ST - GENERIC SCAN TOOL

ON BOARD DIAGNOSTIC

On Board Diagnostic

The following table provides quick links.

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Generic Scan Tool Manual Contents

Generic Scan Tool Manual Contents

GST is an acronym for Generic Scan Tool Manual.

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

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

OBD Systems

OBD Systems

OBD II

OBD is an acronym for the On Board Diagnostic System.

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

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

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

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

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

Malfunction Indicator Lamp

Malfunction Indicator Lamp

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

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

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

CAN Data Link

CAN Data Link

CAN is an acronym for Controller Area Network.

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

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

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

Electronic Power Control Warning Lamp

Electronic Power Control Warning Lamp

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

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

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

DIAGNOSTIC MODES

Diagnostic Modes

The information provided in Modes 01 through 09 displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTC trouble codes, 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).**

The following table provides quick links.

--> **Diagnostic Mode 01 - Obtain Data**
--> **Diagnostic Mode 02 - Obtain Operating Conditions**
--> **Diagnostic Mode 03 - Interrogating Fault Memory**
--> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**
--> **Diagnostic Mode 05 - Check Lambda Test Results**
--> **Diagnostic Mode 06 - Checking Test Results of Components Not Continuously Monitored**
--> **Diagnostic Mode 07 - Check Test Results of Continuously Monitored Components**
--> **Diagnostic Mode 08 - Tank Leak Test**
--> **Diagnostic Mode 09 - Vehicle Information**

Diagnostic Mode 01 - Obtain Data

Diagnostic Mode 01 - Obtain Data

Diagnostic Mode 01 is used to display and monitor all emissions related measured values.

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

Test requirement

- Coolant temperature at least 80 C.

Procedure

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

- Select "Diagnostic Mode 1: Obtain data.".
- From the following table, select the desired the "PID" that is to be monitored, e.g. "PID 05-Coolant temperature".

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

PID	Component or System
04:	Calculated load value
05:	Coolant temperature
06:	Oxygen integrator, bank 1
07:	Oxygen adaptation value, bank 1
08:	Oxygen integrator, bank 2
09:	Oxygen adaptation value, bank 2
12:	Engine RPM
13:	Vehicle speed
14:	Ignition timing adjustment at 1. cyl. in direction
15:	Intake air temperature (IAT)
16:	Air flow quantity at Mass Air Flow (MAF) sensor
17:	Throttle valve position (absolute)
18:	Secondary air injection (AIR)
19:	Oxygen sensor location
21:	Sensor voltage Bank 1 Sensor 2
25:	Sensor voltage Bank 2 Sensor 2
28:	OBD request is designed for diagnostic of this vehicle
33:	Driven distance after MIL on
52:	Oxygen sensor value Bank 1 Sensor 1
56:	Oxygen sensor value Bank 2- sensor 1

- Switch the ignition off.

Diagnostic Mode 02 - Obtain Operating Conditions

Diagnostic Mode 02 - Obtain Operating Conditions

Diagnostic Mode 02 is used to monitor the operating conditions under which the Engine Control Module (ECM) has detected and stored an emissions related DTC.

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.
- 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
04:	Calculated load value
05:	Coolant temperature
06:	Oxygen integrator, bank 1
07:	Oxygen adaptation value, bank 1
08:	Oxygen integrator, bank 2
09:	Oxygen adaptation value, bank 2
12:	Engine RPM
13:	Vehicle speed

- Switch the ignition off.

Diagnostic Mode 03 - Interrogating Fault Memory

Diagnostic Mode 03 - Interrogating Fault Memory

Description

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.

Diagnostic Mode 03 is used to retrieve and view any DTC which may be stored in the Engine Control Module (ECM).

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

NOTE:

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

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

P-Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations
P	x	1	x	x	Fuel and air ratios
P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system
P	x	4	x	x	Additional exhaust system
P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output

					signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission
P	x	9	x	x	Control modules, input and output signals

U-Codes

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

Procedure

- Connect the scan tool.
- Switch the ignition to the "ON" position.
- Select "Diagnostic Mode 03: Interrogating fault memory ".
- The stored DTC or DTCs will be displayed on the scan tool screen.

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

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

--> **SAE P0xxx Diagnostic Trouble Codes**

--> **SAE P2xxx Diagnostic Trouble Codes**

--> **SAE P3xxx Diagnostic Trouble Codes**

--> **SAE U0xxx- Diagnostic Trouble Codes**

- Switch the ignition off.

Diagnostic Mode 04 - Reset/Delete Diagnostic Data

Diagnostic Mode 04 - Reset/Delete Diagnostic Data

Diagnostic Mode 04 is used to reset or delete the following stored information:

- All emission related malfunctions in the DTC memory.
- The operating conditions at which a malfunction was stored will be reset.
- All adaptation values.
- The test results of all diagnostic functions.

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.

Diagnostic Mode 05 - Check Lambda Test Results

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 2005 and later Audi A6 3.2L Generic Scan Tool (GST) service manual and has been moved to "Diagnostic Mode 6: Checking test results of components that are not continuously monitored" section. --> Diagnostic Mode 06 - Checking Test Results of Components Not Continuously Monitored**

Diagnostic Mode 06 - Checking Test Results of Components Not Continuously Monitored

Diagnostic Mode 06 - Checking Test Results of Components Not Continuously Monitored

Mode 06 makes it possible to query test results for special components and systems that are being continuously or not continuously monitored. When the system diagnosis is complete, the results and the associated parameter values are stored in memory and displayed in Mode 06. This data is stored in memory (even when the ignition

is off) until either a new diagnostic results are present or if the fault memory is cleared. System Initialization Values (after fault memory has been cleared): Test Results = 0, Test Parameter Values = 0.

	Minimum Value
GST Manual documentation	0.3499
Aftermarket Scan Tool display	0.35

NOTE:

- **Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number. The min max values for each individual test in Mode 06 represent the min max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool companies development process.**

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 "Diagnostic Mode 06 - Checking test 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.

Test-ID (Hex-ID)	Component or System
01 ($01):	Oxygen Sensor (Bank 1, Sensor 1)
05 ($05):	Oxygen Sensor (Bank 2, Sensor 1)
02 ($02):	Oxygen Sensor (Bank 1, Sensor 2)
06 ($06):	Oxygen Sensor (Bank 2, Sensor 2)
33 ($21):	Catalytic Converter Monitoring Bank 1
34 ($22):	Catalytic Converter Monitoring Bank 2
58 ($3A) :	Fuel Tank EVAP System Leak Test (0.090)

59 ($3B):	Fuel Tank EVAP System Leak Test (0.040)
69 ($3C):	Fuel Tank EVAP System Leak Test (0.020/0.5 mm)
61 ($3D):	Tank Vent Valve - Function Check
65 ($41):	Oxygen Sensor Heating in front of Catalytic Converter (Bank 1 - Sensor 1)
69 ($45):	Oxygen Sensor Heating in front of Catalytic Converter (Bank 2- Sensor 1)
66 ($42):	Oxygen Sensor Monitoring Behind Catalytic Converter (Bank 1 - Sensor 2)
70 ($46):	Oxygen Sensor Monitoring Behind Catalytic Converter (Bank 2 - Sensor 2)
162 ($A2):	Combustion Misfire Cylinder 1 Data
163 ($A3):	Combustion Misfire Cylinder 2 Data
164 ($A4):	Combustion Misfire Cylinder 3 Data
165 ($A5):	Combustion Misfire Cylinder 4 Data
162 ($A2):	Combustion Misfire Cylinder 5 Data
162 ($A2):	Combustion Misfire Cylinder 6 Data
11:	Misfire, Averaging over 10 Drive Cycles:
12:	Misfire, in this Drive Cycle

Test-ID 01 ($01): O2 Sensor in front of Catalytic Converter, (Bank 1- Sensor 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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.	----	> 0.7998	Refer to DTC P0133 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
132($84)	P2195	Oscillation Check.	---	> 0.75 V	Refer to DTC P2195 under

					SAE P2xxx Diagnostic Trouble Codes for all monitoring values.
132($84)	P2196	Oscillation Check.	---	0.15 V	Refer to DTC P2196 under **SAE P2xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 05 ($05): O2 Sensor in front of Catalytic Converter, (Bank 2- Sensor 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".
- Select the desired "Test-ID".

Select "Test-ID 05 ($05)".

- Check specified values at idle.

Test-ID (TID) (Hex-ID)	DTC	Component or System	Min.	Max.	Additional Information
131($83)	P0153	Response Check.	----	> 0.7998	Refer to DTC P0153 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
132($84)	P2197	Oscillation Check.	---	> 0.75 V	Refer to DTC P2197 under **SAE P2xxx Diagnostic**

					Trouble Codes for all monitoring values.
132($84)	P2198	Oscillation Check.	---	0.15 V	Refer to DTC P2198 under **SAE P2xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

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

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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
129 ($81)	P0138	Signal activity check.	0 V	> 1.5 V	P0138 Refer to DTC P0138 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
130 ($82)	P0138	Signal activity check.	0 V	> 1.5 V	P0138 Refer to DTC P0138 under **SAE P0xxx Diagnostic**

					Trouble Codes for all monitoring values.
131($83)	P0138	Fuel cut off check.	0 V	> 1.5 V	P0138 Refer to DTC P0138 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 06 ($06): Oxygen Sensor (Bank 2, Sensor 2)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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
129 ($81)	P0158	Signal activity check.	0 V	> 1.5 V	Refer to DTC P0158 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
130 ($82)	P0158	Signal activity check.	0 V	> 1.5 V	Refer to DTC P0158 under **SAE P0xxx Diagnostic Trouble Codes**

					for all monitoring values.
131($83)	P0158	Fuel cut off check.	0 V	> 1.5 V	Refer to DTC P0158 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 33 ($21): Catalytic Converter Monitoring Bank 1

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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)	P0421	Conversion Capability (storage) Check.	---	> 0.6	Refer to DTC P0421 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
135 ($87)	P0421	Conversion Capability (storage) Check.	---	> 0.6	Refer to DTC P0421 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring

					values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 34 ($22): Catalytic Converter Monitoring Bank 2

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

Check Test Results of Components

- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 34 ($22): Catalytic Converter Monitoring Bank 2".

- 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)	P0431	Conversion Capability (storage) Check.	---	> 0.6	Refer to DTC P0431 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
135 ($87)	P0431	Conversion Capability (storage) Check.	---	> 0.6	Refer to DTC P0431 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 58 ($3A)): Fuel Tank EVAP System Leak Test (0.090)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 03 ($03)".

- 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	---	6.5-0.8 Sec	Refer to DTC P0455 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 59 ($3B)): Fuel Tank EVAP System Leak Test (0.040)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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	---	1.0-1.3 Sec	Refer to DTC P0442 under **SAE P0xxx Diagnostic**

					Trouble Codes for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 60 ($3C) : Fuel Tank EVAP System Leak Test (0.020/0.5mm)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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
130 ($82)	P0456	Fuel Tank Leak Test.	---	4.5-6 Sec	Refer to DTC P0456 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID 61 ($3D): Tank Vent Valve - Function Check

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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%	12%	Refer to DTC P0441 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

65 ($41): Oxygen Sensor Heating in front of Catalytic Converter (Bank 1 - Sensor 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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.	730° C	> 830° C	Refer to DTC P0135 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.

