Repair Manual

Gallardo MY09 – 10 – 11 – 12➤

Engine Scan Tool									
Engine ID	CEH								

Edition 09.2009

Refer to Gallardo Repair Manual for any further information

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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.

1.1 Safety Precautions

⚠ WARNING

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

♦ *Vehicles with FSI engine: 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, pressure must be relieved to residual pressure before opening high pressure components. Refer to Repair Manual.*

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

♦ Disconnect the battery Ground (GND) cable with the ignition switched off. Refer to Repair Manual.

♦ Open the fuel filler flap briefly and then close again.

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

♦ The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary.

♦ Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m3/h can be used.

♦ Prevent fuel from contacting the skin! Wear fuel-resistant gloves!

1.2 Clean Working Conditions

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

♦ Thoroughly clean all unions and adjacent areas with engine or brake cleaner and dry before disconnecting.

♦ Plug open lines and connections immediately with appropriate protective caps.

♦ Place removed parts on a clean surface and cover. Use lint-free cloths.

♦ Install clean components: Remove replacement parts immediately prior to installation. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).

♦ When the system is open: Do not work with compressed air. Do not move vehicle unless absolutely necessary.

♦ Separated electrical connectors: Protect from dirt and moisture. Make sure connections are dry when reconnecting.

1.3 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 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 monitors electronic power control 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 1

View clean working conditions:

⇒ “1.2 Clean Working Conditions”, page 2

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 pressure 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
⇒ “3.3.5 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 7.

3.2 Readiness Code

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 (IAT) 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.

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

Drive Cycle Procedure

– Connect the scan tool.

– Switch the ignition on and start the vehicle.

– Idle the vehicle for 2-3 minutes. This executes the O2S Heater, Misfire, Secondary AIR, Fuel Trim, and Purge system monitors.

– Drive the vehicle at 45-55 mph for a continuous 7-minute period, avoid stopping. This executes the EVAP, O2S, Fuel Trim, and Misfire monitors.

– Accelerate the vehicle to an engine speed of 5000 RPM (with automatic transmission use the tip-tronic mode); lift off the throttle until the engine speed is around 1200 rpm. This executes the fuel cut off

– Accelerate the vehicle smoothly to 60-65 mph, cruise constantly for 5 min, this executes the Catalyst; O2S, Misfire, Fuel Trim, and Purge System monitors.

– Decelerate and idle the vehicle again for 3 minutes. This executes the Misfire, Secondary AIR, Fuel Trim, and Purge system monitors.

– Check the status of the readiness code.

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

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

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

If the drive cycle operation fails again.

– Check the DTC memory for stored DTC's.

Repair the vehicle if necessary.

– Repeat the drive cycle operation until all engine monitors have successfully run through and passed.

– Remove the scan tool and switch the ignition off.

– End of operation.

3.3 Diagnostic Modes 01 - 0A

⇒ “3.3.1 Diagnostic Mode 01 - Read Current System Data”, page 10

⇒ “3.3.2 Diagnostic Mode 02 - Read Operating Conditions”, page 12

⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 13

⇒ “3.3.4 Interrogating the Fault Memory”, page 14

⇒ “3.3.5 Diagnostic Mode 04 - Erase DTC Memory”, page 15

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⇒ “3.3.8 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle”, page 38

⇒ “3.3.9 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component ”, page 39

⇒ “3.3.10 Diagnostic Mode 09 - Read Vehicle Information”, page 40

⇒ “3.3.11 Diagnostic Mode 0A - Check Permanent DTC Memory”, page 41

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

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

Note
Depending on scan tool and protocol used, the information 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”.

Note
More than one “PID” may be selected and monitored.

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

PID	Description
$00	Supported definition PIDs $01- $20
$01:	Number of malfunctions in Mode 3/MIL, Status/Readiness status
$03:	Fuel System Status
$04:	Calculated load value
$05:	Coolant temperature
$06:	Oxygen sensor integrator Bank 1 / Bank 3
$07:	Oxygen sensor adaptation value Bank 1 / Bank 3
$08:	Oxygen sensor integrator Bank 2 / Bank 4
$09:	Oxygen sensor adaptation value Bank 2 / Bank 4
$0B:	Intake manifold pressure
$0C:	Engine speed
$0D:	Vehicle speed
$0E:	Ignition angle cylinder 1
$0F:	Intake air temperature
$10:	Air mass
$11:	Throttle valve position 1 absolute

PID	Description
$12:	Secondary air injection
$13:	Location of oxygen sensor LSF
$14:	LSF sensor voltage Bank 1 Sensor 1, Oxygen sensor integrator Bank 1
$15:	LSF sensor voltage Bank 1 Sensor 2
$16:	LSF sensor voltage Bank 1 Sensor 3
$18:	LSF sensor voltage Bank 2 Sensor 1, Oxygen sensor integrator Bank 2
$19:	LSF sensor voltage Bank 2 Sensor 2
$1A:	LSF sensor voltage Bank 2 Sensor 3
$1D:	OBD requirements
$15:	LSF sensor voltage Bank 1 Sensor 1, Oxygen sensor integrator Bank 1
$17:	LSF sensor voltage Bank 2 Sensor 2
$19:	LSF sensor voltage Bank 3 Sensor 2
$1B:	LSF sensor voltage Bank 4 Sensor 2
$1C:	OBD requirements
$1F:	Time after engine start
$20:	Supported definition PIDs $21 - $40
$21:	Distance covered with MIL ON
$23:	Fuel pressure (rail pressure)
$2C:	EGR activation
$2D:	EGR error
$2E:	Tank ventilation valve activation
$30:	No. of WUCs after erasing DTC memory
$31:	Distance driven after erasing DTD memory
$33:	Ambient pressure
$34:	Oxygen sensor actual value Bank 1 - Sensor 1, Oxygen sensor monitoring pump current Bank 1 - Sensor 1
$36:	Oxygen sensor actual value Bank 2 - Sensor 1, Oxygen sensor monitoring pump current Bank 2 - Sensor 1
$38:	Oxygen sensor actual value Bank 3- Sensor 1, Oxygen sensor monitoring pump current Bank 3- Sensor 1
$3A:	Oxygen sensor actual value Bank 4 - Sensor 1, Oxygen sensor monitoring pump current Bank 4 - Sensor 1
$3C:	Catalytic converter temperature Bank 1 – Sensor 1
$3D:	Catalytic converter temperature Bank 2 – Sensor 1
$40:	Supported definition PIDs $41 - $60
$41:	Monitor status in this driving cycle
$42:	Control modules system voltage
$43:	Absolute load value
$44:	Oxygen sensor specified value
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Absolute throttle valve position 2
$49:	Absolute accelerator pedal position 1
$4A:	Absolute accelerator pedal position 2
$4C:	Throttle valve specified position
$56:	Offset oxygen sensor control behind cat. Bank 1 / Bank 3
$58:	Offset oxygen sensor control behind cat. Bank 2 / Bank 4

– Switch the ignition off.
– End of diagnosis.

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 under any circumstances.

– Select “Diagnostic Mode 2: Obtain operating conditions.”.

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

Note

More than one “PID” may be selected and 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- 20
$02:	Fault code that activated the Freeze Frame save
$03:	Fuel system status
$04:	Calculated load value
$05:	Coolant temperature
$06:	Oxygen sensor integrator Bank 1 / Bank 3
$07:	Oxygen sensor adaptation value Bank 1 / Bank 3
$08:	Oxygen sensor integrator Bank 2 / Bank 4

PID	Component or System
$09:	Oxygen sensor adaptation Bank 2 / Bank 4
$0B:	Intake manifold pressure
$0C:	Engine speed
$0D:	Vehicle speed
$0E:	Ignition angle
$0F:	Intake air temperature
$10:	Air mass
$11:	Absolute throttle valve position 1 (throttle valve signal 1)
$12:	Secondary air injection status
$1F:	Time since engine start
$20:	supported definition, PIDs 21- 40
$23:	Fuel pressure (rail pressure) (only FSI)
$2C:	EGR activation (only EGR designs)
$2D:	EGR error (only EGR designs)
$2E:	Tank ventilation valve activation
$33:	Ambient pressure
$40:	Supported definition, PIDs 41-60
$42:	Control modules system voltage
$43:	Absolute load value
$44:	Oxygen sensor specified value
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Absolute throttle valve position 2 (Throttle valve position signal 2)
$49:	Absolute accelerator pedal position 1
$4A:	Absolute accelerator pedal position 2)
$4C:	Throttle valve specified position
$56:	Offset oxygen sensor control behind cat., Bank 1 / Bank 3
$58:	Offset oxygen sensor control behind cat., Bank 2 / Bank 4

– Switch the ignition off.

– End of diagnosis.

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

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

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 MY2000
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

3.3.4 Interrogating the Fault Memory

Procedure

– Connect the scan tool.

– Switch the ignition to the “ON” position.

– Select “Diagnostic Mode 03: Interrogating fault memory”.

– The stored DTC or DTC's will be displayed on the scan tool screen.

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

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

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

♦ SAE P0xxxDTCs. ⇒ “3.4.1 SAE P0xxx DTCs”, page 42.

♦ SAE P1xxx-DTCs ⇒ “3.4.2 SAE P1xxx DTCs”, page 90 .

♦ SAE P2xxxDTCs. ⇒ “3.4.3 SAE P2xxx DTCs”, page 98.

♦ SAE P3xxxDTCs. ⇒ “3.4.4 SAE P3xxx DTCs”, page 118.

♦ SAE U0xxxDTCs, ⇒ “3.4.5 SAE U0xxx DTCs”, page 120.

– Switch the ignition off.

3.3.5 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 to the “ON” position.

– 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.

3.3.6 Diagnostic Mode 05 - Check Lambda Test Results

Note

♦ *The diagnostic information for “Diagnostic Mode 5: check lambda test results” is not supported in this section of the 2010 R8 5.2L Generic Scan Tool service manual and has been moved to “Diagnostic Mode 6: Checking test results of components that are not continuously monitored” section.*

♦ *Refer to “Diagnostic Mode 6: Checking test results of components that are not continuously monitored” for the static values of all oxygen sensors and all emission related components*

⇒ *“3.3.7 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions ”, page 16.*

Note

Depending on scan tool and protocol used, diagnostic mode 05 and the information provided may be referred to by a different name.

3.3.7 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 values of the individual test results must reach the specified value or must be within the min. and max. limits.

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 catalytic converter and cylinder head.

• No DTCs in the DTC memory.

• Coolant temperature at least 80° C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select the desired “Test-ID”.

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

OBDMID (Hex-ID)	Component or System
01 ($01): ⇒ page 20	Oxygen Sensor Monitor Bank 1 - Sensor 1
02 ($02): ⇒ page 20	Oxygen Sensor Monitor Bank 1 - Sensor 2
05 ($05): ⇒ page 22	Oxygen Sensor Monitor Bank 2 - Sensor 1
06 ($06): ⇒ page 22	Oxygen Sensor Monitor Bank 2 - Sensor 2
09 ($09): ⇒ page 23	Oxygen Sensor Monitor Bank 3 - Sensor 1
10 ($0A): ⇒ page 23	Oxygen Sensor Monitor Bank 3 - Sensor 2
13 ($0D): ⇒ page 24	Oxygen Sensor Monitor Bank 4 - Sensor 1
14 ($0E): ⇒ page 24	Oxygen Sensor Monitor Bank 4 - Sensor 2
33 ($21): ⇒ page 25	Catalyst Monitor Bank 1
34 ($22): ⇒ page 25	Catalyst Monitor Bank 2
35 ($23): ⇒ page 26	Catalyst Monitor Bank 3

36 ($24): ⇒ page 26	Catalyst Monitor Bank 4
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OBDMID (Hex-ID)	Component or System
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OBDMID 01 ($01): Oxygen Sensor Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 01 ($01)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
131 ($83)	P0133	Response Check.	0.32	1.999	Refer to DTC P0133 in the DTC table.
132 ($84)	P2195	Rationality Check.	-0.05999	0.05999	Refer to DTC P2195 in the DTC table
132 ($84)	P2196	Rationality Check.	-0.05999	0.05999	Refer to DTC P2196 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

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

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 02 ($02)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)	--	NO DTC	45 mV	860 mV	--
02 ($02)	--	NO DTC	45 mV	860 mV	--
07 ($07)	--	NO DTC	0.0 V	450 mV	--
08 ($08)	--	NO DTC	450 mV	1.299 V	--

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P0139	Signal activity check.	0 mV	860 mV	Refer to DTC P0139 in the DTC table.
130 ($82)	P0139	Signal activity check.	45 mV	1.299 V	Refer to DTC P0139 in the DTC table.
131 ($83)	P0139	Fuel cut off check.	0 V	8.192 V	Refer to DTC P0139 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 05 ($05): Oxygen Sensor Monitor Bank 2 - Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 05 ($05)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
131 ($83)	P0153	Response Check.	0.32	1.999	Refer to DTC P0153 in the DTC table.
132 ($84)	P2197	Rationality Check.	-0.05999	-0.05999	Refer to DTC P2197 in the DTC table
132 ($84)	P2198	Rationality Check.	-0.05999	-0.05999	Refer to DTC P2198 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 06 ($06): Oxygen Sensor Monitor Bank 2 - Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 06 ($06)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)	--	NO DTC	45 mV	860 mV	--
02 ($02)	--	NO DTC	45 mV	860 mV	--
07 ($07)	--	NO DTC	0 mV	8192 mV	--
08 ($08)	--	NO DTC	450 mV	1.299 V	--
129 ($81)	P0159	Signal activity check.	0 mV	860 mV	Refer to DTC P0159 in the DTC table.
130 ($82)	P0159	Signal activity check.	45 mV	1.299 mV	Refer to DTC P0159 in the DTC table.
131 ($83)	P0159	Fuel cut off check.	0 V	202 mV	Refer to DTC P0159 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 09 ($09): Oxygen Sensor Monitor Bank 3 - Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 09 ($09)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
131 ($83)	P3209	Response Check.	0.32	1.999	Refer to DTC P3209 in the DTC table.
132 ($84)	P3144	Rationality Check.	-0.05999	0.05999	Refer to DTC P3144 in the DTC table
132 ($84)	P3145	Rationality Check.	-0.05999	0.05999	Refer to DTC P3145 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 10 ($0A): Oxygen Sensor Monitor Bank 3 - Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 06 ($06)”.

– Select the desired “Test-ID”.
– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information

01 ($01)	--	NO DTC	79 mV	860 mV	--
02 ($02)	--	NO DTC	79 mV	860 mV	--
07 ($07)	--	NO DTC	0.0 mV	8192 mV	--
08 ($08)	--	NO DTC	450 mV	1.299 V	--
129 ($81)	P0139	Signal activity check.	0 mV	0.625 V	Refer to DTC P0139 in the DTC table.
130 ($82)	P3224	Signal activity check.	0.625 V	1.299 V	Refer to DTC P3224 in the DTC table.
131 ($83)	P3224	Fuel cut off check.	0 V	0.202 V	Refer to DTC P3224 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 13 ($0D): Oxygen Sensor Monitor Bank 4 - Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 13 ($0D)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
131 ($83)	P3239	Response Check.	0.32	1.999	Refer to DTC P3239 in the DTC table.
132 ($84)	P3146	Rationality Check.	-0.05999	0.05999	Refer to DTC P3146 in the DTC table
132 ($84)	P3147	Rationality Check.	-0.05999	0.05999	Refer to DTC P3147 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 14 ($0E): Oxygen Sensor Monitor Bank 4 - Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 14 ($0E)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
01 ($01)	--	NO DTC	45 mV	860 mV	--
02 ($02)	--	NO DTC	45 mV	860 mV	--
07 ($07)	--	NO DTC	0.0 V	450 mV	--
08 ($08)	--	NO DTC	450 mV	1.299 mV	--
129 ($81)	P0159	Signal activity check.	0 mV	860 mV	Refer to DTC P0159 in the DTC table.
130 ($82)	P0159	Signal activity check.	45 mV	1.299 mV	Refer to DTC P0159 in the DTC table.
131 ($83)	P0159	Fuel cut off check.	0 V	0.202 mV	Refer to DTC P0159 in the DTC table.

OBDMID 33 ($21): Catalyst Monitor Bank 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 33 ($21)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
132 ($84)	P0420	Conversion Capability (storage) Check.	16 mV	1.299 mV	Refer to DTC P0420 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 34 ($22): Catalyst Monitor Bank 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 34 ($22)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
132 ($84)	P0430	Conversion Capability (storage) Check.	16 mV	1.900 mV	Refer to DTC P0430 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 35 ($23): Catalyst Monitor Bank 3

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 35 ($23)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
132 ($84)	P0420	Conversion Capability (storage) Check.	16 mV	1.999 mV	Refer to DTC P0420 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

Test-ID 36 ($24): Catalyst Monitor Bank 4

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 35 ($23)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
132 ($84)	P0430	Conversion Capability (storage) Check.	16 mV	1.999 mV	Refer to DTC P0430 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 58 ($3A): Fuel Tank EVAP System Leak Test (0.090“)

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 59 ($3B)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P0455	Fuel Tank Leak Test.Large leak.	0.95 - 1.1 Sec	65535	Refer to DTC P0455 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 59 (3B): EVAP Monitor (0.040)

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 59 ($3B)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P0442	Fuel Tank Leak Test. Small Leak.	1.7 - 2.2 Sec	65535	Refer to DTC P0442 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 60 (3C): EVAP Monitor (0.020)

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 60 ($3C)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P0456	Fuel Tank Leak Test. Pin hole Leak.	4.0...5.0 Sec	65535	Refer to DTC P0456 in the DTC table

– If any component or system fails 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.

