Injection (SAI) Pump Relay -J299- (early models) or Fuel Pump Relay -J17- (later models) for a short circuit to Ground, or an open circuit. Refer to Wiring Diagrams for circuit/pin locations.
- 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

- Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.
- Using a multimeter, check the Secondary Air Injection (SAI) Solenoid Valve --N112-- electrical harness connector terminal 2 to the Engine Control Module (ECM) -J623- electrical harness connector T60 for an open circuit.

Secondary Air Injection (SAI) Solenoid Valve --N112-- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical connector T60 terminal or test box socket
2	48

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

- Check the wiring for an open, high resistance or short to ground.
- Check the electrical harness connector for damage, corrosion, loose or broken terminals.
- If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

- Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.35 Secondary Air Injection Sensor 1, Checking

Special tools and workshop equipment required

- Multimeter
- Wiring diagram.

Test requirements

- The Engine Control Module (ECM) - J623- fuses OK.
- The fuel filter OK.
- The battery voltage at least 12.5 V.
- All electrical consumers switched off (radiator fan must NOT run during test).
- A/C switched off.
- The fuel tank at least $^1/_4$ filled.
- The ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to the Repair Manual.

Checking voltage

– Disconnect the Secondary Air Injection Sensor 1 -G609- electrical harness connector.

– Switch the ignition ON.

– Using a multimeter, check the Secondary Air Injection Sensor 1 -G609- electrical harness connector for voltage using the chart below.

Secondary Air Injection Sensor 1 - G609- electrical harness connector terminals	Specified value
1 to Battery Positive	Battery Voltage
3 to Ground	near 5 V
4 to ECM pin T60/55	1.5 Ω Max.

– Switch the ignition OFF.

If the specified value was obtained:

– Replace the Secondary Air Injection Sensor 1 -G609- .

If the specified value was Not obtained:

Checking wiring connections

If the manufacturers test box is being used, perform the following step.

– Install the test box.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Secondary Air Injection Sensor 1 -G609- electrical harness connector terminals to the Engine Control Module (ECM) -J623- electrical harness connector T60 terminals for an open circuit. Refer to Wiring Diagrams for pin locations.

Secondary Air Injection Sensor 1 -G609- electrical harness connector terminals	Engine Control Module (ECM) - J623- electrical connector T60 terminals or test box socket
1	13
3	44
4	55

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring for an open, high resistance or short to ground.

– Check the electrical harness connector for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

If no malfunction is detected in the wiring:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Install the engine cover with air filter. Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.36 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 Engine Control Module (ECM) - J623- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.

- Ground connections between engine/transmission/chassis OK.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to the Repair Manual.

– Disconnect the Camshaft Position Sensor electrical harness connector.

– 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 specified value was Not obtained:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, Check the Camshaft Position (CMP) Sensor -G40- electrical harness connector to the Engine Control Module (ECM) electrical harness connector T60 for an open circuit. Refer to Wiring Diagrams for pin locations.

Camshaft Position (CMP) Sensor -G40- electrical harness connector terminals	Engine Control Module (ECM) electrical harness connector T60 terminals or test box sockets
1	26
2	44
3	52

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.

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

– If necessary, repair the faulty wiring connection.

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

– Replace the Camshaft Position (CMP) Sensor -G40- .

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Install the engine cover with air filter. Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory
⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code
⇒ “3.2 Readiness Code”, page 8 .

3.5.37 Camshaft Position Sensor 3, Checking

The following procedure is used to diagnose Camshaft Position (CMP) Sensor 3 -G300- which is controlled by Engine Control Module - J623- .

Note

Use only gold-plated when servicing the electrical harness connector terminals of the Camshaft Position (CMP) Sensor 3 - G300- .

Special tools and workshop equipment required

- multimeter.
- Wiring diagram.
- Diode test lamp

Test requirements

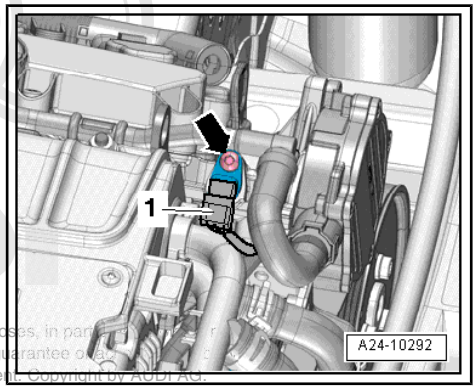
- The Engine Control Module - J623- fuses OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground (GND) connections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

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

– Remove the engine cover with air filter. Refer to appropriate service manual.

– Remove the sensor connector-1-

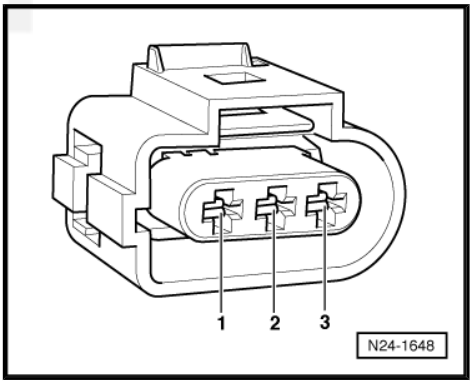


Checking activation

– Connect diode test lamp between terminal 2 and terminal 1.
– Turn key on
– Operate starter for a few Sec.
– LED in test lamp must blink
– Turn key off

Checking voltage

– Disconnect the Camshaft Position (CMP) Sensor 3 -G300- electrical harness connector .
– Switch the ignition on.



– Using a multimeter, Check the Camshaft Position (CMP) Sensor 3 -G300- 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.

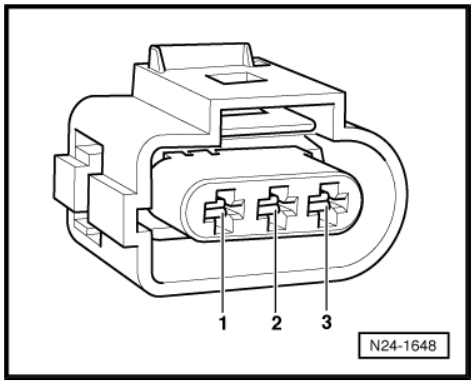
– Install the test box.

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

– Remove the Engine Control Module -J623- . Refer to appropriate service manual.

– Using a multimeter, check the Camshaft Position (CMP) Sensor 3 -G300- electrical harness connector to the Engine Control Module -J623- electrical harness connector.

Camshaft Position (CMP) Sensor 3 -G300- electrical harness connector terminals	Engine Control Module -J623- electrical harness connector terminals or test box sockets
1	T60 /26
2	T60 /59
3	T60 /52



Specified value: 1.5 Ω Max.

If the specified value was not obtained:

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

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

– If necessary, repair the faulty wiring connection.

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

– Replace Camshaft Position (CMP) Sensor 3 -G300- . Refer to .

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

– Replace the Engine Control Module -J623- . Refer to appropriate service manual.

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

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.38 Camshaft Adjustment Valve, Checking

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirements

- The Camshaft Adjustment Valve 1 -N205- fuse OK.
- Engine Control Module (ECM) Power Supply Relay -J271- OK, checking.
- 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 connections between engine/transmission/chassis OK.
- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover with air filter. Refer to the Repair Manual.

– Disconnect Camshaft Adjustment Valve 1 -N205- electrical harness connector.

– Using a multimeter, check the Camshaft Adjustment Valve 1 -N205- for resistance.

Specified value: 5.0 to 9.0 Ω (at approx. 20° C)

If the specified value was Not obtained:

– Replace the Camshaft Adjustment Valve 1 -N205- Refer to the Repair Manual.

If the specified value was obtained:

Checking voltage

– Start the engine.

– Using a multimeter, Check the Camshaft Adjustment Valve 1 -N205- electrical harness connector terminal 2 for voltage.

– Switch the ignition OFF.

Specified value: Battery voltage.

If the specified value was Not obtained:

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

– Check the wiring connection for damage, corrosion, loose 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.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, Check the Camshaft Adjustment Valve 1 -N205- electrical harness connector terminal 1 to the Engine Control Module (ECM) electrical harness connector T60 terminal 45 for an open circuit. Refer to Wiring Diagrams for pin locations.

Camshaft Adjustment Valve 1 -N205 - electrical harness connector terminal	Engine Control Module (ECM) electrical harness connector T60 terminal or test box socket
1	45

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.

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

– If necessary, repair the faulty wiring connection.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Install the engine cover with air filter. Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.39 Camshaft Adjustment Valve 1, Exhaust

The following procedure is used to diagnose Camshaft Adjustment Valve 1 (exhaust) -N318- which is controlled by Engine Control Module (ECM) - J623- .

Special tools and workshop equipment required

- Multimeter .
- Wiring diagram.

Test requirements

- Fuse -SC7- OK.
- Engine Control Module (ECM) Power Supply Relay -J271- OK.
- Battery voltage at least 12.5 volts.
- All electrical consumers such as, lights and rear window defroster, switched off.
- Vehicles with automatic transmission, shift selector lever into position “P” or “N”.
- A/C switched off.
- Ground (GND) connections between engine/transmission/ chassis OK.
- Ignition switched off.

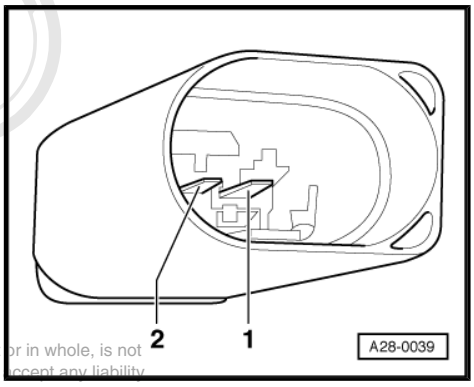
Test Procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

– Disconnect the Camshaft Adjustment Valve 1 (exhaust) -N318- electrical harness connector

Checking internal resistance

– Using a Multimeter , check the Camshaft Adjustment Valve 1 (exhaust) -N318- terminals 1 to 2 for resistance.



Specified value: 5.0 to 8.0 Ω (at approx. 20° C)

If the specified value was not obtained:

– Replace Camshaft Adjustment Valve 1 (exhaust) -N318- . Refer to Repair Manual.

If the specified value was obtained:

Checking voltage

– Switch the ignition on.

– Using a Multimeter , Check the Camshaft Adjustment Valve 1 (exhaust) -N318- electrical harness connector terminal 2 to Ground (GND) for voltage.

– Switch the ignition off.

Specified value: battery voltage.

If the specified value was not obtained:

– Check the wiring connection from the Camshaft Adjustment Valve 1 (exhaust) -N318- electrical harness connector terminal 2 to the Engine Control Module (ECM) Power Supply Relay -J271- socket 2/87 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 the specified value was obtained:

Checking wiring

If the manufacturers test box is being used, perform the following step.

– Install the test box. Refer to Repair Manual.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to Repair Manual.

– Using a Multimeter , check the Camshaft Adjustment Valve 1 (exhaust) -N318- electrical harness connector terminal 1 to the Engine Control Module (ECM) -J623- electrical harness connector T60 for an open circuit.

Camshaft Adjustment Valve 1 (exhaust) -N318- electrical harness connector terminal	Engine Control Module (ECM) -J623- electrical harness connector T60 terminal or test box socket
1	5

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 not OK:

– Replace the Engine Control Module (ECM) -J623- . Refer to Repair Manual.

– Assembly is performed in the reverse order of removal.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.40 Knock Sensor, Checking

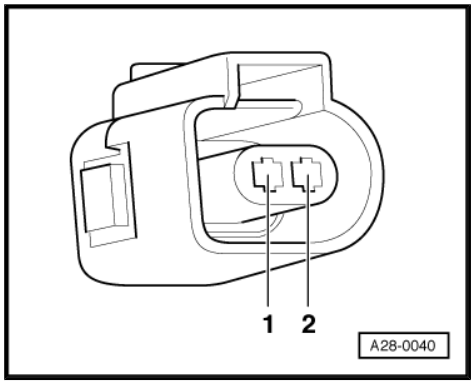
The following procedure is used to diagnose all Knock Sensors .

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



- Ignition switched OFF.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover. Refer to the Repair Manual.

Note

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

– Disconnect the Knock Sensor (KS) 1 -G61- electrical harness connector or the Knock Sensor (KS) 2 -G66- electrical harness connector.

Checking internal resistance

– Using a multimeter, check the Knock Sensor terminals 1 to 3 for an internal short.

Specified value: ∞ (Infinity or OL reading).

If the specified value was Not obtained:

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

If the specified value was obtained:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, Check the Knock Sensor electrical harness connector to the Engine Control Module (ECM) -J623- electrical harness connector T60 for an open circuit. Refer to Wiring Diagrams for pin locations.

Knock Sensor (KS) 1 -G61 - electrical harness connector terminals	Engine Control Module (ECM) electrical harness connector T60 terminals or test box sockets
1	39
2	54
3	52

Knock Sensor (KS) 2 -G66 - electrical harness connector terminals	Engine Control Module (ECM) electrical harness connector T60 terminals or test box sockets
1	9
2	24
3	52

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.

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

– If necessary, repair the faulty wiring connection.

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

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Install the engine cover with air filter. Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.41 Ignition Coil with Power Output Stage, Checking

The following procedure is used to diagnose all Ignition Coils with Power Output Stage .

Special tools and workshop equipment required

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

Test requirements

- The Ignition Coils with Power Output Stage - N70, N127, N291, N292, N323- fuses OK.
- The Engine Control Module (ECM) Power Supply Relay - J271- OK.
- The Engine Speed (RPM) Sensor -G28- OK.
- The Camshaft Position (CMP) Sensor -G40- 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 connections between engine/transmission/chassis OK.
- Ignition switched Off.

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Remove the engine cover. Refer to the Repair Manual.

– Remove the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- electrical harness screws.

– Disconnect the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- electrical harness connectors from the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- .

Checking voltage supply

– Switch the ignition ON.

– Using a multimeter, check the Ignition Coil electrical harness connector terminals 1 to 4 for voltage.

Specified value: Battery voltage.

– Switch the ignition OFF.

If the specified value was Not obtained:

– Check the Ignition Coil electrical harness connector terminal 1 through fuse SB8 in fuse panel B to the Engine Control Module (ECM) Power Supply Relay -J271 - terminal 2 (relay terminal 87) for an open circuit. Refer to Wiring Diagrams for circuit locations.

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring connection for an open circuit, high resistance or short circuit to Ground.

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

– If necessary, repair the faulty wiring connection and replace fuse if blown.

If the specified value was obtained:

Checking activation

WARNING

Do not touch the Ignition Coils connecting parts or adapter cables during the following test.

– Disable the power supply to the Fuel Injectors -N30, N31, N32, N33, N83- by removing fuse.

– Connect a diode test lamp to the Ignition Coil electrical harness connector terminals 2 and 3.

– Crank the engine while monitoring the diode test lamp.

The LED should flicker.

– Switch the ignition OFF.

If the LED flickers and the voltage was OK:

– Replace the faulty Ignition Coils with Power Output Stage - N70, N127, N291, N292, N323- Refer to the Repair Manual.

If the LED does not flicker:

Checking wiring

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, Check the Ignition Coil electrical harness connector to the Engine Control Module (ECM) -J623- electrical harness connector T60 for an open circuit. Refer to Wiring Diagrams for pin locations.

Ignition Coils with Power Output Stage - N70,N127,N291,N292, N323- electrical harness connector terminal	Engine Control Module (ECM) electrical harness connector T60 terminal or test box socket
3	58
3	43
3	57
3	56
3	41

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.

– 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 voltage was Not present:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Connect the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- electrical harness connectors to the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- .

– Install the Ignition Coils with Power Output Stage -N70, N127, N291, N292, N323- electrical harness screws.

– Install the engine cover with air filter. Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.42 Speed Signal, Checking

The following procedure requires a test drive. Observe all safety precautions. Refer to ⇒ “1.1 Safety Precautions”, page 2 .

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring diagram.

♦

Test requirements

- The Speedometer -G21- OK.
- The Engine Control Module (ECM) -J623- fuses OK.

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

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– 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:

– For models with ABS, check the wheel speed signal in the ABS controller with a scan tool. If the signal is not present or a code is set, refer to the ABS diagnostics in the Repair Manual.

– On other models check the wiring from the Engine Control Module (ECM) -J623- to the Instrument Cluster Control Module -J285- for an open circuit, Short to Battery (+), or to Ground.

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

– If necessary, repair the faulty wiring connection.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.43 CAN Bus Terminal Resistance, Checking

Special tools and workshop equipment required

- Multimeter.
- Wiring diagram.

Test requirement

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

Function

The Engine Control Module (ECM) -J623- communicates with other CAN-Bus capable control modules.

The control modules are connected by two data bus wires referred to as CAN High and CAN Low. The CAN bus allows the exchange of information (messages) between the connected modules. Messages that are missing data on the CAN bus are recognized as a malfunction by the control module connected to the CAN bus that received the invalid data .

Trouble-free operation of the CAN Bus requires that it have a Terminal Resistance. This central Terminal Resistance is located in the Engine Control Module (ECM) -J623- .

Test Procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8 .

– Disconnect the Data Bus On Board Diagnostic Interface - J533- electrical harness connector.

Note

The Engine Control Module (ECM) -J623- must remain connected for the following step.

– Disconnect the Data Bus On Board Diagnostic Interface - J533- electrical harness connector.

– Using a multimeter, check the Data Bus On Board Diagnostic Interface -J533- electrical harness connector terminals 6 to 16 for the correct Terminal Resistance. Refer to Wiring Diagrams for pin locations.

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

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.

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

– Remove the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

– Using a multimeter, check the Data Bus On Board Diagnostic Interface -J533- electrical harness connector to the Engine Control Module (ECM) -J623- electrical harness connector T94 for short to ground, high resistance or an open circuit. Refer to Wiring Diagrams for pin locations.

Data Bus On Board Diagnostic Interface -J533- electrical harness connector terminals	Engine Control Module (ECM) - J623- electrical connector T94 terminals or test box sockets
6 (Can Bus Low)	67
16 (Can Bus High)	68

Specified value: 1.5 Ω Max.

If the specified value was Not obtained:

– Check the wiring connection for short to ground, high resistance or an open circuit.

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

– If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring and the Terminal Resistance was Not OK:

– Replace the Engine Control Module (ECM) -J623- . Refer to the Repair Manual.

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

– Replace the Data Bus On Board Diagnostic Interface -J533- .

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

3.5.44 CAN-Bus Terminal Resistance, Transmission Control Module to Engine Control Module, Checking

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring diagram.

Test requirement

• A CAN-Bus malfunction was recognized.

• The Engine Control Module (ECM) - J623- Direct Shift Gearbox (DSG) Mechatronic -J743- 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 connections between engine/transmission/chassis OK.
- Ignition switched Off.

Function

The Engine Control Module -J623- communicates with other CAN-Bus capable control modules.

The control modules are connected by two Data Bus wires which are twisted together (CAN High and CAN Low), and exchange information (messages). Missing information on the CAN-Bus is recognized as a malfunction by the Engine Control Module -J623- and the other control modules connected to the CAN-Bus.

Trouble-free operation of the CAN-Bus requires that it have a terminal resistance. This central terminal resistance is located in the Engine Control Module -J623- .

Test procedure

– Perform a preliminary check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 8

Start diagnosis

– Disconnect the Direct Shift Gearbox (DSG) Mechatronic -J743- electrical harness connector.

Note

The Engine Control Module -J623- must remain connected for the following step.

– Using a multimeter, check the Direct Shift Gearbox (DSG) Mechatronic -J743- electrical harness connector terminals 10 to 15 for resistance.

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

If the specified value was obtained:

– Check the TCM power and grounds at the module. Refer to the Wiring Diagram. If power or ground is lost, the TCM will not communicate. Correct any power or ground fault before replacement of any component.

If the TCM has power and ground present, Bus resistance was OK and the TCM does not communicate:

– Replace the Direct Shift Gearbox (DSG) Mechatronic -J743- . Refer to the Repair Manual.

If the specified Bus resistance was Not obtained:

– Remove the Engine Control Module -J623- . Refer to the Repair Manual.
– Using a multimeter, check the Direct Shift Gearbox (DSG) Mechatronic -J743- electrical harness connector to the Engine Control Module -J623- electrical harness connector T94 for resistance.

Direct Shift Gearbox (DSG) Mechatronic -J743- electrical harness connector terminals	Engine Control Module -J623- electrical connector T94 terminals
15 (Can-Bus Low)	67 (Can-Bus Low)
10 (Can-Bus High)	68 (Can-Bus High)

Specified value: 1.5 Ω Max.

If the specified resistance was Not obtained:

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

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

– If necessary, repair the faulty wiring connection.

If no malfunction is found in the wiring:

– Replace the Engine Control Module -J623- . Refer to the Repair Manual.

Final procedures

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

1 - Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

2 - If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 15 .

3 - If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 8 .

7/14/2011

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Audi retailer or other qualified shop. We especially urge you to consult an authorized Audi retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Audi.

- Disconnect the battery negative terminal (ground strap)whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Audi is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Audi retailer parts department for the latest information.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

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Cautions & Warnings

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly, do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Audi specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

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Cautions & Warnings

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Audi Service technicians should test, disassemble or service the airbag system.

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Audi Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

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