STRATEGY BASED DIAGNOSIS

The goal of Strategy Based Diagnostics is to provide guidance when you create a plan of action for each specific diagnostic situation. Following a similar plan for each diagnostic situation, you will achieve maximum efficiency when you diagnose and repair vehicles. Although each of the Strategy Based Diagnostics boxes is numbered, you are not required to complete every box in order to successfully diagnose a customer concern. The first step of your diagnostic process should always be, verify the Customer Concern box . The final step of your diagnostic process should be Repair and verify the Fix box 7. Refer to the following chart for the correct Strategy Based Diagnostics.

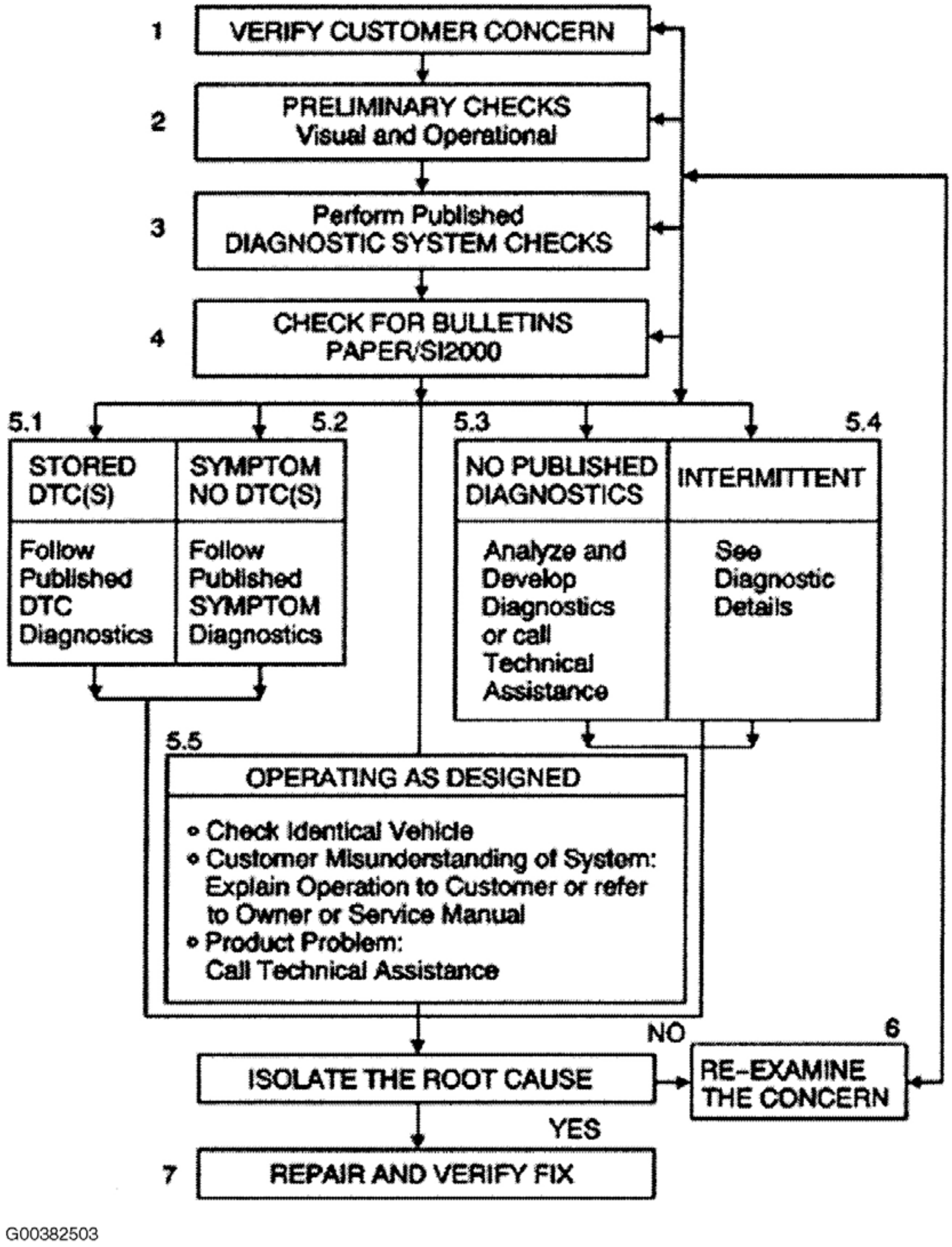

Fig. 1: Strategy Based Diagnosis

1. Verify the Customer Concern: The first part of this step is to obtain as much information as possible from the customer. Are there aftermarket accessories on the vehicle? When does the condition occur? Where does the condition occur? How long does the condition last? How often does the condition occur? In

order to verify the concern, the technician should be familiar with the normal operation of the system and refer to the owner or service manual for any information needed.

2. Preliminary Checks: Conduct a thorough visual inspection. Review the service history. Detect unusual sounds or odors. Gather diagnostic trouble code (DTC) information in order to achieve an effective repair.
3. Perform Published Diagnostic System Checks: One or more DTCs may not support a system. System checks verify the proper operation of the system. This will lead the technician in an organized approach to diagnostics.
4. Check Bulletins and Other Service Information: Use videos, newsletters, and the Pulsat programs.
5.

    5.1 Stored DTCs: Follow the designated DTC table exactly in order to make an effective repair.

    5.2 Symptom No DTC: Select the symptom from the symptom tables. Follow the diagnostic steps or suggestions in order to complete the repair, or refer to the applicable component/system check.

    5.3 No Published Diagnostics: Analyze the Concern. Develop a plan for the diagnostics. The service manual schematics will help you to see system power, ground, input and output circuits. You can also identify splices and other areas where multiple circuits are tied together. Look at component locations to see if components, connectors or harnesses may be exposed to extreme temperature, moisture, road salt or other corrosives battery acid, oil or other fluids. Utilize the wiring diagrams, system description and operation, and system circuit description.

    5.4 Intermittents: An intermittent condition is one that does not occur continuously and will occur when certain conditions are met. Generally, intermittents are caused by faulty electrical connections and wiring, malfunctioning components, electromagnetic/radio frequency interference, and aftermarket equipment. Combine technician knowledge with efficient use of the available service information. Evaluate the symptoms and conditions described by the customer. Use a check sheet or other method in order to identify the component. Follow the suggestions for intermittent diagnosis found in the service manual. The Tech 1 and Tech 2 scan tools, and the J 39200 (Fluke 87) have data capturing capabilities that can assist in detection of intermittents.

    5.5 Vehicle Operates as Designed: This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify against another like vehicle that is operating normally under the same conditions described by the customer. Explain your findings and the operation of that system to the customer.

6. Re-examine the Concern: If a technician cannot successfully find or isolate the concern, a re-evaluation is necessary. Re-verify the concern. The concern could be an intermittent or normal.
7. Repair and Verify Fix: After isolating the cause, make the repairs and validate for proper operation. Verify that the symptom has been corrected, which may involve road testing the vehicle.

DIAGNOSTIC INFORMATION & PROCEDURES

DIAGNOSTIC STARTING POINT - ENGINE CONTROLS

Begin the system diagnosis with **Diagnostic System Check - Engine Controls** . The Diagnostic System Check-Engine Controls will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and the codes' statuses

The use of the Diagnostic System Check-Engine Controls will identify the correct procedure for diagnosing the system and where the procedure is located.

DIAGNOSTIC SYSTEM CHECK - ENGINE CONTROLS

Description

The Diagnostic System Check is an organized approach to identifying a condition created by an electronic engine control system malfunction. The Diagnostic System Check must be the starting point for any driveability concern. The Diagnostic System Check directs the service technician to the next logical step in diagnosing the concern. Understanding the table and using the table correctly reduces diagnostic time and prevents the replacement of good parts.

Diagnostic System Check - Engine Controls

Step	Action	Yes	No
1	Perform the following preliminary inspections: 1. Ensure that the battery is fully charged. Refer to **Battery Inspection/Test** in Engine Electrical. 2. Ensure that the battery cables are clean and tight. 3. Inspect the easily accessible systems or the visible system components for obvious damage or conditions that could cause the symptom. Refer to **Strategy Based Diagnosis** in General Information		

	4. Ensure that the engine and control module grounds are clean, tight, and in the correct location. 5. Inspect for aftermarket devices that could affect the operation of the system. Refer to **Checking Aftermarket Accessories** in Wiring Systems. Did you find and correct the condition?	System OK	Go to **Step 2**
2	1. Install a scan tool. 2. Turn ON the scan tool. Does the scan tool turn ON?	Go to **Step 3**	Go to **Scan Tool Does Not Power Up** in Data Link Communications
3	1. Turn ON the ignition, with the engine OFF. 2. Attempt to establish communication with the listed control modules. If you are using a Tech 2, obtain the information using the Class 2 Message Monitor feature: • Powertrain control module (PCM) • Electronic brake control module (EBCM) • Body control module (BCM) Does the scan tool communicate with all the listed modules?	Go to **Step 4**	Go to **Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications
4	**IMPORTANT:** **The engine may start during the following step. Turn OFF the engine as soon as you have observed the Crank power mode.** 1. Access the Class 2 Power Mode in the Diagnostic Circuit Check on the scan tool. 2. Rotate the ignition switch through all positions while observing the ignition switch power mode parameter.		

	Refer to the **Body Control System Description and Operation** in Body Control Systems, for a list of the power mode states that correspond to each ignition switch position. Does the ignition switch parameter reading match the ignition switch position for all switch positions?	Go to **Step 5**	Go to **Power Mode Mismatch** in Body Control System
5	Attempt to start the engine. Does the engine crank?	Go to **Step 6**	Go to **Symptoms - Engine Electrical** in Engine Electrical
6	Did the engine start and idle?	Go to **Step 7**	Go to **Engine Cranks but Does Not Run**
7	**IMPORTANT:** **Do NOT clear the DTCs unless instructed by a diagnostic procedure.** 1. Select the DTC display function for the following control modules and record the DTCs: • PCM • EBCM • BCM 2. If multiple powertrain DTCs are stored, diagnose the DTCs in the following order: 1. Component level DTCs. For example, sensor DTCs, solenoid DTCs, and relay DTCs. Begin with the lowest number DTC unless the diagnostic table directs you otherwise. 2. System level DTCs. For example, misfire DTCs, EVAP system DTCs, fuel trim DTCs, and system		

	voltage DTCs. 3. Search for applicable service bulletins. Does the scan tool display any DTCs?	Go to **Step 8**	Go to **Step 9**
8	If there are any powertrain DTCs, select Capture Info to store the powertrain DTC information with a scan tool. Did you complete the action?	Go to **Diagnostic Trouble Code (DTC) List** for applicable diagnostic procedure	-
9	Is the customer's concern with Inspection/Maintenance (I/M) testing?	Go to **Inspection/Maintenance (I/M) System Check**	Go to **Step 10**
10	Are there any driveability symptoms observed?	Go to **Symptoms - Engine Controls**	System OK

SCAN TOOL DATA LIST

The Engine Scan Tool Data List contains all engine related parameters that are available on the scan tool. The list is arranged in alphabetical order. A parameter may appear in any one of the data lists, and in some cases may appear more than once, or in more than one data list in order to group certain related parameters together.

Use the Engine Scan Tool Data List only after the following conditions are determined:

- The Diagnostic System Check-Engine Controls is completed.
- There are no diagnostic trouble codes (DTCs).
- The On-Board diagnostics are functioning properly.

Scan tool values from a properly running engine may be used for comparison with the engine you are diagnosing. The Engine Scan Tool Data List represents the values that would be seen on a normal running engine.

IMPORTANT: Do not use a scan tool that displays faulty data. The scan tool concern should be reported to the manufacturer. Use of a faulty scan tool can result in misdiagnosis and in unnecessary parts replacement.

Only the parameters listed below are referenced in this service manual for use in diagnosis. If all values are within the typical range described below, refer to **Symptoms - Engine Controls** for diagnosis.

The column labeled Data List indicates where a parameter is located on the scan tool. Review the scan tool operating manual for the exact locations of the data lists. The following is a description of each term listed:

All

The Parameter is in all data lists indicated below.

Eng 1

Engine Data 1 List

Eng 2

Engine Data 2 List

Eng 3

Engine Data 3 List

CC

Cruise Control Data

EE

Enhanced EVAP Data

FT

Fuel Trim Data List

HO2S

HO2S Data List

MF

Misfire Data List

TAC

TAC Data List

Scan Tool Data List

Scan Tool Parameter	Data List	Parameter Range/Units	Typical Data Values
Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off			
A/C Clutch Feedback Signal	Eng 2	On/Off	Off
A/C High Side Pressure Sensor	Eng 2	kPa/psi	680 kPa/98 psi
A/C High Side Pressure Sensor	Eng 2	Volts	1.2-1.3

A/C Relay Command	Eng 1, Eng 2, Eng 3, MF	On/Off	Off
A/C Request Signal	Eng 2	Yes/No	No
Air Fuel Ratio	ENG 3, Eng 2	Ratio	14.7:1
AIR Pump Relay Command	Eng 1, FT	On/Off	Off
AIR Solenoid Command	Eng 1, FT	On/Off	Off
APP Average	TAC	Counts	0
APP Indicated Angle	ENG 1, Eng 2, EE, FT, CC, TAC, HO2S	0-100%	0
APP Sensor 1	TAC	Volts	0.25-1.1V
APP Sensor 2	TAC	Volts	3.9-4.8
APP Sensor 3	TAC	Volts	3.2-4.5
APP Sensor 1	TAC	0-100%	0%
APP Sensor 2	TAC	0-100%	0%
APP Sensor 3	TAC	0-100%	0%
APP Sensor 1 and 2	TAC	Agree/Disagree	agree
APP Sensor 1 and 3	TAC	Agree/Disagree	agree
APP Sensor 2 and 3	TAC	Agree/Disagree	agree
BARO	Eng 1, FT, EE	kPa/Volts	65-104 kPa/3.5-4.9V (Varies w/Altitude)
CMP Sensor High to Low	Eng 2	Counts	cycles
CMP Sensor Low to High	Eng 2	Counts	cycles
Clutch Pedal Switch	CC, Eng 1	Applied/Released	Released
Cold Start Up	EE	Yes/No	Varies
Column Lock Fuel Disable-ABS DTC	Eng 3	Yes/No	No
Column Lock Fuel Disable-BCM DTC	Eng 3	Yes/No	No
Column Lock PCM-BCM Com.	Eng 3	Fault/OK	OK
Cruise Control Active	Eng 1, Eng 2, Eng 3, TAC, CC	Yes/No	No
Cruise Disengage History 1-8	CC	Go to **Diagnostic System Check - Cruise Control** in Cruise Control	Varies
Cruise ON/OFF Switch	CC, TAC	On/Off	Off
Cruise Resume/Accel	TAC, CC	On/Off	Off
Cruise Set/Coast	TAC, CC	On/Off	Off

Current Gear	Eng 1, Eng 2, FT	1-4	1
Cycles Of Misfire Data	MF	Counts	cycles
Decel Fuel Cutoff	HO2S	ON/OFF	OFF
Desired Idle Speed	Eng 1, Eng 2, Eng 3, EE, TAC	RPM	PCM Controlled
DTC Set This Ignition	Eng 1, Eng 2, EE, FT, CC, HO2S	Yes/No	No
ECT Sensor	Eng 1, Eng 2, Eng 3, EE, FT, MF, HO2S	-39° to 140°C (-38° to 284°F)	90° to 110°C (194° to 230°F)
Engine Load	All	0-100%	2% at Idle 9% at 2500 RPM
Engine Oil Level Switch	Eng 2, Eng 3	OK/Not OK	OK
Engine Oil Life Remaining	Eng 3	0-100%	Varies
Engine Oil Pressure Sensor	Eng 3	kPa/psi/Volts	Varies
Engine Run Time	ALL	Hrs, Min, Sec	Varies
Engine Speed	All	0-10,000 RPM	Varies
EVAP Purge Solenoid Command	Eng 1, EE, FT	0-100%	20
EVAP Vent Solenoid Command	Eng 1, EE, FT	Venting/Not Venting	Venting
Extended Travel Brake Pedal Switch	Eng 1, Eng 2, Eng 3	Applied/Released	Released
FC Relay 1 Command	Eng 2, Eng 3	On/Off	Depends on engine temperature and A/C Pressure
FC Relay 2 and 3 Command	Eng 2, Eng 3	On/Off	Depends on engine temperature and A/C Pressure
Fuel Level Sensor Left Tank	EE	5-0V	0.7-2.5 Volts
Fuel Level Sensor Right Tank	EE	5-0V	0.7-2.5 Volts
Fuel Tank Level Remaining	FT, EE	0-19 gal./0-73L	Varies
Fuel Tank Level Remaining	EE	0-100%	Varies
Fuel Tank Pressure Sensor	Eng 1, EE	-32.7 to 14.0 mm/Hg -17.5 to 7.5 in/H2O	Varies
Fuel Tank Pressure Sensor	EE	0-5 Volts	Varies

Fuel Tank Rated Capacity	EE	73L (19 gal.)	73L (19 gal.)
Fuel Trim Cell	Eng 1, FT, EE	0-23	Varies
Fuel Trim Learn	Eng 1, EE, FT	Enabled/Disabled	Enabled (may Toggle)
Gen F-Terminal Signal	Eng 2	0-100%	Varies
Gen L-Terminal Signal	Eng 2	Voltage/No Voltage	Voltage
HO2S Bank 1 Sensor 1	Eng 1, FT, EE, HO2S	Millivolts	10-1,000 mV and Varying
HO2S Bank 1 Sensor 2	Eng 1, FT, HO2S	Millivolts	10-1,000 mV and Varying
HO2S Bank 2 Sensor 1	Eng 1, FT, EE, HO2S	Millivolts	10-1,000 mV and Varying
HO2S Bank 2 Sensor 2	Eng 1, FT, HO2S	Millivolts	10-1,000 mV and Varying
HO2S Heater Bank 1 Sensor 1	HO2S	Amps	0.65-0.85
HO2S Heater Bank 1 Sensor 2	HO2S	Amps	0.43-0.59
HO2S Heater Bank 2 Sensor 1	HO2S	Amps	0.65-0.85
HO2S Heater Bank 2 Sensor 2	HO2S	Amps	0.43-0.59
IAT Sensor	Eng 1, Eng 2, Eng 3, EE, FT	-39° to 140°C (-38° to 284°F)	Varies
Ignition 1 Signal	Eng 1, Eng 2, Eng 3, EE, CC, FT, TAC	0-25 Volts	11.5-14.5
Inj. PWM Bank 1 Average	Eng 2, FF, FT, MF	Milliseconds	1-4
Inj. PWM Bank 2 Average	Eng 2, FT, FF, MF	Milliseconds	1-4
Knock Retard	Eng 1	0°-16°	0
Long Term FT Avg. Bn 1	FT	Percentage	Near 0 %
Long Term FT Avg. Bn 2	FT	Percentage	Near 0 %
Long Term FT Bank 1	Eng 1, Eng 2, Eng 3, EE, FT, HO2S	Percentage	Near 0 %
Long Term FT Bank 2	Eng 1, Eng 2, Eng 3, EE, FT, HO2S	Percentage	Near 0 %
Loop Status	Eng 1, Eng 2, Eng 3, EE, FT, HO2S	Open/Closed	Closed
	Eng 1, Eng 2, Eng		5-9 at Idle (depends on

MAF Sensor	3, EE, FT, MF, TAC, HO2S	Grams Per Second (g/s)	altitude)
MAF Sensor	Eng 3	Hz	2800-2900
MAP Sensor	Eng 1, Eng 2, Eng 3, EE, FT, MF, TAC, HO2S	kPa	20-48 kPa
MAP Sensor	Eng 1, Eng 2, Eng 3	Volts	1.0-2.0 V (varies w/altitude)
MIL Command	Eng 1	Off/On	Off
Mileage Since DTC Cleared	Eng 3	km/Miles	Varies
Misfire Current 1-8	MF	0-200	0
Misfire History 1-8	MF	0-65,535	0
PCM Reset	Eng 1, EE, FT	Yes/No	No
PCM/VCM in VTD Fail Enable	Eng 3	Yes/No	No
Power Enrichment	Eng 2, FT, HO2S	Active/Inactive	Inactive
Powertrain Induced Chassis Pitch	Eng 3	Active/Inactive	Inactive
Reduced Engine Power	Eng 1, Eng 3, TAC, CC	Active/Inactive	Inactive
Reverse Inhibit Solenoid	Eng 1	On/Off	No
Short Term FT Avg. Bn 1	FT	Percentage	Near 0 %
Short Term FT Avg. Bn 2	FT	Percentage	Near 0 %
Short Term FT Bank 1	Eng 1, Eng 2, Eng 3, EE, FT, HO2S	Percentage	Near 0 %
Short Term FT Bank 2	Eng 1, Eng 2, Eng 3, EE, FT, HO2S	Percentage	Near 0 %
Skip Shift Lamp Command	Eng 1	On/Off	Off
Skip Shift Solenoid Command	Eng 1	No Skip/Skip	No Skip
Spark	Eng 1, Eng 2, Eng 3, FT, MF, HO2S	Degrees	16-19
Start Up ECT	Eng 2, EE, FT	C°/F°	Varies
Stoplamp Pedal Switch	Eng 1, Eng 2, Eng 3, TAC, CC	Applied/Released	Released
TAC/PCM Communication Signal	TAC, CC	OK/Fault	OK
TCC/Cruise Brake	TAC, Eng 1, Eng	Applied/Released	Released

Pedal Switch	2, Eng 3, CC		
TCC Enable Solenoid Command	Eng 1, Eng 2, MF, CC	Enabled/Disabled	Disabled
TFP Sw.	Eng 2, Eng 3, CC, FT	Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, Drive 1, Invalid	Park/Neutral
Torque Delivered Signal	ENG 2, TAC,	N.m/lb.ft.	16-20 Nm / 11-14 lb.ft.
Torque Request Signal	ENG 2, TAC	N.m/Ft-Lbs	473 Nm / 349 lb.ft
TP Desired Angle	Eng 1, Eng 2, EE, TAC, CC	Percentage	3-10 %
TP Indicated Angle	All	Percentage	3-9%
TP Sensor 1	TAC	Percentage	3-10
TP Sensor 1	TAC	Volts	0.25-1.5 V
TP Sensor 2	TAC	Percentage	3-10
TP Sensor 2	TAC	Volts	4.0-1.5 V
TP Sensors 1 and 2	TAC	Agree/Disagree	agree
Traction Control Signal	CC	Active/Inactive	Inactive
Traction Control Status	Eng 2, TAC	Active/Inactive	Inactive
Tr Sw.	FT, Eng 2, Eng 3, CC	Transaxle Gear Position	Park/Neutral
Vehicle Speed Sensor	ALL	km/h/mph	0 km/h (0 mph)
VTD Auto Learn Timer	Eng 3	Active/Inactive	Inactive
VTD Fuel Disable	Eng 3	Active/Inactive	Inactive
VTD Fuel Disable Until Ign. Off	Eng 3	Yes/No	No
Warm-Ups w/o Emis. Faults	Eng 3	Counts	0-255
Warm-Ups w/o Non-Emis. Faults	Eng 3	Counts	0-255

SCAN TOOL DATA DEFINITIONS

The Engine Scan Tool Data Definitions contain a brief description of all engine related parameters available on the scan tool. The list is in alphabetical order. A given parameter may appear in any one of the data lists. In some cases, the parameter may appear more than once or in more than one data list in order to group certain related parameters together.

Skip Shift Lamp Command

The scan tool displays On or Off. When the powertrain control module (PCM) enables the skip shift solenoid, the skip shift lamp comes on and the scan tool displays ON. The scan tool displays OFF under the normal operating conditions.

Skip Shift Solenoid Command

The scan tool displays Skip or No Skip. When the PCM enables the skip shift solenoid, the scan tool displays Skip. The scan tool displays No Skip under the normal operating conditions.

A/C Clutch Feedback Signal

The scan tool displays ON or OFF. This parameter displays the signal received from the A/C clutch to the powertrain control module (PCM) to indicate that the A/C clutch is ON or OFF.

A/C Relay Command

The scan tool displays On or Off. The A/C clutch represents the PCM commanded state of the A/C clutch control relay. When the scan tool indicates ON, the A/C clutch should be engaged.

A/C High Side Pressure

The scan tool displays 103-3116 kPa/15-452 psi. This parameter represents the A/C refrigerant pressure sensor signal. The amount of pressure indicates the amount of load that the A/C compressor places on the engine. The PCM uses this information in order to adjust the idle, and in order to control the cooling fans.

A/C High Side Pressure

The scan tool displays 0-5 volts. This parameter represents the A/C refrigerant pressure sensor signal. The amount of pressure indicates the amount of load that the A/C compressor places on the engine. The PCM uses this information in order to adjust the idle, and in order to control the cooling fans.

A/C Request

The scan tool displays Yes or No. The A/C Request indicates the state of the A/C request input circuit from the HVAC controls (C60). Vehicles equipped with the CJ2 A/C system, use the class 2 serial data in order to inform the PCM that the A/C is requested. The PCM uses the A/C request signal in order to determine whether the A/C compressor operation is being requested.

Air Fuel Ratio

The scan tool displays the ratio of the air to fuel. A typical ratio is about 14.7:1.

AIR Pump Relay

The scan tool displays On or Off. When the PCM grounds the secondary air injection (AIR) pump relay control circuit, the scan tool indicates ON. When the PCM disables the ground circuit, the scan tool indicates OFF.

AIR Solenoid Command

The scan tool displays On or Off. When the PCM grounds the AIR pump solenoid control circuit, the scan tool indicates ON. When the PCM disables the ground circuit, the scan tool indicates OFF.

APP Average

The scan tool displays 0-125 counts. The throttle actuator control (TAC) module takes the voltages from the 3 accelerator pedal position (APP) sensors, averages the readings, and converts the readings into counts. The scan tool displays the average. The average is different on every vehicle.

APP Indicated Angle

The scan tool displays 0-100 percent. The scan tool displays the accelerator pedal position (APP) as a percentage. When the APP is at rest, the display shows 0 percent. When the APP is fully depressed, the display shows 100 percent.

APP Sensor 1

The scan tool displays 0-5 volts. When the accelerator pedal is at 0 percent, the pedal is at rest, the display shows less than 1.1 volt. When the accelerator pedal is at 100 percent the pedal is fully depressed, the display shows more than 2.0 volts.

APP Sensor 2

The scan tool displays 5-0 volts. When the accelerator pedal is at 0 percent the pedal is at rest, the display shows more than 3.9 volts. When the accelerator pedal is at 100 percent, the pedal is fully depressed, the display shows less than 3.0 volt.

APP Sensor 3

The scan tool displays 5-0 volts. When the accelerator pedal is at 0 percent, the pedal is at rest, the display shows more than 3.2 volts. When the accelerator pedal is at 100 percent, the pedal is fully depressed, the display shows less than 3.5 volts.

APP Sensor 1 Angle

The scan tool displays 0-100 percent. When the accelerator pedal is at rest, the display shows 0 percent. When the accelerator pedal is fully depressed, the display shows 100 percent. This percentage indicates to the throttle actuator control (TAC) module the actual pedal position.

APP Sensor 2 Angle

The scan tool displays 0-100 percent. When the accelerator pedal is at rest, the display shows 0 percent. When the accelerator pedal is fully depressed, the display shows 100 percent. This percentage indicates to the TAC module the actual pedal position

APP Sensor 3 Angle

The scan tool displays 0-100 percent. When the accelerator pedal is at rest, the display shows 0 percent. When the accelerator pedal is fully depressed, the display shows 100 percent. This percentage indicates to the TAC module the actual pedal position.

APP Sensor 1 and 2

The scan tool displays Agree or Disagree. When the TAC module receives a signal voltage from APP sensor 1 that is not in proper relationship to APP sensor 2, the scan tool displays Disagree. The scan tool displays Agree under the normal operating conditions.

APP Sensor 1 and 3

The scan tool displays Agree or Disagree. When the TAC module receives a signal voltage from APP sensor 1 that is not in proper relationship to APP sensor 3, the scan tool displays Disagree. The scan tool displays Agree under the normal operating conditions.

APP Sensor 2 and 3

The scan tool displays Agree or Disagree. When the TAC module receives a signal voltage from APP sensor 2 that is not in proper relationship to APP sensor 3, the scan tool displays Disagree. The scan tool displays Agree under the normal operating conditions.

BARO

Scan Tool Range 10-105 kPa/0.0-5 volts. The barometric pressure (BARO) reading is determined from the manifold absolute pressure (MAP) sensor signal. The PCM monitors the MAP signal during key up and wide-open throttle (WOT) conditions. The barometric pressure compensates for altitude differences.

CMP Sensor High to Low

The scan tool displays 0-65,535 counts. The counts increment as the PCM detects the camshaft sensor signal voltage going from high to low.

CMP Sensor Low to High

The scan tool displays 0-65,535 counts. The counts increment as the PCM detects the camshaft sensor signal voltage going from low to high.

Clutch Pedal Switch

The scan tool displays Applied or Released. When the vehicle clutch pedal is depressed the scan tool display shows Applied, and the cruise control will disengage. When the vehicle clutch pedal is released, the scan tool displays Released, and the cruise control can be resumed.

Cold Start Up

The scan tool displays Yes or No. A cold start-up is when the engine coolant temperature (ECT) rises above a predetermined temperature during an ignition cycle. The next ignition cycle the engine coolant temperature should be below a predetermined temperature. Also the engine coolant temperature and the air intake temperature are less than 50°C (122°F) and are within 3°C (5°F) of each other at start-up. When the above conditions are true the scan tool displays Yes.

Column Lock Fuel Disable-ABS DTC

The scan tool displays Yes or No. The PCM disables the fuel when an antilock brake system (ABS) wheel speed sensor and a body control module (BCM) DTC set. When this failure occurs, the engine will start and then stall after 5 seconds. The engine will not start if you attempt to start the engine during that same ignition cycle.

Column Lock Fuel Disable-BCM DTC

The scan tool displays Yes or No. The PCM disables the fuel when a BCM DTC related to the column lock system is detected. The engine will start and idle. When the vehicle reaches 1.5 mph, the PCM disables the fuel. This occurs because the status of the column lock position is unknown.

Column Lock PCM-BCM Com.

The scan tool displays Fault or OK. The PCM disables fuel when a serial data communication malfunction occurs between the PCM and the BCM. The engine will start and idle. When the vehicle reaches 1.5 mph, the PCM disables the fuel. This occurs because the status of the column lock position is unknown.

Cruise Control Active

The scan tool displays Yes or No. When the cruise control switch is ON and the set/coast switch is activated, the scan tool displays YES. When the cruise control switch is ON and the set/coast switch is released, the scan tool displays NO.

Cruise Disengage History 1-8

The Scan tool displays the last 8 cruise control disengages in order from 1 to 8. There are 20 possible causes for the cruise control to disengage. Refer to **Diagnostic System Check - Cruise Control** in Cruise Control for descriptions.

Cruise Resume/Accel

The scan tool displays On or Off. When the Cruise control switch is ON and the resume/accel switch is activated, the scan tool displays ON. When the resume/accel switch is released the scan tool displays OFF.

Cruise Set/Coast

The scan tool displays On or Off. When the cruise control switch is ON and the set/coast switch is activated, the scan tool displays ON. When the set/coast switch is released, the scan tool displays OFF.

Current Gear

The scan tool displays 0-4. The scan tool displays which gear the transmission is in. The scan tool displays 9 if the transmission gear is unknown.

Cycles of Misfire Data

Scan Tool Range 0-100. The PCM counts the number of misfire tests during 200 revolutions.

DTC Set This Ignition

The scan tool displays Yes or No. This parameter indicates if a diagnostic trouble code (DTC) has set on the current ignition cycle.

Desired Idle Speed

Scan Tool Range 0-3187 RPM. The PCM commands the desired idle speed. The PCM compensates for various engine loads in order to keep the engine at the desired speed.

ECT

Scan Tool Range -39°C to 140°C (-38°F to 284°F). The engine coolant temperature (ECT) sensor parameter displays the temperature of the engine.

Engine Load

Scan Tool Range 0-100 percent. The PCM calculates the engine load from engine speed and mass air flow (MAF) sensor readings. The engine load increases with an increase in RPM or airflow.

Engine Oil Level Switch

The scan tool displays OK or Not OK. The parameter displays Not OK if the engine oil level remains low, about 1 quart or more, for a sufficient period of time.

Engine Oil Life Remaining

The scan tool displays 0-100 percent. The scan tool displays the percent of Engine Oil Life Remaining. The PCM calculates the Engine Oil Life by monitoring engine load, engine temperature, and engine speed, etc.

Engine Oil Pressure Sensor

The scan tool displays 0-992 kPa/0-144 psi. The scan tool displays engine oil pressure.

Engine Oil Pressure Sensor

The scan tool displays 0-5 volts. The scan tool displays the engine oil pressure in volts.

Engine Run Time

The scan tool displays Hours, Minutes, Seconds. This indicates the amount of Engine Run Time. When the ignition is cycled OFF, the timer will reset to zero.

Engine Speed

Scan Tool Range 0-10,000 RPM. The PCM computes the engine speed from the ignition reference pulses. The engine speed should remain close to the desired idle under various engine loads with the engine idling.

EVAP Purge Solenoid Command

Scan Tool Range 0-100 percent. The PCM commands the pulse width modulation (PWM) duty cycle of the evaporative emission (EVAP) purge solenoid valve. 0 percent displayed indicates no purge and 100 percent displayed indicates full purge.

EVAP Vent Solenoid Command

The scan tool displays Venting or Not Venting. The EVAP canister vent valve is normally open, or venting. The PCM commands the EVAP canister vent valve closed, or not venting during testing of the EVAP system.

Extended Travel Brake Pedal Switch

The scan tool displays Applied or Released. This parameter indicates the state of the extended travel brake switch. This switch is normally closed with the brake pedal released. The scan tool displays Released with the brake pedal released. The scan tool displays Applied with the brake pedal applied approximately greater than 40 percent.

Fail Counter

The scan tool displays the number of times a diagnostic failed.

FC Relay 1

The scan tool displays On or Off. When the PCM commands a coolant fan relay ON, the scan tool indicates ON. When cooling fan relay #1 is activated, both fans are enabled on low speed.

FC Relay 2 and 3

The scan tool displays On or Off. When the PCM commands a coolant fan relay ON, the scan tool indicates ON. When cooling fan relays #2 and #3 are activated, in conjunction with cooling fan relay #1, the cooling fans are enabled on high speed.

Fuel Level Sensor Left Tank

The scan tool displays 5-0 volts. The PCM supplies a 5-volt signal circuit to the fuel level sensor. The float inside the fuel tank is a variable resistor which varies the resistance based on the fuel level. The PCM then averages this voltage and the signal voltage from the right tank in order to determine the fuel level. The scan tool displays close to 0.7 volts for an empty tank, and close to 2.5 volts for a full tank.

Fuel Level Sensor Right Tank

The scan tool displays 0-5 volts. The PCM supplies a 5-volt signal circuit to the fuel level sensor. The float inside the fuel tank is a variable resistor which varies resistance based on the fuel level. The PCM then averages this voltage as well as the signal voltage from the left tank in order to determine the fuel level. The scan tool displays close to 0.7 volts for an empty tank, and close to 2.5 volts for a full tank

Fuel Tank Level Remaining

The scan tool displays 0-73 L (0-19 gal). The scan tool displays the amount of fuel remaining in the fuel tank in liters or gallons.

Fuel Tank Level Remaining

The scan tool displays 0-100 percent. The scan tool displays the amount of fuel remaining in the fuel tanks in percentage.

Fuel Tank Pressure Sensor

The scan tool displays -32.7 to 13.96 mm/Hg or -17.4 to 7.5 in/H2O. This parameter indicates the pressure/vacuum inside the fuel tank. A negative value indicates a vacuum. A positive value indicates a pressure.

Fuel Tank Pressure Sensor

The scan tool displays 0-5 volts. The scan tool displays in voltage the pressure/vacuum inside the fuel tank.

Fuel Tank Rated Capacity

The scan tool displays 73 L (19 gal). The scan tool displays the capacity of the fuel tank in liters or gallons.

Fuel Trim Cell

The scan tool displays a range of 0 to 23. The PCM determines from the MAP sensor and the engine speed which fuel trim cell to use in order to operate the engine. The fuel trim cell displayed on the scan tool is the cell that the engine is operating under.

Fuel Trim Learn

The scan tool displays Enabled or Disabled. When conditions are appropriate for enabling long term fuel trim corrections, the scan tool displays Enabled. This indicates that the long term fuel trim is responding to the short term fuel trim. If the scan tool displays Disabled, then long term fuel trim will not respond to changes in short term fuel trim.

Generator F Terminal

The scan tool displays 0-100 percent. The display shows generator F terminal duty cycle in percent from 0-100 percent. The generator is able to produce the desired voltage by varying the duty cycle of the field current.

Generator L Terminal

The scan tool displays Voltage or No Voltage. The scan tool displays No Voltage if the PCM does not detect a correct voltage on the L terminal circuit. The scan tool displays Voltage under the normal operating conditions.

HO2S Bank 1 and Bank 2 Sensor 1

Scan Tool Range 0-1,000 mV. The heated oxygen sensor (HO2S) bank 1 and 2 sensor 1 parameter represents the fuel control exhaust oxygen sensor output voltage. The voltage should fluctuate constantly within a range between 10 mV, or lean exhaust and 1,000 mV, or rich exhaust while operating in Closed Loop.

HO2S Bank 1 and Bank 2 Sensor 2

Scan Tool Range 0-1,000 mV. The HO2S bank 1 and bank 2 sensor 2 parameter represents the rear exhaust oxygen sensor output voltage. The voltage should fluctuate constantly within a range between 10 mV, or lean exhaust and 1,000 mV, or rich exhaust while operating in Closed Loop.

IAT

Scan Tool Range -39°C to 140°C (-38°F to 284°F). The PCM converts the resistance of the intake air temperature (IAT) sensor to degrees. The PCM uses the intake air temperature (IAT) in order to adjust the fuel delivery and the spark timing according to the incoming air temperature.

Ignition 1

The scan tool displays 0-25.5 volts. The ignition-1 represents the system voltage measured by the PCM at its ignition feed.

Inj. PWM Average Bank 1 and Bank 2

Scan Tool Range 0-1,000 m/sec. The injector average Indicates the amount of time the PCM commands each injector ON during each engine cycle. A longer injector pulse width causes more fuel to be delivered. The injector pulse width should increase with an increased engine load.

Knock Retard

Scan Tool Range 0°-16°. The knock retard indicates the amount of spark advance the PCM removes from the ignition control (IC) spark advance in response to the signal from the knock sensors.

Long Term FT Avg. Bn 1 and Bn 2

The scan tool displays Percentage. This parameter indicates the average of all long term fuel trim cells. The short term fuel trim cells are rated, or weighted for the amount of which they are used. For example, an idle cell is rated higher then a wide open cell. If a fueling malfunction occurs in the idle cell and the wide open cell, the average would be more affected by the idle cell then the wide open cell. A negative value significantly below 0 percent indicates that the fuel system is rich and fuel delivery is being reduced, or a decreased injector pulse width. A positive value significantly greater than 0 percent indicates that a lean condition exists and the PCM compensates by adding fuel, or an increased injector pulse width. When the average of the cells reach a predetermined high or low, a fuel trim DTC will set.

Long Term FT Bank 1 and 2

The scan tool displays Percentage. The PCM derives the Long Term Fuel Trim from the Short Term Fuel Trim value. The Long Term Fuel Trim represents a long-term correction of the fuel delivery. A value of 0 percent indicates that the fuel delivery requires no compensation in order to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0 percent indicates that the fuel system is rich and the PCM is reducing the fuel delivery, or decreasing injector pulse width. A positive value significantly greater than 0 percent indicates that a lean condition exists and the PCM compensates by adding fuel, or increasing injector pulse width. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

Loop Status

The scan tool displays Open or Closed. Closed Loop indicates that the PCM is controlling the fuel delivery according to the oxygen sensor (O2S) voltage. In Open Loop, the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on throttle position (TP) sensor, engine coolant sensor, and MAF sensor inputs only.

MAF

Scan Tool Range 0.0-655 g/s. Mass air flow (MAF) is the MAF input frequency converted to grams of air per second. This indicates the amount of air entering the engine.

MAF Frequency

The scan tool displays 0-31,999 Hz. The MAF converts the current draw required to keep the hot wires at a constant temperature into a frequency signal. The scan tool displays this frequency in Hertz.

MAP

Scan Tool Range 10-105 kPa/0.0-5 volts. The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, and speed changes. As intake manifold pressure increases, the intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The PCM uses the MAP sensor signal for the following: (1) Updating the BARO reading; (2) As an enabling factor for several of the diagnostics.

MIL Command

The scan tool displays On or Off. The scan tool indicates if the PCM has commanded the malfunction indicator lamp (MIL) ON.

Mileage Since DTC Cleared

The scan tool displays Km or Miles. This parameter indicates the mileage accumulated since an emission diagnostic trouble code cleared. The PCM stores this mileage in the Freeze Frame/Failure Records memory.

Mileage Since First Fail

The scan tool displays Km or Miles. This parameter indicates the mileage accumulated since an emission diagnostic trouble code first failed. The PCM stores this mileage in the Freeze Frame/Failure Records memory.

Mileage Since Last Fail

The scan tool displays Km or Miles. This parameter indicates the mileage accumulated since an emission diagnostic trouble code last failed. The PCM stores this mileage in the Failure Records memory.

Mileage Since MIL Request

The scan tool displays Km or Miles. This parameter displays the mileage accumulated since the PCM requested the MIL to illuminate. The PCM stores the mileage in the Failure Records memory.

Misfire Current Cylinder 1- 8

Scan Tool Range 0-255 Counts. The misfire current counters increment at a rate according to the number of possible misfires the PCM detects on each cylinder during the last 200 firing events. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

Misfire History Cylinder 1- 8

Scan Tool Range 0-65,535 Counts. The misfire history counters display the total level of misfires that have been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire DTC P0300 has become active. The misfire history counters will update every 200 firing events.

Not Run Counter

The scan tool displays 0-65,535 counts. The scan tool displays the number of times a DTC has not reached the predetermined criteria in order to run since the first failure.

Pass Counter

The scan tool displays 0-65,535 counts. The scan tool displays the number of times a DTC has passed, since the first failure.

PCM/VCM in VTD Fail Enabled

The scan tool displays YES or NO. If the BCM and PCM lose communications with each other after sending the correct password, the PCM will enable a VTD Fail-Enable mode. This allows the driver to restart the vehicle on future ignition cycles until the communications between the BCM and PCM are restored. The scan tool displays NO under normal operating conditions.

PCM Reset

The scan tool displays Yes or No. This parameter indicates when the PCM resets. The scan tool displays YES when an internal PCM reset occurred. The scan tool displays NO under the normal operating conditions.

Power Enrichment

The scan tool displays Active or Inactive. When Active is displayed, the powertrain control module (PCM) has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected.

Powertrain Induced Chassis Pitch

The scan tool displays Active or Inactive. The scan tool displays Active when the PCM determines from various inputs (MAF, TP, APP, MAP, etc.) that occurring conditions would cause the vehicles chassis to pitch. The scan tool displays Inactive under the normal operating conditions.

Reduced Engine Power

The scan tool displays Active or Inactive. The scan tool displays Active when the PCM receives a signal from the TAC module that a throttle actuator control system fault is occurring. The PCM limits the engine power.

Reverse Inhibit

The scan tool displays Yes or No (manual transmission). When the vehicle speed is above 4 mph, the PCM enables the reverse inhibit solenoid, and the scan tool indicates Yes.

Short Term FT Avg. Bn 1 and Bn 2 Average

The scan tool displays Percentage. This parameter indicates the average of the short term fuel trim cells.

The short term fuel trim cells are rated, or weighted for the amount of which they are used. For example, the PCM rates an idle cell higher then a wide open cell. If a fueling malfunction occurs in the idle cell and the wide open cell, the idle cell would affect more than then the wide open cell. A negative value significantly below 0 percent indicates that the fuel system is rich and the PCM is reducing the fuel delivery, or decreasing injector pulse width. A positive value significantly greater than 0 percent indicates that a lean condition exists and the PCM is compensating by adding fuel, or increasing injector pulse width. When the average of the cells reach a predetermined high or low, a fuel trim DTC sets.

Short Term FT Bank 1 and 2

The scan tool displays Percentage. The Short Term Fuel Trim represents a short-term correction to the fuel delivery by the PCM in response to the amount of time the fuel control oxygen sensor voltage spends above or below the 450 mV threshold. If the oxygen sensor voltage averages less than 450 mV, indicating a lean air/fuel mixture, short term fuel trim increases into the positive range above 0 percent. The PCM adds fuel. If the oxygen sensor voltage averages above the 450 mV threshold, the short term fuel trim decreases below 0 percent into the negative range. The PCM reduces the fuel delivery in order to compensate for the indicated rich condition. Under certain conditions such as an extended idle and a high ambient temperature, the canister purge may cause the Short Term Fuel Trim to read in the negative range during normal operation. The Fuel trim values at maximum authority may indicate an excessively rich or lean system.

Spark

Scan Tool Range -64° to 64°. Displays the amount the PCM commands the spark advance on the IC circuit. The PCM computes the desired spark advance using the following: (1) The engine coolant temperature, (2) The engine speed (RPM), (3) The load, (4) The vehicle speed.

Start Up ECT

Scan Tool Range -39°C to 140°C (-38°F to 284°F). Indicates the engine coolant temperature at the time the engine was started. The PCM uses Start Up ECT for certain DTCs.

Stop Lamp Pedal Switch

The scan tool displays Applied or Released. When the brake pedal is depressed, the scan tool displays applied and the stop lamps go ON. When the brake pedal is at rest, the scan tool displays Released and the stop lamps go OFF.

TAC/PCM Communication

The scan tool displays OK or Fault. If the communication between the TAC module and the PCM is interrupted, the scan tool displays Fault. The scan tool displays OK under the normal operating conditions.