– Switch the ignition off.

– End of diagnosis.

OBDMID 61 (3D): Tank Vent Valve function check

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 61 ($3D)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
128 ($80)	P0441	Function Check.	0.1	1.999	Refer to DTC P0441 in the DTC table
130 ($82)	--	NO DTC	0.0498	10.0	--
130 ($82)	--	NO DTC	-10.0	0.0498	--

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 65 ($41): Oxygen Sensor Heater Monitor Bank 1 – Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 65 ($41)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
133 ($85)	P0135	Readiness Check.	684.99° C	1200° C	Refer to DTC P0135 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 66 ($42): Oxygen Sensor Heater Monitor Bank 1 – Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 66 ($42)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P0141	Readiness Check.	560	22950	Refer to DTC P0141 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 69 ($45): Oxygen Sensor Heater Monitor Bank 2- Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 69 ($45)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
133 ($85)	P0135	Readiness Check.	684.99° C	1200° C	Refer to DTC P0135 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 70 ($46): Oxygen Sensor Heater Monitor Bank 2 – Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 70 ($46)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P0161	Readiness Check.	0	560 ..22950	Refer to DTC P0161 in the DTC table.

– If any of the 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.

– Switch the ignition off.

OBDMID 73 ($49): Oxygen Sensor Heater Monitor Bank 3 – Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 73 ($49)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
133 ($85)	P3252	Readiness Check.	684.998° C	1200° C	Refer to DTC P3252 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 74 ($4A): Oxygen Sensor Heater Monitor Bank 3 – Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 70 ($46)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P3218	Readiness Check.	0	7 -10	Refer to DTC P3218 in the DTC table.

– If any of the 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.

– Switch the ignition off.

OBDMID 77 ($4D): Oxygen Sensor Heater Monitor Bank 4 – Sensor 1

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 77 ($4D)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
133 ($85)	P3153	Readiness Check.	684.998° C	1200° C	Refer to DTC P3153 in the DTC table.

– If any component or system fails 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.

– Switch the ignition off.

OBDMID 78 ($4E): Oxygen Sensor Heater Monitor Bank 4 – Sensor 2

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 78 ($4E)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
129 ($81)	P3248	Readiness Check.	0	7 -10	Refer to DTC P3248 in the DTC table.

– If any of the 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.

– Switch the ignition off.

OBDMID $71 (113): Secondary Air Injection (AIR) System 1 (Bank 1)

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 71 ($113)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
128 ($80)	P0491	Function Check	0.0468	--	Refer to DTC P0491 in the DTC table.

– If any of the 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.

– Switch the ignition off.

OBDMID $72 (114): Secondary Air Injection (AIR) System 2 (Bank 2)

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “Test-ID 72 ($114)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
128 ($80)	P0492	Function Check	0.0468	--	Refer to DTC P0492 in the DTC table.

– If any of the 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.

– Switch the ignition off.

OBDMID $73 (115): Secondary Air Injection (AIR) System 3 (Bank 3)

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 115 ($73)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
128 ($80)	P1497	Function Check	0.0468	--	Refer to DTC P1497 in the DTC table.

– If any of the 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.

– Switch the ignition off.

OBDMID $74 (116): Secondary Air Injection (AIR) System 4 (Bank 4)

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 116 ($74)”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
128 ($80)	P1498	Function Check	0.0468	--	Refer to DTC P1498 in the DTC table.

– If any of the 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.

– Switch the ignition off.

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

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 162 ($A2)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0301	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC table
12 ($0C)	P0301	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC table

– If any of the 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.

– Switch the ignition off.

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

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 163 ($A3)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0302	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC table
12 ($0C)	P0302	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC table

– If any of the 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.

– Switch the ignition off.

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

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 164 ($A4)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0303	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC table
12 ($0C)	P0303	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC table

– If any of the 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.

– Switch the ignition off.

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

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 165 ($A5)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0304	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC table
12 ($0C)	P0304	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC table

– If any of the 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.

– Switch the ignition off.

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

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 166 ($A6)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0305	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0305 in the DTC table
12 ($0C)	P0305	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0305 in the DTC table

– If any of the 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.

– Switch the ignition off.

OBDMID 167 ($A7): Mis-Fire Cylinder 6 Data

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 167 ($A7)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0306	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0306 in the DTC table
12 ($0C)	P0306	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0306 in the DTC table

– If any of the 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.

– Switch the ignition off.

OBDMID 168 ($A8): Mis-Fire Cylinder 7 Data

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “OBDMID 168 ($A8)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0307	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0307 in the DTC table
12 ($0C)	P0307	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0307 in the DTC table

– If any of the 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.

– Switch the ignition off.

Test-ID 169 ($A9): Mis-Fire Cylinder 8 Data

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “Test-ID 169 ($A9)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0308	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0308 in the DTC table
12 ($0C)	P0308	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0308 in the DTC table

– If any of the 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.

– Switch the ignition off.

Test-ID 170 ($AA): Mis-Fire Cylinder 9 Data

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “Test-ID 170 ($AA)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0309	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0309 in the DTC table
12 ($0C)	P0309	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0309 in the DTC table

– If any of the 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.

– Switch the ignition off.

Test-ID 171 ($AB): Mis-Fire Cylinder 10 Data

– Connect the scan tool.

– Start the engine and let run at idle speed.

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

Select “Test-ID 171 ($AB)”.

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

– Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min./Max. Values	Additional Information
11 ($0B)	P0310	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0310 in the DTC table
12 ($0C)	P0310	Crankshaft speed fluctuation, single or multiple misfire check.	0 - 65535 (counts)	Refer to DTC P0310 in the DTC table

– If any of the 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.

– Switch the ignition off.

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

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

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

– If the fault is detected again by the end of the following driving cycle, a confirmed DTC is entered (output via Mode 03) and the MIL is activated.

– If this malfunction is not detected again by the end of the following driving cycle, the corresponding pending code will be deleted at the end of the driving cycle.

Note

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

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

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

– Select “Mode 7: Check test results of components that are continuously monitored”.

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

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

♦ SAE P0xxx DTCs ⇒ “3.4.1 SAE P0xxx DTCs”, page 42.

♦ SAE P1xxx DTCs ⇒ “3.4.2 SAE P1xxx DTCs”, page 90.

♦ SAE P2xxx DTCs ⇒ “3.4.3 SAE P2xxx DTCs”, page 98.

♦ SAE P3xxx DTCs ⇒ “3.4.4 SAE P3xxx DTCs”, page 118.

♦ SAE U0xxx DTCs ⇒ “3.4.5 SAE U0xxx DTCs”, page 120.

– Switch the ignition off.

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

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

Diagnostic Mode 08, TID $01

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

Note

Depending on scan tool and protocol used, diagnostic mode 08 and the information provided may be referred to by a different name.

Note

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

Test requirements

• No DTCs stored in the DTC memory.

• Intake Air Temperature (IAT) maximum 60° C.

• Coolant temperature 80 tp 110° C.

• Throttle valve angle 12.0 to 16.0%.

Procedure

– Connect the scan tool.

– Start the engine and run at idle for at least 15 minutes.

– Select “Mode 8: Tank Leak Test”.

– Select “Test-ID 01: Tank Leak Test”.

– Check the specified value of the tank leak test at idle.

– The following will be displayed on the scan tool screen:

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

– Switch the ignition off.

If the specified value is obtained:

– Refer to “Diagnostic mode 03: Interrogating fault memory ” to check for any DTC's that may be stored.

– To repeat the tank test, switch the ignition off and start the engine again and let run for 15 minutes at idle.

– Switch the ignition off.

– End of diagnosis.

3.3.10 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 DTCs stored in the DTC memory.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select “Mode 09: Vehicle information”.

– Select the desired “Test-ID”.

– The information requested will be displayed on the scan tool screen.

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

Test-ID	Diagnostic text
02:	Vehicle identification number e.g.
	♦ A different 17 digit number will be displayed for each vehicle
04:	Calibration identification e.g.
	♦ Engine Control Module (ECM)
	♦ Transmission Control Module (TCM)
06:	CVN (check sum) e.g.
	♦ EC5AE460 the check sum is different for every control module version
	♦ 000D105
08:	In Use Performance Tracking

– Switch the ignition off.

– End of diagnosis.