- Switch the ignition off.

69 ($45): Oxygen Sensor Heating in front of Catalytic Converter (Bank 2 - Sensor 1)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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
129 ($81)	P0155	Readiness check.	730° C	> 830° C	Refer to DTC P0155 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

66 ($42): Oxygen Sensor Monitoring Behind Catalytic Converter (Bank 1 - Sensor 2)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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.	0 ohms	> 65535 ohms	Refer to DTC P0141 under

					SAE P0xxx Diagnostic Trouble Codes for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

70 ($46): Oxygen Sensor Monitoring Behind Catalytic Converter (Bank 2 - Sensor 2)

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 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)	P0161	Readiness check.	0 ohms	> 65535 ohms	Refer to DTC P0161 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

162 ($A2): Combustion Misfire Cylinder 1 Data

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 162 ($A2): ".

- Select the desired "Test-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 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
12 ($0C)	P0301	Crankshaft speed fluctuation, single or multiple misfire check.	0 65535 (counts)	Refer to DTC P0301 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

163 ($A3): Combustion Misfire Cylinder 2 Data

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 163 ($A3) ".

- Select the desired "Test-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,	0 65535 (counts)	Refer to DTC P0302 under **SAE P0xxx**

		single or multiple misfire check.		**Diagnostic Trouble Codes** for all monitoring values.
12 ($0C)	P0302	Crankshaft speed fluctuation, single or multiple misfire check.	0 65535 (counts)	Refer to DTC P0302 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

164 ($A4): Combustion Misfire Cylinder 3 Data

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 164 ($A4): ".

- Select the desired "Test-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 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
12 ($0C)	P0303	Crankshaft speed fluctuation, single or multiple misfire	0 65535 (counts)	Refer to DTC P0303 under **SAE P0xxx Diagnostic Trouble Codes**

		check.		for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

165 ($A5): Combustion Misfire Cylinder 4 Data

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 165 ($A5): ".

- Select the desired "Test-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 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
12 ($0C)	P0304	Crankshaft speed fluctuation, single or multiple misfire check.	0 65535 (counts)	Refer to DTC P0304 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

166 ($A6): Combustion Misfire Cylinder 5 Data

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 166 ($A6): ".

- Select the desired "Test-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 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
12 ($0C)	P0305	Crankshaft speed fluctuation, single or multiple misfire check.	0 65535 (counts)	Refer to DTC P0305 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

167 ($A7): Combustion Misfire Cylinder 6 Data

- Connect the scan tool.
- Start the engine and let run at idle speed.
- Select "Diagnostic Mode 06 - Checking test results of components that are not continuously monitored".

Select "Test-ID 167 ($A7): ".

- Select the desired "Test-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 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.
12 ($0C)	P0306	Crankshaft speed fluctuation, single or multiple misfire check.	0 65535 (counts)	Refer to DTC P0306 under **SAE P0xxx Diagnostic Trouble Codes** for all monitoring values.

- If any component or system fails to meet the specified values, refer to --> **Diagnostic Mode 03 - Interrogating Fault Memory** to check for stored DTCs or the corresponding diagnostic repair procedure.
- Switch the ignition off.

Test-ID (TID) 11: Misfire, Averaging over 10 Drive Cycles

This value is calculated once per drive cycle (after ignition).

Test-ID (TID) 12: Misfire, in this Drive Cycle

This value is updated during the drive. During next ignition the engine misfires from the last drive cycle will be displayed. The TID 12 counter will not be reset until the engine is started.

Diagnostic Mode 07 - Check Test Results of Continuously Monitored Components

Diagnostic Mode 07 - Check Test Results of Continuously Monitored Components

Diagnostic Mode 07 displays all stored DTCs of emission related components and systems which are continuously monitored.

NOTE:

- **Depending on scan tool and protocol used, diagnostic mode 07 and the information provided may be referred to by a different name.**

Procedure

- Connect the scan tool.

- Start the engine and run at idle.
- Select "Diagnostic Mode 07 - Check Test Results of Components that are Continuously Monitored".

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

- Switch the ignition off.
- Refer to the following DTC tables for the diagnostic repair procedure:

--> **SAE P0xxx Diagnostic Trouble Codes**

--> **SAE P2xxx Diagnostic Trouble Codes**

--> **SAE P3xxx Diagnostic Trouble Codes**

--> **SAE U0xxx- Diagnostic Trouble Codes**

Diagnostic Mode 08 - Tank Leak Test

Diagnostic Mode 08 - Tank Leak Test

Diagnostic Mode 08 is used to determine if the fuel system is leaking.

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

If the scan tool being used will operate Diagnostic Mode 08, perform the test below.

NOTE:

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

Test requirements

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

Function test

NOTE:

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

- Connect the scan tool.
- Start the engine and run at idle for at least 15 minutes.
- Select "Diagnostic Mode 08 - Tank Leak Test".

- Select " Tank Leak Test".
- Check the specified value of the tank leak test at idle.
- The following may be displayed on the scan tool screen:

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

- Switch the ignition off.

If the specified result is obtained:

System OK.

If the specified result is not obtained:

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

If the specified result is again not obtained:

- A leak may be present. Refer to --> **EVAP System, Checking for Leaks**

Diagnostic Mode 09 - Vehicle Information

Diagnostic Mode 09 - Vehicle Information

Diagnostic Mode 09 is used to display vehicle specific information, e.g. the different Engine Control Module (ECM) and Transmission Control Module (TCM) versions.

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 "Diagnostic Mode 09 - Vehicle Information".

- Select the desired "Test-ID".
- The information requested will be displayed on the scan tool screen.

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

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

- Switch the ignition off.

PRELIMINARY CHECK

Preliminary Check

Preliminary Check

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

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

- 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 --> **Diagnostic Mode 04 - Reset/Delete Diagnostic Data**.
- 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 --> **Readiness Code**.

READINESS CODE

Readiness Code

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 manufacturers 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 V.
- Fuel tank level 1/4 to 3/4 full.

CAUTION: 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 5,000 RPM (with automatic transmission use the tip-tronic mode); lift off the throttle until the engine speed is around 1,200 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 DTCs.

Repair the vehicle if necessary.

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

DTC TABLES

DTC Tables

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

--> **SAE P0xxx Diagnostic Trouble Codes**
--> **SAE P2xxx Diagnostic Trouble Codes**
--> **SAE P3xxx Diagnostic Trouble Codes**
--> **SAE U0xxx- Diagnostic Trouble Codes**

SAE P0xxx Diagnostic Trouble Codes

SAE P0xxx Diagnostic Trouble Codes

Fuel, air mixture, and additional emissions regulations

NOTE:

- **For additional Monitor Strategy information, refer to the Siemens Simos 6 OBD System Strategy document.**

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0010	A Camshaft Position Actuator Circuit Bank 1 Malfunction	Check Camshaft Adjustment Valve 1 N205 --> **Camshaft Adjustment Valve,**	Signal current->0.8 mA	Camshaft valve-commanded on	0.5 second	Continuous 2 DCY

		Checking				
P0011	'A Camshaft Position (Bank 1) Timing Over-Advanced or System Performance	Check Camshaft Adjustment Valve 1 N205 --> **Camshaft Adjustment Valve, Checking**	Adjustment angle difference- > 9° CA for more than 2 Sec Number of checks- 3 times	Engine speed- >800 rpm Modeled oil temperature - 15 - 130° C Delta set point - 1 degree CA Than wait- 3 - 6 Sec	3 Sec	Continuous 2 DCY
P0013	'B Camshaft Position Actuator Circuit (Bank 1) Malfunction	Check Camshaft Adjustment Valve 1 N208 --> **Camshaft Adjustment Valve, Checking**	Signal current - > 0.8 mA	Camshaft valve- commanded on	2 Sec	Continuous 2 DCY
P0014	'B Camshaft Position (Bank 1) Timing Over-Advanced or System Performance	Check Camshaft Adjustment Valve 1 N208 --> **Camshaft Adjustment Valve, Checking**	Adjustment angle difference- > 9° CA for more than 2 Sec Number of checks- 3 times	Engine speed- >800 rpm Modeled oil temperature - 15 - 130° C Delta set point - 1 degree CA Than wait- 3 - 6 Sec.	0.25 Sec.	Continuous 2 DCY
P0020	A Camshaft Position Actuator Circuit/Open (Bank 2)	Check Camshaft Adjustment Valve 1 (exhaust) N318 --> **Camshaft Adjustment Valve, Checking**	Signal current- > 0.8 mA	Camshaft valve- commanded on	0.5 Sec.	Continuous 2 DCY
P0021	"A" Camshaft Position - Timing Over-Advanced or System Performance	Check Camshaft Adjustment Valve 1 (exhaust) N318 --> **Camshaft Adjustment Valve, Checking**	Adjustment angle difference- > 9° CA for more than 2 Sec. Number of checks- 3 times	Engine speed- >800 rpm Modeled oil temperature - 15 - 130° C Delta set point - 1 degree CA Than wait- 3 - 6 Sec	3 Sec.	Continuous 2 DCY

P0023	"B" Camshaft Position - Actuator Circuit/Open	Check the Camshaft Adjustment Valve 1 (exhaust) N319. Refer to --> **Camshaft Adjustment Valve, Checking**.	Signal current- > 0.8 mA	Camshaft valve- commanded on	2 Sec.	Continuous 2 DCY
P0024	"B" Camshaft Position - Timing Over-Advanced or System Performance	Check the Camshaft Adjustment Valve 1 (exhaust) N319. Refer to --> **Camshaft Adjustment Valve, Checking**.	Adjustment angle difference- > 9° CA for more than 2 Sec. Number of checks- 3 times	Engine speed- >800 rpm Modeled oil temperature - 15 - 130° C Delta set point - 1° CA Than wait- 3 - 6 Sec.	0.25 Sec.	Continuous 2 DCY
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	Check Oxygen Sensor (O2S) Heater Z19 --> **Oxygen Sensor Heater before Catalytic Converter, Checking**	Heater current- 8 - 40 mA	Heater- commanded on Duty cycle- 0.4 - 99.6%	5.2 Sec.	Continuous 5 Sec.
P0031	HO2S Heater Control Circuit (Bank 1 Sensor 1) Low	Check Oxygen Sensor (O2S) Heater Z19 --> **Oxygen Sensor Heater before Catalytic Converter, Checking**	Heater voltage- 1.9 - 2.22 V	Heater- commanded off Duty cycle- 99.6%	5.2 Sec.	Continuous 5 Sec.
P0032	HO2S Heater Control Circuit (Bank	Check Oxygen Sensor (O2S)	Heater current- > 8 - 11 A	Heater- commanded off Duty	5.2 Sec.	Continuous 5 Sec.