TCC/Cruise Brake Pedal Switch

The scan tool displays Applied or Released. This parameter indicates the state of the TCC/CC brake switch circuit input. Open indicates 0 voltage input, the brake switch is open and the brake pedal is applied. Closed indicates a B+ voltage input, the brake switch is closed and the brake pedal is released. When you apply the vehicle brakes, the scan tool displays Applied. The torque converter clutch and cruise control disengage. When you release the vehicle brakes, the scan tool displays Released. This allows the cruise control resume and the torque converter clutch to engage.

TCC Enable Solenoid Command

The scan tool displays Enabled or Disabled. When the PCM applies a voltage to the TCC enable solenoid, the scan tool displays Enabled.

Torque Delivered Signal

The scan tool displays -473 to 473 N.m/-349 to 349 ft/lbs. This is the calculated torque output from the engine to the transaxle used by the EBTCM for the traction control system operation.

Torque Request Signal

The scan tool displays -473 to 473 N.m/-349 to 349 ft-lbs. The EBTCM sends a Desired Torque Level signal request to the PCM. This decreases torque from the powertrain in order to reduce wheel slip during acceleration for the traction control.

TP Desired Angle

The scan tool displays 0-100 percent. The PCM indicates the desired throttle angle commanded by the vehicle operator.

TP Indicated Angle

The scan tool displays 0-100 percent. The TP Indicated Angle displays in percentage the amount of throttle opening.

TP Sensor 1

The scan tool displays 0-100 percent. The scan tool displays the amount of throttle opening in percentage. Closed throttle displays 0 percent and wide open throttle displays near 100 percent.

TP Sensor 2

The scan tool displays 0-100 percent. The scan tool displays the amount of throttle opening in percentage. Closed throttle displays 0 percent and wide open throttle displays near 100 percent.

TP Sensor 1

The scan tool displays 0-5 volts. The scan tool displays the amount of throttle opening in volts. Closed throttle displays about 1 volt and wide open throttle displays above 3.5 volts.

TP Sensor 2

The scan tool displays 5-0 volts. The scan tool displays the amount of throttle opening in volts. Closed throttle displays about 4 volts and wide open throttle displays below 1.5 volts.

TP Sensors 1 and 2

The scan tool displays Agree or Disagree. When the TAC module receives a signal voltage from one of the Throttle Position Sensors not in proper relationship to the other, the scan tool displays Disagree. The scan tool displays Agree under normal operating conditions.

Traction Control Signal

The scan tool displays Active or Inactive (if equipped). The scan tool displays active if the PCM receives a signal from the electronic brake and traction control module (EBTCM) requesting torque reduction during a traction control maneuver.

Traction Control Status

The scan tool displays Active or Inactive (if equipped). The scan tool displays active if the PCM receives a signal from the electronic brake and traction control module (EBTCM) requesting torque reduction during a traction control maneuver.

TFT Sensor (Export only)

Scan Tool Range -39°C to 140°C (-38°F to 284°F). The Transmission Fluid Temperature. sensor parameter displays the temperature of the manual transmission.

TFT SW.

The scan tool displays Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, Drive 1, or Invalid. This parameter is the decoded status of the three A/B/C inputs from the automatic transmission fluid pressure manual valve position switch. Invalid is displayed when the powertrain control module (PCM) does not recognize a valid combination of inputs.

TR SW.

Scan tool displays the transaxle gear position.

Vehicle Speed

The scan tool displays km/h and mph. The vehicle speed sensor (VSS) signal is converted into km/h and mph for display.

VTD Auto Learn Timer

The scan tool displays Active or Inactive. The auto learn timer indicates if the vehicle theft deterrent (VTD) system is in the learn mode and has not timed out (10 minutes).

VTD Fuel Disable

The scan tool displays Active or Inactive. If the PCM has not received the correct password from the body control module (BCM), the PCM will disable the fuel system, and Active will be displayed on the scan tool. The scan tool displays Inactive under normal running conditions.

VTD Fuel Disable Until Ign. Off

The scan tool displays Yes or No. With the ignition ON and a VTD code present the scan tool displays YES. With the ignition OFF the scan tool displays NO.

Warm-Ups w/o Emissions Faults

Scan Tool Range 0-255. This parameter counts the number of warm up cycles without an emission fault present. The counter increments to 255 and resets to 0 unless a fault occurs. If a fault occurs, the counter reverts back to 0 until the fault is corrected. Clearing the information with a scan tool or a loss of power to the PCM also resets the counter to 0.

Warm Ups w/o Non-Emissions Faults

Scan Tool Range 0-255. This parameter counts the number of warm up cycles without a non-emission fault present. The counter increments to 255 and resets to 0 unless a fault occurs. If a fault occurs, the counter reverts back to 0 until the fault is corrected. Clearing information with a scan tool or a loss of power to the PCM also resets the counter to 0.

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selection(s)	Description
AIR Pump Relay	Engine Output Controls / AIR System	Activates the AIR pump relay. The normal commanded state of the AIR pump relay is NONE. With the AIR pump relay commanded ON, the AIR pump relay and pump only remains ON for a maximum of 30 seconds.
AIR Solenoid	Engine Output Controls / AIR System	Activates the AIR solenoid. The normal commanded state of the AIR solenoid is NONE. With the AIR solenoid commanded ON, the AIR solenoid only remains ON for a maximum of 30 seconds.
AIR System	Engine Output Controls / AIR System	Activates the AIR Solenoid and AIR pump relay. The normal commanded state of the AIR pump relay is NONE. With the system commanded ON, the system remains ON for a maximum of 30 seconds.

Crankshaft Position Variation Learn	-	Enables the powertrain control module (PCM) to learn the variations in the crankshaft position (CKP) system. The PCM will learn the variations once the following conditions are met: • Engine coolant temperature (ECT) is more than a specified value. • All instructions on the scan tool have been completed. • The accelerator pedal is smoothly applied until the fuel cut-OFF, as specified on the scan tool, is achieved, and then immediately released. The PCM learns the variation values on the deceleration from fuel cut-OFF.
Cylinder Power Balance	Fuel System	Enables/Disables a cylinder by turning OFF the fuel injector to the cylinder. The fuel injector is normally enabled. The PCM disables the fuel injector when the following conditions are met: • All instruction on the scan tool are completed • Stabilized engine speed • The fuel injector is selected When Disable is selected the PCM turns the injector OFF for 30 seconds. During this period, the engine operates with a misfire.
Engine Speed Control	TAC System	Activates the throttle activation control (TAC) system to change engine RPM. The normal commanded state is None. To enable the RPM control, all instruction on the scan tool must be completed. The system will increase or decrease the RPM within a range of 350-2,000 RPM. The set step value changes the RPM by increments of 25 RPM, 100 RPM, and 500 RPM. The system remains in the commanded state until cancelled by the scan tool.
EVAP Purge Solenoid	Engine Output Controls / EVAP System	Activates the EVAP Purge Valve. The normal commanded state is NONE. The system will INCREASE or DECREASE the amount of EVAP purge valve opening by 10 percent increments within a range of 0% to 100%. The system remains in the commanded state until cancelled by the tool or the fuel tank pressure exceeds 24 mm Hg (12 inches H20).
EVAP Purge/Seal	Engine Output Controls / EVAP System	This control enables two functions. One function increases or decreases the amount of purge by changing the duty cycle of the purge valve and commanding the vent ON (non-venting). The normal commanded state of both valves is NONE. The system will INCREASE or DECREASE the amount of EVAP purge valve opening by 10 percent increments within a range of 0 percent to 100 percent. The second function seals the system after using the purge function to obtain a specific amount of fuel tank pressure. When activated the purge valve is commanded to 0% and the vent valve is commanded ON (non-venting). Both functions remain in the commanded state until cancelled by the tool or the fuel tank pressure exceeds 24 mm Hg (12 inches H20).

EVAP Vent Solenoid	Engine Output Controls / EVAP System	Activates the EVAP vent solenoid. The normal commanded state is NONE. When commanded ON, the vent valve switches to non-venting. The system remains in the commanded state unless one of the following conditions occurs: • Cancelled by the tool • Purge is greater than 0%, and the fuel tank pressure exceeds 24 mm Hg (12 inches H20)
Fuel Injector Balance	Fuel System	Enables the fuel injector in order to verify proper fuel injector flow. The PCM will pulse the selected injector when the following conditions are met: • All instruction on the scan tool completed • Fuel injector selected • Key ON, engine OFF The selected fuel injector can only be flowed/pulsed once per ignition cycle.
Fuel Pump	Engine Output Controls	Controls the fuel pump relay. The normal commanded state is NONE. When commanded ON/OFF, the PCM turns the fuel pump ON/OFF. If the engine is running, and the fuel pump is commanded OFF, the engine will stall. The system remains in the commanded state until cancelled by the scan tool.
Fuel Trim Reset	Fuel System	Activates the reset of fuel trim data in all of the fuel trim cells.
Loop Status	Engine Output Controls	Controls the system loop status. The commanded states include NONE, OPEN, or CLOSED. The normal commanded state is NONE. When commanded OPEN or CLOSED, the system remains in the commanded state until cancelled by the scan tool.
Malfunction Indicator Lamp	Engine Output Controls	Controls the malfunction indicator lamp (MIL). The commanded states include NONE, ON, and OFF. When commanded ON or OFF, the system remains in the commanded state until cancelled by the scan tool.
Misfire Graphic	-	Graphs the accumulated misfires occurring in each cylinder. The scan tool allows for a reset of the misfire graph.
O2S Heater Control	Engine Output Controls	Activates the HO2S Heater. The commanded states include None, ON, and OFF. The normal commanded state is None. On a cold engine, with the key ON, engine OFF, the HO2S signal will continue to drop below bias when commanded ON. The system remains in the commanded state until cancelled by the tool.
Request PCM/VCM Info for SPS	-	Allows a technician to program a control module through the data link connector (DLC). This procedure offers the ability to install software/calibrations matched to a particular vehicle. Follow Service Programming System (SPS) Procedures. Refer to **Service Programming System (SPS)** in Vehicle Control Systems.

DIAGNOSTIC TROUBLE CODE (DTC) LIST

Diagnostic Trouble Code (DTC) List

DTC	Diagnostic Procedure	Module(s)
P0068	**DTC P0068**	PCM
P0101	**DTC P0101**	PCM
P0102	**DTC P0102**	PCM
P0103	**DTC P0103**	PCM
P0106	**DTC P0106**	PCM
P0107	**DTC P0107**	PCM
P0108	**DTC P0108**	PCM
P0112	**DTC P0112**	PCM
P0113	**DTC P0113**	PCM
P0116	**DTC P0116**	PCM
P0117	**DTC P0117**	PCM
P0118	**DTC P0118**	PCM
P0120	**DTC P0120**	PCM
P0125	**DTC P0125**	PCM
P0128	**DTC P0128**	PCM
P0131	**DTC P0131 or P0151**	PCM
P0132	**DTC P0132 or P0152**	PCM
P0133	**DTC P0133 or P0153**	PCM
P0134	**DTC P0134 or P0154**	PCM
P0135	**DTC P0135, P0141, P0155, or P0161**	PCM
P0136	**DTC P0136 or P0156**	PCM
P0137	**DTC P0137 or P0157**	PCM
P0138	**DTC P0138 or P0158**	PCM
P0140	**DTC P0140 or P0160**	PCM
P0141	**DTC P0135, P0141, P0155, or P0161**	PCM
P0151	**DTC P0131 or P0151**	PCM
P0152	**DTC P0132 or P0152**	PCM
P0153	**DTC P0133 or P0153**	PCM
P0154	**DTC P0134 or P0154**	PCM
P0155	**DTC P0135, P0141, P0155, or P0161**	PCM
P0156	**DTC P0136 or P0156**	PCM
P0157	**DTC P0137 or P0157**	PCM
P0158	**DTC P0138 or P0158**	PCM
P0160	**DTC P0140 or P0160**	PCM
P0161	**DTC P0135, P0141, P0155, or P0161**	PCM
P0171	**DTC P0171 or P0174**	PCM
P0172	**DTC P0172 or P0175**	PCM

P0174	**DTC P0171 or P0174**	PCM
P0175	**DTC P0172 or P0175**	PCM
P0200	**DTC P0200**	PCM
P0218	**DTC P0218** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0220	**DTC P0220**	PCM
P0230	**DTC P0230**	PCM
P0300	**DTC P0300**	PCM
P0315	**DTC P0315**	PCM
P0325	**DTC P0325**	PCM
P0327	**DTC P0327 or P0332**	PCM
P0332	**DTC P0327 or P0332**	PCM
P0335	**DTC P0335**	PCM
P0336	**DTC P0336**	PCM
P0341	**DTC P0341**	PCM
P0342	**DTC P0342**	PCM
P0343	**DTC P0343**	PCM
P0351-P0358	**DTC P0351-P0358**	PCM
P0410	**DTC P0410**	PCM
P0412	**DTC P0412**	PCM
P0418	**DTC P0418**	PCM
P0420	**DTC P0420 or P0430**	PCM
P0430	**DTC P0420 or P0430**	PCM
P0442	**DTC P0442**	PCM
P0443	**DTC P0443**	PCM
P0446	**DTC P0446**	PCM
P0449	**DTC P0449**	PCM
P0452	**DTC P0452**	PCM
P0453	**DTC P0453**	PCM
P0455	**DTC P0455**	PCM
P0461	**DTC P0461** in Instrument Panel, Gages, and Console	PCM, IPC
P0462	**DTC P0462** in Instrument Panel, Gages, and Console	PCM, IPC
P0463	**DTC P0463** in Instrument Panel, Gages, and Console	PCM, IPC
P0480	**DTC P0480** in Engine Cooling	PCM
P0481	**DTC P0481** in Engine Cooling	PCM
P0491	**DTC P0491 or P0492**	PCM
P0492	**DTC P0491 or P0492**	PCM
P0496	**DTC P0496**	PCM
P0500	**DTC P0500** in Manual Transmission - MM6/M12	PCM
P0502	**DTC P0502** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0503	**DTC P0503** in Automatic Transmission - 4L60-E/4L65-E	PCM

P0506	**DTC P0506**	PCM
P0507	**DTC P0507**	PCM
P0522	**DTC P0522** in Instrument Panel, Gages, and Console	PCM, IPC
P0523	**DTC P0523** in Instrument Panel, Gages, and Console	PCM, IPC
P0530	**DTC P0530** in HVAC Systems - Automatic	PCM
P0562	**DTC P0562** in Engine Electrical	PCM
P0563	**DTC P0563** in Engine Electrical	PCM
P0567	**DTC P0567** in Cruise Control	PCM
P0568	**DTC P0568** in Cruise Control	PCM
P0571	**DTC P0571** in Cruise Control	PCM
P0601-P0607	**DTC P0601-P0607, P1600, P1621, P1627, P1680, P1681, P1683, or P2610**	PCM
P0608	**DTC P0608** in Instrument Panel, Gages, and Console	PCM, IPC
P0622	**DTC P0622** In Engine Electrical	PCM
P0641	**DTC P0641**	PCM
P0645	**DTC P0645** in HVAC Systems - Automatic	PCM
P0650	**DTC P0650**	PCM
P0651	**DTC P0651**	PCM
P0654	**DTC P0654** in Instrument Panel, Gages, and Console	PCM, IPC
P0706	**DTC P0706** in Automatic Transmission - 4L60-E/4L65-E	PCM, IPC
P0711	**DTC P0711** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0712	**DTC P0712** in Automatic Transmission - 4L60-E/4L65-E or **DTC P0712** in Manual Transmission - MM6/M12	PCM
P0713	**DTC P0713** in Automatic Transmission - 4L60-E/4L65-E or **DTC P0713** in Manual Transmission - MM6/M12	PCM
P0719	**DTC P0719** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0724	**DTC P0724** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0740	**DTC P0740** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0742	**DTC P0742** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0748	**DTC P0748** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0751	**DTC P0751** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0752	**DTC P0752** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0753	**DTC P0753** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0756	**DTC P0756** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0757	**DTC P0757** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0758	**DTC P0758** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0785	**DTC P0785** in Automatic Transmission - 4L60-E/4L65-E	PCM
P0801	**DTC P0801** in Manual Transmission - MM6/M12	PCM
P0803	**DTC P0803** in Manual Transmission - MM6/M12	PCM
P0804	**DTC P0804** in Manual Transmission - MM6/M12	PCM
P0833	**DTC P0833** in Manual Transmission - MM6/M12	PCM

P0856	**DTC C1277 or P0856** in Antilock Brake System	EBCM
P0894	**DTC P0894** in Manual Transmission - MM6/M12	PCM
P1111	**DTC P1111**	PCM
P1112	**DTC P1112**	PCM
P1114	**DTC P1114**	PCM
P1115	**DTC P1115**	PCM
P1125	**DTC P1125**	PCM
P1133	**DTC P1133 or P1153**	PCM
P1134	**DTC P1134 or P1154**	PCM
P1153	**DTC P1133 or P1153**	PCM
P1154	**DTC P1134 or P1154**	PCM
P1258	**DTC P1258** in Engine Cooling	PCM
P1380	**DTC P1380**	PCM
P1381	**DTC P1381**	PCM
P1516	**DTC P1516**	PCM
P1539	**DTC P1539** in HVAC Systems - Automatic	PCM
P1546	**DTC P1546** in HVAC Systems - Automatic	PCM
P1574	**DTC P1574** in Cruise Control	PCM
P1575	**DTC P1575** in Cruise Control	PCM
P1626	**DTC P1626** in Theft Deterrent	PCM
P1630	**DTC P1630** in Theft Deterrent	PCM
P1631	**DTC P1631** in Theft Deterrent	PCM
P1637	**DTC P1637** in Engine Electrical	PCM
P1638	**DTC P1638** in Engine Electrical	PCM
P1689	**DTC C1276, P1644, or P1689** in Antilock Brakes	PCM
P1810	**DTC P1810** in Automatic Transmission - 4L60-E/4L65-E	PCM
P2066	**DTC P2066** in Instrument Panel, Gages, and Console	PCM
P2067	**DTC P2067** in Instrument Panel, Gages, and Console	PCM
P2068	**DTC P2068** in Instrument Panel, Gages, and Console	PCM
P2101	**DTC P2101**	PCM
P2108	**DTC P2108**	PCM
P2120	**DTC P2120**	PCM
P2121	**DTC P2121**	PCM
P2125	**DTC P2125**	PCM
P2126	**DTC P2126**	PCM
P2130	**DTC P2130**	PCM
P2131	**DTC P2131**	PCM
P2135	**DTC P2135**	PCM
P2610	**DTC P0601-P0607, P1600, P1621, P1627, P1680, P1681, P1683, or P2610**	PCM
P2761	**DTC P2761** in Automatic Transmission - 4L60-E/4L65-E	PCM

U0107	**DTC U0107**	PCM
UXXXX	**Scan Tool Does Not Communicate with Class 2 Device** in Data Link Communications	PCM, BCM, IPC, VTD, EBCM

DIAGNOSIS

DTC P0068

Circuit Description

The powertrain control module (PCM) uses the throttle position (TP), barometric pressure (BARO), intake air temperature (IAT), and engine RPM in order to calculate the predicted mass airflow rate. The PCM compares the predicted mass air flow (MAF) value to the actual mass airflow value and the speed density calculation in order to verify the proper throttle operation. If the PCM detects that the difference between the actual air flow (MAF) and the speed density calculated air flow is greater than expected, DTC P0068 sets.

Conditions for Running the DTC

- DTCs P0601, P0602, P0604, P0606, P1516, P2101, P2108, U0107 are not set.
- DTCs P0120, P0220, and P2135 are not set at the same time or DTCs P0120 and P0220 are not set at the same time.
- The engine operates longer than 1 second.
- The engine speed is more than 500 RPM.

Conditions for Setting the DTC

- The PCM detects that the difference between the actual airflow (MAF) and the speed density calculated airflow is greater than expected.
- The above condition is met for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.

- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the throttle blade for being broken, bent, or missing.
- Inspect the TP sensor for proper installation. A sensor that is mis-aligned could set this DTC.
- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- Physically and visually inspect the throttle body assembly, and correct any problems that you observe. Manually move the throttle blade from closed to wide open throttle (WOT). You should not need to use excessive force. The throttle blade should move smoothly through the full range and should return to a slightly open position on its own.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the stored information, Capture info.
- For an intermittent condition, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

5: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the stored information, Capture info.

DTC P0068

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Is DTC P0101, P0102, P0103, P0107, P0108, P0112, P0113, P1111, or P1112 set?	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
	CAUTION: **Turn OFF the ignition before inserting fingers into the throttle bore. Unexpected movement of the throttle blade could cause personal injury.**		

3	**IMPORTANT:** **If any of the conditions listed below exist, replace the throttle body assembly. Refer to Throttle Body Assembly Replacement .** Inspect the throttle body for the following conditions: • A loose or damaged throttle position (TP) sensor • A loose or damaged throttle blade • A cracked or bent throttle shaft • Drive mechanism damage Did you find and correct the condition?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 5**
5	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0101

Circuit Description

The mass air flow (MAF) sensor is an air flow meter that measures the amount of air entering the engine. The powertrain control module (PCM) uses the MAF sensor signal to provide the correct fuel delivery for all engine speeds and loads. A small quantity of air entering the engine indicates a deceleration or idle condition. A large quantity of air entering the engine indicates an acceleration or high load condition. The MAF sensor has the following circuits:

- An ignition 1 voltage circuit
- A ground circuit
- A signal circuit

The PCM applies a voltage to the sensor on the signal circuit. The sensor uses the voltage to produce a frequency based on the inlet air flow through the sensor bore. The frequency varies within a range of near 2,000 Hertz at idle to near 11,500 Hertz at maximum engine load. The PCM uses the following sensor inputs to calculate a predicted MAF value:

- The manifold absolute pressure (MAP) sensor
- The intake air temperature (IAT) sensor
- The engine coolant temperature (ECT) sensor
- The engine speed (RPM)

The PCM compares the actual MAF sensor frequency signal to the predicted MAF value. This comparison will determine if the signal is stuck based on a lack of variation, or is too low or too high for a given operating condition. If the PCM detects the actual MAF sensor frequency signal is not within a predetermined range of the calculated MAF value DTC P0101 sets.

Conditions for Running the DTC

- DTCs P0102, P0103, P0106, P0107, P0108, P0120, P0220, P0442, P0446, P0449, P0455, P0496 and P2135 are not set.
- The engine is running.
- The ignition 1 signal is between 11 and 18 volts.
- The throttle position (TP) indicated angle is less than 95 percent.
- The change in the TP indicated angle is less than 5 percent.
- The MAP sensor is more than 17 kPa.
- The change in the MAP sensor is less than 3 kPa.
- The above conditions are met for 1.5 seconds.

Conditions for Setting the DTC

The PCM detects that the actual MAF sensor frequency signal is not within a predetermined range of the calculated MAF value for more than 4 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.

- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the harness of the MAF sensor to verify that it is not routed too close to the following components:
  - The secondary ignition wires or coils
  - Any solenoids
  - Any relays
  - Any motors
- A low minimum air rate through the sensor bore at idle or during deceleration may cause this DTC to set. Inspect for the following conditions:
  - Any deposits on the throttle plate or in the throttle bore
  - Any vacuum leak downstream of the MAF sensor
- Inspect for any contamination or debris on the sensing elements of the MAF sensor.
- Inspect the air induction system for any water intrusion. Any water that reaches the MAF sensor will skew the sensor and may cause this DTC to set.
- Inspect the secondary air injection system (AIR) for any water intrusion.
- A wide open throttle acceleration from a stop should cause the MAF sensor parameter on the scan tool to increase rapidly. This increase should be from 5-12 g/s at idle to 200 g/s or more at the time of the 1-2 shift. If the increase is not observed, inspect for a restriction in the induction system or the exhaust system.
- Inspect for a skewed or stuck ECT sensor.
- A high resistance of 15 ohms or more on the ignition 1 voltage circuit may cause the DTC to set. A high resistance may cause a driveability concern before this DTC sets.
- The barometric pressure that is used to calculate the predicted mass air flow value is initially based on the MAP sensor at key ON. When the engine is running the BARO value is continually updated near wide open throttle. A skewed MAP sensor will cause the calculated mass air flow value to be inaccurate and may result in a no start condition. The value shown for the MAP sensor parameter varies with the altitude. With the ignition ON and the engine OFF, 101 kPa is the approximate value near sea level. This value will decrease by approximately 3 kPa for every 305 meters (1,000 feet) of altitude.
- A high resistance on the low reference circuit of the MAP sensor may cause this DTC to set.
- A short to voltage on the 5 volt reference circuit of the MAP sensor may cause this DTC to set.

If the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: This step will determine if the MAP sensor pressure is within the proper range for a given altitude.

6: This step will determine if the MAP sensor voltage is within the proper range at idle.

7: This step will determine if the MAP sensor responds properly to the change in manifold pressure.

8: This step will determine if the throttle position (TP) sensors are operating properly.

9: This step will determine if any mechanical faults have caused this DTC to set.

10: This voltage drop will determine if high resistance has caused this DTC to set.

DTC P0101

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Attempt to start the engine. Does the engine start?	-	Go to **Step 3**	Go to **Step 5**
3	Observe the Diagnostic Trouble Code (DTC) Information with the scan tool. Does the scan tool display any DTCs set other than DTC P0068 or DTC P0101?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 4**
4	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to Diagnostic Aids
5	**IMPORTANT:** **The Altitude vs. Barometric Pressure table indicates a pressure range for a given altitude under normal weather conditions. Weather conditions consisting of very low or very high pressure and/or temperature may cause a reading to be slightly out of range.** 1. Turn ON the ignition, with the engine OFF. 2. Observe the MAP sensor kPa parameter with a scan tool. 3. The manifold absolute pressure (MAP)	-		

	sensor pressure should be within the specified range for your altitude. Refer to **Altitude vs Barometric Pressure** . Is the MAP sensor pressure within the specified range, as indicated on the altitude vs. barometric pressure table?		Go to **Step 6**	Go to **DTC P0106**
6	1. Start the engine. 2. Turn OFF all accessories. 3. Allow the engine to reach operating temperature. 4. Observe the MAP sensor parameter with a scan tool. Is the MAP sensor parameter within the specified range?	0.8-2.0 V	Go to **Step 7**	Go to **DTC P0106**
7	1. Idle the engine. 2. Observe the MAP sensor parameter with a scan tool. 3. Increase the engine speed slowly to 3,000 RPM and then back to idle. Does the MAP sensor parameter change smoothly and gradually through the specified range of the test?	-	Go to **Step 8**	Go to **DTC P0106**
8	1. Turn OFF the ignition for 30 seconds. 2. Turn ON the ignition with the engine OFF. 3. Observe the TP indicated angle parameter with a scan tool. 4. Depress the accelerator pedal completely. Is the TP indicated angle parameter within the specified range?	95-100%	Go to **Step 9**	Go to **DTC P0120**
	1. Turn OFF the ignition. 2. Inspect for the following conditions: • An improperly routed mass air flow (MAF) sensor harness • A restricted or collapsed air intake duct • A misaligned air intake duct • A dirty or deteriorating air filter element			

9	• Any objects blocking the air inlet screen of the MAF sensor, if equipped • Any contamination or debris on the sensing elements of the MAF sensor • Any water intrusion in the induction system • Any water intrusion in the secondary air injection (AIR) system • Any vacuum leak downstream of the MAF sensor • A skewed or stuck engine coolant temperature (ECT) sensor • Any type of restriction in the exhaust system- Refer to **Restricted Exhaust** in Engine Exhaust. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 10**	
10	1. Disconnect the harness connector of the MAF sensor. 2. Measure the battery voltage with a DMM. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the ignition 1 voltage circuit of the MAF sensor and a good ground. Refer to **Circuit Testing** in Wiring Systems. 5. Connect a DMM to the probe of the test lamp and a good ground. Refer to **Measuring Voltage Drop** in Wiring Systems. Is the voltage within 0.50 volts of the specified value?	B+	Go to **Step 11**	Go to **Step 12**	
11	Test for an intermittent and for a poor connection at the MAF sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 13**	
12	Repair the high resistance in the ignition 1 voltage circuit of the MAF sensor. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 14**	-	
13	Replace the MAF/intake air temperature (IAT) sensor. Refer to **Mass Air Flow (MAF)/Intake**	-			

	Air Temperature (IAT) Sensor Replacement . Did you complete the replacement?		Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0102

Circuit Description

The mass air flow (MAF) sensor is an air flow meter that measures the amount of air entering the engine. The powertrain control module (PCM) uses the MAF sensor signal to provide the correct fuel delivery for all engine speeds and loads. A small quantity of air entering the engine indicates a deceleration or idle condition. A large quantity of air entering the engine indicates an acceleration or high load condition. The MAF sensor has the following circuits:

- An ignition 1 voltage circuit
- A ground circuit
- A signal circuit

The PCM applies a voltage to the sensor on the signal circuit. The sensor uses the voltage to produce a frequency based on inlet air flow through the sensor bore. The frequency varies within a range of near 2,000 Hertz at idle to near 11,500 Hertz at maximum engine load. If the PCM detects a frequency signal less than the possible range of a correctly operating MAF sensor DTC P0102 sets.

Conditions for Running the DTC

- The engine is running for more than 2 seconds.
- The engine speed is more than 400 RPM.
- The ignition 1 signal is more than 8 volts.
- The MAF sensor frequency is stable for more than 1 second.

Conditions for Setting the DTC

The PCM detects that the MAF sensor frequency signal is less than 1,200 Hz. for more than 0.6 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the harness of the MAF sensor to verify that it is not routed too close to the following components:
  - The secondary ignition wires or coils
  - Any solenoids
  - Any relays
  - Any motors
- Inspect for any contamination or debris on the sensing elements of the MAF sensor.
- A wide open throttle acceleration from a stop should cause the MAF sensor parameter on the scan tool to increase rapidly. This increase should be from 7-12 g/s at idle to 200 g/s or more at the time of the 1-2 shift. If the increase is not observed, inspect for a restriction in the induction system or the exhaust system.
- A high resistance of 15 ohms or more on the ignition 1 voltage circuit may cause this DTC to set. A high resistance may cause a driveability concern before this DTC sets.
- A high resistance of 15 ohms or more on the ground circuit of the MAF sensor may cause this DTC to set. A high resistance may cause a driveability concern before this DTC sets.

If the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: This step will determine if any mechanical faults have caused this DTC to set.

7: This voltage drop test will determine if high resistance has caused this DTC to set.

9: This step verifies the voltage signal from the PCM to the MAF sensor connector.

10: This step tests the signal circuit of the MAF sensor for a short to another 5-volt reference circuit.

11: This step will determine if the PCM is able to process the frequency signal that it receives from the MAF sensor.

14: This step will determine which portion of the circuit or which component is shorted to ground.

17: This step verifies that the signal circuit is not shorted to any other PCM circuit.

DTC P0102

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views** or **Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Observe the MAF Sensor parameter with a scan tool. Is the MAF Sensor parameter less than the specified value?	1,200 Hz	Go to **Step 4**	Go to **Step 3**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
4	1. Observe the MAF Sensor parameter with a scan tool. 2. Move the harness and the connector of the mass air flow (MAF)/intake air temperature (IAT) sensor.	-		

	Does the movement of the harness or the connector affect the MAF Sensor parameter?		Go to **Step 20**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Inspect for the following conditions: • A restricted or collapsed air intake duct • A misaligned air intake duct • A dirty or deteriorating air filter element • Any objects blocking the air inlet screen of the MAF/IAT sensor • Any water intrusion in the Induction System • Any contamination or debris on the sensing elements of the MAF sensor Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 6**
6	Inspect the fuse in the ignition 1 voltage circuit of the MAF sensor. Is the fuse open?	-	Go to **Step 14**	Go to **Step 7**
7	1. Turn ON the ignition, with the engine OFF. 2. Measure the battery voltage with a DMM. 3. Disconnect the MAF/IAT sensor. 4. Connect a test lamp between the ignition 1 voltage circuit of the MAF sensor and a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. 5. Connect the DMM to the probe of the test lamp and a good ground. Refer to **Measuring Voltage Drop** and **Circuit Testing** in Wiring Systems. Is the voltage within 0.5 volts of the specified value?	B+	Go to **Step 8**	Go to **Step 21**
8	**IMPORTANT:** **All electrical components and accessories must be turned OFF.** 1. Turn OFF the ignition for 60 seconds to allow the control modules to power down. 2. Measure the resistance from the ground circuit of the MAF sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems.	5 ohm		

	Is the resistance less than the specified value?		Go to **Step 9**	Go to **Step 22**
9	1. Turn ON the ignition, with the engine OFF. 2. Measure the voltage from the signal circuit of the MAF sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Step 10**	Go to **Step 13**
10	1. Connect a 3-amp fused jumper wire between the signal circuit of the MAF sensor and a good ground. Refer to **Circuit Testing** in Wiring Systems. 2. Start the engine. 3. Observe the DTC Information with a scan tool. Do any additional DTCs set?	-	Go to **Step 24**	Go to **Step 11**
11	1. Turn OFF the ignition. 2. Connect the voltage supply and the ground lead of the J 38522 Variable Signal Generator to the vehicle. 3. Connect the red lead of the J 38522 to the signal circuit of the MAF sensor. Refer to **Probing Electrical Connectors** in Wiring Systems. 4. Set the Duty Cycle switch of the J 38522 to Normal. 5. Set the Frequency switch of the J 38522 to 5 K. 6. Set the Signal switch of the J 38522 to 5 V. 7. Start the engine and allow it to idle. 8. Observe the MAF Sensor parameter with a scan tool. Is the MAF Sensor parameter within the specified range?	4,950-5,025 Hz	Go to **Step 12**	Go to **Step 15**
	IMPORTANT: **An abnormal resistance on the signal circuit will disable the MAF sensor frequency before the voltage starts to drop out of the correct parameter of 4.8-5.2 volts.** 1. Turn OFF the ignition.			

12	2. Disconnect the powertrain control module (PCM). 3. Test the MAF sensor signal circuit for a high resistance and for a short to the IAT signal circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 18**
13	Is the voltage less than the specified value?	4.8 V	Go to **Step 15**	Go to **Step 16**
14	**IMPORTANT:** **The ignition 1 voltage circuit of the MAF sensor is spliced to other components of the vehicle.** Test the ignition 1 voltage circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 28**	-
15	1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Test the signal circuit between the PCM and the MAF sensor for the following conditions: • A high resistance • An open circuit • A short to ground Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 17**
16	**IMPORTANT:** **Disconnecting the PCM connectors may eliminate the short to voltage if the signal circuit is shorted to another PCM circuit.** 1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Turn ON the ignition, with the engine OFF. 4. Measure the voltage from the signal circuit of the MAF sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	0 V	Go to **Step 23**	Go to **Step 17**

17	Measure the resistance from the signal circuit of the MAF sensor to all other circuits at both PCM connectors with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the resistance less than the specified value?	Infinity ohm	Go to **Step 25**	Go to **Step 19**
18	Test for an intermittent and for a poor connection at the MAF sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 26**
19	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 27**
20	Repair the wiring or the connector as needed. Refer to **Wiring Repairs** and **Connector Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 28**	-
21	Repair the high resistance or the open in the MAF sensor ignition 1 voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 28**	-
22	Repair the high resistance or the open in the MAF sensor ground circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 28**	-
23	Repair the short to voltage in the MAF sensor signal circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 28**	-
24	Repair the short between the MAF sensor signal circuit and the 5-volt reference circuit for which the DTC set. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 28**	-
25	Repair the circuits that are shorted together. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 28**	-
26	Replace the MAF/IAT sensor. Refer to **Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 28**	-
27	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 28**	-

28	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 29**
29	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0103

Circuit Description

The mass air flow (MAF) sensor is an air flow meter that measures the amount of air entering the engine. The powertrain control module (PCM) uses the MAF sensor signal to provide the correct fuel delivery for all engine speeds and loads. A small quantity of air entering the engine indicates a deceleration or idle condition. A large quantity of air entering the engine indicates an acceleration or high load condition. The MAF sensor has the following circuits:

- An ignition 1 voltage circuit
- A ground circuit
- A signal circuit

The PCM applies a voltage to the sensor on the signal circuit. The sensor uses the voltage to produce a frequency based on the inlet air flow through the sensor bore. The frequency varies within a range of near 2,000 Hertz at idle to near 11,500 Hertz at maximum engine load. If the PCM detects a frequency signal more than the possible range of a correctly operating MAF sensor DTC P0103 sets.

Conditions for Running the DTC

- The engine is running for more than 2 seconds.
- The engine speed is more than 400 RPM.
- The ignition 1 signal is more than 8 volts.
- The MAF sensor frequency is stable for more than 1 second.

Conditions for Setting the DTC

The PCM detects that the MAF sensor frequency signal is more than 13,500 Hertz for more than 1.2 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the air induction system for any water intrusion. The water rapidly cools the hot sensing elements in the sensor causing a false indication of excessive air flow. Any water that reaches the MAF sensor will skew the sensor and may cause this DTC to set.
- Inspect the secondary air injection system (AIR) for any water intrusion.
- A poor connection in the ignition 1 voltage circuit of the MAF sensor may cause this DTC to set.

If the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for Electromagnetic Interference (EMI) on the signal circuit of the MAF sensor. A frequency reading with the MAF sensor disconnected indicates an EMI related fault or a poor connection at the PCM. Disconnecting the MAF sensor may set additional related DTCs.

4: This step will determine if incorrect harness routing has caused this DTC to set.

5: This step will determine if water intrusion has caused this DTC to set.

DTC P0103

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
	Did you perform the Diagnostic System Check-Engine			Go to **Diagnostic**

1	Controls?	-	Go to **Step 2**	**System Check - Engine Controls**
2	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 3**	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Disconnect the MAF sensor. 3. Start the engine. 4. Observe the MAF sensor parameter with a scan tool. Is the MAF sensor parameter more than the specified value?	0 Hz	Go to **Step 4**	Go to **Step 5**
4	1. Turn OFF the ignition. 2. Inspect the harness of the MAF sensor for incorrect routing that is too close to the following components: • Any aftermarket accessories-Refer to **Checking Aftermarket Accessories** . • The secondary ignition wires or the coils • Any solenoids • Any relays • Any motors Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 7**
5	1. Turn OFF the ignition. 2. Inspect the following systems for any water intrusion. • The air induction system. • The secondary air injection system (AIR). Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 6**
	Test for an intermittent and for a poor connection at the MAF sensor. Refer to **Testing for Intermittent**			

6	**Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 8**
7	Test for an intermittent and for a poor connection at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 9**
8	Replace the MAF/IAT sensor. Refer to **Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
9	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
10	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 11**
11	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0106

Circuit Description

The manifold absolute pressure (MAP) sensor responds to pressure changes in the intake manifold. The pressure changes occur based on the engine load. The MAP sensor has the following circuits:

- A 5-volt reference circuit
- A low reference circuit
- A MAP sensor signal circuit

The powertrain control module (PCM) supplies 5 volts to the MAP sensor on the 5-volt reference circuit. The PCM, also, provides a ground on the low reference circuit. The MAP sensor provides a signal to the PCM on the MAP sensor signal circuit which is relative to the pressure changes in the manifold. The PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. The PCM should detect a high signal voltage at a high MAP, such as the ignition is ON, with the engine OFF, or at a wide-open throttle (WOT). The MAP sensor is also used in order to determine the barometric pressure (BARO). This occurs when the ignition switch is turned ON, with the engine OFF. The BARO reading may also be updated whenever the engine is operated at WOT. The PCM monitors the MAP sensor signal for voltage outside of the normal range.

The PCM calculates a predicted value for the MAP sensor based on throttle position (TP) and engine speed. The PCM then compares the predicted value to the actual MAP sensor signal. If the PCM detects that the MAP sensor signal is not within the predicted range, DTC P0106 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0120, P0220, P0442, P0443, P0446, P0455, P1125, P1514, P1515, P1516, P1518, P2108, P2120, P2121, P2125, P2126, P2130, P2131, P2135 are not set.
- The engine speed is between 400-5,000 RPM.
- The change in engine speed is less than 125 RPM.
- Traction control is not active.
- The A/C compressor clutch is steady.
- The power steering is stable.
- The clutch switch state does not change.
- The brake switch state does not change.
- The above conditions are met for 1 second.

Conditions for Setting the DTC

The PCM detects that the MAP sensor voltage is not within the predicted range for 2 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step tests the ability of the MAP sensor to correctly indicate BARO.
6: This step tests the ability of the MAP sensor to respond to an increase in engine vacuum.
8: This step tests for a proper MAP sensor pressure with an applied vacuum.

DTC P0106

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Inspect for the following conditions: • Vacuum hoses that are disconnected, damaged, or incorrectly routed • Manifold absolute pressure (MAP) sensor seal that is missing or damaged • Restrictions in the MAP sensor vacuum source • Intake manifold vacuum leaks Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 3**
3	**IMPORTANT:** **The vehicle used for the comparison is not limited to the same type of vehicle as is being serviced. A vehicle known to provide an accurate reading is acceptable.** Do you have access to another vehicle in which the MAP sensor pressure can be observed with a scan tool?	-	Go to **Step 4**	Go to **Step 5**
4	1. Turn ON the ignition, with the engine OFF. 2. Observe the MAP sensor pressure with a scan tool. 3. Observe the MAP sensor pressure in the known good vehicle with a scan tool. 4. Compare the values. Is the difference between the values less than the specified value?	3 kPa	Go to **Step 6**	Go to **Step 11**

5	**IMPORTANT:** **The Altitude vs. Barometric Pressure table indicates a pressure range for a given altitude under normal weather conditions. Weather conditions consisting of very low or very high pressure and/or very low or very high temperature may cause a reading to be slightly out of range.** 1. Turn ON the ignition, with the engine OFF. 2. Observe the MAP sensor pressure with a scan tool. Refer to **Altitude vs Barometric Pressure** . 3. The MAP sensor pressure should be within the range specified for your altitude. Does the MAP sensor indicate the correct barometric pressure?	-	Go to **Step 6**	Go to **Step 11**
6	1. Turn OFF the ignition. 2. Remove the MAP sensor from the intake manifold. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** . Leave the MAP sensor connected to the electrical harness. 3. Connect a **J 23738-A** Mityvac to the MAP sensor. 4. Turn ON the ignition, with the engine OFF. 5. Observe the MAP sensor pressure with a scan tool. 6. Apply vacuum to the MAP sensor with the **J 23738-A** until 5 inch Hg is reached. Does the MAP sensor pressure change?	-	Go to **Step 7**	Go to **Step 11**
7	1. Observe the MAP sensor pressure with the scan tool. 2. Apply vacuum to the MAP sensor with the **J 23738-A** in 1 inch Hg increments until 15 inches Hg is reached. Each 1 inch Hg should decrease MAP sensor pressure by 3-4 kPa. Is the decrease in MAP sensor pressure consistent?	-	Go to **Step 8**	Go to **Step 11**
8	1. Observe the MAP sensor pressure with the scan tool. 2. Apply vacuum with the **J 23738-A** until 20 inches Hg is reached.	34 kPa		

	Is the MAP sensor pressure less than the specified value?		Go to **Step 9**	Go to **Step 11**
9	1. Observe the MAP sensor pressure with the scan tool. 2. Disconnect the **J 23738-A** from the MAP sensor. Does the MAP sensor pressure return to the original reading observed in Step 4 or Step 5?	-	Go to **Step 10**	Go to **Step 19**
10	Inspect for the following conditions: • Incorrect cam timing-Refer to **Timing Chain and Sprockets Replacement** in Engine Mechanical for the correct timing. • Restricted exhaust flow-Refer to **Restricted Exhaust** in Engine Exhaust. • Worn piston rings-Refer to **Engine Compression Test** in Engine Mechanical. Did you find and correct the condition?	-	Go to **Step 21**	Go to **Intermittent Conditions**
11	Test for an intermittent and a poor connection at the MAP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 12**
12	1. Disconnect the MAP sensor harness connector. 2. Turn ON the ignition, with the engine OFF. 3. Measure the voltage from the 5-volt reference circuit of the MAP sensor to a good ground, with a DMM. Note the measurement as "Supply voltage". 4. Connect a test lamp and a DMM in series between the 5-volt reference circuit and the low reference circuit of the MAP sensor at the harness connector. 5. Measure the amperage with the DMM. Note the measurement as "Amperage". Is the amperage equal to the specified value?	0 mA	Go to **Step 16**	Go to **Step 13**
	1. Remove the DMM from the circuit. 2. Connect the test lamp between the 5-volt reference circuit and the low reference circuit of the MAP sensor, at the harness connector.			

13	3. Measure the voltage from the 5-volt reference circuit at the test lamp to a good ground, with the DMM. Note the measurement as "Load voltage drop". 4. Subtract the "Load voltage drop" from the "Supply voltage". Note the result as "Supply voltage drop". 5. Divide the "Supply voltage drop" by the amperage. Is the result more than the specified value?	5 ohm	Go to **Step 15**	Go to **Step 14**
14	1. Measure the voltage from the low reference circuit of the MAP sensor at the test lamp to a good ground, with the DMM. Note the result as "Low reference voltage drop". 2. Divide the "Low reference voltage drop" by the amperage. Is the result more than the specified value?	5 ohm	Go to **Step 17**	Go to **Step 19**
15	Test the 5-volt reference circuit between the powertrain control module (PCM) and the MAP sensor for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 18**
16	Test the low reference circuit between the PCM and the MAP sensor for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 18**
17	Test the low reference circuit between the PCM and the MAP sensor for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 18**
18	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 20**
19	Replace the MAP sensor. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 21**	-
20	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 21**	-
	1. Clear the DTCs with a scan tool.			

21	2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the conditions for running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 22**
22	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0107

Circuit Description

The manifold absolute pressure (MAP) sensor responds to pressure changes in the intake manifold. The pressure changes occur based on the engine load. The MAP sensor has the following circuits:

- 5-volt reference circuit
- Low reference circuit
- MAP sensor signal circuit

The powertrain control module (PCM) supplies 5 volts to the MAP sensor on the 5-volt reference circuit. The PCM also provides a ground on the low reference circuit. The MAP sensor provides a signal to the PCM on the MAP sensor signal circuit which is relative to the pressure changes in the manifold. The PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. The PCM should detect a high signal voltage at a high MAP, such as the ignition is ON, with the engine OFF, or at a wide open throttle (WOT). The MAP sensor is also used in order to determine the barometric pressure (BARO). This occurs when the ignition switch is turned ON, with the engine OFF. The BARO reading may also be updated whenever the engine is operated at WOT. The PCM monitors the MAP sensor signal for voltage outside of the normal range.