3.3.11 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

⇒ “3.4.1 SAE P0xxx DTCs”, page 42

⇒ “3.4.2 SAE P1xxx DTCs”, page 90

⇒ “3.4.3 SAE P2xxx DTCs”, page 98

⇒ “3.4.4 SAE P3xxx DTCs”, page 118

⇒ “3.4.5 SAE U0xxx DTCs”, page 120

3.4.1 SAE P0xxx DTCs

Fuel, air mixture, and additional emissions regulations

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 (A) Cam shaft Position Slow Response Bank 1	– Check Camshaft Adjustment Valve 1 -N205- .	Adjustment angle difference < 5.3...6.6 °CA/s	• Engine speed, > 550 RPM • ECT, >-7.5° C • Time after engine start, >3.5 Sec. • Number of checks 3 • number of checks@normal operation 3 • Time length for more than 1.5 Sec. • Camshaft position change, >4° CA	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
P000B	Intake (B) Cam shaft Position Slow Response Bank 1	– Check Camshaft Adjustment Valve 1 (exhaust) -N318- .	Adjustment angle difference < 5.3...6.6 °CA/s	• Engine speed, > 550 RPM • ECT, >-7.5° C • Time after engine start, >3.5 Sec. • Number of checks 3 • number of checks@normal operation 3 • Time length for more than 1.5 Sec.	2 Sec	• Continuous • 2 DCY
P000C	Intake (A) Cam shaft Position Slow Response Bank 2	– Check Camshaft Adjustment Valve 2 -N208- .	Adjustment angle difference < 5.3...6.6 °CA/s	• Engine speed, > 550 RPM • ECT, >-7.5° C • Time after engine start, >3.5 Sec. • Number of checks 3 • number of checks@normal operation 3 • Time length for more than 1.5 Sec. • Camshaft position change, >4° CA	2 Sec	• Continuous • 2 DCY
P000D	Intake (B) Cam shaft Position Slow Response Bank 2	– Check Camshaft Adjustment Valve 2 (exhaust) -N319- .	Adjustment angle difference < 5.3...6.6 °CA/s	• Engine speed, > 550 RPM • ECT, >-7.5° C • Time after engine start, >3.5 Sec. • Number of checks 3 • number of checks@normal operation 3 • Time length for more than 1.5 Sec.	2 Sec	• Continuous • 2 DCY
P008A	Fuel System Pressure Sensor Low pressure system	– Check Low Fuel Pressure Sensor -G410- .	Actual pressure, < 0.08 MPa	--	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
P008B	Fuel System Pressure Sensor Low pressure system	– Check Low Fuel Pressure Sensor - G410- .	Actual pressure, > 0.08 MPa	--	5 Sec	• Continuous • 2 DCY
P0010	Intake (A) Camshaft Position Actuator Circuit / Open (Bank 1)	– Check Camshaft Adjustment Valve 1 -N205- .	Signal voltage 4.4-5.6 V	• Camshaft valve, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Continuous • 2 DCY
P0011	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1)	– Check Camshaft Adjustment Valve 1 -N205- .	Adjustment angle difference > 8 …10 °CA	• Engine speed, > 550 RPM • ECT, >-7.5° C • Time after engine start, >3.5 Sec. • Number of checks 3 • number of checks@normal operation 3 • Time length for more than 1.5 Sec.	2 Sec	• Continuous • 2 DCY
P0013	"B" Camshaft Position – Actuator Circuit Bank	– Check Camshaft Adjustment Valve 1 (exhaust) - N318- .	Signal voltage 4.4...5.6 V	• Camshaft valve, Off • Engine speed, > 80 RPM	0.5 Sec	• Continuous • 2 DCY
P0014	"B" Camshaft Position – Timing Over-Advanced or System Performance Bank 1	– Check Camshaft Adjustment Valve 1 (exhaust) - N318- .	Adjustment angle difference >8...10 °CA/s	• Engine speed, > 550 RPM • ECT, >-7.5° C • Time after engine start, > 3.5 Sec. • Number of checks 3 • number of checks@normal operation 3 • Time length for more than 1.5 Sec.	2 Sec	• Continuous • 2 DCY
P0016	Crankshaft Position – Camshaft Position Correlation Bank 1 Sensor A	– Check Camshaft Adjustment Valve 1 -N205- .	Adaptive value at limit >11° CA	• Engine speed, <1000 RPM • Engine load, <30% • ECT, -15–110° C • Time after engine start, >5 Sec.	0.6 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
P0017	Crankshaft Position – Camshaft Position Correlation Bank 1 Sensor B	– Check Camshaft Adjustment Valve 1 (exhaust) - N318- .	Adaptive value at limit >11° CA	• Engine speed, <1000 RPM • Engine load, <30% • ECT, -15–110° C • Time after engine start, >5 Sec.	0.6 Sec.	• Multiple • 2 DCY
P0018	Crankshaft Position – Camshaft Position Correlation Bank 2 Sensor A	– Check Camshaft Adjustment Valve 2 -N208- .	Adaptive value at limit >11° CA	• Engine speed, <1000 RPM • Engine load, <30% • ECT, -15–110° C • Time after engine start, >5 Sec.	0.6 Sec	• Multiple • 2 DCY
P0019	Crankshaft Position – Camshaft Position Correlation Bank 2 Sensor B	– Check Camshaft Adjustment Valve 2 (exhaust) - N319- .	Adaptive value at limit >11° CA	• Engine speed, <1000 RPM • Engine load, <30% • ECT, -15–110° C • Time after engine start, > 5 Sec.	0.6 Sec	• Multiple • 2 DCY
P0020	"A" Camshaft Position Actuator Circuit Bank 2	– Check Camshaft Adjustment Valve 2 -N208- .	Signal voltage 4.4...5.6 V	• Camshaft valve, Commanded off • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P0021	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 2)	– Check Camshaft Adjustment Valve 2 -N208- .	Adjustment angle difference > 8 …10 °CA	• Engine speed, > 550 RPM • ECT, >-7.5° C • Time after engine start, > 3.5 Sec. • Number of checks 3 • number of checks@normal operation 3 • Time length for more than 1.5 Sec.	2 Sec	• Continuous • 2 DCY
P0023	"B" Camshaft Position – Actuator Circuit Bank 2	– Check Camshaft Adjustment Valve 2 (exhaust) - N319- .	Signal voltage 4.4...5.6 V	• Camshaft valve, Off • Engine speed, >80 RPM	0.5 Sec	• Continuous • 2 DCY
P0024	"B" Camshaft Position – Timing Over-Advanced or System Performance Bank 2	– Check Camshaft Adjustment Valve 2 (exhaust) - N319- .	Adjustment angle difference >8...10 °CA/s	• Engine speed, >550 RPM • ECT, >-7.5° C • Time after engine start, >3.5 Sec. • Number of checks 3 • Time length for more than 1.5 Sec.	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
P0030	HO2S Heater Control Circuit (Bank 1, Sensor 1)	– Check Oxygen Sensor (O2S) Heater -Z19- .	Signal voltage > 4.4-5.6 V	• Heater, Commanded off • Engine speed, >40 RPM	5 Sec	• Multiple • 2 DCY
P0031	HO2S Heater Control Circuit Low (Bank 1, Sensor 1)	– Check Oxygen Sensor (O2S) Heater -Z19- .	Signal voltage < 2.15-2.25 V	• Heater, Commanded off • Engine speed, >40 RPM	5 Sec	• Multiple • 2 DCY
P0032	HO2S Heater Control Circuit High (Bank 1, Sensor 1)	– Check Oxygen Sensor (O2S) Heater -Z19- .	Heater current, > 2.2 A	• Heater, Commanded on • Engine speed, >40 RPM	5 Sec	• Multiple • 2 DCY
P0036	HO2S Heater Control Circuit (Bank 1, Sensor 2)	– Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter(TWC)) Heater - Z29- .	Heater voltage, 4.4-5.6 V	• Heater, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Multiple • 2 DCY
P0037	HO2S Heater Control Circuit Low (Bank 1, Sensor 2)	– Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater - Z29- .	Signal voltage, <2.15-3.25 V	• Heater, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Multiple • 2 DCY
P0038	HO2S Heater Control Circuit High (Bank 1, Sensor 2)	– Oxygen Sensor (O2S) 1 (behind Three Way Catalytic Converter (TWC)) Heater - Z29- .	Signal current, > 3 A	• Heater, Commanded on • Engine speed, >40 RPM	0.5 Sec	• Multiple • 2 DCY
P0050	HO2S Heater Control Circuit Bank 2 Sensor 1	– Check Oxygen Sensor (O2S) 2 Heater - Z28- .	Signal voltage > 4.4-5.6 V	• Heater, Commanded off • Engine speed, >40 RPM	5 Sec	• Multiple • 2 DCY
P0051	HO2S Heater Control Circuit Low Bank 2 Sensor 1	– Check Oxygen Sensor (O2S) 2 Heater - Z28- .	Signal voltage < 2.15-2.25 V	• Heater, Commanded off • Engine speed, >40 RPM	5 Sec	• Multiple • 2 DCY
P0052	HO2S Heater Control Circuit High Bank 2 Sensor 1	– Check Oxygen Sensor (O2S) 2 Heater - Z28- .	Heater current, > 2.2 A	• Heater, Commanded on • Engine speed, >40 RPM	5 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
P0056	HO2S Heater Control Circuit Bank 2 Sensor 2	– Check Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater - Z30- .	Heater voltage, 4.4-5.6 V	• Heater, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Multiple • 2 DCY
P0057	HO2S Heater Control Circuit Low Bank 2 Sensor 2	– Check Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater - Z30- .	Signal voltage, <2.15-3.25 V	• Heater, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Multiple • 2 DCY
P0058	HO2S Heater Control Circuit High Bank 2 Sensor 2	– Check Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater - Z30- .	Signal current, > 3 A	• Heater, Commanded on • Engine speed, >40 RPM	0.5 Sec	• Multiple • 2 DCY
P0070	Ambient Air Temperature Sensor,		ambient temperature < -50° C	CAN active	6 Sec	• Continuous • 2 DCY
P0071	Ambient Air Temperature Sensor,		• ambient temperature minus engine temperature @ engine start >40…25 K	• engine off time >6….18 H • ambient air temperature @ engine start <40…25 K • engine temperature @ engine start < 1.5° C • time since engine start >60 Sec • ambient temperature @ engine start <= 5.25° C • vehicle speed > 25 MPH • for time >30 Sec • intake air temperature@ engine start <= 5.25° C	0 Sec	• Once/ DCY • 2 DCY
P0072	Ambient Air Temperature Sensor,		ambient temperature > 87° C	CAN active	6 Sec	• Continuous • 2 DCY
P0087	Fuel Rail/ System Pressure – Too Low	– Check Low Fuel Pressure Sensor - G410- .	• Pressure control activity, > 0.28 MPa • Fuel trim activity, 0.9...2 • Difference between actual pressure – Target pressure < -1.2MPa	• Lambda control, Closed loop • EVAP purge flow, < 15 kg/h • ECT > 60° C • IAT < 60° C • Engine speed, 500...900 RPM • Engine load, 10...20% • Fuel cut off, Not active	10 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 Fuel Pressure Sensor - G247-.	• Difference between actual pressure – Target pressure <-0.2 MPa • Difference between actual pressure - Target pressure >0.15 MPa • Pressure control activity > 0.450 <- 0.250 MPa	• Time after engine start, 60 Sec. • Fuel cut off, Not active • Time after fuel cut off, 20 Sec. • Time after engine start, 60 Sec.	• 6 Sec • 5 Sec • 120 Sec	• Continuous • 2 DCY
P0100	2 MAF Sensors MAF 1 MAF 2		PWM time length 0 uSec	engine speed > 80 RPM	1 Sec	• Continuous • 2 DCY
P0101	2 MAF Sensors MAF 1		• mass air flow HFM2 vs. lower threshold map HFM2 < 0 .. 450 kg/h • mass air flow HFM2 vs. upper threshold map > 55… 1082	• DTC P1009 (Map) detected • engine speed 1300 .. 5000 RPM • throttle position > 12% • vehicle speed 19 .. 99 MPH	2 Sec	• multiple • 2 DCY
P0102	2 MAF Sensors MAF 1 MAF 2		PWM time length < 83 uSec	engine speed > 80 RPM	1 Sec	• Continuous • 2 DCY
P0103	2 MAF Sensors MAF 1 MAF 2		PWM time length > 4500 uSec	engine speed > 80 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
P0111	Intake Air Temperature Sensor 1 Circuit Rationality Check		IAT minus engine tempeture @ engine start and IAT minus ambient air temperature @ engine start > 40…25 K	• engine off time >6….18 H • ambient air temperature @ engine start <40…25 K • engine temperature @ engine start < 1.5° C • time since engine start >60 Sec • ambient temperature @ engine start <= 5.25° C • vehicle speed > 25 MPH • for time >30 Sec • intake air temperature @ engine start <= 5.25° C	0 Sec	• Once/ DCY • 2 DCY
P0112	Intake Air Temperature Sensor 1 Circuit Low		IAT > 125.0° C	---	2 Sec	• Continuous • 2 DCY
P0113	Intake Air Temperature Sensor 1 Circuit High		IAT < - 36° 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
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance		• delta ECT < 3K • engine temperature minus ambient air temperature @ engine start and engine temperature minus IAT @ engine start > 40…25 K	• ECT @ start > 50° C • driving condition one time > 600 Sec • vehicle speed 0…. 99 MPH • mass air flow 0….. 1000 kg/h • and if " no pass result during driving" • ignition off > 600 Sec • engine off time >6….18 H • |intake air temperature @ engine start < 40…25° C • minus ambient air temperature @ engine start| • engine temperature @ engine start < 1.5° C • minus engine temperature @ condition: 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	600 Sec	• Once/ DCY • 2 DCY
P0117	Engine Coolant Temperature Sensor 1 Circuit Low		Short to ground-ECT > 141° C	--	2 Sec	• Continuous • 2 DCY
P0118	Engine Coolant Temperature Sensor 1 Circuit High		Short to battery positive or open circuit-ECT < -45.75° 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	Throttle Position Sensor 1 Bank 1 Bank 2		• TPS1 – TPS 2 > 6.3% • and actual TPS 1 - calc. value > actual TPS 2 - calc. value 1 % • actual TPS 1 - calc. value > 9%	• TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480 RPM • OR • engine speed > 1200 RPM • TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480 RPM	0.42 Sec	• Continuous • 2 DCY
P0122	Throttle Position Sensor 1 Bank 1 Bank 2		signal voltage < 0.313 V	--	14 Sec	• Continuous • 2 DCY
P0123	Throttle Position Sensor 1 Bank 1 Bank 2		signal voltage > 4.69 V	---	14 Sec	• Continuous • 2 DCY
P0130	O2 Sensor Circuit		• sensor element temperature < 640° C • OR • heater resistance > 950 Ω	• exhaust gas temp. > 330° C • fuel cut off not active	13 Sec	• multiple • 2 DCY
P0131	O2 Sensor Circuit , Bank 1- Sensor 1 Low Voltage		• virtual mass (VM) voltage < 2 V • Nernst voltage (UN) < 1.75 V • adjustment voltage (IA) < 0.3 V • adjustment voltage (IP) < 0.3 V	engine speed > 25 RPM	2 Sec	• Continuous • 2 DCY
P0132	O2 Sensor Circuit High Voltage		• virtual mass (VM) voltage >3 V • Nernst voltage (UN) > 4 V • adjustment voltage (IA) > 1.5 V • adjustment voltage (IP) > 1.5 V	engine speed > 25 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
P0133	O2 Circuit Slow Response		• lower value of both area ratios R2L and L2L in case of symmetric fault < 0.4 • AND • lower value of both counters for area ratio R2L and L2R >= 5	• O2S front -- min.operation temperatur is reached > 720°C (for LSU 4.9) • O2S front – time since operation readiness > 10 Sec • O2S front no sensor fault detected in current driving cycle • engine speed 1200 ... 3520 RPM • engine load 15 ... 70% • exhaust system lag time calculation 0.07 … 0.35 Sec • load gradient threshold <= 10% • gradient of exhaust system lag time calculation <=0.5% • ECT >= 50.3° C • 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 • misfire monitor no fault • canister purge valve no fault • SAIR no fault • EGR no fault • Fuel System additive adaption no fault • VVT no fault • relative fuel amount from transient compensation (wall-applied fuel dynamics and canister purge dynamics) <= 0.1	60 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
P0135	O2 Sensor Heater Circui		• sensor element temperature < 720° C	• heater control active • heater duty cycle 100% • fuel cut off not active • exhaust gas temp. > 300° C • time after engine start > 50 Sec • engine shut off time > 300 Sec • ECT@start > -9.8° C • fuel cut off not active	45 Sec	• multiple • 2 DCY
P0136	Oxygen Sensor rear Bank 1 Bank 2		• delta O2S signal rear > 2 V • number of heater coupling faults > 4	• O2S rear ready • exhaust gas temp. 250 ... 800° C • for > 30 Sec • engine speed > 25 RPM	50 Sec	• multiple • 2 DCY
P0137	O2 Sensor Circuit (Bank 1, Sensor 2)		• signal voltage < 60 mV warm engine conditions	• O2S rear dewpoint exceeded • O2S rear fully heated up • engine speed > 25 RPM • exhaust gas temp. 250 ... 800° C • for > 30 Sec	60 Sec	• multiple • 2 DCY
P0138	O2 Circuit High Voltage		signal voltage > 1.3	• O2S rear dewpoint exceeded • O2S rear fully heated up • engine speed > 25 RPM • exhaust gas temp. 250 ... 800° C • for > 30 Sec	5.1 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
P0139	O2 Circuit Slow Response		• O2S rear signal not oscillating at reference 635...659 mV • O2S signal rear during fuel cut off > 200 mV	• mass air flow 17.5...140 kg/h • O2S rear readiness > 30 Sec • modeled exhaust gas temp. > 350° C • fuel cut off > 3.5 Sec • O2S signal rear > 580 mV • O2S rear readiness > 30 • modeled exhaust gas temp. > 350° C	125 Sec	• multiple • 2 DCY
P0140	O2 Circuit No Activity Detected		• signal voltage 401 .. 499 mV • exhaust gas temp. > 600° C • and O2S rear internal resistance > 20KΩ	• O2S rear ready • exhaust gas temp. 250 ... 800° C • for > 30 Sec • engine speed > 25 RPM	200 Sec	• multiple • 2 DCY
P0141	HO2S Heater Control Circuit High Bank 2 Sensor 2	– Check Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater - Z30- .	• heater resistance 0.88 ... 31.2KΩ • depends on catalyst temp.	• modeled exhaust gas temp. 270… 600° C • heater commanded on • engine shut off time >300 Sec • IAT > - 8.3° C	10 Sec	• multiple • 2 DCY
P0150	O2 Sensor Circuit		• sensor element temperature < 640° C • OR • heater resistance > 950 Ω	• exhaust gas temp. > 330° C • fuel cut off not active	13 Sec	• multiple • 2 DCY
P0151	O2 Sensor Circuit , Bank 1-Sensor 1 Low Voltage		• virtual mass (VM) voltage < 2 V • Nernst voltage (UN) < 1.75 V • adjustment voltage (IA) < 0.3 V • adjustment voltage (IP) < 0.3 V	engine speed > 25 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
P0152	O2 Sensor Circuit High Voltage		• virtual mass (VM) voltage >3 V • Nernst voltage (UN) > 4 V • adjustment voltage (IA) > 1.5 V • adjustment voltage (IP) > 1.5 V RPM	engine speed > 25 RPM	2 Sec	• Continuous • 2 DCY
P0153	O2 Circuit Slow Response		• lower value of both area ratios R2L and L2L in case of symmetric fault < 0.4 • AND • lower value of both counters for area ratio R2L and L2R >= 5	• O2S front -- min.operation temperatur is reached > 720°C (for LSU 4.9) • O2S front – time since operation readiness > 10 Sec • O2S front no sensor fault detected in current driving cycle • engine speed 1200 ... 3520 RPM • engine load 15 ... 70% • exhaust system lag time calculation 0.07 … 0.35 Sec • load gradient threshold <= 10% • gradient of exhaust system lag time calculation <=0.5% • ECT >= 50.3° C • 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 • misfire monitor no fault • canister purge valve no fault • SAIR no fault • EGR no fault • Fuel System additive adaption no fault • VVT no fault • relative fuel amount from transient compensation (wall-applied fuel dynamics and canister purge dynamics) <= 0.1	60 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
P0155	O2 Sensor Heater Circuit		• sensor element temperature < 720° C	• heater control active • heater duty cycle 100% • fuel cut off not active • exhaust gas temp. > 300° C • time after engine start > 50 Sec • engine shut off time > 300 Sec • ECT@start > -9.8° C • fuel cut off not active	45 Sec	• multiple • 2 DCY
P0156	Oxygen Sensor rear Bank 1 Bank 2		• delta O2S signal rear > 2 V • number of heater coupling faults > 4	• O2S rear ready • exhaust gas temp. 250 ... 800° C • for > 30 Sec • engine speed > 25 RPM	50 Sec	• multiple • 2 DCY
P0157	O2 Sensor Circuit, Bank 2- Sensor 2 Low Voltage		• signal voltage < 60 mV warm engine conditions	• O2S rear dewpoint exceeded • O2S rear fully heated up • engine speed > 25 RPM • exhaust gas temp. 250 ... 800° C • for > 30 Sec	60 Sec	• multiple • 2 DCY
P0158	O2 Sensor Circuit, High Voltage		signal voltage > 1.3	• O2S rear dewpoint exceeded • O2S rear fully heated up • engine speed > 25 RPM • exhaust gas temp. 250 ... 800° C • for > 30 Sec	5.1 Sec	• multiple • 2 DCY
P0159	O2 Sensor Circuit, Slow Response		• O2S rear signal not oscillating at reference 635...659 mV • O2S signal rear during fuel cut off > 200 mV	• mass air flow 17.5...140 kg/h • O2S rear readiness > 30 Sec • modeled exhaust gas temp. > 350° C • fuel cut off > 3.5 Sec • O2S signal rear > 580 mV • O2S rear readiness > 30 • modeled exhaust gas temp. > 350° C	125 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
P0160	O2 Sensor Circuit No Activity Detected		• signal voltage 401 .. 499 mV • exhaust gas temp. > 600° C • and O2S rear internal resistance > 20KΩ	• O2S rear ready • exhaust gas temp. 250 ... 800° C • for > 30 Sec • engine speed > 25 RPM	200 Sec	• multiple • 2 DCY
P0161	HO2S Heater Control Circuit High Bank 2 Sensor 2	– Check Oxygen Sensor (O2S) 2 (behind Three Way Catalytic Converter (TWC)) Heater - Z30- .	• heater resistance 0.88 ... 31.2KΩ • depends on catalyst temp.	• modeled exhaust gas temp. 270… 600° C • heater commanded on • engine shut off time >300 Sec • IAT > - 8.3° C	10 Sec	• multiple • 2 DCY
P0171	Fuel System additive Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air) .	adaptive value > 5 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed < 880 RPM • mass air flow < 20 kg/h	45 Sec	• Continuous • 2 DCY
P0171	Fuel System multiplicative Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air) .	adaptive value > - 20 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed 1200...3720 RPM • mass air flow 22.5...110 kg/h	45 Sec	• Continuous • 2 DCY
P0172	Fuel System additive Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air).	adaptive value < 5 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed < 880 RPM • mass air flow < 20 kg/h	45 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	Fuel System multiplicative Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air).	adaptive value < - 20 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed 1200...3720 RPM • mass air flow 22.5...110 kg/h	45 Sec	• Continuous • 2 DCY
P0174	Fuel System additive Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air).	adaptive value > 5 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed < 880 RPM • mass air flow < 20 kg/h	45 Sec	• Continuous • 2 DCY
P0174	Fuel System multiplicative Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air).	adaptive value > - 20 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed 1200...3720 RPM • mass air flow 22.5...110 kg/h	45 Sec	• Continuous • 2 DCY
P0175	Fuel System additive Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air).	adaptive value < 5 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed < 880 RPM • mass air flow < 20 kg/h	45 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
P0175	Fuel System multiplicative Bank 1 Bank 2	– Check the Fuel pressure regulator and residual pressure. – Check intake system for leaks (false air) .	adaptive value < - 20 %	• lambda control closed loop • evap purge valve closed • ECT > 60° C • or substitute ECT • IAT < 60° C • engine speed 1200...3720 RPM • mass air flow 22.5...110 kg/h	45 Sec	• Continuous • 2 DCY
P0190	Fuel Rail Pressure Sensor	– Check Fuel Pressure Sensor - G247- .	signal voltage > 4.8 V	--	0.5 Sec	• Continuous • 2 DCY
P0191	Fuel Rail Pressure Sensor	– Check Fuel Pressure Sensor - G247-	Rail pressure > 13.5 mPa	--	5 Sec	• Continuous • 2 DCY
P0192	Fuel Rail Pressure Sensor	– Check Fuel Pressure Sensor - G247- .	signal voltage < 0.2 V	--	0.5 Sec	• Continuous • 2 DCY
P0221	Throttle Position Sensor 2 Bank 1 Bank 2		• TPS - TPS 2 > 6.3% • actual TPS 2 - calc. value > actual TPS 1 - calc. value • actual TPS 2 - calc. value > 9%	• TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480 or engine speed > 1200 • TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480	0.42 Sec	• Multiple • 2 DCY
P0222	Throttle Position Sensor 2 Bank 1 Bank 2		signal voltage < 0.215 V	--	0.14 Sec	• Continuous • 2 DCY
P0223	Throttle Position Sensor 2 Bank 1 Bank 2		signal voltage > 4.78 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
P0201	Injector Circuit / Open – Cylinder 1	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0202	Injector Circuit / Open – Cylinder 2	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0203	Injector Circuit / Open - Cylinder 3	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0204	Injector Circuit / Open – Cylinder 4	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0205	Injector Circuit / Open – Cylinder 5	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0206	Injector Circuit / Open - Cylinder 6	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0207	Injector Circuit / Open – Cylinder 7	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0208	Injector Circuit / Open - Cylinder 8	– Check the Fuel injectors - N84,N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	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
P0209	Injector Circuit / Open – Cylinder 9	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0210	Injector Circuit / Open - Cylinder 10	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 2.6 A • engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P0261	Injection Valves – low side cylinder #1	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0262	Injection Valves - low side cylinder #1	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0264	Injection Valves – low side cylinder #2	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0265	Injection Valves - low side cylinder #2	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0267	Injection Valves – low side cylinder #3	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0268	Injection Valves – low side cylinder #3	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current > 14.7 A	• injection valve commanded on • 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
P0270	Injection Valves – low side cylinder #4	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0271	Injection Valves – low side cylinder #4	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0273	Injection Valves – low side cylinder #5	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0274	Injection Valves - low side cylinder #5	– Check the Fuel injectors -N30, N31, N32, N33, N84, N84, N85, N86- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0276	Injection Valves – low side cylinder #6	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0277	Injection Valves – low side cylinder #6	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0279	Injection Valves - low side cylinder #7	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0280	Injection Valves – low side cylinder #7	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current > 14.7 A	• injection valve commanded on • 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
P0282	Injection Valves – low side cylinder #8	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0282 3	Injection Valves - low side cylinder #8	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0285	Injection Valves – low side cylinder #9	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0286	Injection Valves - low side cylinder #9	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0288	Injection Valves – low side cylinder #10	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current < 2.1 A	• injection valve commanded on • high pressure system current > 4.2 A • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P0289	Injection Valves - low side cylinder #10	– Check the Fuel injectors -N84, N85, N86, N299, N300- .	signal current > 14.7 A	• injection valve commanded on • engine speed > 80 RPM	2 Sec	• Continuous • 2 DCY
P010B	(MAF 2)		• mass air flow HFM2 vs. lower threshold map HFM2 < 0 .. 450 kg/h • mass air flow HFM2 vs. upper threshold map > 55… 1082	• DTC P1009 (Map) detected • engine speed 1300 .. 5000 RPM • throttle position > 12% • vehicle speed 19 .. 99 MPH	2 Sec	• Multiple • 2 DCY
P010C	2 MAF Sensors MAF 1 MAF 2		PWM time length < 83 uSec	engine speed > 80 MPH	1 Sec	• Continuous • 2 DCY
P010D	2 MAF Sensors MAF 1 MAF 2		PWM time length > 4500 uSec	engine speed > 80 MPH	1 Sec	• Continuous • 2 DCY
P010E	2 MAF Sensors MAF 1 MAF 2		PWM time length 0 uSec	engine speed > 80 MPH	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
P018A	Fuel Rail Pressure Sensor	– Check Fuel Pressure Sensor - G247- .	signal voltage > 4.8 V	---	0.5 Sec	• Continuous • 2 DCY
P018B	Fuel Rail Pressure Sensor	– Check Fuel Pressure Sensor - G247- .	Rail pressure > 13.5 mPa	---	5 Sec	• Continuous • 2 DCY
P018C	Fuel Rail Pressure Sensor	– Check Fuel Pressure Sensor - G247- .	signal voltage < 0.2 V	---	0.5 Sec	• Continuous • 2 DCY
P025A	Fuel Pump Open circuit		signal voltage > 4.4 .. 5.6 V	engine speed > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P025C	Fuel Pump short to ground		signal voltage < 2.15 .. 3.25 V	engine speed > 40 RPM	0.43 Sec	• Continuous • 2 DCY
P025D	Fuel Pump short to B+		signal current > 1.1 A	engine speed > 40 RPM	0.5 Sec	• Continuous • 2 DCY