	1 Sensor 1) High	Heater Z19 --> **Oxygen Sensor Heater before Catalytic Converter, Checking**		cycle-> 0.4 V		
P0036	HO2S Heater Control Circuit (Bank 1 Sensor 2)	Check Oxygen Sensor (O2S) Heater Z29 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Heater current- 8 - 40 mA	Heater-commanded on Duty cycle- 0.4 - 99.6%	5.2 Sec.	Continuous 2 DCY
P0037	HO2S Heater Control Circuit (Bank 1 Sensor 2) Low	Check Oxygen Sensor (O2S) Heater Z29 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Heater voltage- 1.9 - 2.22 V	Heater-commanded off Duty cycle- 99.6%	5.2 Sec.	Continuous 2 DCY
P0038	HO2S Heater Control Circuit (Bank 1 Sensor 2) High	Check Oxygen Sensor (O2S) Heater Z29 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Heater current Bank 1 > 8 - 11 A	Heater-commanded off Duty cycle- 99.6%	5.2 Sec.	Continuous 2 DCY
P0040	O2 Sensor Circuit, Bank 1- Sensor 1/Bank 2 - Sensor 1 Swapped	Check oxygen sensors for swapping. Check harness connector with correct coding and color for affiliation to	Deviation lambda control-sensor 1 - > 24% and sensor 2 - - 24% or sensor 1- -24% and sensor 2- > 24%	Lambda control-active	50 Sec.	Continuous 2 DCY

		the correct primary catalytic converter according to the wiring diagram.				
P0041	O2 Sensor Circuit, Bank 1 - Sensor 2/Bank 2 - Sensor 2 Swapped	Check oxygen sensors for swapping. Check harness connector with correct coding and color for affiliation to the correct primary catalytic converter according to the wiring diagram..	Sensor 1 - > 0.830 V and Sensor 2 - 0.156 V or Sensor 1 - 0.156 V and Sensor 2 - 0.830 V	Mass air flow integrated- >400g O2S rear - no other faults O2S rear-closed loop	50 Sec.	Continuous 2 DCY
P0050	O2 Sensor Heater Circuit Bank 2 - Sensor 1 Electrical Fault	Check Oxygen Sensor (O2S) Heater Z28 --> **Oxygen Sensor Heater before Catalytic Converter, Checking**	Heater current - 8 - 40 mA	Heater-commanded on Duty cycle- 0.4 - 99.6%	5.2 Sec.	Continuous 5 Sec.
P0051	HO2S Heater Control Circuit (Bank 2 Sensor 1) Low	Check Oxygen Sensor (O2S) Heater Z28 --> **Oxygen Sensor Heater before Catalytic Converter, Checking**	Heater voltage - 1.9 - 2.22 V	Heater-commanded off Duty cycle- 99.6%	5.2 Sec.	Continuous 5 Sec.
P0052	HO2S Heater Control	Check Oxygen	Heater current - > 8 - 11 A	Heater-commanded	5.2 Sec.	Continuous 5 Sec.

	Circuit (Bank 2 Sensor 1) High	Sensor (O2S) Heater Z28 --> **Oxygen Sensor Heater before Catalytic Converter, Checking**		off Duty cycle-> 0.4 V		
P0056	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Check Oxygen Sensor (O2S) Heater Z30 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Heater current - 8 - 40 mA	Heater-commanded on Duty cycle- 0.4 - 99.6%	5.2 Sec.	Continuous 2 DCY
P0057	HO2S Heater Control Circuit (Bank 2 Sensor 2) Low	Check Oxygen Sensor (O2S) Heater Z30 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Heater voltage - 1.9 - 2.22 V	Heater-commanded off Duty cycle- 99.6%	5.2 Sec.	Continuous 2 DCY
P0058	HO2S Heater Control Circuit (Bank 2 Sensor 2) High	Check Oxygen Sensor (O2S) Heater Z30 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Heater current Bank 2 - > 3 - 5 A	Heater-commanded off Duty cycle-> 0.4 V	5.2 Sec.	Continuous 2 DCY

Fuel and air ratios

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination

P0069	Intake manifold -> air pressure incorrect allocation	Check Intake Air Temperature (IAT) Sensor G42 --> **Intake Air Temperature Sensor, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Altitude sensor signal vs IM pressure->27 kPa	Modeled pressure ratio @ throttle - 0.05 or Throttle position - 28° - 81° Engine speed - 600 - 4,000 rpm	3 Sec.	Continuous 2 DCY
P0090	Fuel Metering Valve Electrical Malfunction	Check Fuel pressure regulator and residual pressure Fuel Injection and Ignition 24 Fuel Injection System, Servicing Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal voltage - 3 V	Camshaft valve commanded off	2 Sec.	Continuous 2 DCY
P0091	Fuel Pressure Regulator 1 Control Circuit Low	Check Fuel pressure regulator and residual pressure Fuel Injection and Ignition 24 Fuel Injection System, Servicing Check Fuel Pressure	Signal current - > 1 Amp	Camshaft valve - commanded on	2 Sec.	Continuous 2 DCY

		Sensor G247 --> **Fuel Pressure Sensor, Checking**				
P0094	Fuel System Leak Detected - Small Leak	Check Fuel pressure regulator and residual pressure Fuel Injection and Ignition 24 Fuel Injection System, Servicing Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal voltage - 3 V	Camshaft valve - commanded off	2 Sec.	Continuous 2 DCY
P0095	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	Check Intake Air Temperature (IAT) Sensor G42 --> **Intake Air Temperature Sensor, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Signal current - > 1 Amp	Camshaft valve - commanded on	2 Sec.	Continuous 2 DCY
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	Check Intake Air Temperature (IAT) Sensor G42 --> **Intake Air Temperature**	Altitude sensor signal vs IM pressure- > 20 kPa Altitude sensor signal	Engine speed- 0 rpm Time after engine start- 0 Sec. Engine speed- 0 rpm Time after	3 Sec.	Continuous 2 DCY

		Sensor, Checking Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	vs IM pressure- > 20 kPa Altitude sensor signal vs IM pressure- > 27 kPa	engine start- 0 Sec.. Modeled pressure ratio @ throttle- 0.05 or Throttle position- 28° - 81° Engine speed- 600 - 4,000 rpm		
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low	Check Intake Air Temperature (IAT) Sensor G42 --> **Intake Air Temperature Sensor, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Signal voltage- 0.2 V	---	2 Sec.	Continuous 2 DCY
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High	Check Intake Air Temperature (IAT) Sensor G42 --> **Intake Air Temperature Sensor, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Signal voltage- > 4.8 V	---	2 Sec.	Continuous 2 DCY

P0112	Intake Air Temperature Sensor 1 Circuit Low	Check Intake Air Temperature (IAT) Sensor G42 --> **Intake Air Temperature Sensor, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	IAT > 141.0° C	---	2 Sec.	Continuous 2 DCY
P0113	Intake Air Temperature Sensor 1 Circuit High	Check Intake Air Temperature (IAT) Sensor G42 --> **Intake Air Temperature Sensor, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	IAT- 1.992 V	---	2 Sec.	Continuous 2 DCY
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	Check Engine Coolant Temperature (ECT) Sensor G62 --> **Engine Coolant Temperature Sensor, Checking**	Delta ECT- 3 K Delta ECT- 11 - 2 K	ECT @ start- 75° - 87° C or 110° - 141° C Driving condition 1 > 22 Sec. Vehicle speed->12.5 mph Engine speed- >	155 Sec. 30 Sec.	Once per DCY 2 DCY

				2,500 rpm and Driving condition 2 > 22 Sec. Fuel cut off-active or Vehicle speed- > 65 mph Engine speed - idle ECT @ start- 75° C Delta modeled ECT- 22.5 - 4.5 K		
P0117	Engine Coolant Temperature Sensor 1 Circuit Low	Check Engine Coolant Temperature (ECT) Sensor G62 --> **Engine Coolant Temperature Sensor, Checking**	ECT- > 14 1° C	---	2 Sec.	Continuous 2 DCY
P0118	Engine Coolant Temperature Sensor 1 Circuit High	Check Engine Coolant Temperature (ECT) Sensor G62 --> **Engine Coolant Temperature Sensor, Checking**	ECT--45.75° C	---	2 Sec.	Continuous 2 DCY
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance	Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking**	TPS 1 - TPS 2-> 5.79° and Relative mass air integral- >100 @ 0.45 Sec.	Engine start - completed TPS - no fault	0.2 Sec.	Continuous 2 DCY
P0122	Throttle/Pedal Position Sensor A Circuit Low Input.	Check Throttle Valve	Signal voltage- 0.117 V TPS	--- Engine start - completed	0.2 Sec.	Continuous 2 DCY

		Control Module J338 --> **Throttle Valve Control Module, Checking**	1 - TPS 2- > 5.79° and Relative mass air integral- > 100 @ 0.45 Sec.	TPS - no fault		
P0123	Throttle/Pedal Position Sensor A Circuit High Input	Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking**	Signal voltage- > 4.888 V	---	0.2 Sec.	Continuous 2 DCY
P0131	O2 Sensor Circuit, Bank 1- Sensor 1 Low Voltage	Check Heated Oxygen Sensor (HO2S) G39 --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Short to ground- 0.13 V. O2S not ready after dew-point exceeded-> 40 Sec. UEGO ceramic temperature- 730 or 830° C Lambda deflection cumulated- 0.5 after 30 cycles O2S signal front- 2.1 V O2S signal front- 0.2 V for 5 Sec.	Engine speed- > 416 rpm O2S front dew-point exceeded LSU heater control - active. O2S front dew-point - exceeded LSU heater control - active Lambda control - active O2S signal front - 1.982 - 2.1 V Engine speed- > 992 rpm Engine load->20 kg/h Lambda modulation- >1% and >1.4 Sec. Fuel cut off- >2 Sec.	3 Sec. 40 Sec. 120 Sec. 42 Sec. 4.5 Sec. 10 Sec.	Continuous 2 DCY Once per DCY 2 DCY Continuous 2 DCY Continuous 2 DCY Continuous 2 DCY Once per DCY 2 DCY

				Modeled exhaust gas temperature- >380° C Heater-failed		
P0132	O2 Sensor Circuit High Voltage	Check Heated Oxygen Sensor (HO2S) G39 --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Short to battery positive- > 5.5 V	Engine speed- > 416 rpm	3 Sec.	Continuous 5 Sec.
P0133	O2 Sensor Circuit Slow Response	Check Heated Oxygen Sensor (HO2S) G39 --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Lambda value vs. modeled lambda value- >0.7998	Modeled temperature- 500 - 950° C ECT->60° C Engine speed- 700 - 3,000 rpm Engine speed deviation - 518 rpm Mass air flow - 0.426 - 1.2 g/rev Delta mass air flow - 0.264 g/rev EVAP canister load- 40%	65 Sec.	Once per DCY 2 DCY
P0135	O2 Sensor Heater Circuit, Bank 1- Sensor 1 Electrical Fault	Check Oxygen Sensor (O2S) Heater Z19 --> **Oxygen Sensor Heater before Catalytic Converter, Checking**	O2S not ready after dew-point exceeded -.40 Sec. UEGO ceramic temperature - 730° or > 830° C	O2S front dew-point - exceeded Heater control - active O2S front - no other faults O2S front dew-point - exceeded Heater control -	240 Sec. 120 Sec.	Once per DCY 2 DCY Continuous 2 DCY

				active Lambda control - active O2S front- no other faults		
P0136	O2 Sensor Circuit, Bank 1 - Sensor 2 Malfunction	Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 --> **Heated Oxygen Sensor after Catalytic Converter, Checking**	Signal voltage- > 0.3 V	Integrated mass air flow- 20 - 150g Fuel cut off-active	5 Sec.	Continuous 2 DCY
P0137	O2 Sensor Circuit, Bank 1- Sensor 2 Low Voltage	Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 --> **Heated Oxygen Sensor after Catalytic Converter, Checking**	Signal voltage- 20 mV and Internal resistance- 10 ohms	O2S rear dew-point - exceeded O2S rear- fully heated up Mass air flow- > 12 kg/h	5 Sec.	Continuous 2 DCY
P0138	O2 Sensor Circuit High Voltage	Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 --> **Heated Oxygen Sensor after Catalytic Converter,**	Signal voltage-> 1.5 V	---	5 Sec.	Continuous 2 DCY