If the PCM detects a MAP sensor signal voltage that is excessively low, DTC P0107 sets.

If the PCM detects a MAP sensor signal voltage that is excessively low, DTC P0107 sets.

Conditions for Running the DTC

- DTCs P0120, P0220, P1125, P1514, P1515, P1516, P1518, P2108, P2120, P2121, P2125, P2126, P2130, P2131, P2135 are not set.
- The engine is running.
- The throttle angle is 0 percent when the engine speed is less than 800 RPM.

  OR

- The throttle angle is more than 12.5 percent when the engine speed is more than 800 RPM.

Conditions for Setting the DTC

The PCM detects that the MAP sensor voltage is less than 0.10 volt for more than 4 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

> **4:** Operate the vehicle within the same conditions as when the DTC failed. If you cannot duplicate the DTC, the information included in the Freeze Frame/Failure Records can help to locate an intermittent condition.

DTC P0107

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Turn ON the ignition, with the engine OFF. 2. Monitor the Diagnostic Trouble Code (DTC) Information with the scan tool.	-	Go to **DTC**	

	Is DTC P0641 also set?		**P0641**	Go to **Step 3**
3	Observe the MAP sensor parameter with the scan tool. Is the voltage less than the specified value?	0.1 V	Go to **Step 5**	Go to **Step 4**
4	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to **Intermittent Conditions**
5	1. Turn OFF the ignition. 2. Disconnect the manifold absolute pressure (MAP) sensor electrical connector. 3. Turn ON the ignition, with the engine OFF. 4. Measure the voltage from the 5-volt reference circuit of the MAP sensor to a good ground, with a DMM, at the MAP sensor connector. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	4.8 V	Go to **Step 6**	Go to **Step 7**
6	1. Connect a 3-amp fused jumper wire between the 5-volt reference circuit of the MAP sensor and the signal circuit of the MAP sensor. 2. Observe the MAP sensor parameter with the scan tool. Is the voltage more than the specified value?	4.9 V	Go to **Step 9**	Go to **Step 8**
7	Test the 5-volt reference circuit between the powertrain control module (PCM) and the MAP sensor for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 10**
8	Test the MAP sensor signal circuit between the powertrain control module (PCM) and the MAP sensor for a short to ground or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 10**

9	Test for an intermittent and for a poor connection at the MAP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
11	Replace the MAP sensor. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
13	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 14**
14	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0108

Circuit Description

The manifold absolute pressure (MAP) sensor responds to pressure changes in the intake manifold. The pressure changes occur based on the engine load. The MAP sensor has the following circuits:

- 5-volt reference circuit
- Low reference circuit
- MAP sensor signal circuit

The powertrain control module (PCM) supplies 5 volts to the MAP sensor on the 5-volt reference circuit. The PCM also provides a ground on the low reference circuit. The MAP sensor provides a signal to the PCM on the

MAP sensor signal circuit which is relative to the pressure changes in the manifold. The PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. The PCM should detect a high signal voltage at a high MAP, such as the ignition is ON, with the engine OFF, or at a wide open throttle (WOT). The MAP sensor is also used in order to determine the barometric pressure (BARO). This occurs when the ignition switch is turned ON, with the engine OFF. The BARO reading may also be updated whenever the engine is operated at WOT. The PCM monitors the MAP sensor signal for voltage outside of the normal range.

If the PCM detects a MAP sensor signal voltage that is excessively high, DTC P0108 sets.

Conditions for Running the DTC

- DTCs P0120, P0220, P1125, P1514, P1515, P1516, P1518, P2108, P2120, P2121, P2125, P2126, P2130, P2131, P2135 are not set.
- The engine has been running for a length of time that is determined by the start-up coolant temperature. The length of time ranges from 4 minutes at less than -30°C (-22°F) to 30 seconds at more than 30°C (86° F).
- The throttle angle is less than 1 percent when the engine speed is less than 1,200 RPM.

  Or

- The throttle angle is less than 20 percent when the engine speed is more than 1,200 RPM.

Conditions for Setting the DTC

The PCM detects that the MAP sensor voltage is more than 4.9 volts for more than 4 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect for any vacuum leaks.
- This DTC may set as the result of a misfire.
- This DTC may set as the result of improper tension or alignment of the timing chain.
- If this DTC is determined to be intermittent, refer to **Intermittent Conditions** .

DTC P0108

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Attempt to start the engine. Does the engine start and run?	-	Go to **Step 3**	Go to **Step 4**
3	Observe the MAP Sensor parameter with a scan tool. Is the voltage more than the specified value?	4.9 V	Go to **Step 6**	Go to **Step 5**
4	1. Turn OFF the ignition. 2. Remove the manifold absolute pressure (MAP) sensor from the intake manifold. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** . Leave the electrical harness connected. 3. Connect a **J 23738-A** Mityvac to the MAP sensor. 4. Apply vacuum until 5 inch Hg is reached. 5. Observe the MAP Sensor parameter with the scan tool. Is the voltage more than the specified value?	4.9 V	Go to **Step 6**	Go to Diagnostic Aids
5	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Does the DTC fail this ignition?	-	Go to **Step 6**	Go to Diagnostic Aids
	Inspect for the following conditions:			

6	• Disconnected, damaged, or incorrectly routed vacuum hoses • The MAP sensor disconnected from the vacuum source • Restrictions in the MAP sensor vacuum source • Intake manifold vacuum leaks Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 7**
7	1. Turn OFF the ignition. 2. Turn ON the ignition, with the engine OFF. 3. Monitor the Diagnostic Trouble Code (DTC) Information with the scan tool. Is DTC P0641 also set?	-	Go to **Step 10**	Go to **Step 8**
8	1. Disconnect the MAP sensor electrical connector. 2. Observe the MAP sensor parameter with the scan tool. Is the voltage less than the specified value?	0.1 V	Go to **Step 9**	Go to **Step 11**
9	1. Unless already done, remove the MAP sensor from the intake manifold. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** . 2. Connect a jumper wire between each of the terminals in the MAP sensor harness connector and the corresponding terminal at the MAP sensor. Refer to **Using Connector Test Adapters** in Wiring Systems. 3. Measure the voltage from the low reference circuit of the MAP sensor at the jumper wire terminal to a good ground with the DMM. Refer to **Measuring Voltage Drop** in Wiring Systems. Is the voltage more than the specified value?	0.2 V	Go to **Step 12**	Go to **Step 13**
10	1. Disconnect the MAP sensor electrical connector. 2. Observe the MAP sensor parameter with the scan tool.	0.1 V	Go to **DTC**	

	Is the voltage less than the specified value?		**P0641**	Go to **Step 11**
11	Test the MAP sensor signal circuit between the powertrain control module (PCM) and the MAP sensor for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
12	Test the low reference circuit between the PCM and the MAP sensor for high resistance or for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
13	Inspect for an intermittent and for a poor connection at the MAP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
14	Inspect for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
15	Replace the MAP sensor. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
16	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
17	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0112

Circuit Description

The intake air temperature (IAT) sensor is a variable resistor. The IAT sensor has a signal circuit and a low reference circuit. The IAT sensor measures the temperature of the air entering the engine. The powertrain control module (PCM) supplies 5 volts to the IAT signal circuit and a ground for the IAT low reference circuit. When the IAT sensor is cold, the sensor resistance is high. When the air temperature increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the IAT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the IAT signal circuit. If the PCM detects an excessively low IAT signal voltage, indicating a high temperature, DTC P0112 sets.

Conditions for Running the DTC

- DTCs P0502, P0503 are not set.
- The engine run time is more than 45 seconds.
- The vehicle speed sensor (VSS) indicates that the vehicle speed is more than 40 km/h (25 mph).

Conditions for Setting the DTC

The PCM detects that the IAT sensor parameter is more than 128°C (262°F) for 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- When the vehicle is at ambient temperature the IAT sensor and the ECT sensor should be relatively close to each other. Refer to **Temperature vs Resistance** .
- If an intermittent condition is suspected, refer to **Intermittent Conditions** .

DTC P0112

Step	Action	Values	Yes	No

Schematic Reference: Engine Controls Schematics
Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views

1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Turn ON the ignition, with the engine OFF. 2. Observe the intake air temperature (IAT) sensor parameter with a scan tool. Is the IAT sensor parameter more than the specified value?	128°C (262°F)	Go to **Step 4**	Go to **Step 3**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Fame/Failure Records. Does the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
4	1. Disconnect the IAT sensor. 2. Observe the IAT sensor parameter with a scan tool. Is the IAT sensor parameter less than the specified value?	-38°C (-36°F)	Go to **Step 6**	Go to **Step 5**
5	Test the signal circuit of the IAT sensor for a short to ground or a short to the IAT low reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 8**
6	Test for an intermittent and for a poor connection at the IAT sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 7**
7	Replace the IAT sensor. Refer to **Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
	Test for an intermittent and for a poor connection at			

8	the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 9**
9	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
10	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 11**
11	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0113

Circuit Description

The intake air temperature (IAT) sensor is a variable resistor. The IAT sensor has a signal circuit and a low reference circuit. The IAT sensor measures the temperature of the air entering the engine. The powertrain control module (PCM) supplies 5 volts to the IAT signal circuit and a ground for the IAT low reference circuit. When the IAT sensor is cold, the sensor resistance is high. When the air temperature increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the IAT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the IAT signal circuit. If the PCM detects an excessively high IAT signal voltage, indicating a low temperature, DTC P0113 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0116, P0117, P0118, P0125, P0128, P0502, P0503 are not set.
- The engine run time is more than 120 seconds.
- The vehicle speed sensor (VSS) indicates that the vehicle speed is less than 11 km/h (7 mph).
- The engine coolant temperature (ECT) is more than 60°C (140°F).
- The mass air flow (MAF) is less than 15 g/s.

Conditions for Setting the DTC

The PCM detects that the IAT Sensor parameter is less than -38°C (-36°F) for more than 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- When the vehicle is at ambient temperature the IAT sensor and the ECT sensor temperatures should be relatively close to each other. Refer to **Temperature vs Resistance** .
- If a short to a separate 5-volt source occurs this DTC may set.
- If an intermittent condition is suspected, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

6: This step tests for the proper operation of the circuit in the low voltage range.

DTC P0113

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Observe the IAT sensor parameter with a scan tool. Is the IAT sensor parameter less than the specified value?	-38°C (-36°F)	Go to **Step 4**	Go to **Step 3**

3	1. Observe the Freeze Frame/Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
4	1. Disconnect the mass air flow/intake air temperature (MAF/IAT) sensor. 2. Connect a DMM between the signal circuit of the IAT sensor and a good ground. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	5.2 V	Go to **Step 5**	Go to **Step 6**
5	**IMPORTANT:** **The sensor may be damaged if the circuit is shorted to a voltage source.** Test the signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
6	1. Connect a 3-amp fused jumper wire between the signal circuit of the IAT sensor and the low reference circuit of the IAT sensor. Refer to **Using Fused Jumper Wires** in Wiring Systems. 2. Observe the IAT sensor parameter with a scan tool. Is the IAT sensor parameter more than the specified value?	128°C (262°F)	Go to **Step 10**	Go to **Step 7**
7	1. Connect a 3-amp fused jumper wire between the signal circuit of the IAT sensor and a good ground. Refer to **Using Fused Jumper Wires** in Wiring Systems. 2. Observe the IAT sensor parameter with a scan tool. Is the IAT sensor parameter more than the specified value?	128°C (262°F)	Go to **Step 9**	Go to **Step 8**

8	Test the signal circuit of the IAT sensor for an open circuit or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
9	Test the IAT sensor low reference circuit for high resistance or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
10	Test the IAT signal circuit for a short to any 5-volt reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
11	**IMPORTANT:** **The sensor may be damaged if the circuit is shorted to a voltage source.** Test for an intermittent and for a poor connection at the IAT sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring SystemsDid you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	Replace the IAT sensor. Refer to **Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
14	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 16**
16	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code**	

DTC P0116

Circuit Description

The engine coolant temperature (ECT) sensor is a variable resistor that measures the temperature of the engine coolant. The powertrain control module (PCM) supplies 5 volts to the signal circuit and a ground for the ECT low reference circuit. When the ECT is low, the sensor resistance is high. When the ECT is high, the sensor resistance is low. The PCM uses this input for engine controls and enabling criteria for diagnostics. The PCM uses this High Side Coolant Rationality test to determine if the ECT input is skewed high. The internal clock of the PCM will record the amount of time the ignition is OFF. At restart the PCM will compare the temperature difference between the ECT and the intake air temperature (IAT). This DTC will only run once during the ignition cycle within the enabling conditions. Before failing this test, the PCM will perform a calculation to determine the presence of a block heater. If the PCM detects that the temperature difference is not within the calibrated range after the ignition OFF time, DTC P0116 sets.

Conditions for Running the DTC

- The ignition is ON.
- DTCs P0112, P0113, P0117, P0118, P0125, P0128, P0601, P0602, P1621, P2610 are not set.
- The vehicle has a minimum ignition off time of 10 hours.
- The IAT sensor parameter is more than 15°C (59°F).

Conditions for Setting the DTC

If the PCM detects a temperature difference between the ECT sensor and the IAT sensor of more than 15°C (27°F), the vehicle must be driven for more than 400 seconds over 24 km/h (15 mph). If the IAT sensor temperature decreases more than 3°C (5°F), a block heater is detected and the test is aborted. If the IAT sensor temperature does not decrease, a block heater was not detected and DTC P0116 sets.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.

- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

7: A snapshot is the quickest method to capture the data before it changes.

8: An IAT sensor that is skewed low can cause this DTC to set.

10: This step will determine if high resistance has caused this DTC to set.

12: A high resistance short from the signal circuit to the low reference circuit can cause this DTC to set.

DTC P0116

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **The cooling fans are commanded ON when certain engine coolant temperature (ECT) DTCs are set.** Inspect the cooling system coolant level.Is the cooling system coolant low?	-	Go to **Draining and Filling Cooling System** in Engine Cooling	Go to **Step 3**
3	Observe and record the ambient air temperature of the vehicle environment using an accurate thermometer. Did you complete the action?	-	Go to **Step 4**	-
4	**IMPORTANT:** **The vehicle needs to have been OFF for at least 10 hours for the ECT and the intake air temperature (IAT) to be at ambient temperature. The vehicle should not have changed environments during this time.** Has the engine been OFF for the specified amount of time?	10 hrs	Go to **Step 7**	Go to **Step 5**
	1. Remove the mass air flow/intake air temperature (MAF/IAT) sensor. Refer to **Mass Air Flow (MAF)/Intake Air**			

5	**Temperature (IAT) Sensor Replacement** . 2. Remove the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . 3. Place the sensors on a work surface away from any heat source. 4. Allow the sensors to reach the ambient air temperature for 30-60 minutes. Are the sensors at the ambient temperature?	-	Go to **Step 6**	-
6	1. Connect the MAF/IAT sensor to the electrical connector, but DO NOT install it. 2. Insulate the sensor from any engine heat source. 3. Connect the ECT sensor to the electrical connector, but DO NOT install it. 4. Insulate the sensor from any engine heat source. Are the sensors connected?	-	Go to **Step 7**	-
7	**IMPORTANT:** **The IAT sensor will start to warm-up as soon as the ignition is turned ON.** 1. Turn ON the ignition. 2. Take a snapshot of the Engine Data List with a scan tool. Refer to **Scan Tool Snapshot Procedure** in Wiring Systems. 3. Review the snapshot data that was taken with the scan tool. 4. Observe the ECT Sensor parameter with a scan tool. 5. Observe the IAT Sensor parameter with a scan tool. Is the difference between the ECT Sensor parameter and the IAT Sensor parameter more than the specified value?	15°C (27°F)	Go to **Step 8**	Go to **Intermittent Conditions**
8	Observe the recorded IAT Sensor parameter. Is the difference between the IAT Sensor parameter and the ambient air temperature less than the specified value?	8°C (14°F)	Go to **Step 9**	Go to **Step 10**

9	Observe the recorded ECT Sensor parameter. Is the difference between the ECT Sensor parameter and the ambient air temperature less than the specified value?	8°C (14°F)	Go to **Intermittent Conditions**	Go to **Step 12**
10	1. Disconnect the MAF/IAT sensor. 2. Test for an intermittent and for a poor connection at the IAT sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 11**
11	1. At the sensor, measure the resistance between the IAT signal and the IAT low reference terminals with a DMM and record the value. Refer to **Circuit Testing** in Wiring Systems. 2. Observe the recorded ambient air temperature. 3. Compare the resistance measurement of the IAT sensor to the ambient air temperature using the Temperature vs. Resistance table. Refer to **Temperature vs Resistance** . Is the resistance measurement of the IAT sensor within the specified range?	-	Go to **Step 14**	Go to **Step 22**
12	1. Disconnect the ECT sensor. 2. Inspect for the following conditions: • An ECT sensor leaking engine coolant internally through the sensor • Corrosion on the ECT sensor terminals • Corrosion on the ECT harness connector terminals Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 13**
	IMPORTANT: **Do not hold the ECT sensor by the probe.** 1. At the sensor, measure the resistance between the ECT signal and the ECT low reference terminals with a DMM and			

13	record the value. Refer to **Circuit Testing** in Wiring Systems. 2. Observe the recorded ambient air temperature. 3. Compare the resistance measurement of the ECT sensor to the ambient air temperature using the Temperature vs. Resistance table. Refer to **Temperature vs Resistance** . Is the resistance measurement of the ECT sensor within the specified range?	-	Go to **Step 15**	Go to **Step 23**
14	Measure the voltage from the IAT signal circuit to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Step 16**	Go to **Step 17**
15	Measure the voltage from the ECT signal circuit to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Intermittent Conditions**	Go to **Step 19**
16	**IMPORTANT:** **All electrical components and accessories must be turned OFF. Performing this step will disable the diagnostic for 10 hours.** 1. Turn OFF the ignition for 90 seconds to allow the control modules to power down. 2. Measure the resistance from the low reference circuit of the IAT sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the resistance less than the specified value?	5 ohm	Go to **Intermittent Conditions**	Go to **Step 18**
17	Test the IAT signal circuit for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 20**
18	Test the IAT low reference circuit for a high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 20**
19	Test the ECT signal circuit for a high resistance short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 21**
	Test for an intermittent and for a poor connection			

20	at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 24**
21	Test for shorted terminals and poor connections at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** , **Connector Repairs** in Wiring Systems, and **Intermittent Conditions** . Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 24**
22	Replace the MAF/IAT sensor. Refer to **Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 25**	-
23	Replace the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 25**	-
24	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 25**	-
25	Reassemble the vehicle as necessary. Did you complete the action?	-	Go to **Step 26**	-
26	**IMPORTANT:** **This DTC will not run without the ignition being OFF for at least 10 hours.** 1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 10 hours. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running in the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 27**
27	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0117

Circuit Description

The engine coolant temperature (ECT) sensor is a variable resistor, that measures the temperature of the engine coolant. The powertrain control module (PCM) supplies 5 volts to the ECT signal circuit and a ground for the ECT low reference circuit. When the ECT is cold, the sensor resistance is high. When the ECT increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the ECT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the ECT signal circuit. If the PCM detects an excessively low ECT signal voltage, which is a high temperature indication, DTC P0117 sets.

Conditions for Running the DTC

The engine run time is more than 10 seconds.

OR

The engine run time is less than 10 seconds when IAT is less than 50°C (122°F).

Conditions for Setting the DTC

The ECT sensor temperature is more than 139°C (282°F) for more than 20 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- An overheating condition may cause this DTC to set.
- After starting the engine, the ECT should rise steadily to about 90°C (194°F) then stabilize when the thermostat opens.
- Use the Temperature vs. Resistance table to test the ECT sensor at various temperature levels to evaluate the possibility of a skewed sensor. A skewed sensor could result in poor driveability concerns. Refer to **Temperature vs Resistance** .

- If the condition is suspected of being intermittent, refer to **Intermittent Conditions** .

DTC P0117

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **The PCM will enable the engine cooling fans when certain ECT diagnostic trouble codes are set.** Observe the engine coolant temperature (ECT) sensor parameter with a scan tool.Is the ECT sensor parameter more than the specified value?	138°C (280°F)	Go to **Step 4**	Go to **Step 3**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
4	1. Disconnect the ECT sensor. 2. Observe the ECT sensor parameter with a scan tool. Is the ECT sensor parameter less than the specified value?	-38°C (-36°F)	Go to **Step 6**	Go to **Step 5**
5	Test the signal circuit of the ECT sensor for a short to ground or a short to the ECT low reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 8**
6	Test for an intermittent and for a poor connection at the ECT sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 10**	Go to **Step 7**
7	Replace the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
8	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and complete the replacement?	-	Go to **Step 10**	Go to **Step 9**
9	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 10**	-
10	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 11**
11	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0118

Circuit Description

The engine coolant temperature (ECT) sensor is a variable resistor, that measures the temperature of the engine coolant. The ECT sensor has a signal circuit and a low reference circuit. The powertrain control module (PCM) supplies 5 volts to the ECT signal circuit and a ground for the ECT low reference circuit. When the ECT is cold, the sensor resistance is high. When the ECT increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the ECT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the ECT signal circuit. If the PCM detects an excessively high ECT signal voltage, which is a low temperature indication, DTC P0118 sets.

Conditions for Running the DTC

The engine has been running for more than 60 seconds.

OR

The engine run time is less than 60 seconds when the intake air temperature (IAT) is more than 0°C (32°F)

Conditions for Setting the DTC

The PCM detects that the ECT sensor parameter is less than -38°C (-36°F) for 20 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- If a short to a separate 5-volt source occurs, this DTC may set.
- After starting the engine, the ECT should rise steadily, then stabilize when the thermostat opens.
- Use the Temperature vs. Resistance table to test the ECT sensor. A skewed sensor could result in poor driveability conditions. Refer to **Temperature vs Resistance** .
- If the condition is suspected of being intermittent, refer to **Intermittent Conditions** .

DTC P0118

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **The PCM will enable the engine cooling fans when certain ECT diagnostic trouble codes are set.** Observe the ECT sensor parameter with a scan	-38°C (-36°F)		

	tool.Is the ECT sensor parameter less than the specified value?		Go to **Step 4**	Go to **Step 3**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
4	1. Disconnect the ECT sensor. 2. Measure the voltage from the signal circuit of the ECT sensor to a good ground with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Is the voltage more than the specified value?	5.2 V	Go to **Step 5**	Go to **Step 6**
5	**IMPORTANT:** **If a short to voltage occurs, the ECT sensor may be damaged.** Test the ECT signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
6	1. Connect a 3-amp fused jumper between the signal circuit of the ECT sensor and the low reference circuit. Refer to **Using Fused Jumper Wires** in Wiring Systems. 2. Observe the ECT sensor parameter with the scan tool. Is the ECT sensor parameter more than the specified value?	138°C (280°F)	Go to **Step 10**	Go to **Step 7**
7	1. Connect a 3-amp fused jumper between the signal circuit of the ECT sensor and a good ground. 2. Observe the ECT sensor parameter with a scan tool.	138°C (280°F)		

	Is the ECT sensor parameter more than the specified value?		Go to **Step 9**	Go to **Step 8**
8	Test the signal circuit of the ECT sensor for a high resistance or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
9	Test the low reference circuit of the ECT sensor for a high resistance or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
10	Test the ECT signal circuit for a short to any 5-volt reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
11	Test for an intermittent and for a poor connection at the ECT sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	Replace the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
14	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 16**
16	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0120

Circuit Description

The throttle position (TP) sensor is mounted on the throttle body assembly. The sensor is actually 2 individual TP sensors within 1 housing. Two separate signal circuits, low reference circuits and 5-volt reference circuits are used in order to connect the TP sensor assembly to the throttle actuator control (TAC) module. The 2 sensors have opposite functionality. The TP sensor 1 signal voltage is pulled up to the reference voltage as the throttle opens, from below 1 volt at closed throttle to above 3.5 volts at wide open throttle (WOT). The TP sensor 2 signal voltage is pulled down to low reference from around 3.8 volts at closed throttle to below 1 volt at WOT. TP sensor 1 and accelerator pedal position (APP) sensor 1 share a 5-volt reference circuit that is connected within the TAC module. TP sensor 2 and APP sensor 2 share a 5-volt reference circuit that is connected within the TAC module. If an out of range condition is detected with the TP sensor 1, this DTC will set and the Reduced Engine Power message will be displayed.

Conditions for Running the DTC

- DTCs P2108, or P1518 are not set.
- The ignition switch is in the crank or in the run position.
- The ignition voltage greater than 5.23 volts.

Conditions for Setting the DTC

- TP sensor 1 signal voltage is less than 0.13 volts or greater than 4.87 volts.
- All of the above conditions present for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple

DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.

- When the TAC module detects a condition within the TAC system, more than one TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting the components during testing may set additional DTCs. Keep this in mind when reviewing the Capture info.
- If this DTC is determined to be intermittent, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

33: When the TAC module detects a condition within the TAC System, more than one TAC System related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting the components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P0120

Step	Action	Values	Yes	No
Schematic References:Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views , or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Is DTC P1515, P1516, or P1518 also set?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Remove the air inlet duct from the throttle body assembly. 3. Disconnect the throttle actuator motor harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Manually close the throttle blade completely while observing the throttle position (TP) sensor 1 voltage on the scan tool. Does the scan tool indicate TP sensor 1 voltage within the specified values?	0.13-0.67 V	Go to **Step 4**	Go to **Step 8**
4	Manually open the throttle blade to wide open throttle (WOT) while observing the TP sensor 1 voltage parameter on the scan tool.	4.09-4.87 V		

	Does the scan tool indicate that the TP sensor 1 voltage is within the specified values?		Go to **Step 5**	Go to **Step 8**
5	1. Disconnect the TP sensor harness connector. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the TP sensor circuits. 3. With a DMM, test the TP sensor low reference circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 6**
6	1. Turn OFF the ignition for 15 seconds. 2. Reconnect the TAC module harness connector. 3. Reconnect the throttle actuator motor harness connector. 4. Reinstall the air inlet duct. 5. Turn ON the ignition, with the engine OFF. 6. Select the DTC Info on the scan tool. 7. Lightly touch and move the related engine wiring harnesses and connectors for the TP sensor while observing the DTC Info. The DTC will set if an intermittent condition is present. Refer to **Connector Repairs** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 7**
7	1. Continue to observe DTC Info. 2. Slowly depress the accelerator pedal to WOT, and then slowly return the pedal to the released position 3 times. Does the scan tool indicate this DTC failed this ignition?	-	Go to **Step 27**	Go to Diagnostic Aids
8	1. Disconnect the TP sensor harness connector. 2. Measure voltage at the TP sensor 1 signal circuit with a DMM connected to ground. Does the DMM indicate voltage within the specified values?	3.94-6.06 V	Go to **Step 13**	Go to **Step 9**
	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits.			

9	3. Turn ON the ignition with the engine OFF. 4. With a DMM, test the TP sensor 1 signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 10**
10	With a DMM, test the TP sensor 1 signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 11**
11	With a DMM, test the TP sensor 1 signal circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 12**
12	1. Disconnect the other TAC module harness connector. 2. With a DMM, test for a short between the TP sensor 1 signal circuit and all other TAC module circuits. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 28**
13	With a DMM, test the TP sensor 1, 5-volt reference circuit for voltage. Does the DMM indicate voltage within the specified values?	3.94-6.06 V	Go to **Step 23**	Go to **Step 14**
14	Does the DMM indicate voltage greater than the specified value?	6.06 V	Go to **Step 15**	Go to **Step 17**
15	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Turn ON the ignition with the engine OFF. 4. With a DMM, test the TP sensor 1 5-volt reference circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 16**
	1. Turn OFF the ignition. 2. Disconnect the accelerator pedal position (APP) sensor harness connector. 3. Disconnect the other TAC module harness connector.			

16	4. Turn ON the ignition, with the engine OFF. 5. With a DMM, test the APP sensor 1 5-volt reference circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 21**
17	Disconnect the APP sensor. Does the DMM indicate voltage less than the specified value?	3.94 V	Go to **Step 18**	Go to **Step 30**
18	1. Disconnect the TAC module harness connector containing the TP sensor circuits. 2. With a DMM, test the TP sensor 1 5-volt reference circuit for an open or for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 19**
19	With a DMM, test the TP sensor 1 5-volt reference circuit for a short to ground. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 20**
20	With a DMM, test the APP sensor 1 5-volt reference circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 21**
21	With a DMM, test for a short between the TP sensor 1 5-volt reference circuit and all other TAC module circuits. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 22**
22	With a DMM, test for a short between the APP sensor 1 5-volt reference circuit and all other TAC module circuits. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 28**
23	1. Disconnect the TAC module connector containing the TP sensor circuits. 2. With a DMM, test the TP sensor 1 signal circuit for a short to any other TP sensor circuit. If a short is found refer to **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 24**
	1. Reconnect the TAC module harness connector			

24	containing the TP sensor circuits. 2. Connect a fused jumper between the TP sensor 1 low reference circuit and the TP sensor 1 signal circuit. 3. With a scan tool, observe the TP sensor 1 voltage parameter. Does the scan tool indicate voltage near the specified value?	0 V	Go to **Step 26**	Go to **Step 25**
25	1. Turn OFF the ignition. 2. Disconnect the TAC Module harness connector containing the TP sensor circuits. 3. With a DMM, test the TP sensor 1 low reference circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 28**
26	Inspect for poor connections at the TP sensor harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 29**
27	Inspect for poor connections at the APP module harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 30**
28	Inspect for a poor connection at the TAC Module harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 32**	Go to **Step 31**
29	**IMPORTANT:** **The throttle position sensor is not a serviceable part and should only be replaced with the throttle body assembly.** Replace the throttle body assembly. Refer to **Throttle Body Assembly Replacement** .Did you complete the replacement?	-	Go to **Step 32**	-
30	Replace the APP sensor. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 32**	-

31	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 32**	-
32	1. Use the scan tool to clear the DTCs. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	-	Go to **Step 33**	Go to **Step 2**
33	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0125

Circuit Description

The engine coolant temperature (ECT) sensor monitors the temperature of the coolant. This input is used by the powertrain control module (PCM) for engine control, and as an enabling criteria for some diagnostics.

The air flow coming into the engine is accumulated and used to determine if the vehicle has been driven within the conditions that would allow the engine coolant to heat up normally to the Closed Loop temperature. If the coolant temperature does not increase normally or does not reach Closed Loop temperature, the diagnostics that use engine coolant temperature as enabling criteria may not run when expected.

This DTC will only run once per ignition cycle within the enabling conditions. If the PCM detects the calibrated amount of air flow and engine run time have been met and the ECT has not met the Closed Loop temperature, DTC P0125 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0116, P0117, P0118, P0500, P0502, P0503 are not present.
- The intake air temperature (IAT) sensor parameter is between -7 to +55°C (+19 to +131°F).
- The start-up engine coolant temperature parameter is less than 28.5°C (83°F).
- The engine is running between 120-1,370 seconds.
- The vehicle speed is more than 8 km/h (5 mph) for more than 0.8 km (0.5 miles).
- The mass air flow (MAF) is between 15-75 g/s with the average more than 14 g/s.

Conditions for Setting the DTC

- The calibrated amount of engine run time has been met.
- The calibrated amount of engine air flow has been met.
- The calibrated vehicle speed and distance have been met.
- The engine coolant temperature for Closed Loop of 34°C (93°F) has not been met.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

DTC P0125

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **The cooling fans are commanded ON when certain engine coolant temperature (ECT) DTCs are set.** Is the cooling system coolant low?	-	Go to **Draining and Filling Cooling System** in Engine Cooling	Go to **Step 3**
3	Test and verify the proper operation of the thermostat. Refer to **Thermostat Diagnosis** in Engine Cooling. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 4**

4	1. Disconnect the ECT sensor. 2. Inspect for the following conditions: • Corrosion on the ECT sensor terminals • Improper or corroded terminals at the ECT harness connector • Loose terminals in the ECT harness connector-Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 5**
5	Measure the voltage from the signal circuit of the ECT sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Step 6**	Go to **Step 8**
6	Measure the voltage from the signal circuit of the ECT sensor to the low reference circuit of the ECT sensor with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Step 9**	Go to **Step 7**
7	Test the ECT sensor low reference circuit for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
8	Test the ECT sensor signal circuit for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
9	1. Turn OFF the ignition. 2. Remove the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . 3. Place the sensor on a work surface away from any heat source. 4. Allow the sensor to reach the ambient air temperature for 30-60 minutes. 5. Observe and record the ambient air temperature of the vehicle environment using an accurate thermometer. **IMPORTANT:** **Do not hold the ECT sensor by the probe.**	-		

	6. Measure the resistance of the ECT sensor and record the value. 7. Compare the resistance measurement of the ECT sensor to the ambient air temperature on the Temperature vs. Resistance table. Refer to **Temperature vs Resistance** . Is the resistance measurement of the ECT sensor within the specified range?		Go to **Step 10**	Go to **Step 12**
10	Install the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . Is the action complete?	-	Go to **Intermittent Conditions**	-
11	Test for an intermittent and for a poor connection at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 13**
12	Replace the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-
13	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0128

Circuit Description

An engine coolant temperature (ECT) sensor monitors the temperature of the coolant. This input is used by the powertrain control module (PCM) for engine control, and as an enabling criteria for some diagnostics.

The air flow coming into the engine is accumulated and used to determine if the vehicle has been driven within the conditions that would allow the engine coolant to heat up normally to the thermostat regulating temperature. If the coolant temperature does not increase normally or does not reach the regulating temperature of the thermostat, diagnostics that use ECT as enabling criteria, may not run when expected. This DTC will only run once per ignition cycle within the enabling conditions.

If the PCM detects the calibrated amount of air flow and engine run time have been met and the ECT has not met the minimum thermostat regulating temperature, DTC P0128 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0112, P0113, P0116, P0117, P0118, P0125, P0500, P0502, P0503 are not present.
- The start up engine coolant temperature is less than 70°C (158°F).
- The intake air temperature (IAT) sensor parameter is between -7 to +55°C (+19 to +131°F).
- The engine is running between 120-1,370 seconds.
- The vehicle speed is more than 8 km/h (5 mph) for more than 2.5 kilometers (1.5 miles).
- The mass air flow (MAF) is between 15-75 g/s with the average more than 14 g/s.

Conditions for Setting the DTC

- The calibrated amount of engine run time has been met.
- The calibrated amount of engine air flow has been met.
- The calibrated vehicle speed and distance have been met.
- The calibrated minimum engine coolant temperature of 75°C (167°F) has not been met.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

DTC P0128

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **The cooling fans are commanded ON when certain engine coolant temperature (ECT) DTCs are set.** Is the cooling system coolant low?	-	Go to **Draining and Filling Cooling System** in Engine Cooling	Go to **Step 3**
3	Test and verify the proper operation of the thermostat. Refer to **Thermostat Diagnosis** in Engine Cooling. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 4**
4	1. Disconnect the ECT sensor. 2. Inspect for the following conditions: • Corrosion on the ECT sensor terminals • Improper or corroded terminals at the ECT harness connector • Loose terminals in the ECT harness connector-Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 5**
5	Measure the voltage from the signal circuit of the ECT sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Step 6**	Go to **Step 8**
6	Measure the voltage from the signal circuit of the ECT sensor to the low reference circuit of the ECT sensor with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Step 9**	Go to **Step 7**
7	Test the ECT sensor low reference circuit for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 14**	Go to **Step 11**
8	Test the ECT sensor signal circuit for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
9	1. Turn OFF the ignition. 2. Remove the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . 3. Place the sensor on a work surface away from any heat source. 4. Allow the sensor to reach the ambient air temperature for 30-60 minutes. 5. Observe and record the ambient air temperature of the vehicle environment using an accurate thermometer. **IMPORTANT:** **Do not hold the ECT sensor by the probe.** 6. Measure the resistance of the ECT sensor and record the value. 7. Compare the resistance measurement of the ECT sensor to the ambient air temperature on the Temperature vs. Resistance table. Refer to **Temperature vs Resistance** . Is the resistance measurement of the ECT sensor within the specified range?	-	Go to **Step 10**	Go to **Step 12**
10	Install the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . Is the action complete?	-	Go to **Intermittent Conditions**	-
11	Test for an intermittent and for a poor connection at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 13**
12	Replace the ECT sensor. Refer to **Engine Coolant Temperature (ECT) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-
13	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-

14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info. with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0131 OR P0151

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. If the PCM detects an HO2S voltage that stays below a specified value, DTC P0131 sets for HO2S bank 1 sensor 1, or DTC P0151 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

Lean Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1514, P2102, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The TP Indicated Angle parameter is between 3-70 percent more than the value observed at idle.

Power Enrichment Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1514, P2102, P2108, P2135, U0107 are not set.

- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The Engine Run Time parameter is more than 30 seconds.
- The Power Enrichment parameter is active for more than 1 second.

Conditions for Setting the DTC

Lean Test:

The PCM detects that the affected HO2S voltage parameter is less than 200 mV for 165 seconds.

or

Power Enrichment Test:

The PCM detects that the affected HO2S voltage parameter is less than 360 mV for 10 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.
- The control module commands the Loop Status open.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage is varying above and below the specified range, the condition is not present.

DTC P0131 or P0151

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Observe the affected heated oxygen sensor (HO2S) voltage parameter with a scan tool. Is the HO2S voltage parameter varying above and below the specified range?	300-600 mV	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the affected heated oxygen sensor (HO2S). 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 6**	Go to **Step 5**
5	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground. 2. Observe the HO2S voltage parameter with a scan tool.	100 mV		

	Is the HO2S voltage parameter less than the specified value?		Go to **Step 7**	Go to **Step 8**
6	Test the HO2S high signal circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 9**
7	Test the HO2S low signal circuit for a short to the HO2S heater low control circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 10**
8	Test the HO2S high signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
9	Test the HO2S high signal circuit for a short to the following circuits: • HO2S low signal circuit • HO2S heater low control circuit Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
10	1. The HO2S may be detecting a lean exhaust condition or may be contaminated. Inspect for the following conditions: **NOTE:** **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** • A silicon contaminated HO2S • Any water intrusion into the HO2S connector • An exhaust leak between the HO2S and the engine • Any vacuum leaks • An incorrect fuel pressure-Refer to **Fuel System Diagnosis** . • Any lean fuel injectors-Refer to **Fuel Injector Balance Test with Tech 2** . • An inaccurate mass air flow (MAF)	-		

	sensor-Refer to **Scan Tool Data List** . 2. Repair any of the above or similar engine conditions as necessary. Did you find and correct the condition?		Go to **Step 15**	Go to **Step 11**
11	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
12	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
13	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1** . Did you complete the replacement?	-	Go to **Step 15**	-
14	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 16**
16	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0132 OR P0152

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. If the PCM detects an HO2S voltage that stays above a specified value, DTC P0132 sets for HO2S bank 1 sensor 1, or DTC P0152 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

Rich Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1514, P2102, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The TP Indicated Angle parameter is between 3-70 percent more than the value observed at idle.

or

Decel. Fuel Cutoff Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1514, P2102, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The Engine Run Time parameter is more than 30 seconds.
- The Decel. Fuel Cutoff parameter is active for more than 2 seconds.

Conditions for Setting the DTC

Rich Test:

The PCM detects that the affected HO2S voltage parameter is more than 900 mV for 165 seconds.

or

Decel. Fuel Cutoff Test:

The PCM detects that the affected HO2S voltage parameter is more than 540 mV for 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.
- The control module commands the Loop Status open.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage is varying above and below the specified range, the condition is not present.

DTC P0132 or P0152

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Observe the affected heated oxygen sensor (HO2S) voltage parameter with a scan tool. Is the HO2S voltage parameter varying above and below the specified range?	300-600 mV	Go to **Step 3**	Go to **Step 4**
	1. Observe the Freeze Frame/Failure Records for			

3	this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the affected heated oxygen sensor (HO2S). 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter within the specified range?	400-500 mV	Go to **Step 5**	Go to **Step 6**
5	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground. 2. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 7**	Go to **Step 8**
6	Test the HO2S high signal circuit for a short to the HO2S heater low control circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 10**
7	1. Remove the jumper wire from the previous step. 2. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 3. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 9**	Go to **Step 11**
	Test the HO2S high signal circuit for an open or high	-		

8	resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 17**	Go to **Step 14**
9	Test the HO2S low signal circuit for a short to the HO2S heater low control circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 12**
10	**IMPORTANT:** **The sensor may be damaged if the circuit is shorted to a voltage source.** Test the HO2S high signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
11	Test the HO2S low signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
12	1. The HO2S may be detecting a rich exhaust condition or may be contaminated. Inspect for the following conditions: **NOTE:** **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** • A silicon contaminated HO2S • Any water intrusion into the HO2S connector • Engine oil contaminated with fuel • An EVAP canister purge condition • An incorrect fuel pressure-Refer to **Fuel System Diagnosis** . • Any rich fuel injectors-Refer to **Fuel Injector Balance Test with Tech 2** . • An inaccurate mass air flow (MAF) sensor-Refer to **Scan Tool Data List** . • An air intake restriction or collapsed air intake duct 2. Repair any of the above or similar engine conditions as necessary.	-		

	Did you find and correct the condition?		Go to **Step 17**	Go to **Step 13**
13	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
14	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
15	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1** . Did you complete the replacement?	-	Go to **Step 17**	-
16	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
17	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0133 OR P0153

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. This diagnostic will only run once per ignition cycle. The PCM monitors the rich-to-lean and lean-to-rich transition time. A transition is defined as, the HO2S voltage changes from above 625 mV to below 250 mV or from below 250 mV to above 625 mV. If the PCM detects that the transition time is too long, DTC P0133 sets for HO2S bank 1 sensor 1, or DTC P0153 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0131, P0132, P0135, P0151, P0152, P0155, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ECT Sensor parameter is more than 50°C (122°F).
- The EVAP Purge Solenoid Command parameter is more than 1 percent.
- The MAF Sensor parameter is between 20-55 g/s.
- The Engine Speed parameter is between 1,000-2,300 RPM.
- The TP Indicated Angle parameter is 5 percent more than the value observed at idle.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The Engine Run Time parameter is more than 160 seconds.
- The above conditions are met for 60 seconds.

Conditions for Setting the DTC

The PCM detects that the affected HO2S rich-to-lean or lean-to-rich average response time is more than a calibrated value.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.

- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage is varying above and below the specified value, the condition is not present.

DTC P0133 or P0153

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. Observe the affected heated oxygen sensor (HO2S) voltage parameter with a scan tool. Is the HO2S voltage parameter varying above and below the specified range?	250-625 mV	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the affected heated oxygen sensor (HO2S). 3. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground.	100		

	4. Turn ON the ignition, with the engine OFF. 5. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	mV	Go to **Step 6**	Go to **Step 5**
5	Test the HO2S high signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 9**
6	1. Remove the jumper wire from the previous step. 2. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 3. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 8**	Go to **Step 7**
7	Test the HO2S low signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 9**
8	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
9	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
	NOTE: **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** **IMPORTANT:** **The HO2S may be damaged due to contamination. Prior to replacing the HO2S inspect for the following sources of contamination:**			

10	• A silicon contaminated HO2S • Fuel contamination-Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (without Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (with Special Tool)** . • Engine oil consumption-Refer to **Oil Consumption Diagnosis** in Engine Mechanical. • Engine coolant consumption-Refer to **Loss of Coolant** in Engine Cooling. Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1** .Did you complete the replacement?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
12	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 13**
13	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0134 OR P0154

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream.

If the PCM detects that the HO2S voltage remains within the bias voltage range, DTC P0134 sets for HO2S bank 1 sensor 1, or DTC P0154 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1514, P2102, P2108, P2135, U0107 are not set.
- The Engine Run Time parameter is more than 300 seconds.
- The Ignition 1 Signal parameter is between 10-18 volts.

Conditions for Setting the DTC

The PCM detects that the affected HO2S voltage parameter is between 350-550 mV for 60 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.
- The control module commands the Loop Status open.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

3: If the voltage is varying above and below the specified value, the condition is not present.

DTC P0134 or P0154

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics				

Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views

1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **Whenever the heated oxygen sensor (HO2S) heaters are commanded ON with a scan tool, they will continue to be pulsed ON once per second until the ignition is turned OFF for 30 seconds.** 1. Turn ON the ignition, with the engine OFF. 2. Command the HO2S heaters ON with a scan tool. 3. Wait 15 seconds to allow the HO2S heater current to stabilize. 4. Observe the affected HO2S heater current parameter with a scan tool. Is the HO2S heater current parameter within the specified range?	0.25-3.125 A	Go to **Step 3**	Go to **DTC P0135, P0141, P0155, or P0161**
3	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. Observe the affected HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter varying above and below the specified range?	300-600 mV	Go to **Step 4**	Go to **Step 5**
4	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to **Intermittent Conditions**
	1. Turn OFF the ignition.			