Ignition System

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 fuel injectors. – Check Ignition Coils with Power Output Stage. – Check Spark plugs. – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.
P0301	Cylinder 1 Misfire Detected	– Check fuel injector - N30-. – Check Ignition Coil with Power Output Stage - N70- . – Check Spark plugs. – Check the intake system for leaks . – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.

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 fuel injector - N31- . – Check Ignition Coil with Power Output Stage - N127- . – Check Spark plugs. – Check the intake system for leaks . – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.
P0303	Cylinder 3 Misfire Detected	– Check fuel injector - N32- . – Check Ignition Coil with Power Output Stage - N291- . – Check Spark plugs. – Check the intake system for leaks. – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.

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 fuel injector - N33- . – Check Ignition Coil with Power Output Stage - N292- . – Check Spark plugs. – Check the intake system for leaks . – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.
P0305	Cylinder 5 Misfire Detected	– Check fuel injector - N83- . – Check Ignition Coil with Power Output Stage - N323- . – Check Spark plugs. – Check the intake system for leaks. – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0306	Cylinder 6 Misfire Detected	– Check fuel injector - N84- . – Check Ignition Coil with Power Output Stage - N324- . – Check Spark plugs. – Check the intake system for leaks . – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.
P0307	Cylinder 7 Misfire Detected	– Check fuel injector - N85- . – Check Ignition Coil with Power Output Stage - N325- . – Check Spark plugs. – Check the intake system for leaks. – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0308	Cylinder 8 Misfire Detected	– Check fuel injector - N86- . – Check Ignition Coil with Power Output Stage - N326- . – Check Spark plugs. – Check the intake system for leaks . – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.
P0309	Cylinder 9 Misfire Detected	– Check fuel injector - N299- . – Check Ignition Coil with Power Output Stage - N327- . – Check Spark plugs. – Check the intake system for leaks . – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0310	Cylinder 10 Misfire Detected	– Check fuel injector - N300- . – Check Ignition Coil with Power Output Stage - N328- . – Check Spark plugs. – Check the intake system for leaks . – Check fuel pump delivery and quantity . – Check Fuel pressure regulator and residual pressure before high pressure fuel pumps . Refer to Repair Manual.	• Emission threshold 1st interval %(MR), > 1.9% • calibrated threshold 1st interval misfire rate (MR) > 1.5% • Catalyst damage misfire rate (MR), > 5%	• Time after engine start, 0 • camshaft revolution 1 Rev • Engine speed range, idle150-8500 RPM •Engine torque, > 0 (Nm) • Fuel cut off, Not active • ECT at start, > -9° C • If ECT at start, < -9° C then wait until actual ECT, > 18° C •IAT > -48° C	• 1000 Rev. • 200 Rev.	• Continuous • 2 DCY • Immed.
P0321	Ignition/ Distributor Engine Speed Input Circuit Range/ Performance	– Check Engine Speed (RPM) Sensor -G28- .	• Counted versus referenced teeth, > 1 • Reference gap during engine start, not detected • Teeth during engine start, detected • Reference gap at normal operation, lost	• Engine speed, >0 RPM • Crankshaft revolutions, 2 revs	0.5 Sec	• Continuous • 2 DCY
P0322	Ignition/ Distributor Engine Speed Input Circuit No Signal	– Check Engine Speed (RPM) Sensor -G28- .	• Engine speed, No signal • Phase signal, O.K.	• Camshaft revolutions, 4 revs	0.5 Sec	• Continuous • 2 DCY
P0341	Camshaft Position Sensor A Circuit Range/ Performance (Bank 1 or single sensor)	– Check Camshaft Position (CMP) Sensor - G40- .	Phase changes last 10 revs < 11 or > 13	—	0.5 Sec	• Continuous • 2 DCY
P0342	Camshaft Position Sensor A Circuit Low Input (Bank 1 or single sensor)	– Check Camshaft Position (CMP) Sensor - G40- .	Signal low voltage, 10 Rev.	—	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
P0343	Camshaft Position Sensor A Circuit High Input (Bank 1 or single sensor)	– Check Camshaft Position (CMP) Sensor - G40- .	Signal voltage high, 10 rev.	—	0.5 Sec	• Continuous • 2 DCY
P0346	Camshaft Position Sensor "A" Circuit Range/ Performance Bank 2	– Check Camshaft Position (CMP) Sensor 2 - G163- .	Phase changes last 10 revs < 11 or > 13	—	0.5 Sec	• Continuous • 2 DCY
P0347	Camshaft Position Sensor "A" Circuit Low Bank 2	– Check Camshaft Position (CMP) Sensor 2 - G163- ..	Signal low voltage, 10 Rev.	—	0.5 Sec	• Continuous • 2 DCY
P0348	Camshaft Position Sensor "A" Circuit High Bank 2	– Check Camshaft Position (CMP) Sensor 2 - G163- .	Signal voltage high, 10 rev.	—	0.5 Sec	• Continuous • 2 DCY
P0351	Ignition Coil A Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N70- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0352	Ignition Coil B Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N127- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0353	Ignition Coil C Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N291- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0354	Ignition Coil D Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N292- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0355	Ignition Coil "E" Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N323- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0356	Ignition Coil "F" Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N324- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	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
P0357	Ignition Coil "G" Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N325- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0358	Ignition Coil "H" Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N326- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0359	Ignition Coil "I" Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N327- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0360	Ignition Coil "J" Primary/ Secondary Circuit	– Check Ignition Coil with Power Output Stage - N328- .	Signal current, < 4.95...8.82 mA	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P0366	Camshaft Position Sensor "B" Circuit Range/ Performance Bank 1	– Check Camshaft Position (CMP) Sensor 3 - G300- .	Phase changes last 10 revs < 11 or > 13	—	0.5 Sec	• Continuous • 2 DCY
P0367	Camshaft Position Sensor "B" Circuit Low Bank 1	– Check Camshaft Position (CMP) Sensor 3 - G300- .	Signal low voltage, 10 Rev.	—	0.5 Sec	• Continuous • 2 DCY
P0368	Camshaft Position Sensor "B" Circuit High Bank 1	– Check Camshaft Position (CMP) Sensor 3 - G300- .	Signal voltage high, 10 rev.	—	0.5 Sec	• Continuous • 2 DCY
P0391	Camshaft Position Sensor "B" Circuit Range/ Performance Bank 2	– Check Camshaft Position (CMP) Sensor 4 - G301- .	Phase changes last 10 revs < 11 or > 13	—	0.5 Sec	• Continuous • 2 DCY
P0392	Camshaft Position Sensor "B" Circuit Low Bank 2	– Check Camshaft Position (CMP) Sensor 4 - G301- .	Signal low voltage, 10 Rev.	—	0.5 Sec	• Continuous • 2 DCY
P0393	Camshaft Position Sensor "B" Circuit High Bank 2	– Check Camshaft Position (CMP) Sensor 4 - G301- .	Signal voltage high, 10 rev.	—	0.5 Sec	• Continuous • 2 DCY

Additional exhaust regulation

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0410	Secondary Air Injection System	– Check Secondary Air Injection (AIR) Pump Motor -- V101-- . – Check Combination valve for secondary air injection (AIR). Refer to Repair Manual.	"difference of secondary air pressure during phase 3 to secondary air pressure before secondary air injection" > 30	• ECT @ engine start 5.3 .. 36° C • IAT > 5.3° C • altitude < 2700 M • mass air flow 138 .. 190 kg/h • engine shut off time > 550 Sec	30...60 Sec	• Once/ DCY • 2 DCY
P0413	Air Valve open circuit	– Check Secondary Air Injection (AIR) Solenoid Valve - N112- .	signal voltage > 5.6…4.4 V	• engine speed > 40 RPM	0.5 Sec	• Once/ DCY • 2 DCY
P0414	Air Valve short to B+	– Check Secondary Air Injection (AIR) Solenoid Valve - N112- .	signal current > 2.2 A	• relay commanded on • engine speed > 40 RPM	0.5 Sec	• Once/ DCY • 2 DCY
P0418	Secondary Air Injection System Control "A" Circuit	– Check Secondary Air Injection (AIR) Pump Relay -- J299-- .	Signal voltage > 4.4–5.6 V	• Pump relay, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Continuous • 1 DCY
P0419	Secondary Air Injection System Control "A" Circuit	– Check Secondary Air Injection (AIR) Pump Relay -- J299-- .	Signal voltage > 4.4–5.6 V	• Pump relay, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Continuous • 1 DCY
P0420	Catalyst System Efficiency Below Thresh old (Bank 1)	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter. – Check Three Way Catalytic Converter (TWC).	<1.0 -	• Ambient Temp. > -10° C • Delta mass airflow < 25 kg/h/s • EVAP purge flow < 30% • Mass air flow 50-210 kg/h • Engine speed, 1200-3720 RPM • Catalyst temp. 500-820° C • Delta catalyst temp -20 k/s	60 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
P0421	Catalyst System Efficiency (Bank 1)	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter. – Check Three Way Catalytic Converter (TWC).	• EWMA filter value for catalyst < 0.2	• Ambient Temp. > -10° C • Delta mass airflow < 25 kg/h/s • EVAP purge flow < 30% • Mass air flow 50-210 kg/h • Engine speed, 1200-3720 RPM • Catalyst temp. 500-820° C • Delta catalyst temp - 20 k/s	60 Sec	• Once/ DCY • 2 DCY
P0430	Warm Up Catalyst Efficiency Below Thresh old Bank 2	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter. – Check Three Way Catalytic Converter (TWC).	<1.0 -	• Ambient Temp. > -10° C • Delta mass airflow < 15 kg/h/s • EVAP purge flow < 30% • Mass air flow 30-100 kg/h • Engine speed, 1000-2200 RPM • Catalyst temp. 400-630° C • Delta catalyst temp - 15 k/s	60 Sec	• Once/ DCY • 2 DCY
P0431	Catalyst System Efficiency (Bank 1)	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter. – Check Three Way Catalytic Converter (TWC).	• EWMA filter value for catalyst < 0.2	• Ambient Temp. > -10° C • Delta mass airflow < 25 kg/h/s • EVAP purge flow < 30% • Mass air flow 50-210 kg/h • Engine speed, 1200-3720 RPM • Catalyst temp. 500-820° C • Delta catalyst temp - 20 k/s	60 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
P0441	Evaporative Emission System Incorrect Purge Flow	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . – Check Leak Detection Pump (LDP) -V144- . – Check Evaporative Emission (EVAP) Canister System for proper seal.	• Deviation lambda control < 6% • Deviation idle control < 20%	• Engine speed, Idle • Engine speed deviation, < 80 RPM • Time after engine start >350 Sec. • ECT >59.25° C Or substitute ECT >59.25° C • IAT >5.25° C • IAT at start >5.25° C	25 Sec	• Once/DCY • 2 DCY
P0442	Evaporative Emission System Leak Detected (Small Leak)	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . – Check Leak Detection Pump (LDP) -V144- . – Check Evaporative Emission (EVAP) Canister System for proper seal.	Time for pressure drop < 1.7-2.2 Sec	• EVAP purge valve, Closed • LDP, Activated • Altitude, <2700 m • IAT, >4° C • delta ambient pressure, <.25 kPa • IAT drop after engine start, <6 K • Time after engine start, 230–1200 Sec. • intake manifold vacuum, >15 kPa • ECT, 4–115° C • ECT at start, 4–35° C • Number of diagnostic attempts, 15 • Vehicle speed, >25 MPH • Selected gear, Any drive	140 Sec	• Once/ DCY • 2 DCY
P0444	Evaporative Emission System Purge Control Valve Circuit Open	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- .	Signal voltage > 4.4- 5.6 V	• Evap purge valve Commanded off • Engine speed > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P0449	Evaporative Emission System Vent Valve/ Solenoid Circuit	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . – Check Evaporative Emission (EVAP) Canister Purge Solenoid Valve 2 - N115- .	Signal voltage > 4.4- 5.5 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
P0455	Evaporative Emission System Leak Detected (gross leak/no flow)	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . – Check Evaporative Emission (EVAP) Canister Purge Solenoid Valve 2 -N115- . – Check Leak Detection Pump (LDP) -V144- . – Check Evaporative Emission (EVAP) Canister System for proper seal.	Time for pressure drop < 0.95 -1.1 Sec	• EVAP purge valve, Closed • LDP, Activated • Altitude, <2700 m • IAT, >4° C • delta ambient pressure, <.25 kPa • IAT drop after engine start, <6 K • Time after engine start, 230–1200 Sec. • intake manifold vacuum, >15 kPa • ECT, 4–115° C • ECT at start, 4–35° C • Number of diagnostic attempts, 15 • Vehicle speed, >25 MPH • Selected gear, Any drive	140 Sec	• Once/ DCY • 2 DCY
P0456	Evaporative Emission System Leak Detected (very small leak)	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . – Check Evaporative Emission (EVAP) Canister Purge Solenoid Valve 2 -N115- . – Check Leak Detection Pump (LDP) -V144- . – Check Evaporative Emission (EVAP) Canister System for proper seal.	time for pressure drop < 4 .. 5.5 Sec	• EVAP purge valve, Closed • LDP, Activated • Altitude, < 2600 m • IAT, > 4° C • delta ambient pressure, < 2.5 kPa • IAT drop after engine start, < 6 K • Time after engine start, 230–900 Sec. • intake manifold vacuum, > 15 kPa • ECT, 4–115° C • ECT at start, 4–35° C • Number of diagnostic attempts, 5 • Vehicle speed, 25...93 MPH • Selected gear, Any drive Additional: • Vehicle speed, 25–93 MPH • Vehicle acceleration, <3 m/s2 • Delta ambient pressure, <0.2 kPa • Delta engine load, <36%/seg.	140 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
P0458	Evaporative Emission System Purge Control Valve Circuit Low	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- . – Check Leak Detection Pump (LDP) -V144- . – Check Evaporative Emission (EVAP) Canister System for proper seal.	Signal voltage, 3.25.. 2.15 V	• Evap purge valve Commanded off • Engine speed > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P0459	Evaporative Emission System Purge Control Valve Circuit High	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve -N80- .	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 Bank 1	– Check Secondary Air Injection (AIR) Pump Motor --V101--. – Check Combination valve for secondary air injection (AIR). Refer to Repair Manual.	• Relative secondary air mass flow <0.047 • Relative secondary air mass flow , <0.05	• Mass air flow, 138...190 kg/h • ECT, 5.3–60° C • IAT, >5.3° C • Altitude, <2700 m • engine shut off time > 550 Sec	30–60 Sec	• Once/DCY • 2 DCY
P0492	Secondary Air Injection System Insufficient Flow Bank 2	– Check Secondary Air Injection (AIR) Pump Motor --V101--. – Check Combination valve for secondary air injection (AIR). Refer to Repair Manual.	• Relative secondary air mass flow <0.047 • Relative Secondary sir mass flow , <0.05	• Mass air flow, 138...190 kg/h • ECT, 5.3–60° C • IAT, >5.3° C • Altitude, <2700 m • engine shut off time > 550 Sec	30–60 Sec	• Once/DCY • 2 DCY
P0498	Evaporative Emission System Vent Valve Control Circuit Low	– Check Secondary Air Injection (AIR) Solenoid Valve -N112- .	Signal Voltage, < 3.01 V	• Evap purge valve Commanded off • 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
P0499	Evaporative Emission System Vent Valve Control Circuit High	– Check Secondary Air Injection (AIR) Solenoid Valve - N112- .	Signal current, 2.7-5.5 A	• Evap purge valve Commanded off • Engine speed > 40 RPM	0.5 Sec	• Continuous • 2 DCY