		Checking				
P0140	O2 Sensor Circuit No Activity Detected	Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G130 --> **Heated Oxygen Sensor after Catalytic Converter, Checking**	Internal resistance-> 60 kohms and Signal voltage - 0.376 - 0.474 V	Modeled exhaust temperature-> 555° C or Signal voltage - 0.21 - 0.76 V	5 Sec.	Continuous 2 DCY
P0141	O2 Sensor Heater Circuit, Bank 1 - Sensor 2 Electrical Fault	Check Oxygen Sensor (O2S) Heater Z29 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Internal resistance- > 65535 ohms	Modeled exhaust gas temperature- xxx - 400° C Heater duty cycle- 0.8 - 99.2%	60 Sec.	Once per driving cycle 2 DCY
P0151	Bank 2- sensor 1 Voltage too low	Check Heated Oxygen Sensor (HO2S) 2 G108 --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Short to ground - 0.13 V O2S not ready after dew-point exceeded- > 40 Sec. UEGO ceramic temperature- 730° or 830° C Lambda deflection cumulated- 0.5 after 30 cycles O2S signal front- 2.1 V O2S signal front- 0.2 V for 5 Sec.	Engine speed->416 rpm O2S front dew-point - exceeded LSU heater control- active O2S front dew-point - exceeded LSU heater control- active Lambda control- active O2S signal front- 1.982 - 2.1 V Engine speed- > 992	3 Sec 40 Sec 120 Sec 42 Sec 4.5 Sec 10 Sec	Continuous 2 DCY Once per driving cycle 2 DCY Continuous 2 DCY Continuous 2 DCY Continuous 2 DCY Once per driving cycle 2 DCY

				rpm Engine load->20 kg/h Lambda modulation-> 1% and >1.4 Sec Fuel cut off->2 Sec. Modeled exhaust gas temperature->380° C Heater-failed		
P0152	O2 Sensor Circuit, Bank 2 - Sensor 1 High Voltage	Check Heated Oxygen Sensor (HO2S) 2 G108 --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Short to battery positive- > 5.5 V	Engine speed -> 416 rpm	3 Sec	Continuous 5 Sec
P0153	O2 Sensor Circuit, Bank 2 - Sensor 1 Slow Response	Check Heated Oxygen Sensor (HO2S) 2 G108 --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Lambda value vs. modeled lambda value- > 0.7998	Modeled temperature- 500° - 950° C ECT-> 60° C Engine speed- 700 - 3,000 rpm Engine speed deviation - 518 rpm Mass air flow - 0.426 - 1.2 g/rev Delta mass air flow- 0.264 g/rev EVAP canister load- 40%	65 Sec	Once per driving cycle 2 DCY
P0155	O2 Sensor Heater Circuit, Bank 2 - Sensor 1 Electrical Fault	Check Oxygen Sensor (O2S) Heater Z28 --	O2S not ready after dew-point exceeded -.40	O2S front dew-point - exceeded Heater	240 Sec. 120 Sec	Once per DCY 2 DCY Continuous 2 DCY

		> **Oxygen Sensor Heater before Catalytic Converter, Checking**	Sec UEGO ceramic temperature- 730° C or > 830° C	control - active O2S front-no other faults O2S front dew-point - exceeded Heater control - active Lambda control - active O2S front-no other faults		
P0156	O2 Sensor Circuit, Bank 2 - Sensor 2 Malfunction	Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G131 --> **Heated Oxygen Sensor after Catalytic Converter, Checking**	Signal voltage- > 0.3 V	Integrated mass air flow - 20 - 150g Fuel cut off-active	5 Sec	Continuous 2 DCY
P0157	O2 Sensor Circuit, Bank 2 - Sensor 2 Low Voltage	Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G131 --> **Heated Oxygen Sensor after Catalytic Converter, Checking**	Signal voltage- 20 mV and Internal resistance- 10 ohms	O2S rear dew-point-exceeded O2S rear-fully heated up Mass air flow- > 12 kg/h	5 Sec	Continuous 2 DCY
P0158	O2 Sensor Circuit, Bank 2 - Sensor 2 High Voltage Signal	Check Oxygen Sensor (O2S) Behind Three	Voltage- > 1.5 V	---	5 Sec	Continuous 2 DCY

		Way Catalytic Converter (TWC) G131 --> **Heated Oxygen Sensor after Catalytic Converter, Checking**				
P0160	O2 Sensor Circuit No Activity Detected	Check Oxygen Sensor (O2S) Behind Three Way Catalytic Converter (TWC) G131 --> **Heated Oxygen Sensor after Catalytic Converter, Checking**	Internal resistance-> 60kohms and Signal voltage - 0.376 - 0.474 V	Modeled exhaust temperature-> 555° C or Signal voltage - 0.21 - 0.76 V	5 Sec	Continuous 2 DCY
P0161	HO2S Heater Control Circuit (Bank 2 Sensor 2)	Check Oxygen Sensor (O2S) Heater Z30 --> **Oxygen Sensor Heater after Catalytic Converter, Checking**	Internal resistance-> 65535 ohms	Modeled exhaust gas temperature - xxx - 400° C Heater duty cycle - 0.8 - 99.2%	60 Sec	Once per DCY 2 DCY
P0171	System too Lean, Bank 1	Check fuel pump delivery and quantity --> **Fuel Delivery, Checking** Check Fuel pressure regulator and residual pressure Fuel Injection and	Additive System too lean Adaptive value - > 6% Multiplicative System too lean Adaptive value- > 25%	Lambda control-closed loop EVAP purge valve - closed IAT->-10° C ECT or Sub. ECT->75° C Engine speed - 1,100 rpm Mass air flow-22 kg/h	35 Sec	Continuous 2 DCY

		Ignition 24 Fuel Injection System, Servicing Check Fuel injectors --> **Fuel Injectors, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing Check exhaust system for proper seal Engine Mechanical 26 Exhaust System Components, Removing and Installing Check vacuum lines for leaks Fuel Injection and Ignition 24 Fuel Injection System, Servicing		Fuel adaptation-active stable Lambda control-closed loop EVAP purge valve-closed IAT->-10° C ECT or Sub. ECT- > 75° C Engine speed-4,800 rpm Mass air flow - 34 - 450 kg/h Fuel adaptation-active stable Engine load->12 - 60%		
P0172	System too Rich, Bank 1	Check Fuel pressure regulator and residual pressure Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Additive System too rich Adaptive value - -8% Multiplicative System too rich Adaptive value- -25%	Lambda control-closed loop EVAP purge valve - closed IAT->-10° C ECT or Sub. ECT->75° C Engine speed	35 Sec	Continuous 2 DCY

		Check Fuel injectors --> **Fuel Injectors, Checking** Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors behind Three Way Catalytic Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking**		- 1,100 rpm Mass air flow-22 kg/h Fuel adaptation-active stable Lambda control-closed loop EVAP purge valve-closed IAT->-10° C ECT or Sub. ECT- > 75° C Engine speed-4,800 rpm Mass air flow - 34 - 450 kg/h Fuel adaptation-active stable Engine load->12 - 60%		
P0174	System too Lean,	Check fuel	Additive	Lambda	35 Sec	Continuous 2

	Bank 2	pump delivery and quantity --> **Fuel Delivery, Checking** Check Fuel pressure regulator and residual pressure Fuel Injection and Ignition 24 Fuel Injection System, Servicing Check Fuel injectors --> **Fuel Injectors, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing Check exhaust system for proper seal Engine Mechanical 26 Exhaust System Components, Removing and Installing Check vacuum lines for leaks Fuel Injection and Ignition 24 Fuel Injection	System too lean Adaptive value - > 6% Multiplicative System too lean Adaptive value- > 25%	control-closed loop EVAP purge valve - closed IAT->-10° C ECT or Sub. ECT->75° C Engine speed - 1,100 rpm Mass air flow-22 kg/h Fuel adaptation-active stable Lambda control-closed loop EVAP purge valve-closed IAT->-10° C ECT or Sub. ECT- > 75° C Engine speed-4,800 rpm Mass air flow - 34 - 450 kg/h Fuel adaptation-active stable Engine load->12 - 60%		DCY

		System, Servicing				
P0175	System too Rich, Bank 2	Check Fuel pressure regulator and residual pressure Fuel Injection and Ignition 24 Fuel Injection System, Servicing Check Fuel injectors --> **Fuel Injectors, Checking** Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors	Additive System too rich Adaptive value - - 8% Multiplicative System too rich Adaptive value- -25%	Lambda control-closed loop EVAP purge valve - closed IAT->-10° C ECT or Sub. ECT->75° C Engine speed - 1,100 rpm Mass air flow-22 kg/h Fuel adaptation-active stable Lambda control-closed loop EVAP purge valve-closed IAT->-10° C ECT or Sub. ECT- > 75° C Engine speed-4,800 rpm Mass air flow - 34 - 450 kg/h Fuel adaptation-active stable Engine load->12 - 60%	35 Sec	Continuous 2 DCY

		behind Three Way Catalytic Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking**				
P0190	Fuel Pressure Sensor -G247- Electrical Malfunction	Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal voltage- > 4.8 V	---	2 Sec	Continuous 2 DCY
P0192	Fuel Rail Pressure Sensor Circuit Low	Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal voltage- 0.2 V	---	2 Sec	Continuous 2 DCY
P0201	Injector Circuit/Open Cylinder 1	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current-10 A and Signal voltage- > 3.5 V	Injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0202	Injector Circuit/Open Cylinder 2	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current-10 A and Signal voltage- > 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0203	Injector Circuit/Open Cylinder 3	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current-10 A and Signal voltage- > 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY

P0204	Injector Circuit/Open Cylinder 4	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current-10 A and Signal voltage- > 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0205	Injector Circuit/Open Cylinder 5	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current-10 A and Signal voltage- > 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0206	Injector Circuit/Open Cylinder 6	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current-10 A and Signal voltage- > 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0222	Throttle/Pedal Position Sensor/Switch -B- Circuit Low	Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking**	Signal voltage-0.117 V	---	0.2 Sec	Continuous 2 DCY
P0223	Throttle/Pedal Position Sensor/Switch -B- Circuit High	Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking**	Signal voltage- > 4.888 V	---	0.2 Sec	Continuous 2 DCY
P0261	Cylinder 1 Injector Circuit Low	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current 10 A and Signal Voltage 3.5 V	injection valve-commanded on Injection valve-commanded	3 Sec	Continuous 2 DCY

				off		
P0262	Cylinder 1 Injector Circuit High	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current-> 16 A	Injection valve-commanded on	3 Sec	Continuous 2 DCY
P0264	Cylinder 2 Injector Circuit Low	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current 10 A and Signal Voltage 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0265	Cylinder 2 Injector Circuit High	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current- > 16 A	Injection valve-commanded on	3 Sec	Continuous 2 DCY
P0267	Cylinder 3 Injector Circuit Low	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current 10 A and Signal Voltage 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0268	Cylinder 3 Injector Circuit High	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current- > 16 A	Injection valve-commanded on	3 Sec	Continuous 2 DCY
P0270	Cylinder 4 Injector Circuit Low	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current 10 A and Signal Voltage 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0271	Cylinder 4 Injector Circuit High	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current- > 16 A	Injection valve-commanded on	3 Sec	Continuous 2 DCY
P0273	Cylinder 5 Fuel Injector -N83-Short circuit to Ground (GND)	Check Fuel injectors --> **Fuel Injectors,**	Signal current 10 A and Signal Voltage 3.5 V	injection valve-commanded on Injection	3 Sec	Continuous 2 DCY

		Checking		valve-commanded off		
P0274	Cylinder 5 Fuel Injector -N83-Short circuit to B+	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current- > 16 A	Injection valve-commanded on	3 Sec	Continuous 2 DCY
P0276	Cylinder 6 Fuel Injector -N84-Short circuit to Ground (GND)	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current 10 A and Signal Voltage 3.5 V	injection valve-commanded on Injection valve-commanded off	3 Sec	Continuous 2 DCY
P0277	Cylinder 6 Fuel Injector -N84-Short circuit to B+	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current- > 16 A	Injection valve-commanded on	3 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 Illumination
P0300	Random/Multiple Cylinder Misfire Detected	Check Fuel injectors --> **Fuel Injectors, Checking** Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Emission Threshold, 1st interval % MR- > 2.0% Emission Threshold, misfire rate MR- > 1.5% Catalyst damage, misfire rate MR- >1.5 - 15%	Engine speed range- 150 - 6,850 rpm Engine torque-> 0 Nm fuel cut off- Not active	1,000 rev 200 rev	Continuous 2 DCY Immed
P0301	Cylinder 1 Misfire Detected	Check Fuel injectors --> **Fuel Injectors,**	Emission Threshold, 1st interval % MR- > 2.0%	Engine speed range- 150 - 6,850 rpm Engine	1,000 rev 200 rev	Continuous 2 DCY Immed

		Checking Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Emission Threshold, misfire rate MR- > 1.5% Catalyst damage, misfire rate MR- >1.5 - 15%	torque-> 0 Nm fuel cut off- Not active		
P0302	Cylinder 2 Misfire Detected	Check Fuel injectors --> **Fuel Injectors, Checking** Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Emission Threshold, 1st interval % MR- > 2.0% Emission Threshold, misfire rate MR- > 1.5% Catalyst damage, misfire rate MR- >1.5 - 15%	Engine speed range- 150 - 6,850 rpm Engine torque-> 0 Nm fuel cut off- Not active	1,000 rev 200 rev	Continuous 2 DCY Immed
P0303	Cylinder 3 Misfire Detected	Check Fuel injectors --> **Fuel Injectors, Checking** Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Emission Threshold, 1st interval % MR- > 2.0% Emission Threshold, misfire rate MR- > 1.5% Catalyst damage, misfire rate MR- >1.5 - 15%	Engine speed range- 150 - 6,850 rpm Engine torque-> 0 Nm fuel cut off- Not active	1,000 rev 200 rev	Continuous 2 DCY Immed
P0304	Cylinder 4 Misfire Detected	Check Fuel injectors --> **Fuel Injectors, Checking** Check	Emission Threshold, 1st interval % MR- > 2.0% Emission Threshold,	Engine speed range- 150 - 6,850 rpm Engine torque-> 0 Nm fuel cut	1,000 rev 200 rev	Continuous 2 DCY Immed

		Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	misfire rate MR- > 1.5% Catalyst damage, misfire rate MR- >1.5 - 15%	off- Not active		
P0305	Cylinder 5 Misfire Detected	Check Fuel injectors --> **Fuel Injectors, Checking** Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Emission Threshold, 1st interval % MR- > 2.0% Emission Threshold, misfire rate MR- > 1.5% Catalyst damage, misfire rate MR- >1.5 - 15%	Engine speed range- 150 - 6,850 rpm Engine torque-> 0 Nm fuel cut off- Not active	1,000 rev 200 rev	Continuous 2 DCY Immed
P0306	Cylinder 6 Misfire Detected	Check Fuel injectors --> **Fuel Injectors, Checking** Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Emission Threshold, 1st interval % MR- > 2.0% Emission Threshold, misfire rate MR- > 1.5% Catalyst damage, misfire rate MR- >1.5 - 15%	Engine speed range- 150 - 6,850 rpm Engine torque-> 0 Nm fuel cut off- Not active	1,000 rev 200 rev	Continuous 2 DCY Immed
P0326	Knock Sensor 1 Circuit Range/Performance	Check Knock Sensor (KS) 1 G61 Loosen knock sensor and tighten again to 20 Nm	Lower threshold- 0.029 V	Engine speed->2,656 rpm Mass air flow->0.75 g/rev	40 times	Continuous 2 DCY

		Eliminate abnormal engine noise (components loose, brackets/bolts broken) Change fuel types				
P0327	Knock Sensor 1 Circuit Low	Check Knock Sensor (KS) 1 G61 Loosen knock sensor and tighten again to 20 Nm Eliminate abnormal engine noise (components loose, brackets/bolts broken) Change fuel types	Lower threshold- 0.18 V	Engine speed->2,656 rpm Mass air flow->0.75 g/rev	40 times	Continuous 2 DCY
P0328	Knock Sensor 1-G61 Circuit High	Check Knock Sensor (KS) 1 G61 Loosen knock sensor and tighten again to 20 Nm Eliminate abnormal engine noise (components loose, brackets/bolts broken) Change fuel types	Upper threshold- 4.8 V	Engine speed->2,656 rpm Mass air flow->0.75 g/rev	40 times	Continuous 2 DCY
P0331	Knock Sensor 2-G66 Circuit Range/Performance	Check Knock Sensor (KS) 2 G66 --> **Knock**	Upper threshold- > 1.992 V	Engine speed->2,656 rpm Mass air flow->0.75	40 times	Continuous 2 DCY

		Sensor, Checking Loosen knock sensor and tighten again to 20 Nm Eliminate abnormal engine noise (components loose, brackets/bolts broken) Change fuel types		g/rev		
P0332	Knock Sensor 2 Circuit Low	Check Knock Sensor (KS) 2 G66 --> **Knock Sensor, Checking** Loosen knock sensor and tighten again to 20 Nm Eliminate abnormal engine noise (components loose, brackets/bolts broken) Change fuel types	Lower threshold- 0.18 V	Engine speed->2,656 rpm Mass air flow->0.75 g/rev	40 times	Continuous 2 DCY
P0333	Knock Sensor 2-G66 Circuit High	Check Knock Sensor (KS) 2 G66 --> **Knock Sensor, Checking** Loosen knock sensor and tighten again to 20 Nm	Upper threshold- 4.8 V	Engine speed->2,656 rpm Mass air flow->0.75 g/rev	40 times	Continuous 2 DCY

		Eliminate abnormal engine noise (components loose, brackets/bolts broken) Change fuel types				
P0335	Crankshaft Position Sensor (A) Circuit-G28 Malfunction	Check Engine Speed (RPM) Sensor G28 --> **Engine Speed Sensor, Checking**	Delta signal voltage- > 1 V Internal signal voltage- 1.5 V Internal voltage- > 3.5 V RPM signal-no signal	Engine speed- 32 rpm	0.4 Sec.	Continuous 2 DCY
P0336	Crankshaft Position Sensor (A) Circuit-G28 Range/Performance	Check Engine Speed (RPM) Sensor G28 --> **Engine Speed Sensor, Checking**	RPM signal comparison with phase sensor- not synchronous Counted versus reference teeth- > 1 Counted versus reference teeth- > 1 Actual time value vs. modeled time value - >1.375	Engine speed- > 32 rpm Engine speed- > 416 rpm Engine speed- > 480 rpm	0.4 Sec. 0.3 Sec. 25 Sec.	Continuous 2 DCY
P0340	Camshaft Position Sensor (A) Circuit Incorrect allocation	Check Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163 -->	Signal voltage-no altering @ 4 revs.	Engine speed->416 rpm	0.4 Sec.	Continuous 2 DCY

		Camshaft Position Sensors, Checking				
P0341	Camshaft Position Sensor (A) Circuit Range/Performance	Check Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163 --> **Camshaft Position Sensors, Checking**	Actual time value- 1 (-)	Engine speed->416 rpm	0.1 Sec.	Continuous 2 DCY
P0345	Camshaft Position Sensor (A) Circuit	Check Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163 --> **Camshaft Position Sensors, Checking**	Signal voltage-no altering @ 4 revs.	Engine speed->416 rpm	0.4 Sec.	Continuous 2 DCY
P0346	Camshaft Position Sensor A Circuit Range/Performance	Check Camshaft Position (CMP) Sensor G40 and Camshaft Position (CMP) Sensor 2 G163 --> **Camshaft Position Sensors, Checking**	Actual time value- 1 (-)	Engine speed->416 rpm	0.1 Sec.	Continuous 2 DCY
P0351	Ignition Coil (A)	Check	Signal	Engine	2 Sec.	Continuous 2

	Primary/Secondary Circuit Malfunction	Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	current- 0.05 - 0.2 mA	speed- 512 rpm		DCY
P0352	Ignition Coil (B) Primary/Secondary Circuit Malfunction	Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Signal current- 0.05 - 0.2 mA	Engine speed- 512 rpm	2 Sec.	Continuous 2 DCY
P0353	Ignition Coil (C) Primary/Secondary Circuit Malfunction	Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Signal current- 0.05 - 0.2 mA	Engine speed- 512 rpm	2 Sec.	Continuous 2 DCY
P0354	Ignition Coil (D) Primary/Secondary Circuit Malfunction	Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Signal current- 0.05 - 0.2 mA	Engine speed- 512 rpm	2 Sec.	Continuous 2 DCY
P0355	Ignition Coil (E) Primary/Secondary Circuit Malfunction	Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output**	Signal current- 0.05 - 0.2 mA	Engine speed- 512 rpm	2 Sec.	Continuous 2 DCY