5	2. Disconnect the affected HO2S. 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter more than the specified value?	800 mV	Go to **Step 7**	Go to **Step 6**
6	Measure the voltage from the high signal circuit of the HO2S harness connector on the engine harness side to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	0.2 V	Go to **Step 8**	Go to **Step 9**
7	**IMPORTANT:** **The sensor may be damaged if the circuit is shorted to a voltage source.** Test the HO2S high signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
8	Measure the voltage from the low signal circuit of the HO2S harness connector on the engine harness side to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	2 V	Go to **Step 12**	Go to **Step 10**
9	Test the HO2S high signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
10	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 2. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 13**	Go to **Step 11**
11	Test the HO2S low signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
	Test the HO2S low signal circuit for a short to			

12	voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
13	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
14	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
15	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1** . Did you complete the replacement?	-	Go to **Step 17**	-
16	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
17	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0135, P0141, P0155, OR P0161

Circuit Description

The heated oxygen sensor (HO2S) must reach operating temperature to provide an accurate voltage signal. A heating element inside the HO2S minimizes the time required for the sensor to reach operating temperature. Voltage is provided to the heater by the ignition 3 voltage circuit through a fuse. With the engine running, ground is provided to the heater by the HO2S heater low control circuit, through a low side driver within the powertrain control module (PCM). The PCM commands the heater ON or OFF to maintain a specific HO2S operating temperature range. The PCM determines the temperature by measuring the current flow through the heater. When the heater is in the ON state, the PCM will pulse the heater OFF for a duration of 50 ms, once per second. When the heater is in the OFF state, the PCM will pulse the heater ON for a duration of 50 ms, once per second. The PCM monitors the heater current with the engine running. The PCM also calculates the heater resistance on a cold start. Both diagnostics will only run once per ignition cycle. If the PCM detects that the heater current or the heater calculated resistance is not within the expected range, the following DTCs will set:

- DTC P0135 for HO2S bank 1 sensor 1
- DTC P0141 for HO2S bank 1 sensor 2
- DTC P0155 for HO2S bank 2 sensor 1
- DTC P0161 for HO2S bank 2 sensor 2

Conditions for Running the DTC

Heater Current Test

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ECT Sensor parameter is more than 50°C (122°F).
- The Ignition 1 Signal parameter is between 10-18 volts.
- The MAF Sensor parameter is between 3-40 g/s.
- The Engine Speed parameter is between 500-3,000 RPM.
- The Engine Run Time parameter is more than 120 seconds.

Heater Resistance Test

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ignition is OFF for more than 10 hours.
- The ECT Sensor parameter is between -30°C and +45°C (-22°F and +113°F) at engine start-up.
- The ECT Sensor parameter minus the IAT Sensor parameter is less than 8°C (14°F) at engine start-up.
- The engine is started.

Conditions for Setting the DTC

Heater Current Test

- DTCs P0135 or P0155
  - The PCM detects that the affected HO2S Heater Current parameter is more than 3.125 amps or less than 0.25 amps.

- The above condition is met for 10 seconds.
- DTCs P0141 or P0161
  - The PCM detects that the affected HO2S Heater Current parameter is more than 1.375 amps or less than 0.25 amps.
  - The above condition is met for 10 seconds.

Heater Resistance Test

DTCs P0135, P0141, P0155, or P0161-The PCM detects that the affected HO2S heater calculated resistance is not within an expected range at engine start-up.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

11: With no fault present, the test lamp will blink once per second.

DTC P0135, P0141, P0155, or P0161

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**

2	Is DTC P0135 or P0155 set?	-	Go to **Step 4**	Go to **Step 3**
3	**IMPORTANT:** **Whenever the heated oxygen sensor (HO2S) heaters are commanded ON with a scan tool, they will continue to be pulsed ON once per second until the ignition is turned OFF for 30 seconds.** 1. Turn ON the ignition, with the engine OFF. 2. Command the HO2S heaters ON with a scan tool. 3. Wait 15 seconds to allow the HO2S heater current to stabilize. 4. Observe the affected HO2S heater current parameter with a scan tool. Is the HO2S heater current parameter within the specified range?	0.25-1.375 A	Go to **Step 5**	Go to **Step 8**
4	**IMPORTANT:** **Whenever the HO2S heaters are commanded ON with a scan tool, they will continue to be pulsed ON once per second until the ignition is turned OFF for 30 seconds.** 1. Turn ON the ignition, with the engine OFF. 2. Command the HO2S heaters ON with a scan tool. 3. Wait 15 seconds to allow the HO2S heater current to stabilize. 4. Observe the affected HO2S heater current parameter with a scan tool. Is the HO2S heater current parameter within the specified range?	0.25-3.125 A	Go to **Step 5**	Go to **Step 8**
5	Observe the Freeze Frame/Failure Records for this DTC. Did the DTC fail with an engine run time of less than 10 seconds?	-	Go to **Step 6**	Go to **Step 7**
6	1. Operate the vehicle within the conditions for running the Heater Resistance Test. 2. Start the engine. Did the DTC fail this ignition?	-	Go to **Step 8**	Go to **Intermittent Conditions**
	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds.			

7	3. Start the engine. 4. Operate the vehicle within the Conditions for Running the Heater Current Test. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 8**	Go to **Intermittent Conditions**
8	Inspect the OXY SEN fuse. Is the OXY SEN fuse open?	-	Go to **Step 9**	Go to **Step 10**
9	Test the ignition 3 voltage circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 12**
10	1. Disconnect the affected HO2S. 2. Turn ON the ignition, with the engine OFF. 3. Probe the ignition 3 voltage circuit of the HO2S harness connector on the engine harness side with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 11**	Go to **Step 21**
11	**IMPORTANT:** **The test lamp may blink prior to commanding the heaters ON. This is because the heaters were commanded ON in a previous step. To command the heaters OFF, turn OFF the ignition for 30 seconds.** 1. Connect a test lamp between the ignition 3 voltage circuit of the HO2S harness connector on the engine harness side and the HO2S heater low control circuit of the HO2S harness connector on the engine harness side. 2. Command the HO2S heaters ON with a scan tool. Does the test lamp blink once per second?	-	Go to **Step 13**	Go to **Step 14**
12	**IMPORTANT:** **Perform the following test on all HO2S' which are supplied voltage by the suspect circuit.** Test the ignition 3 voltage circuit on the sensor side of the HO2S connector for a short to ground. Refer to **Circuit Testing** in Wiring Systems.Is any sensor shorted to ground?	-	Go to **Step 22**	Go to **Intermittent Conditions**

13	Measure the resistance of the following circuits with a DMM: • The HO2S heater low control circuit • The ignition 3 voltage circuit Refer to **Circuit Testing** in Wiring Systems. Is the resistance of either circuit more than the specified value?	3 ohm	Go to **Step 20**	Go to **Step 18**
14	Is the test lamp on steady?	-	Go to **Step 15**	Go to **Step 16**
15	Test the HO2S heater low control circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 19**
16	Test the HO2S heater low control circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 17**
17	Test the HO2S heater low control circuit for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 19**
18	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 22**
19	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 23**
20	Repair the circuit with high resistance. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 24**	-
21	Repair the open in the ignition 3 voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 24**	-
22	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1** , **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1** , **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2** , **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2** .	-		

	Did you complete the replacement?		Go to **Step 24**	-
23	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 24**	-
24	Were you sent to this diagnostic from DTC P0134 or P0154?	-	Go to Step 17 in **DTC P0134 or P0154**	Go to **Step 25**
25	Were you sent to this diagnostic from DTC P0140 or P0160?	-	Go to Step 17 in **DTC P0140 or P0160**	Go to **Step 26**
26	1. Replace the OXY SEN fuse if necessary. 2. Clear the DTCs with a scan tool. 3. Turn OFF the ignition for 30 seconds. 4. Start the engine. 5. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 27**
27	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0136 OR P0156

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream.

The HO2S bank 1 sensor 2 and HO2S bank 2 sensor 2 are used for catalyst monitoring. This diagnostic runs once per ignition cycle. This diagnostic consists of two tests, a passive test and an intrusive test. During the passive test, if the HO2S bank 1 sensor 2 or HO2S bank 2 sensor 2 voltage transitions below 350 mV and above 709 mV, the DTC will pass for this ignition cycle. If the DTC does not pass during the passive test, the intrusive test will begin. During the intrusive test, the control module will force the air-to-fuel ratio rich and/or lean. The control module then waits for a predicted response from the HO2S. If the HO2S voltage transitions below 350 mV and/or above 709 mV, the DTC will pass for this ignition cycle. If the control module does not receive the expected response from the HO2S, DTC P0136 will set for HO2S bank 1 sensor 2 or DTC P0156 will set for HO2S bank 2 sensor 2.

Conditions for Running the DTC

DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0157, P0158, P0160, P0161, P0200, P0410, P0442, P0443, P0446, P0449, P0455, P0491, P0492, P0496, P1133, P1134, P1153, P1154, U0107 are not set.

Passive Test

- The engine is running.
- The Engine Run Time parameter is less than 13.5 minutes.

Intrusive Test

- The Engine Run Time parameter is more than 13.5 minutes.
- The ignition 1 Signal parameter is between 10-18 volts.
- The Engine Speed parameter is between 500-5,000 RPM.
- The MAF Sensor parameter is between 5-55 g/s.
- The Vehicle Speed parameter is between 24-131 km/h (15-82 mph).
- The Short Term FT Bank 1 and Bank 2 parameter is between -10 and +10 percent.
- The maximum number of intrusive attempts is less than 13.

Conditions for Setting the DTC

1. The PCM detects that the HO2S bank 1 sensor 2 or HO2S bank 2 sensor 2 did not transition below 350 mV and above 709 mV during the passive test.
2. One of the following tests fail:
   - Lean Intrusive Test
     - The PCM detects that the HO2S bank 1 sensor 2 or HO2S bank 2 sensor 2 is more than 350 mV for 25.4 seconds.
     - The HO2S bank 1 sensor 1 and HO2S bank 2 sensor 1 is less than 300 mV.

       OR
   - Rich Intrusive Test
     - The PCM detects that the HO2S bank 1 sensor 2 or HO2S bank 2 sensor 2 is less than 709 mV for 25.4 seconds.
     - The HO2S bank 1 sensor 1 and HO2S bank 2 sensor 1 is more than 600 mV.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage does not change more that the specified value, the condition is present.

DTC P0136 or P0156

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. While observing the affected HO2S voltage parameter with a scan tool, quickly cycle the throttle from closed throttle to wide open throttle, 3 times. Did the HO2S voltage parameter change more than the specified value?	200 mV	Go to **Step 3**	Go to **Step 4**
	1. Observe the Freeze Frame/Failure Records for			

3	this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the affected heated oxygen sensor (HO2S). 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 6**	Go to **Step 5**
5	Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter more than the specified value?	800 mV	Go to **Step 7**	Go to **Step 8**
6	Test the HO2S high signal circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 9**
7	**IMPORTANT:** **The sensor may be damaged if the circuit is shorted to a voltage source.** Test the HO2S high signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
8	Measure the voltage from the low signal circuit of the HO2S harness connector on the engine harness side to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	2 V	Go to **Step 10**	Go to **Step 11**
9	Test the HO2S high signal circuit for a short to the HO2S low signal circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
	Test the HO2S low signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in			

10	Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
11	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground. 2. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 12**	Go to **Step 14**
12	1. Remove the jumper wire from the previous step. 2. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 3. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 15**	Go to **Step 13**
13	Test the HO2S low signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
14	Test the HO2S high signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
15	1. The HO2S may be detecting a rich exhaust condition, a lean exhaust condition, or the HO2S may be contaminated. Inspect for the following conditions: **NOTE:** **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** • A silicon contaminated HO2S • Any water intrusion into the HO2S connector • An exhaust leak between the HO2S and	-		

	the engine • Any vacuum leaks • Engine oil contaminated with fuel • An incorrect fuel pressure-Refer to **Fuel System Diagnosis** . • Any lean or rich fuel injectors-Refer to **Fuel Injector Balance Test with Tech 2** . • An inaccurate mass air flow (MAF) sensor-Refer to **Scan Tool Data List** . 2. Repair any of the above or similar engine conditions as necessary. Did you find and correct the condition?		Go to **Step 20**	Go to **Step 16**
16	Test for an intermittent and for a poor connection at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 18**
17	Test for an intermittent and for a poor connection at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
18	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2** . Did you complete the replacement?	-	Go to **Step 20**	-
19	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
20	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 21**
21	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code**	

DTC P0137 OR P0157

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. If the PCM detects an HO2S voltage that stays below a specified value, DTC P0137 sets for HO2S bank 1 sensor 2, or DTC P0157 sets for HO2S bank 2 sensor 2.

Conditions for Running the DTC

Lean Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2102, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The TP Indicated Angle parameter is between 3-70 percent more than the value observed at idle.

or

Power Enrichment Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2102, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The Engine Run Time parameter is more than 30 seconds.
- The Power Enrichment parameter is active for more than 2 seconds.

Conditions for Setting the DTC

Lean Test

The PCM detects that the affected HO2S voltage parameter is less than 80 mV for 200 seconds.

or

Power Enrichment Test

The PCM detects that the affected HO2S voltage parameter is less than 420 mV for 10 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage does not change more that the specified value, the condition is present.

DTC P0137 or P0157

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
	IMPORTANT: **With the engine running, observe the heated oxygen sensor (HO2S) Bank 1 Sensor 1 and HO2S Bank 2**			

2	**Sensor 1 voltage parameters with a scan tool. The voltage should vary from below 300 mV to above 600 mV. If the voltage is not varying, refer to DTC P0132 or P0152 .** 1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. While observing the affected HO2S voltage parameter with a scan tool, quickly cycle the throttle from closed throttle to wide open throttle, 3 times. Did the HO2S voltage parameter change more than the specified value?	200 mV	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the affected HO2S. 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 6**	Go to **Step 5**
5	Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter more than the specified value?	800 mV	Go to **Step 7**	Go to **Step 8**
6	Test the HO2S high signal circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 9**
	IMPORTANT: **The sensor may be damaged if the circuit is shorted to**			

	a voltage source.			
7	Test the HO2S high signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
8	Measure the voltage from the low signal circuit of the HO2S harness connector on the engine harness side to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	2 V	Go to **Step 10**	Go to **Step 11**
9	Test the HO2S high signal circuit for a short to the HO2S low signal circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
10	Test the HO2S low signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
11	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground. 2. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 12**	Go to **Step 14**
12	1. Remove the jumper wire from the previous step. 2. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 3. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 15**	Go to **Step 13**
13	Test the HO2S low signal circuit for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
14	Test the HO2S high signal circuit for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 17**
	1. The HO2S may be detecting a lean exhaust			

15	condition or may be contaminated. Inspect for the following conditions: **NOTE:** **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** • A silicon contaminated HO2S • Any water intrusion into the HO2S connector • An exhaust leak between the HO2S and the engine • Any vacuum leaks • An incorrect fuel pressure-Refer to **Fuel System Diagnosis** . • Any lean fuel injectors-Refer to **Fuel Injector Balance Test with Tech 2** . • An inaccurate mass air flow (MAF) sensor-Refer to **Scan Tool Data List** . 2. Repair any of the above or similar engine conditions as necessary. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 16**
16	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 18**
17	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 19**
18	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2** . Did you complete the replacement?	-	Go to **Step 20**	-
19	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds.			

20	3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 21**
21	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0138 OR P0158

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. If the PCM detects an HO2S voltage that stays above a specified value, DTC P0138 sets for HO2S bank 1 sensor 2, or DTC P0158 sets for HO2S bank 2 sensor 2.

Conditions for Running the DTC

Rich Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2102, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The TP Indicated Angle parameter is between 3-70 percent more than the value observed at idle.

or

Decel. Fuel Cutoff Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2102, P2108, P2135, U0107 are not set.

- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The Engine Run Time parameter is more than 30 seconds.
- The Decel. Fuel Cutoff parameter is active for more than 10 seconds.

Conditions for Setting the DTC

Rich Test

The PCM detects that the affected HO2S voltage parameter is more than 950 mV for 200 seconds.

or

Decel. Fuel Cutoff Test

The PCM detects that the affected HO2S voltage parameter is more than 480 mV for 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage does not change more that the specified value, the condition is present.

DTC P0138 or P0158

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **With the engine running, observe the heated oxygen sensor (HO2S) Bank 1 Sensor 1 and HO2S Bank 2 Sensor 1 voltage parameters with a scan tool. The voltage should vary from below 300 mV to above 600 mV. If the voltage is not varying, refer to DTC P0131 or P0151 .** 1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. While observing the affected HO2S voltage parameter with a scan tool, quickly cycle the throttle from closed throttle to wide open throttle, 3 times. Did the HO2S voltage parameter change more than the specified value?	200 mV	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the affected HO2S. 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool.	800 mV		

	Is the HO2S voltage parameter more than the specified value?		Go to **Step 6**	Go to **Step 5**
5	Measure the voltage from the low signal circuit of the HO2S harness connector on the engine harness side to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	2 V	Go to **Step 7**	Go to **Step 8**
6	**IMPORTANT:** **The sensor may be damaged if the circuit is shorted to a voltage source.** Test the HO2S high signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
7	Test the HO2S low signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
8	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground. 2. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 9**	Go to **Step 11**
9	1. Remove the jumper wire from the previous step. 2. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 3. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 12**	Go to **Step 10**
10	Test the HO2S low signal circuit for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
11	Test the HO2S high signal circuit for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
	1. The HO2S may be detecting a rich exhaust			

12	condition or may be contaminated. Inspect for the following conditions: **NOTE:** **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** • A silicon contaminated HO2S • Any water intrusion into the HO2S connector • Engine oil contaminated with fuel • An EVAP canister purge condition • An incorrect fuel pressure-Refer to **Fuel System Diagnosis** . • Any rich fuel injectors-Refer to **Fuel Injector Balance Test with Tech 2** . • An inaccurate mass air flow (MAF) sensor-Refer to **Scan Tool Data List** . • An air intake restriction or collapsed air intake duct 2. Repair any of the above or similar engine conditions as necessary. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 13**
13	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
14	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
15	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2** . Did you complete the replacement?	-	Go to **Step 17**	-
16	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
	1. Clear the DTCs with a scan tool.			

17	2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0140 OR P0160

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. This diagnostic will only run once per ignition cycle. If the PCM detects that the HO2S voltage remains within the bias voltage range, DTC P0140 sets for HO2S bank 1 sensor 2, or P0160 sets for HO2S bank 2 sensor 2.

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0141, P0161, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The Engine Run Time parameter is more than 300 seconds.
- The Loop Status is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.

Conditions for Setting the DTC

- The PCM detects that the affected HO2S voltage parameter is between 410-490 mV for 150 seconds.
- The TP Indicated Angle parameter changes more than 5 percent within 1 second, 6 times.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.

- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

3: If the voltage is varying above and below the specified value, the condition is not present.

DTC P0140 or P0160

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **Whenever the heated oxygen sensor (HO2S) heaters are commanded ON with a scan tool, they will continue to be pulsed ON once per second until the ignition is turned OFF for 30 seconds.** 1. Turn ON the ignition, with the engine OFF. 2. Command the HO2S heaters ON with a scan tool. 3. Wait 15 seconds to allow the HO2S heater current to stabilize. 4. Observe the affected HO2S heater current parameter with a scan tool.	0.25-1.375 A		Go to **DTC P0135,**

	Is the HO2S heater current parameter within the specified range?		Go to **Step 3**	**P0141, P0155, or P0161**
3	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. While observing the affected HO2S voltage parameter with a scan tool, quickly cycle the throttle from closed throttle to wide open throttle, 3 times. Did the HO2S voltage parameter change more than the specified value?	200 mV	Go to **Step 4**	Go to **Step 5**
4	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to **Intermittent Conditions**
5	1. Turn OFF the ignition. 2. Disconnect the affected HO2S. 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter more than the specified value?	800 mV	Go to **Step 7**	Go to **Step 6**
6	Measure the voltage from the high signal circuit of the HO2S harness connector on the engine harness side to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	0.2 V	Go to **Step 8**	Go to **Step 9**
7	**IMPORTANT:** **The sensor may be damaged if the circuit is shorted to a voltage source.** Test the HO2S high signal circuit for a short to	-		

	voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?		Go to **Step 17**	Go to **Step 14**
8	Measure the voltage from the low signal circuit of the HO2S harness connector on the engine harness side to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	2 V	Go to **Step 12**	Go to **Step 10**
9	Test the HO2S high signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
10	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 2. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 13**	Go to **Step 11**
11	Test the HO2S low signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
12	Test the HO2S low signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
13	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
14	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
15	Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2** .	-		

	Did you complete the replacement?		Go to **Step 17**	-
16	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
17	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0171 OR P0174

Circuit Description

The powertrain control module (PCM) controls the air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. Fuel delivery is controlled differently during Open and Closed Loop. During Open Loop, the PCM determines fuel delivery based on sensor signals without oxygen sensor (O2S) input. During Closed Loop, the O2S inputs are added and used by the PCM to calculate short and long term fuel trim fuel delivery adjustments. If the O2S indicate a lean condition, fuel trim values will be above 0 percent. If the O2S indicate a rich condition, fuel trim values will be below 0 percent. Short term fuel trim values change rapidly in response to the heated oxygen sensor (HO2S) voltage signals. Long term fuel trim makes coarse adjustments in order to maintain an air/fuel ratio of 14.7:1. If the PCM detects an excessively lean condition, DTC P0171 or P0174 sets.

Conditions for Running the DTC

- DTCs P0101, P0103, P0108, P0135, P0137, P0141, P0200, P0300, P0410, P0420, P0430, P0440, P0442, P0443, P0446, P0449, P0506, P0507 or P1441 are not set.
- The engine coolant temperature (ECT) is between 75-115°C (167-239°F).
- The intake air temperature (IAT) is between -20 to +90°C (4-194°F).
- The manifold absolute pressure (MAP) is between 26-90 kPa (3.7-13 psi).
- The vehicle speed is less than 137 km/h (85 mph).
- The engine speed is between 400-3,000 RPM.
- The barometric pressure (BARO) is more than 74 kPa (10.7 psi).
- The mass airflow (MAF) is between 5-90 g/s.

- The fuel level is more than 10 percent.
- The throttle position (TP) is less than 90 percent.

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Conditions for Setting the DTC

- The average long term fuel trim cell value is above 23 percent.
- All of the above conditions are present for 6 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- The system will go lean if an injector is not suppling enough fuel.
- A lean condition could be present during high fuel demand.
- Use a scan tool in order to review the Failure Records. If an intermittent condition is suspected, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: If conditions were not corrected, refer to Fuel System Diagnosis for a possible fuel problem.

6: If conditions were not corrected, a worn cam, worn intake or exhaust valves, or other engine mechanical failure may be the problem.

DTC P0171 or P0174

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **If any DTCs other than P0171 or P0174 are set, refer to those DTCs before continuing.** 1. Install the scan tool. 2. Start and idle the engine at the normal operating temperature in Closed Loop. 3. Record the long term fuel trim. 4. Turn OFF the engine. 5. Turn ON ignition, with engine OFF. 6. Review the Freeze Frame/Failure Records and record the displayed data for this DTC. Does the scan tool indicate that the long term fuel trim is greater than the specified value?	23%	Go to **Step 3**	Go to Diagnostic Aids
3	1. Operate engine at idle. 2. Observe the HO2S parameters with a scan tool. Does the scan tool indicate that the parameter is within the specified range and fluctuating?	200-800 mV	Go to **Step 4**	Go to **Step 5**
4	1. Turn OFF the engine. 2. Visually and physically inspect the following items: • The vacuum hoses for splits, kinks, and proper connections-Refer to **Emission Hose Routing Diagram** . • Ensure that the vehicle has sufficient fuel in tank. If fuel pressure is too low this DTC may set. Refer to **Fuel System Diagnosis** . • Fuel contamination-Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (without Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (with Special Tool)** . Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
	1. Turn OFF the engine.			

5	2. Inspect the HO2S for proper installation. 3. Verify the electrical connectors and the wires are secure, and not contacting the exhaust system. 4. Test for continuity between the HO2S signal circuit and the low reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Fuel System Diagnosis**
6	1. Operate the engine at idle. 2. Inspect for any missing, loose, or leaking exhaust components forward of the HO2S. 3. Inspect for vacuum leaks at the intake manifold, throttle body, and injector O-rings. 4. Inspect the air induction system and the air intake ducts for leaks. 5. Inspect the secondary air injection (AIR) system for leaks, improper air delivery, and for the shut-off valves not closing. 6. Inspect the crankcase ventilation system for leaks. Refer to **Crankcase Ventilation System Inspection/Diagnosis** in Engine Mechanical. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Symptoms - Engine Mechanical** in Engine Mechanical
7	**IMPORTANT:** **After repairs, use the scan tool Fuel Trim Reset function in order to reset the Long Term Fuel Trim.** 1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 8**
8	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code**	

				(DTC) List	System OK

DIAGNOSIS

DTC P0172 OR P0175

Circuit Description

The powertrain control module (PCM) controls the air/fuel metering system in order to provide the best possible combination of driveability, fuel economy, and emission control. Fuel delivery is controlled differently during Open and Closed Loop. During Open Loop the PCM determines fuel delivery based on sensor signals without oxygen sensor (O2S) input. During Closed Loop, the oxygen sensor inputs are added and used by the PCM to calculate short and long term fuel trim fuel delivery adjustments. If the O2S indicate a lean condition, the fuel trim values will be above 0 percent. If the O2S indicate a rich condition, the fuel trim values will be below 0 percent. Short term fuel trim values change rapidly in response to the heated oxygen sensor (HO2S) voltage signals. Long term fuel trim makes coarse adjustments in order to maintain an air/fuel ratio of 14.7:1. The fuel trim diagnostic will conduct a test to determine if a rich failure actually exists, or if excessive vapor from the evaporative emission (EVAP) canister is causing a rich condition. If the PCM detects an excessively rich condition, DTC P0172 or P0175 sets.

Conditions for Running the DTC

- DTCs P0101, P0103, P0108, P0135, P0137, P0141, P0200, P0300, P0410, P0420, P0430, P0440, P0442, P0443, P0446, P0449, P0506, P0507 or P1441 are not set.
- The engine coolant temperature (ECT) is between 75-115°C (167-239° F).
- The intake air temperature (IAT) is between -20 to +90°C (4-194°F).
- The manifold absolute pressure (MAP) is between 26-90 kPa (3.7-13 psi).
- The vehicle speed is less than 137 km/h (85 mph).
- The engine speed is between 400-3,000 RPM.
- The barometric pressure (BARO) is more than 74 kPa (10.7 psi).
- The mass airflow (MAF) is between 5-90 g/s.
- The fuel level is more than 10 percent.
- The throttle position (TP) is less than 90 percent.

Conditions for Setting the DTC

- The average long term fuel trim value is below -13 percent.
- All of the above conditions are present for 40 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.

- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Fuel contamination, such as water or alcohol will effect fuel trim.
- A malfunctioning mass air flow sensor can cause a rich condition and set this DTC. Refer to **DTC P0101** .
- Use a scan tool in order to review Failure Records. If an intermittent condition is suspected, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: If conditions were not corrected, refer to Fuel System Diagnosis for a possible fuel problem.

6: An EVAP canister that is saturated will cause a rich condition. If the conditions were not corrected, a worn cam, worn intake or exhaust valves, or other engine mechanical failure may be the problem.

DTC P0172 or P0175

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
	IMPORTANT: **If any DTCs other than P0172 are set, refer to those DTCs before continuing.** 1. Install scan tool. 2. Start and idle the engine at the normal operating temperature in Closed Loop.			

2	3. Record the long term fuel trim data. 4. Turn OFF the engine. 5. Turn ON ignition, with the engine OFF. 6. Review the Freeze Frame/Failure Records, and record the displayed data for this DTC. Does the scan tool indicate that the long term fuel trim is less than the specified value?	-13%	Go to **Step 3**	Go to Diagnostic Aids
3	1. Operate engine at idle. 2. Observe HO2S parameters with a scan tool. Does the scan tool indicate that the values are within the specified range and fluctuating?	200-800 mV	Go to **Step 4**	Go to **Step 5**
4	1. Turn OFF engine. 2. Visually and physically inspect the following items: • The EVAP lines and components for damage or blockage-Refer to **Evaporative Emissions (EVAP) Hose Routing Diagram** . • The inlet screen of the MAF sensor for blockage • The vacuum hoses for splits, kinks, and proper connections-Refer to **Emission Hose Routing Diagram** . • The air intake duct for being collapsed or restricted • The air filter for being dirty or restricted • Inspect for objects blocking the throttle body. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
5	1. Turn OFF engine 2. Inspect the HO2S for proper installation. 3. Inspect to ensure that the electrical connectors and the wires are secure and not contacting the exhaust system. 4. Test for continuity between the signal circuit and the low reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 7**	Go to **Fuel System Diagnosis**
6	Inspect for the following: • Excessive fuel in the crankcase • Proper operation of the fuel pressure regulator-Refer to **Fuel System Diagnosis** . • All injectors are functioning properly-Refer to **Fuel Injector Coil Test** . Did you find and correct the condition?	-	Go to **Step 7**	Go to **Symptoms - Engine Mechanical** in Engine Mechanical
7	**IMPORTANT:** **After repairs, use the scan tool Fuel Trim Reset function in order to reset the Long Term Fuel Trim.** 1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 8**
8	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0200

Circuit Description

The control module enables the appropriate fuel injector on the intake stroke for each cylinder. Ignition 1 voltage is supplied to the fuel injectors. The control module controls each fuel injector by grounding the control circuit via a solid state device called a driver. The control module monitors the status of each driver. If the control module detects an incorrect voltage for the commanded state of the driver, a fuel injector control DTC sets.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.

- The ignition voltage is between 6-18 volts.

Conditions for Setting the DTC

- The powertrain control module (PCM) detects an incorrect voltage on a fuel injector control circuit.
- The condition exists for 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Performing the Fuel Injector Coil Test may help to isolate an intermittent condition. Refer to **Fuel Injector Coil Test** .
- For an intermittent condition, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: This step verifies that the PCM is able to control the fuel injector.

6: This step tests if a ground is constantly being applied to the fuel injector.

DTC P0200

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
	Did you perform the Diagnostic System Check-Engine		Go to **Diagnostic**

1	Controls?	Go to**Step 2**	**System Check - Engine Controls**
2	1. Clear the DTCs with a scan tool. 2. Idle the engine at the normal operating temperature. 3. Monitor the misfire current counters with a scan tool. Are any of the misfire current counters incrementing?	Go to**Step 4**	Go to**Step 3**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to**Step 4**	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Disconnect the injector which displays the highest number of misfire current counters. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the fuel injector with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to**Step 5**	Go to **Step 11**
5	1. Connect the **J 34730-2C** Fuel Injector Test Lamp between the control circuit of the fuel injector and the ignition 1 voltage circuit of the fuel injector. 2. Start the engine. Does the test lamp flash?	Go to **Step 9**	Go to**Step 6**
6	Does the test lamp remain illuminated?	Go to **Step 8**	Go to**Step 7**
7	Test the fuel injector control circuit for the following conditions: • A short to voltage • An open • High resistance		

	Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to**Step 10**
8	Test the fuel injector control circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
9	Test for an intermittent and for a poor connection at the fuel injector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to**Step 12**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
11	**IMPORTANT:** **The INJ fuse also supplies voltage to the ignition coil modules. If the fuse is open, inspect all related circuits and components for a short to ground. Refer to Circuit Testing in Wiring Systems.** Test the ignition 1 voltage circuit of the fuel injector for: • An open • High resistance • A short to ground Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	Go to**Step 14**	-
12	Replace the fuel injector. Refer to **Fuel Injector Replacement** . Did you complete the replacement?	Go to **Step 14**	-
13	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.		

	Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0220

Circuit Description

The throttle position (TP) sensor is mounted on the throttle body assembly. The sensor is actually 2 individual TP sensors within 1 housing. Two separate signal, low reference and 5-volt reference circuits are used in order to connect the TP sensor assembly to the throttle actuator control (TAC) module. The 2 sensors have opposite functionality. The TP sensor 1 signal voltage is pulled up to the reference voltage as the throttle opens, from below 1 volt at closed throttle to above 3.5 volts at wide open throttle (WOT). The TP sensor 2 signal voltage is pulled down to the low reference from around 3.8 volts at closed throttle to below 1 volt at WOT. TP sensor 1 and accelerator pedal position (APP) sensor 1 share a 5-volt reference circuit that is connected within the TAC module. TP sensor 2 and APP sensor 2 share a 5-volt reference circuit that is connected within the TAC module. If an out of range condition is detected with the TP sensor 2, this DTC will set and the Reduced Engine Power message will be displayed.

Conditions for Running the DTC

- DTCs P2108, or P1518 are not set.
- The ignition switch in the crank position or the run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- The TP sensor 2 voltage is less than 0.13 volts or greater than 4.87 volts.
- All above conditions present for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.

- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects a condition within the TAC System, more than one TAC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- If this DTC is determined to be intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

12: Using a test lamp reduces the amount of current fed into the signal circuit. The scan tool should display the maximum value for this parameter, 5-volts even though the actual voltage is higher.

18: The TP 2 sensor and the APP 2 sensor share a common 5 volt reference. The 5-volt reference circuits are connected internally within the TAC module. Disconnecting the TAC module will isolate the 5-volt reference circuits.

19: The TP sensor 2 and the APP sensor 2 share a common 5-volt reference. A short to voltage on the APP sensor 2 5-volt reference circuit will affect the TP sensor 2 5-volt reference circuit.

36: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This condition is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P0220

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Is DTC P1515, P1516, or P1518 also set?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**

3	1. Turn OFF the ignition. 2. Remove the air inlet duct from the throttle body assembly. 3. Disconnect the throttle actuator motor harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Manually close the throttle blade completely while observing the throttle position (TP) sensor 2 voltage parameter on the scan tool. Does the scan tool indicate that the TP sensor 2 voltage is within the specified values?	4.3-4.8 V	Go to **Step 4**	Go to **Step 7**
4	Open the throttle blade to wide open throttle (WOT) by hand while observing the TP sensor 2 voltage parameter on the scan tool. Does the scan tool indicate TP sensor 2 voltage within the specified values?	0.13-1 V	Go to **Step 5**	Go to **Step 7**
5	1. Turn OFF the ignition for 15 seconds. 2. Reconnect the throttle actuator motor harness connector. 3. Reinstall the air inlet duct. 4. Turn ON the ignition with the engine OFF. 5. Select the DTC Info. Option on the scan tool. 6. Lightly touch and move the related engine wiring harnesses and connectors for the throttle position (TP) sensor while observing the DTC Info. The DTC will set if an intermittent condition is present. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 6**
6	1. Continue to observe DTC Info. 2. Slowly depress the accelerator pedal to WOT and then slowly return the pedal to the released position 3 times. Does the scan tool indicate this DTC failed this ignition?	-	Go to **Step 26**	Go to Diagnostic Aids
7	Observe the TP sensor 2 voltage parameter, with a scan tool. Does the scan tool indicate that the TP sensor 2 voltage is at the specified value?	5 V	Go to **Step 8**	Go to **Step 12**
	Disconnect the TP sensor harness connector.			

8	Does the scan tool indicate that the TP sensor 2 voltage is at the specified value?	0 V	Go to **Step 9**	Go to **Step 13**
9	1. Disconnect the accelerator pedal position (APP) sensor harness connector. 2. Turn ON the ignition with the engine OFF. 3. Test the TP sensor 2 5-volt reference circuit for voltage, with a DMM. Does the DMM indicate voltage near the specified value?	5 V	Go to **Step 10**	Go to **Step 18**
10	With a DMM connected between the TP sensor 1 low reference circuit and the TP sensor 2 low reference circuit at the TP sensor harness connector, test for resistance Does the DMM indicate resistance within the specified values?	0-5 ohm	Go to **Step 14**	Go to **Step 11**
11	1. Turn OFF the ignition. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the TP sensor circuits. 3. Test the TP sensor 2 low reference circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 32**
12	1. Disconnect the TP sensor harness connector. 2. Connect a test lamp between the TP sensor 2 signal circuit and the battery positive voltage. Does the scan tool indicate TP sensor 2 voltage near the specified value?	5 V	Go to **Step 20**	Go to **Step 15**
13	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Turn ON the ignition. 4. Test the TP sensor 2 signal circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 17**
	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits.			

14	3. Turn ON the ignition with the engine OFF. 4. Test the APP sensor 2 signal circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 24**
15	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Test the TP sensor 2 signal circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 16**
16	Test the TP sensor 2 signal circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 17**
17	Test for a short between the TP sensor 2 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 32**
18	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Turn ON the ignition with the engine OFF. 4. Test the TP sensor 2 5-volt reference circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 19**
19	1. Turn OFF the ignition. 2. Disconnect the other TAC module harness connector. 3. Turn ON the ignition with the engine OFF. 4. Test the APP sensor 2 5-volt reference circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 24**
	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector			

20	containing the TP sensor circuits. 3. Test the TP sensor 2 5-volt reference circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 21**
21	Test the TP sensor 2 5-volt reference circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 22**
22	1. Disconnect the APP sensor harness connector. 2. Disconnect the other TAC module harness connector. 3. Turn ON the ignition with the engine OFF. 4. Test the APP sensor 2 signal circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 23**
23	Test the APP sensor 2 5-volt reference circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 24**
24	Test the TP sensor 2 5-volt reference circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 25**
25	Test for a short between the TP sensor 2 5-volt reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 26**
26	Test for a short between the APP sensor 2 5-volt reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 27**
27	Test the TP sensor 2 signal circuit for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 28**
28	Test the TP sensor 2 low reference circuit for resistance, with a DMM. Refer to **Circuit Testing** and **Wiring**	-		

	Repairs in Wiring Systems. Did you find and correct the condition?		Go to **Step 35**	Go to **Step 29**
29	1. Reconnect the TAC module connectors. 2. Turn ON the ignition. 3. Measure the voltage at the TP sensor 2 5-volt reference circuit, with a DMM. Does the DMM indicate voltage greater than the specified value?	6.06 V	Go to **Step 32**	Go to **Step 30**
30	1. Turn OFF the ignition. 2. Connect a test lamp between APP sensor 2 5-volt reference and battery positive voltage. Does the test lamp illuminate?	-	Go to **Step 32**	Go to **Step 31**
31	Inspect for poor connections at the TP sensor harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 33**
32	Inspect for poor connections at the TAC module harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 35**	Go to **Step 34**
33	**IMPORTANT:** **The TP sensor is not a serviceable part and should only be replaced with the throttle body assembly.** Replace the throttle body assembly. Refer to **Throttle Body Assembly Replacement** .Did you complete the replacement?	-	Go to **Step 35**	-
34	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 35**	-
35	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	-	Go to **Step 36**	Go to **Step 2**

36	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0230

Circuit Description

When the ignition switch is turned ON, the control module enables the fuel pump relay, which supplies current to the fuel pump. The fuel pump remains enabled as long as the engine is cranking or running and the control module receives ignition reference pulses. If there are no ignition reference pulses, the control module shuts the fuel pump OFF approximately 2 seconds after the ignition was switched to the ON position or if the engine stops. The control module monitors the voltage on the fuel pump relay control circuit. If the control module detects an incorrect voltage on the fuel pump relay control circuit, a fuel pump relay control DTC sets.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6-18 volts.

Conditions for Setting the DTC

- The Powertrain Control Module (PCM) detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The above conditions are present for a minimum of 2.5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

DTC P0230

Fuel Pump Relay Underhood Electrical Center Terminal Identification			
Front of vehicle			
Left side of vehicle	Ground	Ignition	Right side of vehicle
	Fuel Pump Supply	Control	

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step verifies that the PCM is providing voltage to the fuel pump relay.

5: This step tests for an open in the ground circuit to the fuel pump relay.

6: This step tests if the voltage is constantly being applied to the control circuit of the fuel pump relay.

DTC P0230

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Turn ON the ignition, with the engine OFF. 2. Command the fuel pump relay ON and OFF with a scan tool. Does the fuel pump relay turn ON and OFF when commanded with a scan tool?	Go to**Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to**Intermittent Conditions**
	1. Turn OFF the ignition. 2. Remove the fuel pump relay.		

4	3. Turn ON the ignition, with the engine OFF. 4. Probe the control circuit of the fuel pump relay with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. 5. Command the fuel pump relay ON and OFF with a scan tool. Does the test lamp turn ON and OFF when commanded with a scan tool?	Go to**Step 5**	Go to **Step 6**
5	1. Connect a test lamp between the control circuit of the fuel pump relay and the ground circuit of the fuel pump relay. 2. Command the fuel pump relay ON and OFF with a scan tool. Does the test lamp turn ON and OFF when commanded with a scan tool?	Go to **Step 9**	Go to **Step 11**
6	Does the test lamp remain illuminated?	Go to **Step 8**	Go to **Step 7**
7	Test the control circuit of the fuel pump relay for a short to ground or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to**Step 10**
8	Test the control circuit of the fuel pump relay for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
9	Test for an intermittent and for a poor connection at the fuel pump relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
11	Test the ground circuit of the fuel pump relay for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	-
12	Replace the fuel pump relay. Did you complete the replacement?	Go to **Step 14**	-
	Replace the PCM. Refer to **Powertrain Control**		

13	**Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0300

System Description

The powertrain control module (PCM) uses information from the crankshaft position (CKP) sensor and the camshaft position (CMP) sensor in order to determine when an engine misfire is occurring. By monitoring variations in the crankshaft rotation speed for each cylinder, the PCM is able to detect individual misfire events. A misfire rate that is high enough can cause the 3-way catalytic converter (TWC) to overheat under certain driving conditions. The malfunction indicator lamp (MIL) will flash ON and OFF when the conditions for TWC overheating are present. If the PCM detects a misfire rate sufficient to cause emission levels to exceed mandated standards, DTC P0300 will set.

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0125, P0128, P0335, P0336, P0341, P0342, P0343, P0410, P0500, P0502, P0503, P1114, P1115, P1120, and P1220 are not set.
- The engine speed is between 425-3,000 RPM.
- The ignition voltage is between 10-18 volts.
- The engine coolant temperature (ECT) is between -7 and +130°C (19-266°F).
- The fuel level is more than 10 percent.
- The throttle angle is steady within 1 percent.
- The antilock brake system (ABS) and the traction control system are not active.
- The transmission is not changing gears.
- The A/C clutch is not changing states.
- The PCM is not in fuel shut-off or decel fuel cut-off mode.
- The PCM is not receiving a rough road signal.

Conditions for Setting the DTC

The PCM is detecting a crankshaft rotation speed variation indicating a misfire sufficient to cause emission levels to exceed mandated standards.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Excessive vibration from sources other than the engine could cause DTC P0300 to set. The following are possible sources of vibration:
  - Variable thickness brake rotors-Refer to **Symptoms - Hydraulic Brakes** in Hydraulic Brakes.
  - Drive shaft not balanced-Refer to **Vibration Analysis - Driveline** in Vibration Diagnosis and Correction.
  - Worn or damaged accessory drive belt-Refer to **Base Engine Misfire without Internal Engine Noises** in Engine Mechanical.
- There may be more or less cylinders actually misfiring than indicated by the scan tool.
- Spray water on the secondary ignition components using a spray bottle. Look and listen for arcing or misfiring.
- If there are multiple misfires on only one bank, inspect the fuel injector and ignition coil, power and ground circuits for that bank. Refer to **Engine Controls Schematics** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **2:** If the actual CKP variation values are not within the learned values, the misfire counters may increment.
>
> **3:** DTC P0135 or P0155 can be set because of a misfire.

DTC P0300

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **You must perform the crankshaft position (CKP) system variation learn procedure before proceeding with this diagnostic table. Refer to CKP System Variation Learn Procedure .** 1. Start the engine. 2. Allow the engine to idle or operate within the conditions listed in the Freeze Frame/Failure Records. 3. Monitor all of the misfire counters with the scan tool. Are any of the current misfire counters incrementing?	-	Go to **Step 3**	Go to Diagnostic Aids
3	Are any DTCs other than P0300, P0135 or P0155 set?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 4**
4	Can any abnormal engine noise be heard?	-	Go to **Base Engine Misfire without Internal Engine Noises**	Go to **Step 5**
5	Does the scan tool indicate that the HO2S bank 1 sensor 1 or HO2S bank 2 sensor 1 voltage parameters are below the specified value?	200 mV	Go to **DTC P0131 or P0151**	Go to **Step 6**
6	Does the scan tool indicate that the HO2S bank 1 sensor 1 or HO2S bank 2 sensor 1 voltage parameters are fixed above the specified value?	900 mV	Go to **DTC P0132 or P0152**	Go to **Step 7**
	Inspect the following components: • The vacuum hoses and seals for splits, restrictions, and improper connection-Refer to **Emission Hose Routing Diagram** . • The throttle body and intake manifold for vacuum leaks • The crankcase ventilation system for vacuum leaks-Refer to **Crankcase Ventilation System Inspection/Diagnosis** in Engine Mechanical. • The PCM grounds for corrosion and loose			

7	connections-Refer to **Ground Distribution Schematics** in Wiring Systems. • The exhaust system for restrictions-Refer to **Restricted Exhaust** in Engine Exhaust. • The fuel for contamination-Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (without Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (with Special Tool)** . Did you find and correct the condition?	-	Go to **Step 20**	Go to **Step 8**
8	1. Turn OFF the ignition. 2. Disconnect the spark plug wire from the spark plug that corresponds to the Misfire Current counters that were incrementing. Refer to **Spark Plug Wire Replacement** . 3. Install the **J 26792** Spark Tester to a good ground. 4. Start the engine. Does the spark jump the tester gap, and is the spark consistent?	-	Go to **Step 10**	Go to **Step 9**
9	1. Remove the spark plug wire for the affected cylinder. Refer to **Spark Plug Wire Replacement** . 2. Inspect the spark plug wire. Refer to **Spark Plug Wire Inspection** . 3. Measure the resistance of the spark plug wire with a DMM. Is the spark plug wire resistance less than the specified value?	700 ohm	Go to **Electronic Ignition (EI) System Diagnosis**	Go to **Step 19**
10	1. Remove the spark plug from the cylinders that indicated a misfire. 2. Inspect the spark plug. Refer to **Spark Plug Inspection** . Does the spark plug appear to be OK?	-	Go to **Step 11**	Go to **Step 12**
11	1. Exchange the suspected spark plug with another cylinder that is operating properly. Refer to **Spark Plug Replacement** . 2. Operate the vehicle under the same conditions	-		

	that the misfire occurred. Did the misfire move with the spark plug?		Go to **Step 18**	Go to **Step 15**
12	Are the spark plugs oil or coolant fouled?	-	Go to **Base Engine Misfire without Internal Engine Noises**	Go to **Step 13**
13	Are the spark plugs gas fouled?	-	Go to **Step 16**	Go to **Step 14**
14	Do the spark plugs show any signs of being cracked, worn, or improperly gapped?	-	Go to **Step 17**	Go to **Step 15**
15	Perform the fuel injector coil test. Refer to **Fuel Injector Coil Test** . Did you find and correct the condition?	-	Go to **Step 20**	Go to **Base Engine Misfire without Internal Engine Noises**
16	Perform the fuel system diagnosis. Refer to **Fuel System Diagnosis** . Did you find and correct the condition?	-	Go to **Step 20**	Go to **Base Engine Misfire without Internal Engine Noises**
17	Replace or gap the spark plug. Refer to **Spark Plug Replacement** . If an improper gap is found, be sure to gap the spark plugs using a wire type gage. Did you complete the replacement?	-	Go to **Step 20**	-
18	Replace the faulty spark plug. Refer to **Spark Plug Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
19	Replace the faulty spark plug wire. Refer to **Spark Plug Wire Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
20	Was the customer concern the MIL flashing?	-	Go to **Step 21**	Go to **Step 22**
21	1. Operate the vehicle at the specified value for 4 minutes. 2. Operate the vehicle within the Conditions for Running the DTC P0420 or P0430 as specified in the supporting text. Refer to **DTC P0420 or P0430** . Does the DTC run and pass?	2500 RPM	Go to **Step 22**	Go to **DTC P0420 or P0430**
22	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure	-		

	Records. Did the DTC fail this ignition?		Go to **Step 2**	Go to **Step 23**
23	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0315

Circuit Description

The Crankshaft Position (CKP) System Variation Learn feature is used to calculate reference period errors caused by slight tolerance variations in the crankshaft, and the crankshaft position sensor. The calculated error allows the powertrain control module (PCM) to accurately compensate for reference period variations. This enhances the ability of the PCM to detect misfire events over a wider range of engine speed and load.