Speed and idle control

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0501	Vehicle Speed Sensor A Range/ Performance	– Check vehicle speed signal.	VSS signal, < 2.5 MPH	• Fuel cut off, Active • Engine speed, 1120-4520 RPM • ECT, >39.75° C	2.5 Sec	• Multiple • 2 DCY
P0506	Idle Air Control System RPM Lower Than Expected	– Check the Throttle Valve Control Modules.	• Engine speed deviation, < -80 RPM • AND Idle controller at upper limit 0.51%	• Engine speed, idle • Accelerator PP, 0% • Vehicle speed, 0 MPH • EVAP purge valve, Closed • Altitude, < 2700 m • IAT, >-10° C • ECT, >60° C • Engine load, < 24...40%	10 Sec	• Multiple • 2 DCY
P0507	Idle Air Control System RPM Higher Than Expected	– Check the Throttle Valve Control Modules.	• Engine speed deviation> 80 RPM • AND Idle controller at lower limit -7%	• Engine speed, idle • Accelerator PP, 0% • Fuel cut off, Not active • Vehicle speed, 0 MPH • external torque request not demanded • Altitude, < 2600 m • ECT, >60° C	10 Sec	• Multiple • 2 DCY
P050 A	Idle Air Control System RPM Lower Or Higher Than Expected	– Check the Throttle Valve Control Module - J338- .	• engine speed deviation < -200 RPM • AND • idle controller at max. value 0 .. 4.8%	• engine speed idle • vehicle speed 0 MPH • altitude <2700 • IAT > -10° • catalyst heating active • external torque request not demanded • engine load <45...60%	9 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
P052 A	Crankshaft Position – Camshaft Position Correlation Bank 1 Sensor A	– Check the Camshaft Position (CMP) Sensor - G40- .	difference between target position vs. actual position > 8° CA	• time after engine start >= 0.8…60 Sec • modelled oil temperature >= -273° C • Catalyst heating active • minimal adjustment > 8° CA • for longer than (cumulative) >= 12.75 Sec	5 Sec	• Once/DCY • 2 DCY
P052 C	Crankshaft Position – Camshaft Position Correlation Bank 1 Sensor A	– Check the Camshaft Position (CMP) Sensor - G40- .	difference between target position vs. actual position > 8° CA	• time after engine start >= 0.8…60 Sec • modelled oil temperature >= -273° C • Catalyst heating active • minimal adjustment > 8° CA • for longer than (cumulative) >= 12.75 Sec	5 Sec	• Once/DCY • 2 DCY
P054 A	Crankshaft Position – Camshaft Position Correlation Bank 2 Sensor B	– Check the Camshaft Position (CMP) Sensor - G40- .	difference between target position vs. actual position > 6° CA	• time after engine start >= 0.8…60 Sec • modelled oil temperature >= -273° C • Catalyst heating active • minimal adjustment > 6° CA • for longer than (cumulative) >= 12.75 Sec	5 Sec	• Once/DCY • 2 DCY
P054 C	Crankshaft Position - Camshaft Position Correlation Bank 2 Sensor B	– Check the Camshaft Position (CMP) Sensor - G40- .	difference between target position vs. actual position > 6° CA	• time after engine start >= 0.8…60 Sec • modelled oil temperature >= -273°C • Catalyst heating active • minimal adjustment > 6° CA • for longer than (cumulative) >= 12.75 Sec	5 Sec	• Once/DCY • 2 DCY

Control module and output signals

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0601	Internal Control Module Memory Check Sum Error	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual. – Replace Transmission Control Module (TCM) - J217- . Refer to Repair Manual.	Internal check sum, incorrect	---	0.5 Sec	•Continuous • 2 DCY
P0602	Control Module Programming Error	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual. – Replace Transmission Control Module (TCM) - J217- . Refer to Repair Manual.	Reprogramming not completed	---	0.5 Sec	•Continuous • 2 DCY
P0604	Internal Control Module Random Access Memory (RAM) Error	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual. – Replace Transmission Control Module (TCM) - J217- . Refer to Repair Manual.	Write ability check, failed	---	0.5 Sec	•Continuous • 2 DCY
P0605	ECM Checksum ROM	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual.	check failed	---	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
P0606	ECM/ PCM Processor	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual.	• Sensor offset correction >0.1 V • Sensor IC power supply voltage <9 V •Communication CPU sensor IC Failed • Delta resistance measured vs. modelled >15Ω • Signal voltage <0.2 V • Signal voltage >4.88 V • Drive by wire module check failed • EEPROM check failed • Engine torque out of range • Engine operation condition out of range	• Engine speed, Idle >2 Sec. • Engine speed, >25 RPM	• 10 Sec • 0.2 Sec • 0.5 Sec	•Continuous • 2 DCY
P0613	TCM Procesor	– Replace Transmission Control Module (TCM) - J217- . Refer to Repair Manual.	Check-calculation of 1st CPU failed, Single reset does not cover problem			
P0614	ECM / TCM Incompatibl e	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual. – Replace Transmission Control Module (TCM) - J217- .	Detection of error signal	• CAN bus, Active • ECU communication, Active • ECU data update, Active	250 ms	
P062B	Injector Valves Communicat ion CPU	– Check Fuel Injectors.	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
P0638	Throttle Actuator Control Range/ Performanc e - Bank 1	– Check Throttle Valve Control Module -J338- .	• Time to open over reference point + 12%, > 0.14 Sec. • Time to close below reference point, + 3%, > 0.56 Sec. • Time to close below reference point + 3% > 0.56 Sec.	• fuel cutoff active • throttle position setpoint limitation inactive • Engine speed, <= 300 RPM • IAT, >5° C • Vehicle speed, <= 0 MPH • ECT, >= 5.3° C • IAT >= 5.3° C	5 Sec	•Continuous • 2 DCY
P0639	Throttle Actuator Control Range/ Performanc e Bank 2	– Check Throttle Valve Control Module 2 -J544-.	• Duty cycle >80% • AND ECM power stage No Failure • Deviation throttle valve angles vs. calculated values >4-50%	—	• 0.5 Sec • 0.6 Sec	•Continuous • 2 DCY
P0641	Sensor Reference Voltage A Circuit/ Open	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual.	Internal Fault	---	0.4 Sec	•Continuous • 2 DCY
P0642	Sensor Reference Voltage A Circuit Low	– Replace the faulty Engine Control Module (ECM). Refer to Repair Manual.	Signal voltage, <4.606...4.998V	---	0.4 Sec	•Continuous • 2 DCY
P0643	Sensor Reference Voltage A Circuit High	– Replace the faulty Engine Control Module (ECM). Refer to Repair Manual.	Signal voltage, >4.998...5.406V	---	0.4 Sec	•Continuous • 2 DCY
P0651	Sensor Reference Voltage B Circuit/ Open	– Replace the faulty Engine Control Module (ECM). Refer to Repair Manual.	Internal Fault	---	0.4 Sec	•Continuous • 2 DCY
P0652	Sensor Reference Voltage B Circuit Low	– Replace the faulty Engine Control Module (ECM). Refer to Repair Manual.	Signal voltage, < 4.606...4.998V	---	0.4 Sec	•Continuous • 2 DCY
P0653	Sensor Reference Voltage B Circuit High	– Replace the faulty Engine Control Module (ECM). Refer to Repair Manual.	Signal voltage, >4.998-5.406V	---	0.4 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
P0657	Actuator Supply Voltage A Circuit / Open	– Check Motronic Engine Control Module (ECM) Power Supply Relay -J271- .	Signal voltage, > 4.4...5.6 V	• Relay, Commanded off • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P0658	Actuator Supply Voltage A Circuit Low	– Check Motronic Engine Control Module (ECM) Power Supply Relay -J271- .	Signal voltage, < 2.15...3.25 V	• Relay, Commanded off • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P0659	Actuator Supply Voltage "A" Circuit High	– Check Motronic Engine Control Module (ECM) Power Supply Relay -J271- .	Signal current >1.1 A	• Relay, Commanded on • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P0685	ECM/ PCM Power Relay Control Circuit/ Open	– Check Motronic Engine Control Module (ECM) Power Supply Relay -J271- .	• Signal voltage, 2.6...3.7 V • Sense circuit voltage, < 6.0 V	• Main relay, Commanded on • ECM keep alive time	0.5 Sec	• Continuous • 2 DCY
P0686	ECM/ PCM Power Relay Control Circuit Low	– Check Motronic Engine Control Module (ECM) Power Supply Relay -J271- .	• Signal voltage, 2.6...3.7 V • Sense circuit voltage, < 6.0V	• Main relay, Commanded on • ECM keep alive time	0.5 Sec	•Continuous • 2 DCY
P0687	ECM/ PCM Power Relay Control Circuit High	– Check Motronic Engine Control Module (ECM) Power Supply Relay -J271-.	• Signal current, >0.7...1.4 A • Sense circuit voltage, < 6.0V	• Main relay, Commanded on • ECM keep alive time	0.5 Sec	•Continuous • 2 DCY
P0688	ECM/ PCM Power Relay Sense Circuit	– Check Motronic Engine Control Module (ECM) Power Supply Relay -J271- .	• Sense voltage, < 4.0V	• Main relay, Commanded on	• 1 Sec	•Continuous • 2 DCY
P0697	Sensor Reference Voltage C Circuit / Open	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual.	Internal Fault	---	0.4 Sec	•Continuous • 2 DCY
P0698	Sensor Reference Voltage C Circuit Low	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual.	Signal voltage, <4.606...4.998V	---	0.4 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 C Circuit High	– Replace the faulty Engine Control Module (ECM) . Refer to Repair Manual.	Signal voltage, >4.998...5.406V	---	0.4 Sec	•Continuous • 2 DCY