		Stage, Checking				
P0356	Ignition Coil (F) Primary/Secondary Circuit Malfunction	Check Ignition Coil with Power Output Stage --> **Ignition Coil with Power Output Stage, Checking**	Signal current- 0.05 - 0.2 mA	Engine speed- 512 rpm	2 Sec.	Continuous 2 DCY
P0365	Camshaft Position Sensor (B) Circuit (Bank 1) Malfunction	Check Camshaft Position (CMP) Sensor 3 G300 and Camshaft Position (CMP) Sensor 4 G301 --> **Camshaft Position Sensors, Checking**	Signal voltage-no altering @ 4 revs.	Engine speed->416 rpm	0.4 Sec.	Continuous 2 DCY
P0366	Camshaft Position Sensor (B) Circuit (Bank 1) Range/Performance	Check Camshaft Position (CMP) Sensor 3 G300 and Camshaft Position (CMP) Sensor 4 G301 --> **Camshaft Position Sensors, Checking**	Actual time value-1 (-)	Engine speed->416 rpm	0.1 Sec.	Continuous 2 DCY
P0390	Camshaft Position Sensor (B) Circuit (Bank 2) Malfunction	Check Camshaft Position (CMP) Sensor 3	Signal voltage-no altering @ 4 revs.	Engine speed->416 rpm	0.4 Sec.	Continuous 2 DCY

		G300 and Camshaft Position (CMP) Sensor 4 G301 --> **Camshaft Position Sensors, Checking**				
P0391	Camshaft Position Sensor (B) Circuit (Bank 2) Range/Performance	Check Camshaft Position (CMP) Sensor 3 G300 and Camshaft Position (CMP) Sensor 4 G301 --> **Camshaft Position Sensors, Checking**	Adaptive value vs. target value-> 21° Actual time value- vs. modeled time value- 1 - 3.5	Engine speed->416 rpm Duty cycle- commanded off ---	2.0 Sec. 3.0 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 Illumination
P0421	Warm Up Catalyst, Bank 1 Efficiency Below Threshold	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors behind Three Way Catalytic	Amplitude ratio O2S ->0.6 (-)	Modeled exhaust temperature- 500° - 950° C ECT- > 60° C Engine speed- 700 - 3,500 rpm Engine speed- deviation- 350 rpm Mass air flow- 0.48 - 1.11 g/rev EVAP canister load-	70 Sec.	Once per driving cycle 2 DCY

		Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking** Check catalytic converter --> **Three Way Catalytic Converter, Checking**		low		
P0431	Warm Up Catalyst Efficiency Below Threshold	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors behind Three Way Catalytic Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking** Check catalytic converter --> **Three Way Catalytic Converter, Checking**	Amplitude ratio O2S - >0.6 (-)	Modeled exhaust temperature- 500° - 950° C ECT- > 60° C Engine speed- 700 - 3,500 rpm Engine speed-deviation- 350 rpm Mass air flow- 0.48 - 1.11 g/rev EVAP canister load-low	70 Sec.	Once per driving cycle 2 DCY
P0441	Evaporative Emission	Check Evaporative	Deviation lambda	Engine speed-idle rpm	25 Sec.	Once per driving cycle

	System Incorrect Purge Flow	Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	control 12% or deviation idle control- 8%	Engine speed deviation- 80 rpm ECT- > 59.25° C Sub. ECT- > 59.25° C IAT @ engine start- > 5° C Altitude- 2,500 m		2 DCY
P0442	Evaporative Emission System Leak Detected (small leak)	Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	Time for pressure drop- 1.0 - 1.3 Sec.	EVAP purge valve- closed LDP- activated Number of diagnosis attempts- =2 IAT- > 5.25° C Delta ambient pressure- 0.3 kPa Delta drop after engine start- 9.75 K Time after engine start- > 210 - 1,200 Sec. ECT @ start- 4.5 - 35° C Vehicle speed- > 6 mph	140 Sec.	Once per driving cycle 2 DCY
P0444	Evaporative	Check	Open circuit-	EVAP purge	2.0 Sec.	Once per

	Emission System Pure Control Valve Circuit Open	Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	>0.8 mA	valve-commanded off		driving cycle 2 DCY
P0455	Evaporative Emission System Leak Detected (large leak)	Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	Time for pressure drop-0.65 - 0.8 Sec.	EVAP purge valve-closed LDP-activated Altitude-2,500 m Number of diagnosis attempts- =2 IAT->5.25° C Delta ambient pressure- 0.3 kPa IAT drop after engine start- 9.75 K Time after engine start-> 210 - 1,022 Sec. ECT @ start- 4.5 - 35° C Vehicle speed->6 mph	140 Sec.	Once per driving cycle 2 DCY

P0456	Evaporative Emission System Leak Detected (very small leak)	Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	Time for pressure drop- 4.5 - 6.0 Sec.	EVAP purge valve- closed LDP- activated Altitude- 2,500 m Number of diagnosis attempts- = 10 IAT->5.25° C Delta ambient pressure- 0.2 kPa IAT drop after engine start- 9.75 K Time after engine start- > 210 - 1,200 Sec. ECT @ start - 4.5° - 35° C Vehicle speed- 6 - 80.7 mph Vehicle acceleration- 2.1 m/s	140 Sec.	Once per driving cycle 2 DCY
P0458	Evaporative Emission (EVAP) Canister Purge Regulator Valve- N80- Short circuit to Ground (GND)	Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal	Short to ground- 2.0 V	EVAP purge valve- commanded off Engine start- completed	2 Sec.	Once per driving cycle 2 DCY

		Fuel Supply System 20 EVAP System				
P0459	Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- Short circuit to B+	Check Evaporative Emission (EVAP) Canister Purge Regulator Valve N80 --> **EVAP Canister Purge Regulator Valve, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	Short to battery positive- > 1.0 A	EVAP purge valve- commanded off Engine start- completed	2 Sec.	Once per driving cycle 2 DCY

Speed and idle control

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0501	Vehicle Speed Sensor A Range/Performance	Check Engine Speed (RPM) Sensor G28 --> **Engine Speed Sensor, Checking**	VSS signal- > 184 mph	Time after start- 3 Sec.	5 Sec.	Multiple 2 DCY
P0506	Idle Air Control System RPM Lower Than Expected	Check Throttle Valve Control Module J338	Engine speed deviation-> -80 rpm	Engine speed- idle Vehicle speed- 0 mph Mass air	13 Sec.	Multiple 2 DCY

		--> **Throttle Valve Control Module, Checking**		flow- 0.72 g/rev EVAP purge flow-1 kg/h ECT- 60° - 110° C		
P0507	Idle Air Control System RPM Higher Than Expected	Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking**	Engine speed deviation-> 80 rpm	Engine speed- idle Vehicle speed- 0 mph Mass air flow- 0.72 g/rev EVAP purge flow-1 kg/h ECT- 60° - 110° C	13 Sec.	Multiple 2 DCY

Control module and output signals

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
P0601	Internal Control Module Memory Check Sum Error	Replace Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**	Internal check sum-incorrect	---	2 Sec.	Once per driving cycle 2 DCY
P0603	Internal Control Module Keep Alive Memory (KAM) Error	Replace the Transmission Control Module (TCM) J217 Refer to --> **Transmission Control Module, Replacing** for 09L transmissions or --> **Transmission Control Module, Replacing** for 01J transmissions.	SPI communication-lost	---	1.5 Sec.	Continuous 2 DCY
P0604	Internal Control Module Random Access Memory (RAM) Error	Replace Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing**	Write ability check- failed	---	2 Sec.	Continuous 2 DCY

		Replace the Transmission Control Module (TCM) J217 Refer to --> **Transmission Control Module, Replacing** for 09L transmissions or --> **Transmission Control Module, Replacing** for 01J transmissions.				
P0605	Internal Control Module Read Only Memory (ROM) Error	Replace Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing** Replace the Transmission Control Module (TCM) J217 Refer to --> **Transmission Control Module, Replacing** for 09L transmissions or --> **Transmission Control Module, Replacing** for 01J transmissions.	ROM check-failed	---	2 Sec.	Continuous 2 DCY
P0606	Internal Control Module Memory Check Sum Error	Replace Engine Control Module (ECM) J623 --> **Engine Control Module, Replacing** Replace the Transmission Control Module (TCM) J217 Refer to --> **Transmission Control Module, Replacing** for 09L transmissions or --> **Transmission Control Module,**	SPI communication-lost Signal voltage- 4.8 V Signal voltage- 0.2 V Boost voltage- 30 or 75 V EEPROM check- failed Drive by wire module check-failed Engine torque- out of range Engine operation-out of range CAN bus-	--- --- --- --- --- --- --- --- ---	10 m Sec. 2 Sec. 2 Sec. 2 Sec. 2 Sec. 2 Sec. 2 Sec. 0.51 Sec.	Continuous 2 DCY Once per driving cycle 2 DCY Continuous 2 DCY Continuous 2 DCY Continuous 2 DCY Continuous 2 DCY

		Replacing for 01J transmissions.	no message			
P0638	Throttle Actuator Control, Bank 1 Range/Performance	Check Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking** Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position Sensor/Accelerator Pedal Position Sensor 2, Checking**	Duty cycle->0.4 Sec. @ >98° Open to 15° ->1.275 Sec. then close to ref. point->1.28 Sec. Gradient->7° Close to 1.99° ->1.275 Sec. Then open to ref. point->1.28 Sec. Gradient-7° TPS 1 signal voltage- 0.2.8 - 0.852 V or TPS 2 signal voltage- 4.158 - 4.802 V	Engine start- not active ECT- 6 - 105° C IAT-> 5° C Engine speed- 320 rpm Vehicle speed-1 mph	0.45 Sec.	Continuous 2 DCY
P0657	Supply for engine components Open circuit	Check Engine Control Module (ECM) Power Supply Relay J363 --> **Engine Control Module Power Supply Relay, Checking**	Signal voltage->0.8 mA	Engine relay-commanded on	1.5 Sec.	Continuous 2 DCY
P0658	Supply for engine components Too low	Check Engine Control Module (ECM) Power Supply Relay J363 --> **Engine Control Module Power Supply Relay, Checking**	Signal voltage->2.0 V	Engine relay-commanded off	1.5 Sec.	Continuous 2 DCY
P0659	Supply voltage for engine components too large	Check Engine Control Module (ECM) Power Supply Relay J363 --> **Engine Control Module Power Supply Relay, Checking**	Signal current->1 Amp	Engine relay-commanded on	1.5 Sec.	Continuous 2 DCY
P0686	(ECM/PCM) Power Relay	Check Engine Control Module	Sense voltage->4.0 V	Main relay-commanded	0.1 Sec.	Once per driving cycle

	Control Circuit = > - J363- Low	(ECM) Power Supply Relay J363 --> **Engine Control Module Power Supply Relay, Checking**		off		2 DCY
P0687	(ECM/PCM) Power Relay Control Circuit = > - J363- High	Check Engine Control Module (ECM) Power Supply Relay J363 --> **Engine Control Module Power Supply Relay, Checking**	Sense voltage- 6.0 V	Main relay- commanded on	0.1 Sec.	Continuous 2 DCY

SAE P2xxx Diagnostic Trouble Codes

SAE P2xxx Diagnostic Trouble Codes

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 Illumination
P2004	Intake Manifold Runner Control (IMRC), bank 1 Stuck open	Check Intake Manifold Runner Position Sensor G336 --> **Intake Manifold Runner Position Sensor 1, Checking**	Signal voltage- 2.65 V	Time after engine start- 15 Sec. Duty cycle- commanded open	8 Sec.	Continuous 2 DCY
P2005	Intake manifold flap for air stream regulation, bank 2 Stuck open	Check Intake Manifold Runner Position Sensor 2 (P2020) G512 --> **Intake Manifold Runner Position Sensor 2, Checking**	Signal voltage- 2.65 V	Time after engine start- 15 Sec. Duty cycle- commanded open	8 Sec.	Continuous 2 DCY
P2006	Intake manifold flap for air stream regulation, bank 1 Stuck closed	Check Intake Manifold Runner Position Sensor G336 --> **Intake Manifold Runner Position Sensor 1, Checking**	Signal voltage-> 4 V	Time after engine start- 15 Sec. Duty cycle- commanded closed	8 Sec.	Continuous 2 DCY

P2007	Intake manifold flap for air stream regulation, bank 2 Stuck closed	Check Intake Manifold Runner Position Sensor 2 (P2020) G512 --> **Intake Manifold Runner Position Sensor 2, Checking**	Signal voltage-> 4 V	Time after engine start-15 Sec. Duty cycle-commanded closed	8 Sec.	Continuous 2 DCY
P2008	Intake manifold Runner Control (IMRC) electrical malfunction	Check Intake Manifold Runner Position Sensor G336 --> **Intake Manifold Runner Position Sensor 1, Checking**	Signal current->0.8 mA	Duty cycle-commanded on	2 Sec.	Continuous 2 DCY
P2009	Intake Manifold Runner Bank 1 Short to ground	Check Intake Manifold Runner Position Sensor G336 --> **Intake Manifold Runner Position Sensor 1, Checking**	Signal voltage-. 2 V	Duty cycle-commanded off	2 Sec.	Continuous 2 DCY
P2010	Intake Manifold Runner Bank 1 Short to B+	Check Intake Manifold Runner Position Sensor G336 --> **Intake Manifold Runner Position Sensor 1, Checking**	Signal current->1 A	Duty cycle-commanded on	2 Sec.	Continuous 2 DCY
P2014	Intake Manifold Runner Position Sensor/Switch Circuit	Check Intake Manifold Runner Position Sensor G336 --> **Intake Manifold Runner Position Sensor 1, Checking**	Signal voltage-0.2 V	---	2 Sec.	Continuous 2 DCY
P2015	Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance	Check Intake Manifold Runner Position Sensor G336 --> **Intake Manifold Runner Position Sensor 1, Checking**	Signal voltage- 4.5 - 4.8 V 0.5 - 0.2 V	ECT- > 6° C IAT- > 6° C	0.5 Sec.	Continuous 3 DCY
P2017	Intake Manifold Runner Position Sensor Short to B+	Check Intake Manifold Runner Position Sensor	Signal voltage-> 4.8 V	---	2 Sec.	Continuous 2 DCY

		G336 --> **Intake Manifold Runner Position Sensor 1, Checking**				
P2019	Sensor for intake manifold flap position 2 Electrical Malfunction	Check Intake Manifold Runner Position Sensor 2 (P2020) G512 --> **Intake Manifold Runner Position Sensor 2, Checking**	Signal voltage- 0.2 V	---	2 Sec.	Continuous 2 DCY
P2020	Sensor for intake manifold flap position 2 Range/Performance	Check Intake Manifold Runner Position Sensor 2 (P2020) G512 --> **Intake Manifold Runner Position Sensor 2, Checking**	Signal voltage- 4.5 - 4.8 V 0.5 - 0.2 V	ECT- > 6° C IAT- > 6° C	0.5 Sec.	Continuous 2 DCY
P2022	Intake Manifold Runner Position Sensor 2 Short to B+	Check Intake Manifold Runner Position Sensor 2 (P2020) G512 --> **Intake Manifold Runner Position Sensor 2, Checking**	Signal voltage->4.8 V	---	2 Sec.	Continuous 2 DCY
P2088	'A' Camshaft Position Actuator Circuit Bank 1 Short circuit to Ground (GND)	Check Camshaft Adjustment Valve 1 (exhaust) N318 --> **Camshaft Adjustment Valve, Checking**	Signal voltage- 3 V	Camshaft valve- commanded off	2 Sec.	Continuous 2 DCY
P2089	'A' Camshaft Position Actuator Circuit Bank 1 Short circuit to B+	Check Camshaft Adjustment Valve 1 (exhaust) N318 --> **Camshaft Adjustment Valve, Checking**	Signal current-> 1 Amp	Camshaft valve- commanded on	2 Sec.	Continuous 2 DCY
P2092	'A' Camshaft Position Actuator Control Circuit Low	Check Camshaft Adjustment Valve 1 (exhaust) N318 --> **Camshaft Adjustment Valve, Checking**	Signal voltage- 3 V	Camshaft valve- commanded off	2 Sec.	Continuous 2 DCY

P2093	'A' Camshaft Position Actuator Control Circuit High	Check Camshaft Adjustment Valve 1 (exhaust) N318 --> **Camshaft Adjustment Valve, Checking**	Signal current-> 1 Amp	Camshaft valve-commanded on	2 Sec.	Continuous 2 DCY
P2096	Bank 1, oxygen sensor correction behind cat Lean control limit exceeded	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors behind Three Way Catalytic Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Integral part of lambda control post cat->10%	Lambda control-closed loop lambda control post cat-closed loop Engine speed- 1,200 - 4,000 rpm Engine load- 14.4 - 5.8% Modeled catalyst temperature->62° C Set value- 0.96 - 1.04	120 Sec..	Continuous 2 DCY
P2097	Bank 1, oxygen sensor correction behind cat Rich control limit exceeded	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors behind Three Way Catalytic Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking** Check intake system for leaks (false air). Fuel Injection and	Integral part of lambda control post cat--10%	Lambda control-closed loop lambda control post cat-closed loop Engine speed- 1,200 - 4,000 rpm Engine load- 14.4 - 5.8% Modeled catalyst temperature->62° C Set value- 0.96 - 1.04	120 Sec..	Continuous 2 DCY

		Ignition 24 Fuel Injection System, Servicing				
P2098	Bank 2, oxygen sensor correction behind cat Lean control limit exceeded	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors behind Three Way Catalytic Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Integral part of lambda control post cat->10%	Lambda control-closed loop lambda control post cat-closed loop Engine speed- 1,200 - 4,000 rpm Engine load- 14.4 - 5.8% Modeled catalyst temperature->62° C Set value- 0.96 - 1.04	120 Sec..	Continuous 2 DCY
P2099	Bank 2, oxygen sensor correction behind cat Rich control limit exceeded	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check oxygen sensors behind Three Way Catalytic Converter (TWC) --> **Heated Oxygen Sensor after Catalytic Converter, Checking** Check intake system for leaks (false air). Fuel Injection and Ignition 24 Fuel Injection System, Servicing	Integral part of lambda control post cat--10%	Lambda control-closed loop lambda control post cat-closed loop Engine speed- 1,200 - 4,000 rpm Engine load- 14.4 - 5.8% Modeled catalyst temperature->62° C Set value- 0.96 - 1.04	120 Sec..	Continuous 2 DCY

P2101	Throttle Actuator Control Motor Circuit Range/Performance	Check the Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking**	Duty cycle- > 0.4 Sec. @ >98% and Actual TPS-ref. point- >1.5° or Actual TPS-calc. value- > 0.4 @ > 8°	Engine start-not active	0.45 Sec.	Continuous 2 DCY
P2106	Throttle Actuator Control System - Forced Limited Power	Check the Throttle Valve Control Module J338 --> **Throttle Valve Control Module, Checking**	ECM power stage-failure	Engine start-completed	0.45 Sec.	Continuous 2 DCY
P2122	Throttle/Pedal Position Sensor/Switch -C- Circuit Low	Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position Sensor/Accelerator Pedal Position Sensor 2, Checking**	Signal voltage- 0.4 V	---	0.2 Sec.	Continuous 2 DCY
P2123	Throttle/Pedal Position Sensor/Switch -C- Circuit High	Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position Sensor/Accelerator Pedal Position Sensor 2, Checking**	Signal voltage-> 4.844 V	---	0.2 Sec.	Continuous 2 DCY
P2127	Accelerator pedal position sender 2 - G185 signal too low	Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position Sensor/Accelerator Pedal Position Sensor 2,**	Signal voltage- 0.2 V	---	0.2 Sec.	Continuous 2 DCY

		Checking				
P2128	Accelerator pedal position sender 2 - G185 signal too low	Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position Sensor/Accelerator Pedal Position Sensor 2, Checking**	Signal voltage- > 2.8 V	---	---	---
P2138	Throttle/Pedal Position Sensor/Switch -C- Circuit Range/Performance	Check Throttle Position (TP) Sensor G79/Accelerator Pedal Position Sensor 2 G185 --> **Throttle Position Sensor/Accelerator Pedal Position Sensor 2, Checking**	Delta signal voltage sensor 1 vs. sensor 2- > 0.244 V	---	0.35 Sec..	Continuous 2 DCY
P2147	Fuel Injector Group A Supply Voltage Circuit Low	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current->12 A	Injection valve-commanded on	3 Sec.	Continuous 2 DCY
P2148	Fuel Injector Group A Supply Voltage Circuit High	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current->33 A	Injection valve-commanded on	3 Sec.	Continuous 2 DCY
P2150	Fuel Injector Group B Supply Voltage Circuit Low	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current->12 A	Injection valve-commanded on	3 Sec.	Continuous 2 DCY
P2151	Fuel Injector Group "B" Supply Voltage Circuit High	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current->33 A	Injection valve-commanded on	3 Sec.	Continuous 2 DCY
P2153	Fuel Injector Group C Supply Voltage Circuit Low	Check Fuel injectors --> **Fuel Injectors, Checking**	Signal current->12 A	Injection valve-commanded on	3 Sec.	Continuous 2 DCY
P2154	Fuel Injector Group "C" Supply Voltage Circuit	Check Fuel injectors --> **Fuel Injectors,**	Signal current->33 A	Injection valve-commanded	3 Sec.	Continuous 2 DCY

	High	**Checking**		on		
P2181	Malfunction in cooling system	Check Engine Coolant Temperature (ECT) Sensor G62 --> **Engine Coolant Temperature Sensor, Checking** Check Coolant Pump V50 Engine Mechanical 19 Cooling System Components, Removing and Installing Check Coolant Thermostat. Engine Mechanical 19 Cooling System Components, Removing and Installing	ECT-75° C @ Mass air integral- 5.0 - 14.0 kg	ECT @ start- 5.0 - 57° C Accum. fuel cut off- 120 Sec. Delta ambient pressure average value: 1.5 kPa Vehicle speed- 19 - 75 mph Mass air flow- 50 - 200 kg/h	500 Sec.	Once per driving cycle 2 DCY
P2195	O2 Sensor Signal Stuck Lean Bank 1 Sensor 1	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Lambda value- > 0.9941 Lambda value->1.1(-)	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear- ready Exhaust mass air integral-> 0.1 kg set-value- 0.85 Lambda control-closed loop Lambda control post cat.-closed loop ECT->60° C Engine speed- > 992 rpm Engine speed deviation-	25 Sec.. 100 Sec..	Once per driving cycle 2 DCY Continuous 2 DCY

				150 rev. Engine load- 30 - 300 kg/h Delta engine load- 0.15 g/rev Lambda deviation- 3% Integrated mass air flow- 150 g Modeled exhaust temperature- 500° - 750° C O2S signal rear-> 0.752 V Deviation lambda control- > 35%		
P2196	O2 Sensor Signal Stuck Rich Bank 1 Sensor 1	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Lambda valve-1.04 Lambda value-0.9	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear- ready Exhaust mass air integral-> 0.1 kg set-value 1.15 Lambda control- closed loop Lambda control post cat.-closed loop ECT- >60° C Engine speed- > 992 rpm Engine speed	25 Sec.. 100 Sec..	Once per driving cycle 2 DCY Continuous 2 DCY

				deviation- 150 rev. Engine load- 30 - 300 kg/h Delta engine load- 0.15 g/rev Lambda deviation- 3% Integrated mass air flow- 150 g Modeled exhaust temperature- 500° - 750° C O2S signal rear-> 0.151 V deviation lambda control- > -35%		
P2197	O2 Sensor Signal Stuck Lean Bank 2 Sensor 1	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Lambda value- > 0.9941 Lambda value->1.1(-)	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear- ready Exhaust mass air integral-> 0.1 kg set-value- 0.85 Lambda control- closed loop Lambda control post cat.-closed loop ECT- >60° C Engine speed- > 992 rpm Engine	25 Sec.. 100 Sec..	Once per driving cycle 2 DCY Continuous 2 DCY

				speed deviation- 150 rev. Engine load- 30 - 300 kg/h Delta engine load- 0.15 g/rev Lambda deviation- 3% Integrated mass air flow- 150 g Modeled exhaust temperature- 500° - 750° C O2S signal rear-> 0.752 V deviation lambda control- > 35%		
P2198	O2 Sensor Signal Stuck Rich Bank 2 Sensor 1	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Lambda valve- 1.04 Lambda value- 0.9	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear- ready Exhaust mass air integral-> 0.1 kg set-value 1.15 Lambda control- closed loop Lambda control post cat.-closed loop ECT- > 60° C Engine speed- > 992	25 Sec.. 100 Sec..	Once per driving cycle 2 DCY Continuous 2 DCY

				rpm Engine speed deviation- 150 rev. Engine load- 30 - 300 kg/h Delta engine load- 0.15 g/rev Lambda deviation 3% Integrated mass air flow- 150 g Modeled exhaust temperature- 500° - 750° C O2S signal rear-> 0.151 V deviation lambda control- > - 35%		
P2237	O2 Sensor Positive Current Control Circuit Bank 1 Sensor 1 Open	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Signal activity check-failed	O2S front-no other faults	65 Sec.	Continuous 2 DCY
P2240	Linear Lambda probe, exhaust gas bank 2/pump current open	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Signal activity check-failed	O2S front-no other faults	65 Sec.	Continuous 2 DCY
P2243	O2 Sensor Reference Voltage Circuit Bank 2 Sensor 1 Open	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic**	Functional check, heater-failed and Intrusive check, heater-failed	---	130 Sec.	Continuous 2 DCY

		Converter, Checking				
P2247	O2 Sensor Reference Voltage Circuit Bank 2 Sensor 1 Open	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Functional check, heater-failed and Intrusive check, heater-failed	---	130 Sec.	Continuous 2 DCY
P2251	O2 Sensor Negative Current Control Circuit Bank 1 Sensor 1 Open	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Functional check, heater-failed and Signal activity check-failed	---	162 Sec.	Continuous 2 DCY
P2254	O2 Sensor Negative Current Control Circuit/Open	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Functional check, heater-failed and Signal activity check-failed	---	162 Sec.	Continuous 2 DCY
P2270	O2 Sensor Signal Stuck Lean Bank 1 Sensor 2	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Signal voltage- 0.718 V While stet-value- 0.85	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear-ready Exhaust mass air integral- > 0.1 kg	25 Sec.	Once per driving cycle 2 DCY
P2271	O2 Sensor Signal Stuck Rich Bank 1 Sensor 2	Check oxygen sensors before catalytic converter -> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Signal voltage- > 0.298 V While set-value- 1.15	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear-ready Exhaust mass air integral- >	25 Sec.	Once per driving cycle 2 DCY

				0.1 kg		
P2272	O2 Sensor Signal Stuck Lean Bank 2 Sensor 2	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Signal voltage- 0.718 V While stet-value- 0.85	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear-ready Exhaust mass air integral- > 0.1 kg	25 Sec.	Once per driving cycle 2 DCY
P2273	O2 Sensor Signal Stuck Rich Bank 2 Sensor 2	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	Signal voltage- > 0.298 V While set-value- 1.15	Fault code detected- P2096 or P2097 or P2098 or P2099 O2S rear-ready Exhaust mass air integral- > 0.1 kg	25 Sec.	Once per driving cycle 2 DCY
P2294	Fuel Pressure Regulator Valve - N276 - Open circuit	Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal current- 0.8 mA	Time after engine start- 100 - 400 Sec.	2 Sec.	Continuous 2 DCY
P2295	Fuel Pressure Regulator Valve - N276 - Short circuit to Ground (GND)	Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal voltage- 2 V	Time after engine start- 100 - 400 Sec..	2 Sec.	Continuous 2 DCY
P2296	Fuel Pressure Regulator Valve - N276 - Short circuit to B+	Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal current- > 8 A	Time after engine start- 100 - 400 Sec..	2 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 Illumination
P2400	Evaporative	Check Leak	Open circuit-	LDP-	2 Sec.	Continuous 5

	Emission System Leak Detection Pump Control Circuit/Open	Detection Pump (LDP) V144 --> **Leak Detection Pump, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	> 0.5 mA	commanded on Engine speed- > 416 rpm		Sec.
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Check Leak Detection Pump (LDP) V144 --> **Leak Detection Pump, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	Short to ground- > 2 V	LDP-commanded on Engine speed- > 416 rpm	2 Sec.	Continuous 5 Sec.
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	Check Leak Detection Pump (LDP) V144 --> **Leak Detection Pump, Checking** Check Evaporative	Short to battery positive->1 A	LDP-commanded on Engine speed- > 416 rpm	2 Sec.	Continuous 5 Sec.

		Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System				
P2403	Evaporative Emission System Leak Detection Pump Sense Circuit/Open	Check Leak Detection Pump (LDP) V144 --> **Leak Detection Pump, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal Fuel Supply System 20 EVAP System	Low signal voltage time-> 1 Sec.	LDP-commanded off Altitude-2,500 m Number of diagnosis attempts-=2 IAT- > 5.25° C Delta ambient pressure- 0.3 kPa Delta drop after engine start-9.75 K Time after engine start->210 - 1,200 Sec. ECT @ start-4.5 - 35° C Vehicle speed->6 mph	10 Sec.	Continuous 2 DCY
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	Check Leak Detection Pump (LDP) V144 --> **Leak Detection Pump, Checking** Check Evaporative Emission (EVAP) Canister System for proper seal	High signal voltage time-> 0.36 Sec.	LDP-commanded off Altitude-2,500 m Number of diagnosis attempts-=2 IAT- > 5.25° C Delta ambient pressure- 0.3 kPa Delta drop after engine start-9.75 K Time	10 Sec.	Continuous 2 DCY

		Fuel Supply System 20 EVAP System		after engine start->210 - 1,200 Sec. ECT @ start-4.5 - 35° C Vehicle speed->6 mph		
P2414	Bank 1- probe 1 Voltage too low/leakage air	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking** Check exhaust system between catalytic converters and cylinder head for proper seal Engine Mechanical 26 Exhaust System Components, Removing and Installing	O2S signal front -> 3.1 V	Lambda control-active Engine torque-positive Engine speed-no idle	100 Sec.	Continuous 2 DCY
P2415	Bank 2- probe 1 Voltage too low/leakage air	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before**	O2S signal front- > 3.1 V	Lambda control-active Engine torque-positive Engine speed-no idle	100 Sec.	Continuous 2 DCY

		Catalytic Converter, Checking Check exhaust system between catalytic converters and cylinder head for proper seal Engine Mechanical 26 Exhaust System Components, Removing and Installing				
P2539	Low Fuel Pressure Sensor- G410 Open circuit	Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal voltage- > 4.8 V	---	2 Sec.	Continuous 2 DCY
P2541	Low Fuel Pressure Sensor- G410 Short circuit to Ground (GND)	Check Fuel Pressure Sensor G247 --> **Fuel Pressure Sensor, Checking**	Signal voltage- 0.2 V	---	2 Sec.	Continuous 2 DCY
P2626	Linear oxy. sensor, exh-bank 1/compensat. wire pump current Open circuit	Check oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	O2S signal front- > 4.7 V	Fuel cut off- > 2 Sec.. Modeled exhaust gas temperature- > 380° C	4.5 Sec.	Continuous 2 DCY
P2629	Linear oxy. sensor,	Check	O2S signal	Fuel cut off-	4.5 Sec.	Continuous 2

	exh- bank 2/compensat. wire pump current Open circuit	oxygen sensors before catalytic converter --> **Heated Oxygen Sensor before Catalytic Converter, Checking**	front- > 4.7 V	> 2 Sec.. Modeled exhaust gas temperature- > 380° C		DCY

SAE P3xxx Diagnostic Trouble Codes

SAE P3xxx Diagnostic Trouble Codes

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 Illumination
P3081	Engine temperature too low	Allow engine to warm up. Coolant temperature must be at least 50° C	ECT- 35° C	ECT- 1 x > 40° C	2 Sec.	Continuous 2 DCY

SAE U0xxx- Diagnostic Trouble Codes

SAE U0xxx- Diagnostic Trouble Codes

Control module and output signals

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illumination
U0001	High Speed CAN Communication Bus	Check terminal resistance of CAN-Bus. --> **Can-Bus Terminal Resistance,**	CAN bus-no activity	----	0.51 Sec.	Continuous 2 DCY

		Checking				
U0101	Lost Communication with TCM	Check terminal resistance of CAN-Bus. --> **Can-Bus Terminal Resistance, Checking**	CAN message-no message	----	0.51 Sec.	Continuous 2 DCY
U0302	Software Incompatibility With Transmission Control Module	Replace the Transmission Control Module (TCM) J217 Refer to --> **Transmission Control Module, Replacing** for 09L transmissions or --> **Transmission Control Module, Replacing** for 01J transmissions.	MT vehicle: ECM coded as-AT vehicle	----	5 Sec.	Continuous 2 DCY
U0402	Invalid Data Received From TCM	Check wiring connection between Engine Control Module (ECM) J623 and the Transmission Control Module (TCM) J217 according to wiring diagrams	AT vehicle: ECM coded as-MT vehicle	----	5 Sec.	Continuous 2 DCY