The PCM stores the crankshaft position system variation values after a learn procedure has been performed. If the actual crankshaft position variation is not within the crankshaft position system variation compensating values stored in the PCM, DTC P0300 may set. If the PCM detects the CKP system variation values are not stored in the PCM memory, DTC P0315 sets.

Conditions for Running the DTC

- DTCs P0335, P0336, P0341, P0342, P0343 are not set.
- The engine coolant temperature is more than 70°C (158°F).

Conditions for Setting the DTC

The CKP system variation values are not stored in the PCM memory.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame/Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

DTC P0315

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Perform the Crankshaft Position System Variation Learn Procedure. Refer to **CKP System Variation Learn Procedure** . Does the scan tool display Learned This Ignition?	Go to **Step 4**	Go to **Step 3**
3	If the Crankshaft Position System Variation Learn Procedure cannot be performed successfully, inspect for the following conditions: • Worn crankshaft main bearing • A damaged reluctor wheel • Excessive crankshaft runout • A damaged crankshaft • Any foreign material passing between the crankshaft position (CKP) sensor and the reluctor wheel • Interference in the signal circuit of the CKP sensor • A coolant temperature that is not within the Condition for Running the DTC • The ignition switch is in the ON position until the battery has insufficient voltage • A powertrain control module (PCM) power disconnect with the ignition ON may erase the stored value and set the DTC P0315 Did you complete the inspection?	Go to **Step 4**	-
4	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 5**
5	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0325

Circuit Description

The knock sensors (KS) produce an AC signal under all engine operating conditions. The powertrain control module (PCM) calculates the average voltage range of each KS signal. If the KS system is operating normally, the PCM should monitor the KS voltage varying above and below a calculated average voltage. This DTC will set if the PCM malfunctions in a manner that will not allow proper diagnosis of the KS system.

Conditions for Running the DTC

- Engine run time is more than 10 seconds.
- Ignition voltage is more than 10 volts.

Conditions for Setting the DTC

- A malfunction with the KS system within the PCM are faulty.
- All of the above conditions are present for 12 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

DTC P0325

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
	IMPORTANT: **If you can hear the engine knock, repair the engine**		

2	**mechanical problem before proceeding with this diagnostic.** 1. Observe the Freeze Frame/Failure Records data for this DTC. 2. Turn off the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text or as close to the Freeze Frame/Failure Records data that you observed Does the DTC fail this ignition?	Go to **Step 3**	Go to**Intermittent Conditions**
3	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 4**	-
4	1. Use the scan tool in order to clear the DTCs 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the conditions for Running the DTC as specified in the supporting text. Does the scan tool indicate that this test ran and passed?	Go to **Step 5**	Go to **Step 2**
5	With a scan tool, observe the stored information, Capture Info. Does the scan tool display any DTCs that you have not diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0327 OR P0332

Circuit Description

The knock sensors (KS) produce an AC signal under all engine operating conditions. The powertrain control module (PCM) calculates the average voltage range of each KS signal. If the KS system is operating normally, the PCM should monitor the KS voltage varying above and below calculated average voltage. If the PCM detects a KS-1 signal or a KS-2 signal voltage within the calculated average range, a DTC will be set. DTC P0327 refers to the front knock sensor. DTC P0332 refers to the rear knock sensor.

Conditions for Running the DTC

- DTCs P0117, P0118, P0121, P0122, P0123, P0125, P1114, P1115, P1121 or P1122 are not set.
- The minimum noise level must be learned. The minimum noise level is learned when the following

conditions are met:
    - The ECT must be greater than 60°C (140°F).
    - The engine RPM is between 475-975 for 10 seconds.
- Engine speed is between 1500 RPM and 3,000 RPM.
- Map is less than 49 kPa.
- Engine coolant temperature (ECT) is more than 60°C (140°F).
- Throttle angle is more than 0 percent.
- Engine run time is more than 10 seconds.
- Ignition voltage is more than 10 volts.

Conditions for Setting the DTC

The PCM determines that this signal is less than the expected amount for more than 9 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

IMPORTANT: If the knock sensor is dropped, it must be replaced.

- Check the knock sensor for proper installation. A knock sensor that is loose or over torqued may cause the DTC to set.
- If DTCs P0327 and P0332 are set at the same time, inspect for poor connections at the KS harness jumper, located at the left rear side of the intake manifold.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **2:** This verifies the malfunction is present.
> **3:** This test will isolate the knock sensor from the rest of the circuit.
> **4:** Tapping on the engine block will simulate an engine knock.

DTC P0327 or P0332

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **If an engine knock can be heard, repair the engine mechanical condition before proceeding with this diagnostic.** 1. Observe the Freeze Frame/Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the engine within the Conditions for Running the DTC as close to the Freeze Frame/Failure Records data that you observed. Does the scan tool indicate that this diagnostic failed this ignition?	-	Go to **Step 3**	Go to Diagnostic Aids
3	1. Remove the left engine sight shield. 2. Disconnect the knock sensor (KS) jumper harness connector located on the left side of the intake manifold. 3. Set the DMM to the 400K ohm scale. 4. Measure the resistance of the affected KS using the DMM connected to battery ground. Is the resistance of the knock sensor within the specified range?	93-107K ohm	Go to **Step 4**	Go to **Step 6**

4	1. Connect the DMM between the affected KS signal circuit on the sensor side and a good ground. 2. Set the DMM to the 400 mV AC hertz scale. Refer to **Measuring Frequency** in Wiring Systems. **IMPORTANT:** **Do not tap on plastic engine components.** 3. Tap on the engine block near the affected KS while observing the signal indicated on the DMM. Is any signal indicated on the DMM while tapping on the engine block near the KS?	-	Go to **Step 5**	Go to **Step 7**
5	1. Disconnect the PCM connector. Refer to **Powertrain Control Module (PCM) Replacement** . 2. Test the KS signal circuit between the PCM and the KS jumper harness connector for the following: • An open or high resistance • A short to voltage • A short to ground Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 9**
6	1. Remove the intake manifold. Refer to **Intake Manifold Replacement** in Engine Mechanical. 2. Test for an open, high resistance or a short to ground in the signal circuit between the knock sensor jumper harness connector, located at the left side of the intake manifold and the KS connector. Refer to **Testing for Continuity** or **Testing for Short to Ground** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 7**
7	1. Inspect the KS signal circuit for a poor connection at the affected KS. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems. 2. If you find a poor connection repair the connector as necessary. Refer to **Connector Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 12**	Go to **Step 8**
8	Replace the KS. Refer to **Knock Sensor (KS) Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
9	1. Inspect the KS signal circuit for a poor connection at the KS jumper harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems. 2. If you find a poor connection, repair the connector as necessary. Refer to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
10	1. Inspect the KS signal circuit for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems. 2. If you find a poor connection, repair the connector as necessary. Refer to **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
12	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC run and pass?	-	Go to **Step 13**	Go to **Step 2**
13	With a scan tool, observe the stored information, Capture Info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0335

Circuit Description

The crankshaft position (CKP) sensor signal indicates the crankshaft speed and position. The CKP sensor is connected directly to the powertrain control module (PCM) and consists of the following circuits:

- The 12-volt reference circuit
- The low reference circuit
- The CKP sensor signal circuit

If the PCM detects no signal from the CKP sensor for less than 4 seconds.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0341, P0342, or P0343 are not set.
- The camshaft position (CMP) sensor is in transition.
- The mass airflow (MAF) is more than 3 grams per second.
- The ignition switch is in the crank mode.

Conditions for Setting the DTC

The PCM does not receive signals from the CKP sensor for less than 4 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

> **6:** This step simulates a CKP sensor signal to the PCM. If the PCM receives the signal, the fuel pump will operate for 2 seconds. If the fuel pump operates, the condition involves terminal contact at one of the following components:
>
> - The CKP sensor

- The CKP sensor reluctor wheel

DTC P0335

Step	Action	Value	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Does the engine start and continue to run?	-	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records data. Does the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn ON the ignition, with the engine OFF. 2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information. 3. Disconnect the CKP sensor. 4. Measure the voltage from the 12-volt reference circuit of the CKP sensor to a good ground with a DMM. Does the DMM display the specified value?	B+	Go to **Step 5**	Go to **Step 7**
5	Measure the voltage between the 12-volt reference circuit and the low reference circuit with the DMM. Does the DMM display the specified value?	B+	Go to **Step 6**	Go to **Step 8**
6	Connect the test lamp between the CKP sensor signal circuit and the 12-volt reference of the CKP sensor. Does the fuel pump operate if you apply the ignition voltage to the CKP sensor signal circuit?	-	Go to **Step 11**	Go to **Step 9**
7	Test for an open or short to ground in the 12-volt reference circuit of the CKP. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
8	Test for an open CKP low reference circuit. Refer to **Circuit Testing** or **Wiring Repairs** in Wiring	-		

	Systems. Did you find and correct the condition?		Go to **Step 15**	Go to **Step 14**
9	Test the CKP sensor signal circuit for the following conditions: • An open • A short to ground • A short to voltage Refer to **Testing for Intermittent Conditions and Poor Connections** and **Circuit Testing** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 10**
10	Test for poor connections at the CKP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
11	1. Remove the CKP sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . 2. Inspect the CKP Sensor for the following conditions: • Excessive air gap between the CKP sensor and the reluctor wheel • Physical damage • Improper installation • Electromagnetic interference in the CKP sensor circuits • Foreign material passing between the CKP sensor and the reluctor wheel 3. If you locate a condition, repair the condition as necessary. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
12	Test the CKP sensor reluctor wheel for the following conditions: • Physical damage • Improper installation • Excessive endplay or looseness	-		

	Refer to **Crankshaft and Bearings Removal** in Engine Mechanical. Did you find and correct the condition?		Go to **Step 15**	Go to **Step 13**
13	Replace the CKP Sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . Did you complete the repair?	-	Go to **Step 16**	-
14	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the repair?	-	Go to **Step 15**	-
15	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 16**
16	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0336

Circuit Description

The crankshaft position (CKP) sensor signal indicates the crankshaft speed and position. The CKP sensor is connected directly to the powertrain control module (PCM) and consists of the following circuits:

- The 12-volt reference circuit
- The low reference circuit
- The CKP sensor signal circuit

If the PCM detects that the CKP sensor is inconsistent for less than 2 seconds.

Conditions for Running the DTC

The engine is cranking or running.

Conditions for Setting the DTC

The PCM determines that the CKP sensor signal is for less than 2 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for electromagnetic interference (EMI) on the CKP sensor circuits.

6: Vertical lines across the face of the sensor may indicate foreign material passing between the CKP sensor and the reluctor wheel. Lines which are not vertical across the face of the sensor may indicate a crack in the CKP sensor. Either of these conditions will cause this DTC to set.

7: Damage to the reluctor wheel can affect the CKP sensor output.

DTC P0336

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **Before proceeding with this DTC, diagnose DTC P0335, if active.** 1. Observe the Freeze Frame/Failure records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the conditions for		

	Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Does the DTC fail this ignition?	Go to **Step 3**	Go to **Intermittent Conditions**
3	1. Inspect the CKP sensor for circuit harnesses and for wires that are routed too close to the following components: • The wires to other components, or the secondary ignition wires • Aftermarket add-on electrical equipment • The solenoids • The relays • The motors 2. Inspect for incorrect harness routing. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 4**
4	Test for poor connections at the CKP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 5**
5	Test for poor connections at the PCM for the CKP sensor circuits, refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 6**
6	1. Remove the CKP sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . 2. Inspect the CKP sensor for the following conditions: • Excessive air gap between the CKP sensor and the reluctor wheel • Foreign material passing between the CKP sensor and the reluctor wheel • Physical damage • Improper installation • Electromagnetic interference in the CKP sensor circuits Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
	Inspect the CKP reluctor wheel for the following conditions:		

7	• Physical damage • Improper installation • Excessive endplay or looseness Refer to **Crankshaft and Bearings Removal** in Engine Mechanical. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
8	Replace the CKP sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . Did you find and correct the condition?	Go to **Step 9**	-
9	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 10**
10	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0341

Circuit Description

The camshaft position (CMP) sensor works in conjunction with a 1 X reluctor wheel on the camshaft. The powertrain control module (PCM) provides a 12 volt reference to the CMP sensor as well as a low reference and a signal circuit.

As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The sensors internal circuitry detects this and produces a signal which the PCM reads. The PCM uses this 1 X signal in combination with the crankshaft position (CKP) sensor signal in order to determine the CKP and stroke.

The CMP sensor 1 X signal is used by the PCM to determine if the cylinder at top dead center (TDC) is on the firing stroke or the exhaust stroke. The PCM can determine TDC for all cylinders by using the CKP sensor signal alone. Observe that as long as the PCM receives the CKP sensor signal, the engine will start without a CMP signal. A slightly longer cranking time may be a symptom of this condition. The system attempts synchronization and looks for an increase in engine speed indicating that the engine started. If the PCM does not detect an increase in engine speed, the PCM assumes that the PCM incorrectly synchronized to the exhaust stroke and re-syncs to the opposite cam position. If the PCM detects that a CMP to CKP mis-match has occurred DTC P0341 sets.

Conditions for Running the DTC

The engine is running and the engine speed is less than 4,000 RPM.

Conditions for Setting the DTC

The PCM detects that a CMP to CKP mis-match has occurred.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

The following conditions may cause this DTC to set:

- Camshaft reluctor ring damage
- The sensor coming in contact with the reluctor ring
- Foreign material passing between the sensor and the reluctor ring
- Excessive camshaft end-play
- Wiring routed too close to secondary ignition components

If you suspect the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step inspects for electromagnetic interference (EMI) on the CMP sensor circuits.

6: Damage to the face of the sensor could indicate foreign material passing between the CMP sensor and the reluctor wheel. This condition would cause this DTC to set. Damage to the reluctor wheel would affect the CMP sensor output.

DTC P0341

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **If DTC P0342 or P0343 are set diagnose those DTCs first. Refer to DTC P0342 and DTC P0343** 1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 3**	Go to Diagnostic Aids
3	1. Visually and physically inspect all circuits going to the CMP sensor for the following: Refer to **Camshaft Position (CMP) Sensor Replacement** . • Being routed too close to secondary ignition wires or components • Being routed too close to after-market add-on electrical equipment • Being routed too close to solenoids, relays, and motors 2. If you find incorrect routing, correct the harness routing Did you find and correct the condition?	Go to **Step 9**	Go to **Step 4**
4	Test for an intermittent and for a poor connection at the CMP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector**		

	Repairs in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 5**
5	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 6**
6	1. Remove the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . 2. Visually inspect the CMP sensor for the following conditions: • Physical damage • Excessive wear of the sensor • Loose or improper installation Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
7	1. Visually inspect the CMP sensor reluctor ring for damage. 2. If the CMP reluctor ring is damaged, Refer to **Camshaft and Bearings Cleaning and Inspection** in Engine Mechanical. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
8	Replace the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . Did you complete the replacement?	Go to **Step 9**	-
9	1. Use the scan tool in order to clear any DTCs. 2. Turn the ignition OFF for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC run and pass?	Go to **Step 10**	Go to **Step 2**
10	Observe the Capture Info with a scan tool. Are there any DTC's that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0342

Circuit Description

The camshaft position (CMP) sensor works in conjunction with a 1 X reluctor wheel on the camshaft. The powertrain control module (PCM) provides a 12-volt reference to the CMP sensor as well as a low reference and a signal circuit.

As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The sensors internal circuitry detects this and produces a signal which the PCM reads. The PCM uses this 1X signal in combination with the crankshaft position (CKP) sensor signal in order to determine the CKP and stroke.

The CMP sensor 1X signal is used by the PCM to determine if the cylinder at top dead center (TDC) is on the firing stroke or the exhaust stroke. The PCM can determine TDC for all cylinders by using the CKP sensor signal alone. Observe that as long as the PCM receives the CKP sensor signal, the engine will start without a CMP signal. A slightly longer cranking time may be a symptom of this condition. The system attempts synchronization and looks for an increase in engine speed indicating that the engine started. If the PCM does not detect an increase in engine speed, the PCM assumes that the PCM incorrectly synchronized to the exhaust stroke and re-syncs to the opposite cam position. If the PCM detects that the CMP signal is constantly low, DTC P0342 sets.

Conditions for Running the DTC

- The engine is running.
- The engine speed is less than 4,000 RPM.

Conditions for Setting the DTC

The PCM detects that the CMP sensor signal is low for 1.5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- The following conditions may cause this DTC to set:
  - Camshaft reluctor ring damage
  - The sensor coming in contact with the reluctor ring
  - Foreign material passing between the sensor and the reluctor ring
  - Excessive camshaft end-play
  - Wiring routed too close to secondary ignition components
- If the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

> **4:** This step tests the CMP sensor and circuits from the CMP sensor to the PCM. If there is not duty cycle displayed or if the duty cycle is not within range there is a problem with the sensor or the circuits.

DTC P0342

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Observe the camshaft position (CMP) sensor high to low and low to high transition parameter with a scan tool. Does the scan tool parameter increment?	-	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
	1. Disconnect the powertrain control module (PCM). Refer to **Powertrain Control Module (PCM) Replacement** .			

4	2. Jumper the low reference circuit of the CMP sensor from the PCM connector to a good ground. Refer to **Using Connector Test Adapters** in Wiring Systems. 3. Jumper the 12-volt reference circuit of the CMP sensor from the PCM connector to battery voltage. Refer to **Using Connector Test Adapters** in Wiring Systems. 4. Measure the DC duty cycle on the signal circuit of the CMP sensor at the PCM connector with a DMM while cranking the engine. Is the duty cycle within the specified range?	45-55%	Go to **Step 9**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Connect the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . 3. Remove fuel pump relay using a **J 43244** . 4. Remove the intake manifold. Refer to **Intake Manifold Replacement** in Engine Mechanical. 5. Disconnect the CMP sensor. 6. Turn ON the ignition, with the engine OFF. 7. Probe the 12-volt reference circuit of the CMP sensor with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 7**	Go to **Step 6**
6	Test the 12-volt reference circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 9**
7	Test the CMP sensor signal circuit for an open or for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 8**
8	Test for an intermittent and for a poor connection at the CMP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 10**
	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent**			

9	**Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 13**
10	1. Remove the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . 2. Visually inspect the CMP sensor for the following conditions: • Physical damage • Loose or improper installation Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
11	1. Visually inspect the CMP sensor reluctor ring for damage. 2. If the CMP reluctor ring is damaged, refer to **Camshaft and Bearings Cleaning and Inspection** in Engine Mechanical. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 12**
12	Replace the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-
13	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0343

Circuit Description

The camshaft position (CMP) sensor works in conjunction with a 1X reluctor wheel on the camshaft. The powertrain control module (PCM) provides a 12-volt reference to the CMP sensor as well as a low reference and a signal circuit.

As the camshaft rotates, the reluctor wheel interrupts a magnetic field produced by a magnet within the sensor. The sensors internal circuitry detects this and produces a signal which the PCM reads.

The CMP sensor 1X signal is used by the PCM to determine if the cylinder at top dead center (TDC) is on the firing stroke or the exhaust stroke. The PCM can determine TDC for all cylinders by using the CKP sensor signal alone. The engine will start without a CMP signal as long as the PCM receives the CKP sensor signal. A slightly longer cranking time may be a symptom of this condition. The system attempts synchronization and looks for an increase in engine speed indicating that the engine started. If the PCM does not detect an increase in engine speed, the PCM assumes that the PCM incorrectly synchronized to the exhaust stroke and re-syncs to the opposite cam position. If the PCM detects that the CMP signal is constantly high, DTC P0343 sets.

Conditions for Running the DTC

- The engine is running.
- The engine speed is less than 4,000 RPM.

Conditions for Setting the DTC

The PCM detects that the CMP sensor signal is high for 1.5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- The following conditions may cause this DTC to set:
    - Camshaft reluctor ring damage

- The sensor coming in contact with the reluctor ring
  - Foreign material passing between the sensor and the reluctor ring
  - Excessive camshaft end-play
  - Wiring routed too close to secondary ignition components
- If the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

> **4:** This step tests the CMP sensor and circuits from the CMP sensor to the PCM. If there is not duty cycle displayed or if the duty cycle is not within range there is a problem with the sensor or the circuits.

DTC P0343

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Observe the camshaft position (CMP) sensor high to low and low to high transition parameter with a scan tool. Does the scan tool parameter increment?	-	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
	1. Disconnect the powertrain control module (PCM). Refer to **Powertrain Control Module (PCM) Replacement** . 2. Jumper the low reference circuit of the CMP sensor from the PCM connector to a good ground. Refer to **Using Connector Test**			

4	**Adapters** in Wiring Systems. 3. Jumper the 12-volt reference circuit of the CMP sensor from the PCM connector to battery voltage. Refer to **Using Connector Test Adapters** in Wiring Systems. 4. Measure the DC duty cycle on the signal circuit of the CMP sensor at the PCM connector with a DMM while cranking the engine. Is the duty cycle within the specified range?	45-50%	Go to **Step 10**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Connect the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . 3. Remove fuel pump relay using a **J 43244** . 4. Remove the intake manifold. Refer to **Intake Manifold Replacement** in Engine Mechanical. 5. Disconnect the CMP sensor. 6. Turn ON the ignition, with the engine OFF. 7. Probe the signal circuit of the CMP sensor with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 7**	Go to **Step 6**
6	1. Turn OFF the ignition. 2. Jumper the CMP circuits from the CMP sensor to the CMP sensor harness connector. Refer to **Using Connector Test Adapters** in Wiring Systems. 3. Turn ON the ignition with the engine OFF. 4. Measure the Voltage Drop from the low reference circuit of the CMP sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	0.2 V	Go to **Step 8**	Go to **Step 9**
7	Test the CMP sensor signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 10**
	Test the low reference circuit for an open or high			

8	resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 10**
9	Test for an intermittent and for a poor connection at the CMP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 11**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 14**
11	1. Remove the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . 2. Visually inspect the CMP sensor for the following conditions: • Physical damage • Loose or improper installation Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
12	1. Visually inspect the CMP sensor reluctor ring for damage. 2. If the CMP reluctor ring is damaged, refer to **Camshaft and Bearings Cleaning and Inspection** in Engine Mechanical. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 13**
13	Replace the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
14	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 16**

16	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0351-P0358

Circuit Description

The ignition system on this engine uses an individual ignition coil for each cylinder. The powertrain control module (PCM) controls the ignition system operation. The PCM controls each coil using one of eight ignition control (IC) circuits. The PCM commands the IC circuit low when a spark event is requested. This causes the IC module to energize the ignition coil to create a spark at the spark plug. Each ignition coil has the following circuits:

- An ignition 1 voltage circuit
- A ground circuit
- An ignition control (IC) circuit
- A low reference circuit

Sequencing and timing are PCM controlled. If the PCM detects that the IC circuit is out of range, DTC P0351-P0358 sets.

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

The PCM detects the IC circuit is grounded, open, or shorted to voltage for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.

- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **3:** This step verifies the integrity of the IC circuit and the PCM output.
> **4:** This step tests for a short to ground on the IC circuit.

DTC P0351-P0358

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions**
3	1. Turn OFF the engine. 2. Disconnect the respective ignition coil. 3. Start the engine. 4. Measure the frequency at the IC circuit with the DMM set to DC Hertz. Refer to **Measuring Frequency** in Wiring Systems. Is the frequency within the specified range?	3-20 Hz	Go to **Step 7**	Go to **Step 4**
4	Measure the voltage from the IC circuit of the ignition coil to a good ground with the DMM. Is the voltage more than the specified value?	1 V	Go to **Step 13**	Go to **Step 5**
	1. Turn OFF the ignition. 2. Disconnect the PCM connector.			

5	3. Test the IC circuit between the ignition coil connector and the PCM connector for continuity with the DMM. Does the DMM indicate continuity?	-	Go to **Step 6**	Go to **Step 14**
6	Test the respective IC circuit for a short to ground. Refer to **Testing for Short to Ground** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 10**
7	1. Turn ON the ignition, with the engine OFF. 2. Probe the ignition 1 voltage circuit of the ignition coil with a test lamp that is connected to battery ground. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 8**	Go to **Step 11**
8	Probe the ground circuit of the ignition coil with a test lamp connected to battery voltage. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 9**	Go to **Step 12**
9	Test for an intermittent and for a poor connection at the ignition coil. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
11	Repair the open in the ignition 1 voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
12	Repair the open in the ground circuit for the ignition coil. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
13	Repair the IC circuit for a short to voltage. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
14	Repair open in the IC circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
15	Replace the ignition coil. Refer to **Ignition Coil(s) Replacement** .	-		

	Did you complete the replacement?		Go to **Step 17**	-
16	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
17	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0410

Circuit Description

The Secondary Air Injection (AIR) System is designed to lower exhaust emission levels on initial start up. The AIR pump runs until closed loop is achieved.

The powertrain control module (PCM) commands the AIR pump relay and the AIR vacuum solenoid ON simultaneously by supplying a ground on the AIR pump relay control circuit and a ground to the AIR vacuum solenoid control circuit. When engine vacuum is applied to the AIR shut-off valve, airflow from the AIR pump flows through the pipes/hoses to the exhaust check valves. The air enters the exhaust stream, accelerating catalyst operation. When inactive, the exhaust check valves and the AIR shut-off valve prevent airflow in either direction.

The PCM detects a system airflow problem by monitoring the heated oxygen sensors (HO2S) during normal AIR system operation. This is a passive test. If the passive test indicates a pass, the PCM takes no further action. If the passive test fails or is inconclusive, the diagnostic will proceed with an intrusive or active test. The PCM will command the AIR system ON during closed loop operation under normal operating conditions. The active test will pass or fail based on the response from the HO2S. A lean HO2S response indicates that the secondary AIR system is functioning normally. An increasing short term fuel trim (FT) value also indicates a normally functioning system. The AIR diagnostic consists of the passive test and the active tests. The AIR diagnostic requires failure of the passive and active tests on two consecutive key cycles to illuminate the MIL and store a DTC. If the PCM detects that the HO2S and Short Term FT did not respond as expected on both of the engine banks, DTC P0410 sets.

Conditions for Running the DTC

- DTCs P0101, P0102,P0103, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0125, P0128, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0171, P0172, P0174, P0175, P0200, P0220, P0300, P0335, P0336, P0351, P0352, P0353, P0354, P0355, P0356, P0357, P0358, P0442, P0443, P0455, P0446, P0449, P0496, P1133, P1134, P1153, P1154, P1235, P1258, P2135 are not set.
- The fuel level is more than 12.5 percent but less than 87.5 percent.
- The engine is running for more than 30 seconds.
- The mass air flow (MAF) is less than 23 g/s.
- The air fuel ratio is 14.7:1.
- The engine load is less than 40 percent.
- The ignition voltage is more than 11.7 volts.
- The vehicle speed is more than 25 km/h (15 mph).
- The engine is operating in closed loop for more than 15 seconds.
- The engine speed is more than 850 RPM.
- The engine coolant temperature (ECT) is between -10 and +110°C (+14 and +230°F).
- The intake air temperature (IAT) is between -10 and +100°C (+14 and +212°F).
- The fuel system is operating in fuel trim cells 1, 2, 3, 4 or 5.
- The short term FT is between -4 and +4 percent.
- The start-up engine coolant temp is less than 70°C (158°F).
- The engine is not operating in any of the following modes:
    - Power enrichment
    - Decel fuel cut-off mode
    - Catalyst over temperature

Conditions for Setting the DTC

- When the AIR pump is commanded ON, during closed loop operation and the HO2S voltages do not decrease below 222 mV for 1.5 seconds.
- The short term FT does not change more than a predetermined amount.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- When commanding the AIR system ON with a scan tool the PCM will activate the AIR pump and the AIR solenoid. The fuel control system will then enter a open loop status. This action will allow fresh air to enter the exhaust stream and allow the HO2S 1 mV parameters to drop to near 0 mV. This would indicate a properly operating system.

  However if the AIR pump does not operate or there is no airflow from the AIR pump entering the exhaust stream due to a leak in the AIR system, the HO2S 1 mV parameter may still decrease to 100 mV. This is due to fresh air being drawn into the exhaust stream from the exhaust check valve operation and the opening of the AIR shut-off valve. The HO2S 1 will respond with a decreasing mV parameter as a result of fresh air leaning out the exhaust gases. The HO2S 1 parameter voltages may decrease to nearly 100 mV but not approach the near 0 mV parameter.

- For any test that requires probing the PCM harness connector or probing a component harness connector, use the **J 35616** Connector Test Adapter Kit. Using this kit prevents damage to the component terminals and to the harness. Refer to **Using Connector Test Adapters** in Wiring Systems.

DTC P0410

<table>
<tr><th colspan="4">AIR Pump Relay Underhood Electrical Center Terminal Identification</th></tr>
<tr><th colspan="4">Front of Vehicle</th></tr>
<tr><td rowspan="2">Left Side of Vehicle</td><td>Ignition 1 voltage</td><td>Battery positive voltage</td><td rowspan="2">Right Side of Vehicle</td></tr>
<tr><td>Pump Supply</td><td>Control</td></tr>
</table>

- For an intermittent condition, refer to **Intermittent Conditions** .
- The vacuum lines at the AIR solenoid cannot be reversed, this condition may hold the shut-off valve open continually.
- Leaking exhaust check valves will leave traces of exhaust carbon and water laden exhaust gases in the AIR system and a possibility of heat damage to the AIR hoses and AIR shut-off valve.
- An intermittent may be caused by any of the following conditions:
  - Low system air flow
  - Excessive exhaust system back pressure
  - Moisture, water or debris ingested into the AIR pump
  - Pinched, kinked, heat damaged, or deteriorated hoses or vacuum hoses.
  - Restrictions in the pump inlet, duct, or filter

Test Description

The numbers below refer to the step numbers on the diagnostic table.

14: This step determines if excessive resistance on the AIR pump supply circuit is the cause for an inoperative AIR pump. Two ohms of resistance on this circuit can prevent the AIR pump from running.

15: This step determines if excessive resistance on the AIR pump ground circuit is the cause for an inoperative AIR pump. Two ohms of resistance on this circuit can prevent the AIR pump from running.

18: This step determines if the AIR system is operating normally.

DTC P0410

Step -	Action	values	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Is DTC P0412 or DTC P0418 also set?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	1. Turn ON the ignition, with the engine OFF. 2. Command the secondary air injection (AIR) pump relay ON and OFF with a scan tool. 3. Listen for AIR pump operation. Does the AIR pump turn ON and OFF with each command of the scan tool?	-	Go to **Step 18**	Go to **Step 4**
4	Inspect the AIR pump fuse. Is the AIR pump fuse open?	-	Go to **Step 5**	Go to **Step 9**
5	1. Turn OFF the ignition. 2. Disconnect the AIR pump connector. 3. Connect a test lamp between the AIR pump supply voltage circuit and the ground circuit of the AIR pump at the harness connector. 4. Replace the AIR pump fuse. 5. Command the AIR pump relay ON and OFF with a scan tool. Does the test lamp turn ON and OFF with each command of the scan tool?	-	Go to **Step 8**	Go to **Step 6**

6	Does the test lamp remain illuminated when the air pump relay is commanded ON and OFF with a scan tool?	-	Go to **Step 7**	Go to **Step 34**
7	1. Remove the AIR pump relay. 2. Turn ON the ignition, with the engine OFF. Does the test lamp remain illuminated?	-	Go to **Step 33**	Go to **Step 39**
8	1. Connect the AIR pump connector. 2. Replace the AIR pump fuse as necessary. 3. Command the AIR pump relay ON and OFF with a scan tool. 4. Listen for AIR pump operation. Does the AIR pump turn ON?	-	Go to **Intermittent Conditions**	Go to **Step 41**
9	1. Remove the AIR pump relay. Refer to **Relay Replacement (Within an Electrical Center)** or **Relay Replacement (Attached to Wire Harness)** in Wiring Systems. 2. Inspect the AIR pump relay for an intermittent and for a poor connection at the AIR pump relay underhood fuse block. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 42**	Go to **Step 10**
10	Connect a 30-amp**J 36169-A** Fused Jumper Wire between the battery positive circuit and the AIR pump supply voltage circuit at the AIR pump relay connector. Refer to **Using Fused Jumper Wires** in Wiring Systems. Does the AIR pump turn ON?	-	Go to **Step 16**	Go to **Step 11**
11	Test the battery positive voltage circuit between the AIR pump fuse and AIR pump relay for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 42**	Go to **Step 12**
12	1. Ensure the 30-amp **J 36169-A** is connected at the underhood fuse block. 2. Disconnect the AIR pump connector. 3. Probe the AIR pump supply voltage circuit at the AIR pump harness connector with a test lamp that is connected to a good ground.	-		

	Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?		Go to **Step 13**	Go to **Step 35**
13	Probe the ground circuit of the AIR pump harness connector with a test lamp that is connected to a battery voltage. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 14**	Go to **Step 36**
14	1. Connect a jumper wire between each of the terminals in the AIR pump harness connector and the corresponding terminal at the AIR pump. Refer to **Using Connector Test Adapters** in Wiring Systems. 2. Ensure the 30-amp **J 36169-A** is connected at the underhood fuse block. 3. Measure the voltage drop from the AIR pump supply voltage circuit at the AIR pump connector to the AIR pump supply voltage circuit at the AIR pump relay with a DMM. Refer to **Measuring Voltage Drop** and **Circuit Testing** in Wiring Systems. Is the voltage drop less than the specified value?	0.6 V	Go to **Step 15**	Go to **Step 35**
15	Measure the voltage drop from the AIR pump ground circuit at the AIR pump harness connector to a good ground with a DMM. Refer to **Circuit Testing** and **Measuring Voltage Drop** in Wiring Systems. Is the voltage drop less than the specified value?	0.6 V	Go to **Step 17**	Go to **Step 36**
16	Measure the resistance of the AIR pump relay control circuit between the powertrain control module (PCM) and the AIR pump relay with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the resistance less than the specified value?	15 ohm	Go to **Step 17**	Go to **Step 37**
17	**IMPORTANT:** **The DMM and test leads must be calibrated to 0 ohms in order to prevent misdiagnosis. Refer to the DMM User Manual for calibration procedure.** 1. With the AIR pump relay removed from the vehicle, energize the relay with a 12-volt power and ground source. 2. Measure the resistance at the relay switch circuit with a DMM.	1-3 ohm		

	Is the resistance within the specified range?		Go to **Step 27**	Go to **Step 39**
18	1. Start and idle the engine. 2. Monitor the HO2S bank 1 sensor 1 and bank 2 sensor 1 voltage parameters. 3. Command the AIR pump system ON with a scan tool. Do both of the HO2S voltage parameters decrease to the specified value within 20 seconds?	75 mV	Go to Diagnostic Aids	Go to **Step 19**
19	1. Turn OFF the ignition. 2. Disconnect the AIR shut-off valve outlet hose at the in-line connector beside the generator. 3. Turn ON the ignition, with the engine OFF. 4. Command the AIR pump relay ON with a scan tool. Is a pressurized airflow present at the AIR pump shut-off valve outlet hose?	-	Go to **Step 31**	Go to **Step 20**
20	1. Connect the AIR shut-off valve outlet hose at the in-line connector. 2. Disconnect the AIR shut-off valve from the AIR pump outlet hose. Refer to **Secondary Air Injection (AIR) Shut-Off Valve Replacement** . 3. Command the AIR pump relay ON with a scan tool. Is a pressurized airflow present at the AIR pump outlet hose?	-	Go to **Step 21**	Go to **Step 29**
21	1. Turn OFF the ignition. 2. Remove the vacuum hose from the AIR shut-off valve. 3. Connect a vacuum gage to the hose. 4. Start and idle the engine. 5. Command the AIR solenoid ON with a scan tool. Is the vacuum displayed on the gage above the specified value?	10 in Hg (254 mm)	Go to **Step 22**	Go to **Step 24**
	1. Turn OFF the ignition. 2. Connect a vacuum pump to the AIR shut-off			

22	valve. 3. Apply 10 inches Hg (254 mm) of vacuum to the AIR shut-off valve. Does the AIR shut-off valve hold vacuum for the specified amount of time?	30 seconds	Go to **Step 23**	Go to **Step 38**
23	Inspect for a restriction or for a blockage in the AIR shut-off valve. Did you find and correct the condition?	-	Go to **Step 43**	Go to **Step 30**
24	1. Turn OFF the ignition. 2. Disconnect the vacuum supply hose from the inlet of the AIR solenoid. Refer to **Secondary Air Injection (AIR) Vacuum Control Solenoid Valve Replacement** . 3. Install a vacuum gage to the hose. 4. Start and idle the engine. Is the vacuum displayed on the gage above the specified amount?	10 in Hg (254 mm)	Go to **Step 25**	Go to **Step 32**
25	Measure the resistance of the AIR solenoid control circuit between the PCM and the AIR solenoid with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the resistance less than the specified value?	15 ohm	Go to **Step 26**	Go to **Step 37**
26	Measure the resistance of the AIR solenoid ignition 1 voltage circuit between the ENG IGN 1 fuse and the AIR solenoid with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the resistance less than the specified value?	15 ohm	Go to **Step 28**	Go to **Step 37**
27	Test for an intermittent and for a poor connection at the AIR pump. Refer to**Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 42**	Go to **Step 41**
28	Inspect the vacuum hose between the AIR shut-off valve and AIR solenoid for a leak or restriction. Did you find and correct a condition?	-	Go to **Step 43**	Go to **Step 40**
29	Inspect for a restriction in one of the following components: • The AIR pump inlet hose • The AIR pump outlet hose-Refer to **Secondary Air Injection (AIR) Shut-Off Valve Replacement** .	-		

	Did you find and correct a condition?		Go to **Step 43**	Go to **Step 41**
30	Repair the restriction or leak in the AIR shut-off valve outlet hose between the AIR shut-off valve and the crossover pipe. Did you complete the repair?	-	Go to **Step 43**	-
31	**CAUTION:** **Refer to Hot Exhaust System Caution in Cautions and Notices.** Repair the restriction in one of the following components: • The AIR shut-off valve outlet hose between the in-line connector and the crossover pipe. • The crossover pipe • Both exhaust check valves-Refer to **Secondary Air Injection (AIR) Check Valve/Pipe Replacement - Bank 1** and **Secondary Air Injection (AIR) Check Valve/Pipe Replacement - Bank 2** . • Both exhaust check valve outlet pipes Did you complete the repair?	-	Go to **Step 43**	-
32	Repair the restriction or leak in one of the following components: • The vacuum hose, from the intake manifold to the AIR solenoid • The vacuum check valve • The intake manifold vacuum port Did you complete the repair?	-	Go to **Step 43**	-
33	1. Repair the short to voltage in the AIR pump supply voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. 2. Replace the AIR pump fuse as necessary. Did you complete the repair?	-	Go to **Step 42**	-
34	1. Repair the short to ground in the AIR pump supply voltage circuit. Refer to **Wiring Repairs** in Wiring Systems.	-		

	2. Replace the AIR pump fuse as necessary. Did you complete the repair?		Go to **Step 43**	-
35	Repair the open or high resistance in the AIR pump supply voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 43**	-
36	Repair the open or high resistance in the AIR pump ground circuit. Refer to**Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 43**	-
37	Repair the circuit with the high resistance. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 43**	-
38	Replace the AIR shut-off valve. Refer to **Secondary Air Injection (AIR) Shut-Off Valve Replacement** . Did you complete the replacement?	-	Go to **Step 43**	-
39	Replace the AIR pump relay. Refer to **Relay Replacement (Within an Electrical Center)** or **Relay Replacement (Attached to Wire Harness)** in Wiring Systems. Did you complete the replacement?	-	Go to **Step 42**	-
40	Replace the AIR Solenoid. Refer to **Secondary Air Injection (AIR) Vacuum Control Solenoid Valve Replacement** . Did you complete the replacement?	-	Go to **Step 43**	-
41	1. Replace the AIR pump. Refer to **Secondary Air Injection (AIR) Pump Replacement** . 2. Replace the AIR pump fuse as necessary. Did you complete the replacement?	-	Go to **Step 42**	-
42	1. Ensure all components are installed and secured. 2. Ensure the AIR pump is connected. 3. Command the AIR pump relay ON and OFF with a scan tool. Does the AIR pump relay turn ON and OFF when commanded with a scan tool?	-	Go to **Step 43**	Go to **Step 2**
	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine.			

43	4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 44**
44	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0412

Circuit Description

Voltage is supplied to the secondary air injection (AIR) solenoid by the ignition 1 voltage circuit. The powertrain control module (PCM) supplies the ground path to the solenoid by an internal integrated circuit called an output driver module (ODM). One of the ODM output circuits is configured to operate as a low side driver for the solenoid. The low side driver also incorporates a fault detection circuit, which is continuously monitored by the PCM. When the PCM completes the ground circuit to the solenoid, engine vacuum is applied to the AIR shut-off valve. If the PCM detects a low voltage on the control circuit when the solenoid is commanded OFF, or a high voltage when the solenoid is commanded ON, DTC P0412 sets.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The system voltage is between 6-18 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The above conditions exist for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: This step tests for voltage to the AIR solenoid.

6: This step verifies that the PCM is providing ground to the AIR solenoid.

7: This step tests if a ground is constantly being applied to the AIR solenoid.

DTC P0412

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Inspect the ENG IGN 1 fuse. Is the ENG IGN 1 fuse open?	Go to **Step 12**	Go to **Step 3**
3	1. Turn ON the ignition, with the engine OFF. 2. Command the secondary air injection (AIR) solenoid ON and OFF with a scan tool. 3. Listen for a click at the rear of the right front fender when the AIR solenoid operates. Repeat commands as necessary. Does the AIR solenoid click ON and OFF when commanded with a scan tool?	Go to **Step 4**	Go to **Step 5**
4	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 1 minute. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 5**	Go to **Intermittent Conditions**
	1. Turn OFF the ignition.		

5	2. Disconnect the AIR solenoid valve. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit at the AIR solenoid connector with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	Go to **Step 6**	Go to **Step 13**
6	1. Connect a test lamp between the AIR solenoid control circuit and the ignition 1 voltage circuit at the AIR solenoid connector. 2. Command the AIR solenoid ON and OFF with a scan tool. Does the test lamp turn ON and OFF with each command?	Go to **Step 10**	Go to **Step 7**
7	Does the test lamp remain illuminated with each command of the scan tool?	Go to **Step 9**	Go to **Step 8**
8	Test the AIR solenoid control circuit for an open or short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 11**
9	Test the AIR solenoid control circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 15**
10	Test for an intermittent and for a poor connection at the AIR solenoid. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 14**
11	Test for an intermittent and for a poor connection at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 15**
12	**IMPORTANT:** **The ignition 1 voltage circuit of the AIR solenoid is spiced to other components of the vehicle.** Test all circuits and components that are supplied by the ENG IGN 1 fuse for excessive current draw. Refer to **Circuit Testing** and **Wiring Repairs** in		Go to **Testing for Intermittent Conditions**

	Wiring Systems.Did you find and correct the condition?	Go to **Step 16**	**and Poor Connections** in Wiring Systems
13	Repair the open in the ignition 1 voltage circuit. Refer to**Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	-
14	Replace the AIR solenoid. Refer to **Secondary Air Injection (AIR) Vacuum Control Solenoid Valve Replacement** . Did you complete the replacement?	Go to **Step 16**	-
15	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 16**	-
16	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Does the DTC fail this ignition?	Go to **Step 2**	Go to **Step 17**
17	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0418

Circuit Description

The secondary air injection (AIR) pump relay controls the high current flow to the AIR pump. Ignition voltage is supplied to the AIR pump relay coil when the ignition is ON. Battery positive voltage is supplied to the armature contacts at all times. The powertrain control module (PCM) controls the relay by supplying a ground path to the relay coil control circuit by an internal integrated circuit called an output driver module (ODM). The low side driver also incorporates a fault detection circuit that is continuously monitored by the PCM. The voltage on the control circuit should be battery voltage when the ignition is ON and the AIR pump relay is at rest. If the fault detection circuit measures a low voltage under this condition it is an indication of an open or short to ground on the control or ignition 1 circuits. An open AIR pump relay coil fault may also be present. If the PCM detects low voltage on the AIR pump relay control circuit when the AIR pump relay is commanded OFF or a high voltage when the AIR pump relay is commanded ON, DTC P0418 sets.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The system voltage is between 6-18 volts.