Transmission

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	– Check Multi-Function Transmission Range (TR) Switch -F125- .	---	• Sensor supply, > 6.51–<10 V • Status, OK	0.1 Sec	•Continuous • 2 DCY
P0706	Transmission Range Sensor ”A” Circuit Range/ Performance	– Check Multi-Function Transmission Range (TR) Switch -F125- .	4 bit position code, incorrect	• Sensor supply, > 6.51–<10 V • Status, OK	0.1 Sec	• Continuous • 2 DCY
P0707	Transmission Range Sensor Circuit Low	– Check Multi-Function Transmission Range (TR) Switch -F125- .	---	• Sensor supply, > 6.51–<10 V • Status, OK	0.1 Sec	• Continuous • 2 DCY
P0708	Transmission Range Sensor Circuit High	– Check Multi-Function Transmission Range (TR) Switch -F125-	---	• Sensor supply, > 6.51–<10 V • Status, OK	0.1 Sec	•Continuous • 2 DCY
P0710	Transmission Fluid Temperature Sensor ”A” Circuit	– Check ATF level. Refer to Repair Manual. – Check Transmission Fluid Temperature Sensor -G93- .	Sensor short circuit: • U_sensor (+), and U_sensor (-) diagnosis by ASIC	—	1.5 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
P0711	Transmission Fluid Temperature Sensor ”A” Circuit Range/ Performance	– Check ATF level. Refer to Repair Manual. – Check Transmission Fluid Temperature Sensor -G93- .	Discontinual temperature: • ATF temperature delta T between 2 measurements, >20° C Sensor stuck: • Comparision ATF vs. chip temperature, ATF temp. must follow chip temp. in certain ranges, 25-40° C	• Temperature fault, no other fault detected • Chip temperature, status OK • Engine speed or input speed, > 400 RPM • Signal status, status, OK	1.5 Sec	•Continuous • 2 DCY
P0712	Transmission Fluid Temperature Sensor ”A” Circuit Low	– Check ATF level. Refer to Repair Manual. – Check Transmission Fluid Temperature Sensor -G93- .	Circuit low: • U_sensor (+), and U_sensor (-) diagnosis by ASIC	—	1.5 Sec	• continuous • 2 DCY
P0713	Transmission Fluid Temperature Sensor ”A” Circuit High	– Check ATF level. Refer to Repair Manual. – Check Transmission Fluid Temperature Sensor -G93- .	Circuit high: • U_sensor (+), and U_sensor (-) diagnosis by ASIC	—	1.5 Sec	• continuous • 2 DCY
P0714	Transmission Fluid Temperature Sensor ”A” Circuit Intermittent	– Check ATF level. Refer to Repair Manual. – Check Transmission Fluid Temperature Sensor -G93- .	Circuit high: • U_sensor (+), and U_sensor (-) diagnosis by ASIC	—	1.5 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
P0716	Input/Turbine Speed Sensor ”A” Circuit Range/ Performance	– Check Transmission Input Speed (RPM) Sensor - G182- .	Signal higher or lower than threshold • Higher, > + 8000 RPM • Lower, < 20 RPM	Higher: • Sensor supply, OK • Sensor, no electrical error Lower: • Sensor supply, OK • Engine speed, >600 RPM • Status engine speed, OK • Output speed, >500 RPM • Status output speed, OK or substitute value • Range position, OK or substitute value • Sensor, no electrical error • Transmission condition, frictionlocked • Error flag fnabvra_err, not set	0.6 Sec	•Continuous • 2 DCY
P0717	Input/Turbine Speed Sensor ”A” Circuit No Signal	– Check Transmission Input Speed (RPM) Sensor - G182- .	Hardware detection	Sensor supply, OK	0.6 Sec	• Continuous • 2 DCY
P0721	Output Speed Sensor Circuit Range/ Performance	Check Transmission Output Speed (RPM) Sensor - G195- .	• Signal> threshold, > 10000 RPM • Difference between last and actual value >threshold, -1000 RPM • Difference to wheel speeds, > 500 RPM and input speed, > 200 RPM	• Sensor supply, OK • Sensor, no electrical error • Transmission condition, friction locked • Input speed sensor, OK • Difference between output speed and input speed, > 200 RPM • Transmission condition, friction locked backwards or forwards • Shift flag, = 0 (no shift) • Input speed, OK • Sensor supply, OK • Wheel speeds, OK	• 0.8 Sec • 1 Sec	• Continuous • 2 DCY
P0722	Output Speed Sensor Circuit No Signal	– Check Transmission Output Speed (RPM) Sensor - G195- .	Hardware detection	Sensor supply, OK	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
P0727	Engine Speed Input Circuit No Signal	– Check the wiring connection Between Engine Control Module (ECM) -J623- and the Transmission Control Module (TCM) -J217- . – Check Engine Speed (RPM) Sensor -G28- .	CAN message signal error flag, =1	• Ignition, on • CAN Bus, OK • DME CAN connection, OK	1 Second	• Continuous • Immediate
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	– Check Engine Speed (RPM) Sensor -G28- .. – Check Transmission Input Speed (RPM) Sensor -G182- . – Check Automatic Transmission Pressure Regulating Valve 6 - N371- .	rate of (setting of nominal value) - actual value, > 50 RPM	status of clutch, closed or closed loop control	15 Sec	• continuous • 2 DCY
P0746	Pressure Control Solenoid 'A" Performance or Stuck Off	– Check Automatic Transmission Pressure Regulating Valve 1 - N215- .	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.05 Sec	• Continuous • 2 DCY
P0747	Pressure Control Solenoid 'A" Stuck On	– Check Automatic Transmission Pressure Regulating Valve 1 - N215- .	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.05 Sec	• Continuous • 2 DCY
P0748	Pressure Control Solenoid 'A" Electrical	– Check Automatic Transmission Pressure Regulating Valve 1 - N215- .	• Current higher or lower than threshold, > 220 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow	• Off operation mode	0.05 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
P0751	Shift Solenoid ”A” Performance or Stuck Off	– Check Solenoid Valve 1 - N88- .	• If PWM = 0%, diagnosis by ASIC • if 0% < = PWM , 7.6% voltage return lead (low), < 0.75 V • if 7.6% < = PWM , 92.4% voltage return lead (high), < 0.75 V • if 7.6% < = PWM , 92.4% voltage return lead (low), < 0.75 V	• high side FET voltage drop, < = 1 V • high side FET, enabled • low side FET, enabled	0.05 Sec	• Continuous • 2 DCY
P0752	Shift Solenoid Stuck On	– Check Solenoid Valve 1 - N88- .	• If PWM = 100%, diagnosis by ASIC • if 7.6% < = PWM <= 100% voltage return lead (high), >0.3 V	• high side FET voltage drop, < = 1 V • high side FET, enabled • low side FET, enabled	0.05 Sec	• Continuous • 2 DCY
P0754	Shift Solenoid "A" Intermittent	– Check Solenoid Valve 1 - N88- .	• If PWM = 0%, diagnosis by ASIC • if 0% < = PWM , 7.6% voltage return lead (low), < 0.75 V • if 7.6% < = PWM , 92.4% voltage return lead (high), < 0.75 V • if 7.6% < = PWM , 92.4% voltage return lead (low), < 0.75 V	• high side FET voltage drop, < = 1 V • high side FET, enabled • low side FET, enabled	0.05 Sec	• Continuous • 2 DCY
P0776	Pressure Control Solenoid ”B” Performance or Stuck Off	– Check ATF level. Refer to Repair Manual. – Check Automatic Transmission Pressure Regulating Valves.	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.05 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
P0777	Pressure Control Solenoid ”B” Stuck On	– Check ATF level. Refer to Repair Manual. – Check Automatic Transmission Pressure Regulating Valves.	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.05 Sec	• Continuous • 2 DCY
P0778	Pressure Control Solenoid ”B” Electrical	– Check ATF level. Refer to Repair Manual. – Check Automatic Transmission Pressure Regulating Valves.	• Current higher or lower than threshold, <730 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow	• Off operation mode	0.05 Sec	• Continuous • 2 DCY
P0796	Pressure Control Solenoid ”C” Performance or Stuck Off	– Check Automatic Transmission Pressure Regulating Valve 3 - N217- .	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.05 Sec	• Continuous • 2 DCY
P0797	Pressure Control Solenoid ”C” Stuck On	– Check Automatic Transmission Pressure Regulating Valve 3 - N217- .	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.05 Sec	• Continuous • 2 DCY
P0798	Pressure Control Solenoid ”C” Electrical	– Check Automatic Transmission Pressure Regulating Valve 3 - N217- .	• Current higher or lower than threshold, >220 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow	• Off operation mode	0.05 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
P0889	TCM Power Relay Sense Circuit Range/ Performance	– Check Transmission Control Module (TCM) -J217- . Refer to Repair Manual.	FET drive, not possible	• Filtered battery voltage, >6.75 V • High side and low side FET, enabled • Status counter initialization, 0 or 1	0.03 Sec	• Continuous • 2 DCY
P0890	TCM Power Relay Sense Circuit Low	– Check Transmission Control Module (TCM) -J217- . Refer to Repair Manual.	• Solenoid power supply voltage, <1.4V • Drop voltage over high side FET, > 1 V	• Filtered battery voltage, >6.75 V • High side and low side FET, enabled • Status counter initialization, 0 or 1	0.03 Sec	• Continuous • 2 DCY
P0891	TCM Power Relay Sense Circuit High	– Check Transmission Control Module (TCM) -J217- . Refer to Repair Manual.	Hardware detection	• Filtered battery voltage, >6.75 V • High side and low side FET, enabled • Status counter initialization, 0 or 1	0.03 Sec	• continuous • 2 DCY
P0892	TCM Power Relay Sense Circuit Intermittent	– Check Transmission Control Module (TCM) -J217- . Refer to Repair Manual.	Hardware detection	• Filtered battery voltage, >6.75 V • High side and low side FET, enabled • Status counter initialization, 0 or 1	0.03 Sec	• continuous • 2 DCY

3.4.2 SAE P1xxx DTCs

Engine

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P100 F	Fuel Rail Injection Valves	– Check fuel injectors .	• volume part of rail pressure controller > 20 mm • misfire failure	• engine speed < 900 RPM • engine load < 50% • rail pressure controller active	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
P1009	Air mass meter ½ implausible signal from load detection (Via throttle position and engine speed map)	– Check the Mass Air Flow (MAF) Sensors .	• mass air flow HFM2 vs. lower threshold map HFM2 < 0 .. 450 kg/h • mass air flow HFM2 vs. upper threshold map > 55… 1082	• Time after engine start, 20 camshaft revs	2 Sec	• Continuous • 2 DCY
P1491	Evaporative Emission System Purge Control Valve Circuit Open	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- .	Signal voltage > 4.4- 5.6 V	• Evap purge valve Commanded off • Engine speed > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P1647	Checking coding/ versions of control modules in CAN bus	Check CAN-Bus terminal resistance.	---	—	2.5 Sec	• Continuous • 2 DCY
P117 C	Post Catalyst Fuel Trim System Too Lean Bank 3	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter .	Deviation lambda control > -0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • Engine speed, 1360...3920 RPM • Engine load, 20...70% • Mass air flow, 15...60 kg/h	30 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
P117 D	Post Catalyst Fuel Trim System Too Rich Bank 3	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter .	Deviation lambda control > -0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • Engine speed, 1360...3920 RPM • Engine load, 20...70% • Mass air flow, 15-60 kg/h	30 Sec	• Continuous • 2 DCY
P117 E	Post Catalyst Fuel Trim System Too Lean Bank 4	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter .	Deviation lambda control > -0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • Engine speed, 1360...3920 RPM • Engine load, 20...70% • Mass air flow, 15...60 kg/h	30 Sec	• Continuous • 2 DCY
P117 F	Post Catalyst Fuel Trim System Too Rich Bank 4	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter .	Deviation lambda control > -0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • Engine speed, 1360...3920 RPM • Engine load, 20...70% • Mass air flow, 15...60 kg/h	30 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
P12A1	Fuel Rail Pressure Sensor High Pressure System	– Check Fuel Pressure Sensor - G247- .	• Pressure control activity >0.07 mPa • Fuel trim activity <0.85 • difference between target pressure – actual pressure -1...1	• Lambda control, Closed loop • EVAP purge flow, < 15 kg/h • ECT > 60° C • IAT < 60° C • Engine speed, 400...900 RPM • Engine load, 10...20% • Fuel cut off, Not active	5 Sec	• Continuous • 2 DCY
P12A2	Fuel Rail Pressure Sensor High Pressure System	– Check Fuel Pressure Sensor - G247- .	• Pressure control activity <-0.0035 MPa • Fuel trim activity >1.25 • difference between target pressure – actual pressure -1...1	• Lambda control, Closed loop • EVAP purge flow, < 15 kg/h • ECT > 60° C • IAT < 60° C • Engine speed, 400...900 RPM • Engine load, 10...20% • Fuel cut off, Not active	5 Sec	• Continuous • 2 DCY
P12A4	Fuel Rail Pressure Control valve	– Check Fuel Pressure Sensor - G247- .	• Pressure control activity <-7.0 MPa • Fuel trim activity 0.9–1.3 • difference between target pressure – actual pressure < -8.0 mPa	• Lambda control, Closed loop • EVAP purge flow, < 15 kg/h • ECT > 60° C • IAT < 60° C • Engine speed, 400...900 RPM • Engine load, 10...20% • Fuel cut off, Not active	10 Sec	• Continuous • 2 DCY
P12A5	Fuel Rail Pressure Sensor High Pressure System	– Check Fuel Pressure Sensor - G247- .	• Pressure control activity >0.07 mPa • Fuel trim activity <0.85 • difference between target pressure – actual pressure -1...1	• Lambda control, Closed loop • EVAP purge flow, < 15 kg/h • ECT > 60° C • IAT < 60° C • Engine speed, 400...900 RPM • Engine load, 10...20% • Fuel cut off, Not active	5 Sec	• Continuous • 2 DCY
P12A6	Fuel Rail Pressure Sensor High Pressure System	– Check Fuel Pressure Sensor - G247- .	• Pressure control activity <-0.0035 MPa • Fuel trim activity >1.25 • difference between target pressure – actual pressure -1...1	• Lambda control, Closed loop • EVAP purge flow, < 15 kg/h • ECT > 60° C • IAT < 60° C • Engine speed, 400...900 RPM • Engine load, 10...20% • 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
P12A7	Fuel Rail Pressure Control valve	– Check Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.21 Fuel Pressure Sensor, Checking”, page 230 .	• Pressure control activity <-7.0 MPa • Fuel trim activity 0.9–1.3 • difference between target pressure – actual pressure < -8.0 mPa	• Lambda control, Closed loop • EVAP purge flow, < 15 kg/h • ECT > 60° C • IAT < 60° C • Engine speed, 400...900 RPM • Engine load, 10...20% • Fuel cut off, Not active	10 Sec	• Continuous • 2 DCY
P129B	Fuel Pressure Regulator 2 Control Circuit	– Check Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.21 Fuel Pressure Sensor, Checking”, page 230 .	Signal voltage 1.8...4.5 V	• Evap purge valve Commanded off • Engine relay, Commanded on	0.5 Sec	• Continuous • 2 DCY
P129C	Fuel Pressure Regulator 2 Control Circuit Low	– Check Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.21 Fuel Pressure Sensor, Checking”, page 230 .	Signal voltage < 1.8 V	• Evap purge valve Commanded off • Engine relay, Commanded on	0.5 Sec	• Continuous • 2 DCY
P129D	Fuel Pressure Regulator 2 Control Circuit High	– Check Fuel Pressure Sensor - G247- . Refer to ⇒ “3.5.21 Fuel Pressure Sensor, Checking”, page 230 .	Signal voltage > 4.5 V	• Evap purge valve Commanded on • Engine relay, Commanded on	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
P1489	Evaporative Emission System Purge Control Valve Circuit High	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.5.16 EVAP Canister Purge Regulator Valve, Checking”, page 218 .	signal current > 2.2 A	• Evap purge valve, Commanded on • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P1490	Evaporative Emission System Purge Control Valve Circuit Low	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.5.16 EVAP Canister Purge Regulator Valve, Checking”, page 218 . – Check Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.5.48 Leak Detection Pump, Checking”, page 308. – Check Evaporative Emission (EVAP) Canister System for proper seal. Refer to ⇒ “3.5.14 EVAP System, Leak Detection”, page 217.	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
P1494	Evaporative Emission System Incorrect Purge Flow	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . – Check Leak Detection Pump (LDP) - V144-. – Check Evaporative Emission (EVAP) Canister System for proper seal.	• Deviation lambda control < 6% • Deviation idle control < 20%	• Engine speed, Idle • Engine speed deviation, < 80 RPM • Time after engine start >350 Sec. • ECT >59.25° C Or substitute ECT >59.25° C • IAT >5.25° C • IAT at start >5.25° C	25 Sec	• Once/ DCY • 2 DCY
P1497	Secondary Air Injection System Insufficient Flow Bank 3	– Check Secondary Air Injection (AIR) Pump Motor -- V101-- . – Check Combination valve for secondary air injection (AIR). Refer to Repair Manual.	• Relative secondary air mass flow <0.047 • Relative secondary sir mass flow , <0.05	• Mass air flow, 24– 140 kg/h • ECT, 5.3...60° C • IAT, > 5.3° C • Altitude, <2600 m • Delta engine load, <7%/rev • Functional check, ready, no faults Flow Check • Mass air flow (), 14–60 kg/h • Vehicle speed, <3.1 MPH • Mass air intergral after start, >3 Kg • Delta engine load, <10%/rev • Engine speed, idle	30–60 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
P1498	Secondary Air Injection System Insufficient Flow Bank 4	– Check Secondary Air Injection (AIR) Pump Motor -- V101-- . – Check Combination valve for secondary air injection (AIR). Refer to Repair Manual.	• Relative secondary air mass flow <0.047 • Relative secondary sir mass flow , <0.05	• Mass air flow, 24– 140 kg/h • ECT, 5.3...60° C • IAT, > 5.3° C • Altitude, <2600 m • Delta engine load, <7%/rev • Functional check, ready, no faults Flow Check • Mass air flow (), 14–60 kg/h • Vehicle speed, <3.1 MPH • Mass air intergral after start, >3 Kg • Delta engine load, <10%/rev • Engine speed, idle	30–60 Sec	• Once/ DCY • 2 DCY
P150 A	Engine- Off-Time	Comparing engine off time from instrument cluster control unit with engine after run time	• difference between engine-offtime and ECM after run-time < - 12 Sec • difference between engine-offtime and ECM after run-time > 12 Sec	• key-on after ECM after run time active CAN	0 Sec	• Once/ DCY • 2 DCY

Transmission

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P1702	Impossible combination of substitute functions or not allowed actuating of valves	– Replace Transmission Control Module (TCM) -J217- . Refer to Repair Manual.	SW functions: actuating solenoid valves colliding with 2 substitute functions with same priority as driven solenoid valves that have short circuit to supply or interruption	---	0.02 Sec	• Continuous • 2 DCY