Conditions for Setting the DTC

- The PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- All the above conditions exist for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

DTC P0418

AIR Pump Relay Terminal Identification			
Front of Vehicle			
Left Side of Vehicle	Ignition	B+	Right Side of Vehicle
	Pump Supply	Control	

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: This step tests for voltage at the coil side of the relay.

6: This step verifies that the PCM is providing ground to the AIR pump relay.

8: This step tests if a ground is constantly being applied to the AIR pump relay.

DTC P0418

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics			

1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Inspect the ENG IGN 1 fuse. Is the ENG IGN 1 fuse open?	Go to **Step 13**	Go to **Step 3**
3	1. Turn ON the ignition, with the engine OFF. 2. Command the secondary air injection (AIR) pump relay ON and OFF with a scan tool. 3. Listen for a click when the relay operates. Repeat the commands as necessary. Does the AIR pump relay turn ON and OFF with each command?	Go to **Step 4**	Go to **Step 5**
4	1. Observe the Freeze Frame/Failure Records data for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. Does the DTC fail this ignition?	Go to **Step 5**	Go to **Intermittent Conditions**
5	1. Turn OFF the ignition. 2. Remove the AIR pump relay. Refer to **Relay Replacement (Within an Electrical Center)** or **Relay Replacement (Attached to Wire Harness)** in Wiring Systems. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit at the AIR pump relay connector with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	Go to **Step 6**	Go to **Step 12**
6	1. Connect a test lamp between the control circuit of the AIR pump relay and the ignition 1 voltage circuit of the AIR pump relay connector. 2. Command the AIR pump relay ON and OFF with a scan tool. Refer to Diagnostic Aids for terminal identification. Does the test lamp turn ON and OFF when commanded		

	with a scan tool?	Go to **Step 10**	Go to **Step 7**
7	Did the test lamp remain illuminated when the scan tool was commanded ON and OFF?	Go to **Step 9**	Go to **Step 8**
8	**IMPORTANT:** **The AIR pump may be damaged if the control circuit is shorted to voltage.** Test the AIR pump relay control circuit for a short to voltage or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	Go to **Step 14**	Go to **Step 11**
9	**IMPORTANT:** **The AIR pump may be damage if the control circuit is shorted to ground.** Test the AIR pump relay control circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	Go to **Step 14**	Go to **Step 17**
10	Test for an intermittent and for a poor connection at the AIR pump relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 18**	Go to **Step 16**
11	Test for an intermittent and for a poor connection at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 18**	Go to **Step 17**
12	Repair the open circuit in the ignition 1 voltage circuit of the AIR pump relay. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	Go to **Step 18**	-
13	**IMPORTANT:** **The ignition 1 voltage circuit of the AIR pump relay is spiced to other components of the vehicle.** Test all circuits and components that are supplied by the ENG IGN 1 fuse for excessive current draw. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.Did you find and correct the condition?	Go to **Step 18**	-
14	1. Ensure all components are installed and all connections are secured. 2. Command the AIR pump relay ON and OFF with a scan tool.		

	Does the AIR pump turn ON and OFF when commanded with a scan tool?	Go to **Step 18**	Go to **Step 15**
15	1. Replace the AIR pump. Refer to **Secondary Air Injection (AIR) Pump Replacement** . 2. Replace the AIR pump fuse as necessary. Did you complete the replacement?	Go to **Step 18**	-
16	Replace the AIR pump relay. Did you complete the replacement?	Go to **Step 18**	-
17	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 18**	-
18	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/ Failure Records. 5. This DTC will not report a pass. The scan tool status for this DTC will not report a pass. The scan tool will only display if the diagnostic test fails. The repair is not complete if the scan tool indicates that the diagnostic test ran and failed. Does the DTC fail this ignition?	Go to **Step 2**	Go to **Step 19**
19	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0420 OR P0430

Circuit Description

The three-way catalytic converter (TWC) reduces emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converter promotes a chemical reaction, which oxidizes the HC and CO that are present in the exhaust gas. This process converts these chemicals into water vapor and carbon dioxide (CO2), and will reduce the NOx, by converting them into nitrogen. The catalytic converter also stores oxygen. The powertrain control module (PCM) monitors this process using heated oxygen sensor (HO2S) bank 1 sensor 2 and HO2S bank 2 sensor 2, located in the exhaust stream after the TWC. These sensors are referred to as the catalyst monitor sensors. The catalyst monitor sensors produce an output signal that the PCM uses to indicate the oxygen storage capacity of the catalyst. This determines the catalyst's ability to effectively convert the exhaust emissions.

If the catalyst is functioning correctly, the HO2S bank 1 sensor 2 and the HO2S bank 2 sensor 2 signals will be far less active than the signals that are produced by the HO2S bank 1 sensor 1 and the HO2S bank 2 sensor 1. This indicates that the TWC oxygen storage capacity is at an acceptable threshold. When the response time of the catalyst monitor sensors are close to that of the fuel control sensors, the ability of the catalyst to store oxygen may be below an acceptable threshold.

The PCM performs this diagnostic test at idle. When the conditions for running this DTC are met, the following occurs:

- The air-to-fuel ratio transitions from lean to rich.
- The air-to-fuel ratio transitions a second time rich to lean, opposite the first air-to-fuel ratio transition.
- The PCM captures the response time of the front and the rear HO2S when the air-to-fuel ratio transitions occur. The HO2S response time changes from less than 350 mV to more than 600 mV, and from more than 600 mV to less than 350 mV.
- The PCM measures the time necessary for the rear HO2S voltage to cross a reference lean-to-rich threshold, and the time necessary for the front HO2S voltage to cross the same lean-to-rich threshold. The difference between the front HO2S time and the rear HO2S time indicates the oxygen storage capacity of the catalyst. If the PCM detects that this time difference is less than a predetermined value, DTC P0420 for bank 1 or DTC P0430 for bank 2 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0125, P0128, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0171, P0172, P0174, P0175, P0200, P0220, P0300, P0325, P0327, P0336, P0341, P0342, P0343, P0351-P0358, P0410, P0442, P0443, P0446, P0449, P0455, P0491, P0492, P0496, P0502, P0503, P0506, P0507, P1133, P1134, P1153, P1154, P1516, P1518, P2108, P2121, P2125, P2126, P2130, P2131, P2135 are not set.
- The engine has been running for more than 10 minutes.
- The intake air temperature (IAT) is between -7 and +85°C (+20 and +185°F).
- The barometric pressure (BARO) is more than 74 kPa (10.7 psi).
- The engine coolant temperature (ECT) is between 70-120°C (158-248°F).
- Since the end of the last idle period, the engine speed has been more than 900 RPM for 42 seconds.
- The Closed Loop fuel control is enabled.
- The engine must be at a stable idle speed, within 200 RPM of desired idle.
- The battery voltage is more than 10.7 volts.

Conditions for Setting the DTC

The PCM determines that the oxygen storage capability of the TWC has degraded to less than a calibrated threshold.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.

- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame/Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- These conditions may cause a catalytic converter to degrade. Inspect for the following conditions:
  - An engine misfire
  - High engine oil or high coolant consumption
  - Retarded spark timing
  - A weak or poor spark
  - A lean fuel mixture
  - A rich fuel mixture
  - A damaged oxygen sensor or wiring harness
- If an intermittent condition cannot be duplicated, the information included in Freeze Frame data can be useful in determining the vehicle operating conditions when the DTC was set.
- The catalyst may have been temporarily contaminated with a chemical from a fuel additive, fuel contamination or any of the above conditions.
- If the condition is determined to be intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **5:** This step indicates that a catalytic converter which has been discolored may be due to an engine running rich, lean or had a previous misfire. Verifying the fuel trim percentages may be of assistance in determining if such a condition exists.
>
> **6:** This step inspects for conditions that can cause the three-way catalytic converter efficiency to appear degraded.

DTC P0420 or P0430

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**

2	Review the DTC information on the scan tool. Are any other DTCs set?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	1. Start and idle the engine until Closed Loop is achieved. 2. Increase the engine speed to 1,500 RPM for 1 minute. 3. Return the engine to a stabilized idle. 4. Observe the catalyst monitor HO2S 2 voltage parameter on the scan tool for the applicable bank. Is the HO2S 2 voltage parameter transitioning below the first specified value and above the second specified value?	350 mV 600 mV	Go to **Step 5**	Go to **Step 4**
4	1. Clear the DTCs with a scan tool. 2. Start the engine. 3. Operate the vehicle within the Conditions For Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did DTC P0420 or DTC P0430 set?	-	Go to **Step 5**	Go to Diagnostic Aids
5	**IMPORTANT:** **Verify that the three-way catalytic converter is a high quality part that meets the OEM specifications.** Visually and physically inspect the three-way catalytic convertor for the following conditions: • Dents • Severe discoloration caused by excessive temperatures • Internal rattles caused by loose catalyst substrate • Restrictions-Refer to **Restricted Exhaust** in Engine Exhaust. Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 6**
	Visually inspect the exhaust system for the following conditions:			

6	• The Exhaust System for leaks-Refer to **Exhaust Leakage** in Engine Exhaust. • Physical damage • Loose or missing hardware • The heated oxygen sensor (HO2S) 2 for the applicable bank for proper torque Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 7**
7	Visually inspect the HO2S 2 at the applicable bank for the following conditions: • The pigtail and wiring harness contacting the exhaust or any ground. • Road Damage Did you find a condition?	-	Go to **Step 8**	Go to **Step 9**
8	Replace the applicable HO2S 2 sensor. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2** . Did you complete the replacement?	-	Go to **Step 10**	-
9	**NOTE:** **In order to avoid damaging the replacement three-way catalytic converter, correct the engine misfire or mechanical fault before replacing the three-way catalytic converter.** Replace the three-way catalytic converter. Refer to **Catalytic Converter Replacement** in Engine Exhaust.Did you complete the replacement?	-	Go to **Step 10**	-
10	1. Clear the DTCs with a scan tool 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions For Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 11**
11	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?		Go to **Diagnostic Trouble Code**	

DTC P0442

System Description

This diagnostic tests the Evaporative Emission (EVAP) System for a small leak when the key is turned OFF and the correct conditions are met.

Heat is transferred into a vehicle fuel tank while the vehicle is operating. When the vehicle is turned OFF, a change in the fuel tank vapor temperature occurs, which results in corresponding pressure changes in the fuel tank vapor space. This change is monitored by the control module using the fuel tank pressure sensor input. The control module then makes a judgement on the integrity of the system. With a 0.51 mm (0.020 inches) leak in the system, the amount of pressure change observed is significantly less than that of a sealed system.

If the control module detects a pressure change less than a calibrated amount, DTC P0442 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0335, P0336, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0500, P0502, P0503, P1683 are not set.
- The diagnostic runs once with a 10 hour minimum between tests after a fail.
- DTC P0455 must run and pass.
- The start up intake air temperature (IAT) is between 4-30°C (39-86°F).
- The start up engine coolant temperature (ECT) is less than 30°C (86°F).
- The start up IAT and ECT are within 8°C (15°F).
- The barometric pressure (BARO) is more than 74 kPa.
- The ambient air temperature is between 2-32°C (36-90°F).
- The engine run time minimum is 10 minutes.
- The odometer displays more than 10 miles.
- The vehicle has traveled more than 3 miles this trip.
- The ECT is more than 70°C (158°F).
- The fuel level is between 15-85 percent.
- The ignition is OFF.

Conditions for Setting the DTC

The control module detects a pressure change that is less than a calibrated amount.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module

stores this information in the Freeze Frame/Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- To help locate intermittent leaks, use the **J 41413-200** Evaporative Emissions System Tester (EEST) to introduce smoke into the EVAP system. Move all EVAP components while observing smoke with the **J 41413-SPT** High Intensity White Light.
- To improve the visibility of the smoke exiting the EVAP system, observe the suspected leak area from different angles with the **J 41413-SPT** .
- For intermittent conditions, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: Introducing smoke in 15 second intervals may allow smaller leak areas to be more noticeable. When the system is less pressurized, the smoke will sometimes escape in a more condensed manner.

5: This step verifies that repairs are complete and that no other condition is present.

DTC P0442

Step	Action	Yes	No
Schematic Reference: Evaporative Emissions (EVAP) Hose Routing Diagram			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Inspect the evaporative emission (EVAP) system for the following conditions: • Loose, missing, or damaged service port dust cap and/or schrader valve • Loose, incorrect, missing, or damaged fuel fill cap • A damaged EVAP canister purge solenoid valve 2. Raise the vehicle on a hoist. Refer to **Lifting and Jacking the Vehicle** in General Information.		

	3. Inspect the EVAP system for the following conditions: • Disconnected, improperly routed, kinked, or damaged EVAP pipes and hose • A damaged EVAP canister vent solenoid valve or EVAP canister Did you find and correct the condition?	Go to **Step 5**	Go to **Step 3**
3	**IMPORTANT:** **Ensure that the vehicle underbody temperature is similar to the ambient temperature and allow the surrounding air to stabilize before starting the diagnostic procedure. System flow will be less with higher temperatures.** 1. Turn OFF the ignition. 2. Connect the **J 41413-200** Evaporative Emissions System Tester (EEST) power supply clips to a known good 12-volt source. 3. Install the **J 41415-40** Fuel Tank Cap Adapter or GE-41415-50 Interrupted Thread Fuel Tank Cap Adapter to the fuel fill pipe. 4. Connect the **J 41413-200** nitrogen/smoke supply hose to the **J 41415-40** or GE-41415-50 . 5. Turn ON the ignition, with the engine OFF. 6. Command the EVAP canister vent solenoid valve closed with a scan tool. 7. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to SMOKE. 8. Use the remote switch to introduce smoke into the EVAP system. 9. Use the **J 41413-VLV** EVAP Service Port Vent Fitting to open the EVAP service port. 10. Remove the **J 41413-VLV** once smoke is observed. 11. Continue to introduce smoke into the EVAP system for an additional 60 seconds. 12. Inspect the entire EVAP system for exiting smoke with the **J 41413-SPT** High Intensity White Light. 13. Continue to introduce smoke at 15 second intervals until the leak source has been located. Did you locate and repair a leak source?	Go to **Step 5**	Go to **Step 4**
	1. Disconnect the **J 41415-40** or GE-41415-50 from the fuel fill pipe.		

4	2. Install the fuel fill cap to the fuel fill pipe. 3. Connect the **J 41413-200** nitrogen/smoke supply hose to the EVAP service port. 4. Use the remote switch to introduce smoke into the EVAP system. 5. Inspect the entire EVAP system for exiting smoke with the **J 41413-SPT** . 6. Continue to introduce smoke at 15 second intervals until the leak source has been located. Did you locate and repair a leak source?	Go to **Step 5**	Go to Diagnostic Aids
5	**IMPORTANT:** **Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize.** 1. Turn the nitrogen/smoke valve to nitrogen. 2. Connect the nitrogen/smoke hose to the 0.5 mm (0.20 in) test orifice on the bottom-front of the **J 41413-200** . 3. Use the remote switch to activate the **J 41413-200** . 4. Align the red flag on the flow meter with the floating indicator. Use the remote switch to de-activate the **J 41413-200** . 5. Install the **J 41415-40** or GE-41415-50 to the fuel fill pipe. 6. Remove the nitrogen/smoke hose from the test orifice and install the hose onto the **J 41415-40** or GE-41415-50 . 7. Turn ON the ignition, with the engine OFF. 8. Command the EVAP canister vent solenoid valve closed with a scan tool. 9. Use the remote switch to introduce nitrogen and fill the EVAP system until the floating stabilizes. 10. Compare the flow meter's stable floating indicator position to the red flag. Is the floating indicator below the red flag?	Go to **Step 6**	Go to **Step 2**
6	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0443

Circuit Description

An ignition voltage is supplied directly to the evaporative emission (EVAP) canister purge solenoid valve. The EVAP canister purge solenoid valve is pulse width modulated (PWM). The scan tool displays the amount of ON time as a percentage. The control module monitors the status of the driver. The control module controls the EVAP canister purge solenoid valve ON time by grounding the control circuit via an internal switch called a driver. If the control module detects an incorrect voltage for the commanded state of the driver, this DTC sets.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The system voltage is between 6-18 volts.

Conditions for Setting the DTC

- The control module detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The above conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **2:** This step tests if the concern is active. The EVAP canister purge solenoid valve is pulse width modulated (PWM). A clicking should be heard or felt when the EVAP canister purge solenoid valve is commanded to 50 percent and should stop when the EVAP canister purge solenoid valve is commanded to 0 percent. The rate at which the EVAP canister purge solenoid valve cycles should increase as the

commanded state is increased and decrease as the commanded state is decreased. Repeat the commands as necessary.

5: This step tests if a ground is constantly being applied to the EVAP canister purge solenoid valve.

6: This step verifies that the control module is providing ground to the EVAP canister purge solenoid valve.

DTC P0443

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference:Powertrain Control Module (PCM) Connector End Views** or **Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Turn ON the ignition, with the engine OFF. 2. Command the evaporative emission (EVAP) canister purge solenoid valve to 50 percent and then to 0 percent with a scan tool. Do you hear or feel a clicking from the EVAP canister purge solenoid valve when it is commanded to 50 percent?	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/ Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the EVAP canister purge solenoid valve harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the EVAP canister purge solenoid valve with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to **Step 5**	Go to **Step 11**
	1. Connect a test lamp between the control circuit of the EVAP canister purge solenoid valve and the		

5	ignition 1 voltage circuit of the EVAP canister purge solenoid valve. 2. Command the EVAP canister purge solenoid valve to 0 percent with a scan tool. Does the test lamp illuminated?	Go to **Step 8**	Go to **Step 6**
6	Command the EVAP canister purge solenoid valve to 50 percent with a scan tool. Does the test lamp illuminate or pulse when the EVAP canister purge solenoid valve is commanded to 50 percent?	Go to **Step 9**	Go to **Step 7**
7	Test the control circuit of the EVAP canister purge solenoid valve for an open or short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
8	Test the control circuit of the EVAP canister purge solenoid valve for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
9	Test for an intermittent and for a poor connection at the EVAP canister purge solenoid valve. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
10	Test for an intermittent and for a poor connection at the control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
11	Repair the open or short to ground in the ignition 1 voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. Replace the fuse if necessary. Did you complete the repair?	Go to **Step 14**	-
12	Replace the EVAP canister purge solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . Did you complete the replacement?	Go to **Step 14**	-
13	Replace the control module. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for		

	Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0446

System Description

This DTC tests the Evaporative Emission (EVAP) System for a restricted or blocked EVAP canister vent path. The control module commands the EVAP canister purge solenoid valve Open and the EVAP canister vent solenoid valve Closed. This allows vacuum to be applied to the EVAP system. Once a calibrated vacuum level has been reached, the control module commands the EVAP canister purge solenoid valve Closed and the EVAP canister vent solenoid valve Open. The control module monitors the fuel tank pressure (FTP) sensor for a decrease in vacuum. If the vacuum does not decrease to near 0 inches H2O in a calibrated time, this DTC sets.

The following table illustrates the relationship between the ON and OFF states, and the Open or Closed states of the EVAP canister purge and vent solenoid valves.

DTC P0446

Control Module Command	EVAP Canister Purge Solenoid Valve	EVAP Canister Vent Solenoid Valve
ON	Open	Closed
OFF	Closed	Open

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0442, P0443, P0449, P0452, P0453, P0455, P0502, P0503, P1112, P1114, P1115, P1120, P1133, P1134, P1153, P1154, P1220, P1221 are not set.
- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is more than 75 kPa.
- The fuel level is between 15-85 percent.
- The engine coolant temperature (ECT) is between 4-30°C (39-86°F).
- The intake air temperature (IAT) is between 4-30°C (39-86°F).
- The start up ECT and IAT are within 9°C (16°F) of each other.

Conditions for Setting the DTC

- The FTP sensor is less than -10 inches H2O.

- The condition is present for more than 30 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- An intermittent condition could be caused by a damaged EVAP vent housing, a temporary blockage at the EVAP canister vent solenoid valve inlet, or a pinched vent hose. A blockage in the Vent System will also cause a poor fuel fill problem.
- For intermittent conditions, refer to **Intermittent Conditions**

DTC P0446

Step -	Action	Values	Yes	No
Schematic Reference: Evaporative Emissions (EVAP) Hose Routing Diagram				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Inspect the Evaporative Emission (EVAP) System for the following conditions: • A damaged EVAP canister vent solenoid valve-Refer to **Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement** . • A pinched EVAP canister vent hose • A damaged EVAP canister-Refer to	-		

	Evaporative Emission (EVAP) Canister Replacement . Did you find and correct the condition?		Go to **Step 15**		Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the purge line from the EVAP canister vent solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . 3. Turn ON the ignition, with the engine OFF. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 in H2O	Go to **Step 4**	Go to **Step 9**	
4	**IMPORTANT:** **DO NOT exceed the specified value in this step. Exceeding the specified value may produce incorrect test results.** 1. Turn OFF the ignition. 2. Connect the EVAP canister purge pipe. 3. Connect the **J 41413-200** Evaporative Emissions System Tester (EEST) power supply clips to a known good 12-volt source. 4. Install the **J 41415-40** Fuel Tank Cap Adapter or GE-41415-50 Interrupted Thread Fuel Tank Cap Adapter to the fuel fill pipe. 5. Connect the fuel fill cap to the **J 41415-40** or GE-41415-50 . 6. Connect the **J 41413-200** nitrogen/smoke supply hose to the **J 41415-40** or GE-41415-50 . 7. Turn ON the ignition, with the engine OFF. 8. Command the EVAP canister vent solenoid valve closed with a scan tool. 9. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to NITROGEN. 10. Use the remote switch to pressurize the	5 in H2O 1 in H2O			

	EVAP system to the first specified value. 11. Observe the fuel tank pressure sensor in H2O with a scan tool. 12. Command the EVAP canister vent solenoid valve open with a scan tool. Is the fuel tank pressure sensor parameter less than the second specified value?		Go to **Step 5**	Go to **Step 7**
5	1. Connect the nitrogen/smoke hose to the EVAP service port. 2. Remove the **J 41415-40** or GE-41415-50 . 3. Install the fuel fill cap to the fuel fill pipe. 4. Start the engine. 5. Allow the engine to idle. 6. Use the purge/seal function to seal the system with a scan tool. 7. Command the EVAP canister purge solenoid valve to 30 percent. 8. Observe the vacuum/pressure gage of the **J 41413-200** and the FTP parameter on the scan tool. 9. Allow the vacuum to increase on the gage of the **J 41413-200** , until it reaches approximately 16 inch H2O. 10. Use the purge/seal function to seal the system, with a scan tool. Is the FTP parameter on a scan tool within the specified value of the vacuum/pressure gage on the **J 41413-200** , until the vacuum reached the abort limit on a scan tool?	1 in H2O	Go to **Step 6**	Go to **Step 9**
6	Did the FTP parameter on a scan tool display more than the specified value?	3.2 V	Go to Diagnostic Aids	Go to **Step 9**
7	Disconnect the EVAP vent hose from the EVAP canister vent solenoid valve. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 13**	Go to **Step 8**
8	Disconnect the EVAP canister vent hose from the EVAP canister. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 11**	Go to **Step 14**

9	Test the low reference circuit of the fuel tank pressure (FTP) sensor for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 10**
10	Test for poor connections at the harness connector of the FTP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
11	Repair the pinched or restricted EVAP canister vent hose. Did you complete the repair?	-	Go to **Step 15**	-
12	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
13	Replace the EVAP canister vent solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
14	Replace the EVAP canister. Refer to **Evaporative Emission (EVAP) Canister Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
15	1. Turn OFF the ignition. 2. Disconnect the purge line from the EVAP canister purge solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . 3. Turn ON the ignition, with the engine OFF. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 in H2O	Go to **Step 16**	Go to **Step 2**
	IMPORTANT: **DO NOT exceed the specified value in this step. Exceeding the specified value may produce incorrect test results.** 1. Turn OFF the ignition. 2. Reconnect all disconnected components. 3. Connect the **J 41413-200** to the fuel fill pipe.			

16	4. Turn ON the ignition, with the engine OFF 5. Command the EVAP canister vent solenoid valve closed with a scan tool. 6. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to NITROGEN. 7. Use the remote switch to pressurize the EVAP system to the first specified value. 8. Observe the fuel tank pressure sensor in H2O with a scan tool. 9. Command the EVAP canister vent solenoid valve open with a scan tool. Is the fuel tank pressure sensor parameter less than the second specified value?	5 in H2O 1 in H2O	Go to **Step 17**	Go to **Step 2**	
17	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK	

DTC P0449

Circuit Description

An ignition voltage is supplied to the evaporative emission (EVAP) canister vent solenoid valve. The control module grounds the EVAP canister vent solenoid valve control circuit to close the valve by means of an internal switch called a driver. The scan tool displays the commanded state of the EVAP canister vent solenoid valve as ON or OFF. The control module monitors the status of the driver. If the control module detects an incorrect voltage for the commanded state of the driver, this DTC sets.

The following table illustrates the relationship between the ON and OFF states, and the OPEN or CLOSED states of the EVAP canister vent solenoid valve.

DTC P0449

Control Module Command	EVAP Canister Vent Valve Position
ON	CLOSED
OFF	OPEN

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The system voltage is between 6-18 volts.

Conditions for Setting the DTC

- The control module detects that the commanded state of the driver and the actual state of the control circuit do not match.
- The above conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: A click should be heard or felt when the EVAP canister vent solenoid valve operates. Be sure that both the ON and the OFF states are commanded. Repeat the commands as necessary.

5: This step verifies that the control module is providing ground to the EVAP canister vent solenoid valve.

6: This step tests if the EVAP canister vent solenoid valve control circuit is grounded.

DTC P0449

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Turn ON the ignition, with the engine OFF. 2. Command the evaporative emission (EVAP) canister vent solenoid valve ON and OFF with a scan tool.		

	Do you hear or feel a click from the EVAP canister vent solenoid valve when it is commanded ON and OFF?	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the EVAP canister vent solenoid valve. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the EVAP canister vent solenoid valve with a test lamp that is connected to a good ground. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. Does the test lamp illuminate?	Go to **Step 5**	Go to **Step 11**
5	1. Connect a test lamp between the control circuit of the EVAP canister vent solenoid valve and the ignition 1 voltage circuit of the EVAP canister vent solenoid valve. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. 2. Command the EVAP canister vent solenoid valve ON and OFF with a scan tool. Does the test lamp turn ON or OFF with each command?	Go to **Step 9**	Go to **Step 6**
6	Does the test lamp remain illuminated with each command?	Go to **Step 8**	Go to **Step 7**
7	Test the control circuit for a short to voltage or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
8	Test the control circuit for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
9	Test for an intermittent and for a poor connection at the EVAP canister vent solenoid valve. Refer to **Testing for Intermittent Conditions and Poor Connections** and		

	Connector Repairs in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
10	Test for an intermittent and for a poor connection at the control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
11	1. Repair the open or short to ground in the ignition 1 voltage circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. 2. Replace the fuse if necessary. Did you complete the repair?	Go to **Step 14**	-
12	Replace the EVAP canister vent solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement** . Did you complete the replacement?	Go to **Step 14**	-
13	Replace the control module. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 15**
15	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0452

Circuit Description

The fuel tank pressure (FTP) sensor measures the difference between the air pressure or vacuum in the evaporative emission (EVAP) system, and the outside air pressure. The control module supplies a 5-volt reference and a low reference circuit to the FTP sensor. The FTP sensor signal circuit voltage varies depending on EVAP system pressure or vacuum. If the FTP sensor signal voltage goes below a calibrated value, this DTC sets.

The following table illustrates the relationship between the FTP sensor signal voltage and the EVAP system pressure/vacuum.

DTC P0452

FTP Sensor Signal Voltage	Fuel Tank Pressure
High, Approximately 1.5 Volts or More	Negative Pressure/Vacuum
Low, Approximately 1.5 Volts or Less	Positive Pressure

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The fuel tank pressure (FTP) sensor voltage is less than 0.1 volts
- All conditions present for more than 5 seconds

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

5: Tests for the proper operation of the circuit in the high voltage range.

DTC P0452

Step	Action	Value (s)	Yes	No

Schematic Reference: Engine Controls Schematics
Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views

1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Idle the engine for 1 minute. 2. Monitor the diagnostic trouble codes (DTC) information using the scan tool Did DTC P1639 fail this ignition?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	Observe the Fuel Tank Pressure sensor parameter with a scan tool. Is the Fuel Tank Pressure sensor parameter less than the specified value?	0.1 V	Go to **Step 5**	Go to **Step 4**
4	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to **Intermittent Conditions**
5	1. Turn OFF the ignition. 2. Disconnect the FTP sensor harness connector. 3. Connect a 3-amp fused jumper wire between the 5-volt reference circuit of the FTP sensor and the signal circuit of the FTP sensor. 4. Turn ON the ignition, with the engine OFF. 5. Observe the FTP voltage with a scan tool. Is the Fuel Tank Pressure sensor parameter within the specified value?	4.9-5.1 V	Go to **Step 8**	Go to **Step 6**
6	Test the 5-volt reference circuit for an open circuit or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 7**
	Test the signal circuit for the following conditions:			

7	• A short to ground • An open • High resistance Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 9**
8	Test for an intermittent and for a poor connection at the FTP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
9	Test for an intermittent and for a poor connection at the control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
10	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
11	Replace the control module. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
12	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 13**
13	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0453

Circuit Description

The fuel tank pressure (FTP) sensor measures the difference between the air pressure or vacuum in the evaporative emission (EVAP) system, and the outside air pressure. The control module supplies a 5-volt reference and a low reference circuit to the FTP sensor. The FTP sensor signal circuit voltage varies depending on EVAP system pressure or vacuum. If the FTP sensor signal voltage increases above a calibrated value, this DTC sets.

The following table illustrates the relationship between FTP sensor signal voltage and the EVAP system pressure/vacuum.

DTC P0453

FTP Sensor Signal Voltage	Fuel Tank Pressure
High, Approximately 1.5 Volts or More	Negative Pressure/Vacuum
Low, Approximately 1.5 Volts or Less	Positive Pressure

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- The fuel tank pressure (FTP) sensor voltage is more than 4.9 volts.
- All conditions present for more than 5 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If DTC P1639 is set, the 5-volt reference circuit may be shorted to a voltage.

DTC P0453

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views** or **Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check- Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Idle the engine for 1 minute. 2. Monitor the Diagnostic Trouble Code (DTC) Information using the scan tool. Did DTC P1639 fail this ignition?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	1. Turn ON the ignition, with the engine OFF. 2. Observe the Fuel Tank Pressure sensor parameter with a scan tool. Is the Fuel Tank Pressure sensor parameter more than the specified value?	4.3 V	Go to **Step 5**	Go to **Step 4**
4	1. Observe the Freeze Frame / Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to **Intermittent Conditions**
5	1. Turn OFF the ignition. 2. Disconnect the FTP sensor harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Observe the Fuel Tank Pressure sensor parameter with a scan tool. Does the scan tool indicate that the FTP sensor voltage is more than the specified value?	4.3 V	Go to **Step 6**	Go to **Step 7**
6	Test the signal circuit for a short to voltage. Refer to **Testing for Short to Ground** and **Wiring Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 13**	Go to **Step 10**
7	Probe the low reference circuit of the FTP sensor with a test lamp that is connected to battery voltage. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. Did the test lamp illuminate?	-	Go to **Step 9**	Go to **Step 8**
8	Test the low reference circuit for an open. Refer to **Testing for Continuity** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 10**
9	Test for an intermittent and for a poor connection at the FTP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 11**
10	Test for an intermittent and for a poor connection at the control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
11	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the control module. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
13	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 14**
14	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0455

System Description

The control module tests the Evaporative Emission (EVAP) System for a large leak. The control module monitors the fuel tank pressure (FTP) sensor signal to determine the EVAP system vacuum level. When the conditions for running are met, the control module commands the EVAP canister purge solenoid valve OPEN and the EVAP canister vent solenoid valve CLOSED. This allows engine vacuum to enter the EVAP system. At a calibrated time, or vacuum level, the control module commands the EVAP canister purge solenoid valve closed, sealing the system, and monitors the FTP sensor input in order to determine the EVAP system vacuum level. If the system is unable to achieve the calibrated vacuum level, or the vacuum level decreases too rapidly, this DTC sets.

The following table illustrates the relationship between the ON and OFF states, and the OPEN or CLOSED states of the EVAP canister purge and vent solenoid valves.

DTC P0455

Control Module Command	EVAP Canister Purge Solenoid Valve	EVAP Canister Vent Solenoid Valve
ON	Open	Closed
OFF	Closed	Open

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0442, P0443, P0449, P0452, P0453, P1112, P1114, P1115, P1120, P1133, P1134, P1153, P1154, P1220, P1221 are not set.
- The engine is running.
- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is more than 75 kPa.
- The fuel level is between 15-85 percent.
- The engine coolant temperature (ECT) is between 4-30°C (39-86°F).
- The intake air temperature (IAT) is between 4-30°C (39-86°F).
- The start-up ECT and IAT are within 9°C (16°F) of each other.
- The vehicle speed sensor (VSS) is less than 121 km/h (75 mph).

Conditions For Setting the DTC

The EVAP system is not able to achieve or maintain vacuum during the diagnostic test.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- To help locate intermittent leaks, use the **J 41413-200** Evaporative Emissions System Tester (EEST) to introduce smoke into the EVAP system. Move all EVAP components while observing smoke with the **J 41413-SPT** High Intensity White Light. Introducing smoke in 15 second intervals will allow less pressure into the EVAP System. When the system is less pressurized, the smoke will sometimes escape in a more condensed manner.
- A temporary blockage in the EVAP canister purge solenoid valve, purge pipe or EVAP canister could cause an intermittent condition. Inspect and repair any restriction in the EVAP system.
- To improve the visibility of the smoke exiting the EVAP System, observe the suspected leak area from different angles with the **J 41413-SPT** .
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- A condition may exist where a leak in the EVAP System only exists under a vacuum condition. By using the scan tool PURGE/SEAL function to create a vacuum, seal the system and observe the FTP parameter for vacuum decay, this type of leak may be detected.
- For intermittent conditions, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

6: This step verifies proper operation of the FTP sensor.

7: A normal operating FTP sensor should increase above 5 inches of H_2O and stop between 6 inches of H_2O and 7 inches of H_2O.

DTC P0455

Step	Action	Values	Yes	No
Schematic Reference: Evaporative Emissions (EVAP) Hose Routing Diagram				
1	Did you perform the Diagnostic System Check- Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**

2	1. Inspect the Evaporative Emission (EVAP) System for the following conditions: • A loose, missing, or damaged service port schrader valve • A loose, incorrect, missing, or damaged fuel fill cap • A damaged EVAP canister purge solenoid valve 2. Raise the vehicle on a hoist. Refer to **Lifting and Jacking the Vehicle** in General Information. 3. Inspect the EVAP System for the following conditions: • Any disconnected, improperly routed, kinked, or damaged EVAP pipes and hoses • A damaged EVAP canister vent solenoid valve or EVAP canister Did you find and correct the condition?	-	Go to **Step 21**	Go to **Step 3**
3	**IMPORTANT:** **Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize.** 1. Turn OFF the ignition. 2. Connect the **J 41413-200** Evaporative Emissions System Tester (EEST) power supply clips to a known good 12-volt source. 3. Turn the nitrogen/smoke valve to nitrogen. 4. Connect the nitrogen/smoke hose to the 0.5 mm (0.20 in) test orifice on the bottom-front of the **J 41413-200** . 5. Use the remote switch to activate the **J 41413-200** . 6. Align the red flag on the flow meter with the floating indicator. Use the remote switch to de-activate the **J 41413-200** . 7. Install the **J 41415-40** Fuel Tank Cap Adapter or GE-41415-50 Interrupted Thread Fuel Tank Cap Adapter to the fuel fill pipe. 8. Install the fuel fill cap to the **J 41415-40** or GE-41415-50 .	-		

	9. Remove the nitrogen/smoke hose from the test orifice and install the hose onto the **J 41415-40** or GE-41415-50 . 10. Turn ON the ignition, with the engine OFF. 11. Command the EVAP canister vent solenoid valve closed with a scan tool. 12. Use the remote switch to induce nitrogen and fill the EVAP System until the floating indicator stabilizes. 13. Compare the flow meter's stable floating indicator position to the red flag. Is the floating indicator below the red flag?		Go to **Step 6**	Go to **Step 4**	
4	**IMPORTANT:** **Ensure that the vehicle underbody temperature is similar to the ambient temperature and allow the surrounding air to stabilize before starting the diagnostic procedure. System flow will be less with higher temperatures.** 1. Turn OFF the ignition. 2. Connect the **J 41413-200** power supply clips to a known good 12-volt source. 3. Install the **J 41415-40** to the fuel fill pipe. 4. Connect the **J 41413-200** nitrogen/smoke supply hose and vehicle fuel fill cap to the **J 41415-40** or GE-41415-50 . 5. Turn ON the ignition, with the engine OFF. 6. Command the EVAP canister vent solenoid valve closed with a scan tool. 7. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to SMOKE. 8. Use the remote switch to introduce smoke into the EVAP System. 9. Use the **J 41413-VLV** EVAP Service Port Vent Fitting to open the EVAP service port. 10. Remove the **J 41413-VLV** once smoke is observed. 11. Continue to introduce smoke into the EVAP System for an additional 60 seconds. 12. Inspect the entire EVAP System for exiting smoke with the **J 41413-SPT** High Intensity White Light.	-			

	13. Continue to introduce smoke at 15 second intervals until the leak source has been located. Did you locate and repair a leak source?		Go to **Step 21**	Go to **Step 5**	
5	1. Disconnect the **J 41415-40** or GE-41415-50 from the fuel fill pipe. 2. Install the fuel fill cap to the fuel fill pipe. 3. Connect the **J 41413-200** nitrogen/smoke supply hose to the EVAP service port. 4. Use the remote switch to introduce smoke into the EVAP System. 5. Inspect the entire EVAP System for exiting smoke with the **J 41413-SPT** . 6. Continue to introduce smoke at 15 second intervals until the leak source has been located Did you locate and repair a leak source?	-	Go to **Step 21**	Go to **Step 6**	
6	1. Use the remote switch to stop introducing smoke. 2. Install the **J 41415-40** or GE-41415-50 to the fuel fill pipe. 3. Connect the **J 41413-200** nitrogen/smoke supply hose and vehicle fuel fill cap to the **J 41415-40** or GE-41415-50 . 4. Command the EVAP canister vent solenoid valve open with a scan tool. 5. Compare the fuel tank pressure sensor parameter with a scan tool to the**J 41413-200** pressure/vacuum gage. Is the scan tool fuel tank pressure sensor parameter within the specified value of the **J 41413-200** pressure/vacuum gage?	1 in H2O	Go to **Step 7**	Go to **Step 17**	
7	1. Seal the EVAP System using the EVAP Purge/Seal function with a scan tool. 2. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to NITROGEN. 3. Use the **J 41413-200** to pressurize the EVAP System to the first specified value.	10 in H2O 5 in H2O			

	Is the fuel tank pressure sensor parameter more than the second specified value?		Go to **Step 8**	Go to **Step 17**
8	1. Use the remote switch to stop introducing nitrogen into the EVAP System. 2. Increase the EVAP canister purge solenoid valve to 100 percent. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 9**	Go to **Step 11**
9	1. Connect the nitrogen/smoke hose to the EVAP service port. 2. Remove the **J 41415-40** or GE-41415-50 . 3. Install the fuel fill cap to the fuel fill pipe. 4. Start the engine. 5. Allow the engine to idle. 6. Use the purge/seal function to seal the system with a scan tool. 7. Command the EVAP canister purge solenoid valve to 30 percent. 8. Observe the vacuum/pressure gage of the **J 41413-200** and the FTP parameter on the scan tool. 9. Allow the vacuum to increase on the gage of the **J 41413-200** , until it reaches approximately 16 inch H2O. 10. Use the purge/seal function to seal the system, with a scan tool. Is the FTP parameter on a scan tool within the specified value of the vacuum/pressure gage on the **J 41413-200** , until the vacuum reached the abort limit on a scan tool?	1 in H2O	Go to **Step 10**	Go to **Step 17**
10	Did the FTP parameter on a scan tool display more than the specified value?	3.2 V	Go to Diagnostic Aids	Go to **Step 17**
11	Disconnect the EVAP purge vacuum source from the EVAP canister purge solenoid valve. Is the Fuel Tank Pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 15**	Go to **Step 12**
12	Disconnect the EVAP canister purge pipe from the EVAP canister purge solenoid valve. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 18**	Go to **Step 13**

13	Disconnect the EVAP canister purge pipe at the EVAP canister. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 19**	Go to **Step 14**	
14	Disconnect the EVAP canister vapor pipe at the EVAP canister. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 20**	Go to **Step 16**	
15	Repair the pinched or obstructed EVAP canister solenoid valve vacuum source. Did you complete the repair?	-	Go to **Step 21**	-	
16	Repair the pinched or obstructed EVAP canister vapor pipe. Did you complete the repair?	-	Go to **Step 21**	-	
17	Replace the fuel tank pressure (FTP) sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 21**	-	
18	Replace the EVAP canister purge solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . Did you complete the replacement?	-	Go to **Step 21**	-	
19	Repair the restriction in the EVAP canister purge pipe. Refer to **Evaporative Emission (EVAP) System Hoses/Pipes Replacement (Vacuum Supply)** or **Evaporative Emission (EVAP) System Hoses/Pipes Replacement (Engine Purge Pipe)** . Did you complete the repair?	-	Go to **Step 21**	-	
20	Replace the EVAP canister. Refer to **Evaporative Emission (EVAP) Canister Replacement** . Did you complete the replacement?	-	Go to **Step 21**	-	
21	**IMPORTANT:** **DO NOT exceed the specified value in this step. Exceeding the specified value may produce incorrect test results.** 1. Connect the **J 41413-200** to the fuel fill pipe. 2. Turn the nitrogen/smoke valve to NITROGEN. 3. Seal the EVAP System using the EVAP Purge/Seal function with a scan tool. 4. Pressurize the EVAP System to the specified value. 5. Observe the **J 41413-200** pressure/vacuum gage for 5 minutes.	5 in H2O			

	Does the **J 41413-200** pressure/vacuum gage remain constant?		Go to **Step 22**	Go to **Step 3**	
22	Observe the fuel tank pressure sensor parameter with a scan tool. Is the scan tool fuel tank pressure parameter within the specified value of the **J 41413-200** pressure/vacuum gage?	1 in H2O	Go to **Step 23**	Go to **Step 6**	
23	1. Observe the **J 41413-200** pressure/vacuum gage. 2. Increase the EVAP canister purge solenoid valve to 100 percent. Does the pressure decrease?	-	Go to **Step 24**		Go to **Step 12**
24	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK	

DIAGNOSIS

DTC P0491 OR P0492

Circuit Description

The secondary air injection (AIR) pump system is designed to lower exhaust emission levels on a start up. The AIR pump is timed to remain ON for approximately 1 minute or until Closed Loop is achieved.

The powertrain control module (PCM) commands the AIR pump relay ON by supplying a ground to the AIR pump relay control circuit. This action energizes the AIR pump, forcing fresh air into the exhaust stream. The PCM also commands the AIR solenoid ON which applies engine vacuum to the AIR shut-off valve. With vacuum applied to the AIR shut-off valve, airflow from the AIR pump flows through the pipes/hoses to the exhaust check valves, then enters into the exhaust stream. The air, oxygen, that is introduced into the exhaust system accelerates catalyst operation. When inactive, the check exhaust valves and the shut-off valve prevent air flow in either direction.

The PCM detects a system air flow condition by monitoring the heated oxygen sensors (HO2S) and Short Term Fuel Trim during normal Open Loop AIR system operation. This is a passive test. If the passive test indicates a pass, the PCM takes no further action. If the passive test fails or is inconclusive, the diagnostic will proceed with an intrusive or active test. The PCM will command the AIR system ON during Closed Loop operation under normal operating conditions. The active test will pass or fail based on the response from the HO2S. A lean HO2S response indicates that the AIR system is functioning normally. An increasing Short Term Fuel Trim value also indicates a normal functioning system. The AIR diagnostic consists of the passive test and the active tests. The AIR diagnostic requires failure of the passive and active tests on 2 consecutive key cycles to illuminate the malfunction indicator lamp (MIL) and stores a DTC. If the PCM detects that the HO2S and Short Term Fuel Trim did not respond as expected on one of the engine banks, DTC P0491 for bank 1 or DTC P0492 for bank 2 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0125, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0151, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0171, P0172, P0174, P0175, P0200, P0220, P0300, P0335, P0336, P0351, P0352, P0353, P0354, P0355, P0356, P0357, P0358, P0442, P0443, P0446, P0449, P0455, P0496, P1133, P1134, P1153, P1154, P1258, P2135 are not set.
- The mass air flow (MAF) is less than 23 g/s.
- The air/fuel ratio is 14.7:1.
- The engine load is less than 40 percent.
- The ignition voltage is more than 11.7 volts.
- The engine speed is more than 850 RPM.

- The engine coolant temperature (ECT) is between -10 and +110°C (14-230°F).
- The intake air temperature (IAT) is between -10 and +100°C (14-212°F).
- The fuel system is operating in fuel trim cells 1, 2, 4, 5, or 6.
- The engine is not operating in the following Modes:
    - Power Enrichment
    - Decel Fuel Shut-off
    - Catalyst Over-Temperature

Conditions for Setting the DTC

- The HO2S voltage does not decrease to less than 222 mV for 1.3 seconds.

  AND

- The short-term fuel trim does not change more than a predetermined value.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Conditions for Setting the DTC

- The HO2S voltage does not decrease to less than 222 mV for 1.3 seconds.

  OR

- The short-term fuel trim does not change more than a predetermined value.

Diagnostic Aids

- For any test that requires probing the PCM or probing a component harness connector, use the connector test adapter kit. Using this kit prevents damage to the harness or component terminals. Refer to in Wiring Systems.
- Carbon build-up in the exhaust manifold may restrict the amount of air flow necessary to affect the HO2S voltage. If you suspect this condition, remove the air pipe from the manifold and inspect the passage.
- Inspect for the following conditions:
  - Excessive exhaust system back pressure
  - Moisture, water, or debris ingestion into the AIR pump
  - Leaking exhaust check valves will leave traces of exhaust carbon in the AIR system.
  - A check valve that flows in both directions causes heat damage to the AIR system components.

DTC P0491 or P0492

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start and idle the engine until Closed Loop is achieved. 2. Turn OFF all the accessories. 3. Monitor the HO2S bank 1 sensor 1 and bank 2 sensor 1 voltage parameters for the applicable bank with a scan tool. 4. Command the secondary air injection (AIR) system ON with a scan tool. 5. Observe the heated oxygen sensor (HO2S) voltage as the AIR system is enabled. Does the HO2S voltage decrease to less than the specified value?	222 mV	Go to Diagnostic Aids	Go to **Step 3**
3	Perform a visual inspection of all pipes/hoses in the AIR system for the following conditions: • Loose or missing clamps on the AIR pipes/hoses • No kinks, holes, or pinched hoses/pipes • Components with evidence of heat damage Did you find and correct a condition?	-	Go to **Step 7**	Go to **Step 4**

4	1. Remove the crossover hose from the applicable check valve. 2. Command the AIR pump system ON with a scan tool. Is air flow present at the hose outlet?	-	Go to **Step 6**	Go to **Step 5**
5	Repair the restriction or the leak for the applicable bank in the AIR crossover pipes/hoses between the exhaust check valve and the AIR shut-off valve. Did you complete the repair?	-	Go to **Step 7**	-
6	**CAUTION:** **Refer to Hot Exhaust System Caution in Cautions and Notices.** Repair the restriction/leak or blockage for the applicable bank in one of the following components: • The exhaust check valve-Refer to **Secondary Air Injection (AIR) Check Valve/Pipe Replacement - Bank 1** or **Secondary Air Injection (AIR) Check Valve/Pipe Replacement - Bank 2** • The exhaust check valve outlet pipe • The exhaust manifold Did you complete the repair?	-	Go to **Step 7**	-
7	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 8**
8	Observe the Capture Info with a scan tool. Are there any DTCs that you have not yet diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0496

System Description

This DTC tests for undesired intake manifold vacuum flow to the Evaporative Emission (EVAP) System. The control module seals the EVAP System by commanding the EVAP canister purge solenoid valve Closed and the EVAP canister vent solenoid valve Closed. The control module monitors the fuel tank pressure (FTP) sensor to determine if a vacuum is being drawn on the EVAP System. If vacuum in the EVAP system is more than a predetermined value within a predetermined time, this DTC sets.

The following table illustrates the relationship between the ON and OFF states, and the Open or Closed states of the EVAP canister purge and vent solenoid valves.

DTC P0496

Control Module Command	EVAP Canister Purge Solenoid Valve	EVAP Canister Vent Solenoid Valve
ON	Open	Closed
OFF	Closed	Open

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0442, P0443, P0449, P0452, P0453, P0455, P1112, P1114, P1115, P1120, P1133, P1134, P1153, P1154, P1220, P1221 are not set.
- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is more than 75 kPa.
- The fuel level is between 15-85 percent.
- The engine coolant temperature (ECT) is between 4-30°C (39-86°F).
- The intake air temperature (IAT) is between 4-30°C (39-86°F).
- The start up ECT and IAT are within 9°C (16°F) of each other.
- The vehicle speed sensor (VSS) is less than 121 km/h (75 mph).

Conditions for Setting the DTC

The control module detects vacuum during a non-purge condition.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.

- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

DTC P0496

Step	Action	Values	Yes	No
Schematic Reference: Evaporative Emissions (EVAP) Hose Routing Diagram				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Seal the Evaporative Emission (EVAP) System using the Purge/Seal function with a scan tool. 3. Increase the engine idle to 1,200-1,500 RPM. 4. Observe the fuel tank pressure (FTP) sensor in H2O with a scan tool. Is the fuel tank pressure sensor parameter within the specified value?	-1 to +1 H2O	Go to Diagnostic Aids	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the EVAP purge pipe from the EVAP canister purge solenoid valve. 3. Turn ON the ignition, with the engine OFF. 4. Observe the FTP sensor in H2O with a scan tool. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 H2O	Go to **Step 4**	Go to **Step 5**
4	Replace the EVAP canister purge solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . Did you complete the replacement?	-	Go to **Step 6**	-
5	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 6**	-
	1. Connect all EVAP hardware that was previously disconnected. 2. Seal the EVAP System using the			

6	Purge/Seal function with a scan tool. 3. Start the engine and idle at 1,200-1,500 RPM. 4. Observe the fuel tank pressure sensor parameter with a scan tool. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 H2O	Go to **Step 7**	Go to **Step 2**
7	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0506

Circuit Description

The throttle actuator control (TAC) system uses vehicle electronics and components to calculate and control the position of the throttle plate. In order to decrease idle speed the TAC system closes the throttle plate, reducing air flow into the engine. In order to increase idle speed the TAC system opens the throttle plate allowing more air flow into the engine. If the actual idle RPM does not match the desired idle RPM within a calibrated time, this code sets.

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0171, P0172, P0200, P0300, P0336, P0440, P0442, P0446, P0452, P0453, P0502, P0503, P1120, P1220, P1221, P1514, P1515, P1516, P1635, or P1639 are not set.
- The engine is operating for at least 2 seconds.
- The engine coolant temperature (ECT) is more than -40°C (-40°F).
- The intake air temperature (IAT) is more than -40°C (-40°F).
- The barometric pressure (BARO) is more than 65 kPa.
- The system voltage is between 9-18 volts.
- The vehicle speed is less than 4.8 km/h (3 mph).

Conditions for Setting the DTC

- The actual idle speed is approximately 150 RPM lower than or 100 RPM greater than the desired idle speed.
- All above conditions present for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.

- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the malfunction indicator lamp (MIL) during the third consecutive trip in which the diagnostic has run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

Diagnostic Aids

If the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

2: This test determines whether the engine can achieve the commanded RPM. If the engine does not reach the commanded RPMs, the test determines whether the RPM is too high or too low.

DTC P0506

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views and Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Ensure the engine is at operating temperature. 3. Command the engine speed to 1,500 RPM, then to 500 RPM, and back to 1,500 RPM with a scan tool. 4. Exit the RPM control function. Does the engine speed correspond, within 100 RPM, with each command?	Go to **Intermittent Conditions**	Go to **Step 3**
	Inspect for any condition that can reduce idle speed by increasing engine load. The following examples are possible conditions: • Incorrect torque converter clutch (TCC) operation • Accessories that require additional torque to		

3	operate • Restricted exhaust • Mechanical conditions that limit engine speed Did you complete the action?	Go to **Step 4**	-
4	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 5**
5	**IMPORTANT:** **Be aware that repairing 1 individual condition may correct more than 1 DTC.** Observe the Capture Info with a scan tool.Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0507

Circuit Description

The throttle actuator control (TAC) system uses vehicle electronics and components to calculate and control the position of the throttle plate. In order to decrease idle speed the TAC system closes the throttle plate, reducing air flow into the engine. In order to increase idle speed the TAC system opens the throttle plate allowing more air flow into the engine. If the actual idle RPM does not match the desired idle RPM within a calibrated time, this code sets.

Conditions for Running the DTC

- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0171, P0172, P0200, P0300, P0336, P0440, P0442, P0446, P0452, P0453, P0502, P0503, P1120, P1220, P1221, P1514, P1515, P1516, P1635, or P1639 are not set.
- The engine is operating for at least 2 seconds.
- The engine coolant temperature (ECT) is more than -40°C (-40°F).
- The intake air temperature (IAT) is more than -40°C (-40°F).
- The barometric pressure (BARO) is more than 65 kPa.
- The system voltage is between 9-18 volts.
- The vehicle speed is less than 4.8 km/h (3 mph).

Conditions for Setting the DTC

- The actual idle speed is approximately 150 RPM lower than or 100 RPM greater than the desired idle speed.
- All above conditions present for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second consecutive trip in which the diagnostic test has been run and failed.
- The PCM will store conditions which were present when the DTC set as Freeze Frame/Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the malfunction indicator lamp (MIL) during the third consecutive trip in which the diagnostic has run and passed.
- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using a scan tool.

Diagnostic Aids

If the condition is intermittent, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number in the diagnostic table.

2: This test determines whether the engine can achieve the commanded RPM. If the engine does not reach the commanded RPM, the test determines whether the RPM is too high or too low.

DTC P0507

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views and Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Command the engine speed to 1,500 RPM, then to 500 RPM, and back to 1,500 RPM with a scan tool. 3. Exit the RPM control function.		

	Does the engine speed correspond, within 175 RPM, with each command?	Go to **Intermittent Conditions**	Go to **Step 3**
3	Inspect for the following conditions: • Vacuum leaks • Excessive deposits in the throttle body • A faulty positive crankcase ventilation (PCV) valve Did you find and correct the condition?	Go to **Step 4**	-
4	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 5**
5	**IMPORTANT:** **Be aware that repairing 1 individual condition may correct more than 1 DTC.** Observe the Capture Info with a scan tool.Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0601-P0607, P1600, P1621, P1627, P1680, P1681, P1683, OR P2610

Description

This diagnostic applies to internal microprocessor integrity conditions within the powertrain control module (PCM). This diagnostic also addresses if the PCM is not programmed.

Test Description

The number below refers to the step number on the diagnostic table.

2: A DTC P0602 indicates the PCM is not programmed.

DTC P0601-P0607, P1600, P1621, P1627, P1680, P1681, P1683, or P2610

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?		Go to **Diagnostic System Check - Engine**

		Go to **Step 2**	**Controls**
2	Is DTC P0602 set?	Go to **Step 3**	Go to **Step 5**
3	Program the PCM. Refer to **Service Programming System (SPS)** in Programming. Does DTC P0602 reset?	Go to **Step 4**	Go to **Step 6**
4	1. Ensure that all tool connections are secure. 2. Ensure that the programming equipment is operating correctly. 3. Ensure that the correct software/calibration package is used. 4. Attempt to program the PCM. Refer to **Service Programming System (SPS)** in Programming. Does DTC P0602 reset?	Go to **Step 5**	Go to **Step 6**
5	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 6**	-
6	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 7**
7	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0641

Circuit Description

The powertrain control module (PCM) provides 5-volts to the following sensors:

- The manifold absolute pressure (MAP) sensor
- The engine oil pressure (EOP) sensor

These 5-volt reference circuits are independent of each other outside the PCM, but are bussed together inside the PCM. Therefore a circuit condition on one sensor 5-volt reference circuit may affect the other sensor 5-volt reference circuits. The PCM monitors the voltage on the 5-volt reference circuit. If the PCM detects that the voltage is out of tolerance, DTC P0641 sets.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The PCM detects a voltage out of tolerance condition of the 5-volt reference circuit.
- The above condition is present for longer than 10 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

DTC P0641

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Observe the Freeze Frame and/or Failure Records data for the DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions**
	1. Turn OFF the ignition.			

3	2. Disconnect the MAP sensor electrical connector. 3. Turn ON the ignition, with the engine OFF. 4. Measure the voltage from the 5-volt reference circuit of the MAP sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Step 5**	Go to **Step 4**
4	Is the voltage from the previous step more than the specified value?	5.2 V	Go to **Step 8**	Go to **Step 6**
5	1. Reconnect the MAP sensor. 2. Disconnect engine oil pressure (EOP) sensor. 3. Measure the voltage from the 5-volt reference circuit of the EOP sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Intermittent Conditions**	Go to **Step 9**
6	1. Monitor the DMM while disconnecting the engine oil pressure (EOP) sensor. 2. If voltage changes when the sensor is disconnected, replace the component. Refer to **Engine Oil Pressure Sensor and/or Switch Replacement** in Engine Mechanical 5.7L. Was a component replaced?	-	Go to **Step 12**	Go to **Step 7**
7	1. Turn OFF the ignition. 2. Disconnect the Powertrain control module (PCM). 3. Test the 5-volt reference circuit for a short to ground or any sensor low reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
8	1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Turn ON the ignition, with the engine OFF. 4. Test the 5-volt reference circuit for a short	-		

	to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 12**	Go to **Step 11**
9	Test the MAP sensor signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
10	Replace the MAP sensor. Refer to **Manifold Absolute Pressure (MAP) Sensor Replacement** . Is the action complete?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
12	1. Use the scan tool in order to clear the DTCs. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC run and pass?	-	Go to **Step 13**	Go to **Step 2**
13	With a scan tool, observe the stored information, Capture Info. Does the scan tool display any DTCs that you have not diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0650

Circuit Description

The malfunction indicator lamp (MIL) is located on the instrument panel cluster (IPC). The MIL informs the driver that an emission system fault has occurred and that the engine control system requires service. The control module monitors the MIL control circuit for conditions that are incorrect for the commanded state of the MIL. For example, a failure condition exists if the control module detects low voltage when the MIL is commanded OFF, or high voltage when the MIL is commanded ON. If the control module detects an improper voltage on the MIL control circuit, DTC P0650 will set.

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The ignition voltage is between 6-18 volts.

Conditions for Setting the DTC

- The control module detects that the commanded state of the MIL driver and the actual state of the control circuit do not match.
- The conditions are present for a minimum of 5 seconds.

Action Taken When the DTC Sets

The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

> **5:** This step tests for a short to ground in the MIL control circuit. With the powertrain control module (PCM) disconnected and the ignition ON, the MIL should be OFF.
>
> **6:** This step tests for a short to voltage on the MIL control circuit. With the fuse removed, there should be no voltage on the MIL control circuit.

DTC P0650

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check- Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Verify whether the instrument cluster is operational. If the instrument panel (IP) is completely inoperative, refer to **Diagnostic System Check - Instrument Cluster** in Instrument Panel, Gages and Console. 2. Command the MIL ON and OFF with a scan tool.	-		

	Does the MIL turn ON and OFF when commanded with a scan tool?		Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Does the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	Inspect the fuse that supplies battery voltage to the MIL. Is the fuse open?	-	Go to **Step 12**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the powertrain control module (PCM). Refer to **Powertrain Control Module (PCM) Replacement** . 3. Turn ON the ignition. Is the MIL OFF?	-	Go to **Step 6**	Go to **Step 13**
6	1. Turn OFF the ignition. 2. Remove the fuse that supplies voltage to the MIL. 3. Turn ON the ignition, with the engine OFF. 4. Measure the voltage from the MIL control circuit in the PCM to a good ground. Is the voltage less than the specified value?	0.3 V	Go to **Step 7**	Go to **Step 14**
7	1. Turn OFF the ignition. 2. Install the fuse that supplies voltage to the MIL. 3. Turn ON the ignition, with the engine OFF. 4. Connect a 3-amp fused jumper wire between the MIL control circuit of the PCM and a good ground. Is the MIL illuminated?	-	Go to **Step 11**	Go to **Step 8**
	1. Turn OFF the ignition.			

8	2. Remove the instrument panel cluster (IPC). Refer to **Instrument Panel Cluster (IPC) Replacement** in Instrument Panel, Gages, and Console. 3. Probe the MIL battery positive voltage circuit of the IPC harness connector with a test lamp that is connected to a good ground. Does the test lamp illuminate?	-	Go to **Step 9**	Go to **Step 15**
9	Test the MIL control circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct a condition?	-	Go to **Step 18**	Go to **Step 10**
10	Test for an intermittent and for a poor connection at the IPC. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 16**
11	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 17**
12	Repair the short to ground in the battery positive voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 18**	-
13	Repair the short to ground in the MIL control circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 18**	-
14	Repair the short to voltage in the MIL control circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 18**	-
15	Repair the open in the MIL battery positive voltage. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 18**	-
16	Replace the IPC. Refer to **Instrument Panel Cluster (IPC) Replacement** in Instrument Panel, Gages, and Console. Did you complete the replacement?	-	Go to **Step 18**	-
17	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 18**	-
	1. Clear the DTCs with a scan tool.			

18	2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 19**
19	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0651

Circuit Description

The powertrain control module (PCM) provides 5 volts to the following sensors:

- The air conditioning (A/C) pressure sensor.
- The fuel tank pressure (FTP) sensor

These 5-volt reference circuits are independent of each other outside the PCM, but are bussed together inside the PCM. Therefore a circuit condition on one sensor 5-volt reference circuit may affect the other sensor 5-volt reference circuits. The PCM monitors the voltage on the 5-volt reference circuit. If the PCM detects that the voltage is out of tolerance, DTC P0651 sets.

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The PCM detects a voltage out of tolerance condition on the 5-volt reference circuit.
- The above condition is present for longer than 10 seconds.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze

Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

9: A short to voltage on the signal circuit of the fuel tank pressure (FTP) sensor will backfeed through the sensor into the 5-volt reference circuit and set this DTC.

DTC P0651

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Does the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions**
3	1. Turn OFF the ignition. 2. Disconnect the air conditioning (A/C) pressure sensor. 3. Turn ON the ignition, with the engine OFF. 4. Measure the voltage from the 5-volt reference circuit of the A/C pressure sensor	4.8-5.2 V		

	to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?		Go to **Step 4**	Go to **Step 5**
4	1. Connect the A/C pressure sensor. 2. Disconnect the fuel tank pressure (FTP) sensor. 3. Measure the voltage from the 5-volt reference circuit of the FTP sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.8-5.2 V	Go to **Intermittent Conditions**	Go to **Step 11**
5	Is the voltage measured in step 3 more than the specified value?	5.2 V	Go to **Step 8**	Go to **Step 6**
6	Monitor the DMM while disconnecting the FTP sensor. Does the voltage return to within the specified range when the FTP is disconnected?	4.8-5.2 V	Go to **Step 10**	Go to **Step 7**
7	1. Turn OFF the ignition. 2. Disconnect the powertrain control module (PCM). 3. Test the 5-volt reference circuit for a short to ground or any sensor low reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
8	1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Turn ON the ignition, with the engine OFF. 4. Test all 5-volt reference circuits for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 9**
9	Test the FTP sensor signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
10	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-

11	Replace the A/C pressure sensor. Refer to **Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement** in Heating, Ventilation and Air Conditioning. Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
13	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 14**
14	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P1111

Circuit Description

The intake air temperature (IAT) sensor is a variable resistor. The IAT sensor has a signal circuit and a low reference circuit. The IAT sensor measures the temperature of the air entering the engine. The powertrain control module (PCM) supplies 5 volts to the IAT signal circuit and a ground for the IAT low reference circuit. When the IAT sensor is cold, the sensor resistance is high. When the air temperature increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the IAT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the IAT signal circuit. If the PCM detects an intermittent high IAT signal voltage, indicating a low temperature, DTC P1111 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0113 are not set.
- The engine run time is more than 120 seconds.
- The engine coolant is more than 60°C (140°F).
- The vehicle speed is less than 11 km/h (7 mph).
- The mass air flow is less than 15 g/s.

Conditions for Setting the DTC

The intake air temperature is less than -38°C (-36°F) intermittently for a calibrated amount of time.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- The driver information center, if equipped, may display a message.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

DTC P1111

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Observe the DTC Information with a scan tool. Is DTC P0113 set?	Go to **DTC P0113**	Go to **Step 3**
3	Test for an intermittent and for a poor connection at the IAT sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 4**
4	Test the IAT signal circuit between the IAT sensor and the PCM for an intermittent open. Refer to **Inducing Intermittent Fault Conditions** , **Circuit Testing** , and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 5**
5	Test the IAT signal circuit between the IAT sensor and the PCM for an intermittent short to voltage. Refer to **Inducing Intermittent Fault Conditions** , **Circuit Testing** , and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Step 6**
6	Test the low reference circuit for an intermittent open. Refer to **Inducing Intermittent Fault Conditions** , **Circuit Testing** , and **Wiring Repairs** in Wiring Systems.		

	Did you find and correct the condition?	Go to **Step 8**	Go to **Step 7**
7	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 8**	Go to **Intermittent Conditions**
8	1. Clear the DTCs with a scan tool. 2. Turn off the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 9**
9	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P1112

Circuit Description

The intake air temperature (IAT) sensor is a variable resistor. The IAT sensor has a signal circuit and a low reference circuit. The IAT sensor measures the temperature of the air entering the engine. The powertrain control module (PCM) supplies 5 volts to the IAT signal circuit and a ground for the IAT low reference circuit. When the IAT sensor is cold, the sensor resistance is high. When the air temperature increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the IAT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the IAT signal circuit. If the PCM detects an intermittent low IAT signal voltage, indicating a high temperature, DTC P1112 sets.

Conditions for Running the DTC

- DTCs P0112, P0500, P0502, P0503 are not set.
- The engine run time is more than 45 seconds.
- The vehicle speed is more than 40 km/h (25 mph).
- The engine coolant temperature (ECT) is less than 125°C (257°F).

Conditions for Setting the DTC

The PCM detects that the intake air temperature sensor parameter is more than 128°C (262°F) intermittently for a calibrated amount of time.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- The driver information center, if equipped, may display a message.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

DTC P1112

Step	Action	Yes	No
Schematic Reference:Engine Controls Schematics **Connector End View Reference:Powertrain Control Module (PCM) Connector End Views** or **Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Observe the DTC information with a scan tool. Is DTC P0112 set?	Go to **DTC P0112**	Go to **Step 3**
3	Test for an intermittent and for a poor connection at the IAT sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 5**	Go to **Step 4**
4	Test the IAT signal circuit between the IAT sensor and the PCM for an intermittent short to ground. Refer to **Inducing Intermittent Fault Conditions** , **Circuit Testing** , and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 5**	Go to **Intermittent Conditions**
5	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 6**
	Observe the Capture Info with a scan tool.	Go to **Diagnostic**	

6	Are there any DTCs that have not been diagnosed?	**Trouble Code (DTC) List**	System OK

DTC P1114

Circuit Description

The engine coolant temperature (ECT) sensor is a variable resistor, that measures the temperature of the engine coolant. The powertrain control module (PCM) supplies 5 volts to the ECT signal circuit and a ground for the ECT low reference circuit. When the ECT is cold, the sensor resistance is high. When the ECT increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the ECT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the ECT signal circuit. If the PCM detects an excessively low ECT signal voltage, which is a high temperature indication, DTC P1114 sets.

Conditions for Running the DTC

The engine run time is more than 10 seconds.

Conditions for Setting the DTC

The PCM detects that the ECT sensor parameter is more than 139°C (282°F) intermittently for a calibrated amount of time.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- The driver information center, if equipped, may display a message.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

DTC P1114

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views			
1	Did you perform the Diagnostic System Check-Engine Controls?		Go to **Diagnostic System Check -**

		Go to **Step 2**	**Engine Controls**
2	Observe the DTC information with a scan tool. Is DTC P0117 set?	Go to **DTC P0117**	Go to **Step 3**
3	Observe the engine coolant temperature (ECT) sensor parameter with a scan tool while moving the ECT sensor connector and the powertrain control module (PCM) connector. Refer to **Inducing Intermittent Fault Conditions** in Wiring Systems. Does the scan tool indicate an abrupt change in value?	Go to **Step 5**	Go to **Step 4**
4	Observe the ECT parameter with a scan tool while moving the wiring harness at the ECT sensor and the PCM. Refer to **Inducing Intermittent Fault Conditions** in Wiring Systems. Does the scan tool indicate an abrupt change in value?	Go to **Step 6**	Go to **Step 7**
5	Repair the ECT connector or the terminal as necessary. Refer to **Connector Repairs** in Wiring Systems. Did you complete the repair?	Go to **Step 7**	-
6	Repair the ECT wiring or the wiring harness as necessary. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	Go to **Step 7**	-
7	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 8**
8	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P1115

Circuit Description

The engine coolant temperature (ECT) sensor is a variable resistor, that measures the temperature of the engine coolant. The powertrain control module (PCM) supplies 5 volts to the ECT signal circuit and a ground for the ECT low reference circuit. When the ECT is cold, the sensor resistance is high. When the ECT increases, the sensor resistance decreases. With high sensor resistance, the PCM detects a high voltage on the ECT signal circuit. With lower sensor resistance, the PCM detects a lower voltage on the ECT signal circuit. If the PCM detects an excessively high signal voltage, which is a low temperature indication, DTC P1115 sets.

Conditions for Running the DTC

The engine run time is more than 60 seconds.

Conditions for Setting the DTC

The PCM detects an ECT of less than -38°C (-36°F) intermittently for a calibrated amount of time.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- The driver information center, if equipped, may display a message.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

DTC P1115

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Observe the DTC information with a scan tool. Is the DTC P0118 set?	Go to **DTC P0118**	Go to **Step 3**
3	Observe the engine coolant temperature (ECT) sensor parameter with a scan tool while moving the ECT sensor connector and the powertrain control module (PCM) connector. Refer to **Inducing Intermittent Fault Conditions** in Wiring Systems. Does the scan tool indicate an abrupt change in value?	Go to **Step 5**	Go to **Step 4**
4	Observe the ECT parameter with a scan tool while moving the wiring harness at the ECT sensor and the PCM. Refer to **Inducing Intermittent Fault Conditions** in Wiring Systems. Does the scan tool indicate an abrupt change in value?	Go to **Step 6**	Go to **Step 7**
5	Repair the ECT connector or the terminal as necessary. Refer to **Connector Repairs** in Wiring Systems. Did you complete the repair?	Go to **Step 7**	-
	Repair the wiring harness or the wiring as necessary. Refer to		

6	**Wiring Repairs** in Wiring Systems. Did you complete the repair?	Go to **Step 7**	-
7	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 8**
8	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P1125

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually 3 individual APP sensors within 1 housing. Three separate signal, low reference, and 5-volt reference circuits are used in order to connect the accelerator pedal sensor assembly and the throttle actuator control (TAC) module. If only one APP sensor DTC is set, the redundant APP systems allow the TAC system to continue operating normally. This DTC sets if the powertrain control module (PCM) detects a condition with more than one APP sensor. One APP sensor DTC will not cause the Reduced Engine Power message to be displayed. Two APP sensor DTCs for the same sensor also will not cause the Reduced Engine Power message to be displayed. However, if two or more DTCs are set involving more than 1 APP sensor, this DTC will set and the Reduced Engine Power message is displayed.

Conditions for Running the DTC

- DTCs P2108, or P1518 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- Two or more APP sensors are out of range, all 3 APP sensors disagree, or 1 APP sensor is out of range and the other 2 APP sensors disagree.
- All of the above conditions present for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module

stores this information in the Freeze Frame and/or the Failure Records.

- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- The APP sensor 1 and the throttle position (TP) sensor 1 5-volt reference circuits are internally connected within the TAC module.
- The APP sensor 2 and the TP sensor 2 5-volt reference circuits are internally connected within the TAC module.
- When the TAC module detects a condition within the TAC system, more than 1 TAC System related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Keep this in mind when reviewing the DTC Info.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

2: When the problems are corrected which are causing the APP sensor DTCs to set, the status of this DTC will change to History.

DTC P1125 - Accelerator Pedal Position (APP) Sensor System

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	This DTC indicates that two or more accelerator pedal position (APP) sensor DTCs are also set. Go to the APP sensor DTCs that are set and perform those diagnostic tests.	Go to **Diagnostic Trouble Code (DTC) List**	-

DTC P1133 OR P1153

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. This diagnostic will only run once per ignition cycle. The PCM monitors the number of rich-to-lean and lean-to-rich transitions. If the PCM detects that the number of transitions were less than a specified value, DTC P1133 sets for HO2S bank 1 sensor 1, or DTC P1153 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0131, P0132, P0135, P0151, P0152, P0155, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ECT Sensor parameter is more than 50°C (122°F).
- The EVAP Purge Solenoid Command parameter is more than 1 percent.
- The MAF Sensor parameter is between 20-55 g/s.
- The Engine Speed parameter is between 1,000-2,300 RPM.
- The TP Indicated Angle parameter is 5 percent more than the value observed at idle.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The Engine Run Time parameter is more than 160 seconds.
- The above conditions are met for 60 seconds.

Conditions for Setting the DTC

The PCM detects that the affected HO2S lean-to-rich or rich-to-lean transitions are less than a calibrated value.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage is varying above and below the specified value, the condition is not present.

DTC P1133 or P1153

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. Observe the affected heated oxygen sensor (HO2S) voltage parameter with a scan tool. Is the HO2S voltage parameter varying above and below the specified range?	250-625 mV	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**

4	1. Turn OFF the ignition. 2. Disconnect the affected heated oxygen sensor (HO2S). 3. Turn ON the ignition, with the engine OFF. 4. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 6**	Go to **Step 5**
5	1. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground. 2. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 8**	Go to **Step 7**
6	Test the HO2S high signal circuit for a short to the HO2S low signal circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
7	Test the HO2S high signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
8	1. Remove the jumper wire from the previous step. 2. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 3. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 10**	Go to **Step 9**
9	Test the HO2S low signal circuit for an open, or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 11**
10	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector**	-		

	Repairs in Wiring Systems. Did you find and correct the condition?		Go to **Step 14**	Go to **Step 12**
11	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 14**	Go to **Step 13**
12	**NOTE:** **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** **IMPORTANT:** **The HO2S may be damaged due to contamination. Prior to replacing the HO2S inspect for the following sources of contamination:** • A silicon contaminated HO2S • Fuel contamination-Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (without Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (with Special Tool)** . • Engine oil consumption-Refer to **Oil Consumption Diagnosis** in Engine Mechanical. • Engine coolant consumption-Refer to **Loss of Coolant** in Engine Cooling. Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1** .Did you complete the replacement?	-	Go to **Step 14**	-
13	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 14**	-
14	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 15**
	Observe the Capture Info with a scan tool.		Go to	

15	Are there any DTCs that have not been diagnosed?	-	**Diagnostic Trouble Code (DTC) List**	System OK

DTC P1134 OR P1154

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. This diagnostic will only run once per ignition cycle. The PCM monitors the rich-to-lean and lean-to-rich transition time. A transition is defined as, the HO2S voltage changes from above 625 mV to below 250 mV or from below 250 mV to above 625 mV. If the PCM detects that the difference between the rich-to-lean average transition time and lean-to-rich average transition time is more than a specified value, DTC P1134 sets for HO2S bank 1 sensor 1, or DTC P1154 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0131, P0132, P0135, P0151, P0152, P0155, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ECT Sensor parameter is more than 50°C (122°F).
- The EVAP Purge Solenoid Command parameter is more than 1 percent.
- The MAF Sensor parameter is between 20-55 g/s.
- The Engine Speed parameter is between 1,000-2,300 RPM.
- The TP Indicated Angle parameter is 5 percent more than the value observed at idle.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Tank Level Remaining parameter is more than 10 percent.
- The Engine Run Time parameter is more than 160 seconds.
- The above conditions are met for 60 seconds.

Conditions for Setting the DTC

The PCM detects that the difference between the HO2S rich-to-lean average transition time and the lean-to-rich average transition time is more than a calibrated value.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition cycle that the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The first time the diagnostic fails, the control module stores this information in the Failure Records. If the diagnostic reports a failure on the second consecutive ignition cycle, the control module records the operating conditions at the time of the failure. The control module writes the operating conditions to the Freeze Frame and updates the Failure Records.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

2: If the voltage is varying above and below the specified value, the condition is not present.

DTC P1134 or P1154

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Engine Controls Connector End Views or Powertrain Control Module (PCM) Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Start the engine. 2. Allow the engine to reach operating temperature. Refer to **Scan Tool Data List** . 3. Operate the engine at 1,500 RPM for 30 seconds. 4. Observe the affected heated oxygen sensor (HO2S) voltage parameter with a scan tool. Is the HO2S voltage parameter varying above and below the specified range?	250-625 mV	Go to **Step 3**	Go to **Step 4**
	1. Observe the Freeze Frame/Failure Records for this DTC.			

3	2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the affected HO2S. 3. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and a good ground. 4. Turn ON the ignition, with the engine OFF. 5. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 6**	Go to **Step 5**
5	Test the HO2S high signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 9**
6	1. Remove the jumper wire from the previous step. 2. Connect a 3-amp fused jumper wire between the high signal circuit of the HO2S harness connector on the engine harness side and the low signal circuit of the HO2S harness connector on the engine harness side. 3. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter less than the specified value?	100 mV	Go to **Step 8**	Go to **Step 7**
7	Test the HO2S low signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 9**
8	Test for shorted terminals and for poor connections at the HO2S. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 12**	Go to **Step 10**
9	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
10	**NOTE:** **Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** **IMPORTANT:** **The HO2S may be damaged due to contamination. Prior to replacing the HO2S inspect for the following sources of contamination:** • A silicon contaminated HO2S • Fuel contamination-Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (without Special Tool)** or **Alcohol/Contaminants-in-Fuel Diagnosis (with Special Tool)** . • Engine oil consumption-Refer to **Oil Consumption Diagnosis** in Engine Mechanical. • Engine coolant consumption-Refer to **Loss of Coolant** in Engine Cooling. Replace the affected HO2S. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1** .Did you complete the replacement?	-	Go to **Step 12**	-
11	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
12	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 13**
	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?		Go to **Diagnostic**	

13		-	**Trouble Code (DTC) List**	System OK

DTC P1380

System Description

The powertrain control module (PCM) detects engine misfire events by monitoring variations in the crankshaft rotation speed. Wheel speed changes caused by rough road conditions can cause changes in crankshaft rotation speed. By monitoring the wheel speed sensors, the antilock brake system (ABS) can determine if the vehicle is operating on a rough road. If the ABS is detecting a rough road condition severe enough to effect misfire detection, a rough road signal is sent to the PCM on the serial data circuit. If DTC P0300 is set and the rough road information is not available due to an ABS malfunction, DTC P1380 will set.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0335, P0336, P0742, P1120, P1121, P1220, and P1221 are not set.
- The vehicle speed is more than 16 km/h (10 mph).
- The engine load is less than 60 percent.
- The engine misfire is detected-DTC P0300 set.
- The engine speed is less than 3,200 RPM.

Conditions for Setting the DTC

An ABS malfunction exists preventing the PCM from receiving rough road detection data.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- The driver information center, if equipped, may display a message.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

DTC P1380

Step	Action	Yes	No
1	Did you perform the Diagnostic	Go to **Diagnostic System Check -**	Go to **Diagnostic System**

DTC P1381

System Description

The powertrain control module (PCM) detects engine misfire events by monitoring variations in the crankshaft rotation speed. Wheel speed changes caused by rough road conditions can cause changes in crankshaft rotation speed. By monitoring the wheel speed sensors, the antilock brake system (ABS) can determine if the vehicle is operating on a rough road. If the ABS is detecting a rough road condition severe enough to effect misfire detection, a rough road signal is sent to the PCM on the serial data circuit. If DTC P0300 is set and the rough road information is not available due to an ABS malfunction, DTC P1381 will set.

Conditions for Running the DTC

- The vehicle speed is more than 16 km/h (10 mph).
- The engine speed is less than 3,200 RPM.
- The engine load is less than 60 percent.
- Engine misfire is detected-DTC P0300 set.

Conditions for Setting the DTC

- A serial data malfunction exists preventing the PCM from receiving rough road detection data.
- The above conditions met for 20 seconds.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- The driver information center, if equipped, may display a message.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

Test Description

The number below refers to the step number on the diagnostic table.

1: This step will diagnose a malfunction in the serial data circuits.

DTC P1381

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Diagnostic System Check - ABS** in Antilock Brake System	Go to **Diagnostic System Check - Engine Controls**

DTC P1516

Circuit Description

The predicted throttle position is compared to the actual throttle position. The 2 values should be within a calibrated range of each other. Both the powertrain control module (PCM) and the throttle actuator control (TAC) module redundantly monitor the predicted and the actual throttle position. This DTC sets if the TAC detects an out of range condition between the predicted and the actual throttle position.

Conditions for Running the DTC

- DTC P1518 is not set.
- The ignition switch is in the crank or the run position.
- The ignition voltage is greater than 5.23 volts.
- The TAC system is not in the battery saver mode.

Conditions for Setting the DTC

- The TAC module detects that the predicted and actual throttle positions are not within a calibrated range of each other.

  OR

- The PCM and the TAC cannot determine throttle position.

  OR

- Both throttle position (TP) sensors are invalid
- All of the above conditions are met for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- Ensure that the starting and charging systems are operating properly. Low system voltage can cause this DTC to set.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Stored Capture Info.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

7: If the TP Indicated angle does not follow the movement of the throttle blade, and no TP Sensor DTCs are set, there is a mechanical condition with the throttle shaft or the TP sensor.

18: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P1516

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Are DTCs P1518 and P2135 both set also?	Go to **DTC P2135**	Go to **Step 3**
3	Is DTC P2135 set?	Go to **DTC P2135**	Go to **Step 4**

4	1. Turn OFF the ignition for 15 seconds. 2. Turn ON the ignition, with the engine OFF. 3. Observe the throttle position (TP) sensor 1 and the TP sensor 2 angle parameters. 4. Slowly depress the accelerator pedal to wide open throttle (WOT) and slowly return the pedal to the released position. Does the scan tool indicate both angle parameters increasing as the pedal is depressed to WOT and decreasing as the pedal is released?	Go to Diagnostic Aids	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the throttle actuator motor harness connector. 3. Remove the air inlet duct from the throttle body. 4. Inspect the throttle body and the throttle plate for debris, damage, and tampering that could cause the throttle plate to bind. If debris is found, clean the throttle body and repair the source of contamination. If the throttle body and/or throttle plate is damaged, replace the throttle body. Refer to **Throttle Body Assembly Replacement** . Did you find and correct the condition?	Go to **Step 17**	Go to **Step 6**
6	Manually, slowly open the throttle plate to WOT and return the plate back to the closed position several times. Does the throttle plate move smoothly without binding in both directions?	Go to **Step 7**	Go to **Step 14**
7	1. Turn ON the ignition, with the engine OFF. 2. Manually, slowly open the throttle blade to WOT and return the plate to the closed throttle position while observing the TP sensor 1 and TP sensor 2 angle parameters on the scan tool. Does the scan tool indicate both angle parameters increasing as the throttle blade is moved to WOT and decreasing as the throttle blade is moved to the closed position?	Go to **Step 8**	Go to **Step 15**
8	1. Turn OFF the ignition. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the TAC motor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the TAC motor circuits for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.		

	Did you find and correct the condition?	Go to **Step 17**	Go to **Step 9**
9	Test each TAC motor circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 17**	Go to **Step 10**
10	Test each TAC motor circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 17**	Go to **Step 11**
11	1. Disconnect the other TAC module harness connector. 2. Test for a short between each TAC motor circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 17**	Go to **Step 12**
12	1. Turn OFF the ignition. 2. Reconnect the TAC module. 3. Connect a test lamp between the 2 TAC motor circuits at the TAC motor harness connector. 4. Turn ON the ignition, with the engine OFF and observe the test lamp. Did the test lamp illuminate briefly when the ignition was turned ON?	Go to **Step 13**	Go to **Step 15**
13	Inspect for poor connections at the TAC motor harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 17**	Go to **Step 14**
14	Replace the throttle body assembly. Refer to **Throttle Body Assembly Replacement** . Did you complete the replacement?	Go to **Step 17**	-
15	Inspect for poor connections at the TAC module harness connectors. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 17**	Go to **Step 16**
16	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	Go to **Step 17**	-
	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine.		

17	4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	Go to **Step 18**	Go to **Step 2**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2101

Circuit Description

The commanded throttle position, based on accelerator pedal position and possibly on other limiting factors, is compared to the actual throttle position. The 2 values should be within a calibrated range of each other. Both the powertrain control module (PCM) and the throttle actuator control (TAC) module redundantly monitor the commanded and actual throttle position. If the PCM detects an out-of-range condition between the commanded and the actual pedal position, DTC P2101 sets.

Conditions for Running the DTC

- DTCs P0601, P0602, P0604, P0606, P1516, P2108, U0107 are not set.
- DTCs P0120, P0220 and P2135 are not set at the same time, or DTCs P0120 and P0220 are not set at the same time.
- The ignition switch is in the crank or the run position.
- The ignition voltage is greater than 8.5 volts.
- The TAC system is not in the battery saver mode.

Conditions for Setting the DTC

- The PCM detects that the commanded and the actual throttle positions are not within a calibrated range of each other.
- The above condition is met for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- If you do not find any trouble, inspect for mechanical problems or for binding that may be temperature related. Components may not move freely in extreme heat or cold due to the presence of contaminants or due to ice formation.
- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no circuit or component conditions found during diagnostic testing.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the stored information, Capture info.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

5: If the throttle position (TP) Indicated angle does not follow the movement of the throttle blade, and no TP sensor DTCs are set, there is a mechanical condition with the throttle shaft or with the TP sensor.

16: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the stored information, Capture info.

DTC P2101

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Are DTCs P2135 and U0107 both set?	Go to **DTC U0107**	Go to **Step 3**
3	Is DTC P2135 set?	Go to **DTC P2135**	Go to **Step 4**

4	**IMPORTANT:** **The next test must be started within 15 seconds after the ignition is turned ON.** 1. Turn OFF the ignition for 15 seconds. 2. Turn ON the ignition, with the engine OFF. 3. Observe the TP sensor 1 and TP sensor 2 angle parameters with a scan tool. 4. Slowly depress the accelerator pedal to wide open throttle (WOT) and slowly return the pedal to the released position. Does the scan tool indicate both angle parameters increasing as the pedal is depressed to WOT and decreasing as the pedal is moved to the released position?	Go to Diagnostic Aids	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Remove the air duct from the throttle body assembly. 3. Disconnect the throttle actuator control motor harness connector. 4. Turn ON the ignition, with the engine OFF. 5. With your hand, slowly open the throttle blade to WOT and then to the closed throttle position while observing the TP sensor 1 and TP sensor 2 angle parameters on the scan tool. Does the scan tool indicate both angle parameters increasing as the throttle plate is moved to WOT and decreasing as the throttle plate is moved to the closed position?	Go to **Step 6**	Go to **Step 13**
6	1. Turn OFF the ignition. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the throttle actuator control motor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the throttle actuator control motor circuits for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 15**	Go to **Step 7**
7	Test each throttle actuator control motor circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 15**	Go to **Step 8**

8	Test each throttle actuator control motor circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 15**	Go to **Step 9**
9	1. Disconnect the other TAC module harness connector. 2. Test for a short between each throttle actuator control motor circuit and all other TAC module circuits. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 15**	Go to **Step 10**
10	1. Turn OFF the ignition. 2. Connect the TAC module. 3. Connect a test lamp between the two throttle actuator control motor terminals at the throttle actuator control motor harness connector. 4. Turn ON the ignition, with the engine OFF and observe the test lamp. Did the test lamp illuminate briefly when the ignition was turned ON?	Go to **Step 11**	Go to **Step 13**
11	Inspect for poor connections at the throttle actuator control motor harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 15**	Go to **Step 12**
12	Replace the throttle body assembly. Refer to **Throttle Body Assembly Replacement** . Did you complete the replacement?	Go to **Step 15**	-
13	Inspect for poor connections at the TAC module harness connectors. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 15**	Go to **Step 14**
14	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	Go to **Step 15**	-
15	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the		

	Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 16**
16	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2108

Circuit Description

The throttle actuator control (TAC) module contains data which is essential for proper TAC system operation. The TAC module continuously tests the integrity of this data. When the TAC module is unable to write or read data to and from random access memory (RAM) or when the TAC module is unable to correctly read data from the flash memory, or when an internal TAC module processor fault is detected, this DTC sets.

Conditions for Running the DTC

- DTC P1518 is not set.
- The ignition switch is in the crank or the run position.
- The ignition voltage is greater than 6 volts.

Conditions for Setting the DTC

- The TAC module determines that an internal data test did not pass.
- All above conditions met for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Ensure the starting and charging systems are operating properly. Low system voltage can cause this DTC to set.
- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting the components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

Test Description

The number below refers to the step number on the diagnostic table.

4: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting the components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2108

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views , or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Replace the throttle actuator control (TAC) Module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	Go to **Step 3**	-
3	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	Go to **Step 4**	Go to **Step 2**
4	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2120

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually 3 individual APP sensors within 1 housing. Three separate signal, low reference and 5-volt reference circuits connect the APP sensor assembly to the throttle actuator control (TAC) module. Each sensor has a unique functionality. The APP sensor 1 signal is pulled up to the reference voltage as the accelerator pedal is depressed, from below 1 volt at 0 percent pedal travel, with the pedal at rest, to above 2 volts at 100 percent pedal travel, with the pedal fully depressed. The APP sensor 2 signal is pulled down to the low reference from above 4 volts at 0 percent pedal travel to below 2.9 volts at 100 percent pedal travel. The APP sensor 3 signal is pulled down to low reference from above 3.8 volts at 0 percent pedal travel to below 3.1 volts at 100 percent pedal travel. Throttle position (TP) sensor 1 and APP sensor 1 share a 5 volt reference circuit that is connected within the TAC module. TP sensor 2 and APP sensor 2 share a 5-volt reference circuit that is connected within the TAC module. If only 1 APP sensor DTC is set, the redundant APP systems allow the TAC system to continue operating normally. One APP sensor DTC will not cause the Reduced Engine Power message to be displayed. Two APP sensor DTCs for the same sensor also will not cause the Reduced Engine Power message to be displayed. If an out of range condition is detected with this APP sensor, this DTC will be set.

Conditions for Running the DTC

- DTCs P0601, P0602, P0606, P2108, or P1518 are not set.
- The ignition switch is in the crank or the run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- APP sensor 1 voltage ranges between 0.25-4.22 volts.
- All of the above conditions present for less than 1 second.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- If one or more APP sensor DTCs are set for a single APP sensor, the following occurs:
  - The control module will not command Reduced Engine Power mode.
  - The control module will use the remaining two APP sensors to calculate throttle response.
- If certain multiple APP sensor DTCs are set for more than one APP sensor, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to a predetermined value to limit the amount of throttle control.
  - The message center displays Reduced Engine Power.
- If all three APP sensors are out of range, the following occurs:

- The control module commands Reduced Engine Power mode.
- The APP indicated angle is limited to 0 percent. The control module only allows the engine to idle.
- The message center displays Reduced Engine Power.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects throttle movement with a DTC P2120 set, a DTC P2121 also sets.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- For an intermittent, refer to **Intermittent Conditions**

Test Description

The numbers below refer to the step numbers on the diagnostic table.