3.4.3 SAE P2xxx DTCs

Fuel and air mixture, additional emissions regulations

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 Circuit/ Open Bank 1 Bank 2	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	• deviation runner flaps position vs. calculated position > 30%	• ECT > - 10° • IAT > - 10° • engine speed > 400 RPM • desired position < 20% • adaption completed • number of checks 3	5 Sec	• Continuous • 2 DCY
P2005	Intake Manifold Runner Control Circuit/ Open Bank 1 Bank 2	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	• deviation runner flaps position vs. calculated position > 30%	• ECT > - 10° • IAT > - 10° • engine speed > 400 RPM • desired position < 20% • adaption completed • number of checks 3	5 Sec	• Continuous • 2 DCY
P2006	Intake Manifold Runner Control Circuit/ Closed Bank 1 Bank 2	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	• deviation runner flaps position vs. calculated position > 30%	• ECT > - 10° • IAT > - 10° • engine speed > 400 RPM • desired position > 80% • adaption completed • number of checks 3	5 Sec	• Continuous • 2 DCY
P2007	Intake Manifold Runner Control Circuit/ Closed Bank 1 Bank 2	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	• deviation runner flaps position vs. calculated position > 30%	• ECT > - 10° • IAT > - 10° • engine speed > 400 RPM • desired position > 80% • adaption completed • number of checks 3	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
P2008	Intake Manifold Runner Control Circuit/ Open Bank 1	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	Signal voltage >4.4–5.6 V	• Runner flaps, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Continuous • 2 DCY
P2009	Intake Manifold Runner Control Circuit High Bank 1	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	Signal voltage <2.15–3.25 V	• Runner flaps, Commanded off • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P2010	Intake Manifold Runner Control Circuit High Bank 1	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	Signal current >2.2 A	• Runner flaps, Commanded on • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P2014	Intake Manifold Runner Position Sensor/ Switch Circuit Bank 1	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	Signal voltage, <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
P2015	Intake Manifold Runner Position Sensor/ Switch Circuit Range/ Performance Bank 1	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	• Deviation runner flaps position vs. calculated position, >20%	• ECT, >-10° C • Engine speed, > 400 RPM	2 Sec	• Continuous • 2 DCY
P2017	Intake Manifold Runner Position Sensor/ Switch Circuit High Bank 1	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	Signal voltage >4.8 V	—	1 Sec	• Continuous • 2 DCY
P2019	Intake Manifold Runner Position Sensor/ Switch Circuit Bank 2	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	Signal voltage, <0.2 V	—	1 Sec	• Continuous • 2 DCY
P2020	Intake Manifold Runner Position Sensor/ Switch Circuit Range/ Performance Bank 2	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	• Deviation runner flaps position vs. calculated position, >20%	• ECT, >-10° C • Engine speed, > 400 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
P2022	Intake Manifold Runner Position Sensor/ Switch Circuit High Bank 2	– Check Intake Manifold Runner Position Sensor - G336- . – Check Intake Flap Motor - V157- . – Check Variable Intake Manifold Runner Motor - V183- .	Signal voltage >4.8 V	—	1 Sec	• Continuous • 2 DCY
P2088	A Camshaft Position Actuator Control Circuit Low Bank 1	– Check Camshaft Adjustment Valve 1 - N205- .	Signal voltage, <2.15...3.25 V	• Camshaft valve, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Continuous • 2 DCY
P2089	A Camshaft Position Actuator Control Circuit High Bank 1	– Check Camshaft Adjustment Valve 1 - N205- .	Signal current, >2.2 A	• Camshaft valve, Commanded on • Engine speed, >40 RPM	0.5 Sec	• Continuous • 2 DCY
P2090	"B" Camshaft Position Actuator Control Circuit Low Bank 1	– Check Camshaft Adjustment Valve 1 (exhaust) - N318- .	Signal voltage <2.15...3.25	• Camshaft valve, Off • Engine speed, >80 RPM	0.5 Sec	• Continuous • 2 DCY
P2091	"B" Camshaft Position Actuator Control Circuit High Bank 1	– Check Camshaft Adjustment Valve 1 (exhaust) - N318- .	Signal current, >2.2 A	• Camshaft valve, On • Engine speed, >80 RPM	0.5 Sec	• Continuous • 2 DCY
P2092	"A" Camshaft Position Actuator Control Circuit Low Bank 2	– Check Camshaft Adjustment Valve 2 - N208- .	Signal voltage, <2.15...3.25 V	• Camshaft valve, commanded off • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P2093	"A" Camshaft Position Actuator Control Circuit High Bank 2	– Check Camshaft Adjustment Valve 2 - N208- . Refer to	Signal current, >2.2 A	• Camshaft valve, commanded on • Engine speed, > 40 RPM	0.5 Sec	• Continuous • 2 DCY
P2094	"B" Camshaft Position Actuator Control Circuit Low Bank 2	– Check Camshaft Adjustment Valve 2 (exhaust) - N319- .	Signal voltage <2.15...3.25	• Camshaft valve, Off • 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
P2095	"B" Camshaft Position Actuator Control Circuit High Bank 2	– Check Camshaft Adjustment Valve 2 (exhaust) -N319- .	Signal current, >2.2 A	• Camshaft valve, On • Engine speed, >80 RPM	0.5 Sec	• Continuous • 2 DCY
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter . – Check Three Way Catalytic Converter (TWC).	Deviation lambda control >< -0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • ECT > 50° C • Engine load, 20...70% • Mass air flow, 20...100 kg/h	20 Sec	• Continuous • 2 DCY
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter . – Check Three Way Catalytic Converter (TWC).	Deviation lambda control > -0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • ECT > 50° C • Engine load, 20...70% • Mass air flow, 20...100 kg/h	20 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
P2098	Post Catalyst Fuel Trim System Too Lean Bank 2	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter . – Check Three Way Catalytic Converter (TWC)..	Deviation lambda control <-0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • ECT > 50° C • Engine load, 20...70% • Mass air flow, 20...100 kg/h	20 Sec	• Continuous • 2 DCY
P2099	Post Catalyst Fuel Trim System Too Rich Bank 2	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter . – Check Three Way Catalytic Converter (TWC).	Deviation lambda control > -0.03%	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, < 7% • Lambda set point, 1 • Catalyst temperature, 350...850° C • ECT > 50° C • Engine load, 20...70% • Mass air flow, 20...100 kg/h	20 Sec	• Continuous • 2 DCY

Fuel and air ratio

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 Modules .	• Duty cycle > 80% • AND ECM power stage No Failure • Deviation throttle valve angles vs. calculated values > 4...50%	---	• 0.5 Sec • 0.6 Sec	• Continuous • 2 DCY
P2106	Throttle Actuator Control System – Forced Limited Power	– Check the Throttle Valve Control Modules .	• Duty cycle > 80% • AND ECM power stage Failure	---	5 Sec	• Continuous • 2 DCY
P2122	Throttle/ Pedal Position Sensor/ Switch D Circuit Low Input	– Check Throttle Position (TP) Sensor -G79- / Accelerator Pedal Position Sensor 2 - G185- .	Signal voltage, < 0.625 V	---	0.2 Sec	• Continuous • 2 DCY
P2123	Throttle/ Pedal Position Sensor/ Switch D Circuit High Input	– Check Throttle Position (TP) Sensor -G79- / Accelerator Pedal Position Sensor 2 - G185- .	Signal voltage > 4.81 V	---	0.2 Sec	• Continuous • 2 DCY
P2127	Throttle/ Pedal Position Sensor/ Switch E Circuit Low Input	– Check Throttle Position (TP) Sensor -G79- / Accelerator Pedal Position Sensor 2 - G185- .	Signal voltage < 0.29 V	---	0.2 Sec	• Continuous • 2 DCY
P2128	Throttle/ Pedal Position Sensor/ Switch E Circuit High Input	– Check Throttle Position (TP) Sensor -G79- / Accelerator Pedal Position Sensor 2 - G185- .	Signal voltage > 2.5 V	---	0.2 Sec	• Continuous • 2 DCY
P2138	Throttle/ Pedal Position Sensor/ Switch D / E Voltage Correlation	– Check Throttle Position (TP) Sensor -G79- / Accelerator Pedal Position Sensor 2 - G185- .	Signal voltage, sensor 1 vs. sensor 2 > 0.117...0.703 V	Signal voltage • sensor 1, > 0.43 V • sensor 2, > 0.43 V	0.24 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
P2146	Fuel Injector Group A Supply Voltage Circuit / Open	– Check Fuel injectors.	• Signal current, < 2.6 A	• Injection valves, Commanded on • Engine speed > 80 RPM • Low side signal current > 2.7 A	0.2 Sec	• Continuous • 2 DCY
P2149	Fuel Injector Group B Supply Voltage Circuit / Open	– Check Fuel injectors.	• Signal current, < 2.6 A	• Injection valves, Commanded on • Engine speed > 80 RPM • Low side signal current > 2.7 A	0.2 Sec	• Continuous • 2 DCY
P2152	Fuel Injector Group “C” Supply Voltage Circuit/ Open	– Check Fuel injectors.	• Signal current, < 2.6 A	• Injection valves, Commanded on • Engine speed > 80 RPM • Low side signal current > 2.7 A	0.2 Sec	• Continuous • 2 DCY
P2155	Fuel Injector Group “D” Supply Voltage Circuit/ Open	– Check Fuel injectors.	• Signal current, < 2.6 A	• Injection valves, Commanded on • Engine speed > 80 RPM • Low side signal current > 2.7 A	0.2 Sec	• Continuous • 2 DCY
P216 A	Fuel Injector Group "E" Supply Voltage Circuit/ Open	– Check Fuel injectors.	• Signal current> 14.9 A	• Injection valves, Commanded off • Engine speed >80 RPM	0.2 Sec	• Continuous • 2 DCY
P216 D	Fuel Injector Group "F" Supply Voltage Circuit/ Open	– Check Fuel injectors.	• internal logic failure	• Injection valves, Commanded on • Engine speed > 80 RPM	0.2 Sec	• Continuous • 2 DCY
P2181	Cooling System Performance	– Check Engine Coolant Temperature (ECT) Sensor -G62-. – Check Coolant Pump -V50- Refer to Repair Manual. – Check Coolant Thermostat. Refer to Repair Manual.	• ECT < 75° C • Mass air integral 4...12 Kg	• ECT at start, -7...60° C • ECT, > 40° C • Average vehicle speed, 0– 37 MPH • IAT, -7...60 °C • Accum. fuel cut off, < 80...200 Sec. • Delta ambient pressure, < 1.5 kPa • Vehicle speed, < 75 MPH Average value: • Vehicle speed, 21.8...75 MPH • Mass air flow, > 14.4...70.4 kg/ h • Mass air flow, < 70.4...140.8 kg/h	< 1200 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
P2195	O2 Sensor Signal Biased/ Stuck Lean - Bank 1, Sensor 1	– Check Heated Oxygen Sensor (HO2S) -G39- .	• Trim control post catalyst > 0.06	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, > 7% • Lamdba set point, 1 • Catalyst temp, 350...850° C • Mass air flow, 20...120 kg/h • exhaust gas mass integral>0.1 * 10 kg • ECT > 50° C	71 Sec	• Multiple • 2 DCY
P2196	O2 Sensor Signal Biased/ Stuck Rich - Bank 2, Sensor 1	– Check Heated Oxygen Sensor (HO2S) 2 - G108-.	• Trim control post catalyst < -0.06	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, > 7% • Lamdba set point, 1 • Catalyst temp, 350...850° C • Mass air flow, 20...120 kg/h • exhaust gas mass integral >0.1 * 10 kg • ECT > 50° C	71 Sec	• Multiple • 2 DCY
P2197	Post Catalyst Fuel Trim System Too Rich Bank 1	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter.	• Trim control post catalyst > 0.06	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, > 7% • Lamdba set point, 1 • Catalyst temp, 350...850° C • Mass air flow, 20...120 kg/h • exhaust gas mass integral >0.1 * 10 kg • ECT > 50° C	71 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
P2198	Post Catalyst Fuel Trim System Too Lean Bank 2	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter.	• Trim control post catalyst < -0.06	• Lambda control, Closed loop • Lambda control post cat, Closed loop • O2S front, Ready, No DTC • O2S rear, Ready, No DTC • Engine load changes, > 7% • Lamdba set point, 1 • Catalyst temp, 350...850° C • Mass air flow, 20...120 kg/h • exhaust gas mass integral >0.1 * 10 kg • ECT > 50° C	71 Sec	• Multiple • 2 DCY
P2231	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 1 Sensor 1	– Check Oxygen Sensor (O2S) Heater -Z19- .	• Delta O2S signal front > 0.2...0.498 V • Elapsed time since last O2S < 0.05 Sec. • Heater switch on	• Modeled exhaust gas temp, < 800° C • Heater duty cycle, > 5% • Delta engine load, < 3.0% • For at least, 0.5 Sec. • Catalyst heating, Not active • SAI, Not active	50 Sec	• Multiple • 2 DCY
P2234	O2 Sensor Signal Circuit Shorted to Heater Circuit Bank 2 Sensor 1	– Check Oxygen Sensor (O2S) 2 Heater -Z28- .	• Delta O2S signal front >0.2...0.498 V • Elapsed time since last O2S < 0.05 Sec. • Heater switch on	• Modeled exhaust gas temp, < 800° C • Heater duty cycle,> 5% • Delta engine load, < 3.0% • For at least, 0.5 Sec. • Catalyst heating, Not active • SAI, Not active	50 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
P2237	O2 Sensor Positive Current Control Circuit / Open - Bank 1, Sensor 1	– Check Heated Oxygen Sensor (HO2S) -G39- .	• Mass air integral in exhaust gas > 0.2 kg • Fuel cut off active > 3 Sec. • O2S signal front < 1.7 V • Enrichment or lean out Active • O2S signal front 1.49...1.5V • Delta lambda value setting > 0.03	• Lambda control, Closed loop • O2S ceramic temperature, >715° C • Electrical adjustment, Not active • O2S front signal, 1.49...1.51 V • Lambda value, < 0.97 or > 1.03 • Engine speed, > 25 RPM • Engine speed, >25 RPM • O2S ceramic temp, > 715° C • Lambda control, Closed loop • Heater control, Closed loop • Electrical adjustment, Not active • Engine speed, > 25 RPM • O2S ceramic temp, > 715° C	• 3 Sec • 5 Sec • 1.5 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
P2240	O2 Sensor Positive Current Control Circuit/ Open Bank 2 Sensor 1	– Check Heated Oxygen Sensor (HO2S) 2 - G108-.	• Mass air integral in exhaust gas > 0.2 kg • Fuel cut off active > 3 Sec. • O2S signal front < 1.7 V • Enrichment or lean out Active • O2S signal front 1.49...1.5 V • Delta lambda value setting > 0.1	• Lambda control, Closed loop • O2S ceramic temperature, >715° C • Electrical adjustment, Not active • O2S front signal, 1.49...1.51 V • Lambda value, < 0.97 or > 1.03 • Engine speed, > 25 RPM • Engine speed, >25 RPM • O2S ceramic temp, > 715° C • Lambda control, Closed loop • Heater control, Closed loop • Electrical adjustment, Not active • Engine speed, > 25 RPM • O2S ceramic temp, > 715° C	• 3 Sec • 5 Sec • 1.5 Sec	• Multiple • 2 DCY
P2243	O2 Sensor Reference Voltage Circuit / Open - Bank 1, Sensor 1	– Check Heated Oxygen Sensor (HO2S) -G39- .	• O2S signal front > 4.7 V • OR O2S signal front < 0.2 V	• Heater control, Active >25 Sec. • Engine speed, >25 RPM • Internal resistance, > 950 Ω	1 Sec	• Continuous • 2 DCY
P2247	O2 Sensor Reference Voltage Circuit/ Open Bank 2 Sensor 1	– Check Heated Oxygen Sensor (HO2S) 2 - G108-.	• O2S signal front > 4.7 V • OR O2S signal front < 0.2 V	• Heater control, Active >25 Sec. • Engine speed, >25 RPM • Internal resistance, > 950 Ω	1 Sec	• Continuous • 2 DCY
P2251	O2 Sensor Negative Current Control Circuit/ Open Bank 1 Sensor 1	– Check Heated Oxygen Sensor (HO2S) -G39- .	• O2S signal front 1.47...1.53 V • internal resistance > 1500Ω	• Heater control, Active >25 Sec. • Engine speed, >25 RPM	5 Sec	• Continuous • 2 DCY
P2254	O2 Sensor Negative Current Control Circuit/ Open Bank 2 Sensor 1	– Check Heated Oxygen Sensor (HO2S) 2 - G108-.	• O2S signal front 1.47...1.53 V • internal resistance > 1500Ω	• Heater control, Active >25 Sec. • Engine speed, >25 RPM	5 Sec	• Continuous • 2 DCY
P2257	Secondary Air Injection System Control “A” Circuit Low	– Check Secondary Air Injection (AIR) Pump Relay--J299- - .	Signal voltage < 2.15–...3.25 V	• Pump relay, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Continuous • 1 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 “A” Circuit High	– Check Secondary Air Injection (AIR) Pump Relay--J299- - .	Signal current > 1.1 A	• Pump relay, Commanded on • Engine speed, >40 RPM	0.5 Sec	• Continuous • 1 DCY
P2259	Secondary Air Injection System Control “A” Circuit Low	– Check Secondary Air Injection (AIR) Pump Relay--J299- - .	Signal voltage < 2.15–...3.25 V	• Pump relay, Commanded off • Engine speed, >40 RPM	0.5 Sec	• Continuous • 1 DCY
P2260	Secondary Air Injection System Control “A” Circuit High	– Check Secondary Air Injection (AIR) Pump Relay--J299- - .	Signal current > 1.1 A	• Pump relay, Commanded on • Engine speed, >40 RPM	0.5 Sec	• Continuous • 1 DCY
P2293	Fuel Pressure Regulator 2 Performance	– Check Fuel Pressure Sensor - G247- .	Difference between actual pressure – Target pressure >1.30 & < 3.00 MPa	• Time after engine start and fuel cut off, 10 Sec. • Fuel cut off, Not active	5 Sec	• Continuous • 2 DCY
P2294	Fuel Pressure Regulator 2 Control Circuit	– Check Fuel Pressure Sensor - G247- .	Signal voltage 1.8...4.5 V	• Evap purge valve Commanded off • Engine relay, Commanded on	0.5 Sec	• Continuous • 2 DCY
P2295	Fuel Pressure Regulator 2 Control Circuit Low	– Check Fuel Pressure Sensor - G247- .	Signal voltage < 1.8 V	• Evap purge valve Commanded off • Engine relay, Commanded on	0.5 Sec	• Continuous • 2 DCY
P2296	Fuel Pressure Regulator 2 Control Circuit High	– Check Fuel Pressure Sensor -G247- .	Signal voltage > 4.5 V	• Evap purge valve Commanded on • Engine relay, Commanded on	0.5 Sec	• Continuous • 2 DCY

Ignition System

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 Ignition Coil with Power Output Stage - N70- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2301	Ignition Coil A Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N70- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	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
P2303	Ignition Coil B Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N127- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2304	Ignition Coil B Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N127- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2306	Ignition Coil C Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N291- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2307	Ignition Coil C Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N291- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2309	Ignition Coil D Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N292- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2310	Ignition Coil D Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N292- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2312	Ignition Coil “E” Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N323- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2313	Ignition Coil “E” Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N323- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2315	Ignition Coil “F” Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N324- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2316	Ignition Coil “F” Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N324- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	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
P2318	Ignition Coil “G” Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N325- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2319	Ignition Coil “G” Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N325- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2321	Ignition Coil “H” Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N326- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2322	Ignition Coil “H” Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N326- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2324	Ignition Coil "I" Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N327- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2325	Ignition Coil "I" Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N327- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2327	Ignition Coil "J" Primary Control Circuit Low	– Check Ignition Coil with Power Output Stage - N328- .	Signal voltage <0.5...1.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY
P2328	Ignition Coil "J" Primary Control Circuit High	– Check Ignition Coil with Power Output Stage - N328- .	Signal voltage >5.2...6.0 V	• Engine speed, 1400-7000 RPM • Ignition, Synchronized	0.5 Sec	• Continuous • 2 DCY

Additional emission regulations

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2400	Evaporative Emission System Leak Detection Pump Control Circuit/ Open	– Check Leak Detection Pump (LDP) - V144- .	Signal voltage > 4.4- 5.5 V	• LDP, Commanded off • Engine speed > 80 RPM • Time after engine start 10 Sec	0.5 Sec	• Continuous • 2 DCY
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	– Check Leak Detection Pump (LDP) - V144- .	Signal voltage < 3 V	• LDP, Commanded off • Engine speed > 80 RPM • Time after engine start 10 Sec	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
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	– Check Leak Detection Pump (LDP) - V144- .	Signal current > 2.7-5.5 A	• LDP Commanded on • Engine speed > 80 RPM • Time after engine start 10 Sec	0.5 Sec	• Continuous • 2 DCY
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/ Open	– Check Leak Detection Pump (LDP) - V144- .	Low signal voltage > 10.4 Seconds	• LDP Commanded off • Purge mass integral, > 6 g • EVAP purge valve, Closed • LDP, Activated • Altitude, <2600 m • IAT, > 4° C • delta ambient pressure, < 2.5 kPa • IAT drop after engine start, < 6 K • Time after engine start, 230– 1200 Sec. • intake manifold vacuum, > 15 kPa • ECT, 4–115° C • ECT at start, 4–35° C • Number of diagnostic attempts, 5 • Vehicle speed, > 25 MPH • Selected gear, Any drive	11 Sec	• Once/DCY • 2 DCY
P2404	Evaporative Emission System Leak Detection Pump Sense Range/ Performance	– Check Leak Detection Pump (LDP) - V144- .	High signal voltage > 10.4V	• LDP Commanded on • EVAP purge valve, Closed • LDP, Activated • Altitude, <2600 m • IAT, >4° C • delta ambient pressure, < 2.5 kPa • IAT drop after engine start, < 6 K • Time after engine start, 230–1200 Sec. • intake manifold vacuum, > 15 kPa • ECT, 4–115° C • ECT at start, 4–35° C • Number of diagnostic attempts, 5 • Vehicle speed, > 25 MPH • Selected gear, Any drive	11 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
P2414	O2 Sensor Exhaust Sample Error Bank 1, Sensor 1	– Check Heated Oxygen Sensor (HO2S) - G39- .	• Internal voltage 3.7-4.8V	• Engine speed, > 25 RPM • Fuel cut off, Not active • Lambda set point, < 1.6 • O2S ceramic temperature, > 685° C • Low fuel signal On Than wait > 600 Sec.	10 Sec	• Multiple • 2 DCY
P2415	O2 Sensor Exhaust Sample Error Bank 2 Sensor 1	– Check Heated Oxygen Sensor (HO2S) 2 - G108-.	• Internal voltage 2.5–3.0 V	• Engine speed, > 25 RPM • Fuel cut off, Not active • Lambda set point, <1.6 • O2S ceramic temperature, > 685° C • Low fuel signal On Than wait > 600 Sec.	10 Sec	• Multiple • 2 DCY
P2422	Evaporative Emission System Vent Valve Stuck Closed	– Check Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . – Check Evaporative Emission (EVAP) Canister Purge Solenoid Valve 2 - N115- .	Time for pressure drop during 2nd leak check <1.45 Sec.	• EVAP purge valve, Closed • LDP, Activated • Altitude, < 2600 m • IAT, > 4° C • delta ambient pressure, < 2.5 kPa • IAT drop after engine start, < 6 K • Time after engine start, 230–1200 Sec. • intake manifold vacuum, > 15 kPa • ECT, 4–115° C • ECT at start, 4–35° C • Vehicle speed, > 25 MPH • Selected gear, Any drive • Solenoid valve, Commanded off	140 Sec	• Once/DCY • 2 DCY
P2431	AIR System pressure Sensor	– Check Secondary Air Injection Sensor 1 - G609- .	difference between SAI pressure and ambient pressure NOT (-60 .. ..60 hPa)	ambient pressure sensor no fault. SAI done	60 Sec	• Once/DCY • 2 DCY
P2432	AIR System pressure Sensor	– Check Secondary Air Injection Sensor 1 - G609- .	Signal voltage < 0.4 V	ambient pressure sensor no fault	0.5 Sec	• Continuous • 2 DCY
P2433	AIR System pressure Sensor	– Check Secondary Air Injection Sensor 2 - G610- .	Signal voltage > 4.6 V	ambient pressure sensor no fault	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
P2436	AIR System pressure Sensor	– Check Secondary Air Injection Sensor 1 - G609- .	difference between SAI pressure and ambient pressure NOT (-60 .. ..60 hPa)	ambient pressure sensor no fault. SAI done	60 Sec	• Once/DCY • 2 DCY
P2437	AIR System pressure Sensor	– Check Secondary Air Injection Sensor 2 - G610- .	Signal voltage < 0.4 V	ambient pressure sensor no fault	0.5 Sec	• Continuous • 2 DCY
P2438	AIR System pressure Sensor	– Check Secondary Air Injection Sensor 2 - G610- .	Signal voltage > 4.6 V	ambient pressure sensor no fault	0.5 Sec	• Continuous • 2 DCY
P2440	Secondary Air Injection System Insufficient Flow Bank 1	– Check Secondary Air Injection (AIR) Pump Motor -- V101-- . – Check Combination valve for secondary air injection (AIR). Refer to Repair Manual.	• blockage: relative secondary air mass flow (phase 1) >= 0,27 • leakage: relative secondary air mass flow (phase 1) >= 0,27	• air valve commanded off • air pump commanded on	20 Sec	• Once/DCY • 2 DCY
P2442	Secondary Air Injection System Insufficient Flow Bank 2	– Check Secondary Air Injection (AIR) Pump Motor -- V101-- . – Check Combination valve for secondary air injection (AIR). Refer to Repair Manual.	• blockage: relative secondary air mass flow (phase 1) >= 0,27 • leakage: relative secondary air mass flow (phase 1) >= 0,27	• air valve commanded off • air pump commanded on	20 Sec	• Once/DCY • 2 DCY
P2539	Low Pressure Fuel System Sensor Circuit	– Check Low Fuel Pressure Sensor - G410- .	Signal voltage > 4.8 V	---	5 Sec	• Continuous • 2 DCY
P2541	Low Pressure Fuel System Sensor Circuit Low	– Check Low Fuel Pressure Sensor - G410- .	Signal voltage, < 2.0 V	---	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
P2626	O2 Sensor Pumping Current Trim Circuit/ Open Bank 1 Sensor 1	– Check Heated Oxygen Sensor (HO2S) - G39- .	O2S signal front > 4.8 V	• O2S ceramic temperature, >715° C • Modeled exhaust gas temp, < 750° C • Fuel cut off, Active • Engine speed, > 25 RPM • Low fuel signal, On Than wait > 600 Sec.	2 Sec	• Multiple • 2 DCY
P2629	O2 Sensor Pumping Current Trim Circuit/ Open Bank 2 Sensor 1	– Check Heated Oxygen Sensor (HO2S) 2 - G108-.	O2S signal front > 4.8 V	• O2S ceramic temperature, >715° C • Modeled exhaust gas temp, < 750° C • Fuel cut off, Active • Engine speed, > 25 RPM • Low fuel signal, On Than wait > 600 Sec.	2 Sec	• Multiple • 2 DCY

Transmission

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2637	Torque management Feedback Signal ”A”	– Check the CAN-Bus terminal resistance, Transmission Control Module (TCM) -J217- to Engine Control Module (ECM) -J623-.	CAN message signal error flag, = 1	• Ignition, on • CAN Bus, OK • DME CAN connection, OK	0.5 Sec	• Continuous • 2 DCY
P2714	Pressure Control Solenoid ”D” Performance or Stuck off	– Check Automatic Transmission Pressure Regulating Valve 4 - N218- .	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.5 Sec	• Continuous • 2 DCY
P2715	Pressure Control Solenoid ”D” Stuck On	– Check Automatic Transmission Pressure Regulating Valve 4 - N218-.	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 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
P2716	Pressure Control Solenoid ”D” Electrical	– Check Automatic Transmission Pressure Regulating Valve 4 - N218-.	• Current higher or lower than threshold, <730 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow	• Off operation mode	0.5 Sec	• Continuous • 2 DCY
P2723	Pressure Control Solenoid ”E” Performance or Stuck off	– Check Automatic Transmission Pressure Regulating Valve 5 - N233-.	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.5 Sec	• Continuous • 2 DCY
P2725	Pressure Control Solenoid "E" Electrical	– Check Automatic Transmission Pressure Regulating Valve 5 - N233- .	• Current higher or lower than threshold, <730 mA • EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow	• Off operation mode	0.5 Sec	• Continuous • 2 DCY
P2732	Pressure Control Solenoid ”F” Performance or Stuck off	– Check Automatic Transmission Pressure Regulating Valve 6 - N371- .	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.5 Sec	• Continuous • 2 DCY
P2733	Pressure Control Solenoid ”F” Stuck On	– Check Automatic Transmission Pressure Regulating Valve 6 - N371- .	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 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
P2734	Pressure Control Solenoid "F" Electrical	– Check Automatic Transmission Pressure Regulating Valve 6 - N371- .	• EDS output voltage at short to ground or open circuit ~ 0,5 V smaller than EDS supply voltage • Static leakage current flow	• Off operation mode	0.5 Sec	• Continuous • 2 DCY
P2735	Pressure Control Solenoid "F" Intermittent	– Check Automatic Transmission Pressure Regulating Valve 6 - N371-.	PWM hardware detection, 0 or 100%	• Low side and high side FET, activated • Power supply, > 8.7 V • Voltage drop at FET, < = 1 V • Solenoid supply, > 9 V	0.5 Sec	• Continuous • 2 DCY

3.4.4 SAE P3xxx DTCs

Fuel and air mixture, additional emissions regulations

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P3025	Angle sensor 1 (on throttle drive 2 power accelerator actuation)	– Check Throttle Valve Control Module -J338- .	• TPS 1-TPS 2, >6.3% • TPS 2 – calc value > TPS 1 calc. value • OR TPS 2 calc. value, >9%	• TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480 RPM • OR • engine speed > 1200 RPM • TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480 RPM	0.42 Sec	• Multiple • 2 DCY
P3026	Angle sensor 1 (on throttle drive 2 power accelerator actuation)	– Check Throttle Valve Control Module -J338- .	Signal voltage, < 0.176 V	---	0.14 Sec	• Continuous • 2 DCY
P3027	Angle sensor 1 (on throttle drive 2 power accelerator actuation)	– Check Throttle Valve Control Module -J338- .	Signal voltage, > 4.63 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
P3028	Angle sensor 2 (on throttle drive 2 power accelerator actuation)	– Check Throttle Valve Control Module 2 - J544- .	• TPS 1-TPS 2, >6.3% • TPS 2 – calc value > TPS 1 calc. value • OR TPS 2 calc. value, >9%	• TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480 or engine speed > 1200 • TPS electrical range no failure • unthrottled condition not fullfilled • engine speed > 480	0.42 Sec	• Multiple • 2 DCY
P3029	Angle sensor 2 (on throttle drive 2 power accelerator actuation)	– Check Throttle Valve Control Module 2 - J544- .	Signal voltage, <0.21 V	---	0.14 Sec	• Continuous • 2 DCY
P3030	Angle sensor 2 (on throttle drive 2 power accelerator actuation)	– Check Throttle Valve Control Module 2 - J544- .	Signal voltage, > 4.78 V	---	0.14 Sec	• Continuous • 2 DCY
P3031	Throttle Drive 2 (power accelerator actuation) Electrical malfunction in circuit	– Check Throttle Valve Control Module -J338- .	• Duty cycle >80% • AND ECM power stage Failure	---	5 Sec	• Continuous • 2 DCY
P3032	Throttle Actuator Basic Setting Bank 1 Bank 2	– Check Throttle Valve Control Module -J338- .	• TPS 1 signal voltage < 0.21 or > 0.87 V • TPS 2 signal voltage < 4.14 or > 4.84 V	• fuel cutoff active • throttle position setpoint limitation inactive • Engine speed, <= 300 RPM • IAT, >5° C • Vehicle speed, <= 0 MPH • ECT, >= 5.3° C • IAT >= 5.3° C	5 Sec	• Continuous • 2 DCY
P3035	Throttle Valve Control Module 2 Mechanical malfunction	– Check Throttle Valve Control Module -J338- .	• Time to open over reference point + 12%, > 0.14 Sec. • Time to close below reference point, + 3%, > 0.56 Sec. • Time to close below reference point + 3% > 0.56 Sec.	• fuel cutoff active • throttle position setpoint limitation inactive • Engine speed, <= 300 RPM • IAT, >5° C • Vehicle speed, <= 0 MPH • ECT, >= 5.3° C • IAT >= 5.3° 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
P3081	Engine Temperature Too Low	– Allow engine to warm up. • Coolant temperature must be at least 50° C.	• Modeled ECT, Minus ECT > 9.75 K	ECT < 50° C	2 Sec.	• Once/DCY • 2 DCY
P3298	Warm Up Catalyst Efficiency Below Threshold Bank 3	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter . – Check Three Way Catalytic Converter (TWC).	<1.0 -	• Ambient Temp. > -10° C • Delta mass airflow < 15 kg/h/s • EVAP purge flow < 30% • Mass air flow 30-100 kg/h • Engine speed, 1000-2200 RPM • Catalyst temp. 400-630 °C • Delta catalyst temp - 15 k/s	60 Sec	• Once/DCY • 2 DCY
P3299	Warm Up Catalyst Efficiency Below Threshold Bank 4	– Check Heated Oxygen Sensor (HO2S) and oxygen sensor regulation before catalytic converter. – Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) and oxygen sensor regulation behind catalytic converter . – Check Three Way Catalytic Converter (TWC).	<1.0 -	• Ambient Temp. > -10° C • Delta mass airflow < 15 kg/h/s • EVAP purge flow < 30% • Mass air flow 30-100 kg/h • Engine speed, 1000-2200 RPM • Catalyst temp. 400-630° C • Delta catalyst temp - 15 k/s	60 Sec	• Once/DCY • 2 DCY

3.4.5 SAE U0xxx DTCs

Control module and output signals

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0001	High Speed CAN Communication Bus	– Check terminal resistance of CAN-Bus	CAN message, No feedback	---	25 Sec	•Continuous • 2 DCY

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DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0002	High Speed CAN Communication Bus	– Check terminal resistance of CAN-Bus	global timeout receiving no message	---	0,5 Sec	•Continuous • 2 DCY
U0037	Vehicle Communication Bus B	– Check terminal resistance of CAN-Bus	• "CAN message on Master/ Slave-CAN" • "no feedback on Master/ Slave-CAN"	---	0.45 Sec	•Continuous • 2 DCY
U0100	Lost Communication With ECM/ PCM "A"	– Check terminal resistance of CAN-Bus	no time triggered CAN message received from Master. no feedback	---	0.5 Sec	•Continuous • 2 DCY
U0101	Lost Communication with TCM	– Check terminal resistance of CAN-Bus between Engine Control Module (ECM) -J623- and Transmission Control Module (TCM) -J217- .	no CAN message received from TCM no feedback	---	0.5 Sec	•Continuous • 2 DCY
U0115	Lost Communication With ECM/ PCM "B"	– Check terminal resistance of CAN-Bus	no time triggered CAN message received from Slave; no feedback	---	0.5 Sec	•Continuous • 2 DCY
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	– Check terminal resistance of CAN-Bus	no time triggered CAN message received from Instrument Cluster Module. No feedback	---	0.50 Sec	•Continuous • 2 DCY
U0302	Correct coding of gear model	– Check terminal resistance of CAN-Bus between Engine Control Module (ECM) -J623- and Transmission Control Module (TCM) -J217- .	OBD relevant Gear-ECU wrong coded	ignition off	0 Sec	•Continuous • 2 DCY
U0322	Invalid Data Received from Instrument Panel Cluster	– Check terminal resistance of CAN-Bus	Temperature received from CAN <= -50	CAN Message correctly received	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
U0401	CAN (only slave)	– Check terminal resistance of CAN-Bus	Communication on private CAN failed	---	5.5 Sec	•Continuous • 2 DCY
U0402	Invalid Data Received from Transmission Control Module	– Check terminal resistance of CAN-Bus between Engine Control Module (ECM) -J623- and Transmission Control Module (TCM) -J217- .	Invalid data received from TCM	---	0.5 Sec	•Continuous • 2 DCY
U0415	Vehicle Speed	– Check vehicle speed signal.	receiving fault value 206 MPH	---	0.5 Sec	•Continuous • 2 DCY
U0423	CAN: Instrument cluster	– Check the CAN-Bus terminal resistance.	Temperature received from CAN <= -49,5	CAN Message correctly received	2 Sec	• Continuous • 2 DCY