12: This test isolates whether the short is to another TAC system circuit in the harness or within the TAC module.

26: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2120

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
	IMPORTANT: **If DTC P1518 or P0120 is also set, refer to the appropriate DTC for further diagnosis.**			

2	1. Turn ON the ignition, with the engine OFF and your foot OFF the accelerator pedal. 2. Observe the accelerator pedal position (APP) sensor 1 voltage, with a scan tool. Does the scan tool indicate APP sensor 1 voltage within the specified values?	0.25-2.2 V	Go to **Step 3**	Go to **Step 6**
3	Depress the accelerator pedal to the wide open throttle (WOT) position. Does the scan tool indicate APP sensor 1 voltage within the specified values?	2.24-4.2 V	Go to **Step 4**	Go to **Step 6**
4	1. Turn OFF the ignition for 30 seconds. 2. Turn ON the ignition, with the engine OFF 3. Select the DTC option on the scan tool. 4. Lightly touch and move the related engine wiring harnesses and the connectors, while monitoring the DTC Information. Did this DTC fail this ignition, during the above test ?	-	Go to **Step 24**	Go to **Step 5**
5	1. Continue to observe the DTC Information. 2. Depress the accelerator pedal to WOT and then return the pedal to the released position. Did this DTC fail this ignition, during the above test ?	-	Go to **Step 19**	Go to Diagnostic Aids
6	Disconnect the APP sensor harness connector. Does the scan tool indicate APP sensor 1 voltage at the specified value?	0 V	Go to **Step 7**	Go to **Step 11**
7	Connect a test lamp between the APP sensor 1 signal circuit and B+. Does the scan tool indicate APP sensor 1 voltage at the specified value?	5 V	Go to **Step 8**	Go to **Step 13**
8	Test the APP sensor 1 5-volt reference circuit for voltage, with a DMM. Does the DMM indicate voltage within the specified values?	4.6-5.4 V	Go to **Step 10**	Go to **Step 9**
	1. Turn OFF the ignition. 2. Disconnect the throttle actuator motor harness connector. 3. Remove the air inlet duct from the throttle body assembly.			

9	4. Turn ON the ignition. 5. Manually rotate the throttle blade to WOT and hold. 6. Test the APP sensor 1 5-volt reference circuit for voltage, with a DMM. Does the DMM indicate voltage within the specified values?	4.6-5.4 V	Go to **Step 21**	Go to **Step 16**
10	1. Connect a fused jumper between the APP sensor 1 low reference circuit and the APP sensor 1 5-volt reference circuit. 2. Observe the throttle position (TP) sensor 1 voltage parameter, with a scan tool. Does the scan tool indicate the TP sensor 1 voltage is at the specified value?	0 V	Go to **Step 19**	Go to **Step 17**
11	1. Turn OFF the ignition. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the APP sensor circuits. 3. Turn ON the ignition with the engine OFF. 4. Test the APP sensor 1 signal circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 12**
12	1. Turn OFF the ignition. 2. Disconnect the other TAC module harness connector. 3. Test for a short between the APP sensor 1 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 22**
13	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits. 3. Test the APP sensor 1 signal circuit for an open or for high resistance, with a DMM.	-		

	Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 25**	Go to **Step 14**
14	Test the APP sensor 1 signal circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 15**
15	1. Turn OFF the ignition. 2. Disconnect the other TAC module harness connector. 3. Test for a short between the APP sensor 1 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 22**
16	1. Turn OFF the ignition. 2. Disconnect the TAC module connector containing the APP sensor circuits. 3. Test the APP sensor 1 5-volt reference circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 22**
17	1. Disconnect the TAC module connector containing the APP sensor circuits. 2. Test the APP sensor 1 low reference circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 18**
18	Test the TAC module ground circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 22**
19	Inspect for poor connections at the harness connector of the APP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 25**	Go to **Step 20**
20	Replace the APP sensor assembly. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the repair?	-	Go to **Step 25**	-
21	Did DTC P1120 set while performing step 9?	-	Go to **DTC P0120**	Go to **Step 22**
22	Inspect for poor connections at the harness connector of the TAC module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 23**
23	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the repair?	-	Go to **Step 25**	-
24	Repair the intermittent condition as necessary. Refer to **Connector Repairs** and **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 25**	-
25	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	-	Go to **Step 26**	Go to **Step 2**
26	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2121

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually 3 individual APP sensors within 1 housing. Three separate signal, low reference and 5-volt reference circuits connect the APP sensor assembly to the throttle actuator control (TAC) module. Each sensor has a unique functionality. The APP sensor 1 signal is pulled up to the reference voltage as the accelerator pedal is depressed, from below 1 volt at 0 percent pedal travel, with the pedal at rest. To above 2 volts at 100 percent pedal travel, with the pedal fully depressed. The APP sensor 2 signal is pulled down to the low reference from above 4 volts at 0 percent pedal travel to below 2.9 volts at 100 percent pedal travel. The APP sensor 3 signal is pulled down to low reference from above 3.8 volts at 0 percent pedal travel to below 3.1 volts at 100 percent pedal travel. TP sensor 1 and APP sensor 1 share a 5 volt reference circuit that is connected within the TAC module. TP sensor 2 and APP sensor 2 share a 5-volt reference circuit that is connected within the TAC module. If only 1 APP sensor DTC is set, the redundant APP systems allow the TAC system to continue operating normally. One APP sensor DTC will not cause the Reduced Engine Power message to be displayed. Two APP sensor DTCs for the same sensor also will not cause the Reduced Engine Power message to be displayed. If an out of range condition is detected with the APP sensors, DTC 2121 sets.

Conditions for Running the DTC

- DTCs P0606, P2108, or U0107 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- APP sensor 1 disagrees with APP sensor 2 by more than 10.5 percent and APP sensor 1 disagrees with APP sensor 3 by more than 13 percent.
- All of the above conditions are present for less than 1 second.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- If one or more APP sensor DTCs are set for a single APP sensor, the following occurs:
  - The control module will not command Reduced Engine Power mode.
  - The control module will use the remaining two APP sensors to calculate throttle response.
- If certain multiple APP sensor DTCs are set for more than one APP sensor, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to a predetermined value to limit the amount of throttle control.
  - The message center displays Reduced Engine Power.
- If all three APP sensors are out of range, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to 0 percent. The control module only allows the engine to idle.
  - The message center displays Reduced Engine Power.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other

non-emission related diagnostic.
- Clear the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects throttle movement with a DTC P2120 set, a DTC P2121 also sets.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- For an intermittent, refer to **Intermittent Conditions** .

Test description

The numbers below refer to the steps numbers in the diagnostic table.

2: This step determines if a communication condition exists.

5: This step isolates an internal APP sensor failure. The condition may only occur at a certain accelerator pedal position. Monitoring the APP angles for sensor 2 and sensor 3 is an accurate way of verifying the actual position of the pedal. The APP angles for all 3 sensors should be within a few percentages of each other. When the pedal is at rest, the APP angle for all 3 sensors should be 0 percent. When the pedal is fully depressed, all APP angles should be 100 percent.

6: The APP sensor 1 shares a common 5-volt reference circuit with the TP sensor 1. Monitoring the TP sensor 1 voltage aids in diagnosing the APP sensor 5-volt reference and the low reference circuits. If the scan tool displays near 0 volts then the circuits are OK.

9: With the TAC module still connected, this test will help determine a short to the signal circuit either within the TAC module or the wiring.

10: This step determines whether the TAC module or a shorted circuit is causing the condition.

19: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting the components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2121

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views , or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Is DTC U0107 also set?	-	Go to **DTC**	

			U0107	Go to **Step 3**
3	**IMPORTANT:** **Do not depress the accelerator pedal.** 1. Turn OFF the ignition for 15 seconds. 2. Start the engine. 3. Observe the DTC Information, with a scan tool. Did any other throttle actuator control (TAC) module or accelerator pedal position (APP) sensor DTC set except P1125?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 4**
4	Observe the APP sensor Agree/Disagree parameters, with a scan tool. Does the scan tool indicate Disagree for any of the APP Agree/Disagree parameters?	-	Go to **Step 6**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Turn ON the ignition with the engine OFF. 3. Observe the APP sensor angles for all 3 APP sensors, with a scan tool. 4. Slowly depress the accelerator pedal, stopping at 25, 50, 75, and 100 percent. 5. Slowly release the accelerator pedal, stopping at 75, 50, 25, and 0 percent. Does the scan tool indicate APP sensor 1 angle within 10.5 percent of the APP sensor 2 angle and APP sensor 1 angle within 13 percent of the APP sensor 3 angle during the above test?	-	Go to Diagnostic Aids	Go to **Step 6**
6	1. Turn OFF the ignition. 2. Disconnect the APP sensor harness connector. 3. Connect a fused jumper between the APP sensor 1 5-volt reference circuit and ground. 4. Turn ON the ignition with the engine OFF. 5. Observe the throttle position (TP) sensor 1 voltage parameter, with a scan tool. Does the scan tool indicate TP sensor 1 voltage at the specified value?	0.0 V	Go to **Step 7**	Go to **Step 11**
7	1. Connect a fused jumper between the APP sensor 1 5-volt reference circuit and the APP sensor 1 low reference circuit. 2. Observe the TP sensor 1 voltage parameter.	0.0 V		

	Does the scan tool indicate TP sensor 1 voltage at specified value?		Go to **Step 8**	Go to **Step 12**
8	1. Connect a fused jumper between the APP sensor 1 signal circuit and the APP sensor 1 5-volt reference circuit. 2. Observe the APP sensor 1 voltage parameter, with a scan tool. Does the scan tool indicate APP sensor 1 voltage near the specified value?	5.0 V	Go to **Step 14**	Go to **Step 9**
9	Test for a short between the APP sensor 1 signal circuit and all other APP circuits at the APP sensor harness connector, with a DMM. Does the DMM indicate a short to another circuit?	-	Go to **Step 10**	Go to **Step 13**
10	1. Turn OFF the ignition. 2. Disconnect both of the TAC module harness connectors. 3. Test for a short between the APP sensor 1 signal circuit and all other APP circuits at the APP sensor harness connector, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 15**
11	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP circuits. 3. Test the APP sensor 1 5-volt reference circuit for an open or the high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 15**
12	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP circuits. 3. Test the APP sensor 1 low reference circuit for an open or high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 15**

13	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP circuits. 3. Test the APP sensor 1 signal circuit for an open or the high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find an open or high resistance?	-	Go to **Step 18**	Go to **Step 15**
14	Inspect for poor connections at the harness connector of the APP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 16**
15	Inspect for poor connections at the harness connectors of the TAC Module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 18**	Go to **Step 17**
16	Replace the APP sensor assembly. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 18**	-
17	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 18**	-
18	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 19**
19	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2125

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually 3 individual APP sensors within 1 housing. Three separate signal, low reference and 5-volt reference circuits connect the APP sensor assembly to the throttle actuator control (TAC) module. Each sensor has a unique functionality. The APP sensor 1 signal is pulled up to the reference voltage as the accelerator pedal is depressed, from below 1 volt at 0 percent pedal travel, with the pedal at rest, to above 2 volts at 100 percent pedal travel, with the pedal fully depressed. The APP sensor 2 signal is pulled down to the low reference from above 4 volts at 0 percent pedal travel to below 2.9 volts at 100 percent pedal travel. The APP sensor 3 signal is pulled down to low reference from above 3.8 volts at 0 percent pedal travel to below 3.1 volts at 100 percent pedal travel. Throttle position (TP) sensor 1 and APP sensor 1 share a 5-volt reference circuit that is connected within the TAC module. TP sensor 2 and APP sensor 2 share a 5-volt reference circuit that is connected within the TAC module. If only 1 APP sensor DTC is set, the redundant APP systems allow the TAC system to continue operating normally. One APP sensor DTC will not cause the Reduced Engine Power message to be displayed. Two APP sensor DTCs for the same sensor also will not cause the Reduced Engine Power message to be displayed. If an out of range condition is detected with this APP sensor, this DTC will be set.

Conditions for Running the DTC

- DTCs P0601, P0602, P0606, P2108, or P1518 are not set.
- The ignition switch is in the crank or the run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- The APP sensor 2 voltage is less than 0.83 volts or greater than 4.81 volts.
- All of the above conditions are present for less than 1 second.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- If one or more APP sensor DTCs are set for a single APP sensor, the following occurs:
  - The control module will not command Reduced Engine Power mode.
  - The control module will use the remaining two APP sensors to calculate throttle response.
- If certain multiple APP sensor DTCs are set for more than one APP sensor, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to a predetermined value to limit the amount of throttle control.
  - The message center displays Reduced Engine Power.
- If all three APP sensors are out of range, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to 0 percent. The control module only allows the engine to idle.
  - The message center displays Reduced Engine Power.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects throttle movement with a DTC P2120 set, a DTC P2121 also sets.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: TP sensor 2 and the APP sensor 2 share a common 5-volt reference source. Diagnose DTC P0220 first, if this DTC is also set.

18: This test determines whether the TAC module can recognize a change in signal voltage.

19: There are 3 separate 5-volt reference sources within the TAC module. TP sensor 1 and APP sensor 1 share one 5-volt reference source, TP sensor 2 and APP sensor 2 share another common 5-volt reference source and APP sensor 3 uses the third by itself. This test determines whether the signal circuit is shorted to any one of the 5-volt reference circuits. If a short exists, the corresponding sensor voltage will be pulled low.

20: The previous step found the signal circuit and a 5-volt reference circuit shorted together. This test isolates whether the short is in the harness or within the TAC module.

26: When the TAC module detects a condition within the TAC System, more than 1 TAC System related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2125

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views , or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-		Go to **Diagnostic System Check -**

			Go to **Step 2**	**Engine Controls**
2	**IMPORTANT:** **If DTC P1518 or P0220 is also set, refer to Diagnostic Trouble Code (DTC) List and diagnose the applicable DTC first.** 1. Turn ON the ignition, with the engine OFF. 2. Observe the accelerator pedal position (APP) sensor 2 voltage parameter, with a scan tool. Does the scan tool indicate APP sensor 2 voltage is within the specified values?	3.90-4.81 V	Go to **Step 3**	Go to **Step 6**
3	Fully depress the accelerator pedal to the wide open throttle (WOT) position. Does the scan tool indicate APP sensor 2 voltage is within the specified values?	0.83-2.9 V	Go to **Step 4**	Go to **Step 6**
4	1. Turn OFF the ignition for 15 seconds. 2. Turn ON the ignition, with the engine OFF. 3. Observe the DTC Info with a scan tool. 4. Lightly touch and move the related engine wiring harnesses and the connectors for the APP sensor while observing the DTC status. 5. If the scan tool indicates this DTC failed this ignition during the above test, repair the intermittent condition as necessary. Refer to **Wiring Repairs** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 5**
5	Slowly depress the accelerator pedal to WOT and then slowly return the pedal to closed throttle while observing the DTC status. Did the scan tool indicator this DTC failed this ignition during the above test?	-	Go to **Step 21**	Go to Diagnostic Aids
6	1. Disconnect the APP sensor harness connector. 2. Test the APP sensor 2 signal circuit for voltage, with a DMM. Does the DMM indicate APP sensor 2 signal voltage within the specified values?	3.94-6.06 V	Go to **Step 11**	Go to **Step 7**
	1. Turn OFF the ignition. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the APP			

7	sensor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the APP sensor 2 signal circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 8**
8	Test the APP sensor 2 signal circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 9**
9	Test the APP sensor 2 signal circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 10**
10	Test for a short between the APP sensor 2 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 23**
11	Test the APP sensor 2 5-volt reference circuit for voltage, with a DMM. Does the DMM indicate voltage within the specified values?	3.94-6.06 V	Go to **Step 16**	Go to **Step 12**
12	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the APP sensor 2 5-volt reference circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 13**
13	Test the APP sensor 2 5-volt reference circuit for an open or high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 14**
14	Test the APP sensor 2 5-volt reference circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 15**

15	Test for a short between the APP sensor 2 5-volt reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 23**
16	With a DMM connected between the APP sensor 2 low reference circuit and the APP sensor 1 low reference circuit, measure resistance. Does the DMM indicate resistance within the specified values?	0-5 ohm	Go to **Step 18**	Go to **Step 17**
17	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits. 3. Test the APP sensor 2 low reference circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 23**
18	1. Connect a fused jumper between the APP sensor 2 signal circuit and the APP sensor 2 low reference circuit at the APP sensor harness connector. 2. Observe the APP sensor 2 voltage parameter, with a scan tool. Does the scan tool indicate APP sensor 2 voltage at the specified value?	0 V	Go to **Step 19**	Go to **Step 23**
19	1. Observe the APP sensor 1, APP sensor 3 and throttle position (TP) sensor 2 voltage parameters, with a scan tool. 2. Connect a fused jumper between the APP sensor 2 signal circuit and the APP sensor 2 low reference circuit at the APP sensor harness connector. Did the scan tool indicate a change in voltage in any of the parameters observed during the above test?	-	Go to **Step 20**	Go to **Step 21**
20	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connectors. 3. Test for a short between the APP sensor 2 signal circuit and all other TAC module	-		

	circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 25**	Go to **Step 23**
21	Inspect for poor connections at the harness connector of the APP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 22**
22	Replace the APP sensor assembly. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 25**	-
23	Inspect for poor connections at the harness connector of the TAC module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 24**
24	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 25**	-
25	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	-	Go to **Step 26**	Go to **Step 2**
26	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2126

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually 3 individual APP sensors within 1 housing. Three separate signal, low reference and 5-volt reference circuits connect the APP sensor assembly to the throttle actuator control (TAC) module. Each sensor has a unique functionality. The APP sensor 1 signal is pulled up to the reference voltage as the accelerator pedal is depressed, from below 1 volt at 0 percent pedal travel, with the pedal at rest, to above 2 volts at 100 percent pedal travel, with the pedal fully depressed. The APP sensor 2 signal is pulled down to the low reference from above 4 volts at 0 percent pedal travel to below 2.9 volts at 100 percent pedal travel. The APP sensor 3 signal is pulled down to low reference from above 3.8 volts at 0 percent pedal travel to below 3.1 volts at 100 percent pedal travel. Throttle position (TP) sensor 1 and APP sensor 1 share a 5-volt reference circuit that is connected within the TAC module. TP sensor 2 and APP sensor 2 share a 5-volt reference circuit that is connected within the TAC module. If only 1 APP sensor DTC is set, the redundant APP systems allow the TAC system to continue operating normally. One APP sensor DTC will not cause the Reduced Engine Power message to be displayed. Two APP sensor DTCs for the same sensor also will not cause the Reduced Engine Power message to be displayed. If an out of range condition is detected with this APP sensor, this DTC will be set.

Conditions for Running the DTC

- DTCs P0606, P2108, or U0107 are not set.
- The ignition switch is in the crank or the run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- APP sensor 2 disagrees with APP sensor 1 by more than 10.5 percent and APP sensor 2 disagrees with APP sensor 3 by more than 13 percent.
- All of the above conditions present for less than 1 second.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- If one or more APP sensor DTCs are set for a single APP sensor, the following occurs:
  - The control module will not command Reduced Engine Power mode.
  - The control module will use the remaining two APP sensors to calculate throttle response.
- If certain multiple APP sensor DTCs are set for more than one APP sensor, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to a predetermined value to limit the amount of throttle control.
  - The message center displays Reduced Engine Power.
- If all three APP sensors are out of range, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to 0 percent. The control module only allows the engine to idle.
  - The message center displays Reduced Engine Power.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects throttle movement with a DTC P2120 set, a DTC P2121 also sets.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the steps numbers in the diagnostic table.

2: This step determines if a communication condition exists.

5: This step isolates an internal APP sensor failure. The condition may only occur at a certain accelerator pedal position. Monitoring the APP angles for sensor 1 and sensor 3 is an accurate way of verifying the actual position of the pedal.

6: The APP sensor 2 shares a common 5-volt reference circuit with the TP sensor 2. Monitoring the TP sensor 2 voltage aids in diagnosing the APP sensor 5-volt reference and low reference circuits. If the scan tool displays near 0 volts then the circuits are OK.

18: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2126

Step	Action	Values	Yes	No
Schematic Reference:Engine Controls Schematics **Connector End View References:Powertrain Control Module (PCM) Connector End Views** or **Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Is DTC U0107 also set?	-	Go to **DTC U0107**	Go to **Step 3**
	IMPORTANT: **Do not depress the accelerator pedal.**			

3	1. Turn OFF the ignition for 15 seconds. 2. Start the engine. 3. Observe the DTC Info, with a scan tool. Did any other throttle actuator control (TAC) module or accelerator pedal position (APP) sensor DTCs set except P1125?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 4**
4	Observe the APP sensor Agree/Disagree parameters, with a scan tool. Does the scan tool indicate Disagree for any of the APP sensors Agree/Disagree parameters?	-	Go to **Step 6**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Turn ON the ignition, with the engine OFF. 3. Observe the APP sensor angles for all 3 APP sensors, with a scan tool. 4. Slowly depress the accelerator pedal, stopping at 25, 50, 75, and 100 percent. 5. Slowly release the accelerator pedal, stopping at 75, 50, 25, and 0 percent. Does the scan tool indicate that the APP sensor 2 angle is within 10.5 percent of the APP sensor 1 angle, and that the APP sensor 2 angle is within 13 percent of the APP sensor 3 angle during the above test?	-	Go to Diagnostic Aids	Go to **Step 6**
6	1. Turn OFF the ignition. 2. Disconnect the APP sensor harness connector. 3. Connect a fused jumper between the APP sensor 2 5-volt reference circuit and ground. 4. Turn ON the ignition, with the engine OFF. 5. Observe the throttle position (TP) sensor 2 voltage parameter, with a scan tool. Does the scan tool indicate TP sensor 2 voltage at the specified value?	0 V	Go to **Step 7**	Go to **Step 11**
7	1. Connect a fused jumper between the APP sensor 2 5-volt reference circuit and the APP sensor 2 low reference circuit. 2. Observe the TP sensor 2 voltage parameter, with a scan tool. Does the scan tool indicate TP sensor 2 voltage at	0 V		

	specified value?		Go to **Step 8**	Go to **Step 11**
8	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP circuits. 3. Test the APP sensor 2 signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 9**
9	1. Turn OFF the ignition. 2. Test for a short between the APP sensor 2 signal circuit and all other APP circuits at the APP sensor harness connector. Does the DMM indicate a short to another circuit?	-	Go to **Step 10**	Go to **Step 13**
10	1. Disconnect the TAC module harness connector containing the APP sensor circuits. 2. Test for a short between the APP sensor 2 signal circuit and all other APP circuits at the APP sensor harness connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 13**
11	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP circuits. 3. Test the APP sensor 2 5-volt reference circuit for an open or for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 12**
12	Test the APP sensor 2 low reference circuit for an open or for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**
13	Inspect for poor connections at the harness connector of the APP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
	Inspect for poor connections at the harness			

14	connectors of the TAC module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 16**
15	Replace the accelerator pedal assembly. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
16	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
17	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2130

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually 3 individual APP sensors within 1 housing. Three separate signal, low reference and 5-volt reference circuits connect the APP sensor assembly and the throttle actuator control (TAC) module. Each sensor has a unique functionality. The APP sensor 1 signal increases as the accelerator pedal is depressed, from below 1 volt at 0 percent pedal travel, with the pedal at rest, to above 2 volts at 100 percent pedal travel, with the pedal fully depressed. The APP sensor 2 signal decreases from above 4 volts at 0 percent pedal travel to below 2.9 volts at 100 percent pedal travel. The APP sensor 3 signal decreases from around 3.8 volts at 0 percent pedal travel to below 3.1 volts at 100 percent pedal travel. Notice that the signal circuits for APP sensor 2 and APP sensor 3 pull up to 5 volts and the APP sensor 1 signal circuit is referenced to low reference within the TAC module.

Conditions for Running the DTC

- DTCs P0606, P2108, or P1518 are not set.
- The ignition switch is in the crank or the run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- APP sensor 3 voltage is less than 01.63 volts or greater than 4.28 volts.
- All above conditions present for less than 1 second.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- If one or more APP sensor DTCs are set for a single APP sensor, the following occurs:
  - The control module will not command Reduced Engine Power mode.
  - The control module will use the remaining two APP sensors to calculate throttle response.
- If certain multiple APP sensor DTCs are set for more than one APP sensor, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to a predetermined value to limit the amount of throttle control.
  - The message center displays Reduced Engine Power.
- If all three APP sensors are out of range, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to 0 percent. The control module only allows the engine to idle.
  - The message center displays Reduced Engine Power.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects throttle movement with a DTC P2130 set, a DTC P2131 also sets.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The number below refers to the step number on the diagnostic table.

26: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting the components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2130

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views , or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **If DTC P1518 or P0220 is also set, refer to Diagnostic Trouble Code (DTC) List for further diagnosis.** 1. Turn ON the ignition, with the engine OFF. 2. Observe the accelerator pedal position (APP) sensor 3 voltage parameter. Does the scan tool indicate APP sensor 3 voltage within the specified values?	3.29-4.28 V	Go to **Step 3**	Go to **Step 6**
3	Fully depress the accelerator pedal to the wide open throttle (WOT) position. Does the scan tool indicate APP sensor 3 voltage within the specified values?	1.63-3.1 V	Go to **Step 4**	Go to **Step 6**
4	1. Turn OFF the ignition for 15 seconds. 2. Turn ON the ignition, with the engine OFF. 3. Observe the DTC Info with a scan tool. 4. Lightly touch and move the related engine wiring harnesses and connectors for the accelerator pedal position (APP) sensor while monitoring the DTC info status. Did this DTC fail this ignition during the above test?	-	Go to **Step 20**	Go to **Step 5**
5	Slowly depress the accelerator pedal to WOT. Slowly return the accelerator pedal to the released position. Did this DTC fail this ignition during the above test?	-	Go to **Step 21**	Go to Diagnostic Aids
	1. Disconnect the APP sensor harness connector.			

6	2. Test the APP sensor 3 signal circuit for voltage, with a DMM. Does the DMM indicate APP sensor 3 signal voltage within the specified values?	3.94-6.06 V	Go to **Step 11**	Go to **Step 7**
7	1. Turn OFF the ignition. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the APP Sensor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the APP sensor 3 signal circuit for a short to voltage, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 8**
8	Test the APP sensor 3 signal circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 9**
9	Test the APP sensor 3 signal circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 10**
10	1. Disconnect the other TAC module harness connector. 2. Test for a short between the APP sensor 3 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 23**
11	Test the APP sensor 3 5-volt reference circuit for voltage, with a DMM. Does the DMM indicate voltage within the specified values?	3.94-6.06 V	Go to **Step 16**	Go to **Step 12**
12	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP Sensor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the APP sensor 3 5-volt reference circuit for a short to voltage, with a DMM. Refer to	-		

	Circuit Testing and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 25**	Go to **Step 13**
13	Test the APP sensor 3 5-volt reference circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 14**
14	Test the APP sensor 3 5-volt reference circuit for a short to ground, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 15**
15	Test for a short between the APP sensor 3 5-volt reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 23**
16	With a DMM connected between the APP sensor 3 low reference circuit and the APP sensor 1 low reference circuit, measure the resistance. Does the DMM indicate resistance within the specified values?	0-5 ohm	Go to **Step 18**	Go to **Step 17**
17	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits. 3. Test the APP sensor 3 low reference circuit for an open or for high resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 23**
18	1. Observe the APP sensor 3 voltage parameter, with a scan tool. 2. Connect a fused jumper between the APP sensor 3 signal circuit and the APP sensor 3 low reference circuit at the APP sensor harness connector. Does the scan tool indicate APP sensor 3 voltage at the specified value?	0 V	Go to **Step 19**	Go to **Step 24**
	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connectors.			

19	3. Test for a short between the APP sensor 3 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 21**
20	Repair the intermittent connection as necessary. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 25**	-
21	Inspect for poor connections at the harness connector of the APP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 22**
22	Replace the APP sensor assembly. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 25**	-
23	Inspect for poor connections at the harness connector of the TAC module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 25**	Go to **Step 24**
24	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 25**	-
25	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	-	Go to **Step 26**	Go to **Step 2**
26	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DIAGNOSIS

DTC P2131

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually 3 individual APP sensors within 1 housing. Three separate signal, low reference and 5-volt reference circuits connect the APP sensor assembly and the throttle actuator control (TAC) module. Each sensor has a unique functionality. The APP sensor 1 signal increases as the accelerator pedal is depressed, from below 1 volt at 0 percent pedal travel, with the pedal at rest, to above 2 volts at 100 percent pedal travel, with the pedal fully depressed. The APP sensor 2 signal decreases from above 4 volts at 0 percent pedal travel to below 2.9 volts at 100 percent pedal travel. The APP sensor 3 signal decreases from around 3.8 volts at 0 percent pedal travel to below 3.1 volts at 100 percent pedal travel. Notice that the signal circuits for APP sensor 2 and APP sensor 3 pull up to 5 volts and the APP sensor 1 signal circuit is referenced to low reference within the TAC module.

Conditions for Running the DTC

- DTCs P0606, P2108, or U0107 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- APP sensor 3 disagrees with APP sensor 1 by more than 13 percent and APP sensor 3 disagrees with APP sensor 2 by more than 13 percent.
- All of the above conditions are present for less than 1 second.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Failure Records.
- If one or more APP sensor DTCs are set for a single APP sensor, the following occurs:
  - The control module will not command Reduced Engine Power mode.
  - The control module will use the remaining two APP sensors to calculate throttle response.
- If certain multiple APP sensor DTCs are set for more than one APP sensor, the following occurs:
  - The control module commands Reduced Engine Power mode.
  - The APP indicated angle is limited to a predetermined value to limit the amount of throttle control.

    - The message center displays Reduced Engine Power.
- If all three APP sensors are out of range, the following occurs:
    - The control module commands Reduced Engine Power mode.
    - The APP indicated angle is limited to 0 percent. The control module only allows the engine to idle.
    - The message center displays Reduced Engine Power.

Conditions for Clearing the DTC

- A current DTC Last Test Failed clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other non-emission related diagnostic.
- Clear the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects throttle movement with a DTC P2130 set, a DTC P2131 also sets.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- For an intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers in the diagnostic table.

2: This step determines if a communication condition exists.

5: This step isolates an internal APP sensor failure. The condition may only occur at a certain accelerator pedal position. Monitoring the APP angles for sensor 1 and sensor 2 is an accurate way of verifying the actual position of the pedal. The APP angles for all 3 sensors should be within a few percent of each other. When the pedal is at rest, the APP angle for all 3 sensors should be 0 percent. When the pedal is fully depressed, all APP angles should be 100 percent.

6: The APP sensor 3 has a dedicated 5-volt reference circuit. Monitoring the APP sensor 1 voltage aids in diagnosing the APP sensor 3 5-volt reference circuit. If the scan tool displays 5 volts then the circuits are OK.

25: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2131

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View Reference: Powertrain Control Module (PCM) Connector End Views ,, or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Is DTC U0107 also set?	-	Go to **DTC U0107**	Go to **Step 3**
3	**IMPORTANT:** **Do not depress the accelerator pedal.** 1. Turn OFF the ignition for 15 seconds. 2. Start the engine. 3. Observe the DTC Info with a scan tool. Did any other throttle actuator control (TAC) module or accelerator pedal position (APP) sensor DTCs set except DTC P1125?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 4**
4	Observe the APP sensor Agree/Disagree parameters, with a scan tool. Does the scan tool indicate Disagree for any of the APP sensor Agree/Disagree parameters?	-	Go to **Step 6**	Go to **Step 5**
5	1. Turn ON the ignition, with the engine OFF. 2. Observe the APP sensor angles for all 3 APP sensors. 3. Slowly depress the accelerator pedal, stopping at 25, 50, 75, and 99 percent. 4. Slowly release the accelerator pedal, stopping at 75, 50, 25, and 0 percent. Does the scan tool indicate that the APP sensor 3 angle is within 13 percent of both APP sensor 1 and sensor 2 angles?	-	Go to Diagnostic Aids	Go to **Step 6**
6	1. Turn OFF the ignition. 2. Disconnect the APP sensor harness connector. 3. Test the APP sensor 3 5-volt reference circuit for voltage, with a DMM. Does the DMM indicate voltage within the specified values?	3.94-6.06 V	Go to **Step 7**	Go to **Step 14**
	Test the APP sensor 3 signal circuit for voltage, with a DMM.	3.94-		

7	Does the DMM indicate voltage within the specified values?	6.06 V	Go to **Step 8**	Go to **Step 16**
8	Measure the resistance between the APP sensor 3 low reference circuit and the APP sensor 1 low reference circuit, with a DMM. Does the DMM indicate resistance within the specified values?	0-5 ohm	Go to **Step 9**	Go to **Step 19**
9	1. Disconnect the TAC module harness connector containing the APP sensor circuits. 2. Test the APP sensor 3 5-volt reference circuit for resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 10**
10	Test for a short between the APP sensor 3 5-volt reference circuit and all other APP circuits at the APP sensor harness connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 11**
11	Test the APP sensor 3 signal circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 12**
12	Test for a short between the APP sensor 3 signal circuit and all other APP circuits at the APP sensor harness connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 13**
13	Test the APP sensor 3 low reference circuit for resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 20**
14	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits. 3. Test the APP sensor 3 5-volt reference circuit for an open or for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 15**
15	Test the APP sensor 3 5-volt reference circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 24**	Go to **Step 21**
16	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits. 3. Test the APP sensor 3 signal circuit for an open or for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 17**
17	Test the APP sensor 3 signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 18**
18	Test for a short between the APP sensor 3 signal circuit and all other APP circuits at the APP sensor harness connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 19**
19	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the APP sensor circuits. 3. Test the APP sensor 3 low reference circuit for an open or for high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 21**
20	Inspect for poor connections at the harness connector of the APP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 22**
21	Inspect for poor connections at the harness connectors of the TAC module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 24**	Go to **Step 23**
22	Replace the APP sensor assembly. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 24**	-

23	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 24**	-
24	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 25**
25	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P2135

Circuit Description

The throttle position (TP) sensor is mounted on the throttle body assembly. The sensor is actually 2 individual TP sensors within 1 housing. Two separate signal, low reference and 5-volt reference circuits are used in order to connect the TP sensor assembly to the throttle actuator control (TAC) module. The 2 sensors have opposite functionality. The TP sensor 1 signal voltage is pulled up to the reference voltage as the throttle opens, from below 1 volt at closed throttle to above 3.5 volts at wide open throttle (WOT). The TP sensor 2 signal voltage is pulled down to the low reference from around 3.8 volts at closed throttle to below 1 volt at WOT. TP sensor 1 and accelerator pedal position (APP) sensor 1 share a 5-volt reference circuit that is connected within the TAC module. TP sensor 2 and APP sensor 2 share a 5-volt reference circuit that is connected within the TAC module. If an out of range condition is detected with the TP sensors, this DTC will set and the Reduced Engine Power message will be displayed.

Conditions for Running the DTC

- DTCs P2108, or P1518 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is greater than 5.23 volts.

Conditions for Setting the DTC

- TP sensor 2 disagrees with TP sensor 1 by more than 7.5 percent.
- All above conditions are present for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.
- If this DTC is determined to be intermittent, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

21: When the TAC module detects a condition within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Keep this in mind when reviewing the Capture Info.

DTC P2135

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views , or Engine Controls Connector End Views**			
1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
	Is DTC P1518 also set?	Go to **Diagnostic**	

2		**Trouble Code (DTC) List**	Go to **Step 3**
3	1. Turn ON the ignition, with the engine OFF. 2. Observe the throttle position (TP) sensor 1 and sensor 2 Agree/Disagree parameter, with a scan tool. Does the scan tool TP sensor 1 and sensor 2 Agree/Disagree parameter indicate Disagree?	Go to **Step 5**	Go to **Step 4**
4	1. Remove the air inlet duct from the throttle body. 2. Disconnect the throttle actuator motor harness connector. 3. Slowly, manually open the throttle blade to wide open throttle (WOT) and back to the closed throttle position several times while observing the scan tool TP sensor Agree/Disagree parameter. Does the TP sensor Agree/Disagree parameter change from Agree to Disagree during the above test?	Go to **Step 18**	Go to **Step 5**
5	1. Disconnect the throttle position (TP) sensor harness connector. 2. Disconnect the throttle actuator control (TAC) module harness connectors. 3. Test the TP sensor 1 5-volt reference circuit for resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 6**
6	Test for a short between the TP sensor 1 5-volt reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 7**
7	Test the TP sensor 1 signal circuit for resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 8**
8	Test for a short between the TP sensor 1 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 9**
9	Test the TP sensor 1 low reference circuit for resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 10**

10	Test for a short between the TP sensor 1 low reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 11**
11	Test the TP sensor 2 5-volt reference circuit for resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 12**
12	Test for a short between the TP sensor 2 5-volt reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 13**
13	Test the TP sensor 2 signal circuit for resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 14**
14	Test for a short between the TP sensor 2 signal circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 15**
15	Test the TP sensor 2 low reference circuit for resistance, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 16**
16	Test for a short between the TP sensor 2 low reference circuit and all other TAC module circuits, with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 17**
17	Inspect for poor connections at the harness connector of the TAC module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 18**
18	Inspect for poor connections at the harness connector of the TP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 20**	Go to **Step 19**
19	**IMPORTANT:** **The TP sensor is not a serviceable part and should only be replaced with the throttle body assembly.** Replace the throttle body assembly. Refer to **Throttle**		

	Body Assembly Replacement .Did you complete the replacement?	Go to **Step 20**	-
20	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze/Frame Failure Records. Does the DTC run and pass?	Go to **Step 21**	Go to **Step 2**
21	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC U0107

Circuit Description

The throttle actuator control (TAC) module and the powertrain control module (PCM) communicate via a dedicated serial data circuit. This serial data circuit is separate from any other serial data circuit on the vehicle. Accurate transmitting and receiving of serial data requires not only good circuit integrity, but also adequate system voltage. This diagnostic monitors the accuracy of the serial data transmitted between the TAC module and the PCM. If the PCM detects a loss of data or invalid data, DTC U0107 sets.

Conditions for Running the DTC

- The ignition switch is in the crank or the run position.
- The ignition voltage is more than 5.23 volts.

Conditions for Setting the DTC

- Invalid or missing serial data messages are detected for a predetermined amount of time.
- All of the above conditions met for less than 1 second.

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) when the diagnostic runs and fails.
- The control module records the operating conditions at the time the diagnostic fails. The control module stores this information in the Freeze Frame and/or the Failure Records.
- The control module commands the TAC system to operate in the Reduced Engine Power mode.
- A message center or an indicator displays Reduced Engine Power.
- Under certain conditions the control module commands the engine OFF.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.
- A current DTC, Last Test Failed, clears when the diagnostic runs and passes.
- A history DTC clears after 40 consecutive warm-up cycles, if no failures are reported by this or any other emission related diagnostic.
- Clear the MIL and the DTC with a scan tool.

Diagnostic Aids

- DTC U0107 sets if the battery voltage is low. If the customer's concern is slow cranking or no crank because battery voltage is low, ignore DTC U0107. Clear any DTCs that may have set from the low battery voltage condition from the memory.
- DTC U0107 sets when there is a short to B+ on the TAC module ground circuit. Inspect the fuses for the circuits that are in the TAC module harness, such as the cruise, or the brake. An inspection of the fuses may lead you to the circuit that is shorted to the TAC module ground circuit.
- DTC U0107 sets if the TAC module ignition feed circuit is shorted to a B+ supply circuit. The TAC module stays powered-up when the ignition switch is turned off. When the ignition switch is turned on, the TAC module is powered-up before the PCM. DTC U0107 sets because no communication is detected by the TAC module from the PCM. Inspect related circuits for being shorted to a B+ supply circuit.
- Inspect the TAC module power and ground circuits and the TAC module/PCM serial data circuits for intermittent connections.
- Inspect the TAC module connectors for signs of water intrusion. When water intrusion occurs, multiple DTCs could be set with no DTC circuit or component conditions found during diagnostic testing.
- When the TAC module detects a problem within the TAC system, more than 1 TAC system related DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual problem may correct more than 1 DTC. Keep this in mind when reviewing captured DTC info.
- For an intermittent condition, refer to **Intermittent Conditions** .

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step determines if the IGN relay is suppling a voltage to the THROT CONT fuse.

5: Increasing the engine speed to 3,000 RPM aids in locating a shorted throttle actuator motor control circuit. Depending on the polarity of the throttle actuator motor transistors, this DTC may not set with a fault in the control circuits. The throttle actuator motor is a bi-directional DC motor. Raising the engine speed changes the polarity of the transistors in the throttle actuator motor. This occurs because 1 set of the transistors is near 0 volts, and the other set is at high B+. Therefore, if 1 set of transistors is at a low voltage and the corresponding circuit is shorted low, DTC U0107 will not set. When the polarity of the transistors change this DTC sets. If this DTC does not Fail This Ignition, continue to monitor this DTC status while moving related harnesses and connectors.

29: When the TAC module detects a condition within the TAC system, more than TAC system related

DTC may set. This is due to the many redundant tests that run continuously on this system. Locating and repairing 1 individual condition may correct more than 1 DTC. Disconnecting the components during testing may set additional DTCs. Keep this in mind when reviewing the stored information, Capture info.

DTC U0107

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics **Connector End View References: Powertrain Control Module (PCM) Connector End Views , or Engine Controls Connector End Views**				
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	1. Turn ON the ignition, with the engine OFF. 2. Remove the cover from the underhood electrical center. 3. With a test lamp connected to ground, test both sides of the THROT CONT fuse. Does the test lamp illuminate on at least 1 side of the fuse?	-	Go to **Step 3**	Go to **Ignition Relay Diagnosis**
3	1. Turn OFF the ignition. 2. With a test lamp connected to ground, test for voltage at the THROT CONT fuse. Does the test lamp illuminate?	-	Go to **Step 22**	Go to **Step 4**
4	Install a scan tool. Is DTC P0606 also set?	-	Go to **DTC P0601-P0607, P1600, P1621, P1627, P1680, P1681, P1683, or P2610**	Go to **Step 5**
5	**IMPORTANT:** **If the Driver Information Center is displaying Reduced Engine Power, go to Step 6.** 1. Start the engine. 2. Increase the engine speed to 3,000 RPM, if possible. 3. Observe the diagnostic trouble code (DTC) Info option using the scan tool. Does the scan tool indicate this DTC failed this ignition?	-	Go to **Step 6**	Go to Diagnostic Aids
	1. Turn OFF the ignition.			

6	2. Disconnect the throttle actuator motor harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Test for voltage at both throttle actuator motor control circuits. Refer to **Circuit Testing** in Wiring Systems. Does the DMM indicate voltage on both circuits above the specified value?	8 V	Go to **Step 12**	Go to **Step 7**
7	1. Turn OFF the ignition. 2. Test both throttle actuator motor control circuits for continuity to ground. Refer to **Circuit Testing** in Wiring Systems. Does the DMM indicate continuity to ground?	-	Go to **Step 10**	Go to **Step 8**
8	1. Turn OFF the ignition. 2. Remove the THROT CONT fuse. 3. Test the throttle actuator control (TAC) side of the fuse terminal for continuity to ground. Refer to Diagnostic Aids for terminal identification table. Does the DMM indicate continuity to ground?	-	Go to **Step 9**	Go to **Step 11**
9	1. Disconnect the TAC module 16-way harness connector. 2. Test the TAC side of the fuse terminal for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 24**
10	1. Disconnect the TAC module 16-way harness connector. 2. Test the throttle actuator motor control circuits for a short to ground at the TAC module 16-way harness connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 24**
	1. Turn OFF the ignition. 2. Disconnect the TAC module 16-way harness connector.			

11	3. Test the TAC module ignition feed circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 24**
12	1. Turn OFF the ignition. 2. Disconnect the TAC module 16-way connector. 3. Turn ON the ignition, with the engine OFF 4. Test for a short to voltage at both Throttle Actuator Motor control circuits. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 13**
13	1. Turn OFF the ignition. 2. Disconnect the TAC module 10-way harness connector. 3. Test for a short between each throttle actuator motor control circuit and all other TAC module circuits. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 14**
14	Test for an open or for high resistance in the TAC module ground circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 15**
15	Test for voltage on the serial data circuits at the TAC module 16-way harness connector. Does the DMM indicate voltage within the specified values for both circuits?	0-4.5 V	Go to **Step 16**	Go to **Step 18**
16	1. Turn OFF the ignition. 2. Test both serial data circuits at the TAC module 16-way harness connector for continuity to ground. Does the DMM indicate OL for both circuits?	-	Go to **Step 20**	Go to **Step 17**
	1. Disconnect the posertrain control module (PCM) connector containing the TAC module serial data circuits.			

17	2. Test both serial data circuits at the TAC module 16-way connector for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 18**
18	Test for a short between both serial data circuits and all other circuits at the PCM and TAC module harness connectors. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 19**
19	Test for a short to voltage on both serial data circuits at the TAC module 16-way connector. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 25**
20	1. Disconnect the PCM connector that contains the TAC module serial data circuits. 2. Test each serial data circuit between the TAC module 16-way harness connector and the PCM harness connector for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 21**
21	1. Connect the PCM. 2. Turn ON the ignition. 3. Test for voltage on the serial data circuit at the TAC module 16-way harness connector. Does the DMM indicate voltage at the specified value?	0 V	Go to **Step 25**	Go to **Step 24**
22	1. Turn OFF the ignition. 2. Disconnect the 16-way TAC module harness connector. 3. Test the TAC module ignition feed circuit for a short to battery voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 23**
	1. Turn ON the ignition.			

23	2. Test both throttle actuator control motor circuits for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 24**
24	Test for poor connections at the TAC module harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 26**
25	Test for poor connections at the PCM harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 28**	Go to **Step 27**
26	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 28**	-
27	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 28**	-
28	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 29**
29	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK