2007
Engines

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ENGINE CONTROLS

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ENGINE CONTROLS

Begin the system diagnosis with Diagnostic System Check - Vehicle . The Diagnostic System Check - Vehicle 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 - Vehicle will identify the correct procedure for diagnosing the system and where the procedure is located.

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 given 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 is determined:

- The Engine Controls Diagnostic Check is completed.
- No diagnostic trouble codes (DTCs)
- 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 values that would be seen on a normal running engine.

IMPORTANT

A scan tool that displays faulty data should not be used. The scan tool problem should be reported to the manufacturer. Use of a faulty scan tool can result in misdiagnosis and 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 can be located on the scan tool. Refer to 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 of the data lists indicated below.

Eng 1: Engine Data 1 List

Eng 2: Engine Data 2 List

EE: Enhanced Evaporative Emission (EVAP) Data

EGR: Exhaust Gas Recirculation (EGR) Data

FF/FR: Freeze Frame/Failure Records

FT: Fuel Trim Data List

HO2S: HO2S Data List

MF: Misfire Data List

TAC: Throttle Actuator Control (TAC) Data

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			
4WD Signal (if equipped)	Eng 2	Enabled/Disabled	Disabled
4WS Low Signal (if equipped)	Eng 2	Enabled/Disabled	Disabled
A/C Clutch Feedback Signal	Eng 2	Relay ON/Relay OFF	Relay OFF
A/C Compressor Cycling Switch	Eng 2	Low Pressure/Normal	Normal
A/C High Pressure Recirculation Switch	Eng 2	High Pressure/Normal	Normal
A/C Relay Command	Eng 1/Eng 2/EGR/MF	ON/OFF	OFF
A/C Request Signal	Eng 2	Yes/No	No
AIR Relay Command	FT	On/OFF	Varies
APP Average	TAC	Counts	Varies
APP Indicated Angle	Eng 1/Eng 2/EE/EGR/FT/HO2S/ TAC/CC	0-100%	0%
APP Sensor 1	TAC	0-100%	0%
APP Sensor 1	TAC	0-5 V	0.4-0.9 V
APP Sensor 2	TAC	0-100%	0%
APP Sensor 2	TAC	5-0 V	4.5-4.1 V
APP Sensor 1 and 2	TAC	Agree/Disagree	Agree
BARO	Eng 1/EE/EGR/FT	kPa	65-104 kPa varies w/ altitude
CMP Sensor-High to Low	Eng 2	Counts	Varies
CMP Sensor-Low to High	Eng 2	Counts	Varies
Cold Startup	Eng 2/EE	Yes/No	Varies
Coolant Level Switch	Eng 2	OK/Low	OK
Cruise Control Active	Eng 1/TAC/CC	Yes/No	No
Cruise Disengage 1-8 History	CC	History/No History	Varies
Cruise On/Off Switch	TAC/CC	ON/OFF	OFF
Cruise Release Brake Pedal Switch	CC	Applied/Released	Released
Cruise Resume/Accel. Switch	TAC/CC	ON/OFF	OFF
Cruise Set/Coast Switch	TAC/CC	ON/OFF	OFF
Current Gear (4 speed only)	Eng 1/Eng 2/EGR/FT	0-4	1
Cycles of Misfire Data	MF	0-100 Counts	Varies

Decel. Fuel Cutoff	HO2S	Active/Inactive	Inactive
Desired EGR Position	Eng 1/EGR/MF	0-100%	0%
Desired EGR Position	EGR	0-5 V	Less than 1.3 V
Desired Idle Speed	Eng 1/Eng 2/TAC/EE	RPM	PCM Controlled
DTC Set This Ignition	Eng 1/Eng 2/EE/FT/HO2S/CC	Yes/No	No
ECT Sensor	Eng 1/Eng 2/EE/EGR/FT/HO2S/MF	-39 to +140°C (-38 to +284°F)	88-105°C (190-221°F)
EGR Learned Minimum Position	EGR	0-5 V	Varies
EGR Position Sensor	EGR	0-5 V	Less than 1.3 V
EGR Position Sensor	MF/ EGR/Eng 1	0-100%	0%
Engine Load	All	0-100%	1-4% @ Idle 7-10% @ 2500 RPM
Engine Oil Level Switch (if equipped)	Eng 2	OK/Low	OK
Engine Oil Life Remaining	Eng 2	0-100%	Varies
Engine Run Time	All	Hrs/Min/Sec	Varies
Engine Speed	All	0-10000 RPM	500-700 RPM
EVAP Purge Solenoid Command	Eng 1/EE/FT	0-100%	0-25%
EVAP Test Result	EE	Passed/Failed/No Result	Varies
EVAP Vent Solenoid Command (if equipped)	Eng 1/EE/FT	Not Venting/Venting	Venting
Fuel Level Sensor	EE	0-5 V	0.7-2.5 V
Fuel Level Sensor Rear Tank (if equipped)	EE/ Eng 1	0-5 V	0.7-2.5 V
Fuel Tank Level Remaining	EE	Gal/L	Varies
Fuel Tank Level Remaining	EE	0-100%	Varies
Fuel Tank Pressure (FTP) Sensor (if equipped)	Eng 1/EE	-32.7 to +13.96 mm/Hg (-17.4 to +7.5 in/H2O)	Varies
FTP Sensor (if equipped)	EE	0-5 V	Varies
Fuel Tank Rated Capacity	EE	L (Gal)	Varies with fuel tank option
Fuel Trim Cell	Eng 1/EE/FT	0-23	16-20
Fuel Trim Learn	Eng 1/EE/FT	Enabled/Disabled	Enabled (may toggle)
Generator F Terminal Signal	Eng 2	%	Varies
Generator L Terminal Signal Command	Eng 2	ON/OFF	ON
HO2S Bank 1 Sensor 1	Eng 1/EE/FT/HO2S	mV	10-1000 mV and Varying

HO2S Bank 1 Sensor 2 (if equipped)	Eng 1/EE/FT/ HO2S	mV	10-1000 mV and Varying
HO2S Bank 2 Sensor 1	Eng 1/EE/FT/HO2S	mV	10-1000 mV and Varying
HO2S Bank 2 Sensor 2 (if equipped)	Eng 1/EE/FT/HO2S	mV	10-1000 mV and Varying
HO2S Heater Bn 1 Sen. 1	HO2S	amps	0.72-0.78 amps
HO2S Heater Bn 1 Sen. 2	HO2S	amps	0.72-0.78 amps
HO2S Heater Bn 2 Sen. 1	HO2S	amps	0.72-0.78 amps
HO2S Heater Bn 2 Sen. 2	HO2S	amps	0.72-0.78 amps
IAT Sensor	Eng 1/Eng 2/EE/EGR/FT/HO2S	-39 to +140°C (-38 to +284°F)	Depends on ambient temperature
Ignition 1 Signal	Eng 1/Eng 2/EE/EGR/FT/TAC/CC	0-25.5 V	11.5-14.5 V
Inj. PWM Bank 1 Average	Eng 2/FT/MF	ms	2-6 ms
Inj. PWM Bank 2 Average	Eng 2/FT/MF	ms	2-6 ms
Knock Retard	Eng 1/EGR	0-16°	0°
Long Term FT Avg. Bn1	FT	%	Near 0%
Long Term FT Avg. Bn2	FT	%	Near 0%
Long Term FT Bank 1	Eng 1/Eng 2/EE/FT/HO2S	%	Near 0%
Long Term FT Bank 2	Eng 1/Eng 2/EE/FT	%	Near 0%
Loop Status	Eng 1/Eng 2/EE/EGR/FT/HO2S	Open/Closed	Closed
Low Oil Lamp Command (if equipped)	Eng 2	ON/OFF	OFF
MAF Sensor	Eng 1/Eng 2/EGR/FT/HO2S/MF/EE/ TAC	0-665 g/s	1-9 g/s @ Idle (depends on altitude) 15-26 g/s @ 2500 RPM (depends on altitude)
MAFSensor	Eng 2	0-31999 Hz	2000-3000 Hz
MAP Sensor	Eng 1/Eng 2/EGR// FT/HO2S/MF/ EE/TAC	10-105 kPa	20-48 kPa
MAP Sensor	Eng 1/Eng 2	0-5 V	1.0-2.0 V Varies with altitude
MIL Command	Eng 2	ON/OFF	OFF
Mileage Since DTC Cleared	Eng 2	Miles/Km	Varies
Misfire Current Cyl. 1-8	MF	0-255 Counts	0
Misfire History Cyl. 1-8	MF	0-65535 Counts	0
PCM Reset	Eng 1/Eng 2/EGR/EE/FT	Yes/No	No
PCM/VCM in VTD Fail Enable (if equipped)	Eng 1	Yes/No	No

Power Enrichment	Eng 1/Eng 2/HO2S	Yes/No	No
Reduced Engine Power	Eng 1/EGR/TAC/CC	Active/Inactive	Inactive
Short Term FT Avg. Bn1	FT	%	Near 0%
Short Term FT Avg. Bn2	FT	%	Near 0%
Short Term FT Bank 1	Eng 1/Eng 2/EE/FT/HO2S	%	Near 0%
Short Term FT Bank 2	Eng 1/Eng 2/EE/FT/HO2S	%	Near 0%
Spark	Eng 1/Eng 2/FT/HO2S/MF	Degrees	15-20°
Start Up ECT	Eng 2/EE// FT	°C/°F	Varies
Stop Lamp Pedal Switch	Eng 2/TAC/CC	Applied/Released	Released
TAC/PCM Communication Signal	Eng 1/TAC/CC	OK/Fault	OK
TCC Brake Pedal Switch	Eng 1/Eng 2	Applied/Released	Released
TCC Enable Solenoid Command (4L80-85E only)	Eng 1/Eng 2/MF/FF-FR	ON/OFF	OFF
TCC PWM Solenoid Command (4L80-85E only)	Eng 2	ON/OFF	OFF
TFP Sw. (4L80-85E only)	Eng 2/EGR/FT	Transmission Gear Position	Varies
TP Desired Angle Eng 1/Eng 2/EE/EGR/TAC/CC	0-100%	3-4.5%	
TP Indicated Angle	All	0-100%	3-7%
TP Sensor 1	TAC	0-100%	3%
TP Sensor 1	TAC	0-5 V	0.4-0.9 V
TP Sensor 2	TAC	0-100%	3%
TP Sensor 2	TAC	5-0 V	4.8-4.3 V
TP Sensors 1 and 2	TAC	Agree/Disagree	Agree
TR Switch (4L80-85E only)	Eng 2/EGR/FT	Transmission Gear Position	Park
Vehicle Speed Sensor	All	km/h-mph	0
VTD Auto Learn Timer (if equipped)	Eng 1	Active/Inactive	Inactive
VTD Fuel Disable (if equipped)	Eng 1	Active/Inactive	Inactive
VTD Fuel Disable Until Ign. Off (if equipped)	Eng 1	Yes/No	No
Warm-Ups w/o Emission Faults	Eng 2	0-255 Counts	Varies
Warm-Ups w/o Non-Emission Faults	Eng 2	0-255 Counts	Varies

SCAN TOOL DATA DEFINITIONS

The Engine Scan Tool Data Definitions contains 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.

4WD Low Signal

This parameter displays the state of the transfer case based on the signal from the four wheel drive (4WD) low switch. The scan tool will display Enabled or Disabled. Enabled indicates the transfer case is in 4WD low gear and the 4WD low switch is closed, completing the low signal circuit. Disabled indicates the transfer case is not in 4WD low gear and the 4WD low switch is open.

4WD Signal

This parameter displays the state of the transfer case based on the signal from the front axle indicator switch. The scan tool will display Enabled or Disabled. Enabled indicates the front axle is locked in four wheel drive and the front axle indicator switch is closed, supplying voltage to the controller on the axle switch signal circuit. Disabled indicates the transfer case is not in four wheel drive and the front axle indicator switch is open.

A/C Clutch Feed Back Signal

This parameter displays the state of the air conditioning (A/C) compressor clutch based on the signal from the switched side of the A/C clutch relay. The scan tool will display Relay On or Relay Off. Relay On indicates the A/C clutch relay has closed, allowing voltage to the A/C compressor clutch. Relay Off indicates the A/C clutch relay is open and the A/C compressor clutch is not engaged.

A/C Compressor Cycling Switch

This parameter displays the state of the air conditioning (A/C) compressor cycling switch as determined by the control module. The scan tool will display Normal or Low Pressure. Normal indicates the A/C system has enough refrigerant to close the A/C compressor cycling switch, allowing the A/C compressor to engage. Low Pressure indicates the A/C refrigerant system has low pressure and the A/C compressor cycling switch is open.

A/C Sec. High Pressure Switch

The scan tool displays High Pressure or Normal. This parameter displays the state of the A/C secondary high pressure switch. The A/C secondary high pressure switch is normally open.

A/C Relay Command

This parameter displays the commanded state of the air conditioning (A/C) clutch relay control circuit. The scan tool will display ON or OFF. ON indicates the A/C clutch relay control circuit is being grounded by the control module, alllowing voltage to the A/C compressor clutch. OFF indicates the A/C clutch relay is not being commanded on by the control module.

A/C Request Signal

This parameter displays the state of the air conditioning (A/C) request input to the control module from the heating, ventilation, and air conditioning (HVAC) controls. The scan tool will display Yes or No. Yes indicates the control module is receiving a request from the HVAC system to ground the A/C clutch relay control circuit, engaging the A/C compressor clutch. No indicates the control module is not receiving a request from the HVAC system to ground the A/C clutch relay control circuit.

AIR Relay Command

This parameter displays the commanded state of the secondary air injection (AIR) pump relay control circuit. The scan tool will display ON or OFF. ON indicates the AIR pump relay control circuit is being grounded by the control module, allowing voltage to the AIR pump. OFF indicates the AIR pump relay is not being commanded on by the control module.

APP Average

This parameter displays the average of the 3 accelerator pedal position (APP) sensors as calculated by the throttle actuator control (TAC) module. The APP average is a range of values indicating a low number when the accelerator pedal is not depressed to a high number when the accelerator pedal is fully depressed. This value is listed in counts.

APP Indicated Angle

This parameter displays the angle of the accelerator pedal as calculated by the control module using the signals from the accelerator pedal position sensors. The APP indicated angle is a range of values indicating a low percentage when the accelerator pedal is not depressed to a high percentage when the accelerator pedal is fully depressed.

APP Sensor 1

This parameter displays the angle of the accelerator pedal position (APP) sensor 1 as calculated by the control module using the signal from the APP sensor 1. APP sensor 1 is a range of values indicating a low percentage when the accelerator pedal is not depressed to a high percentage when the accelerator pedal is fully depressed.

APP Sensor 1

This parameter displays the voltage signal sent to the control module from accelerator pedal position (APP) sensor 1 of the APP sensor assembly. APP sensor 1 is a range of values indicating a low voltage when the accelerator pedal is not depressed to a high voltage when the accelerator pedal is fully depressed.

APP Sensor 1 and 2

This parameter displays the results of a control module test that compares the signals from the accelerator pedal position (APP) sensors 1 and 2 . The scan tool will display Agree or Disagree. Agree indicates that APP sensor 1 and APP sensor 2 voltages correspond to the same accelerator pedal position. Disagree indicates that APP sensor 1 and APP sensor 2 voltages correspond to different accelerator pedal positions.

APP Sensor 2

This parameter displays the angle of the accelerator pedal position (APP) sensor 2 as calculated by the control module using the signal from the APP sensor 2. APP sensor 2 is a range of values indicating a low percentage when the accelerator pedal is not depressed to a high percentage when the accelerator pedal is fully depressed.

APP Sensor 2

This parameter displays the voltage signal sent to the control module from accelerator pedal position (APP) sensor 2 of the APP sensor assembly. APP sensor 2 is a range of values indicating a low voltage when the accelerator pedal is not depressed to a high voltage when the accelerator pedal is fully depressed.

BARO

The scan tool displays a range of 10-105 kPa. The barometric pressure (BARO) reading is determined from the manifold absolute pressure (MAP) sensor signal. The powertrain control module (PCM) monitors the MAP signal during key up or wide open throttle (WOT) conditions. The barometric pressure (BARO) compensates for altitude differences.

CMP Sensor-High to Low

The scan tool displays 0-65,535 counts. The counts increment as the powertrain control module (PCM) detects the camshaft position (CMP) 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 powertrain control module (PCM) detects the camshaft position (CMP) signal voltage going from low to high.

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 ECT should be below a predetermined temperature. Also the ECT and the intake air temperature (IAT) are less than 50°C (122°F) and are within 3°C (5°F) of each other at start-up. When the above is true, the scan tool displays Yes.

Coolant Level Switch

The scan tool displays OK or Low. This parameter indicates when the engine coolant level is low. The scan tool displays Low when the powertrain control module (PCM) detects the engine coolant level is low.

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 1-8 History

This parameter displays the last 8 cruise control disengages in order from 1 to 8. The control module will disengage the cruise control for up to 20 different conditions.

Cruise On/Off Switch

The scan tool displays ON or OFF. When you activate the cruise control switch, the scan tool displays ON. The switch, when in the ON position, sends a signal voltage to the throttle actuator control (TAC) module. This allows all other functions of the cruise control. When you turn OFF the cruise control switch, the scan tool displays OFF.

Cruise Release Brake Pedal Switch

This parameter displays the state of the Cruise Release Brake Pedal Switch as determined by the control module. The scan tool will display Released or Applied. Released indicates the brake pedal is not being pushed down , allowing the cruise control to be enabled. Applied indicates the brake switch is being applied, disabling cruise control operation.

Cruise Resume/Accel

The scan tool displays ON or OFF. When the cruise control switch is in the ON position 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 in the ON position 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. An illegal transmission position displays 9.

Cycles of Misfire Data

The scan tool displays a range of 0-100. The powertrain control module (PCM) counts the number of misfire tests during 200 engine revolutions.

Decel. Fuel Shutoff

The scan tool displays Active or Inactive. The scan tool displays Active when the powertrain control module (PCM) shuts off fuel flow through the fule injectors because of a deceleration condition.

Desired EGR Position

The scan tool displays 0-100 percent . This parameter displays the desired position of the exhaust gas recirculation (EGR) pintle as requested by the powertrain control module (PCM). This parameter should be very close to actual EGR position.

Desired EGR Position

The scan tool displays 0-5 volts. The commanded exhaust gas recirculation (EGR) is the EGR pintle position commanded by the powertrain control module (PCM).

Desired Idle Speed

The scan tool displays a range of 0-3,187 RPM. The powertrain control module (PCM) commands the desired idle speed. The PCM compensates for various engine loads based on engine coolant temperature (ECT) in order to keep the engine at the desired speed.

DTC Set This Ignition

The scan tool displays Yes or No. This parameter indicates if a DTC set during the current ignition cycle.

ECT Sensor

The scan tool displays a range of -39 to +140°C (-38 to +284°F). The powertrain control module (PCM) applies 5 volts to the engine coolant temperature (ECT) sensor circuit. The sensor is a thermistor which changes internal resistance as the engine temperature changes. When the sensor is cold, internal resistance high, the PCM senses a high signal voltage and interprets the voltage as a cold engine. As the sensor warms, internal resistance decreases, the voltage signal decreases and the PCM interprets the lower voltage as a warm engine.

EGR Learned Minimum Position

Represents the learned voltage that the controller uses to determine whether or not the EGR valve is fully closed.

EGR Position Sensor

The scan tool displays 0-5 volts. This parameter displays the actual exhaust gas recirculation (EGR) pintle position in voltage.

EGR Position Sensor

The scan tool displays a range of 0-100 percent. The powertrain control module (PCM) supplies a pulse width modulated (PWM) duty cycle to control the exhaust gas recirculation (EGR) valve. Zero percent indicates no EGR flow. One hundred percent indicates full EGR flow.

Engine Load

The scan tool displays a range of 0-100 percent . The powertrain control module (PCM) calculates the engine load from engine speed and mass airflow (MAF) sensor readings. The engine load increases with an increase in RPM or airflow.

Engine Oil Level Switch

The scan tool displays OK or Low. This parameter indicates when the engine oil level is low. The scan tool displays Low when the powertrain control module (PCM) detects the engine oil level is low.

Engine Oil Life Remaining

The scan tool displays 0-100 percent . This display represents the engine oil life index that is calculated and maintained by the powertrain control module (PCM).

Engine Run Time

The scan tool displays Hours, Minutes and Seconds. This displays the amount of engine run time for the current ignition cycle. When you cycle the ignition OFF, the timer resets to zero.

Engine Speed

The scan tool displays a range of 0-10,000 RPM. The powertrain control module (PCM) computes engine speed from the ignition reference pulses. The engine speed should remain close to desired idle under various engine loads with the engine idling.

EVAP Purge Solenoid Command

The scan tool displays a range of 0-100 percent. The powertrain control module (PCM) supplies a pulse width modulated (PWM) duty cycle to control the evaporative emission (EVAP) purge solenoid valve. 0 percent indicates no purge. 100 percent indicates full purge.

EVAP Test Result

The scan tool displays if the evaporative emission (EVAP) test has passed or failed. The scan tool displays pass when the powertrain control module (PCM) determines that the EVAP diagnostic has passed. The scan tool displays fail when the PCM determines that the EVAP diagnostic has failed.

EVAP Vent Solenoid Command

The scan tool displays Venting or Not Venting. The evaporative emission (EVAP) canister vent valve is normally open. The powertrain control module (PCM) commands the EVAP canister vent valve closed, during testing of the EVAP system.

Fuel Level Sensor

The scan tool displays 0-5 volts. The scan tool displays below 1 volt for an empty tank, and close to 2.5 volts for a full tank.

Fuel Tank Level Remaining

The scan tool displays in liters or gallons the amount of fuel remaining in the fuel tank.

Fuel Tank Level Remaining

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

Fuel Tank Pressure Sensor

The scan tool displays -32.7 to +13.96 mm/Hg (-17.4 to +7.5 in H2O. This parameter indicates the pressure vacuum inside of 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 inside of the fuel tank.

Fuel Tank Rated Capacity

The scan tool displays the capacity of the fuel tank in liters or gallons.

Fuel Trim Cell

The scan tool displays a range of 0-23. The powertrain control module (PCM) determines from the manifold absolute pressure (MAP) and RPM inputs which fuel trim cell to operate the engine in. 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 Signal Command

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 Signal Command

The scan tool displays ON or OFF. The scan tool displays OFF if the powertrain control module (PCM) does not detect a correct voltage on the L-terminal circuit. The scan tool displays ON under normal operating conditions.

HO2S Bank 1 Sensor 1

The scan tool displays a range of 0-1,106 mV. The heated oxygen sensor (HO2S) bank 1 sensor 1 parameter represents the fuel control exhaust oxygen sensor output voltage. The voltage fluctuates constantly within a range between 10-1,000 mV, while operating in Closed Loop.

HO2S Bank 1 Sensor 2

The scan tool displays a range of 0-1,106 mV. The heated oxygen sensor (HO2S) bank 1 sensor 2 parameter represents the fuel control exhaust oxygen sensor output voltage. The voltage fluctuates constantly within a range between 10-1,000 mV, while operating in Closed Loop.

HO2S Bank 2 Sensor 1

The scan tool displays a range of 0-1,106 mV. The heated oxygen sensor (HO2S) bank 2 sensor 1 parameter represents the exhaust oxygen sensor output voltage. The voltage fluctuates constantly within a range between 10-1,000 mV, while operating in Closed Loop.

HO2S Bank 2 Sensor 2

The scan tool displays a range of 0-1,106 mV. The heated oxygen sensor (HO2S) bank 2 sensor 2 parameter represents the fuel control exhaust oxygen sensor output voltage. The voltage fluctuates constantly within a range between 10-1,000 mV, while operating in Closed Loop.

HO2S Heater Bn 1 Sen. 1

This parameter displays the current through the control module when the bank 1 sensor 1 HO2S heater is commanded ON by the control module. HO2S Heater Bn 1 Sen. 1 is a range of values indicating a low current when the heater circuit resistance is high to a high current when the heater circuit resistance is low.

HO2S Heater Bn 1 Sen. 2

This parameter displays the current through the control module when the bank 1 sensor 2 HO2S heater is commanded ON by the control module. HO2S Heater Bn 1 Sen. 2 is a range of values indicating a low current when the heater circuit resistance is high to a high current when the heater circuit resistance is low.

HO2S Heater Bn 2 Sen. 1

This parameter displays the current through the control module when the bank 2 sensor 1 HO2S heater is commanded ON by the control module. HO2S Heater Bn 2 Sen. 1 is a range of values indicating a low current when the heater circuit resistance is high to a high current when the heater circuit resistance is low.

HO2S Heater Bn 2 Sen. 2

This parameter displays the current through the control module when the bank 2 sensor 2 HO2S heater is commanded ON by the control module. HO2S Heater Bn 2 Sen. 2 is a range of values indicating a low current when the heater circuit resistance is high to a high current when the heater circuit resistance is low.

IAT Sensor

The scan tool displays a range of -39 to +140°C (-38 to +284°F). The powertrain control module (PCM) converts the resistance of the intake air temperature (IAT) sensor to degrees. The PCM uses the IAT in order to adjust fuel delivery and spark timing according to incoming air density.

Ignition 1 Signal

The scan tool displays 0-25.5 volts. The ignition 1 represents the system voltage measured by the powertrain control module (PCM) at the ignition feed circuit.

Inj. PWM Average Bank 1 and Bank 2

The scan tool displays a range of 0-1,000 milliseconds. The injector average indicates the amount of time the powertrain control module (PCM) commands each injector ON during each engine cycle. A longer injector pulse width causes more fuel to be delivered. The injector pulse width increases with an increased engine load.

Knock Retard

The scan tool displays a range of 0.0-16 degrees. Knock retard indicates the amount of spark the powertrain control module (PCM) removes from the ignition control (IC) spark advance in response to the signal from the knock sensors (KS).

Long Term FT Avg. Bn1 and Bn2

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, for the amount of which they are used. For example, an idle cell is rated higher than 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 than the wide open cell. A negative value significantly below 0 percent indicates that the fuel system is rich and fuel delivery is being reduced. A positive value significantly more than 0 percent indicates that a lean condition exists and the powertrain control module (PCM) compensates by adding fuel. When the average of the cells reach a predetermined high or low, a fuel trim DTC sets.

Long Term FT Bank 1 and Bank 2

The scan tool displays percentage. The powertrain control module (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 fuel delivery. A value of 0 percent indicates that 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. A positive value significantly more than 0 percent indicates that a lean condition exists and the PCM compensates by adding fuel. Fuel trim values at maximum authority indicates an excessively rich or lean system.

Loop Status

The scan tool displays Open or Closed. Closed Loop indicates that the powertrain control module (PCM) is controlling fuel delivery according to oxygen sensor (HO2S) voltage. In Open Loop, the PCM ignores the HO2S voltage and bases the amount of fuel to be delivered on throttle position (TP) sensor, engine coolant, and mass air flow (MAF) sensor inputs only.

Low Oil Lamp Command

The scan tool displays ON or OFF. The scan tool displays On when the powertrain control module (PCM) detects that there is a low oil level condition. The low oil lamp is then commanded ON by the PCM.

MAF Sensor

The scan tool displays a range of 0-655 g/s. The 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 Sensor

The scan tool displays a range of 0-31,999 Hz. The mass air flow (MAF) sensor is a hot wire type air flow sensor. The powertrain control module (PCM) converts current draw needed by the MAF to keep the hot wires at a constant into a frequency signal. The scan tool displays this frequency in a hertz signal.

MAP Sensor

Scan Tool Range 10-105 kPa/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 powertrain control module (PCM) uses the MAP sensor signal for updating the barometric pressure (BARO) reading and as an enabling factor for several of the diagnostics.

MIL Command

The scan tool displays On or Off. The scan tool indicates if the powertrain control module (PCM) has commanded the MIL ON.

Mileage Since DTC Cleared

The scan tool displays Kilometers or Miles. This parameter indicates the distance traveled since an emission DTC cleared. The powertrain control module (PCM) stores this information in the Freeze Frame/Failure Records memory.

Misfire Current Cyl. #1 - #8

The scan tool displays a range of 0-255 counts. The misfire current counters increment at a rate according to the number of possible misfires the powertrain control module (PCM) detects on each cylinder during the last 200 cylinder firing events. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

Misfire History Cyl. #1 - #8

The scan tool displays a range of 0-65,535 counts. The misfire history counters display the total level of misfire that has 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 cylinder firing events.

PCM Reset

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

PCM/VCM in VTD Fail Enable

The powertrain control module (PCM) displays Yes or No. The scan tool displays Yes if the body control module (BCM) and the PCM lose communications with each other after the BCM sends the correct password. The scan tool displays No if the BCM is communicating the correct password to the PCM.

PNP Switch

The scan tool displays Park/Neutral / In Gear. This parameter indicates the range selection of automatic transmission equipped vehicles. The parameter will display Park/Neutral for the Park or Neutral position of the gear selector. The parameter will display In Gear for the Reverse, Drive, or Low positions of the gear selector.

Power Enrichment

The scan tool displays YES or NO. Yes indicates that 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. While in Power Enrichment, the PCM will increase the amount of fuel delivered by entering Open Loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

Power Take Off (PTO) Enable

The scan tool displays YES or NO. Yes indicates that the power take off (PTO) has been engaged and No indicates that the PTO has been disengaged.

Reduced Engine Power

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

Short Term FT Avg. Bn1 and Bn2

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 for the amount of which they are used. For example, the powertrain control module (PCM) rates an idle cell higher than 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 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. A positive value significantly more than 0 percent indicates that a lean condition exists and the PCM is compensating by adding fuel. When the average of the cells reach a predetermined high or low, a fuel trim DTC sets.

Short Term FT Bank 1 and Bank 2

The scan tool displays percentage. The short term fuel trim represents a short term correction to fuel delivery by the powertrain control module (PCM) in response to the amount of time the fuel control oxygen sensor voltage spends above or below the 450 mV threshold. If the O2S voltage mainly remains 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 O2S voltage stays mainly above the 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

The scan tool displays a range of -64 to +64 degrees. The scan tool displays the amount of degrees the powertrain control module (PCM) commands the spark advance on the ignition control (IC) circuit. The PCM computes the desired spark advance using the following: (1) ECT, (2) Engine speed (RPM), (3) Load, (4) Vehicle speed. The PCM adjusts the timing.

Start Up ECT

The scan tool displays a range of -39 to +140°C (-38 to +284°F). The scan tool displays the engine coolant temperature (ECT) at the time the engine was started. The powertrain control module (PCM) uses start-up ECT for certain DTCs.

Stop Lamp Pedal Switch

The scan tool displays Applied or Released. This parameter indicates the state of the brake switch circuit input. The scan tool displays Applied when you apply the vehicle brakes. The scan tool displays Released when you release the vehicle brakes.

TAC/PCM Communication Signal

The scan tool displays OK or Fault. If the communication between the throttle actuator control (TAC) module and the powertrain control module (PCM) is interrupted the scan tool displays Fault. The scan tool displays OK under the normal operating conditions.

TCC 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, brake switch open, brake pedal applied. Closed indicates a B+ voltage input, brake switch closed, brake pedal released. When you apply the vehicle brakes, the scan tool displays Applied. The TCC and cruise control disengages. When you release the vehicle brakes, the scan tool displays Released. This allows the cruise control to be resumed and the torque converter clutch to engage.

TCC Enable Solenoid Command

The scan tool displays Enabled or Disabled. The scan tool displays Enabled when the electrical system supplies a voltage to the TCC enable solenoid .

TCC PWM Solenoid Command

The scan tool displays 0-100 percent. This parameter is the commanded state of the torque converter clutch (TCC) pulse width modulated (PWM) solenoid. The scan tool displays 100 percent when the commanded state of the solenoid is ON. The scan tool displays 0 percent when the solenoid is OFF.

TFP Sw.

The scan tool displays Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, or Low. Trans range represents the decoded status of the four inputs from the transmission internal mode switch assembly. The combination of the transmission inputs indicates the position of the transmission manual valve.

TP Desired Angle

The scan tool displays 0-100 percent. The powertrain control module (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 (WOT) 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 (WOT) displays above 3.5 volts.

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 (WOT) displays near 100 percent.

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 (WOT) displays below 1.5 volts.

TP Sensors 1 and 2

The scan tool displays Agree or Disagree. When the throttle actuator control (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 No under normal operating conditions.

TR Switch

The scan tool displays the transmission gear position.

Vehicle Speed Sensor

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

VTD Auto Learn Timer

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

VTD Fuel Disabled

The scan tool displays Active/Inactive. If the powertrain control module (PCM) has not received the correct password from the body control module (BCM), the PCM disables the fuel system and the scan tool displays Active. The scan tool displays Inactive under normal operating conditions.

VTD Fuel Disable Until Ignition Off

The scan tool displays Yes or No. With the ignition ON and a vehicle theft deterrent (VTD) code present, the scan tool displays Yes.

Warm Ups w/o Emission Faults

The scan tool displays a range of 0-255. This parameter counts the number of warm up cycles without an emission fault present. The counter increments to 255 and rolls back 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 powertrain control module (PCM) also resets the counter to 0.

Warm Ups w/o Non - Emission Faults

The scan tool displays a range of 0-255. This parameter counts the number of warm up cycles without a non-emission fault present. The counter increments to 255 and rolls back 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 powertrain control module (PCM) also resets the counter to 0.

SCAN TOOL OUTPUT CONTROLS

Scan Tool Special Function	Additional menu Selections	Description
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 the 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 350-2000 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.
EGR Solenoid	Engine Output Controls	Activates the exhaust gas recirculation (EGR) solenoid that controls EGR valve position. The normal commanded state is None. The system will increase or decrease the amount of EGR opening by 10 percent increments within a range of 0-100 percent. The system remains in the commanded state for a maximum of 30 seconds or until cancelled by the scan tool. Once the 30 second timer has expired output control is not allowed for 60 seconds. If the engine is running too much EGR will result in a rough idle and/or stalling.

Scan Tool Special Function	Additional menu Selections	Description
EVAP Purge Solenoid	Engine Output Controls/ EVAP System	Activates the evaporative emission (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 0-100 percent. The system remains in the commanded state until cancelled by the tool or the fuel tank pressure (FTP) exceeds 32 mm Hg (17 in 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 0-100 percent. The second function seals the system after using the purge function to obtain a specific amount of FTP. When activated the purge valve is commanded to 0 percent and the vent valve is commanded ON- non-venting. Both functions remain in the commanded state until one of the following conditions occurs: • Cancelled by the tool • The FTP exceeds 32 mm Hg (17 in H20)
EVAP System Seal	Engine Output Controls/ EVAP System	Commands the purge valve OFF
EVAP Test	Service Bay Test	Activates the Service Bay Test to verify the integrity of the EVAP system. The scan tool initiates the test when the following conditions are met: • All instruction on the scan tool have been completed • ECT is less than a specified value • No DTCs are set
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 until one of the following conditions occurs: • Cancelled by the tool • Purge is greater than 0 percent and the fuel tank pressure exceeds 32 mm Hg (17 in H20)

Scan Tool Special Function	Additional menu Selections	Description
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
Fuel Pump	Engine Output Controls	Controls the fuel pump relay. The normal commanded state is None. When commanded ON/OFF
Fuel Trim Enable	Fuel System	Disables the PCMs ability to learn new fuel trim parameters. 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
Malfunction Indicator Lamp	Engine Output Controls	Controls the malfunction indicator lamp (MIL). The commanded states include None
Misfire Graph	—	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

DTC P0030, P0036, P0050, OR P0056

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. 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 1 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 engine control module (ECM).

The ECM commands the heater ON or OFF to maintain a specific HO2S operating temperature range. The ECM monitors the voltage on the HO2S heater low control circuit for heater fault diagnosis. If the ECM detects that the HO2S heater low control circuit voltage is not within a specified range, DTC P0030 sets for HO2S bank 1 sensor 1, DTC P0036 sets for HO2S bank 1 sensor 2, DTC P0050 sets for HO2S bank 2 sensor 1, or DTC P0056 sets for HO2S bank 2 sensor 2.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0030 HO2S Heater Control Circuit Bank 1 Sensor 1
- DTC P0036 HO2S Heater Control Circuit Bank 1 Sensor 2
- DTC P0050 HO2S Heater Control Circuit Bank 2 Sensor 1
- DTC P0056 HO2S Heater Control Circuit Bank 2 Sensor 2

Conditions for Running the DTC

- The Ignition 1 Signal parameter is between 10-18 volts.
- This diagnostic runs continuously when the above condition is met.

Conditions for Setting the DTC

The ECM detects that the affected HO2S heater low control circuit is not within a specified range 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.

Test Description

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

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

DTC P0030, P0036, P0050, or P0056

Step	Action	Value(s)	Yes	No
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 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 Testing for Intermittent Conditions and Poor Connections
4	Inspect the O2A or O2B fuse. Is the O2A or O2B fuse open?	—	Go to Step 5	Go to Step 6
5	Test the ignition 1 voltage circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 8
6	1. Disconnect the affected HO2S. 2. Turn ON the ignition, with the engine OFF. 3. Probe the ignition 1 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 . Does the test lamp illuminate?	—	Go to Step 7	Go to Step 17

Step	Action	Value(s)	Yes	No
7	**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.** Connect a test lamp between the ignition 1 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. 1.Command the HO2S heaters ON with a scan tool. 2. Does the test lamp blink once per second?	—	Go to Step 9	Go to Step 10
8	**Important: Perform the following test on all HO2S which are supplied voltage by the suspect circuit.** Test the ignition 1 voltage circuit on the sensor side of the HO2S connector for a short to ground. Refer to Circuit Testing . Is any sensor shorted to ground?	—	Go to Step 18	Go to Testing for Intermittent Conditions and Poor Connections
9	Measure the resistance of the following circuits with a DMM: • The HO2S heater low control circuit • The ignition 1 voltage circuit Refer to Circuit Testing . Is the resistance of either circuit more than the specified value?	3 ohms	Go to Step 16	Go to Step 14
10	Is the test lamp on steady?	—	Go to Step 11	Go to Step 12
11	Test the HO2S heater low control circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 15
12	Test the HO2S heater low control circuit for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition? G	—	Go to Step 20	Go to Step 13
13	Test the HO2S heater low control circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 15

Step	Action	Value(s)	Yes	No
14	Test for shorted terminals and for poor connections at the HO2S. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 18
15	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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 19
16	Repair the circuit with high resistance. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 20	—
17	Repair the open or high resistance in the ignition 1 voltage circuit. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 20	—
18	Replace the affected HO2S. Refer to the following: • 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 20	—
19	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?		Go to Step 20	—

Step	Action	Value(s)	Yes	No
20	1. Replace the O2A or O2B 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 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 - Vehicle	System OK

DTC P0053, P0054, P0059, OR P0060

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 1 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. The PCM calculates the heater resistance on a cold start. This diagnostic will only run once per ignition cycle. If the PCM detects that the heater calculated resistance is not within the expected range, the following DTCs will set:

- DTC P0053 for HO2S Bank 1 Sensor 1
- DTC P0054 for HO2S Bank 1 Sensor 2
- DTC P0059 for HO2S Bank 2 Sensor 1
- DTC P0060 for HO2S Bank 2 Sensor 2

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0053 HO2S Heater Resistance Bank 1 Sensor 1
- DTC P0054 HO2S Heater Resistance Bank 1 Sensor 2
- DTC P0059 HO2S Heater Resistance Bank 2 Sensor 1
- DTC P0060 HO2S Heater Resistance Bank 2 Sensor 2

Conditions for Running the DTC

- DTCs P0112, P0113, P0116, P0117, P0118, P0128, P2610 are not set.
- The ignition is OFF for more than 10 hours.
- The Engine Coolant Temperature (ECT) Sensor parameter is between -30 and +45°C (-22 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.
- This diagnostic runs one time per valid cold start once the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the affected HO2S heater calculated resistance is not within an expected range at engine start-up for 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 number below refers to the step number on the diagnostic table.

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

DTC P0053, P0054, P0059, or P0060

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
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?	.25-3.125 A	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.	—	Go to Step 4	Go to Testing for Intermittent Conditions and Poor Connections
4	Inspect the O2A or O2B fuse. Is the O2A or O2B fuse open?	—	Go to Step 5	Go to Step 6
5	Test the ignition 1 voltage circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 8

6	1. Disconnect the affected HO2S. 2. Turn ON the ignition, with the engine OFF. 3. Probe the ignition 1 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 . Does the test lamp illuminate?	—	Go to Step 7	Go to Step 17
7	**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 1 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 9	Go to Step 10
8	**Important: Perform the following test on all HO2S' which are supplied voltage by the suspect circuit.** Test the ignition 1 voltage circuit on the sensor side of the HO2S connector for a short to ground. Refer to Circuit Testing . Is any sensor shorted to ground?		Go to Step 18	Go to Testing for Intermittent Conditions and Poor Connections
9	Measure the resistance of the following circuits with a DMM: • The HO2S heater low control circuit • The ignition 1 voltage circuit Refer to Circuit Testing . Is the resistance of either circuit more than the specified value?	3 ohms	Go to Step 16	Go to Step 14
10	Is the test lamp on steady?	—	Go to Step 11	Go to Step 12
11	Test the HO2S heater low control circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 15

12	Test the HO2S heater low control circuit for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 13
13	Test the HO2S heater low control circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 15
14	Test for shorted terminals and for poor connections at the HO2S. Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 18
15	Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 19
16	Repair the circuit with high resistance. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 20	—
17	Repair the open or high resistance in the ignition 1 voltage circuit. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 20	—

18	Replace the affected HO2S. Refer to the following: • Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 1 • Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2 • Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 1 • Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2 Did you complete the replacement?	—	Go to Step 20	—
19	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 20	—
20	1. Replace the O2A or O2B 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 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 - Vehicle	System OK

DTC P0068

Circuit Description

The powertrain control module (PCM) uses the following readings in order to calculate the predicted mass air flow (MAF) rate:

- The throttle position (TP)
- The barometric (BARO) pressure
- The intake air temperature (IAT)
- The engine revolutions per minute (RPM)

The PCM compares the predicted MAF value to the actual MAF value, and to the speed density calculation in order to verify the proper throttle operation.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0068 Throttle Body Air Flow Performance

Conditions for Running the DTC

- DTCs P0601, P0602, P0604, P0606, P1516, P2101, P2108 or U0107 are not set.
- DTCs P0120 and P0220 are not active at the same time.
- The engine operates longer than 1 second.
- The engine speed is greater than 500 RPM.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The PCM detects that the difference between the actual MAF and the speed density calculated air flow is greater than expected.
- 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

- 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 throttle actuator control (TAC) module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any 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 excess force. The throttle blade should move smoothly through the full range and then should independently return to a slightly open position.

- 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. Remember this if you review the stored information in Capture Info.
- For an intermittent condition, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

5. Locating and repairing an individual condition may correct more than one DTC.

DTC P0068

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Is DTC P0101, P0102, P0103, P0107, P0108, P0112, P0113, P1111, or P1112 set?		Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
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: • Loose or damaged throttle blade • Cracked or bent throttle shaft Did you find and correct the condition?	—	Go to Step 4	Go to Diagnostic Aids
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 DTC run and pass?	—	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 - Vehicle	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 10,000 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 speed revolutions per minute (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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0101 Mass Air Flow (MAF) Sensor Performance

Conditions for Running the DTC

- DTCs P0068, P0102, P0103, P0106, P0107, P0108, P0120, P0220, P0442, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P2135 are not set.
- The engine is cranking or running.
- The ignition 1 signal is between 11-18 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 less than 80 kPa.
- The change in the MAP sensor is less than 3 kPa.
- The above conditions are met for 1.5 seconds.
- DTC P0101 runs continuously when the above conditions are met.

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 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.
- 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 230 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.

- The barometric pressure (BARO) 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 5-volt reference circuit of the MAP sensor may cause this DTC to set.
- A high resistance on the low reference circuit of the MAP sensor may cause this DTC to set.
- If the condition is intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

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 TP sensors are operating properly.
9. This step will determine if any mechanical faults have caused this DTC to set.
10. This voltage drop test will determine if high resistance has caused this DTC to set.

DTC P0101

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Observe the Diagnostic Trouble Code (DTC) Information with the scan tool. Does the scan tool display any other DTCs set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	Attempt to start the engine. Does the engine start?	—	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 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 Manifold Absolute Pressure (MAP) Sensor kPa parameter with a scan tool. 3. The 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	Observe the MAP sensor parameter with a scan tool. 1. Start the engine. 2. Does the MAP Sensor parameter decrease?	—	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 throttle position (TP) Indicated Angle parameter with a scan tool. 4. Depress the accelerator pedal completely. Is the TP Indicated Angle parameter within the specified range? 98-100%	98-100%	Go to Step 9	Go to DTC P0120
9	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 mass air flow (MAF) sensor - Any contamination or debris on the sensing elements of the MAF sensor - Any water intrusion in the induction system - Any vacuum leak downstream of the MAF sensor - A skewed or stuck intake air temperature (IAT) sensor--Refer to Temperature vs Resistance - A MAF sensor harness that is routed too close to any aftermarket accessories--Refer to Checking Aftermarket Accessories . - Any type of restriction in the exhaust system. 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 . 5. Connect a DMM to the probe of the test lamp and a good ground. Refer to Measuring Voltage Drop . 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 . 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 . Did you complete the repair?	—	Go to Step 14	—
13	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 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 - Vehicle	System OK

DTC P0102

Circuit Description

The mass air flow (MAF) sensor is an airflow meter that measures the amount of air entering the engine. The powertrain control module (PCM) uses the MAF sensor signal in order to provide the correct fuel delivery for a wide range of engine speeds and loads. A small quantity of air entering the engine indicates a deceleration or idle. 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 in order to produce a frequency based on inlet air flow through the sensor bore. The frequency varies within a range of around 2,000 Hertz at idle to about 10,000 Hertz at maximum engine load. If the PCM detects a frequency signal lower than the possible range of a properly operating MAF sensor, DTC P0102 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0102 Mass Air Flow (MAF) Sensor Circuit Low Frequency

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 above conditions are met for more than 1 second.
- DTC P0102 runs continuously when the above conditions are met.

Conditions for Setting the DTC

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

Diagnostic Aids

Inspect for the following conditions:

- An incorrectly routed harness--Inspect the harness of the MAF sensor in order 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
  - Any aftermarket accessories--Refer to Checking Aftermarket Accessories .

- A low minimum air rate through the sensor bore may cause this DTC to set at idle or during deceleration. Inspect for any vacuum leaks downstream of the MAF sensor.
- A wide open throttle (WOT) acceleration from a stop should cause the MAF Sensor g/s parameter on the scan tool to increase rapidly. This increase should be from 6-12 g/s at idle to 230 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 resistance of 15 ohms or more on the ground circuit or the ignition 1 circuit of the MAF sensor can cause this DTC to set.

If the condition is intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Start the engine. 2. Observe the Mass Air Flow (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 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 - A restricted Exhaust 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 . 5. Connect the DMM to the probe of the test lamp and a good ground. Refer to Measuring Voltage Drop and Circuit Testing . Is the voltage within 0.50 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 . Is the resistance less than the specified value?	5 ohms	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 . 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 . **Important: Running the engine with the MAF/IAT sensor disconnected may also set DTC P0113.** 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 ground the black 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 . 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

12	**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. 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 . 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 . 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 . 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 . 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 . Is the resistance less than the specified value?	∞ ohms	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 . 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 . 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 . 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 . 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 . 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 . 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 Did you complete the repair?	—	Go to Step 28	—
25	Repair the circuits that are shorted together. Refer to Wiring Repairs . 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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 10,000 Hertz at maximum engine load. If the PCM detects the frequency signal is more than the possible range of a correctly operating MAF sensor DTC P0103 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0103 Mass Air Flow (MAF) Sensor Circuit High Frequency

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 above conditions are met for more than 1 second.
- DTC P0103 runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the MAF sensor frequency signal is more than 12,000 Hz.

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.
- 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 Testing for Intermittent Conditions and Poor Connections .

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 mass air flow (MAF)/intake air temperature (IAT) sensor. **Important: Running the engine with the MAF/IAT sensor disconnected may set additional MAF and IAT DTCs.** 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 air induction system for any water intrusion. Did you find and correct the condition?	—	Go to Step 10	Go to Step 6

6	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 . 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 . 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	System OK

DTC P0106

DTC Descriptor

DTC P0106: Manifold Absolute Pressure (MAP) Sensor Performance

Diagnostic Fault Information

Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

Typical Scan Tool Data

MAP Sensor

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 idle or deceleration. The PCM should detect a high signal voltage at high MAP, such as the ignition is ON, with the engine OFF, or at wide open throttle (WOT). The MAP sensor is also used to in order to determine the barometric pressure (BARO).

This occurs when the ignition switch is turn 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 the throttle position (TP) and the 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 P0068, P0107, P0108, P0120, P0220, P0506, P0507, P2135 are not set.
- The engine is running.
- The engine speed is between 500-5,000 RPM.
- Any change in the engine speed is less than 125 RPM.
- The change in air flow is less than 10 g/s.
- The traction control, if equipped, is not active.
- The power take-off (PTO), if equipped, is not active.
- The A/C compressor clutch state does not change.
- The power steering load is stable.
- The brake switch state does not change.
- The above conditions are met for 1 second.
- DTC P0106 runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the MAP sensor signal is not within the predicted range 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.

Circuit/System Verification

IMPORTANT:
Verify that the engine is in good mechanical condition before continuing with this diagnostic.

- Verify the integrity of the air induction system by inspecting for the following conditions:
  - Any damaged components
  - Loose or improper installation
  - Improperly routed vacuum hoses
  - Any vacuum leak
  - Any type of restriction
  - A MAP sensor seal that is missing or damaged
- Verify that restrictions do not exist in the MAP sensor vacuum source.
- Verify that restrictions do not exist in the exhaust system. Refer to Restricted Exhaust .

- A skewed or stuck engine coolant temperature (ECT) or IAT sensor will cause the calculated models to be inaccurate and may cause this DTC to run when it should not. Refer to Temperature Versus Resistance .
- The BARO that is used by the PCM to calculate the air flow models is initially based on the MAP sensor at ignition ON. When the engine is running, the PCM will continually update the BARO value near wide open throttle using the MAP sensor and a calculation. A skewed MAP sensor will cause the BARO value to be inaccurate. Use the scan tool and compare the BARO parameter at ignition ON to the Altitude vs. Barometric Pressure Table. Refer to Altitude Versus Barometric Pressure .
- A skewed MAP sensor will also cause the first and second intake manifold models to disagree with the actual MAP sensor measurements. Use the scan tool and compare the MAP Sensor parameter to a known good vehicle, under various operating conditions.
- Inspect for the following conditions:
  - Incorrect cam timing--Refer to Timing Chain and Sprockets Replacement .
  - Worn piston rings--Refer to Engine Compression Test .

Circuit/System Testing

Turn ON the ignition, with the engine OFF.

Disconnect the MAP sensor.

IMPORTANT

Certain resistances will not be detectable if a test lamp is not connected to provide a circuit load.

1. Connect a test lamp between the MAP sensor 5-volt reference circuit and a good ground.
2. Measure for a proper range of 4.8-5.2 volts between the MAP sensor 5-volt reference circuit and a good ground.
   - If the voltage is less than the specified range, then test the circuit for an open, or high resistance. If the circuit tests normal, replace the PCM.
   - If the voltage is more than the specified range, then test the circuit for a short to voltage. If the circuit tests normal, replace the PCM.

3. With the MAP sensor still disconnected, use the scan tool to observe the MAP Sensor parameter for the proper value of less than 12 kPa.
   - If the MAP Sensor parameter is more than 12 kPa, then test the MAP sensor signal circuit for a short to voltage. If the circuit tests normal, replace the PCM.
4. Connect a 3-amp jumper wire between the MAP sensor 5-volt reference circuit and the MAP sensor signal circuit.
5. Use the scan tool to observe the MAP Sensor parameter for the proper value of more than 103 kPa.
   - If the MAP Sensor parameter is less than 103 kPa, then test the MAP sensor signal circuit for high resistance. If the circuit tests normal, replace the PCM.
6. Turn OFF the ignition, and all electrical accessories. Allow sufficient time for the control module to power down before taking a resistance measurement.
7. Measure for a proper value of less than 10 ohms of resistance between the low reference circuit of the MAP sensor and a good ground.
   - If the resistance is more than 10 ohms, then test the circuit for high resistance. If the circuit tests normal, replace the PCM.
8. If the MAP sensor circuits test normal, then replace the MAP sensor.

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, diagnostic trouble code (DTC) P0107 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0107 Manifold Absolute Pressure (MAP) Sensor Circuit Low Voltage

Conditions for Running the DTC

- DTC P0068, P0120, P0220, P2135 are not set.
- The engine is running.
- The throttle angle is more than 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.
- DTC P0107 runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the MAP sensor voltage is less than 0.055 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.

DTC P0107

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Start the engine. 2. Monitor the Diagnostic Trouble Code (DTC) Information with the scan tool. Is DTC P0641 also set?	—	Go to DTC P0641	Go to Step 3
3	Observe the Manifold Absolute Pressure (MAP) Sensor parameter with the scan tool. Is the voltage is 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. Does the DTC fail this ignition?	—	Go to Step 5	Go to Testing for Intermittent Conditions and Poor Connections
5	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 . Did you find and correct the condition?	—	Go to Step 13	Go to Step 6
6	1. Turn OFF the ignition. 2. Disconnect the MAP sensor electrical connector. 3. Turn ON the ignition, with the engine OFF. **Important: Certain resistances will not be detectable if a test lamp is not connected to provide a circuit load.** 4. Connect a test lamp between the MAP sensor 5-volt reference circuit and a good ground. 5. Measure the voltage from the 5-volt reference circuit of the MAP sensor to a good ground, with a DMM. Is the voltage more than the specified value?	4.8 V	o to Step 7	Go to Step 8

7	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 11	Go to Step 9
8	Test the 5-volt reference circuit between the powertrain control module (PCM) and the MAP sensor for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 10
9	Test the MAP sensor signal circuit between the PCM and the MAP sensor for a short to ground or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 10
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 . 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0108 Manifold Absolute Pressure (MAP) Sensor Circuit High Voltage

Conditions for Running the DTC

- DTCs P0068, P0120, P0220, P2135 are not set.
- The engine has been running for a length of time that is determined by the startup coolant temperature. The length of time ranges from 10-242 seconds.
- The accelerator pedal 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.
- DTC P0108 runs continuously when the above conditions are met.

Conditions for Setting the DTC

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

DTC P0108

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Start the engine. 2. Observe the Manifold Absolute Pressure (MAP) Sensor parameter with the scan tool. Is the voltage more than the specified value?	4.9 V	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 Testing for Intermittent Conditions and Poor Connections
4	Inspect the MAP sensor vacuum source for the following conditions: • A leak • A restriction • A faulty connection Did you find and correct the condition?	—	Go to Step 15	Go to Step 5
5	Monitor the DTC Information with the scan tool. Is DTC P0641 also set?	—	Go to Step 9	Go to Step 6
6	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 . Did you find and correct the condition?	—	Go to Step 15	Go to Step 7
7	1. Turn OFF the ignition. 2. Disconnect the MAP sensor electrical connector. 3. Turn ON the ignition, with the engine OFF. 4. Observe the MAP Sensor parameter with the scan tool. Is the voltage less than the specified value?	0.1 V	Go to Step 8	Go to Step 10

8	1. Turn OFF the ignition. 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 . 3. Turn ON the ignition, with the engine OFF. 4. 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 . Is the voltage more than the specified value?	0.2 V	Go to Step 11	Go to Step 13
9	1, Turn OFF the ignition. 2. Disconnect the MAP sensor electrical connector. 3. Turn ON the ignition, with the engine OFF. 4. Observe the MAP Sensor parameter with the scan tool. Is the voltage less than the specified value?	0.1 V	Go to DTC P0641	Go to Step 10
10	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 . Did you find and correct the condition?	—	Go to Step 15	Go to Step 14
11	Test the low reference circuit between the PCM and the MAP sensor for an open or for high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 15	Go to Step 12
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 . Did you find and correct the condition?	—	Go to Step 15	Go to Step 14
13	Replace the MAP sensor. Refer to Manifold Absolute Pressure (MAP) Sensor Replacement . Did you complete the replacement?	—	Go to Step 15	—
14	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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 - Vehicle	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Voltage

Conditions for Running the DTC

- DTCs P0116, P0117, P0118, P0128, 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).
- The engine coolant temperature (ECT) is less than 125°C (257°F).
- DTC P0112 runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the IAT Sensor parameter is more than 128°C (262°F) for 12.5 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 an intermittent condition is suspected, refer to Testing for Intermittent Conditions and Poor Connections .

DTC P0112

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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. Did the DTC fail this ignition?	—	Go to Step 4	Go to Diagnostic Aids
4	Disconnect the IAT sensor. 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 . Did you find and correct the condition?	—	Go to Step 8	Go to Step 7
6	Replace the IAT sensor. Refer to Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Replacement . Did you complete the replacement?	—	Go to Step 8	—
7	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 8	—

8	Clear the DTCs with a scan tool. Turn OFF the ignition for 30 seconds. Start the engine. 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 - Vehicle	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Voltage

Conditions for Running the DTC

- DTCs P0116, P0117, P0118, 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.
- DTC P0113 runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the IAT Sensor parameter is less than -38°C (-36°F) for more than 12.5 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 Testing for Intermittent Conditions and Poor Connections .

Test Description

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

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

DTC P0113

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Start the engine. 2. Monitor the DTC information with the scan tool. Is DTC P0641 also set?	—	Go to DTC P0641	Go to Step 3
3	Observe the Intake Air Temperature (IAT) Sensor parameter with a scan tool. Is the IAT Sensor parameter less than the specified value?	-38°C (-36°F)	Go to Step 5	Go to Step 4
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. Did the DTC fail this ignition?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Disconnect the mass air flow (MAF)/IAT sensor. 2. Connect a DMM between the signal circuit of the IAT sensor and a good ground. Is the voltage more than the specified value?	5.2 V	Go to Step 6	Go to Step 7
6	**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 . Did you find and correct the condition?	—	Go to Step 16	Go to Step 13
7	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 . 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 11	Go to Step 8

8	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 . 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 9
9	Test the signal circuit of the IAT sensor for an open circuit or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 16	Go to Step 13
10	Test the IAT sensor low reference circuit for high resistance or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 16	Go to Step 13
11	Test the IAT signal circuit for a short to any 5-volt reference circuit. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 16	Go to Step 12
12	**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 . Did you find and correct the condition?	—	Go to Step 16	Go to Step 14
13	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 . Did you find and correct the condition?	—	Go to Step 16	Go to Step 15
14	Replace the IAT sensor. Refer to Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Replacement . Did you complete the replacement?	—	Go to Step 16	—
15	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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. Did 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 - Vehicle	System OK

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 engine coolant temperature is low, the sensor resistance is high. When the engine coolant temperature is high, the sensor resistance is low. 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). Before failing this test, the PCM will perform a calculation to determine the presence of an engine block heater. If the PCM detects that the temperature difference between the ECT and the IAT is not within the calibrated range after the ignition OFF time, DTC P0116 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0116 Engine Coolant Temperature (ECT) Sensor Performance

Conditions for Running the DTC

- The ignition is ON.
- DTCs P0112, P0113, P0117, P0118, P0128, P0502, P0503 are not set.
- The IAT Sensor parameter is more than -7°C (20°F).
- The vehicle has a minimum ignition OFF time of 10 hours.
- DTC P0116 runs once per drive cycle when the above conditions are met.

Conditions for Setting the DTC

The start-up ECT is more than the start-up IAT by 100°C (180°F).

OR

If the start-up ECT is more than the start-up IAT by 15°C (27°F), then the vehicle must be driven for more than 400 seconds over 24 km/h (15 mph). If the IAT sensor temperature decreases more than 8°C (14°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.

Diagnostic Aids

DTC P0116 may set if the vehicle uses an aftermarket engine block heater.

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Inspect the cooling system coolant level. Is the cooling system coolant low?	—	Service the Cooling System as Required	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 engine coolant temperature (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
5	1. Remove the mass air flow (MAF)/IAT sensor. Refer to Mass Air Flow (MAF)/Intake Air 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 . 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 Testing for Intermittent Conditions and Poor Connections
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 Testing for Intermittent Conditions and Poor Connections	Go to Step 12
10	Disconnect the MAF/IAT sensor. 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 . 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 . 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
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 record the value. Refer to Circuit Testing . 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	**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 . Is the resistance less than the specified value?	5 ohms	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 . Is the voltage within the specified range?	4.8-5.2 V	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 19

16	1. Disconnect the powertrain control module (PCM). 2. Measure the resistance of the IAT sensor signal circuit between the sensor harness and the PCM with a DMM. Refer to Circuit Testing . Is the resistance within the specified range?	0-10 ohms	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 18
17	Test the IAT low reference circuit for a high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 25	Go to Step 20
18	Test the IAT signal circuit for a high resistance. Refer to Circuit Testing and Wiring Repairs . 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 . Did you find and correct the condition?	—	Go to Step 25	- Go to Step 21
20	Test for an intermittent and for a poor connection at the PCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . 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 the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0117 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage

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 the intake air temperature (IAT) is less than 50°C (122°F).
- DTC P0117 runs continuously when the above condition is met.

Conditions for Setting the DTC

The PCM detects that the ECT Sensor parameter is more than 138°C (280°F) for more than 23 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.
- If the condition is suspected of being an intermittent, refer to Testing for Intermittent Conditions and Poor Connections

DTC P0117

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	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 . 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 . 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 powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 10	Go to Step 9

9	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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 - Vehicle	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0118 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage

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)
- DTC P0118 runs continuously when the above condition is met.

Conditions for Setting the DTC

The PCM detects that the ECT Sensor parameter is less than -38°C (-36°F) for 23 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.
- If the condition is suspected of being intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

DTC P0118

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Observe the Engine Coolant Temperature (ECT) Sensor parameter with a scan tool. Is the ECT Sensor parameter less than the specified value? Go to Step 4 Go to Step 3	-38°C (-36°F)		
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 . 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 . 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 . 2. Observe the ECT Sensor parameter with the scan tool. Is the ECT Sensor parameter more than the specified value? 138°C (280°F)	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. Is the ECT Sensor parameter more than the specified value?	138°C (280°F)	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 . 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 . 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 . 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 . 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 powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	System OK

DTC P0120

Circuit Description

The throttle position (TP) sensor 1 is a potentiometer type sensor with 3 circuits:

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

The TP sensor is used to determine the throttle plate angle for various engine management systems. The control module provides the TP sensor a 5-volt reference circuit and a low reference circuit. The TP sensor then provides the control module a signal voltage proportional to throttle plate movement. TP sensor 1 signal voltage is low at closed throttle and increases as the throttle opens. When the control module detects that the TP sensor 1 signal or TP sensor 5-volt reference voltage is outside the predetermined range, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0120 Throttle Position (TP) Sensor 1 Circuit

Conditions for Running the DTC

- DTCs U0107 or P2108 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is more than 5.23 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The TP sensor 1 signal voltage is less than 0.37 volt or more than 4.51 volts.
- The above condition is present for more 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 actuator control (TAC) module connectors for signs of water intrusion. When this 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 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 stored information, Capture info.
- If this DTC is determined to be intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

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 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 stored information, Capture Info.

DTC P0120

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Turn OFF the ignition. 2. Remove the air inlet duct from the throttle body. 3. Disconnect the throttle body harness connector. 4. Connect jumper wires between the throttle position (TP) sensor 1 terminals of the throttle body harness connector and the corresponding TP sensor 1 terminals of the throttle body. 5. Turn ON the ignition, with the engine OFF. 6. Close the throttle blade by hand. 7. Observe the TP sensor 1 voltage with a scan tool. Is the TP sensor 1 voltage within the specified range?	0.37-0.71 V	Go to Step 5	Go to Step 3
3	1. Turn OFF the ignition. 2. Connect jumper wires between the TP sensor 2 terminals of the throttle body harness connector and the corresponding TP sensor 2 terminals of the throttle body. 3. Turn ON the ignition, with the engine OFF. 4. Close the throttle blade by hand. 5. Observe the TP sensor 2 voltage with a scan tool. Is the TP sensor 2 voltage within the specified range?	0.28-0.81 V	Go to Step 9	Go to Step 4
4	Is DTC P1518 also set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 9
5	1. Open the throttle blade to wide open throttle (WOT) by hand. 2. Observe the TP Sensor 1 Voltage parameter on the scan tool. Is the TP Sensor 1 Voltage parameter more than the specified value?	4.51 V	Go to Step 9	Go to Step 6

6	1. Disconnect the TP sensor harness connector. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the TP sensor circuits. 3. Test the TP sensor low-reference circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 32	Go to Step 7
7	1. Turn OFF the ignition for 15 seconds. 2. Connect the TAC module harness connector. 3. Connect the throttle body harness connector. 4. Install the air inlet duct. 5. Turn ON the ignition, with the engine OFF. 6. Select the DTC Info option 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 . Did you find and correct the condition?	—	Go to Step 32	Go to Step 8
8	1. Continue to observe DTC Info. 2. Slowly depress the accelerator pedal to WOT, 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
9	1. Disconnect the TP sensor harness connector. 2. Measure the voltage at the TP sensor 1 signal circuit with a DMM connected to ground. Is the voltage within the specified range?	3.94-6.06 V	Go to Step 14	Go to Step 10
10	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 1 signal circuit for a short to voltage with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 32	Go to Step 11

11	Test the TP sensor 1 signal circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 32	Go to Step 12
12	Test the TP sensor 1 signal circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 32	Go to Step 13
13	1. Disconnect the other TAC module harness connector. 2. 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 . Did you find and correct the condition?	—	Go to Step 32	Go to Step 28
14	Measure the voltage from the TP sensor 1, 5-volt reference circuit to a good ground with a DMM. Refer to Circuit Testing . Is the voltage within the specified range?	4.54-5.21 V	Go to Step 24	Go to Step 15
15	Is the voltage more than the specified value?	—	Go to Step 16	Go to Step 18
16	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 1, 5-volt reference circuit for a short to voltage with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	5.21 V	Go to Step 32	Go to Step 17
17	1. Turn OFF the ignition. 2. Disconnect the accelerator pedal position (APP) sensor harness connector. 3. Disconnect the other TAC module harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Test the APP sensor 1, 5-volt reference circuit for a short to voltage with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 32	Go to Step 22

18	Disconnect the APP sensor. Is the voltage less than the specified value?	4.54 V	Go to Step 19	Go to Step 30
19	1. Disconnect the TAC module harness connector containing the TP sensor circuits. 2. Test the TP sensor 1, 5-volt reference circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find and correct the condition?	—	Go to Step 32	Go to Step 20
20	Test the TP sensor 1, 5-volt reference circuit for a short to ground with a DMM. Did you find and correct the condition?	—	Go to Step 32	Go to Step 21
21	Test the APP sensor 1, 5-volt reference circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition	—	Go to Step 32	Go to Step 22
22	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 . Did you find and correct the condition?	—	Go to Step 32	Go to Step 23
23	Test for a short between the APP sensor 1, 5-volt reference circuit and all other TAC module circuits with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 32	Go to Step 28
24	1. Connect a fused jumper between the TP sensor 1 low-reference circuit and the TP sensor 1 signal circuit. 2. Observe the TP Sensor 1 Voltage parameter with a scan tool. Is the TP Sensor 1 parameter 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. Test the TP sensor 1 low-reference circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find and correct the condition?	—	Go to Step 32	Go to Step 28

26	Inspect for an intermittent and for a poor connection at the throttle body harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 32	Go to Step 29
27	Inspect for an intermittent and for a poor connection at the APP sensor harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 32	Go to Step 30
28	Inspect for an intermittent and for a poor connection at the TAC module harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 32	Go to Step 31
29	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 Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 32	—
32	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 33
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 - Vehicle	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 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 condition. 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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0128 Engine Coolant Temperature (ECT) Below Thermostat Regulating Temperature

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0220, P0502, P0503, P2135 are not present.
- The start-up ECT is less than 74°C (165°F) when the intake air temperature (IAT) is more than 10°C (50°F).

OR

- The start-up ECT is less than 50°C (122°F) when the IAT is between -7 and +10°C (+19 and +50°F).
- The fuel ethanol is less than 87 percent.
- The IAT sensor parameter is between -7 and +55°C (+19 and +131°F).

- The engine run time is between 120-1,370 seconds.
- The vehicle speed is more than 8 km/h (5 mph) for more than 2.5 km (1.5 miles).
- The mass air flow (MAF) is between 20-75 g/s with the average more than 10 g/s.
- DTC P0128 runs one time per drive cycle when the above conditions are met.

Conditions for Setting the DTC

The PCM detects all of the following conditions:

- 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 ECT of 79°C (175°F) has not been met when the IAT is more than 10°C (50°F).

OR

- The calibrated minimum ECT of 55°C (131°F) has not been met when the IAT is between -7 and +10°C (+19 and +50°F).

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**Important: The cooling fans are commanded ON when certain engine coolant temperature (ECT) DTCs are set.** Is the cooling system coolant low?	—	Service the Cooling System as required	Go to Step 3
3	Test and verify the proper operation of the thermostat. Refer to Thermostat Diagnosis . 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 . Did you find and correct the condition?	—	Go to Step 14	Go to Step 5
5	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 . Did you find and correct the condition?	—	Go to Step 14	Go to Step 6
6	Measure the resistance of the ECT sensor signal circuit between the sensor and the PCM with a DMM. Refer to Circuit Testing . Is the resistance within the specified range?	0-10 ohms	Go to Step 7	Go to Step 10
7	Measure the resistance of the ECT sensor low reference circuit between the sensor and the PCM with a DMM. Refer to Circuit Testing . Is the resistance within the specified range?	0-10 ohms	Go to Step 8	Go to Step 11

8	1. Turn OFF the ignition. 2. Remove the ECT sensor. 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. 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 Versus Resistance . Is the resistance measurement of the ECT sensor within the specified range?	—	Go to Step 9	Go to Step 12
9	Install the ECT sensor. Is the action complete?-	—	Go to Step 13	—
10	Repair the high resistance in the ECT sensor signal circuit . Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 14	—
11	Repair the high resistance in the ECT sensor low reference circuit . Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 14	—
12	Replace the ECT sensor. Refer to Engine Coolant Temperature Sensor Replacement . Did you complete the replacement?	—	Go to Step 14	—
13	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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 - Vehicle	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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1
- DTC P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0200, P0220, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, 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.
- The above conditions are met for 2 seconds.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the affected HO2S voltage parameter is less than 200 mV for 165 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 Testing for Intermittent Conditions and Poor Connections
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	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 ground. Refer to the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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: **Notice: 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 . 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 Control Module References for replacement, setup, and programming. 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	In order to ensure that the performance of the catalyst has not been affected by the fault that set this DTC, operate the vehicle within the conditions for running and setting DTC P0420 or P0430 and verify that P0420 or P0430 runs and passes. Refer to DTC P0420 or P0430 . Does the DTC run and pass?	—	Go to Step 17	Go to DTC P0420 or P0430
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 - Vehicle	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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:
- DTC P0132 HO2S High Voltage Bank 1 Sensor 1
- DTC P0152 HO2S High Voltage Bank 2 Sensor 1

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0200, P0220, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, 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.

- The above conditions are met for 2 seconds.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the affected HO2S voltage parameter is more than 1050 mV for 48 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 Testing for Intermittent Conditions and Poor Connections
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 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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
8	1. Test the HO2S high signal circuit for an open or high resistance. Refer to the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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: **Notice: 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 evaporative emission (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 • 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 the following: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 Control Module References for replacement, setup, and programming. 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	In order to ensure that the performance of the catalyst has not been affected by the fault that set this DTC, operate the vehicle within the conditions for running and setting DTC P0420 or P0430 and verify that P0420 or P0430 runs and passes. Refer to DTC P0420 or P0430 . Does the DTC run and pass?	—	Go to Step 19	Go to DTC P0420 or P0430
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 - Vehicle	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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0133 HO2S Slow Response Bank 1 Sensor 1
- DTC P0153 HO2S Slow Response Bank 2 Sensor 1

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0131, P0132, P0134, P0135, P0151, P0152, P0154, P0155, P0200, P0220, P0300, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ECT Sensor parameter is more than 60°C (140°F).
- The EVAP Purge Solenoid Command parameter is more than 1 percent.
- The MAF Sensor parameter is between 29-55 g/s.

- The Engine Speed parameter is between 1,000-3,000 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 1 second.

This diagnostic runs continuously when the above conditions are met.

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 for 100 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 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 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 Testing for Intermittent Conditions and Poor Connections
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. 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs Did you find and correct the condition?	—	Go to Step 12	Go to Step 11

10	**Notice: 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 . • Engine oil consumption--Refer to Oil Consumption Diagnosis . • Engine coolant consumption--Refer to Loss of Coolant . 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1
- DTC P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0200, P0220, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, 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.
- This diagnostic runs continuously when the above conditions are met.

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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**Important: When 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 Testing for Intermittent Conditions and Poor Connections

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 . 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 . 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs Did you find and correct the condition?	—	Go to Step 19	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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs Did you find and correct the condition?	—		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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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 1 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. This diagnostic will only run once per ignition cycle. If the PCM detects that the heater current is not within an 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

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0135 HO2S Heater Performance Bank 1 Sensor 1
- DTC P0141 HO2S Heater Performance Bank 1 Sensor 2
- DTC P0155 HO2S Heater Performance Bank 2 Sensor 1
- DTC P0161 HO2S Heater Performance Bank 2 Sensor 2

Conditions for Running the DTC

- DTCs P0053, P0054, P0059, P0060, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0200, P0220, P0442, P0446, P0452, P0453, P0455, 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.
- The above conditions are met for 2 seconds.
- This diagnostic runs 1 time per drive cycle when the above conditions are met.

Conditions for Setting the DTC

- 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.

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. 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 Step 6
3	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 4	Go to Step 5
4	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 6	Go to Testing for Intermittent Conditions and Poor Connections
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 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 6	Go to Testing for Intermittent Conditions and Poor Connections

6	Inspect the O2A or O2B fuse. Is the O2A or O2B fuse open?	—	Go to Step 7	Go to Step 8
7	Test the ignition 1 voltage circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 22	Go to Step 10
8	1. Disconnect the affected HO2S. 2. Turn ON the ignition, with the engine OFF. 3. Probe the ignition 1 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 . Does the test lamp illuminate?	—	Go to Step 9	Go to Step 19
9	**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 1 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 11	Go to Step 12
10	**Important: Perform the following test on all HO2S' which are supplied voltage by the suspect circuit.** Test the ignition 1 voltage circuit on the sensor side of the HO2S connector for a short to ground. Refer to Circuit Testing . Is any sensor shorted to ground?	—	Go to Step 20	Go to Testing for Intermittent Conditions and Poor Connections
11	Measure the resistance of the following circuits with a DMM: • HO2S heater low control circuit • Ignition 1 voltage circuit Refer to Circuit Testing . Is the resistance of either circuit more than the specified value?	3 ohms	Go to Step 18	Go to Step 16
12	Is the test lamp on steady?	—	Go to Step 13	Go to Step 14

13	Test the HO2S heater low control circuit for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 22	Go to Step 17
14	Test the HO2S heater low control circuit for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 22	Go to Step 15
15	Test the HO2S heater low control circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 22	Go to Step 17
16	Test for shorted terminals and for poor connections at the HO2S. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 22	Go to Step 20
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 . Did you find and correct the condition?	—	Go to Step 22	Go to Step 21
18	Repair the circuit with high resistance. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 22	—
19	Repair the open or high resistance in the ignition 1 voltage circuit. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 22	—
20	Replace the affected HO2S. Refer to the appropriate procedure: • 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 22	—

21	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 22	—
22	Were you sent to this diagnostic from DTC P0134 or P0154?	—	Go to Step 17 in DTC P0134 or P0154	Go to Step 23
23	Were you sent to this diagnostic from DTC P0140 or P0160?	—	Go to Step 17 in DTC P0140 or P0160	Go to Step 24
24	1. Replace the O2A or O2B 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 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 - Vehicle	System OK

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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2
- DTC P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0169, P0178, P0179, P0200, P0220, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Alcohol content parameter is less than 90 percent.

- The Fuel Tank Level Remaining parameter is greater than 10 percent.
- The TP Indicated Angle parameter is between 3-70 percent more than the value observed at idle.
- The above conditions are met for 2 seconds.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the affected HO2S voltage parameter is less than 80 mV for 200 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**Important: With the engine running, observe the HO2S Bank 1 Sensor 1 and HO2S Bank 2 Sensor 1 voltage parameters with a scan tool. The voltage should vary from less than 300 mV to greater than 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 Testing for Intermittent Conditions and Poor
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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 . 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 17

15	1. The HO2S may be detecting a lean exhaust condition or may be contaminated. Inspect for the following conditions: **Notice: 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 . 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 Control Module References for replacement, setup, and programming. 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) List - Vehicle	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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0138 HO2S Circuit High Voltage Bank 1 Sensor 2
- DTC P0158 HO2S Circuit High Voltage Bank 2 Sensor 2

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0169, P0178, P0179, P0200, P0220, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The Loop Status parameter is closed.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Fuel Alcohol content parameter is less than 90 percent.

- The Fuel Tank Level Remaining parameter is greater than 10 percent.
- The TP Indicated Angle parameter is between 3-70 percent more than the value observed at idle.
- The above conditions are met for 2 seconds.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that the affected HO2S voltage parameter is greater than 950 mV for 200 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**Important: With the engine running, observe the HO2S Bank 1 Sensor 1 and HO2S Bank 2 Sensor 1 voltage parameters with a scan tool. The voltage should vary from less than 300 mV to greater than 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 Testing for Intermittent Conditions and Poor Connections
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 more than the specified value?	800 mV	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 . 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 or high resistance. Refer to the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 or high resistance. Refer to the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs Did you find and correct the condition	—	Go to Step 17	Go to Step 14
12	The HO2S may be detecting a rich exhaust condition or may be contaminated. Inspect for the following conditions: **Notice: 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 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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 DTC P0160 sets for HO2S bank 2 sensor 2.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0140 HO2S Circuit/Insufficient Activity Bank 1 Sensor 2
- DTC P0160 HO2S Circuit/Insufficient Activity Bank 2 Sensor 2

Conditions for Running the DTC

- DTCs P0054, P0060, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0141, P0161, P0200, P0220, P0442, P0446, P0452, P0453, P0455, 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.
- This diagnostic runs 1 time per drive cycle when the above conditions are met.

Conditions for Setting the DTC

- The PCM detects that the affected HO2S voltage parameter is etween 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**Important: When 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
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 Testing for Intermittent Conditions and Poor Connections

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 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 . 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Circuit Testing • Wiring Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 the following procedures: • Heated Oxygen Sensor (HO2S) Wiring Repairs • Testing for Intermittent Conditions and Poor Connections • Connector Repairs 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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 input. During Closed Loop, the PCM adds oxygen sensor inputs and level of purge to calculate short and long term fuel trim adjustments. If the oxygen sensors indicate a lean condition, fuel trim values will be above 0 percent. If the oxygen sensors indicate a rich condition, fuel trim values will be below 0 percent. The values for the short term fuel trim change rapidly in response to the heated oxygen sensor (HO2S) voltage signals. Long term fuel trim makes course adjustments in order to maintain an air/fuel ratio of 14.7:1. A block of cells contain information arranged in combinations of engine RPM and engine load for a full range of vehicle operating conditions. The long term fuel trim diagnostic is based on an average of cells currently being used. The PCM selects the cells based on the engine speed and engine load. If the PCM detects an excessively lean condition, DTC P0171 or P0174 sets.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0171 Fuel Trim System Lean Bank 1
- DTC P0174 Fuel Trim System Lean Bank 2

Conditions for Running the DTC

- DTCs P0030, P0036, P0050, P0053, P0054, P0056, P0059, P0060, P0101, P0102, P0103, P0106, P0107, P0108, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0157, P0158, P0160, P0161, P0200, P0300, P0442, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0506, P0507, P1133, P1134, P1153, P1154, P2A01, P2A04 are not set.
- The Fuel Trim Learn parameter is enabled.
- The Loop Status parameter is closed.
- The engine coolant temperature (ECT) is between -40 to +139°C (-40 to +282°F).

- The intake air temperature (IAT) is between -20 to +152°C (-4 to +304°F).
- The manifold absolute pressure (MAP) is between 15-105 kPa (2.2-15.2 psi).
- The vehicle speed is less than 132 km/h (82 mph).
- The engine speed is between 400-6,500 RPM.
- The barometric pressure (BARO) is more than 70 kPa (10.2 psi).
- The mass air flow (MAF) is between 1-250 g/s.
- The fuel level is more than 15 percent.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The long term fuel trim value is more than a calibrated value for approximately 3 minutes after the Conditions for Running the DTC have been met.

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 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 illuminates the malfunction indicator lamp (MIL) when one of the following occur:

- The control module detects the same fuel trim failure during 2 consecutive trips.
- The control module detects any fuel trim failure during any subsequent trip if the conditions at the time of failure meet the following criteria:
  - The engine load is within 20 percent of the previous test that failed.
  - The engine speed is within 375 RPM of the previous test that failed.
  - The engine coolant temperature is in the same range of the previous test that failed.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) at the beginning of the fourth ignition cycle, after 3 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 and related Freeze Frame data clears after 40 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 resistance in the fuel injector control and/or the ignition 1 voltage circuits may cause the following symptoms:
  - A lean condition
  - Misfire
  - Rough idle Refer to DTC P0200 .
- The system may become lean if an injector is not suppling enough fuel.
- A lean condition could be present during high fuel demand.
- Review the Failure Records with a scan tool. If an intermittent condition is suspected, refer to Testing for Intermittent Conditions and Poor Connections .

DTC P0171 or P0174

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Are any DTCs other than DTC P0171 or P0174 also set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	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 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 greater than the specified value?	24%	Go to Step 4	Go to Diagnostic Aids
4	1. Operate the engine at idle. 2. Observe the HO2S parameters with a scan tool. 3. Does the scan tool indicate that the parameter is within the specified range and fluctuating?	200-800 mV	Go to Step 5	Go to Step 6

5	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 the tank. If the fuel pressure is too low, this DTC may set. Refer to Fuel System Diagnosis . - Fuel contamination--Refer to Alcohol/ Contaminants-in-Fuel Diagnosis . - Any lean fuel injectors--Refer to Fuel Injector Balance Test with Tech 2 . Did you find and correct the condition?	—	Go to Step 8	Go to Step 7
6	1, Turn OFF the engine. 2. Inspect the heated oxygen sensor (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 the following procedures: - Circuit Testing - Wiring Repairs - Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 8	Go to Fuel System Diagnosis

7	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 . 7. Inspect the EVAP lines and components for damage or blockage--Refer to Evaporative Emissions (EVAP) Hose Routing Diagram . 8. Inspect the vacuum brake booster for leaks. Did you find and correct the condition?	—	Go to Step 8	Go to Symptoms - Engine Mechanical
8	**Important: After repairs, use the scan tool Fuel Trim Reset function to reset the Long Term Fuel Trim.** 1. Turn ON the ignition, with the engine OFF. 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 9
9	In order to ensure that the performance of the catalyst has not been affected by the fault that set this DTC, operate the vehicle within the conditions for running and setting DTC P0420 or P0430 and verify that P0420 or P0430 runs and passes. Refer to DTC P0420 or P0430 . Does the DTC run and pass	—	Go to Step 10	Go to DTC P0420 or P0430
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 - Vehicle	System OK

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 input. During Closed Loop, the PCM adds oxygen sensor inputs and level of purge to calculate short and long term fuel trim adjustments. If the oxygen sensors indicated a lean condition, fuel trim values will be above 0 percent. If the oxygen sensors indicate a rich condition, fuel trim values will be below 0 percent. The values for the short term fuel trim 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. A block of cells contain information arranged in combinations of engine RPM and engine load for a fuel range of vehicle operating conditions. The long term fuel trim diagnostic is based on an average of cells currently being used. The PCM selects the cells based on the engine speed and engine load. 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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0172 Fuel Trim System Rich Bank 1
- DTC P0175 Fuel Trim System Rich Bank 2

Conditions for Running the DTC

- DTCs P0030, P0036, P0050, P0053, P0054, P0056, P0059, P0060, P0101, P0102, P0103, P0106, P0107, P0108, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0157, P0158, P0160, P0161, P0200, P0300, P0442, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0506, P0507, P1133, P1134, P1153, P1154, P2A01, P2A04 are not set.
- The Fuel Trim Learn parameter is enabled.

- The Loop Status parameter is closed.
- The engine coolant temperature (ECT) is between -40 to +139°C (-40 to +282° F).
- The intake air temperature (IAT) is between -20 to +152°C (-4 to +304°F).
- The manifold absolute pressure (MAP) is between 15-105 kPa (2.2-15.2 psi).
- The vehicle speed is less than 132 km/h (82 mph).
- The engine speed is between 400-6,500 RPM.
- The barometric pressure (BARO) is more than 70 kPa (10.2 psi).
- The mass air flow (MAF) is between 1-250 g/s.
- The fuel level is more than 15 percent.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The long term fuel trim value is more than a calibrated value for approximately 3 minutes after the Conditions for Running the DTC have been met.

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 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 illuminates the malfunction indicator lamp (MIL) when one of the following occur:

- The control module detects the same fuel trim failure during 2 consecutive trips.
- The control module detects any fuel trim failure during any subsequent trip if the conditions at the time of failure meet the following criteria:
  - The engine load is within 20 percent of the previous test that failed.
  - The engine speed is within 375 RPM of the previous test that failed.
  - The engine coolant temperature is in the same range of the previous test that failed.

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) at the beginning of the fourth ignition cycle, after 3 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 and related Freeze Frame data clears after 40 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 MAF sensor can cause a rich condition and set this DTC. Refer to DTC P0101 .
- Review Failure Records with a scan tool. If an intermittent condition is suspected , refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

7. An EVAP canister that is saturated will cause a rich condition.

DTC P0172 or P0175

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Are any DTCs other than DTC P0172 or P0175 also set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	1. Install a scan tool. 2. Start and idle the engine at the normal operating temperature in Closed Loop. 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 4	Go to Diagnostic Aids
4	1. Operate engine at idle. 2. Observe Heated Oxygen Sensor (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 5	Go to Step 6

5	1. Turn OFF the engine. 2. Visually and physically inspect the following items: - The evaporative emission (EVAP) lines and components for damage or blockage--Refer to Evaporative Emissions (EVAP) Hose Routing Diagram . - The inlet screen of the mass air flow (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 - For objects blocking the throttle body Did you find and correct the condition?	—	Go to Step 8	Go to Step 7
6	1. Turn OFF the 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 the following: - Circuit Testing - Wiring Repairs - Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 8	Go to Fuel System Diagnosis
7	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 8	Go to Symptoms - Engine Mechanical

8	**Important: After repairs, use the scan tool Fuel Trim Reset function to reset the Long Term Fuel Trim.** 1. Turn ON the ignition, with the engine OFF. 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 9
9	In order to ensure that the performance of the catalyst has not been affected by the fault that set this DTC, operate the vehicle within the conditions for running and setting DTC P0420 or P0430 and verify that P0420 or P0430 runs and passes. Refer to DTC P0420 or P0430 . Does the DTC run and pass	—	Go to Step 10	Go to DTC P0420 or P0430
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 - Vehicle	System OK

DTC P0200

Circuit Description

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

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0200 Injector Control Circuit

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 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 isolate an intermittent condition. Refer to Fuel Injector Solenoid Coil Test
- For an intermittent condition, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

4. This step tests for voltage at the fuel injector harness connector. The INJ fuse supplies power to the coil side of the fuel injector harness connector. If the fuse is open, a short to ground on the fuel injector B+ supply circuit is indicated.
5. This step verifies that the PCM is able to control the fuel injector. If the test lamp blinks, then the PCM and wiring are OK.
6. This step tests if a ground is constantly being applied to the fuel injector.

DTC P0200

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 as specified in the supporting text or as close to the Freeze Frame/Failure Records that you observed. Does the DTC fail this ignition?	—	Go to Step 4	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Disconnect the harness connector of the fuel injector for the cylinder which indicated misfire. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition voltage circuit of the fuel injector with a test lamp 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 TBI Harness Test Lamp between the control circuit and the ignition 1 voltage circuit of the fuel injector harness connector. 2. Start the engine. Does the test lamp blink?	—	Go to Step 9	Go to Step 6
6	Does the test lamp remain illuminated at all times?	—	Go to Step 8	Go to Step 7
7	Test the control circuit of the fuel injector for a short to voltage or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 10

8	Test the control circuit of the fuel injector for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 13
9	Inspect for poor connections at the harness connector of the fuel injector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 14	Go to Step 12
10	Inspect for poor connections at the harness connector of the powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 14	Go to Step 13
11	**Important: The INJ fuses also supply voltage to the ignition coil modules. If a fuse is open, inspect all related circuits for a short to ground.** **1.** Repair the open or short to ground in the ignition voltage circuit of the fuel injector. Refer to Wiring Repairs . 2. Replace the fuse, if necessary. Did you complete the repair?	—	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 Control Module References for replacement, setup, and programming. 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. Does the DTC run and pass?	—	Go to Step 15	Go to Step 2
15	Observe the Capture Info with a scan tool. Does the scan tool display any DTCs that you have not diagnosed	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P0220

Circuit Description

The throttle position (TP) sensor 2 is a potentiometer type sensor with 3 circuits:

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

The TP sensor is used to determine the throttle plate angle for various engine management systems. The control module provides the TP sensor with a 5-volt reference circuit and a low reference circuit. The TP sensor then provides the control module with a signal voltage proportional to throttle plate movement. TP sensor 1 signal voltage is low at closed throttle and increases as the throttle opens. When the control module detects that the TP sensor 2 signal or TP sensor 5-volt reference voltage is outside the predetermined range, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0220 Throttle Position (TP) Sensor 2 Circuit

Conditions for Running the DTC

- DTCs U0107 or P2108 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is more than 5.23 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The TP sensor 2 voltage is less than 0.28 volt or greater than 4.60 volts.
- The above condition is present for more 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 actuator control (TAC) module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any 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. Remember this if you review the stored information in Capture Info.
- If this DTC is determined to be intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

31. 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 stored information.

DTC P0220

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Turn OFF the ignition. 2. Remove the air inlet duct from the throttle body. 3. Disconnect the throttle body harness connector. 4. Connect jumper wires between the throttle position (TP) sensor 2 terminals of the throttle body harness connector and the corresponding TP sensor 2 terminals of the throttle body. 5. Turn ON the ignition, with the engine OFF. 6. Close the throttle blade by hand. 7. Observe the TP sensor 2 voltage with a scan tool. Is the TP sensor 2 voltage within the specified range?	0.28-0.81 V	Go to Step 3	Go to Step 7
3	1. Open the throttle blade to wide open throttle (WOT) by hand. 2. Observe the TP Sensor 2 Voltage parameter on the scan tool. Is the TP Sensor 2 Voltage parameter more than the specified value?	4.60 V	Go to Step 7	Go to Step 4
4	1. Disconnect the TP sensor harness connector. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the TP sensor circuits. 3. Test the TP sensor low-reference circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 5

5	1. Turn OFF the ignition for 15 seconds. 2. Connect the TAC module harness connector. 3. Connect the throttle body harness connector. 4. Install the air inlet duct. 5. Turn ON the ignition, with the engine OFF. 6. Select the DTC Info option 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 . Did you find and correct the condition?	—	Go to Step 30	Go to Step 6
6	1. Continue to observe DTC Info. 2. Slowly depress the accelerator pedal to WOT, then slowly return the pedal to the released position 3 times. Does the scan tool indicate this DTC failed this ignition?	—	Go to Step 25	Go to Diagnostic Aids
7	1. Disconnect the TP sensor harness connector. 2. Measure the voltage at the TP sensor 2 signal circuit with a DMM connected to ground. Is the voltage within the specified range?	3.94-6.06 V	Go to Step 12	Go to Step 8
8	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 signal circuit for a short to voltage with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 9
9	Test the TP sensor 2 signal circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 10
10	Test the TP sensor 2 signal circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 11

11	1. Disconnect the other TAC module harness connector. 2. 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 . Did you find and correct the condition?	—	Go to Step 30	Go to Step 26
12	Measure the voltage from the TP sensor 2, 5-volt reference circuit to a good ground with a DMM. Refer to Circuit Testing . Is the voltage within the specified range?	4.54-5.21 V	Go to Step 22	Go to Step 13
13	Is the voltage more than the specified value?	5.21 V	Go to Step 14	Go to Step 16
14	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 . Did you find and correct the condition?	—	Go to Step 30	Go to Step 15
15	1. Turn OFF the ignition. 2. Disconnect the accelerator pedal position (APP) sensor harness connector. 3. Disconnect the other TAC module harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Test the APP sensor 2, 5-volt reference circuit for a short to voltage with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 20
16	Disconnect the APP sensor. Is the voltage less than the specified value?	4.54 V	Go to Step 17	Go to Step 28
17	Disconnect the TAC module harness connector containing the TP sensor circuits. Test the TP sensor 2, 5-volt reference circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find and correct the condition?	—	Go to Step 30	Go to Step 18

18	Test the TP sensor 2, 5-volt reference circuit for a short to ground with a DMM. Did you find and correct the condition?	—	Go to Step 30	Go to Step 19
19	Test the APP sensor 2, 5-volt reference circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 20
20	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 . Did you find and correct the condition?	—	Go to Step 30	Go to Step 21
21	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 . Did you find and correct the condition?	—	Go to Step 30	Go to Step 26
22	1. Connect a fused jumper between the TP sensor 2 low-reference circuit and the TP sensor 2 signal circuit. 2. Observe the TP Sensor 2 Voltage parameter with a scan tool. Is the TP Sensor 2 parameter near the specified value?	0 V	Go to Step 24	Go to Step 23
23	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Test the TP sensor 2 low-reference circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find and correct the condition?	—	Go to Step 30	Go to Step 26
24	Inspect for an intermittent and for a poor connection at the throttle body harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 30	Go to Step 27

25	Inspect for an intermittent and for a poor connection at the APP sensor harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 30	Go to Step 28
26	Inspect for an intermittent and for a poor connection at the TAC module harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 30	Go to Step 29
27	Replace the throttle body assembly. Refer to Throttle Body Assembly Replacement . Did you complete the replacement?	—	Go to Step 30	—
28	Replace the APP sensor. Refer to Accelerator Pedal Position (APP) Sensor Replacement . Did you complete the replacement?	—	Go to Step 30	—
29	Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 30	—
30	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 31
31	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P0230

Circuit Description

The powertrain control module (PCM) provides ignition positive voltage to the coil side of the fuel pump relay. When the ignition switch is first turned ON, the PCM energizes the fuel pump relay, which applies power to the fuel pump. The PCM enables the fuel pump relay as long as the engine is cranking or running, and crankshaft reference pulses are received. If no crankshaft reference pulses are received, the PCM de-energizes the fuel pump relay after 2 seconds. The PCM monitors the voltage on the fuel pump relay control circuit. If the PCM detects an incorrect voltage on the fuel pump relay control circuit, DTC P0230 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0230 Fuel Pump Relay Control Circuit

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 PCM detects that the commanded state of the driver and the actual state of the control circuit do not match.
- All 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.

Test Description

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

2. Listen for a click when the fuel pump relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
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 voltage is constantly being applied to the control circuit of the fuel pump relay.

DTC P0230

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Turn ON the ignition, with the engine OFF. 2. Command the fuel pump ON and OFF with a scan tool. Does the fuel pump relay turn ON and OFF with each command?	—	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 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 4	Go to Testing for Intermittent Conditions and Poor Connections
4	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the control circuit of the fuel pump relay with a test lamp connected to a good ground. 5. Command the fuel pump ON and OFF with a scan tool. Does the test lamp turn ON and OFF with each command?	—	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 relay. 2. Command the fuel pump ON and OFF with a scan tool. Does the test lamp turn ON and OFF with each command?	—	Go to Step 9	Go to Step 11
6	Does the test lamp remain illuminated with each command?	—	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 . 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 . Did you find and correct the condition?	—	Go to Step 14	Go to Step 10
9	Inspect for poor connections at the fuel pump relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 12
10	Inspect for poor connections at the harness connectors of the powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 13
11	Repair the ground circuit of the relay. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 14	—
12	Replace the fuel pump relay. Did you complete the replacement?	—	Go to Step 14	—
13	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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 as specified in the supporting text. Does the DTC run and pass?	—	Go to Step 15	Go to Step 2
15	Observe the stored information, Capture Info with a scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0300 Engine Misfire Detected

Conditions for Running the DTC

- DTC P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0125, P0128, P0220, P0315, P0335, P0336, P0341, P0342, P0343, P0721, P0722, P1114, P1115, P1120, P1258 are not set.
- The engine speed is between 450-5,000 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 (TCS) 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.
- This diagnostic runs continuously when the above conditions are met.

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 Symptoms - Engine Mechanical 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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 Misfire current counters incrementing?	—	Go to Step 3	Go to Diagnostic Aids
3	Are any other DTCs set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle in Vehicle DTC Information	Go to Step 4
4	Can any abnormal engine noise be heard?	—	Go to Symptoms - Engine Mechanical	Go to Step 5
5	Does the scan tool indicate that the Heated Oxygen Sensor (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

7	Inspect the following components: • The vacuum hoses and seals for splits, restrictions, and improper connections--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 powertrain control module (PCM) grounds for corrosion and loose 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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 8
8	**Important: An erratic or inconsistent spark is considered a no spark.** 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 a suitable Spark Tester. 4. Start the engine. Does the spark jump the tester gap?	—	Go to Step 10	Go to Step 9
9	1. Remove the spark plug wire for the affected cylinders. 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 ohms	Go to Electronic Ignition (EI) System Diagnosis	Go to Step 19

10	1. Remove the spark plugs from the cylinders that indicated a misfire. Refer to Spark Plug Replacement . 2. Inspect the spark plugs. 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	Is the spark plug oil or coolant fouled?	—	Go to Symptoms - Engine Mechanical	Go to Step 13
13	Is the spark plug gas fouled?	—	Go to Step 16	Go to Step 14
14	Did the spark plug 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 Symptoms - Engine Mechanical
16	Perform the fuel system diagnosis. Refer to Fuel System Diagnosis Did you find and correct the condition?	—	Go to Step 20	Go to Symptoms - Engine Mechanical
17	Replace or gap the spark plug. Refer to Spark Plug Replacement . Did you complete the action?	—	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 wires. Refer to Spark Plug Wire Replacement . Did you complete the replacement?	—	Go to Step 20	—
20	Was the customer concern the malfunction indicator lamp (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 - Vehicle in Vehicle DTC Information	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 sensors. 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 CKP System variation compensating values are stored in PCM memory after a learn procedure has been performed. If the actual CKP variation is not within the CKP System variation compensating values stored in the PCM, DTC P0300 may set.

If the CKP System variation values are not stored in the PCM memory, DTC P0315 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0315 Crankshaft Position (CKP) System Variation Not Learned

Conditions for Running the DTC

- DTCs P0335, P0336, P0341, P0342, P0343 are not set.
  - The engine coolant temperature (ECT) is more than 70°C (158°F).
- This diagnostic runs continuously when the above conditions are met.

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Perform the Crankshaft Position (CKP) 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	Inspect for the following conditions: • Worn crankshaft main bearings • Debris between the CKP sensor and the reluctor wheel • A damaged reluctor wheel • Excessive crankshaft runout • A damaged crankshaft--Refer to Crankshaft and Bearings Cleaning and Inspection in Engine Mechanical - 8.1L. • Electromagnetic interference (EMI) in the signal circuit of the CKP sensor • The ignition switch is in the ON position until the battery has insufficient system voltage. • A powertrain control module (PCM) power disconnect with the ignition ON that may have erased 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 for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC, as specified in the supporting text. 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 - Vehicle in Vehicle DTC Information	System OK

DTC P0325

Circuit Description

The knock sensors (KS) produce an AC signal when specific frequencies are detected. When the engine operates, the powertrain control module (PCM) learns a minimum and maximum frequency of noise of normal engine operation. The KS System monitors both KS in order to determine if knock is present. If the KS System determines that excessive knock is present, the PCM retards the spark timing based on the signals from the KS System. The PCM then retards timing until no knock is present.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0325 Knock Sensor (KS) Circuit

Conditions for Running the DTC

- The engine is running.
- The engine run time more than 10 seconds.
- The ignition 1 signal is more than 10 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

A malfunction with the KS System or the circuits within the PCM are faulty for 15 seconds or more.

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**Important: If you can hear the engine knock, repair the engine 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 Testing for Intermittent Conditions and Poor Connections
3	Replace the powertrain control module (PCM). Refer to Control Module References for replacement, setup, and programming. 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 DTC run and pass?	—	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 - Vehicle	System OK

DTC P0327 OR P0332

Circuit Description

The knock sensors (KS) produce an AC signal when specific frequencies are detected. When the engine operates, the powertrain control module (PCM) learns a minimum and maximum frequency of noise of normal engine operation. The KS System monitors both knock sensors in order to determine if knock is present. If the KS System determines that excessive knock is present, the PCM retards the spark timing based on the signals from the KS system. The PCM then retards the timing until no knock is present. When the PCM detects a frequency that is less than or more than a defined range, DTC P0327 will set for a failure in KS 1 which is located on bank 1 on the drivers side of the engine or DTC P0332 will set for a failure in KS 2 which is located on bank 2 on the passenger side of the engine.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0327 Knock Sensor (KS) 1 Circuit Low Frequency
- DTC P0332 Knock Sensor (KS) 2 Circuit Low Frequency

Conditions for Running the DTC

- DTCs P0106, P0107, P0108, P0116, P0117, P0118, P0125, P1114, or P1115 are not set.
- The engine speed is between 1,600-3,000 RPM.
- The manifold absolute pressure (MAP) is less than 45 kPa.
- The engine coolant temperature (ECT) is more than 60°C (140°F).
- The engine run time is more than 20 seconds.
- The ignition more than 10 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM determines that this frequency is less than or more than the expected amount for 3 seconds or more.

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.

Diagnostic Aids

Inspect the KS for proper installation. A KS that is loose or over torqued may cause either DTC to set.

For an intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

2. This step verifies the malfunction is present.
3. This test will isolate the KS from the rest of the circuit.
4. Tapping on the engine block near the appropriate KS will simulate an engine knock.

DTC P0327 or P0332

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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. 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. Turn the ignition OFF. 2. Disconnect the knock sensor (KS) harness of the appropriate KS. 3. Set the DMM to the 400 K ohm scale. 4. Measure the resistance of the appropriate KS with a DMM connected to battery ground. Is the resistance of the KS within the specified range?	93-107K ohms	Go to Step 4	Go to Step 6
4	1. Set the DMM to the 400 mv AC hertz scale. Refer to Measuring Frequency . **Important: Do not tap on plastic engine components.** 2. Tap on the engine block near the appropriate KS while observing the signal indicated on the DMM. Is any signal indicated on the DMM while tapping on the engine block near the knock sensor?	—	Go to Step 5	Go to Step 6

5	1. Disconnect the powertrain control module (PCM) connector. Refer to Powertrain Control Module (PCM) Replacement . 2. Test the KS signal circuit between the PCM and the KS connector for the following: - An open - A short to voltage - A short to ground Refer to Circuit Testing in Wiring Systems. Did you find and correct the condition?	—	Go to Step 9	Go to Step 7
6	Replace the KS. Refer to Knock Sensor (KS) 1 Replacement or Knock Sensor (KS) 2 Replacement . Did you complete the replacement?	—	Go to Step 9	—
7	1. Inspect the KS signal circuit for a poor connection at the PCM or the KS harness connector. Refer to Testing for Intermittent Conditions and Poor Connections . 2. If you find a poor connection, repair the connector as necessary. Refer to Connector Repairs . Did you find and correct the condition?	—	Go to Step 9	Go to Step 8
8	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	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 as specified in the supporting text. Does the DTC run and pass?	—	Go to Step 10	Go to Step 2
10	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 - Vehicle	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 more than 3 seconds, DTC P0335 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0335 Crankshaft Position (CKP) Sensor Circuit

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0341, P0342, or P0343 are not set.
- The camshaft position (CMP) sensor is transitioning.
- The mass air flow (MAF) is more than 3 g/s in the crank mode.
- The MAF is more than 5 g/s in the running mode.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects no signal from the CKP sensor for more than 3 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 determines if the fault is present.
6. This step simulates a CKP sensor signal to the PCM. If the PCM receives the signal, the fuel pump will operate for about two seconds.

DTC P0335

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 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 Testing for Intermittent Conditions and Poor Connections
4	**Caution: Before proceeding, remove the fuses for the ignition coil and fuel injector feed circuits in order to prevent personal injury from engine rotation, sparks, and excessive engine fueling.** **Important: An internally shorted CAM sensor can cause DTC P0335 to set. Test this circuit for a short before proceeding with this diagnostic table. Refer to Circuit Testing and Wiring Repairs .** 1. Turn ON the ignition, with the engine OFF. 2. Disconnect the crankshaft position (CKP) sensor harness connector. 3. Measure the voltage from the CKP sensor 12-volt reference circuit to a good ground with the DMM. Does the DMM display the specified value?	B+	Go to Step 5	Go to Step 7
5	Measure the voltage between the CKP sensor 12-volt reference circuit and the CKP sensor low reference circuit with the DMM. Does the DMM display the specified value?	B+	Go to Step 6	Go to Step 8
6	Momentarily connect the test lamp between the CKP sensor signal circuit and the CKP sensor 12-volt reference circuit. Does the fuel pump operate when voltage was applied to the CKP sensor signal circuit?	—	Go to Step 11	Go to Step 9

7	Test for an open or a short to ground in the CKP sensor 12-volt reference circuit. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 16	Go to Step 14
8	Test for an open or for high resistance in the CKP sensor low reference circuit. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 16	Go to Step 14
9	Test the CKP sensor signal circuit for the following conditions: • High resistance • An open • A short to ground or low reference • A short to voltage or 12-volt reference Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	—	Go to Step 16	Go to Step 10
10	Inspect for poor connections at the CKP sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 16	Go to Step 14
11	Remove the CKP sensor. Refer to Crankshaft Position (CKP) Sensor Replacement . Visually inspect the CKP sensor for the following conditions: - Excessive play or looseness - Excessive air gap between the CKP sensor and the reluctor wheel - Physical damage - Foreign material passing between the CKP sensor and the reluctor wheel - Improper installation - Electromagnetic interference in the CKP sensor circuits Refer to Wiring Repairs . Did you find and correct the condition?	—	Go to Step 16	Go to Step 12

12	Inspect the CKP reluctor wheel for the following conditions: • Physical damage • Improper installation • Excessive endplay or looseness Refer to Crankshaft and Bearings Cleaning and Inspection . Did you find and correct the condition?	—	Go to Step 16	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	Inspect for poor connections at the powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you complete the repair?	—	Go to Step 16	Go to Step 15
15	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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. Did the DTC run and pass?	—	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 - Vehicle	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 signal is incorrect for more than 120 seconds, DTC P0336 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0336 Crankshaft Position (CKP) Sensor Circuit

Conditions for Running the DTC

- The engine is cranking or running.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM determines that the CKP sensor signal is out of range for more than 120 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 verifies that the malfunction is present.
3. This step tests for electromagnetic interference (EMI) on the CKP sensor circuits.

DTC P0336

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**Important: If DTC P0335 is also set, diagnose DTC P0335 before proceeding with this DTC.** 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 Testing for Intermittent Conditions and Poor Connections
3	Inspect all of the crankshaft position sensor (CKP) circuits for the following conditions: • Wiring routed too closely to secondary ignition wires or components • Wiring routed too closely to after-market add-on electrical equipment • Wiring routed to closely to solenoids, relays, and motors • Electromagnetic interference in the CKP sensor circuits Did you find and correct the condition?	—	Go to Step 12	Go to Step 4
4	Test the 12-volt reference circuit for an intermittent condition or shorted to other circuits. Refer to Testing for Electrical Intermittents and Inducing Intermittent Fault Conditions . Did you find and correct the condition?	—	Go to Step 12	Go to Step 5
5	Test the low reference circuit for an intermittent condition. Refer to Testing for Electrical Intermittents and Inducing Intermittent Fault Conditions . Did you find and correct the condition?	—	Go to Step 12	Go to Step 6

6	Test the CKP sensor signal circuit for an intermittent condition. Refer to Testing for Electrical Intermittents and Inducing Intermittent Fault Conditions . Did you find and correct the condition?	—	Go to Step 12	Go to Step 7
7	Test for an intermittent and for a poor connection at the CKP sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 12	Go to Step 8
8	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 Wiring Repairs . Did you find and correct the condition?	—	Go to Step 12	Go to Step 9
9	1. Remove the CKP sensor. Refer to Crankshaft Position (CKP) Sensor Replacement . 2. Inspect the CKP sensor for the following conditions: - Physical damage - Improper installation - Excessive play or looseness - Excessive air gap between the CKP sensor and the reluctor wheel - Foreign material passing between the CKP sensor and the reluctor wheel - Insufficient fuel Did you find and correct the condition?	—	Go to Step 12	Go to Step 10
10	Inspect the reluctor wheel for the following conditions: • Physical damage • Improper installation • Excessive endplay or looseness Refer to Crankshaft and Bearings Installation . Did you find and correct the condition?	—	Go to Step 12	Go to Step 11

11	Replace the CKP sensor. Refer to Crankshaft Position (CKP) Sensor 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 - Vehicle	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 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 crankshaft position (CKP) sensor 24 X signal alone. The engine will start without a CMP signal as long as the PCM receives the CKP sensor 24 X 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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0341 Camshaft Position (CMP) Sensor Performance

Conditions for Running the DTC

- The engine is running and the engine speed is less than 4,000 RPM.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM detects that a CMP to CKP mismatch 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 Testing for Intermittent Conditions and Poor Connections .

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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. Visually and physically inspect all circuits going to the camshaft position (CMP) sensor for the following: - 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 . Did you find and correct the condition?	—		Go to Step 5
5	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 . 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 Crankshaft and Bearings Cleaning and Inspection . 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. 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 - Vehicle	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 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 crankshaft position (CKP) sensor 24 X signal alone. The engine will start without a CMP signal as long as the PCM receives the CKP sensor 24 X 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 signal is constantly low, DTC P0342 sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0342 Camshaft Position (CMP) Sensor Circuit Low Voltage

Conditions for Running the DTC

- The engine is running.
- The engine speed is less than 4,000 RPM.
- This diagnostic runs continuously when the above conditions are met.

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 Testing for Intermittent Conditions and Poor Connections .

Test Description

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

5. This step tests the CMP sensor signal circuit. Applying a voltage causes the CMP Sensor High to Low and Low to High parameter to increase if the circuit and the PCM are operating properly.

DTC P0342

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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
4	1. Turn OFF the ignition. 2. Disconnect the CMP sensor. 3. Turn ON the ignition, with the engine OFF. 4. 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 . Does the test lamp illuminate?	—	Go to Step 5	Go to Step 6
5	1. Start the engine. 2. Observe the CMP Sensor High to Low and Low to High Transition parameters with the scan tool. 3. Momentarily and repeatedly probe the signal circuit of the CMP sensor with a test lamp that is connected to battery voltage. 4. Does the CMP sensor high to low and low to high transition counters increment when the test lamp contacts the signal circuit?	—	Go to Step 8	Go to Step 7

6	Test the 12-volt reference circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . 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 a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 9
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 . 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 powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . 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 - Wiring routed too close to the secondary ignition components Did you find and correct the condition?	—	Go to Step 14	Go to Step 11
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 Control Module References for replacement, setup, and programming. 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 - Vehicle	System OK

DTC P0343

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 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 crankshaft position (CKP) sensor 24 X signal alone. The engine will start without a CMP signal as long as the PCM receives the CKP sensor 24 X 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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0343 Camshaft Position (CMP) Sensor Circuit High Voltage

Conditions for Running the DTC

- The engine is running.
- The engine speed is less than 4,000 RPM.
- This diagnostic runs continuously when the above conditions are met.

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 Testing for Intermittent Conditions and Poor Connections .

Test Description

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

5. This step tests the CMP sensor signal circuit. Applying a voltage causes the CMP Sensor High to Low and Low to High parameter to increase if the circuit and the PCM are operating properly.

DTC P0343

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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
4	1. Turn OFF the ignition. 2. Disconnect the CMP sensor. 3. Turn ON the ignition, with the engine OFF. 4. Probe the signal circuit of the CMP sensor with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors . Does the test lamp illuminate?	—	Go to Step 7	Go to Step 5
5	1. Start the engine. 2. Observe the CMP Sensor High to Low and Low to High Transition parameters with the scan tool. 3. Momentarily and repeatedly probe the signal circuit of the CMP sensor with a test lamp that is connected to battery voltage. 4. Does the CMP sensor high to low and low to high transition counters increment when the test lamp contacts the signal circuit?	—	Go to Step 6	Go to Step 10

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 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 . 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 . Did you find and correct the condition?	—	Go to Step 15	Go to Step 10
8	Test the low reference circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . 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 . 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 powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . 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 - Wiring routed too close to the secondary ignition components 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 Crankshaft and Bearings Cleaning and Inspection . 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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 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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0351 Ignition Coil 1 Control Circuit
- DTC P0352 Ignition Coil 2 Control Circuit
- DTC P0353 Ignition Coil 3 Control Circuit
- DTC P0354 Ignition Coil 4 Control Circuit
- DTC P0355 Ignition Coil 5 Control Circuit
- DTC P0356 Ignition Coil 6 Control Circuit
- DTC P0357 Ignition Coil 7 Control Circuit
- DTC P0358 Ignition Coil 8 Control Circuit

Conditions for Running the DTC

- The engine is operating.
- This diagnostic runs continuously when the above conditions are met.

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 P0343

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 Testing for Intermittent Conditions and Poor Connections
3	1. Turn OFF the engine. 2. Disconnect the respective ignition coil. 3. Start the engine. 4. Measure the frequency at the ignition control (IC) circuit with the DMM set to DC Hertz. Refer to Measuring Frequency . 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
5	1. Turn OFF the ignition. 2. Disconnect the powertrain control module (PCM) connector. 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 . 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 . 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 . 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 . 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 . 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 . 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 . Did you complete the repair?	—	Go to Step 17	—
13	Repair the IC circuit for a short to voltage. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 17	—
14	Repair open in the IC circuit. Refer to Wiring Repairs . 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 Control Module References for replacement, setup, and programming. 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 - Vehicle	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 the PCM uses to indicate the oxygen storage capacity of the catalyst. This determines the catalysts ability to effectively convert the exhaust emissions.

If the catalyst is functioning correctly, the HO2S bank 1 sensor 2 and HO2S bank 2 sensor 2 signals will be far less active than the signals that are produced by HO2S bank 1 sensor 1 and 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 from 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.

IMPORTANT:
A new converter with less than 100 miles on it may set DTC P0420 or P0430 due to out-gassing of the internal matting. Operating the vehicle at highway speeds for approximately 1 hour may correct the condition.

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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0420 Catalyst System Low Efficiency Bank 1
- DTC P0430 Catalyst System Low Efficiency Bank 2

Conditions for Running the DTC

- DTCs P0030, P0036, P0050, P0053, P0054, P0056, P0059, P0060, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0120, P0128, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0157, P0158, P0160, P0161, P0171, P0172, P0174, P0175, P0200, P0220, P0300, P0325, P0327, P0332, P0335, P0336, P0341, P0342, P0343, P0351-P0358, P0442, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0500, P0502, P0503, P0506, P0507, P1125, P1133, P1134, P1153, P1154, P1516, P2101, P2108, P2120, P2121, P2125, P2135, P2A01, P2A04, U0107 are not set.
- The engine has been running for more than 5 minutes.
- The intake air temperature (IAT) is between -20 to +85°C (-4 and +185°F).
- The barometric pressure (BARO) is more than 70 kPa.
- The engine coolant temperature (ECT) is more than 70-125°C (158-257°F).
- Since the end of the last idle period, the engine speed has been more than 950 RPM for 35 seconds.
- The engine must be at a stable idle speed, within 200 RPM of desired idle.
- The battery voltage is more than 11 volts.

- The Closed Loop fuel control is enabled.
- This diagnostic attempts one test during each valid idle period once the above conditions have been met. This diagnostic attempts up to 12 tests during each drive cycle.

Conditions for Setting the DTC

- The PCM determines that the oxygen storage capability of the TWC has degraded to less than a calibrated threshold.
- This diagnostic may conclude in as few as one test attempt. However, this diagnostic may require as many as 18 test attempts, which would require at least 3 drive cycles. Each test attempt concludes within 15 seconds.

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

- The catalyst test may abort due to a change in the engine load. Do not change the engine load, ensure the AC is OFF, the coolant fan is not cycling, while a catalyst test is in progress.
- Driving the vehicle under the conditions outlined in the Inspection/Maintenance (I/M) section can verify whether the fault is present.
- 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 Testing for Intermittent Conditions and Poor Connections .

Test Description

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

5. 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 steps inspects for conditions than can cause the TWC efficiency to appear degraded.

DTC P0343

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Review the DTC information on the scan tool. Are any other DTCs set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	**Important: A new converter with less than 100 miles on it may set DTC P0420 or P0430 due to out-gassing of the internal matting. Operating the vehicle at highway speeds for approximately 1 hour may correct the condition.** 1. Start and idle the engine. 2. Allow the engine to reach operating temperature. 3. Increase the engine speed to 2,000 RPM for 2 minutes. 4. Ensure Closed Loop operation is enabled. 5. Return the engine to a stabilized idle. 6. Observe the HO2S 2 voltage parameter on the scan tool for the applicable bank. Is the applicable 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 P0430 set?	—	Go to Step 5	Go to Diagnostic Aids

5	**Important: Verify that the three-way catalytic converter (TWC) is a high quality part that meets the original equipment manufacturer (OEM) specifications.** Visually and physically inspect the TWC for the following conditions: • Physical damage • Severe discoloration caused by excessive temperatures • Internal rattles caused by loose catalyst substrate • Restrictions--Refer to Restricted Exhaust . Did you find and correct the condition?	—	Go to Step 10	Go to Step 6
6	Visually inspect the exhaust system for the following conditions: • Leaks--Refer to Exhaust Leakage . • 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	**NOTICE** *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 TWC. Refer to Catalytic Converter 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. **Caution:Refer to Road Test Caution in Cautions and Notices.** **Important: A new converter with less than 100 miles on it may set DTC P0420 or P0430 due to out-gassing of the internal matting. Operating the vehicle at highway speeds for approximately 1 hour may correct the condition.** 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 - Vehicle	System OK

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 in) 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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0442 Evaporative Emission (EVAP) System Small Leak Detected

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0335, P0336, P0443, P0446, P0449, P0451, P0452, P0453, P0454, P0455, P0464, P0496, P0500, P0502, P1106, P1107, P2610 are not set.
- The diagnostic runs once with a 10 hour minimum between tests after a fail.
- 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 greater than 74 kPa.
- The ambient air temperature is between 2-32°C (36-90°F).

- The engine run time minimum is 600 seconds.
- The odometer displays greater 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.
- One test occurs at ignition OFF after a cold start drive cycle and may require up to 45 minutes to complete. For the controller to report a fail, several tests must be completed with at least 17 hours between each test.

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.
- A condition may exist where a leak in the EVAP system only exists under a vacuum condition. This condition may be detected by using a scan tool PURGE/SEAL function to seal the EVAP system and create a vacuum. Then observe the FTP parameter for vacuum decay.
- 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 Testing for Intermittent Conditions and Poor Connections .

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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	**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 (0.020 in) test orifice on the bottom-front of the J 41413-200 Evaporative Emissions System Tester (EEST). 3. Activate the J 41413-200 with the remote switch. 4. Align the red flag on the flow meter with the floating indicator. De-activate the J 41413-200 with the remote switch 5. Install the J 41415-40 Fuel Tank Cap Adapter or GE-41415-50 Fuel Tank Cap Adapter 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 evaporative emissions (EVAP) canister vent solenoid valve closed with a scan tool. 9. Introduce nitrogen and fill the EVAP system until the floating stabilizes with the remote switch. 10. Compare the flow meter stable floating indicator position to the red flag. Is the floating indicator below the red flag?	—	Go to Diagnostic Aids	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 power supply clips to a known good 12-volt source. 3. Install the J 41415-40 or GE-41415-50 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

4	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 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.** **Notice: Follow the operating instructions of the evapoerative emissions in use.** 1. Turn the nitrogen/smoke valve to nitrogen. 2. Connect the nitrogen/smoke hose to the 0.50 mm (0.020 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. Have any more DTCs not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 7
7	**Important: The malfunction indicator lamp (MIL) may remain ON after the repair unless the DTCs are cleared.** Clear the DTCs with the scan tool. Did you complete the action?	—	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0443 Evaporative Emission (EVAP) Purge Solenoid Control Circuit

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The system voltage is between 10-18 volts.
- DTC P0443 runs continuously once the above conditions are met.

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 PWM. You should hear a clicking sound when the EVAP canister purge solenoid valve is commanded to 50 percent. The clicking sound should stop when the EVAP canister purge solenoid valve is commanded to 0 percent. The rate at which the valve cycles should increase when the commanded state is increased, and decrease when the commanded state is decreased.
5. This step verifies that the control module is providing ground to the EVAP canister purge solenoid valve.
6. This step tests if a ground is constantly being applied to the EVAP canister purge solenoid valve.

DTC P0443

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Turn ON the ignition, with the engine OFF. 2. Command the evaporative emission (EVAP) canister purge solenoid valve to 50 percent, then to 0 percent with a scan tool. Does the EVAP canister purge solenoid valve respond to the commanded state?	—	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 Testing for Intermittent Conditions and Poor Connections
4	1. Turn OFF the ignition. 2. Disconnect the EVAP canister purge solenoid valve harness 3. 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
5	1. Connect a test lamp between the control circuit of the EVAP canister purge solenoid valve and the 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 illuminate?	—	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 for a short to voltage. Refer to Circuit Testing and Wiring Repairs . 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 . Did you find and correct the condition?	—	Go to Step 14	Go to Step 13
9	Inspect for poor connections at the harness connector of the EVAP canister purge solenoid valve. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 12
10	Inspect for poor connections at the harness connector of the control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . 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 . 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 powertrain control module (PCM). Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 14	—

14	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 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 - Vehicle	System OK

DTC P0446

System Description

This DTC tests the Evaporative Emission (EVAP) System for a restricted or blocked EVAP 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.

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

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0446 Evaporative Emission (EVAP) Vent System Performance

Conditions for Running the DTC

- DTCs P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0220, P0442, P0443, P0449, P0451, P0452, P0453, P0454, P0455, P0464, P0502, P0503, P1111, P1112, P1114, P1115, P1121, P1122, P1125, P2135 are not set.

- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is greater 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.
- DTC P0446 runs once per cold start when the above conditions are met.

Conditions for Setting the DTC

- The fuel tank pressure sensor is less than -12 inches H_2O.
- The above condition is 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.

Diagnostic Aids

- When using the electronic emission system tester (EEST) to apply pressure, you can regulate the amount of pressure by activating the remote switch ON and OFF while observing pressure in the EVAP system using a scan tool. DO NOT use more than 5 inches H2O. More than 5 inches H2O applied to the EVAP system can cause the canister vent solenoid valve to temporarily remain in the closed position, which could lead to misdiagnosis in this procedure.
- 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 Testing for Intermittent Conditions and Poor Connections .
- An EVAP canister, vent hose or vent solenoid valve that has restricted flow may cause this DTC to set. Using purge solenoid valve command with a scan tool, will allow vacuum to be applied to the system instead of pressure. With the EVAP canister vent solenoid valve open and the EVAP canister purge solenoid valve commanded to 100 percent, vacuum should not increase to more than 9 inches H2O.

DTC P0446

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 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. Remove the fuel filler cap. 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	**Notice: Follow the operating instructions of the evapoerative emissions in use.** 1. Turn OFF the ignition. 2. Connect J 41413-200 Evaporative Emissions System Tester (EEST) power supply clips to a known good 12-volt source. 3. Install J 41415-40 Fuel Tank Cap Adapter or GE-41415-50 Fuel Tank Cap Adapter to the fuel fill pipe. 4. Connect the fuel fill cap to J 41415-40 or to GE-41415-50 . 5. Connect J 41413-200 nitrogen/smoke supply hose to J 41415-40 or to GE-41415-50 . 6. Turn ON the ignition, with the engine OFF. 7. Command the EVAP canister vent solenoid valve closed with a scan tool. 8. Turn the nitrogen/smoke valve on J 41413-200 control panel to NITROGEN. **Important: DO NOT exceed the specified value in this step. Exceeding the specified value may cause the EVAP canister vent solenoid valve to remain closed, or produce incorrect test results.** 9. Use the remote switch to pressurize the EVAP system to the first specified value. 10. Observe the fuel tank pressure sensor in H2O with a scan tool. 11. 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 5	Go to Step 7

5	1. Connect the J 41413-200 nitrogen/smoke supply hose and the vehicle fuel fill cap to the J 41415-40 or GE-41415-50 . 2. Start the engine. 3. Allow the engine to idle. 4. Use the purge/seal function to seal the system with a scan tool. 5. Command the EVAP canister purge solenoid valve to 20 percent. 6. Observe the vacuum/pressure gage of the J 41413-200 and the FTP parameter on the scan tool. 7. Allow the vacuum to increase on the gage of the J 41413-200 until it reaches approximately 16 inches H2O. Did the pressure reading on the gauge agree with the scan tool FTP parameter until the vacuum reached the abort limit on the scan tool?	—	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 12
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 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 for an intermittent and for a poor connection at the fuel tank pressure (FTP) sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 15	Go to Step 10
10	Test the low reference circuit of the FTP sensor for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 15	Go to Step 12
11	Repair the pinched or restricted EVAP 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. Remove the fuel filler cap. 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
16	**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 J 41413-200 to the fuel fill pipe. 4. Turn ON the ignition, with the engine OFF. 5. Command the EVAP canister vent solenoid valve closed with a scan tool. 6. TTurn the nitrogen/smoke valve on J 41413-200 control panel to NITROGEN. 7. 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. Have any other DTCs not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P0449

Circuit Description

A battery positive 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.

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

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0449 Evaporative Emission (EVAP) vent Solenoid Control Circuit

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- The system voltage is between 10-18 volts.
- DTC P0449 runs continuously once the above conditions are met.

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. Listen for a click when the valve operates. Verify that both the ON and the OFF states are commanded.
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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Turn ON the ignition, with the engine OFF. 2. Command the evaporative emission (EVAP) canister vent solenoid valve ON and OFF with the scan tool. Do you hear or feel a click from the EVAP canister vent solenoid valve when the valve 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 Testing for Intermittent Conditions and Poor Connections
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 battert positive voltage circuit of the EVAP canister vent solenoid valve with a test lamp connected to a good ground. Refer to Troubleshooting with a Test Lamp . 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 battery positive voltage circuit of the EVAP canister vent solenoid valve at the EVAP canister vent solenoid valve harness connector. 2. Command the EVAP canister vent solenoid valve ON and OFF with a scan tool. Does the test lamp turn ON and 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 of the EVAP canister vent solenoid valve for a short to voltage or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 10
8	Test the control circuit of the EVAP canister vent solenoid valve for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 10
9	Inspect for poor connections at the harness connector of the EVAP canister vent solenoid valve. Refer to Testing for Intermittent Conditions and Poor Connections and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 12
10	Inspect for poor connections at the harness connector of the control module. Refer to Testing for Intermittent Conditions and Poor Connections and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 13
11	**Important: If the fuse is open, inspect all related circuits for a short to ground.** Repair the open or short to ground in the battery positive voltage circuit. Refer to Wiring Repairs . 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 powertrain control module (PCM). Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 14	—

14	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 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 - Vehicle	System OK

DTC P0451

System Description

The fuel tank pressure (FTP) sensor measures air pressure or vacuum in the Evaporative Emission (EVAP) System. The control module supplies a 5-volt reference and a low reference circuit to the FTP sensor. The FTP sensor signal voltage varies, depending on EVAP System pressure or vacuum. The controller uses this FTP signal to determine atmospheric pressure for use in the engine-off small leak test, P0442. Before using this signal as an atmospheric reference, it must first be re-zeroed. If the FTP signal is out of range during the re-zero procedure, this DTC will set.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0451 Fuel Tank Pressure (FTP) Sensor Performance

Conditions for Running the DTC

- DTC P0451 runs only when the engine-off natural vacuum small leak test, DTC P0442, executes.
- The number of times this test runs can range from 0-2 per engine-off period. The length of the test can be up to 40 minutes.

Conditions for Setting the DTC

This DTC will set if the controller is unable to re-zero the FTP sensor voltage within a calibrated range during the engine-off small leak test, P0442.

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 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 DTC with a scan tool.

Diagnostic Aids

- When using the J 41413-200 Evaporative Emission System Tester (EEST) to apply pressure, you can regulate the amount of pressure by activating the remote switch ON and OFF while observing pressure in the EVAP system using a scan tool.
- A restriction in the EVAP canister or vent lines could prevent fuel vapor pressure from bleeding off fast enough. If the vent system cannot bleed off pressure fast enough, this code can set. When pressure is applied to the system and released, a properly operating system will return to the atmospheric pressure rapidly. By using a scan tool and the J 41413-200 pressure can be applied to the system, then released, while monitoring the FTP Sensor parameter to see that pressure can be released within 30 seconds.
- An FTP sensor that is skewed or does not have a linear transition from low to high may cause this code to set. A scan tool output controls, snapshot, and plot functions can help detect erratic sensor response. To test the sensor signal under vacuum conditions, use the Quick Snapshot and the Purge/Seal functions to capture data while commanding purge to 20 percent, then plot the data to look for erratic sensor operation. A similar test can be done for the pressure side of the sensor operation by applying pressure with the J 41413-200 while taking a snapshot.
- A full fuel tank may cause misdiagnosis.

Test Description

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

4. This step tests for the signal voltage that represents atmospheric pressure. Removing the fuel fill cap ensures a vented EVAP System. Record the value for possible use later in the diagnostic table.
5. This step tests the accuracy of the FTP sensor by comparing the electrical signal value to the EEST mechanical gage value.
8. A restricted EVAP System will not allow the nitrogen to flow freely through the system. A restriction will cause the FTP Signal Voltage parameter to decrease as the pressure builds.

DTC P0451

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Is DTC P0446, P0452, P0453, or P0651 also set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	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 hose • A damaged EVAP canister--Refer to Evaporative Emission (EVAP) Canister Replacement . Did you find and correct the condition?	—	Go to Step 17	Go to Step 4
4	1. Remove the fuel fill cap. 2. Turn ON the ignition, with the engine OFF. 3. Observe and record the Fuel Tank Pressure (FTP) parameter in volts with a scan tool. Is the Fuel Tank Pressure Sensor parameter within the specified amount?	1.3-1.7 V	Go to Step 5	Go to Step 14

5	**Important: Ensure that the vehicle underbody temperature is similar to the ambient temperature.** 1. Turn OFF the ignition. 2. Install the fuel fill cap. 3. Connect the J 41413-200 Evaporative Emission System Tester (EEST) power supply clips to a known good 12-volt source. 4. Install the J 41415-40 Fuel Tank Cap Adapter or the GE-41415-50 Fuel Cap Adapter to the fuel fill pipe. 5. Connect the J 41413-200 NITROGEN/SMOKE supply hose to the J 41415-40 or the GE-41415-50 to the fuel fill pipe. 6. Turn the ignition ON, with the engine OFF. 7. Turn the NITROGEN/SMOKE valve on the J 41413-200 to NITROGEN. 8. Using a scan tool PURGE/SEAL function, seal the EVAP System. 9. Observe the fuel tank pressure sensor in H2O using a scan tool. 10. Use a remote switch to pressurize the EVAP System to the first specified value. A11. llow at least 30 seconds for pressure in the EVAP System to stabilize. Compare the FTP parameter in H2O to the J 41413-200 VACUUM/PRESSURE gage. Is the difference between the FTP parameter on a scan tool and the VACUUM/PRESSURE gage on the J 41413-200 within the second specified value?	5 in H2O 1 in H2O	Go to Step 6	Go to Step 14
6	Release the pressure on the EVAP System with the scan tool. Is the difference between the FTP parameter on the scan tool and the VACUUM/PRESSURE gage on the J 41413-200 within the specified value?	1 in H2O	Go to Step 7	Go to Step 14

7	1. Start the engine. 2. Allow the engine to idle. **Important: Using more than 20 percent purge can cause a misdiagnosis.** 3. Use the PURGE/SEAL function of a scan tool to command 20 percent purge. 4. Observe the VACUUM/PRESSURE gage on the J 41413-200 and the FTP parameter on the scan tool. Allow the vacuum to increase to the first specified value. Is the difference between the FTP parameter on the scan tool and the VACUUM/PRESSURE gage on the J 41413-200 within the second specified value?	5 in H2O	Go to Step 8	Go to Step 14
8	1. Turn ON the ignition, with the engine OFF. 2. TTurn the NITROGEN/SMOKE valve on the J 41413-200 to NITROGEN 3. Observe the FTP sensor in volts using a scan tool. 4. Pressurize the EVAP System with the remote switch. 5. Allow enough time for pressure to stabilize. Is the difference between the observed FTP sensor voltage and the voltage recorded in Step 4 more than the specified value?	0.2 V	Go to Step 9	System OK
9	1. Disconnect the EVAP vapor pipe from the EVAP canister with pressure still applied from the J 41413-200 . Refer to Evaporative Emissions (EVAP) Hose Routing Diagram . 2. Observe the FTP sensor in volts using a scan tool. Is the difference between the observed FTP sensor voltage and the voltage recorded in Step 4 more than the specified value?	0.2 V	Go to Step 10	Go to Step 11
10	1. Disconnect the EVAP vapor pipe from the EVAP canister with pressure still applied from the evap tester. Refer to Evaporative Emissions (EVAP) Hose Routing Diagram . 2. Observe the FTP sensor in volts using a scan tool. Is the difference between the observed FTP sensor voltage and the voltage recorded in Step 4 more than the specified value?	0.2 V	Go to Step 13	Go to Step 12

11	Repair or replace the EVAP canister vent solenoid. Refer to Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement . Did you complete the action?	—	Go to Step 17	—
12	Replace the EVAP canister. Refer to Evaporative Emission (EVAP) Canister Replacement . Did you complete the replacement?	—	Go to Step 17	—
13	Repair or replace the pinched or restricted EVAP vapor pipe. Refer to Evaporative Emissions (EVAP) Hose Routing Diagram . Did you complete the action?	—	Go to Step 17	—
14	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 . Did you find and correct the condition?	—	Go to Step 17	Go to Step 15
15	Test the low reference circuit of the FTP sensor for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 17	Go to Step 16
16	Replace the FTP sensor. Refer to Fuel Tank Pressure Sensor Replacement . Did you complete the replacement?	—	Go to Step 17	—
17	1. Reconnect all components and release any pressure or vacuum applied to the EVAP System. 2. Turn ON the ignition, with the engine OFF. 3. Observe and record the FTP parameter in H2O with a scan tool. Is the Fuel Tank Pressure Sensor parameter within the specified amount?	-1 to +1 in H2O	Go to Step 18	Go to Step 2

18	1. Turn ON the ignition, with the engine OFF. 2. Command the EVAP canister vent solenoid closed with a scan tool. 3. Turn the NITROGEN/SMOKE valve on the J 41413-200 to NITROGEN. 4. Pressurize the EVAP System to the first specified value with the remote switch. 5. Observe the fuel pressure sensor in H2O using a scan tool. 6. 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	Go to Step 19	Go to Diagnostic Aids
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 - Vehicle	Go to Step 20
20	**Important: The malfunction indicator lamp (MIL) may remain ON after the repair unless the DTCs are cleared.** Clear the DTCs with a scan tool. Did you complete the action?	—	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.

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

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0452 Fuel Tank Pressure (FTP) Sensor Circuit Low Voltage

Conditions for Running the DTC

- The engine is running.
- DTC P0452 runs continuously once the above condition is met.

Conditions for Setting the DTC

- The FTP sensor voltage is less than 0.1 volts.
- All conditions are 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 numbers below refer to the step numbers on the diagnostic table.

5. This step 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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Idle the engine for 1 minute. 2. Monitor the diagnostic trouble code (DTC) information with a scan tool. Did DTC P0641 or P0651 fail this ignition?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	Observe the fuel tank pressure sensor parameter with the scan tool. Does the scan tool indicate that fuel tank pressure sensor parameter is 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 Testing for Intermittent Conditions and Poor Connections
5	1. Turn OFF the ignition. 2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 3. Disconnect the fuel tank wiring harness at the fuel tank harness connector. 4. Connect a 3-amp fused jumper wire between the 5-volt reference circuit of the fuel tank pressure (FTP) sensor and the signal circuit of the FTP sensor. 5. Turn ON the ignition, with the engine OFF. 6. Observe the fuel tank pressure sensor voltage with a scan tool. Is the fuel tank pressure sensor parameter greater than the specified value?	4.8 V	Go to Step 8	Go to Step 6

6	Test the 5-volt reference circuit of the FTP sensor for an open between the fuel tank harness connector and the control module. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 12	Go to Step 7
7	Test the signal circuit of the FTP sensor for a short to ground, or an open between the fuel tank harness connector and the control module. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 12	Go to Step 9
8	1. Remove the fuel tank. Refer to Fuel Tank Replacement . 2. Inspect the fuel tank wiring harness for the following: - Damaged wiring - Poor connections - Broken wires inside the insulation Did you find and correct the condition?	—	Go to Step 12	Go to Step 10
9	Inspect for poor connections at the harness connector of the control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . 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 powertrain control module (PCM). Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 12	—
12	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 2	Go to Step 13
13	Observe the Capture Info with a scan tool. Have any other DTCs not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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.

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

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0453 Fuel Tank Pressure (FTP) Sensor Circuit High Voltage

Conditions for Running the DTC

- The engine is running.
- DTC P0453 runs continuously once the above condition is met.

Conditions for Setting the DTC

- The FTP sensor voltage is more than 4.9 volts.
- All conditions are 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 P0641 or P0651 is set, the 5-volt reference circuit may be shorted to a voltage.

DTC P0453

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Idle the engine for 1 minute. 2. Monitor the diagnostic trouble code (DTC) information with the scan tool. Did DTC P0641 or P0651 fail this ignition?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	1. Turn ON the ignition, with the engine OFF. 2. Observe the fuel tank pressure sensor voltage 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 Testing for Intermittent Conditions and Poor Connections
5	1. Turn OFF the ignition. 2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 3. Disconnect the fuel tank wiring harness at the fuel tank harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Observe the fuel tank pressure (FTP) sensor voltage with a scan tool. Does the scan tool indicate that the Fuel Tank Pressure Sensor parameter is more than the specified value?	1 V	Go to Step 6	Go to Step 7

6	Test the signal circuit of the FTP for a short to voltage between the fuel tank harness connector and the control module. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
7	Probe the low reference circuit of the FTP sensor at the fuel tank harness connector with a test lamp connected to battery voltage. Refer to Circuit Testing . Did the test lamp illuminate?	—	Go to Step 9	Go to Step 8
8	Test the low reference circuit of the FTP sensor for an open between the fuel tank harness connector and the control module. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 10
9	1. Remove the fuel tank. Refer to Fuel Tank Replacement . 2. Disconnect the FTP sensor harness connector. 3. Inspect the fuel tank wiring harness for the following: - Damaged wiring - Poor connections - Broken wires inside the insulation--Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 11
10	Inspect for poor connections at the harness connector of the control module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . 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 powertrain control module (PCM). Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 13	—

13	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 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 - Vehicle	System OK

DTC P0454

System Description

The fuel tank pressure (FTP) sensor measures air pressure or vacuum in the Evaporative Emission (EVAP) System. The control module supplies a 5-volt reference and a low reference circuit to the FTP sensor. The FTP sensor signal voltage varies depending on EVAP System pressure or vacuum. The controller uses this FTP signal to determine atmospheric pressure for use in the engine OFF small leak test, P0442. This DTC will set if the control module detects an intermittent signal from the FTP that would prevent the engine-off small leak test, P0442, from running.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0454 Fuel Tank Pressure (FTP) Sensor Circuit Intermittent

Conditions for Running the DTC

- DTC P0454 runs only when the engine-off natural vacuum small leak test, P0442, executes.
- This test can run once per engine-off period. The length of the test can be up to 40 minutes.

Conditions for Setting the DTC

If, during the engine-off natural vacuum small leak test, P0442, the powertrain control module (PCM) detects an abrupt FTP signal change, other than a refueling event, this DTC will set.

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 MIL after 3 consecutive gnition 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 DTC with a scan tool.

Diagnostic Aids

Scan tool output controls, snapshot, and plot functions can help detect erratic sensor response. To look at the sensor signal under vacuum conditions, use snapshot and the purge/seal function to capture data while commanding purge to 20 percent, then plot the data to look for non-linear sensor operation. A similar inspection can be done for the pressure side of the sensor range by applying pressure with the J 41413-200 Evaporative Emissions System Tester (EEST) while taking a snapshot. DO NOT exceed 5 inches H2O when applying pressure.

Test Description

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

3. Sealing the system will allow normal pressure in the EVAP System to preload the sensor. This will help put the sensor in a range that is more sensitive, making the test more accurate.

DTC P0454

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Are DTCs P0442, P0446, P0452, P0453, or P0651 also set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	1. Inspect for an intermittent and for a poor connection at the fuel tank pressure (FTP) sensor. Refer to Testing for Intermittent Conditions and Poor Connections . Did you find and correct the condition?	—	Go to Step 5	Go to Step 4
4	1. Replace the FTP sensor. Refer to Fuel Tank Pressure Sensor Replacement . Did you complete the replacement?	—	Go to Step 5	—
5	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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.

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

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0455 Evaporative Emission (EVAP) System Large Leak Detected

Conditions for Running the DTC

- Before the powertrain control module (PCM) can report DTC P0455 failed, DTC P0496 must run and pass.
- DTCs P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0220, P0442, P0443, P0449, P0451, P0452, P0453, P0454, P0464, P0496, P0502, P0503, P1111, P1112, P1114, P1115, P1125, P1122, P1121, P2135 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 4-65°C (39-149°F).
- The intake air temperature (IAT) is between 4-75°C (39-167°F).
- The start-up ECT and IAT are within 9°C (16°F) of each other.
- DTC P0455 runs once per cold start.

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.
- For intermittent conditions, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

4. 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.
6. This step verifies proper operation of the FTP sensor.
7. A normal operating FTP sensor should increase above 5 inches of H2O and stop between 6-7 inches of H2O.

DTC P0455

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Inspect the evaporative emission (EVAP) system for the following conditions: - Loose, missing, or damaged service port 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 . 3. Inspect the EVAP system for the following conditions: - 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	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 (0.020 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 the GE-41415-50 Fuel Tank Cap Adapter to the fuel fill pipe. 8. Install the fuel fill cap to the J 41415-40 or the GE-41415-50 . 9. Remove the nitrogen/smoke hose from the test orifice and install the hose onto the J 41415-40 or the 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 introduce nitrogen and fill the EVAP system until the floating indicator stabilizes. 13. Compare the flow meter 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 or GE-41415-50 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 locted Did you locate and repair the 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 difference between the 2 gages less than the specified value?	1 in H2O	Go to Step 7	Go to Step 14
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. Is the fuel tank pressure sensor parameter more than the second specified value?	13 in H2O 5 in H2O	Go to Step 8	Go to Step 14

8	1. Stop introducing nitrogen into the EVAP system with the remote switch. 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 purge solenoid valve to 30 percent. 8. Observe the vacuum/pressure gage on the J 41413-200 and the FTP parameter on the scan tool. 9. Use the purge/seal function to seal the system, with a scan tool. Is the difference between the FTP parameter on a scan tool and the vacuum/pressure gage on the J 41413-200 within the specified value, until the vacuum reached the abort limit on the scan tool?	1 in H2O	Go to Step 10	Go to Step 14
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	1. Disconnect the EVAP 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 12
12	1. Disconnect the EVAP 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 13

13	1. Disconnect the EVAP 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
14	1. Test for an intermittent and for a poor connection at the fuel tank pressure (FTP) sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 15
15	1. Test the low reference circuit of the FTP sensor for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 17
16	1. Repair the pinched or obstructed EVAP vapor pipe. Did you complete the repair?	—	Go to Step 21	—
17	1. Replace the FTP sensor. Refer to Fuel Tank Pressure Sensor Replacement . Did you complete the replacement?	—	Go to Step 21	—
18	1. 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	1. Repair the restriction in the EVAP purge pipe. Refer to Evaporative Emission (EVAP) Hoses/Pipes Replacement - Engine/Chassis.	—	Go to Step 21	—
20	1. 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. Does the J 41413-200 pressure/vacuum gage remain constant?	5 in H2O	Go to Step 22	Go to Step 3
22	1. 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 11
24	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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.

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

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0496 Evaporative Emission (EVAP) System Flow During Non-Purge

Conditions for Running the DTC

- DTC P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0220, P0442, P0443, P0449, P0452, P0453, P0455, P0502, P0503, P1111, P1112, P1114, P1115, P1121, P1122, P1125, P2135 are not set.
- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is greater 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 8°C (14°F) of each other.
- DTC P0496 runs continuously when these conditions are met.

Conditions for Setting the DTC

- A continuous open purge flow condition is detected during the diagnostic test.
- The fuel tank pressure decreases to 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.

DTC P0496

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 sensor in H2O with a scan tool. Is the fuel tank pressure sensor parameter within the specified value?	-1 to +1 H2O	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the EVAP purge pipe from the EVAP purge solenoid valve. 3. Turn ON the ignition, with the engine OFF. 4. Observe the fuel tank pressure 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 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 fuel tank pressure (FTP) sensor. Refer to Fuel Tank Pressure Sensor Replacement . Did you complete the replacement?	—	Go to Step 6	—

6	1. Connect all EVAP hardware that was previously disconnected. 2. Seal the EVAP system using the Purge/Seal function with a scan tool. S3. tart 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. Have any other DTCs not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P0506 OR 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 airflow into the engine. In order to increase idle speed the TAC system opens the throttle plate allowing more airflow into the engine. If the actual idle RPM does not match the desired idle RPM within a calibrated time, this DTC sets.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0506 Idle Speed Low
- DTC P0507 Idle Speed High

Conditions for Running the DTC

- DTCs P0068, P0107, P0108, P0112, P0113, P0117, P0118, P0120, P0171, P0172, P0200, P0220, P0300, P0336, P0401, P0404, P0405, P0442, P0446, P0452, P0453, P0641, P0651, P1516, P2101, P2135 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).
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The actual idle speed is approximately 150 RPM lower than or 100 RPM more than the desired idle speed.
- The above condition is 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 Testing for Intermittent Conditions and Poor Connections .

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 RPM, the test determines whether the RPM is too high or too low.

DTC P0506 or P0507

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	1. Start the engine. 2. Command the engine speed up to 1,500 RPM, down to 500 RPM, and up to 1,500 RPM with a scan tool. 3. Exit the engine speed control function. Does the engine speed correspond, within 100 RPM, with each command?	—	Go to Diagnostic Aids	Go to Step 3
3	Is the engine RPM 100 RPM more than the desired RPM?	—	Go to Step 4	Go to Step 5
4	Inspect for the following conditions: • Vacuum leaks • Excessive deposits in the throttle body • A faulty positive crankcase ventilation system Did you complete the repair?	—	Go to Step 6	—
5	Inspect for energy draining load on the engine, such as ones caused by transmission conditions. Did you find and correct the condition?	—	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. 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 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 - Vehicle	System OK

DTC P0601, P0602, P0603, P0604, P0605, P0606, P0607, P1600, P1621, P1627, P1680, P1681, P1683, OR P2610

Circuit Description

This diagnostic applies to internal microprocessor integrity conditions within the powertrain control module (PCM). This diagnostic also addresses whether or not the PCM is not programmed.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0601 Control Module Read Only Memory (ROM)
- DTC P0602 Control Module Not Programmed
- DTC P0604 Control Module Random Access Memory (RAM)
- DTC P0606 Control Module Internal Performance
- DTC P2610 Control module Ignition Off Timer Performance

Conditions For Running The DTC

DTC P0601

- The ignition switch is in the Run or Crank position.
- DTC P0601 runs continuously when the above condition is met.

DTC P0602

- The ignition switch is in the ON position.
- DTC P0602 runs continuously when the above condition is met.

DTC P0604

- The ignition switch is in the Run or Crank position.
- DTC P0604 runs continuously when the above condition is met.

DTC P0606

- The ignition switch is in the Run or Crank position, or the key is being turned OFF.
- DTC P0606 runs continuously when the above condition is met.

DTC P2610

- The PCM is powered down.
- DTC P2610 runs once every time the key is turned OFF.

Conditions For Setting the DTC

The PCM detects an internal failure or incomplete programming for more than 5 seconds.

Action Taken When DTCs P0601, P0602, P0604, P0606 Set

- 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.

Action Taken When DTC P2610 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/DTCs P0601, P0602, P0604, P0606, P2610

- 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. A DTC P0602 indicates the PCM is not programmed.

DTC P0601, P0602, P0603, P0604, P0605, P0606, P0607, P1600, P1621, P1627, P1680, P1681, P1683, or P2610

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
2	Is DTC P0602 set?	—	Go to Step 3	Go to Step 5
3	Program the powertrain control module (PCM). Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Does DTC P0602 reset?	—	Go to Step 4	Go to Step 7
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 and Setup. Does DTC P0602 reset?	—	Go to Step 6	Go to Step 7
5	Test all voltage and ground inputs to the PCM 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 7	Go to Step 6
6	Replace the PCM. Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	—	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. 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 - Vehicle in Vehicle DTC Information	System OK

DTC P0641

Circuit Description

The powertrain control module (PCM) provides 5 volts to the following sensors:

- The engine oil pressure (EOP) sensor
- The manifold absolute pressure (MAP) 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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0641 5-Volt Reference 1 Circuit

Conditions for Running the DTC

- The engine is running.
- DTC P0641 runs continuously when the above condition is met.

Conditions for Setting the DTC

The PCM detects a voltage out of tolerance condition on the 5-volt reference circuit for more 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 number below refers to the step number on the diagnostic table.

9. A short to voltage on the signal circuit of the MAP sensor will backfeed through the sensor into the 5-volt reference circuit and set this DTC.

DTC P0641

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step 2	Go to Diagnostic System Check - Vehicle
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 Testing for Intermittent Conditions and Poor Connections
3	1. Turn OFF the ignition. 2. Disconnect the engine oil pressure (EOP) sensor. 3. Turn ON the ignition, with the engine OFF. 4. Measure the voltage from the 5-volt reference circuit of the EOP sensor to a good ground with a DMM. Refer to Circuit Testing . Is the voltage within the specified range?	4.8-5.2 V	Go to Step 4	Go to Step 5
4	1. Connect the EOP sensor. 2. Disconnect the manifold absolute pressure (MAP) sensor. 3. Measure the voltage from the 5-volt reference circuit of the MAP sensor to a good ground with a DMM. Refer to Circuit Testing . Is the voltage within the specified range?	4.8-5.2 V	Go to Testing for Intermittent Conditions and Poor Connections	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 MAP sensor. Does the voltage return to within the specified range when the MAP sensor 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 . Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
8	Test all 5-volt reference circuits for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 9
9	Test the MAP sensor signal circuit for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
10	Replace the MAP sensor. Refer to Manifold Absolute Pressure (MAP) Sensor Replacement . Did you complete the replacement?	—	Go to Step 13	—
11	Replace the EOP sensor. Refer to Engine Oil Pressure Sensor and/or Switch Replacement . Did you complete the replacement?	—	Go to Step 13	—
12	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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 - Vehicle	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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit

Conditions for Running the DTC

- The engine speed is more than 400 RPM.
- DTC P0650 runs continuously when the above condition is met.

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 for more than 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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Command the malfunction indicator lamp (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 Testing for Intermittent Conditions and Poor Connections
4	Is the MIL always ON?	—	Go to Step 5	Go to Step 6
5	1. Turn OFF the ignition. 2. Disconnect the powertrain control module (PCM). 3. Turn ON the ignition. Is the MIL OFF?	—	Go to Step 11	Go to Step 13
6	1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Remove the fuse that supplies voltage to the MIL. 4. Turn ON the ignition, with the engine OFF. 5. Measure the voltage from the MIL control circuit in the PCM harness connector to a good ground. Is the voltage less than the specified value?	1 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 harness connector and a good ground. Is the MIL illuminated?	—	Go to Step 11	Go to Step 8
8	1. Turn OFF the ignition. 2. Remove the instrument panel cluster (IPC). 3. Turn ON the ignition, with the engine OFF. 4. Probe all ignition and battery positive voltage circuits of the IPC harness connector with a test lamp that is connected to a good ground. Does the test lamp illuminate for all circuits?	—	Go to Step 9	Go to Step 12
9	Test the MIL control circuit for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct a condition?	—	Go to Step 17	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 . Did you find and correct the condition?	—	Go to Step 17	Go to Step 15
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 . Did you find and correct the condition?	—	Go to Step 17	Go to Step 16
12	Repair the open in the ignition voltage or battery positive voltage circuit. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 17	—
13	Repair the short to ground in the MIL control circuit. Refer to Wiring Repairs . Did you find and correct the condition?	—	Go to Step 17	—
14	Repair the short to voltage in the MIL control circuit. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 17	—

15	Replace the IPC. Refer to Instrument Panel Cluster (IPC) Replacement . Did you complete the replacement?	—	Go to Step 17	—
16	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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 - Vehicle	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, if equipped.

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.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0651 5-Volt Reference 2 Circuit

Conditions for Running the DTC

- The engine is running.
- DTC P0651 runs continuously when the above condition is met.

Conditions for Setting the DTC

The PCM detects a voltage out of tolerance condition on the 5-volt reference circuit for more 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.

DTC P0651

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
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 cycle?	—	Go to Step 3	Go to Testing for Intermittent Conditions and Poor Connections
3	Is this vehicle equipped with a fuel tank pressure sensor?	—	Go to Step 4	Go to Step 5
4	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 to a good ground with a DMM. Refer to Circuit Testing . Is the voltage within the specified range?	4.8-5.2 V	Go to Step 6	Go to Step 7
5	1. Turn OFF the ignition. 2. Disconnect the 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 to a good ground with a DMM. Refer to Circuit Testing . Is the voltage within the specified range?	4.8-5.2 V	Go to Step 15	Go to Step 8

6	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 . Is the voltage within the specified range?	4.8-5.2 V	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 15
7	1. Is the voltage measured in the previous step more than the specified value?	5.2 V	Go to Step 11	Go to Step 9
8	Is the voltage measured in the previous step more than the specified value?	5.2 V	Go to Step 12	Go to Step 10
9	1. 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 14	Go to Step 10
10	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 . Did you find and correct the condition?	—	Go to Step 17	Go to Step 16
11	1. Monitor the DMM while disconnecting the FTP sensor. Does the voltage return to within the specified range when the FTP sensor is disconnected?	4.8-5.2 V	Go to Step 13	Go to Step 12
12	1. Test all 5-volt reference circuits for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 17	Go to Step 16
13	1. Test the FTP sensor signal circuit for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 17	Go to Step 14
14	1. Replace the FTP sensor. Refer to Fuel Tank Pressure Sensor Replacement . Did you complete the replacement?	—	Go to Step 17	
15	1. eplace the A/C pressure sensor. Refer to Air Conditioning (A/C) Refrigerant Pressure Sensor Replacement . Did you complete the replacement?	—	Go to Step 17	—

16	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P0802

Circuit Description

The transmission control module (TCM) malfunction indicator lamp (MIL) request circuit signals the powertrain control module (PCM) that the TCM is requesting MIL illumination.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0802 Transmission Control Module (TCM) MIL Request Circuit

Conditions for Running the DTC

- The ignition is ON for less than 7 seconds.
- The ignition voltage is more than 11 volts.
- DTC P0802 runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM is detecting an incorrect voltage level on the TCM MIL request circuit.

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 P0802

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Connect a scan tool. Did P0802 fail this ignition?	—	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 or as close to the Freeze Frame/Failure Records data that you observed. Does the DTC fail this ignition?	—	Go to Step 4	Go to Testing for Intermittent Conditions and Poor Connections
4	1. Turn OFF the ignition. 2. Disconnect the transmission control module (TCM). 3. Connect a DMM from the TCM malfunction indicator lamp (MIL) request circuit at the TCM harness connector to a good ground. 4. Turn ON the ignition, with the engine OFF. Does the voltage measure near the specified value?	B+	Go to Step 5	Go to Step 6
5	1. Test the TCM MIL request circuit for a short to voltage. Repair as necessary. Refer to Circuit Testing and Wiring Repairs . Did you find and correct a condition?	—	Go to Step 12	Go to Step 7
6	1. Test the TCM MIL request circuit for an open. Repair as necessary. Refer to Circuit Testing and Wiring Repairs . Did you find and correct a condition?	—	Go to Step 12	Go to Step 7

7	1. Leave the TCM disconnected. 2. Connect a fused jumper wire from the TCM MIL request circuit in the TCM harness connector to a good ground. 3. Clear the DTCs with a scan tool. Does DTC P0700 set, not setting P0802?	—	Go to Step 8	Go to Step 10
8	1. Test the TCM connectors for a bad connection. Refer to Circuit Testing and Connector Repairs . Did you find and correct a condition?	—	Go to Step 12	Go to Step 9
9	1. Replace the TCM. Refer to Transmission Control Module Replacement . Did you complete the replacement?	—	Go to Step 12	—
10	1. Test the powertrain control module (PCM) connectors for a bad connection. Refer to Circuit Testing and Connector Repairs . Did you find and correct a condition?	—	Go to Step 12	Go to Step 11
11	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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 in the DTC as specified in the supporting text. Does the DTC run and pass?	—	Go to Step 13	Go to Step 2
13	1. Observe the stored information, Capture Info with a scan tool. Does the scan tool display any DTCs that you have not diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P1125

Circuit Description

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal assembly. The sensor is actually two individual APP sensors within one housing. Two separate signal circuits are used 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 one APP sensor, this DTC will set and the Reduced Engine Power message is displayed.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P1125 Accelerator Pedal Position (APP) System

Conditions for Running the DTC

- DTCs 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.
- DTC P1125 runs continuously when the above conditions are met.

Conditions for Setting the DTC

- Two or more APP sensors are out of range. OR
- The APP sensors disagree.
- The above condition is 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. If water intrusion occurs, multiple DTCs may set without any 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 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. Remember this if you review the information stored in Captured Info.
- For an intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

DTC P1125

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	**Important: This DTC indicates that two or more accelerator pedal position (APP) sensor DTCs are also set. Diagnose the APP sensor DTCs that are set.** Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Record the throttle actuator control (TAC) module calibration with a scan tool. Does the TAC module calibration match the part number of the TAC module?	—	Go to Step 3	Go to Step 11
3	1. Observe the DTC Information with a scan tool. Is DTC P2120 or P2125 also set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 4
4	1. Turn OFF the ignition for 30 seconds. 2. Turn ON the ignition, with the engine OFF. 3. Observe the APP Sensors 1 and 2 parameter with a scan tool. Does the scan tool indicate that the APP sensors 1 and 2 parameters disagree?	—	Go to Step 5	Go to Testing for Intermittent Conditions and Poor Connections
5	1. Turn OFF the ignition. 2. Disconnect the APP sensor. 3. Disconnect the TAC module. 4. Measure the resistance of the following circuits for each of the APP sensors with a DMM: - The low reference circuit - The signal circuit - The 5-volt reference circuit Is the resistance more than the specified value for any circuit?	5 ohms	Go to Step 9	Go to Step 6

6	1. Test the signal circuit of the APP sensor 1 for a short to the signal circuit of the APP sensor 2. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 12	Go to Step 7
7	1. Test for an intermittent and for a poor connection at the TAC module. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 12	Go to Step 8
8	1. Test for an intermittent and for a poor connection at the APP sensor. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 12	Go to Step 10
9	1. Repair the high resistance in the circuit that measured above the specified value. Refer to Wiring Repairs . Did you find and correct the condition?	—	Go to Step 12	—
10	1. Replace the APP sensor. Refer to Accelerator Pedal Position (APP) Sensor Replacement . Did you complete the replacement?	—	Go to Step 12	—
11	1. Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 12	—
12	1. Assemble the vehicle, as necessary. 2. Clear the DTCs with a scan tool. 3. Start the engine. 4. Operate the system in order to verify the repair. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 13
13	**Important: Be aware that repairing one individual condition may correct more than one DTC.** 1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:
- DTC P1133 HO2S Insufficient Switching Bank 1 Sensor 1
- DTC P1153 HO2S Insufficient Switching Bank 2 Sensor 1

Conditions for Running the DTC

- DTCs P0053, P0054, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0131, P0132, P0134, P0135, P0151, P0152, P0154, P0155, P0200, P0220, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ECT Sensor parameter is more than 60°C (140°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 1,200-3,000 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.
- This diagnostic runs one time per drive cycle once the above conditions are met.

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 for a 100 second monitoring period.

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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
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 Testing for Intermittent Conditions and Poor Connections
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	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	1. Test the HO2S high signal circuit for a short to the HO2S low signal circuit. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 14	Go to Step 11
7	1. Test the HO2S high signal circuit for an open or high resistance. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs 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	1. Test the HO2S low signal circuit for an open, or high resistance. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 14	Go to Step 11
10	1. Test for shorted terminals and for poor connections at the HO2S. Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 14	Go to Step 12

11	1. Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 14	Go to Step 13
12	**Notice:** 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 . • Engine oil consumption--Refer to Oil Consumption Diagnosis . • Engine coolant consumption--Refer to Loss of Coolant . 1. 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	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P1134 HO2S Transition Time Ratio Bank 1 Sensor 1
- DTC P1154 HO2S Transition Time Ratio Bank 2 Sensor 1

Conditions for Running the DTC

- DTCs P0053, P0054, P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0128, P0131, P0132, P0134, P0135, P0151, P0152, P0154, P0155, P0200, P0220, P0442, P0446, P0452, P0453, P0455, P0496, P1125, P1258, P1516, P2101, P2108, P2135, U0107 are not set.
- The ECT Sensor parameter is more than 60°C (140°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 1,200-3,000 RPM.
- The TP Indicated Angle parameter is 5 percent more than the value observed at idle.
- he 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.
- This diagnostic runs one time per drive cycle once the above conditions are met.

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 for a 100 second monitoring period.

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				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
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 Testing for Intermittent Conditions and Poor Connections

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	1. Test the HO2S high signal circuit for an open or high resistance. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs 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	1. Test the HO2S low signal circuit for an open or high resistance. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 12	Go to Step 9

8	1. Test for shorted terminals and for poor connections at the HO2S. Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 12	Go to Step 10
9	1. Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 12	Go to Step 11
10	**Notice:** 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 . • Engine oil consumption--Refer to Oil Consumption Diagnosis . • Engine coolant consumption--Refer to Loss of Coolant . 1. 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	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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 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 with the malfunction indicator lamp (MIL) illuminated, and the rough road information is not available due to an ABS malfunction, DTC P1380 will set.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P1380 Misfire Detected - Rough Road Data Not Available

Conditions for Running the DTC

- The vehicle speed is more than 8 km/h (5 mph).
- The engine load is less than 60 percent.
- The engine misfire is detected and DTC P0300 is set with the MIL illuminated.
- The engine speed is less than 7,000 RPM.
- DTC P1380 runs continuously when the above conditions are met.

Conditions for Setting the DTC

An ABS malfunction exists for more than 45 seconds, 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 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	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Does the scan tool display any antilock brake system (ABS) DTCs?		Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Symptoms - Antilock Brake 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 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 with the malfunction indicator lamp (MIL) illuminated, and there is no communication with the brake control module, DTC P1381 will set.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P1381 Misfire Detected - No Communication with Brake Control Module

Conditions for Running the DTC

- The vehicle speed is above 8 km/h (5 mph).
- The engine speed is below 7,000 RPM.
- The engine load is less than 60 percent.
- Engine misfire is detected and DTC P0300 is set with the MIL illuminated.
- DTC P1381 runs continuously when the above conditions are met.

Conditions for Setting the DTC

The PCM cannot communicate with the brake control module for more than 45 seconds.

Action Taken When the DTC Sets

- The control module stores the DTC information into memory 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 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 P1381

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Does the scan tool display any antilock brake system (ABS) DTCs?		Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Symptoms - Antilock Brake System

DTC P1516

Circuit Description

The predicted throttle position (TP) is compared to the actual throttle position. The two 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 actual throttle position. This DTC sets if the PCM detects an out of range condition between the predicted and actual throttle position.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P1516 Throttle Actuator Control (TAC) Module Throttle Actuator Position Performance

Conditions for Running the DTC

- DTC U0107 is not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is more than 5.23 volts.
- The TAC System is not in the battery saver mode.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The TAC module detects that the predicted and the actual throttle positions are not within a calibrated range of each other.
- The PCM and the TAC cannot determine the throttle position.
- Both of the TP sensors are invalid.
- All of the above conditions are met for more 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. If water intrusion occurs, multiple DTCs may set without any circuit or component conditions found during diagnostic testing.
- Verify 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 one TAC System related DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing an individual condition may correct more than one DTC. Disconnecting components during testing may set additional DTCs. Remember this if you review the stored information in Capture Info.
- For an intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

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. Locating and repairing an individual condition may correct more than one DTC.

DTC P1516

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Is DTC U0107 set?	—	Go to DTC U0107	Go to Step 3
3	Is DTC P2135 set?	—	Go to DTC P2135	Go to Step 4
4	**Important: Low system voltage may cause this DTC to set. Clear DTCs if low system voltage has been experienced.** 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 TP Sensor 2 Angle parameters with a scan tool. 4. Slowly depress the accelerator pedal to wide open throttle (WOT) and slowly return it 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 throttle plate for the following conditions which may cause the throttle plate to bind: - Debris--If debris is found, clean the throttle body and repair the source of contamination. - Damage or evidence of tampering--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	1. With your hand, slowly open the throttle plate to WOT and 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 OFF the ignition. 2. Disconnect the throttle body harness connector. 3. Connect the jumper wires between the TP sensor terminals of the throttle body harness connector and the corresponding TP sensor terminals of the throttle body. 4. Turn ON the ignition, with the engine OFF. 5. Open the throttle blade to WOT, then to the closed position by hand. 6. Observe the TP Sensor 1 and TP Sensor 2 Angle parameters with a scan tool. Does the scan tool indicate both Angle parameters increasing as the throttle plate is moved to WOT, and decreasing as the plate 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 throttle actuator control 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 . Did you find and correct the condition?	—	Go to Step 17	Go to Step 9
9	1. Test each TAC motor circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 17	Go to Step 10
10	1. Test each TAC motor circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . 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 . Did you find and correct the condition?	—	Go to Step 17	Go to Step 12
12	1. Turn OFF the ignition. 2. Connect the TAC module. 3. Connect a test lamp between the two 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	1. Inspect for poor connections at the TAC motor harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 17	Go to Step 14
14	1. Replace the throttle body assembly. Refer to Throttle Body Assembly Replacement . Did you complete the replacement?	—	Go to Step 15	—
15	1. Inspect for poor connections at the TAC module harness connectors. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition? Go to Step 17 Go to Step 16	—	Go to Step 17	Go to Step 16

16	1. Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement? Go to Step 17	—	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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2101

Circuit Description

The commanded throttle position (TP), based on accelerator pedal position (APP) and possibly other limiting factors, is compared to the actual TP. 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 TP. This DTC sets if the PCM detects an out-of-range condition between commanded and actual pedal position.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2101 Control Module Throttle Actuator Position Performance

Conditions for Running the DTC

- DTCs P0601, P0602, P0604, P0606, P1516, P2108, U0107 are not set.
- DTCs P0120 and P0220 are not active at the same time.
- The ignition switch is in the crank or run position.
- The ignition voltage is more than 8.5 volts.
- The TAC System is not in the battery saver mode.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The PCM detects that the commanded and 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

- Inspect for mechanical concerns or binding that may be temperature related. Components may not move freely in extreme heat or cold due to the presence of contaminants or ice formation.
- Inspect the TAC module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any 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 an individual condition may correct more than one DTC. Disconnecting components during testing may set additional DTCs. Remember this if you review the stored information in Capture Info.
- For an intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

4. 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.
15. Locating and repairing an individual condition may correct more than one DTC.

DTC P2101

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Is DTC U0107 also set?	—	Go to DTC U0107	Go to Step 3
3	**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 Throttle Position (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 4
4	1. Turn OFF the ignition. 2. Remove the air inlet duct from the throttle body. 3. Disconnect the throttle body harness connector. 4. Connect the jumper wires between the TP sensor terminals of the throttle body harness connector and the corresponding TP sensor terminals of the throttle body. 5. Turn ON the ignition with the engine OFF. 6. Open the throttle blade to WOT and then to the closed position by hand. 7. Observe the TP Sensor 1 and TP Sensor 2 Angle parameters with a 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 5	Go to Step 12

5	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 . Did you find and correct the condition?	—	Go to Step 14	Go to Step 6
6	1. Test each TAC motor circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 7
7	1. Test each TAC motor circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 14	Go to Step 8
8	1. Disconnect the other TAC module harness connector. 2. Remove all jumper wires. 3. 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 . Did you find and correct the condition?	—	Go to Step 14	Go to Step 9
9	1. Turn OFF the ignition. 2. Connect the TAC module. 3. Connect a test lamp between the two 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 10	Go to Step 12

10	1. Inspect for poor connections at the TAC motor harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 14	Go to Step 11
11	1. Replace the throttle body assembly. Refer to Throttle Body Assembly Replacement . Did you complete the replacement?	—	Go to Step 14	—
12	1. Inspect for poor connections at the TAC module harness connectors. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 14	Go to Step 13
13	1. Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. 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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed? Go to Diagnostic Trouble Code (DTC) List - Vehicle System OK	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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 the TAC module is unable to correctly read data from the flash memory or an internal TAC module processor fault is detected, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2108 Throttle Actuator Control (TAC) Module Performance

Conditions for Running the DTC

- DTC U0107 is not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is greater than 6 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The TAC module determines that an internal data test did not pass.
- The above condition is met for more 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

- Verify that 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. If water intrusion occurs, multiple DTCs may set without any 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 run continuously on this system. Locating and repairing an individual condition may correct more than 1 DTC. Disconnecting components during testing may set additional DTCs. Remember this if you review the stored information in Capture Info.

Test Description

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

4. Locating and repairing an individual condition may correct more than 1 DTC.

DTC P2108

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Replace the throttle actuator control (TAC) module. Refer to Throttle Actuator Control 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. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 4
4	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2120

Circuit Description

The accelerator pedal position (APP) sensor 1 is a potentiometer type sensor with the following three circuits:

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

The control module provides the APP sensor a 5-volt reference circuit and a low reference circuit. The APP sensor then provides the control module a signal voltage proportional to pedal movement. The APP sensor 1 signal voltage is low at rest and increases as the pedal is depressed. When the control module detects that the APP sensor 1 signal or APP sensor 5-volt reference voltage is outside the predetermined range, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2120 Accelerator Pedal Position (APP) Sensor 1 Circuit

Conditions for Running the DTC

- DTCs P0601, P0602, P0606, P2108, or U0107 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is more than 5.23 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The APP sensor 1 voltage is less than 0.24 volts or more than 4.49 volts. OR
- The 5-volt reference is less than 4.54 volts or more than 5.21 volts.
- One of the above conditions is present for more 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, 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. OR
- 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 throttle actuator control (TAC) module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any 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 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. Remember this if you review the stored information in Capture Info.
- For an intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

4. This test isolates whether the short is to another TAC System circuit in the harness or within the TAC module.
15. 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 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. Remember this if you review the stored information in Capture Info.

DTC P2120

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	**Important: If DTC P0120 or U0107 is also set, refer to the appropriate DTC for further diagnosis.** 1. Turn ON the ignition with the engine OFF, and with 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 the APP sensor 1 voltage is within the specified values?	0.24-2.24 V	Go to Step 3	Go to Step 6
3	1. Depress the accelerator pedal to the wide open throttle (WOT) position. Does the scan tool indicate APP sensor 1 voltage within the specified values?	0.24-4.49 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 diagnostic trouble code (DTC) option using the scan tool. 4. Lightly touch and move the related engine wiring harnesses and 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, then return the pedal to the rest position. Did this DTC fail this ignition during the above test?	—	Go to Step 19	Go to Diagnostic Aids
6	1. Disconnect the APP sensor harness connector. Does the scan tool indicate the APP sensor 1 voltage is at the specified value?	0 V	Go to Step 7	Go to Step 11

7	1. Connect a test lamp between the APP sensor 1 signal circuit and B+. Does the scan tool indicate the APP sensor 1 voltage is at the specified value?	5 V	Go to Step 8	Go to Step 13
8	1. Test the APP sensor 1, 5-volt reference circuit for voltage with a DMM. Does the DMM indicate voltage within the specified values?	4.54-5.21 V	Go to Step 10	Go to Step 9

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. 4. Turn ON the ignition, with the engine OFF. 5. Rotate the throttle blade by hand 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?	4.54-5.21	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. 3. Does the scan tool indicate TP sensor 1 voltage 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 . 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 . 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 high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find and correct the condition?	—	Go to Step 25	Go to Step 14
14	1. Test the APP sensor 1 signal circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . 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 . 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 the following conditions with a DMM: - An open - A short to ground - High resistance Refer to Circuit Testing and Wiring Repairs . 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 high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find and correct the condition?	—	Go to Step 25	Go to Step 18

18	1. Test the TAC module ground circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find and correct the condition?	—	Go to Step 25	Go to Step 22
19	1. 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 20
20	1. 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 P0120 set while performing Step 9?	—	Go to DTC P0120	Go to Step 22
22	1. 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 23
23	1. Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 25	—
24	1. Repair the intermittent condition as necessary. Refer to Connector Repairs and Wiring Repairs . 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. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 26
26	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2121

Circuit Description

The accelerator pedal position (APP) sensor 1 and APP sensor 2 are potentiometer type sensors, each with the following circuits:

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

The control module provides the APP sensors a 5-volt reference circuit and a low reference circuit. The APP sensors then provide the control module signal voltages proportional to pedal movement. The APP sensor 1 signal voltage is low at rest and increases as the pedal is depressed. The APP sensor 2 signal voltage is also low at rest and increases as the pedal is depressed. When the control module detects that the APP sensor 1 signal and the APP sensor 2 signal circuits are out of correlation, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2121 Accelerator Pedal Position (APP) Sensor 1 Performance

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 more than 5.23 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- APP sensor 1 disagrees with APP sensor 2 by more than 10.5 percent.
- The above condition is present for more 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 commands Reduced Engine Power mode.
- The APP indicated angle is limited to a predetermined value to limit the amount of throttle control.
- 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 throttle actuator control (TAC) module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any 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. Remember this if you review the stored information in Capture Info.
- For an intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

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 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 percent of each other. If the pedal is at rest, the APP angle for all 3 sensors should be 0 percent. If 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 throttle position (TP) sensor 1. Monitoring the TP sensor 1 voltage aids in diagnosing the APP sensor 5-volt reference and low-reference circuits. If the scan tool displays near 0 volts, 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 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 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. Remember this if you review the stored information in Capture Info.

DTC P2121

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Is DTC U0107 also set?	—	Go to DTC U0107	Go to DTC U0107
3	**Important: Do not depress the accelerator pedal.** 1. Start the engine. 2. Observe the diagnostic trouble code (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 - Vehicle	Go to Step 4
4	1. 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 ON the ignition, with the engine OFF. 2. Observe the APP sensor angles for both APP sensors with a scan tool. 3. Slowly depress the accelerator pedal, stopping at 25, 50, 75, and 100 percent. 4. 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 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 with a scan tool. Does the scan tool indicate TP sensor 1 voltage at specified value?	0.0 V	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	1. 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 . 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 high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . 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 . 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 high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs Did you find an open or high resistance?	—	Go to Step 18	Go to Step 15
14	1. 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 . Did you find and correct the condition?	—	Go to Step 18	Go to Step 16
15	1. 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 . Did you find and correct the condition?	—	Go to Step 18	Go to Step 17
16	1. Replace the APP sensor assembly. Refer to Accelerator Pedal Position (APP) Sensor Replacement . Did you complete the replacement?	—	Go to Step 18	—
17	1. Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. 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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2125

Circuit Description

The accelerator pedal position (APP) sensor 2 is a potentiometer type sensor with the following circuits:

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

The control module provides the APP sensor a 5-volt reference circuit and a low reference circuit. The APP sensor then provides the control module a signal voltage proportional to pedal movement. The APP sensor 1 signal voltage is low at rest and increases as the pedal is depressed. When the control module detects that the APP sensor 2 signal or the APP sensor 5-volt reference voltage is outside the predetermined range, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2125 Accelerator Pedal Position (APP) Sensor 2 Circuit

Conditions for Running the DTC

- DTCs P0601, P0602, P0606, P2108, U0107 are not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is more than 5.23 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The APP sensor 2 voltage is less than 0.24 volt or more than 4.49 volts. OR
- The 5-volt reference is less than 4.54 volts or more than 5.21 volts.
- One of the above conditions is present for more 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, 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. OR
- 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 throttle actuator control (TAC) module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any 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 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. Remember this if you review the stored information in Capture Info.
- For an intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

2. The throttle position (TP) sensor 2 and the APP sensor 2 share a common 5-volt reference source. Diagnose DTC P0220 first if P0220 is also set.
18. This test determines whether or not the TAC module can recognize a change in signal voltage.
19. There are 2 separate 5-volt reference sources within the TAC module. The TP sensor 1 and the APP sensor 1 share one 5-volt reference source. The TP sensor 2 and the APP sensor 2 share another common 5-volt reference source. 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 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. Remember this if you review the stored information in Capture Info.

DTC P2125

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	**Important: If DTC P0220 or U0107 is also set, refer to Diagnostic Trouble Code (DTC) List - Vehicle and diagnose the applicable DTC first.** 1. Turn ON the ignition, with the engine OFF, and with your foot OFF of the accelerator pedal. 2. Observe the Accelerator Pedal Position (APP) Sensor 2 Voltage parameter with a scan tool. Does the scan tool indicate APP sensor 2 voltage within the specified values?	0.24-2.24 V	Go to Step 3	Go to Step 6
3	1. Fully depress the accelerator pedal to the wide open throttle (WOT) position. Does the scan tool indicate APP sensor 2 voltage within the specified values?	0.24-4.49 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 DTC info with a scan tool. 4. Lightly touch and move the related engine wiring harnesses and 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 Connector Repairs . Did you find and correct the condition?	—	Go to Step 25	Go to Step 5
5	1. Slowly depress the accelerator pedal to WOT, then slowly return the pedal to closed throttle while observing the DTC status. Did the scan tool indicate 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
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 2 signal circuit for a short to voltage with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 25	Go to Step 8
8	1. Test the APP sensor 2 signal circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs. Did you find and correct the condition?	—	Go to Step 25	Go to Step 9
9	1. Test the APP sensor 2 signal circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 25	Go to Step 10
10	1. 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 23
11	1. Test the APP sensor 2, 5-volt reference circuit for voltage with a DMM. Does the DMM indicate voltage within the specified values?	4.54-5.21 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 13
13	1. 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 14
14	1. Test the APP sensor 2, 5-volt reference circuit for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 25	Go to Step 15
15	1. 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 23
16	1, Measure resistance with a DMM connected between the APP sensor 2 low reference circuit and the APP sensor 1 low reference circuit. Does the DMM indicate resistance within the specified values?	0-5 ohms	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 high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs. 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 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 23
21	1. 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 22
22	1. Replace the APP sensor assembly. Refer to Accelerator Pedal Position (APP) Sensor Replacement . Did you complete the replacement?	—	Go to Step 25	—

23	1. 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 . Did you find and correct the condition?	—	Go to Step 25	Go to Step 24
24	1. Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. 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. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 26
26	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2135

Circuit Description

The throttle position (TP) sensors 1 and 2 are potentiometer type sensors each with three circuits:

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

The TP sensors are used to determine the throttle plate angle for various engine management systems. The control module provides each TP sensor a 5-volt reference circuit and a low reference circuit. The TP sensors then provide the control module with signal voltage proportional to throttle plate movement. Both TP sensor signal voltages are low at closed throttle and increase as the throttle opens. When the control module detects that TP sensor 1 signal and TP sensor 2 signals disagree or signal voltages are outside the predetermined range, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2135 Throttle Position (TP) Sensor 1-2 Correlation

Conditions for Running the DTC

- DTCs P2108, or U0107 not set.
- The ignition switch is in the crank or run position.
- The ignition voltage is more than 5.23 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The TP sensor 2 disagrees with the TP sensor 1 by more than 7.5 percent.
- The above condition is present for more 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 actuator control (TAC) module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any 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 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. Remember this if you review the stored information in Capture Info.
- If this DTC is determined to be intermittent, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

The number below refers to the step number 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 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. Remember this if you review the stored information in Capture Info.

DTC P2135

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Is DTC U0107 set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	1. Turn ON the ignition, with the engine OFF. 2. Observe the Throttle Position (TP) Sensor 1 and 2 Agree/ Disagree parameter with a scan tool. Does the scan tool TP Sensor 1 and 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 body harness connector. 3. Observe the TP sensor 1 and 2 with a scan tool. 4. Slowly open the throttle blade to wide open throttle (WOT) and back to the closed throttle position several times by hand. Does the TP Sensor Agree/Disagree parameter change from Agree to Disagree during the above test?	—	Go to Step 18	Go to Step 20
5	1. Disconnect the 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 with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 6
6	1. 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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 7

7	1. Test the TP sensor 1 signal circuit for resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 8
8	1. 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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 9
9	1. Test the TP sensor 1 low-reference circuit for resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 10
10	1. 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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 11
11	1. Test the TP sensor 2, 5-volt reference circuit for resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 12
12	1. 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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 13
13	1. Test the TP sensor 2 signal circuit for resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 14
14	1. 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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 15
15	1. Test the TP sensor 2 low-reference circuit for resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 20	Go to Step 16

16	1. 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 . Did you find and correct the condition?	—	Go to Step 20	Go to Step 17
17	1. Inspect for an intermittent and for a poor connection at the harness connector of the TAC module. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 20	Go to Step 18
18	1. Inspect for an intermittent and for a poor connection at the harness connector of the throttle body. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 20	Go to Step 19
19	1.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. Did the DTC fail this ignition?	—	Go to Step 2	Go to Step 21
21	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2138

Circuit Description

The accelerator pedal position (APP) sensors 1 and 2 are located within the accelerator pedal assembly. Each sensor has the following circuits:

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

This provides the powertrain control module (PCM) with a signal voltage proportional to accelerator pedal movement. The APP sensor 1 signal voltage at rest position is near the low reference and increases as the pedal is actuated. The APP sensor 2 signal voltage at rest position is near the low reference and increases as the pedal is actuated.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2138 Accelerator Pedal Position (APP) Sensor 1-2 Correlation

Conditions for Running the DTC

- The battery voltage is more than 5.23 volts.
- DTCs P2120 or P2125 are not set.
- The accelerator pedal is leaving the idle position.
- DTC P2138 runs continuously when the above conditions are met.

Conditions for Setting the DTC

- The voltage difference between APP sensor 1 and APP sensor 2 exceeds a predetermined value.
- The above condition is met for more than 2 seconds.

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 PCM turns OFF the MIL after 3 consecutive drive trips that the diagnostic runs and does not fail.
- A History DTC clears after 40 consecutive warm up cycles in which no failures are reported by this diagnostic or any other emission related diagnostic.
- The scan tool clears the MIL/DTC.

Diagnostic Aids

- The PCM compares the signal of each of the accelerator pedal position sensor to each other throughout the entire range of operation. Clear the DTCs and actuate the pedal through the entire range with the ignition ON and the engine OFF.
- Use the J 35616 Connector Test Adapter Kit for any test that requires probing the PCM harness connector or a component harness connector. Using this kit will prevent damage to the harness connector terminals.
- For intermittent conditions, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

2. Any circuit faults on either APP sensor 1 or 2 will set one of the DTCs listed. Refer to the appropriate table for diagnosis.

DTC P2138

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Observe the DTC information with a scan tool. Is DTC P0120, P0220, P0641, P0651, P2120, or P2125 also set?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the accelerator pedal position (APP) sensor electrical connector. 3. Disconnect the powertrain control module (PCM). 4. Use a DMM to measure the resistance of the following circuits for each of the APP sensors: - The low reference circuit - The signal circuit - The 5-volt reference circuit Did any of the circuits measure more than the specified value?	5 ohms	Go to Step 5	Go to Step 4
4	1. Test for a short between any of the circuits in the APP sensor harness. 1. Repair the circuit as necessary. Refer to Wiring Repairs . Did you find and correct the condition?	—	Go to Step 7	Go to Step 6
5	1. Repair the high resistance in the circuit. Refer to Wiring Repairs Did you complete the repair?	—	Go to Step 7	—
6	1. Replace the APP sensor. Refer to Accelerator Pedal with Position Sensor Replacement . Did you complete the replacement?	—	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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2636

Circuit Description

The secondary fuel pump is located in the rear fuel tank. The secondary fuel pump is powered by a secondary fuel pump relay. Fuel is transferred from the rear fuel tank to the front fuel tank in order to ensure all of the usable fuel volume is available to the primary fuel pump. The secondary fuel pump relay supply voltage is received from the primary fuel pump relay when the primary fuel pump is energized. This DTC sets when the powertrain control module (PCM) commands the secondary fuel pump ON and a predetermined change in both the front and rear fuel level sensors does not occur.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P2636 Fuel Transfer Pump Flow Insufficient

Conditions for Running the DTC

- DTCs P0461, P0462, P0463, P2066, P2067, P2068 are not set.
- The vehicle speed is 0 km/h (0 mph).
- The engine has been idling for more than 2 minutes and 20 seconds.
- The primary fuel level is less than 60 L (15.8 gal).
- The secondary fuel level is more than 3 L (2.6 gal).

Conditions for Setting the DTC

The PCM does not detect a change of 4 L (1.06 gal), in both the primary and the secondary fuel level sensors, with the secondary pump commanded ON for 120 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The malfunction indicator lamp (MIL) will not illuminate.
- The PCM records the operating conditions at the time the diagnostic fails. The PCM 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 numbers below refer to the step numbers on the diagnostic table.

2. This step tests the supply voltage circuit of the secondary fuel pump relay. The test lamp should illuminate as the primary fuel pump is commanded ON.
4. This step verifies the secondary fuel pump operation. Listen for an audible sound as the secondary fuel pump relay harness connector is jumpered.
5. This step verifies that there is adequate fuel in the rear fuel tank. The rear fuel tank sensor voltage must be above 1 volt in order to continue.
7. This step tests the secondary fuel pumps ability to transfer fuel. The rear fuel level sensor voltage should decrease while the secondary fuel pump is ON.
8. This step tests for a short to ground on the control circuit of the secondary fuel pump relay. If the test lamp illuminates, a short to ground is indicated.
9. This step tests for a short to voltage on the control circuit of the secondary fuel pump relay. If the test lamp illuminates, a short to voltage is indicated.

DTC P2636

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	**Important: The fuel level must be between 25-50 percent to perform this diagnostic procedure. If the fuel level is not within this range, misdiagnosis will occur.** 1. Turn OFF the ignition. 2. Remove the secondary fuel pump relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the secondary fuel pump relay coil supply circuit with a test lamp connectd to a good ground. 5. Command the fuel pump relay ON with a scan tool. Does the test lamp illuminate when the fuel pump relay is commanded ON?	—	Go to Step 3	Go to Step 22
3	1. Probe the ignition voltage circuit of the secondary fuel pump relay, switch side, with a test lamp connected to a good ground. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 12
4	1. Connect a 15-amp fused jumper wire between the ignition 1 voltage and secondary fuel pump supply voltage circuit of the secondary fuel pump relay harness connector. Does the secondary fuel pump turn ON?	—	Go to Step 5	Go to Step 16
5	1. Turn OFF the ignition. 2. Remove the jumper wire from the secondary fuel pump relay harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Observe the rear fuel level voltage parameter with a scan tool. Is the rear fuel level sensor voltage above the specified value?	1V	Go to Step 7	Go to Step 6

6	1. Add the specified amount of fuel to the fuel tank. Did you complete the action?	19 L (5 gal)	Go to Step 7	—
7	1. Turn OFF the ignition. 2. Connect a 15-amp fused jumper wire between the ignition 1 voltage circuit and the secondary fuel pump supply voltage circuit of the secondary fuel pump relay harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Observe the rear fuel level sensor voltage parameter with a scan tool. Does the rear fuel level sensor voltage decrease as the secondary fuel pump is operating?	—	Go to Step 8	Go to Step 18

8	1. Turn OFF the ignition. 2. Remove the jumper wire from the secondary fuel pump relay harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Probe the secondary fuel pump relay control circuit with a test lamp connected to B+. Does the test lamp illuminate?	—	Go to Step 23	Go to Step 9
9	1. Probe the secondary fuel pump relay control circuit with a test lamp connected to a good ground. Does the test lamp illuminate?	—	Go to Step 27	Go to Step 10
10	1. Test the secondary fuel pump relay control circuit for an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 31	Go to Step 21
11	1. Test the secondary fuel pump relay control circuit for an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 31	Go to Step 21
12	1. Inspect the PCM 1 fuse. Is the PCM 1 fuse open?	—	Go to Step 13	Go to Step 25
13	1. Test the ignition 1 voltage circuit of the secondary fuel pump relay for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 31	Go to Step 14
14	1. Test the voltage supply circuit of the secondary fuel pump for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 31	Go to Step 15

15	1. Turn OFF the ignition. 2. Install a new fuse. 3. Connect a 15-amp fused jumper wire between the ignition 1 voltage and the secondary fuel pump supply voltage circuit of the secondary fuel pump relay harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Inspect the PCM 1 fuse. Is the fuse open?	—	Go to Step 29	Go to Testing for Intermittent Conditions and Poor Connections
16	1. Lower the rear fuel tank. Refer to Fuel Tank Replacement . 2. Disconnect the secondary fuel pump harness connector. 3. Probe the voltage supply circuit of the secondary fuel pump with a test lamp connected to a good ground. Does the test lamp illuminate?	—	Go to Step 17	Go to Step 26
17	1. Probe the ground circuit of the secondary fuel pump with a test lamp connected to B+. Does the test lamp illuminate?	—	Go to Step 20	Go to Step 24
18	1. Inspect the fuel line between the primary and secondary fuel tanks for a restriction. Did you find and correct the condition?	—	Go to Step 31	Go to Step 29
19	1.Test for an intermittent and for a poor connection at the harness connector of the secondary fuel pump relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 31	Go to Step 28
20	1. Test for an intermittent and for a poor connection at the harness connector of the secondary fuel pump. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 31	Go to Step 29
21	1. Test for an intermittent and for a poor connection at the harness connector of the powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 31	Go to Step 30

22	1. Repair the open supply voltage circuit of the secondary fuel pump relay. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 31	—
23	1. Repair the short to ground in the control circuit of the secondary fuel pump relay. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 31	—
24	1. Repair the open ground circuit of the secondary fuel pump. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 31	—
25	1. Repair the open ignition voltage circuit of the secondary fuel pump relay. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 31	—
26	1. Repair the open supply voltage circuit of the secondary fuel pump. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 31	—
27	1. Repair the short to voltage on the control circuit of the secondary fuel pump relay. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 31	—
28	1. Replace the secondary fuel pump relay. Did you complete the replacement?	—	Go to Step 31	—
29	1. Replace the rear fuel sender assembly. Refer to Fuel Sender Assembly Replacement . Did you complete the replacement?	—	Go to Step 31	—

30	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 31	—
31	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 32
32	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DTC P2A01 OR P2A04

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 349 mV and above 710 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 349 mV and/or above 710 mV, the DTC will pass for this ignition cycle. If the control module does not receive the expected response from the HO2S, DTC P2A01 will set for HO2S bank 1 sensor 2 or DTC P2A04 will set for HO2S bank 2 sensor 2.

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P2A01 HO2S Circuit Bank 1 Sensor 2
- DTC P2A04 HO2S Circuit Bank 2 Sensor 2

Conditions for Running the DTC

DTCs P0030, P0036, P0050, P0053, P0054, P0056, P0059, P0060, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0128, P0131, P0132, P0133, P0134, P0135, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0157, P0158, P0160, P0161, P0200, P0442, P0443, P0446, P0449, P0455, P0496, P1133, P1134, P1153, P1154 are not set.

Passive Test

- The engine is running.
- The engine run time is more than 2 seconds.
- This diagnostic runs one time per drive cycle when the above conditions are met.

Intrusive Test

- The engine run time is more than 218 seconds.
- The Ignition 1 Signal parameter is between 10-18 volts.
- The Engine Speed parameter is between 900-5,000 RPM.
- The MAF Sensor parameter is between 5-100 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 -4 and +4 percent.
- The maximum number of intrusive attempts is less than 100.
- This diagnostic runs one time per drive cycle when the above conditions are met for 3 seconds.

Conditions for Setting the DTC

The PCM detects that the HO2S bank 1 sensor 2 or HO2S bank 2 sensor 2 did not transition below 349 mV and above 710 mV during the passive test.

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 349 mV for 60 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 710 mV for 60 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 than the specified value, the condition is present.

DTC P2A01 or P2A04

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
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 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 Testing for Intermittent Conditions and Poor Connections
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. Observe the HO2S voltage parameter with a scan tool. Is the HO2S voltage parameter more than the specified value?	800mV	Go to Step 7	Go to Step 8
6	1. Test the HO2S high signal circuit for a short to ground. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs 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.** 1. Test the HO2S high signal circuit for a short to voltage. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 17
8	1. 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 . Is the voltage more than the specified value?	**2V**	Go to Step 10	Go to Step 11

9	1. Test the HO2S high signal circuit for a short to the HO2S low signal circuit. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 17
10	1. Test the HO2S low signal circuit for a short to voltage. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs 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	1. Test the HO2S low signal circuit for an open or high resistance. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 17

14	1. Test the HO2S high signal circuit for an open or high resistance. Refer to the following procedures: • Circuit Testing • Wiring Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs 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: - Notice: 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 Alcohol/Contaminants-in-Fuel Diagnosis . - An inaccurate mass air flow (MAF) sensor--Refer to Scan Tool Data List . 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	1. Test for shorted terminals and for poor connections at the HO2S. Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 18
17	1. Test for shorted terminals and for poor connections at the powertrain control module (PCM). Refer to the following procedures: • Testing for Intermittent Conditions and Poor Connections • Connector Repairs • Heated Oxygen Sensor (HO2S) Wiring Repairs Did you find and correct the condition?	—	Go to Step 20	Go to Step 19
18	1. 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	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	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 test 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, this DTC sets.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC U0107 Lost Communication with Throttle Actuator Control (TAC) Module

Conditions for Running the DTC

- The ignition switch is in the Crank or Run position.
- The ignition voltage is more than 5.23 volts.
- This diagnostic runs continuously when the above conditions are met.

Conditions for Setting the DTC

- Invalid or missing serial data messages are detected for a predetermined amount of time.
- The above condition is met for more 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

Important: Reprogramming the PCM may cause a communication error between the PCM and the TAC. If the PCM detects a communication error, DTC U0107 sets. Clear any DTCs from the memory that may have been set by Reprogramming.

- 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 from memory that may have set from the low battery voltage condition.
- 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--i.e. cruise, 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. If water intrusion occurs, multiple DTCs may set without any circuit or component conditions found during diagnostic testing.
- When the TAC module detects a problem 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 an individual condition may correct more than one DTC. Remember this if you review the stored information in Capture Info.
- For an intermittent condition, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

2. This step determines if the ignition relay is supplying a voltage to the fuse that supplies power to the TAC module.
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 one set of the transistors is low, 0 volts, and the other set is high, B+. Therefore, if one set of transistors is at a low voltage and the corresponding circuit is shorted low, DTC P1518 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.
30. Locating and repairing an individual condition may correct more than one DTC.

DTC U0107

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Turn ON the ignition, with the engine OFF. 2. Remove the cover from the underhood electrical center. 3. Test both sides of the fuse that supplies power to the throttle actuator control (TAC) module Does the test lamp illuminate on at least one side of the fuse?	—	Go to Step 3	Go to Ignition Relay Diagnosis
3	1. Turn OFF the ignition 2. Test for voltage at the fuse that supplies power to the TAC module with a test lamp connected to ground. Does the test lamp illuminate?	—	Go to Step 23	Go to Step 4
4	1. Connect a scan tool. Is DTC P0604 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. Monitor the 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
6	1. Turn OFF the ignition. 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 with a DMM. Does the DMM indicate voltage on both circuits between the specified values?	4-5V	Go to Step 12	Go to Step 7

7	Does the DMM indicate voltage above the specified value?	5V	Go to Step 12	Go to Step 8
8	1. Turn OFF the ignition. 2. Disconnect TAC module connectors. 3. Test both throttle actuator motor control circuits for continuity to ground with a DMM. Does the DMM indicate continuity to ground?	—	Go to Step 11	Go to Step 9
9	1. Turn OFF the ignition. 2. Remove the that fuse supplies power to the TAC module. 3. Test the TAC side of the fuse terminal for continuity to ground with a DMM. Refer to Diagnostic Aids for terminal identification table. Does the DMM indicate continuity to ground?	—	Go to Step 10	Go to Step 12
10	1. Disconnect the TAC module 16-way harness connector. 2. Test the TAC side of the fuse terminal for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 25
11	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 with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 25
12	1. Turn OFF the ignition. 2. Disconnect the TAC module 16-way harness connector. 3. Test the TAC module ignition feed circuit for an open or high resistance with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 25
13	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 with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 14

14	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 with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 15
15	1. Test for an open or high resistance in the TAC module ground circuit with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 16
16	1. Test for voltage on the serial data circuits at the TAC module 16-way harness connector with a DMM. Does the DMM indicate voltage within the specified values for both circuits?	1-4.5V	Go to Step 17	Go to Step 19
17	1. Turn OFF the ignition. 2. Test both serial data circuits at the TAC module 16-way harness connector for continuity to ground with a DMM. Does the DMM indicate OL for both circuits?	—	Go to Step 21	Go to Step 18
18	1. Disconnect the powertrain control module (PCM) connector containing the TAC module serial data circuits. 2. Test both serial data circuits at the TAC module 16-way connector for a short to ground with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 29
19	1. Test for a short between both serial data circuits and all other circuits at the PCM and TAC module harness connectors with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 20
20	1. Test for a short to voltage on both serial data circuits at the TAC module 16-way connector with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 26

21	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 with a DMM. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 22
22	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 with a DMM. Does the DMM indicate voltage at the specified value?	0V	Go to Step 26	Go to Step 25
23	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 . Did you find and correct the condition?	—	Go to Step 29	Go to Step 24
24	1. Turn ON the ignition. 2. Test both TAC motor circuits for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 29	Go to Step 25
25	1. Test for poor connections at the TAC module harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 29	Go to Step 27
26	1. Test for poor connections at the PCM harness connector. Refer to Testing for Intermittent Conditions and Poor Connections and Repairing Connector Terminals . Did you find and correct the condition?	—	Go to Step 29	Go to Step 28
27	1. Replace the TAC module. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 29	—

28	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 29	—
29	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 30
30	1. Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

DIAGNOSTIC STARTING POINT - ENGINE COOLING

Begin the system diagnosis with the Diagnostic System Check - Vehicle in Vehicle DTC Information. The Diagnostic System Check 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 their status.

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

SCAN TOOL DATA DEFINITIONS

Cooling Fan Command: The percent of engine cooling fan requested from the ECM.

Desired Fan Speed: Requested fan speed from the ECM.

ECT Sensor: The scan tool displays -40°C to +151°C (-40°F to +304°F). The Engine Coolant Temperature (ECT) sensor is mounted in the coolant stream. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold and internal resistance is high, the PCM monitors a high signal voltage and interprets it as a cold engine. As the sensor warms and internal resistance decreases, the voltage signal decreases and the PCM interprets the lower voltage as a warm engine.

Fan Speed: Actual fan speed.

DTC P0480 OR P0481

Circuit Description

The powertrain control module (PCM) controls the low speed cooling fan operation by grounding the low speed fan relay control circuit with an internal solid state device called a driver. For high speed cooling fan operation, the PCM grounds the high speed and S/P relay control circuit at the same time the low speed control circuit is grounded. Battery positive voltage is supplied to the low speed, high speed, and S/P fan relays. When the PCM is commanding a fan relay ON, the voltage of the control circuit should be low, near 0 volts. When the PCM is commanding a fan relay OFF, the voltage potential of the control circuit should be high, near battery voltage.

The PCM monitors the relay control circuits for the following conditions:

- Short to ground
- Short to voltage
- An open circuit

If the PCM detects an improper voltage level on the low or high speed driver circuits, then code P0480 or P0481 will set and the effected driver will be disabled.

- Cooling fan relay 1 control circuit refers to the low speed cooling fan relay
- Cooling fan relay 2 control circuit refers to the high speed cooling fan relay

DTC Descriptors

This diagnostic procedure supports the following DTCs:

- DTC P0480 Cooling Fan Relay 1 Control Circuit
- DTC P0481 Cooling Fan Relay 2 Control Circuit

Conditions for Running the DTC

- The ignition voltage is between 8-18 volts.
- The engine speed is more than 40 RPM.
- The ECM driver transitions from ON to OFF or from OFF to ON.

Conditions for Setting the DTC

- P0481--The PCM detects an open circuit on the high speed cooling fan relay control circuit.
- P0480--The PCM detects an open on the low speed cooling fan relay control circuit.
- The above condition is present for one second.

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 and Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL during the third consecutive trip in which the diagnostic has been run and passed.
- The History DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- Use the scan tool Clear DTC Information function.

Diagnostic Aids

- If the condition is not present, refer to Testing for Intermittent Conditions and Poor Connections .
- Review the Freeze Frame/Failure Records vehicle mileage since the diagnostic test failed. This may help determine how often the condition that caused the DTC to be set occurs.

Test Description

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

2. Listen for an audible click when the low speed fan relay operates. Command both the ON and OFF states. Repeat the commands as necessary.
3. Listen for an audible click when the S/P and high speed fan relays operate. Command both the ON and OFF states. Repeat the commands as necessary.

DTC P0480 or P0481

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. With a scan tool, command the Fans Low Speed ON and OFF. Does the low speed fan relay turn ON and OFF with each command?	—	Go to Step 3	Go to Step 4
3	With a scan tool, command the Fans High Speed ON and OFF. Do the S/P and the high speed fan relays turn ON and OFF with each command?	—	Go to Diagnostic Aids	Go to Step 6
4	1. Turn OFF the ignition. 2. Disconnect the low speed fan relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 3 voltage circuit of the low speed fan relay with a test lamp that is connected to a good ground. Does the test lamp illuminate?	—	Go to Step 5	Go to Step 16
5	1. Connect a test lamp between the control circuit of the low speed fan relay and the ignition 3 voltage circuit of the low speed fan relay. 2. With a scan tool, command the Fans Low Speed ON and OFF. Does the test lamp turn ON and OFF with each command?	—	Go to Step 12	Go to Step 9
6	1. Turn OFF the ignition. 2. Disconnect the high speed fan relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 3 voltage circuit of the high speed fan relay with a test lamp that is connected to a good ground. Does the test lamp illuminate?	—	Go to Step 7	Go to Step 16

7	1. Connect a test lamp between the control circuit of the high speed fan relay and the ignition 3 voltage circuit of the high speed fan relay. 2. With a scan tool, command the Fans High Speed ON and OFF. Does the test lamp turn ON and OFF with each command?	—	Go to Step 14	Go to Step 8
8	1. Turn OFF the ignition. 2. Disconnect the S/P fan relay. 3. Turn ON the ignition, with the engine OFF. 4. Connect a test lamp between the control circuit of the S/P fan relay and the ignition 3 voltage circuit of the S/P fan relay. 5. With a scan tool, command the Fans High Speed ON and OFF. Does the test lamp turn ON and OFF with each command?	—	Go to Step 13	Go to Step 9
9	Does the test lamp remain illuminated with each command?	—	Go to Step 11	Go to Step 10
10	Test the control circuit of the appropriate relay for a short to voltage or an open. Refer to Testing for Intermittent Conditions and Poor Connections and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 15
11	Test the control circuit of the appropriate relay for a short to ground. Refer to Testing for Intermittent Conditions and Poor Connections and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 15
12	Inspect for poor connections at the low speed fan relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 17
13	Inspect for poor connections at the S/P fan relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 18

14	Inspect for poor connections at the high speed fan relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 19
15	Inspect for poor connections at the harness connector of the powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 21	Go to Step 20
16	Repair the ignition 3 voltage circuit for an open or high resistance. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 21	--
17	Replace the low speed fan relay. Did you complete the repair?	—	Go to Step 21	--
18	Replace the S/P fan relay. Did you complete the repair?	—	Go to Step 21	--
19	Replace the high speed fan relay. Did you complete the repair?	—	Go to Step 21	--
20	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 21	--
21	Use the scan tool in order to clear the DTCs . Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	—	Go to Step 2	System OK

Conditions for Clearing the DTC

- DTC P0483 is a Type B DTC.

DTC P1258

Circuit Description

The powertrain control module (PCM) uses the ECT sensor to monitor the engine for an over temperature condition. This condition occurs when the coolant temperature is above 132°C (270°F). When an over temperature condition is present, DTC P1258 will set. The PCM will disable two groups of four cylinders by turning OFF the fuel injectors. By switching between the 2 groups of cylinders, the PCM is able to reduce the temperature of the coolant.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P1258 Engine Coolant Overtemperature - Protection Mode Active

Conditions for Running the DTC

- DTCs P0117, P0118, P1114, and P1115 are not active.
- The engine is running.

Conditions for Setting the DTC

- The engine coolant temperature is above 132°C (270°F) for 10 seconds or more.
- Action Taken When the DTC Sets
- The PCM will illuminate the malfunction indicator Lamp (MIL) during the first trip in which the diagnostic test has been run and failed.
- The PCM will signal the instrument panel cluster (IPC) to turn ON the Service Engine Soon indicator.
- The PCM will alternately disable two groups of four cylinders by turning OFF the fuel injectors.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and File Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF after 3 consecutive trips that the diagnostic has been 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 the scan tool Clear DTC Information function.

DTC P0526

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Check the engine cooling fans for proper operation. Are the engine cooling fans operative?	—	Go to Engine Overheating	Go to Symptoms - Engine Cooling

ENGINE COOLING

SYMPTOMS - ENGINE COOLING

IMPORTANT
Review the system operation in order to familiarize yourself with the system functions. Refer to Diagnostic System Check - Vehicle .

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the Cooling System. Refer to Checking Aftermarket Accessories .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the surge tank reservoir for the proper coolant level.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to Testing for Intermittent Conditions and Poor Connections .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:
- Engine Overheated Indicator Always On
- Engine Coolant Temperature Indicator Always On
- Low Engine Coolant Indicator Always On
- Engine Overheating
- Loss of Coolant
- Thermostat Diagnosis

- Coolant Heater Inoperative
- Engine Fails To Reach Normal Operating Temperature
- Fan Clutch Diagnosis Engine Overheated Indicator Always On

ENGINE OVERHEATED INDICATOR ALWAYS ON

Step	Action	Value(s)	Yes	No
Connector End View Reference: Engine Cooling Schematics DEFINITION: One of the following engine coolant temperature indicators is always On: Engine Coolant, Engine Coolant Hot/Idle Engine, Engine Hot--AC Off, Engine Overheated/Stop Engine.				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Start the engine. Does the engine coolant temperature indicator illuminate?	—	Go to Step 3	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems
3	1. Install a scan tool. 2. With the scan tool, observe the engine coolant temperature parameter in the powertrain control module (PCM) data list. Does the scan tool indicate that the coolant temperature is within the temperature range shown on the temperature gage?	—	Go to Engine Overheating	Go to Step 4
4	Replace the instrument panel cluster (IPC). Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 5	—
5	Operate the system in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 2

ENGINE COOLANT TEMPERATURE INDICATOR ALWAYS ON

Step	Action	Value(s)	Yes	No
Connector End View Reference: Cooling System Connector End Views DEFINITION: One of the following engine coolant temperature indicators is always On: Engine Coolant, Engine Coolant Hot/Idle Engine, Engine Hot--AC Off, Engine Overheated/Stop Engine.				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Start the engine. Does the engine coolant temperature indicator illuminate?	—	Go to Step 3	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems
3	1. Install a scan tool. 2. With the scan tool, observe the engine coolant temperature parameter in the powertrain control module (PCM) data list. Does the scan tool indicate that the coolant temperature is within the temperature range shown on the temperature gage?	—	Go to Engine Overheating	Go to Step 4
4	Replace the instrument panel cluster (IPC). Refer to Control Module References in Computer/Integrating Systems for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 5	—
5	Operate the system in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 2

COOLING FAN ALWAYS ON

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Cooling Schematics Connector End View Reference: Cooling System Connector End Views DEFINITION: One or both engine cooling fan motors run continuously in high or low speed.				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	Turn ON the ignition, with the engine OFF. Are both cooling fans operating at low speed?	—	Go to Step 4	Go to Step 3
3	Is the left cooling fan operating at high speed?	—	Go to Step 5	Go to Testing for Intermittent Conditions and Poor Connections in Wiring Systems
4	Remove the low speed fan relay. Did the fans turn OFF?	—	Go to Step 8	Go to Step 6
5	Remove the high speed fan relay. Did the left cooling fan turn OFF?	—	Go to Step 9	Go to Step 7
6	Repair the cooling fan motor supply voltage circuit of the right cooling fan for a short to voltage. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	—	Go to Step 12	—
7	Repair the cooling fan motor supply voltage circuit of the left cooling fan for a short to voltage. Refer to Wiring Repairs in Wiring Systems. Did you complete the repair?	—	Go to Step 12	—
8	Inspect for poor connections at the low speed fan 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 12	Go to Step 10

9	Inspect for poor connections at the high speed fan 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 12	Go to Step 11
10	Replace the low speed fan relay. Did you complete the replacement?	—	Go to Step 12	—
11	Replace the high speed fan relay. Did you complete the replacement?	—	Go to Step 12	—
12	Operate the system in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 2

LOSS OF COOLANT

Step	Action	Value(s)	Yes	No
DEFINITION: The cooling system is losing coolant either internally or externally.				
1	Were you sent here from Symptoms, or another diagnostic table?	—	Go to Step 2	Go to Symptoms - Engine Cooling
2	Repair any present DTCs. Refer to Diagnostic System Check - Vehicle . Is the action complete?	—	Go to Step 3	—
3	Inspect the coolant level. Is the coolant at the proper level?	—	Go to Step 5	Go to Step 4
4	Fill the cooling system to the proper level. Refer to Draining and Filling Cooling System . Is the action complete?	—	Go to Step 5	—
5	Engine overheating can cause a loss of coolant. Is the engine overheating?	—	Go to Step 19	Go to Step 6
6	1. Idle the engine at normal operating temperature. 2. Inspect for heavy white smoke coming out of the exhaust pipe. Is a heavy white smoke present from the exhaust pipe?	—	Go to Step 7	Go to Step 8
7	• Coolant in the exhaust system creates a distinctive, burning coolant odor in the exhaust. • Condensation in the exhaust system can cause an odorless white smoke during engine warm up. Does the white smoke have a burning coolant type odor?	—	Go to Step 20	Go to Step 8
8	Visually inspect the hoses, pipes and hose clamps. Are any of the hoses, clamps or pipes leaking?	—	Go to Step 21	Go to Step 9

9	Visually inspect the following components: • Block heater • Coolant pressure cap • Core plugs • Throttle body • Engine block • Intake manifold • Radiator • Thermostat housing • Water pump Are any of the listed components leaking?	—	Go to Step 21	Go to Step 10
10	1. Pressure test the cooling system. Refer to Cooling System Leak Testing . 2. With the cooling system pressurized, visually inspect the components listed in steps 7 and 8. Are any leaks present?	—	Go to Step 21	Go to Step 11
11	Pressure test the coolant pressure cap. Refer to Pressure Cap Testing . Does the coolant pressure cap hold pressure?	—	Go to Step 12	Go to Step 16
12	Inspect for the following conditions: • A coolant smell inside of the vehicle • Coolant in the HVAC module drain tube • Coolant on the vehicle floor covering near the HVAC module Is coolant present?	—	Go to Step 21	Go to Step 13

13	Inspect the underside of the engine oil fill cap for a gray/white milky substance. Is there a milky substance under the oil fill cap?	—	Go to Step 14	Go to Step 15
14	Inspect the engine oil fluid level indicator for a gray/white milky substance. Is there a milky substance on the engine oil fluid level indicator?	—	Go to Step 17	Go to Step 15
15	Inspect the automatic transmission oil fluid level indicator, if equipped, for a gray/white milky substance. Is there a milky substance on the automatic transmission fluid level indicator?	—	Go to Step 18	Go to Step 22
16	Replace the coolant pressure cap. Is the repair complete?	—	Go to Step 22	—
17	1. Replace the radiator. Refer to Radiator Replacement . 2. Service the engine oil and filter. Refer to one of the following procedures: • Engine Oil and Oil Filter Replacement for the 4.8L and 6.0L engine • Engine Oil and Oil Filter Replacement for the 8.1L engine Is the repair complete?	—	Go to Step 22	—
18	1. Replace the radiator. Refer to Radiator Replacement . 2. Service the automatic transmission. Refer to one of the following procedures: • Engine Coolant/Water in Transmission for the 4L80-E/4L85-E transmission Is the repair complete?	—	Go to Step 22	—

19	Repair the engine overheating condition. Refer to Engine Overheating . Is the repair complete?	—	Go to Step 22	—
20	1. Repair the engine internal coolant leak. Refer to one of the following procedures: • Coolant in Combustion Chamber or Coolant in Engine Oil for the 4.3L engine • Coolant in Combustion Chamber or Coolant in Engine Oil for the 4.8L, 5.3L, and 6.0L enigne • Coolant in Combustion Chamber or Coolant in Engine Oil for the 6.6L (LLY) engine • Coolant in Combustion Chamber or Coolant in Engine Oil for the 8.1L engine Is the repair complete?	—	Go to Step 22	—
21	Repair or replace the leaking component. Refer to the appropriate repair. Is the repair complete?	—	Go to Step 22	—
22	Operate the system in order to verify the repair. Did you find and correct the condition?	—	System OK	Go to Step 2

THERMOSTAT DIAGNOSIS

Tools Required

J 24731 Tempil Stick

Use one of the following procedures in testing for a malfunctioning thermostat.

Thermostat Test Procedure Using Tempil Sticks

The coolant thermostat can be tested using a temperature (tempil) stick. The temperature stick is a pencil like device. It has a wax material containing certain chemicals which melt at a given temperature. Temperature sticks can be used to determine a thermostat's operating range, by rubbing 87°C (188°F) and 97°C (206°F) sticks on the thermostat housing.

1. Use a tempil stick in order to find the opening and the closing temperatures of the coolant thermostat.
   - J 24731 -188 tempil stick melts at 87°C (188°F). The thermostat should begin to open.
   - J 24731 -206 tempil stick melts at 97°C (206°F). The thermostat should be fully open.
2. Replace the coolant thermostat if it does not operate properly between this temperature range.

Thermostat Test Procedure Using Glycol

Inspect the operation of the thermostat by hanging the thermostat on a hook in a 50/50 percent solution of DEX-COOL® and clean drinkable water.

In order to inspect if the thermostat valve is opening properly, perform the following test:

1. Completely submerge the thermostat in the glycol solution. The solution should be 11°C (22°F) above the temperature indicated on the thermostat valve.
2. Thoroughly agitate the solution. Under these conditions, the thermostat valve should open.

In order to inspect if the thermostat valve is closing properly, perform the following test:

1. Completely submerge the thermostat in a glycol solution. The solution should be 6°C (10°F) below the temperature indicated on the thermostat valve.
2. Thoroughly agitate the solution. Under these conditions, the thermostat valve should close completely.

COOLANT HEATER INOPERATIVE (DIESEL)

Circuit/System Description

The optional coolant heater operates using 110 volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather.

Reference Information

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Coolant Heater Replacement

Coolant Heater Cord Replacement

COOLANT HEATER INOPERATIVE (GASOLINE)

Circuit/System Description

The optional coolant heater operates using 110 volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather. There is an internal thermal switch in the power cord that prevents operation above -18°C (0°F). The coolant heater helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is provided to protect the plug when not in use.

Reference Information

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

CIRCUIT/SYSTEM TESTING

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Coolant Heater Replacement

• Coolant Heater Cord Replacement

ENGINE FAILS TO REACH NORMAL OPERATING TEMPERATURE

Step	Action	Value(s)	Yes	No
1	Did you review the Symptoms-Engine Cooling diagnostic information and perform the necessary inspections?	—	Go to Step 2	Go to Symptoms - Engine Cooling
2	Verify that the engine does not reach normal operating temperature. Does the engine reach normal operating temperature?	—	System OK	Go to Step 3
3	Inspect the coolant level. Is the coolant level below the add mark?	—	Go to Step 4	Go to Step 5
4	Add coolant as necessary. Perform a cooling system pressure test. Does the cooling system hold pressure?	—	System OK	Go to Step 5
5	Inspect for a stuck open, missing, or incorrect thermostat. Refer to Thermostat Diagnosis . Is the thermostat operating properly?	—	Go to Step 6	Go to Step 8
6	Is the vehicle equipped with a 6.6 L diesel engine?	—	Go to Step 7	Go to Step 8
7	Inspect for a faulty turbocharger coolant bypass valve Is the turbocharger coolant bypass valve functioning properly?	—	—	Go to Step 9
8	Install the correct replacement thermostat. Refer to Thermostat Replacement . Is the repair complete?	—	Go to Step 10	—
9	Install a new turbocharger coolant bypass valve. Refer to Turbocharger Coolant Bypass Valve Replacement . Is the repair complete?	—	Go to Step 10	—
10	Run the engine in order to verify the repair. Does the engine fail to reach normal operating temperature?	—	—	System OK

PRESSURE CAP TESTING

Tools required

- J 24460-01 Cooling System Pressure Tester
- J 42401 Radiator Cap / Surge Tank Test Adapter

Pressure Cap Testing

CAUTION

To avoid being burned, do not remove the radiator cap or surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if radiator cap or surge tank cap is removed while the engine and radiator are still hot.

1. Remove the pressure cap.
2. Wash the pressure cap sealing surface with water.
3. Use the J 24460-01 (1) with J 42401 (2) in order to test the pressure cap.
4. Test the pressure cap for the following conditions:
   -Pressure release when the J 24460-01 exceeds the pressure rating of the pressure cap.
   -Maintain the rated pressure for at least 10 seconds. Note the rate of pressure loss.
5. Replace the pressure cap under the following conditions:
   -The pressure cap does not release pressure which exceeds the rated pressure of the cap.
   -The pressure cap does not hold the rated pressure.

COOLING SYSTEM LEAK TESTING

Tools Required

- J 24460-01 Cooling System Pressure Tester
- J 42401 Radiator Cap/ Surge Tank Test Adapter

CAUTION

Under pressure, the temperature of the solution in the radiator can be considerably higher, without boiling. Removing the radiator cap while the engine is hot (pressure is high), will cause the solution to boil instantaneously, with explosive force. The solution will spew out over the engine, fenders, and the person removing the cap. Serious bodily injury may result. Flammable antifreeze, such as alcohol, is not recommended for use at any time. Flammable antifreeze could cause a serious fire.

CAUTION

In order to help avoid being burned, do not remove the radiator cap while the engine and the radiator are hot. Scalding fluid and steam can be blown out under pressure if the cap is removed too soon.

1. Remove the pressure cap.
2. Test the operation of the pressure cap. Refer to Pressure Cap Testing .
3. Wash the pressure cap mating surface with water.
4. Use the J 24460-01 with the J 42401 in order to apply pressure to the cooling system. Do not exceed the pressure cap rating.
5. The cooling system should hold the rated pressure for at least 2 minutes. Observe the gage for any pressure loss.
6. Repair any leaks as required.

FAN CLUTCH DIAGNOSIS

Step	Action	Value(s)	Yes	No
1	Were you sent here from Symptoms or another diagnostic table?	—	Go to Step 2	Go to Symptoms - Engine Cooling
2	Is there excessive fan air noise?	—	Go to Step 3	Go to Step 4
3	Fan air noise is normal during cold engine start up. Does the fan noise go away at normal engine operating temperature?	—	Go to Step 13	Go to Step 4
4	**Important** **The engine must be turned OFF and the engine temperature should be cold.** Rotate the fan clutch. Does the fan clutch rotate?	—	Go to Step 5	Go to Step 14
5	Visually inspect the fan blades for cracks, looseness or damage. Are the fan blades in good condition?	—	Go to Step 6	Go to Step 15
6	Visually inspect the fan clutch for signs of silicone leakage. • Slight silicone leakage may not effect the fan clutch engagement. • Excess leakage will prevent the fan clutch from engaging. Is the silicone fluid leakage excessive?	—	Go to Step 14	Go to Step 7
7	Inspect the fan clutch for proper installation. 1. Move the fan blade back and forth in a lateral motion. 2. Inspect for fan blade to fan clutch movement. Is the fan blade loose at the fan clutch?	—	Go to Step 10	Go to Step 8

8	Inspect the fan clutch for wear. 1. Move the fan blade back and forth in a lateral motion. **Important** **Approximately 6.5 mm (¼ in) movement at the tip of the fan blade is normal.** 2. Inspect for fan clutch lateral movement. Is the fan clutch lateral movement excessive?	—	Go to Step 14	Go to Step 9
9	The fan clutch should have more turning resistance when the engine is at or above normal operating temperature. Does the fan clutch have more resistance when the engine temperature is raised?	—	Go to Step 11	Go to Step 14
10	Tighten the fan. Refer to Fastener Tightening Specifications . Is the repair complete?	—	Go to Step 16	—

11	Perform a fan clutch engagement test. 1. Ensure the engine coolant level is full. 2. Ensure the cooling fan drive belt tension is correct and not slipping. 3. Position and secure a thermometer between the fan clutch and the radiator. 4. Ensure the cooling fan is disengaged before starting this test. 5. Sufficiently cover the radiator grille to restrict the air flow. **Important** **Do not allow engine temperature to exceed 121°C (250°F).** 6. Start the engine. 7. Turn the A/C ON, if equipped. 8. Operate the engine at approximately 2,000 RPM. 9. Inspect the thermometer reading when the fan clutch engages. 10. Do not continue this test if the fan clutch does not engage between 85-96°C (185-205°F). Fan clutch engagement will be indicated by an increase in fan air noise, fan speed, and a drop of about 3-10°C (5-15°F) on the thermometer reading. Did the fan clutch engage between 85-96°C (185-205°F)?	—	Go to Step 12	Go to Step 14

12	Once the fan clutch engages, perform the following steps: 1. Uncover the radiator grille. 2. Turn the A/C OFF, if equipped. 3. Operate the engine at approximately 2,500 RPM to reduce the engine operating temperature. 4. Remove the thermometer. Did the engine return to normal operating temperature?	—	Go to Step 13	—
13	As the engine temperature returns to normal, the fan clutch will disengage, indicated by a reduction in fan air noise and fan speed. Did the fan clutch disengage?	—	Go to Step 16	Go to Step 14
14	Replace the fan clutch. Refer to Fan Clutch Replacement . Is the repair complete?	—	Go to Step 16	—
15	Replace the fan blades. Refer to Fan Replacement . Is the repair complete?	—	Go to Step 16	—
16	Operate the fan clutch to verify proper operation. Did you find and correct the condition?	—	System OK	Go to Step 2

ENGINE ELECTRICAL

DIAGNOSTIC STARTING POINT - ENGINE ELECTRICAL

Begin the system diagnosis with the Diagnostic System Check - Vehicle . The Diagnostic System Check 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 their status

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

SCAN TOOL DATA DEFINITIONS

Ignition 1 Signal

The scan tool displays the current voltage at the battery.

GEN L--Terminal Signal Command

The scan tool displays OK/No Output. The scan tool displays OK until malfunction is detected on the generator L terminal circuit, then it reads No Output.

GEN F--Terminal Signal

The scan tool displays 0%-100%. The scan tool displays 0%-5% until the engine is running, then the percentage value varies depending on electrical loads

Diagnostic Aids

IMPORTANT
You must cycle the ignition after clearing the DTC to turn OFF the DIC message of Service Charging System.

DTC P0562

Circuit Description

The powertrain control module (PCM) monitors the system voltage to make sure that the voltage stays within the proper range. If the PCM detects an excessively low system voltage, DTC P0562 will set.

When the charging system detects a fault, the instrument panel cluster (IPC) displays a message or the charge indicator will light.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0562 System Voltage Low

Conditions for Running the DTC

- Engine run time more than 20 seconds and above 1, 200 RPM
- Vehicle speed above 8 km/h (5 mph)

Conditions for Setting the DTC

The PCM detects an improper voltage below 11 volts for 5 seconds.

Action Taken When the DTC Sets

- The PCM stores the DTC information into memory when the diagnostic runs and fails.
- The PCM will store conditions which were present when the DTC set as Failure Records data only.
- The PCM disables most outputs.
- The transmission defaults to a predetermined gear.
- The torque converter clutch (TCC) operation is inhibited.
- The IPC displays a message.
- The malfunction indicator lamp (MIL) will not illuminate.

Conditions for Clearing the DTC

- The Conditions for Setting the DTC are no longer present.
- A history DTC will clear after 40 malfunction free ignition cycles.
- The PCM receives the clear code command from the scan tool.

DTC P0562

Step	Action	Value(s)	Yes	No
Schematic Reference: Starting and Charging Schematics Connector End View Reference: Engine Electrical Connector End Views				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	With the scan tool monitor the Ignition 1 signal voltage in the powertrain control module (PCM) data list. Does the scan tool display Ignition 1 voltage greater than the specified value?	10.5 V	Go to Step 4	Go to Step 3
3	Test the ignition feed circuit to the PCM for high resistance or open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 7	Go to Step 5
4	1. Inspect for poor connections at the PCM. Refer to Testing for Intermittent Conditions and Poor Connections . 2. If you find a poor connection, repair the condition as necessary. Refer to Wiring Repairs . Did you find and correct the condition?	—	Go to Step 7	Go to Step 6
5	Repair the ignition feed circuit to the PCM for an open or a short to ground. Refer to Wiring Repairs . Is the action complete?	—	Go to Step 7	—
6	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Is the action complete?	—	Go to Step 7	—

7	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the DTC reset?	—	Go to Step 2	System OK

DTC P0563

Circuit Description

The powertrain control module (PCM) continuously monitors that the system voltage stays within the proper range. If the PCM detects an excessively high system voltage, DTC P0563 will set. A high voltage condition may cause a stalling condition or other driveability concerns.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0563 System Voltage High

Conditions for Running the DTC

- The engine run time is more than 20 seconds.
- Engine running above 1, 200 RPM
- Vehicle speed above 8 km/h (5 mph)

Conditions for Setting the DTC

- The PCM senses the system voltage is above 19 volts.
- All of the conditions are present for 5 seconds.

Action Taken When the DTC Sets

- The PCM stores DTC P0563 in the PCM memory when the diagnostic runs and fails.
- The PCM will record the operating conditions at the time the diagnostic fails. The PCM stores this information in Failure Records.
- The PCM disables most outputs.
- The transmission defaults to a predetermined gear.
- The torque converter clutch (TCC) operation is inhibited.

- The instrument panel cluster (IPC) displays a message.
- The malfunction indicator lamp (MIL) will not illuminate.

Conditions for Clearing the DTC

- The Conditions for Setting the DTC are no longer present.
- A history DTC will clear after 40 malfunction-free ignition cycles.
- The PCM receives the clear code command from the scan tool.

DTC P0563

Step	Action	Value(s)	Yes	No
Schematic Reference: Starting and Charging Schematics Connector End View Reference: Engine Electrical Connector End Views				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Turn OFF all the accessories. 2. Measure the battery voltage at the battery using the DMM . 3. Operate the engine speed above 2, 000 RPM. Is the battery voltage less than the specified value?	19 V	Go to Step 4	Go to Step 3
3	Replace the generator. Refer to Generator Replacement . Is the action complete?	—	Go to Step 5	—
4	Replace the powertrain control module (PCM). Refer to Control Module References for replacement, setup, and programming. Is the action complete?	—	Go to Step 5	—
5	1. Select the Diagnostic Trouble Code (DTC) option and the Clear DTC Information option using the scan tool. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text, if applicable. Does the DTC reset?	—	Go to Step 2	System OK

DTC P0615

Circuit Description

The powertrain control module (PCM) uses output driver modules (ODMs) to control many functions of the engine. The ODMs supply the ground path for the PCM controlled device when the PCM commands the device ON. Each ODM is able to control several outputs. The PCM monitors the ODMs for circuit conditions that are incorrect for the commanded state of the ODM. If the PCM detects an improper circuit condition in the ODM that controls the starter relay, DTC P0615 will set.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC P0615 Starter Relay Circuit

Conditions for Running the DTC

System voltage is between 8-16 volts.

Conditions for Setting the DTC

- The PCM detects an improper voltage level on the output circuit that controls the starter relay.
- The condition exists for at least 2 seconds.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store the conditions present when the DTC set as Fail Records data only.

Conditions for Clearing the MIL/DTC

- The history DTC will clear after 40 consecutive warm-up cycles have occurred without a malfunction.
- The DTC can be cleared by using the scan tool Clear DTC Information function.

Diagnostic Aids

Ignition system DTCs set with the ignition switch in the START position if the starter relay or the starter is inoperative. When the PCM enables starter operation, the PCM also initiates the diagnostic test routines for DTCs P0335, P0340, and P0385. If a condition exists which prevents the engine from cranking, the PCM will not receive signal input from the crankshaft position (CKP) and camshaft position (CMP) sensors, and the DTCs will set.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may assist in diagnosing the condition. The information may help determine how often the condition that set the DTC occurs.

Test Description

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

2. Listen for an audible click when the start 1 relay operates. Turn the ignition switch back and forth from the ON to START positions. Repeat this as necessary.
3. This step tests for voltage at the coil side of the start 1 relay. The PCM IGN fuse supplies power to the coil side of the start 1 relay.
4. This step verifies that the PCM is providing ground to the start 1 relay.
5. This step tests if ground is constantly being applied to the start 1 relay.

DTC P0615

Step	Action	Value(s)	Yes	No
Schematic Reference: Starting and Charging Schematics Connector End View Reference: Engine Electrical Connector End Views				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Turn the ignition back and forth from the ON to START positions. Does the start 1 relay turn ON and OFF with each command?	—	Go to Testing for Intermittent Conditions and Poor Connections	Go to Step 3
3	1. Turn OFF the ignition. 2. Disconnect the start 1 relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the battery positive voltage of the start 1 relay coil circuit with a test lamp that is connected to a good ground. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 8
4	1. Connect a test lamp between the control circuit of the start 1 relay and the battery positive voltage of the start 1 relay coil circuit. 2. Turn the ignition back and forth from the ON to START positions. Does the test lamp turn ON and OFF with each command?	—	Go to Step 6	Go to Step 5
5	Test the control circuit of the start 1 relay for a short to voltage or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 11	Go to Step 7

6	Inspect for poor connections at the start 1 relay. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 11	Go to Step 9
7	Inspect for poor connections at the powertrain control module (PCM). Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 11	Go to Step 10
8	Repair the battery positive voltage circuit of the start 1 relay. Refer to Connector Repairs . Did you complete the repair?	—	Go to Step 11	—
9	Replace the start 1 relay. Refer to Relay Replacement . Did you complete the replacement?	—	Go to Step 11	—
10	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 11	—
11	1. Review and record the scan tool Fail Records data. 2. Use the scan tool in order to clear the DTC. 3. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. 4. Using the scan tool, observe the Specific DTC Information for DTC P0615 until the test runs. Does the scan tool indicate that DTC P0615 failed this ignition?	—	Go to Step 2	System OK

SYMPTOMS - ENGINE CONTROLS

Important Preliminary Inspections Before Starting

Perform Diagnostic System Check - Vehicle before using the symptom tables, and verify that all of the following are true:

- The powertrain control module (PCM) and malfunction indicator lamp (MIL) are operating correctly.
- There are no DTCs stored.
- Verify that the engine is not in a torque reduction mode. The PCM turns certain injectors OFF or reduces the engine timing when the PCM detects an over torque condition or an abusive maneuver.
- Verify that the engine coolant temperature (ECT) is not above 130°C (266°F). This condition causes the PCM to operate in Engine Coolant Over Temperature-Fuel Disabled Mode. While in Engine Coolant Over Temperature-Fuel Disabled Mode, the PCM turns the fuel OFF to four cylinders at a time in order to keep engine temperatures from reaching damaging levels. The system perceives Engine Coolant Over Temperature as a lack of power, miss, or rough idle. If the vehicle is operating in Engine Coolant Over Temperature-Fuel Disabled Mode, refer to Engine Overheating for diagnosis.
- The scan tool data is within the normal operating range, refer to Scan Tool Data List .
- Verify the customer concern and locate the correct symptom in the table of contents. Inspect the items indicated under that symptom.

Visual/Physical Inspection

Several of the symptom procedures ask for a careful visual and physical inspection. This step is extremely important. The visual and physical inspection can lead to correcting a condition without further inspections, and can save valuable time. Ensure that:

- The PCM grounds are clean, tight, and in the proper location.
- The vacuum hoses are not split or kinked, and properly connected, as shown on the Vehicle Emission Control Information label. Inspect thoroughly for any type of leak or restriction.

- The mass air flow (MAF) sensor is properly installed. The arrows on the plastic portion of the sensor must point toward the engine.
- The air intake ducts are not collapsed or damaged.
- There are no leaks at the throttle body mounting area, the MAF sensor, or the intake manifold sealing surfaces.
- The ignition wires are not cracked, brittle, or carbon tracked.
- The engine harness wiring and terminals are properly connected and are not pinched or cut.

Intermittent

IMPORTANT

Inspect for improper installation of electrical components if an intermittent condition exists. Inspect for aftermarket theft deterrent devices, lights, and cellular phones. Verify that no aftermarket equipment is connected to the class 2 circuit. If you can not locate an intermittent condition, a cellular phone communication signal may cause the condition.

IMPORTANT

The condition may or may not turn ON the MIL or store a DTC.

Faulty electrical connections or wiring cause most intermittent conditions. Perform a careful visual and physical inspection of the suspect connectors for the following conditions:

- Improperly mated connector halves
- Terminals that are not seated
- Terminals that are damaged or improperly formed

Reform or replace connector terminals in the affected circuit to ensure proper contact tension. Refer to Connector Repairs . Remove the terminal from the connector body in order to inspect for poor terminal wire connection. Refer to Testing for Intermittent Conditions and Poor Connections .

Road test the vehicle with the DMM connected to the suspected circuit. An abnormal reading that is observed when the symptom occurs is a good indication that there is a malfunction in the circuit being monitored.

Use a scan tool to help detect intermittent conditions. Useful features of the Tech 2scan tool include the following:

- Trigger the Snapshot feature in order to capture and store engine parameters when the malfunction occurs. Review this stored information in order to see the specific running conditions that caused the malfunction.
- Freeze Frame/Failure Records can also aid in locating an intermittent condition. Review and capture the information in the Freeze Frame/Failure Record associated with the intermittent DTC being diagnosed. Drive the vehicle within the conditions that were present when the DTC originally set.
- Use the Plot Function on the scan tool to plot selected data parameters. Review this stored information to aid in locating an intermittent condition. Refer to the scan tool Users Guide for more information.

IMPORTANT

If the intermittent condition exists as a start and then stall, test for DTCs relating to the vehicle theft deterrent system. Test for improper installation of electrical options such as lights, cellular phones, etc.

Any of the following may cause an intermittent MIL with no stored DTC:

- The ignition coils are shorted to a ground or arcing at the ignition wires or the spark plugs.
- The PCM grounds are loose or dirty. Refer to Engine Controls Schematics .
- The ignition control (IC) wires are routed too close to the secondary ignition wires, coils, or the generator. Ensure that all of the circuits from the PCM to the ignition coils have good connections.
- There is an open diode across the A/C compressor clutch or any other open diodes.

Use the following tables when diagnosing a symptom complaint:

- Testing for Intermittent Conditions and Poor Connections
- Hard Start
- Surges/Chuggles
- Lack of Power, Sluggishness, or Sponginess
- Detonation/Spark Knock
- Hesitation, Sag, Stumble
- Cuts Out, Misses
- Poor Fuel Economy
- Poor Fuel Fill Quality
- Rough, Unstable, or Incorrect Idle and Stalling
- Dieseling, Run-On
- Backfire

HARD START

Inspection/Test	Action
DEFINITION: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.	
Preliminary	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • Search for bulletins.
Sensor/System	• Verify that the engine coolant temperature (ECT) sensor is not shifted in value. Connect a scan tool. Compare the engine coolant temperature to the intake air temperature (IAT) on a cold engine. The ECT and IAT sensor values should be within ± 3°C (5°F) of each other. If the ECT sensor is out of range with the IAT sensor, measure the resistance of the ECT sensor. Refer to Temperature Versus Resistance for resistance specifications. • Inspect the mass air flow (MAF) sensor installation. A MAF sensor that is incorrectly installed may cause a hard start. Important: The embossed arrows on the MAF sensor indicate the direction of the intake air flow. The arrows must point toward the engine. Install the MAF in the proper direction. Refer to Mass Airflow Sensor/Intake Air Temperature Sensor Replacement . • Inspect the camshaft position (CMP) sensor for proper mounting and/or a bad connection. An extended crank occurs if the PCM does not receive a CMP signal.
Fuel System	• Verify that the engine coolant temperature (ECT) sensor is not shifted in value. Connect a scan tool. Compare the engine coolant temperature to the intake air temperature (IAT) on a cold engine. The ECT and IAT sensor values should be within ± 3°C (5°F) of each other. If the ECT sensor is out of range with the IAT sensor, measure the resistance of the ECT sensor. Refer to Temperature Versus Resistance for resistance specifications. • Inspect the mass air flow (MAF) sensor installation. A MAF sensor that is incorrectly installed may cause a hard start. Important: The embossed arrows on the MAF sensor indicate the direction of the intake air flow. The arrows must point toward the engine. Install the MAF in the proper direction. Refer to Mass Airflow Sensor/Intake Air Temperature Sensor Replacement . • Inspect the camshaft position (CMP) sensor for proper mounting and/or a bad connection. An extended crank occurs if the PCM does not receive a CMP signal.

Ignition System	Verify that both fuel injector fuses are not open. An open fuel injector fuse causes four ignition coils and four fuel injectors not to operate. Inspect the ignition coil circuits and the fuel injector circuits for an intermittent short to ground. Refer to Circuit Testing . Replace the fuse. • Inspect for proper ignition voltage output with the J 26792 Spark Tester. Refer to Electronic Ignition (EI) System Diagnosis . • Remove the spark plugs and inspect for the following conditions: - Correct heat range - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • Determine the cause of the conditions before replacing the spark plugs. • Inspect for bare or shorted ignition wires. Refer to Spark Plug Wire Inspection .
Engine Mechanical	Inspect for the following conditions: • Excessive oil in combustion chamber or leaking valve seals--Refer to LINK . • Low cylinder compression--Refer to LINK . • Combustion chambers for excessive carbon buildup--Clean the chambers using top engine cleaner. Follow the instructions on the can. • Incorrect basic or worn engine parts--Inspect the following: - Cylinder heads - Camshaft - Pistons, etc.

SURGES/CHUGGLES

Inspection/Test	Action
DEFINITION: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.	
Preliminary	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Inspect the powertrain control module (PCM) grounds for being clean, tight, and in the proper locations. Refer to Power and Grounding Component Views in Wiring Systems and Engine Controls Schematics . • Verify the driver understands the operation of the transmission torque converter clutch (TCC) and A/C compressor operation as explained in the owners manual. Inform the customer how the TCC and the A/C clutch operates.
Sensor/System	**Notice: Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices.** • Inspect the heated oxygen sensors (HO2S). The HO2S should respond quickly to different throttle positions. If they do not, inspect the HO2S for silicon or other contaminates from fuel or the use of improper RTV sealant. The sensors may have a white , powdery coating and result in a high but false signal voltage rich exhaust indication. The PCM will then reduce the amount of fuel delivered to the engine causing a severe driveability problem. • Inspect the mass air flow (MAF) sensor connections. Repair or replace damaged terminals. Refer to Connector Repairs .

Fuel System	• Test for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Verify that each injector harness is connected to the correct injector or cylinder. Relocate injector harnesses as necessary. • Inspect for the following that may cause the engine to run rich: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the HO2S connector - Engine oil contaminated by fuel - An EVAP canister purge condition - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Leaking fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor - Blockage on the inlet screen of the MAF sensor--Refer to Manifold Absolute Pressure Sensor Replac - Vacuum hoses that are split, kinked, or improperly connected - An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement . - An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement . • Inspect for the following conditions that may cause the engine to run lean: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the HO2S connector - An exhaust leak between the HO2S and the engine--Refer to Exhaust Leakage . - Vacuum leaks - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Restricted fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate MAF sensor - Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis . - Vacuum hoses that are split, kinked, or improperly connected

Ignition System	• Soak the secondary ignition system with water from a spray bottle. Soaking the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Test for proper ignition voltage output with the J 26792 Spark Tester . Refer to Electronic Ignition (EI) System Diagnosis . • Remove the spark plugs and inspect for the following conditions: - Correct heat range - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection • An improper spark plug gap will cause a driveability problem. Gap the spark plugs using a wire gauge gap tool. Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. • Monitor the Misfire Current Counters while driving the vehicle within the conditions that the misfire occurred. If a misfiring cylinder can be located, use the DTC P0300 table for diagnosis. Refer to DTC P0300 . • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis .

Engine Mechanical	Verify that the engine coolant temperature (ECT) is not above 130°C (266°F). This condition causes the PCM to operate in Engine Coolant Over Temperature - Fuel Disabled Mode. While in Engine Coolant Over Temperature - Fuel Disabled Mode, the PCM turns fuel OFF to four cylinders at a time to keep engine temperatures from reaching damaging levels. The system perceives Engine Coolant Over Temperature - Fuel Disabled Mode as a lack of power, miss, or rough idle. If the vehicle operates in Engine Coolant Over Temperature - Fuel Disabled Mode, refer to Engine Overheating for diagnosis.
Additional Inspections	• Visually and physically inspect vacuum hoses for splits, kinks, and proper connections and routing as shown on the Vehicle Emission Control Information label. • Inspect the transmission torque converter clutch (TCC) operation. A TCC applying too soon can cause the engine to spark knock. Refer to Diagnostic Starting Point - Automatic Transmission .

LACK OF POWER, SLUGGISHNESS, OR SPONGINESS

Inspection/Test	Action
DEFINITION: Engine delivers less than expected power. Little or no increase in speed when the accelerator pedal is pushed down part way.	
Preliminary	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • Remove the air filter element and inspect for dirt or for restrictions. Refer to Air Cleaner Element Replacement and replace as necessary.
Sensor/System	Use a scan tool in order to monitor the knock sensor (KS) system for excessive spark retard activity. Refer to Knock Sensor (KS) System Description .

Fuel System	• Inspect both injector fuses for being open. An open injector fuse causes four ignition coils and four injectors not to operate. Replace the fuse. Inspect the ignition coil circuits and the injector circuits for an intermittent short to ground. • Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Inspect the fuel injectors. Refer to Fuel Injector Solenoid Coil Test . • Inspect for the following that may cause the engine to run rich: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the HO2S connector - Engine oil contaminated by fuel - An EVAP canister purge condition - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Leaking fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor - Blockage on the inlet screen of the MAF sensor--Refer to Manifold Absolute Pressure Sensor Replacement . - Vacuum hoses that are split, kinked, or improperly connected - An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement . - An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement . • Inspect for the following conditions that may cause the engine to run lean: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the HO2S connector - An exhaust leak between the HO2S and the engine--Refer to Exhaust Leakage . - Vacuum leaks - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Restricted fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate MAF sensor - Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis . - Vacuum hoses that are split, kinked, or improperly connected

Ignition System	• Verify that both fuel injector fuses are not open. An open fuel injector fuse causes four ignition coils and four fuel injectors not to operate. Inspect the ignition coil circuit and the injector circuits for an intermittent short to ground. Refer to Circuit Testing . Replace the fuse. **• Inspect the secondary ignition components for signs of damage to to excessive heat in the engine compartment.** • Soak the secondary ignition system with water from a spray bottle. Soaking the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as water is applied. • Inspect for proper ignition voltage output with the J 26792 Spark Tester. • Remove the spark plugs and inspect for the following conditions: - Correct heat range - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection • An improper spark plug gap will cause a driveability problem. Gap the spark plugs using a wire gauge gap tool. Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. • Monitor the Misfire Current Counters while driving the vehicle within the conditions that the misfire occurred. If a misfiring cylinder can be located with a misfire, use the DTC P0300 table for diagnosis. Refer to DTC P0300 . • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis .

Engine Mechanical	•Verify that the engine coolant temperature (ECT) is not above 130°C (266°F). This condition causes the PCM to operate in Engine Coolant Over Temperature - Fuel Disabled Mode. While in Engine Coolant Over Temperature - Fuel Disabled Mode, the PCM will disable the fuel injectors to four cylinders at a time to keep engine temperatures from reaching damaging levels. The system perceives the Engine Coolant Over Temperature - Fuel Disabled Mode as a lack of power, miss, or rough idle. If the vehicle operates in Engine Coolant Over Temperature - Fuel Disabled Mode, refer to Engine Overheating for diagnosis. • Inspect for excessive oil in the combustion chambers and leaking valve seals. • Test for low cylinder compression. • Inspect for incorrect basic engine parts, including the following: - The camshaft - The cylinder heads - The pistons, etc.
Additional Inspections	• Inspect the exhaust system for possible restrictions. Perform the following: - Inspect the exhaust system for damaged or collapsed pipes. - Inspect the mufflers for heat distress or internal failure. - Inspect for plugged three-way catalytic converters by comparing the exhaust system back pressure on each side of the engine. Test back pressure by removing the secondary air injection (AIR) check valves near the exhaust manifolds. Refer to Restricted Exhaust .

DETONATION/SPARK KNOCK

Inspection/Test	Action
DEFINITION: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • If there are no engine mechanical faults, fill the fuel tank with a known high quality fuel that meets the vehicles minimum octane requirements. Road test the vehicle and re-evaluate the vehicles performance.
Fuel System	• Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Inspect for the following conditions that may cause the engine to run lean: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the heated oxygen sensor (HO2S) connector - An exhaust leak between the HO2S and the engine--Refer to Exhaust Leakage . - Vacuum leaks - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Restricted fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor--Refer to Scan Tool Data List . - Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis . - Vacuum hoses that are split, kinked, or improperly connected
Ignition System	Verify that the spark plugs are of the proper heat range. Refer to Spark Plug Inspection .
Engine Cooling System	Inspect for obvious overheating conditions: • Low engine coolant--Refer to Loss of Coolant for the type and amount of engine coolant to be used. • Restricted air flow to the radiator or restricted coolant flow through the radiator • Inoperative cooling fan--Refer to Cooling Fan Inoperative .

Engine Mechanical	Inspect for the following engine mechanical conditions: • Excessive oil in combustion chamber--Leaking valve seals. • Low cylinder compression. • Combustion chambers for excessive carbon buildup--Clean the combustion chamber by using top engine cleaner. Follow the instructions on the can. • Inspect for incorrect basic engine parts. Inspect the following: - The camshaft. - The cylinder heads - The pistons, etc.
Additional Inspections	• Inspect the park/neutral position (PNP) switch operation. • Inspect the transmission torque converter clutch (TCC) operation. The TCC applying too soon can cause the engine to spark knock.

HESITATION, SAG, STUMBLE

Inspection/Test	Action
DEFINITION: Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually more pronounced when first trying to make the vehicle move, as from a stop. May cause the engine to stall if severe enough.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Ground Distribution Schematics .
Sensor/System	Inspect the manifold absolute pressure (MAP) sensor operation.

Fuel System	• Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Verify that both fuel injector fuses are not open. An open fuel injector fuse causes 4 ignition coils and 4 fuel injectors not to operate. Inspect the ignition coil circuits and the fuel injector circuits for an intermittent short to ground. Refer to Circuit Testing and Wiring Repairs . Replace the fuse. • Inspect the fuel injectors. Refer to Fuel Injector Solenoid Coil Test . • Inspect for the following that may cause the engine to run rich: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the heated oxygen sensor (HO2S) connector - Engine oil contaminated by fuel - An evaporative emission (EVAP) canister purge condition - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Leaking fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor--Refer to Scan Tool Data List . - Blockage on the inlet screen of the MAF sensor--Refer to Manifold Absolute Pressure Sensor Replacement . - Vacuum hoses that are split, kinked, or improperly connected - An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement . - An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement . • Inspect for the following conditions that may cause the engine to run lean: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the HO2S connector - An exhaust leak between the HO2S and the engine--Refer to Exhaust Leakage . - Vacuum leaks - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Restricted fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate MAF sensor--Refer to Scan Tool Data List . - Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis . - Vacuum hoses that are split, kinked, or improperly connected

Ignition System	• Soak the secondary ignition system with water from a spray bottle. Soaking the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply water. • Test for proper ignition voltage output with the J 26792 Spark Tester . Refer to Electronic Ignition (EI) System Diagnosis for the procedure. • Remove the spark plugs and inspect for the following conditions: - Correct heat range - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • An improper spark plug gap will cause a driveability condition. Gap the spark plugs using a wire gage gap tool. Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. • Monitor the Misfire Current Counters while driving the vehicle in the conditions that the misfire occurred. If a misfiring cylinder can be located, use the DTC P0300 table for diagnosis. Refer to DTC P0300 . • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis .
Engine Cooling System	Inspect the engine thermostat for proper operation and for proper heat range. Refer to Thermostat Diagnosis .
Additional Inspections	Inspect the generator output voltage. Repair the charging system if the generator output voltage is less than 9 volts or more than 16 volts.

CUTS OUT, MISSES

Inspection/Test	Action
DEFINITION: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. This condition is not normally felt above 1,500 RPM or 48 km/h (30 mph). The exhaust has a steady spitting sound at idle or low speed.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • Remove the air filter element and inspect for dirt and for restrictions. Refer to Air Cleaner Element Replacement . Replace as necessary.
Sensor/System	Use a scan tool in order to monitor the knock sensor (KS) system for excessive spark retard activity.

Fuel System	• Test the fuel injectors. Refer to Fuel Injector Solenoid Coil Test . • Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Inspect for the following that may cause the engine to run rich: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the heated oxygen sensor (HO2S) connector - Engine oil contaminated by fuel - An evaporative emission (EVAP) canister purge condition - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Leaking fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor--Refer to Scan Tool Data List . - Blockage on the inlet screen of the MAF sensor - Vacuum hoses that are split, kinked, or improperly connected - An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement . - An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement . • Inspect for the following conditions that may cause the engine to run lean: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the HO2S connector - An exhaust leak between the HO2S and the engine--Refer to Exhaust Leakage . - Vacuum leaks - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Restricted fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate MAF sensor--Refer to Scan Tool Data List . - Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis . - Vacuum hoses that are split, kinked, or improperly connected

Ignition System	• Soak the secondary ignition system with water from a spray bottle. Soaking the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply water. • Test for proper ignition voltage output with the J 26792 Spark Tester . • Remove the spark plugs and inspect for the following conditions: - Correct heat range - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • An improper spark plug gap may cause a driveability problem. Refer to Spark Plug Inspection . Gap the spark plugs using a wire gauge gap tool . Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. • Visually and physically inspect the secondary ignition for the following conditions: - The ignition wires arcing to ground - The ignition wires for proper engagement to spark plug - The ignition coils for cracks or carbon tracking • Monitor the Misfire Current Counters while driving the vehicle in the conditions that the misfire occurred. If a misfiring cylinder can be located, use the DTC P0300 table for diagnosis. Refer to DTC P0300.

Engine Mechanical	• Inspect engine mechanical for the following conditions: - Inspect compression--Refer to LINK . - Sticking or leaking valves - Worn camshaft lobes - Valve timing - Bent push rods - Worn rocker arms - Broken valve springs - Excessive oil in combustion chamber. • For incorrect basic engine parts inspect the following: - The camshaft - The cylinder heads - The pistons, etc.
Additional Inspections	• Inspect the exhaust system for possible restrictions. Inspect for the following: - Inspect the exhaust system for damaged or collapsed pipes. - Inspect the mufflers for heat distress or possible internal failure. - Inspect for possible plugged catalytic converters by comparing the exhaust system back pressure on each side of engine. Refer to Restricted Exhaust . • Electromagnetic interference (EMI) on the reference circuit can cause an engine misfire condition. A sudden increase in indicated RPM with little change in actual engine RPM change indicates EMI is present. Inspect for high voltage components near ignition control circuits if a condition exists. • Inspect the intake manifold and the exhaust manifold passages for casting flash.

POOR FUEL ECONOMY

Inspection/Test	Action
DEFINITION: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, fuel economy is noticeably lower than the economy was on this vehicle at one time, as previously shown by an actual road test.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • Inspect the owners driving habits for the following conditions: - The A/C ON or the Defroster mode ON full time - The tires at the correct pressure - Excessively heavy loads being carried - The acceleration rate is too much, too often • Remove the air filter element and inspect for dirt or for restrictions. Refer to Air Cleaner Element Replacement . Replace as necessary.
Sensor/System	• Inspect the air intake system and crankcase for air leaks. • Inspect the crankcase ventilation system. Refer to Crankcase Ventilation System Inspection/Diagnosis . • Inspect for an inaccurate speedometer. Refer to Instrument Cluster Gages Inoperative . • Monitor the knock sensor (KS) system for excessive spark retard activity with a scan tool. Refer to Knock Sensor (KS) System Description .

Fuel System	• Inspect the type, quality, and alcohol content of the fuel. Oxygenated fuels have lower energy and may deliver reduced fuel economy. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Test the fuel injectors. Refer to Fuel Injector Solenoid Coil Test . • Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Inspect that each fuel injector harness is connected to the correct injector and cylinder. Relocate the injector harnesses as necessary. • Inspect for foreign material accumulation in the throttle bore, coking on the throttle valve, or on the throttle shaft. • Inspect for the following that may cause the engine to run rich: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the heated oxygen sensor (HO2S) connector - Engine oil contaminated by fuel - An evaporative emission (EVAP) canister purge condition - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Leaking fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor--Refer to Scan Tool Data List . - Blockage on the inlet screen of the MAF sensor--Refer to Manifold Absolute Pressure Sensor Replacement . - Vacuum hoses that are split, kinked, or improperly connected - An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement . - An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement .

Ignition System	• Inspect for proper ignition voltage output with the J 26792 Spark Tester . • Remove the spark plugs and inspect for the following conditions: - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • An improper spark plug gap will cause a driveability condition. Refer to Spark Plug Inspection . Gap the spark plugs using a wire gage gap tool Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. Refer to Spark Plug Inspection . • Visually and physically inspect the secondary ignition for the following conditions: - Ignition wires arcing to ground - Ignition wires for proper routing • Soaking the secondary ignition system with water from a spray bottle may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply water. • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis.
Engine Cooling System	• Inspect the engine coolant level for being low. Refer to Loss of Coolant . • Inspect the engine thermostat for proper operation and for the correct heat range. Refer to Thermostat Diagnosis .
Engine Mechanical	• Inspect engine mechanical for the following conditions: - Compression--Refer to LINK . - Sticking or leaking valves - Worn camshaft lobes - Valve timing - Bent push rods - Worn rocker arms - Broken valve springs - Excessive oil in combustion chamber--Leaking valve seals. • For incorrect basic engine parts inspect for the following: - The camshaft - The cylinder heads - The pistons, etc.

Additional Inspections	• Visually and physically inspect the vacuum hoses for splits, kinks, and proper connections and routing as shown on Vehicle Emission Control Information label. • Inspect the transmission torque converter clutch (TCC) operation. The scan tool should indicate a RPM drop, when the system commands the TCC ON. Refer to Torque Converter Diagnosis . • Inspect the exhaust system for a possible restriction. Inspect for the following: - The exhaust system for damaged or collapsed pipes - The mufflers for heat distress or possible internal failure - For possible plugged three-way catalytic converters by comparing the exhaust system back pressure on each side of the engine--Inspect the back pressure by removing the secondary air injection (AIR) check valves near the exhaust manifolds. Refer to Restricted Exhaust . • Electromagnetic interference (EMI) on the reference circuit can cause an engine miss condition. A scan tool can usually detect EMI by monitoring the engine RPM. A sudden increase in RPM with little change in actual engine RPM change indicates EMI is present. Inspect for high voltage components, near ignition control circuits, if a condition exists. • Inspect the park neutral position (PNP) switch circuit. Refer to Range Selector Displays Incorrect Range for the 4L60-E/4L65-E transmission or Range Selector Displays Incorrect Range for the 4L80-E/4L85-E transmission. • Inspect the brake system for dragging or improper operation. Refer to Brake Caliper Inspection . Verify that the vehicle operator does not drive with a foot on the brake pedal.

POOR FUEL FILL QUALITY

Inspection/Test	Action
DEFINITION: Difficulty when refueling the vehicle.	
Difficult to fill	• If the vehicle is equipped with dual fuel tanks and a single filler neck the flow of the fuel into the tanks may exceed the ability of the system to compensate, the fill nozzle will automatically shut off. The system will require 10-20 seconds to equalize pressure before filling can resume. Refer to Fuel System Description . **NOTICE: Workhorse does not install dual fuel tanks. ANY issue arising from the installation of an auxiliary fuel tank should be directed to the body builder.** • The check valve is stuck closed. • The fill limiter vent valve is stuck closed. Refer to Fuel Tank Replacement . • The evaporative emission (EVAP) canister is restricted. Refer to Evaporative Emission (EVAP) Canister Replacement . • The EVAP canister vent solenoid is stuck closed. Refer to Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement . • Restricted EVAP pipes--Refer to Evaporative Emission (EVAP) Hoses/Pipes Replacement - Canister/Fuel Tank . • High Reid Vapor Pressure • High fuel temperature • The fuel filler hose/pipe is pinched, kinked or blocked. Refer to Filler Tube Replacement . • The fuel feed hose, or crossover hose, is pinched, kinked or blocked. Refer to Fuel Rail Assembly Replacement . • The ignition switch is ON.
Over fill	• The pressure relief valve in the fill limiter vent valve, if equipped, is stuck open. Refer to Fuel Tank Replacement . • The pressure relief valve in the fill limiter vent is valve, if equipped, leaking. Refer to Fuel Tank Replacement . • The fill limiter vent valve, if equipped, is stuck open. Refer to Fuel Tank Replacement . • The fill limiter vent valve, if equipped, is leaking. Refer to Fuel Tank Replacement .

Premature shut-off of the fuel dispensing nozzle	• The fill limiter vent valve, if equipped, is stuck closed. Refer to Fuel Tank Replacement . • The EVAP canister is restricted. Refer to Evaporative Emission (EVAP) Canister Replacement . • The EVAP canister vent solenoid is stuck closed. Refer to Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement . • Restricted EVAP pipes--Refer to Evaporative Emission (EVAP) Hoses/Pipes Replacement - Canister/Fuel Tank . • High Reid vapor pressure • High fuel temperature • The fuel filler hose/pipe is pinched, kinked or blocked. Refer to Filler Tube Replacement . • The fuel feed hose, or crossover hose, if equipped, is pinched, kinked or blocked. • The ignition switch is ON.
Fuel spit back	• The check valve is stuck open. • The check valve is stuck closed. • The check valve is leaking. • High Reid vapor pressure • High fuel temperature
Liquid fuel in the EVAP canister	• The fill limiter vent valve is stuck open. Refer to Fuel Tank Replacement . • The fill limiter vent valve is leaking. Refer to Fuel Tank Replacement .
Liquid fuel leak	• The pressure relief valve in the fill limiter vent valve is stuck open. Refer to Fuel Tank Replacement . • The pressure relief valve in the fill limiter vent valve is leaking. Refer to Fuel Tank Replacement . • The fuel filler hose is loose or torn. Refer to Filler Tube Replacement . • The fuel feed hose, or crossover hose, is loose or torn. Refer to Fuel Rail Assembly Replacement . • The fill limiter vent valve is stuck open. Refer to Fuel Tank Replacement .
Fuel odor	• The pressure relief valve in the fill limiter vent valve, if equipped, is stuck open. Refer to Fuel Tank Replacement . • The pressure relief valve in the fill limiter vent valve, if equipped, is leaking. Refer to Fuel Tank Replacement . • The EVAP canister is saturated. Refer to Evaporative Emission (EVAP) Canister Replacement .

ROUGH, UNSTABLE, OR INCORRECT IDLE AND STALLING

Inspection/Test	Action
DEFINITION: Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • Remove and inspect the air filter element for dirt or for restrictions. Refer to Air Cleaner Element Replacement . Replace as necessary.
Sensor/System	• Inspect the crankcase ventilation valve for proper operation. Place a finger over the inlet hole of the valve end several times. The valve should snap back. If not, replace the valve. Refer to Crankcase Ventilation System Description . • Use a scan tool in order to monitor the knock sensor (KS) system for excessive spark retard activity.

Fuel System	• Inspect the fuel injectors. Refer to Fuel Injector Solenoid Coil Test . • Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Inspect that each fuel injector harness is connected to the correct injector/cylinder. Relocate fuel injector harnesses as necessary. • Inspect for the following that may cause the engine to run rich: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the heated oxygen sensor (HO2S) connector - Engine oil contaminated by fuel - An evaporative emission (EVAP) canister purge condition - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Leaking fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor - Blockage on the inlet screen of the MAF sensor--Refer to Manifold Absolute Pressure Sensor Replacement . - Vacuum hoses that are split, kinked, or improperly connected - An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement . - An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement . • Inspect for the following conditions that may cause the engine to run lean: **Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.** - Water intrusion in the HO2S connector - An exhaust leak between the HO2S and the engine--Refer to Exhaust Leakage . - Vacuum leaks - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Restricted fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate MAF sensor - Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis . - Vacuum hoses that are split, kinked, or improperly connected

Ignition System	• Inspect for proper ignition voltage output with the J 26792 Spark Tester . Refer to Electronic Ignition (EI) System Diagnosis for procedure. • Remove spark plugs and check for the following conditions: - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • An improper spark plug gap will cause a driveability problem. Refer to Spark Plug Inspection . Gap the spark plugs using a wire gage gap tool. Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. • Visually and physically inspect secondary ignition for the following conditions: - Ignition wires arcing to ground - Ignition wires for proper routing • Soak the secondary ignition system with water from a spray bottle. Soaking the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply water. • Monitor the Misfire Current Counters while driving the vehicle in the conditions that the misfire occurred. If a misfiring cylinder can be located, use the DTC P0300 table for diagnosis. Refer to DTC P0300 . • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis .

Engine Mechanical	• Inspect engine mechanical for the following conditions: - Compression--Refer to LINK . - Sticking or leaking valves - Worn camshaft lobes - Valve timing - Bent push rods - Worn rocker arms - Broken valve springs - Excessive oil in combustion chamber or leaking valve seals. • For incorrect basic engine parts. Inspect the following: - The camshaft - The cylinder heads - The pistons, etc.
Additional Inspections	• Inspect the exhaust system for possible restrictions. Inspect for the following: - Inspect the exhaust system for damaged or collapsed pipes. - Inspect the mufflers for heat distress or possible internal failure. - Inspect for possible plugged three-way catalytic converters by comparing exhaust system back pressure on each side of engine. Inspect the back pressure by removing secondary air injection (AIR) check valves near exhaust manifolds. Refer to Restricted Exhaust . • Electromagnetic interference (EMI) on the reference circuit can cause an engine miss condition. A scan tool can usually detect EMI by monitoring the engine RPM. A sudden increase in RPM with little change in actual engine RPM change indicates that EMI is present. If a problem exists, inspect routing of secondary ignition wires or high voltage components near the ignition control circuits. • Inspect the park neutral position (PNP) switch circuit. Refer to Park/Neutral Position Switch Adjustment . • Inspect for faulty motor mounts. Refer to Engine Mount Inspection . • Inspect the intake manifold and the exhaust manifold passages for casting flash.

DIESELING, RUN-ON

Inspection/Test	Action
DEFINITION: Engine continues to run after key is turned OFF, but runs very rough. If the engine runs smooth, inspect the ignition switch and the ignition switch adjustment.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics .
Fuel System	Inspect the fuel injectors for a leaking condition. Refer to Fuel System Diagnosis for the proper procedure.

BACKFIRE

Inspection/Test	Action
DEFINITION: Fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics .
Sensor/System	• Inspect the air intake system and crankcase for air leaks. • Inspect for an inaccurate speedometer. Refer to Instrument Cluster Gages Inoperative . • Monitor the knock sensor (KS) system for excessive spark retard activity with a scan tool. Refer to Knock Sensor (KS) System Description .
Fuel System	• Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Inspect the fuel injectors. Refer to Fuel Injector Solenoid Coil Test . • Verify that each injector harness is connected to the correct injector or cylinder. Relocate injector harnesses as necessary.

Ignition System	• Inspect for proper ignition voltage output with the J 26792 Spark Tester . • Remove spark plugs and inspect for the following conditions: - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • An improper spark plug gap will cause a driveability condition. Refer to Spark Plug Inspection . Gap the spark plugs using a wire gage gap tool . Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. Refer to Spark Plug Inspection for diagnosis. • Visually and physically inspect secondary ignition for the following conditions: - Ignition wires arcing to ground - Ignition coils arcing to ground • Soak the secondary ignition system with water from a spray bottle. Soaking the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Monitor the Misfire Current Counters while driving the vehicle in the conditions that the misfire occurred. If a misfiring cylinder can be located, use the DTC P0300 table for diagnosis. Refer to DTC P0300 . • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis .
Engine Cooling System	• Inspect the engine coolant level for being low. Refer to Loss of Coolant . • Inspect the engine thermostat for proper operation and for the correct heat range. Refer to Thermostat Diagnosis .

Engine Mechanical	• Inspect engine mechanical for the following conditions: - Compression--Refer to LINK . - Sticking or leaking valves - Worn camshaft lobes - Valve timing - Bent push rods - Worn rocker arms - Broken valve springs - Excessive oil in combustion chamber or leaking valve seals. • For incorrect basic engine parts. Inspect the following: - The camshaft - The cylinder heads - The pistons, etc.

Additional Inspections	• Visually and physically inspect the vacuum hoses for splits, kinks, and proper connections and routing as shown on the Vehicle Emission Control Information label. • Inspect the intake manifold and the exhaust manifold passages for casting flash. • Inspect the transmission torque converter clutch (TCC) operation. The scan tool should indicate an RPM drop when the TCC is commanded ON. Refer to Torque Converter Diagnosis for the 4L60-E/4L65-E transmission or Torque Converter Diagnosis . • Inspect the exhaust system for possible restrictions. Inspect the following: - The exhaust system for damaged or collapsed pipes - The mufflers for heat distress or possible internal failure - Possible plugged 3-way catalytic converters by comparing exhaust system back pressure on each side of engine--Inspect back pressure by removing AIR check valves near exhaust manifolds. Refer to Restricted Exhaust . • Electromagnetic interference (EMI) on the reference circuit can cause an engine miss condition. A scan tool can usually detect EMI by monitoring the engine RPM. A sudden increase in RPM with little change in actual engine RPM change may indicate that EMI is present. If a condition exists, inspect for high voltage components near the ignition control circuits. • Inspect the park/neutral position (PNP) switch operation. Refer to Park/Neutral Position Switch Adjustment . • Inspect for faulty motor mounts. Refer to Engine Mount Inspection . • Inspect the intake manifold and the exhaust manifold passages for casting flash.

MALFUNCTION INDICATOR LAMP (MIL) DIAGNOSIS

Diagnostic Fault Information

Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

Circuit/System Description

Ignition voltage is supplied to the malfunction indicator lamp (MIL). The engine control module (ECM) turns the MIL ON by grounding the MIL control circuit.

Reference Information

Schematic Reference

- Instrument Cluster Schematics
- Engine Controls Schematics

Connector End View Reference

- Displays and Gages Connector End Views
- Powertrain Control Module Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

- Scan Tool Data List
- Scan Tool Output Controls
- Scan Tool Data Definitions

Circuit/System Verification

Ignition ON, the MIL should turn ON and OFF when commanded with a scan tool.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the instrument panel cluster (IPC).
2. Ignition ON, verify that a test lamp illuminates between the ignition circuit and ground.
   - If the test lamp does not illuminate, test the ignition circuit for a short to ground or an open/high resistance. If the circuit tests normal and the ignition circuit fuse is open, replace the IPC.
3. Connect a test lamp between the control circuit and the ignition circuit.
4. Command the MIL ON and OFF with a scan tool. The test lamp should turn ON and OFF when changing between the commanded states.
   - If the test lamp is always ON, test the control circuit for a short to ground. If the circuit tests normal, replace the ECM.
   - If the test lamp is always OFF, test the control circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the ECM.
5. If all circuits test normal, replace the IPC.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Control Module References
- Instrument Cluster Replacement

ENGINE CRANKS BUT DOES NOT RUN

Description

The Engine Cranks but Does Not Run diagnostic table is an organized approach to identifying a condition that causes an engine to not start. The diagnostic table directs the service technician to the appropriate system diagnosis. The diagnostic table assumes the following conditions are met:

- The battery is completely charged. Refer to Battery Inspection/Test .
- The engine cranking speed is acceptable. Refer to Engine Cranks Slowly .
- There is adequate fuel in the fuel tank.

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	**Important: DO NOT allow the ignition switch to be interrupted during this step.** Crank the engine for the specified amount of time. Does the scan tool display any DTCs that failed this ignition?	15 seconds	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 3
3	Does the scan tool display any body control module (BCM) vehicle theft deterrent (VTD) DTCs?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	Go to Step 4
4	1. Turn ON the ignition, with the engine OFF. 2. Probe both test points of the PCM 1 fuse located in the underhood fuse block, with a test lamp connected to a good ground. Does the test lamp illuminate on at least one test point of the fuse	—	Go to Step 5	Go to Ignition Relay Diagnosis
5	1. Turn OFF the ignition. 2. Disconnect the spark plug wire from the spark plug. I3. nstall the J 26792 Spark Tester to the spark plug wire. 4. Attach the clamp end of the spark tester to a good engine ground. 5. Observe the spark tester. 6. Crank the engine. 7. Repeat the test for the remaining cylinders. 8. Does the spark tester produce a spark on all cylinders?	—	Go to Step 6	Go to Electronic Ignition (EI) System Diagnosis
6	Monitor the ignition 1 signal parameter with a scan tool. Is the ignition 1 signal parameter at the specified value?	B+	Go to Step 7	Go to Step 10
7	Command the fuel pump ON with a scan tool. Does the fuel pump operate?	—	Go to Step 8	Go to Fuel Pump Electrical Circuit Diagnosis

8	1. Turn OFF the ignition. 2. Install a fuel pressure gage. Refer to Fuel System Diagnosis . **Important: The fuel pump operates for about 2 seconds when the ignition is turned ON. The fuel pressure must be observed when the fuel pump is operating.** 3. Turn ON the ignition, with the engine OFF. 4. Observe the fuel pressure while the fuel pump is operating. Is the fuel pressure within the specified range?	385-425 kPa (55-62 psi)	Go to Step 9	Go to Fuel System Diagnosis
9	1. Inspect for the following conditions: •The engine coolant temperature (ECT) sensor is not close to the actual engine temperature. • The duct work between the mass air flow (MAF) sensor and the throttle body for air leaks • A restricted exhaust system--Refer to Restricted Exhaust . • A malfunctioning MAF sensor may cause a no start or a stall after a start. If you suspect this, disconnect the MAF sensor. The powertrain control module (PCM) will default to the speed density in order to calculate the engine load and the intake air flow. If disconnecting the MAF sensor corrects the condition and the connections are OK. Refer to DTC P0102 . • The spark plugs for being gas fouled--Refer to Spark Plug Inspection . • An engine mechanical failure that causes an engine not to start such as timing chain, low compression. • Compare the MAP/BARO parameters to another vehicle. The parameter values should be close to each other. Did you complete the action?	—	Go to Step 13	—
10	1. Test the ignition 1 voltage circuit for an open or for a short to ground. Refer to Circuit Testing and Wiring Repairs . 2. Replace the fuse if necessary. Did you find and correct the condition?	—	Go to Step 13	Go to Step 11

11	Inspect for poor connections at the harness connector of the PCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 12
12	Replace the PCM. Refer to Control Module References for replacement, setup, and programming. 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. Attempt to start the engine. Does the engine start the continue to run?	—	Go to Step 14	Go to Step 2
	1. Allow the engine to reach operating temperature. 2. Observe the DTC information with a scan tool. Are there any DTCs that have not been diagnosed?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

IGNITION RELAY DIAGNOSIS

Circuit Description

The ignition relay is a normally open relay. The relay armature is held in the open position by spring tension. When the ignition switch is turned to the run or start position, current will flow through the relay coil. A wire connected to the other end of the relay coil completes the path to ground. The electomagnetic field created by the relay coil, overcomes the spring tension and moves the armature allowing the relay contacts to close. The closed relay contacts allow current to flow from the battery to the following fuses:

- The PCM 1 fuse
- The ETC/ECM fuse
- The INJ 1 fuse
- The INJ 2 fuse

When the ignition switch is turned to the OFF position, the electromagnetic field collapses. This action allows the spring tension to move the armature away from the relay contacts, which interrupts current flow to the fuses.

If the ignition relay fails to close, the engine will crank, but will not run. The class 2 communications will be available with the use of a scan tool.

The ignition relay table assumes that the vehicle battery is fully charged. Refer to Battery Inspection/Test .

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Turn ON the ignition, with the engine OFF. 2. Remove the underhood junction block cover. 3. Probe the following fuses with a test lamp that is connected to a good ground: • The PCM 1 fuse • The ETC/ECM fuse • The INJ 1 fuse • The INJ 2 fuse Does the test lamp illuminate on at least one test point of each fuse?	—	Go to Step 3	Go to Step 10
3	1. Turn OFF the ignition. 2. Probe both test points of the PCM 1 fuse with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate on either test point of the fuse?	—	Go to Step 4	Go to Step 30
4	1. Turn OFF the ignition. 2. Remove the ignition relay from the underhood junction block with the J 43244 Relay Puller Pliers. Refer to Relay Replacement . **Notice: Refer to Test Probe Notice in Cautions and Notices.** 3. Probe the ignition 1 voltage circuit of the ignition relay at the underhood junction block with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate?	—	Go to Step 7	Go to Step 5

5	Test the relay load bus bar of the underhood junction block between the ignition relay and the fuses to the circuit components for a short to battery positive voltage. Refer to Circuit Testing . Did you find a condition?	—	Go to Step 29	Go to Step 6
6	1. Turn OFF the ignition. 2. Remove the following fuses from the underhood junction block: • The PCM 1 fuse • The ETC/ECM fuse • The INJ 1 fuse • The INJ 2 fuse 3. Probe the above fuse terminals in the underhood junction block with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate at any of the fuse terminals?	—	Go to Diagnostic System Check - Vehicle	Go to Step 27
7	1. Turn OFF the ignition. 2. Disconnect the negative battery cable at the battery. Refer to Battery Negative Cable Disconnect and Connect Procedure . 3. Disconnect the underhood junction block electrical connector that contains the ignition 1 voltage circuit for the ignition relay. 4. Disconnect the ignition switch electrical connector that contains the ignition 1 voltage circuit for the ignition relay. 5. Connect the negative battery cable to the battery. 6. Test the ignition 1 voltage circuit for a short to battery positive voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 8
8	1. Turn OFF the ignition. 2. Probe the ignition 1 voltage terminal on the ignition switch side of the ignition switch electrical connector with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate?	—	Go to Step 28	Go to Step 9

9	Test the ignition 1 voltage bus bar circuit in the underhood junction block for a short to battery positive voltage. Refer to Circuit Testing Did you find a condition?	—	Go to Step 29	Go to Step 27
10	1. Turn OFF the ignition. 2. Inspect the 40-amp IGN B fuse in the underhood junction block. Refer to Circuit Protection - Fuses . Is the fuse open?	—	Go to Step 11	Go to Step 18
11	1. Remove the 40-amp IGN B fuse from the underhood junction block. **Notice: Refer to Test Probe Notice in Cautions and Notices.** 2. Probe both fuse terminals in the underhood junction block with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate on at least one fuse terminal?	—	Go to Step 12	Go to Step 17
12	Test the ignition 1 voltage circuit between the ignition switch and the underhood junction block for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 13
13	Test the ignition switch assembly for a short to ground. Refer to Circuit Testing . Did you find a condition?	—	Go to Step 28	Go to Step 14
14	Test the battery positive voltage circuit between the underhood junction block and the ignition switch for a short to ground. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 15
15	Test the battery positive voltage bus bar circuit of the underhood junction block between the 40-amp IGN B fuse and the ignition switch for a short to ground. Did you find a condition?	—	Go to Step 29	Go to Step 16

16	Test the ignition 1 voltage bus bar circuit of the underhood junction block that contains the ignition relay for a short to ground. Did you find a condition?	—	Go to Step 29	Go to Step 27
17	1. Turn OFF the ignition. 2. Probe the mounting stud for the battery positive cable at the underhood junction block with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate?	—	Go to Step 29	Go to Diagnostic System Check - Vehicle .
18	1. Turn OFF the ignition. 2. Remove the ignition relay with the J 43244 from the underhood junction block. Refer to Relay Replacement . **Notice: Refer to Test Probe Notice in Cautions and Notices.** 3. Probe the battery positive voltage circuit of the ignition relay at the underhood junction block with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate?	—	Go to Step 19	Go to Step 29
19	1. Turn ON the ignition, with the engine OFF. 2. Probe the ignition 1 voltage circuit of the ignition relay at the underhood junction block with a test lamp that is connected to a good ground. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate?	—	Go to Step 23	Go to Step 20
20	1. Turn OFF the ignition. 2. Test the ignition 1 voltage circuit between the ignition switch and the underhood junction block for a high resistance or for an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 21
21	Test the ignition switch assembly for a high resistance or for an open. Refer to Circuit Testing . Did you find a condition?	—	Go to Step 28	Go to Step 22

22	Test the battery positive voltage circuit between the ignition switch and the underhood junction block for a high resistance or for an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 29
23	1. Turn ON the ignition, with the engine OFF. 2. Probe the coil ground circuit of the ignition relay at the underhood junction block with a test lamp that is connected to battery voltage. Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate?	—	Go to Step 25	Go to Step 24
24	1. Turn OFF the ignition. 2. Disconnect the negative battery cable at the battery. Refer to Battery Negative Cable Disconnect and Connect Procedure . 3. Disconnect the underhood junction block electrical connectors. 4. Test the coil ground circuit of the ignition relay at the underhood junction block electrical connector for a high resistance or for an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 30	Go to Step 29
25	1. Turn OFF the ignition. 2. Jumper the ignition relay battery positive voltage circuit and the ignition relay load circuit together at the underhood junction block with a 20-amp fused jumper wire. Refer to Using Fused Jumper Wires . 3. Probe the following fuses with a test lamp that is connected to a good ground: • PCM 1 • ETC/ECM • INJ 1 • INJ 2 • Refer to Probing Electrical Connectors and Troubleshooting with a Test Lamp . Does the test lamp illuminate on at least one test point of each fuse?	—	Go to Step 26	Go to Step 29

26	Test for an intermittent and for a poor connection at the underhood junction block, ignition relay connector location. Refer to Testing for Intermittent Conditions and Poor Connections . Did you find a condition?	—	Go to Step 29	Go to Step 27
27	Replace the ignition relay. Refer to Relay Replacement . Did you complete the replacement?	—	Go to Step 30	—
28	Replace the ignition switch. Refer to Ignition and Start Switch Replacement . Did you complete the replacement?	—	Go to Step 30	—
29	Replace the underhood electrical center. Refer to Underhood Electrical Center or Junction Block Replacement . Did you complete the replacement?	—	Go to Step 30	—
30	1. Replace any open fuses. 2. Turn OFF the ignition for 30 seconds. 3. Attempt to start the engine. Does the engine start and run?	—	Go to Step 31	Go to Engine Cranks
31	1. Clear the DTCs with a scan tool. 2. Operate the vehicle for 5 minutes. Does a DTC set during this ignition cycle?	—	Go to Diagnostic Trouble Code (DTC) List - Vehicle	System OK

FUEL PUMP ELECTRICAL CIRCUIT DIAGNOSIS

Circuit Description

When the ignition is turned ON, the powertrain control module (PCM) will turn ON the in-tank fuel pump. The in-tank fuel pump will remain ON as long as the engine is cranking or running and the PCM is receiving reference pulses. If there are no reference pulses, the PCM will turn the in-tank fuel pump OFF 2 seconds after the ignition is turned ON or 2 seconds after the engine stops running.

Diagnostic Aids

A fuel pump prime terminal is available at the underhood bussed electrical center (UBEC). Refer to the UBEC cover for terminal location.

The following conditions may have caused the fuel pump fuse to open:

- The fuse is faulty.
- There is an intermittent short in the fuel pump power feed circuit.
- The fuel pump has an intermittent internal problem.

For an intermittent condition, refer to Testing for Intermittent Conditions and Poor Connections .

Test Description

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

2. Command both the ON and OFF states. Repeat the commands as necessary.
3. This step determines if the condition is located on the coil side or the switch side of the circuit.
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 determines if a voltage is constantly being applied to the fuel pump relay.
12. To gain access to the fuel pump connector, the fuel tank may need to be removed.
13. This step determines if the condition with the circuit is intermittent. If the fuse does not open, inspect the supply voltage circuit between the fuse and the fuel pump for an intermittent condition.

15. Use the same amperage fuse in the jumper as is used to protect the fuel pump circuit.
16. To gain access to the fuel pump connector, the fuel tank may need to be removed.
17. Inspect the ground connection for the fuel pump. Be certain all ground connections are clean and tight.

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Command the fuel pump relay ON and OFF with a scan tool. Does the fuel pump turn ON and OFF?	—	Go to Diagnostic Aids	Go to Step 3
3	1. Command the fuel pump relay ON and OFF with a scan tool. Do you hear a click when you command the fuel pump relay ON and OFF?	—	Go to Step 9	Go to Step 4
4	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay. 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. 5. Command the fuel pump relay ON and OFF with a scan tool. Does the test lamp turn ON and OFF?	—	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?	—	Go to Step 19	Go to Step 22
6	1. Does the test lamp remain illuminated with each command?	—	Go to Step 7	Go to Step 8
7	1. Test the control circuit of the fuel pump relay for a short to voltage. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 26

8	1. Test the control circuit of the fuel pump relay for a short to ground or an open. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 20
9	1. Turn ON the ignition, with the engine OFF. Does the fuel pump operate continuously?	—	Go to Step 10	Go to Step 11
10	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay. 3. Turn ON the ignition, with the engine OFF. Does the fuel pump operate continuously?	—	Go to Step 21	Go to Step 25
11	Is the fuel pump fuse open?	—	Go to Step 12	Go to Step 14
12	1. Test the supply voltage circuit of the fuel pump for a grounded circuit between the fuel pump fuse and the fuel pump. Refer to Circuit Testing and Wiring Repairs . 2. Replace the fuel pump fuse if necessary. Did you find and correct the condition?	—	Go to Step 27	Go to Step 13
13	1. Install all disconnected electrical components. 2. Install a new fuel pump fuse. 3. Turn ON the fuel pump with a scan tool. Is the fuel pump fuse open?	—	Go to Step 24	Go to Testing for Intermittent Conditions and Poor Connections
14	1. Turn OFF the ignition. 2. Disconnect the fuel pump relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the battery voltage circuit of the fuel pump relay switch with a test lamp that is connected to a good ground. Does the test lamp illuminate?	—	Go to Step 15	Go to Step 23
15	1. Connect a 20-amp fused jumper wire between the battery voltage circuit of the fuel pump relay switch and the supply voltage circuit of the fuel pump. Does the fuel pump operate	—	Go to Step 19	Go to Step 16

16	1. Test the supply voltage circuit of the fuel pump for an open or high resistance between the fuel pump relay and the fuel pump. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 17
17	**Important: Inspect the ground circuit for being tight, corrosion on terminals, or damage to the wiring harness** 1. Test the ground circuit of the fuel pump for an open or high resistance. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 18
18	2. Inspect for poor connections at the fuel pump. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 24
19	1. Inspect for poor connections at fuel pump relay. Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 25
20	1. Inspect for poor connections at the harness connector of the powertrain control module (PCM). Refer to Circuit Testing and Wiring Repairs . Did you find and correct the condition?	—	Go to Step 27	Go to Step 26
21	1. Repair the supply voltage circuit of the fuel pump for a short to voltage. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 27	—
22	1. Repair the open fuel pump relay ground circuit. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 27	—
23	1. Repair the battery voltage circuit of the fuel pump relay switch. Refer to Wiring Repairs . Did you complete the repair?	—	Go to Step 27	—
24	**Important: Inspect for poor connections at the fuel pump, within the fuel tank, before replacing the fuel pump.** 1. Replace the fuel pump. Refer to Fuel Sender Assembly Replacement . 2. Replace the fuel pump fuse if necessary. Did you complete the replacement?	—	Go to Step 27	—

25	1. Replace the fuel pump relay. Did you complete the replacement?	—	Go to Step 27	—
26	1. Replace the PCM. Refer to Control Module References for replacement, setup, and programming. Did you complete the replacement?	—	Go to Step 27	—
27	Operate the system in order to verify the repair. Did you correct the condition?	—	System OK	Go to Step 2

FUEL SYSTEM DIAGNOSIS

System Description

The powertrain control module (PCM) enables the fuel pump relay when the ignition switch is turned ON. The PCM will disable the fuel pump relay within 2 seconds unless the PCM detects ignition reference pulses. The PCM continues to enable the fuel pump relay as long as ignition reference pulses are detected. The PCM disables the fuel pump relay within 2 seconds if ignition reference pulses cease to be detected and the ignition remains ON.

The Fuel System is a returnless on-demand design. The fuel pressure regulator is a part of the fuel sender assembly, eliminating the need for a return pipe from the engine. A returnless fuel system reduces the internal temperature of the fuel tank by not returning hot fuel from the engine to the fuel tank. Reducing the internal temperature of the fuel tank results in lower evaporative emissions.

The fuel tank stores the fuel supply. An electric turbine style fuel pump attaches to the fuel sender assembly inside the fuel tank. The fuel pump supplies high pressure fuel through the fuel filter and the fuel feed pipe to the fuel injection system. The fuel pump provides fuel at a higher rate of flow than is needed by the fuel injection system. The fuel pump also supplies fuel to a venturi pump located on the bottom of the fuel sender assembly. The function of the venturi pump is to fill the fuel sender assembly reservoir. The fuel pressure regulator, a part of the fuel sender assembly, maintains the correct fuel pressure to the fuel injection system. The fuel pump and sender assembly contains a reverse flow check valve. The check valve and the fuel pressure regulator maintain fuel pressure in the fuel feed pipe and the fuel rail in order to prevent long cranking times.

Test Description

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

2. This step verifies that the fuel pump is operating.
4. This step tests for an internal fuel leak. If the fuel pressure drops during this test, then an internal loss of pressure is indicated.
7. This step tests for a loss of fuel pressure between the fuel feed pipe shut-off adapter and the fuel pump.
11. This step verifies that a circuit condition is not the cause of a fuel pressure concern. Inspect all fuel pump electrical circuits thoroughly.
11. This step tests for a leaking fuel injector, or fuel pressure regulator. If the fuel pressure remains constant during this test, the fuel injectors are not leaking fuel.

Step	Action	Value(s)	Yes	No
Schematic Reference: Engine Controls Schematics				
1	Did you perform the Diagnostic System Check - Vehicle?	—	Go to Step2	Go to Diagnostic System Check - Vehicle
2	**Important: Inspect the fuel system for damage, or external leaks, before proceeding with this diagnostic.** Turn ON the ignition, with the engine OFF. Command the fuel pump ON with a scan tool. Does the fuel pump operate?	—	Go to Step 3	Go to Fuel Pump Electrical Circuit Diagnosis

3	**Important: Verify there is adequate fuel in the fuel tank before proceeding with this diagnostic.** 1. Turn OFF the ignition. 2. Turn OFF all accessories. **Caution: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gage. Place the towel in an approved container when the connection of the fuel pressure gage is complete.** 3. Install the J 34730-1A Fuel Pressure Gage. 4. Place the bleed hose of the fuel pressure gage into an approved gasoline container. 5. Turn ON the ignition, with the engine OFF. 6. Command the fuel pump ON with a scan tool. 7. Bleed the air out of the fuel pressure gage. **Important:** • **It may be necessary to command the fuel pump ON several times in order to obtain the highest possible fuel pressure.** • **DO NOT start the engine.** 8. Command the fuel pump ON with a scan tool. Observe the fuel pressure gage, with the fuel pump commanded ON. Is the fuel pressure within the specified value?	384-425 kPa (56-62 psi)	Go to Step 4	Go to Step 8
4	**Important: The fuel pressure may vary slightly when the fuel pump stops operating. After the fuel pump stops operating, the fuel pressure should stabilize and remain constant.** Observe the fuel pressure gage for 1 minute. Does the fuel pressure drop more than the specified value?	34 kPa (5 psi)	Go to Step 7	Go to Step 5

5	1. Relieve the fuel pressure to the first specified value. 2. Observe the fuel pressure gage for 5 minutes. Does the fuel drop more than the second specified value?	69 kPa (10 psi) 14 kPa (2 psi)	Go to Step 12	Go to Step 6
6	1. Operate the vehicle within the conditions of the customer concern. 2. Observe the fuel related parameters with a scan tool. Do any of the scan tool parameters indicate a lean condition?	—	Go to Step 9	Go to Symptoms - Engine Controls
7	1. Turn OFF the ignition. 2. Relieve the fuel pressure. Refer to Fuel Pressure Relief . 3. Disconnect the fuel feed hose from the fuel rail pipe. 4. Install the J 37287 Fuel Line Shut-Off Adaptor between the fuel hoses and the fuel rail pipe. 5. Open the valve on the fuel pipe shut-off adapter. 6. Turn ON the ignition, with the engine OFF. 7. Command the fuel pump ON with a scan tool. 8. Bleed the air from the fuel pressure gage. 9. Command the fuel pump ON and then OFF with a scan tool. 10. Close the fuel feed pipe shut-off valve. Observe the fuel pressure gage for 1 minute. Does the fuel pressure remain constant?	—	Go to Step 12	Go to Step 11
8	Is the fuel pressure more than the specified value?	427 kPa (62 psi)	Go to Step 12	Go to Step 9
9	Inspect the fuel feed pipe for a restriction. Did you find and correct the condition?	—	Go to Step 13	Go to Step 10
10	Inspect the harness connectors and ground circuits of the fuel pump for poor connections. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs . Did you find and correct the condition?	—	Go to Step 13	Go to Step 12

11	1. Turn OFF the ignition. 2. Raise the fuel rail, with the fuel lines connected. Refer to 3. Fuel Rail Assembly Replacement . 4. Turn ON the ignition, with the engine OFF. 5. Command the fuel pump ON with a scan tool. Locate and replace the leaking fuel injector. Refer to Fuel Injector Replacement . Did you complete the replacement?	—	Go to Step 13	—
12	Replace the fuel pump. Refer to Fuel Sender Assembly Replacement . Did you complete the replacement?	—	Go to Step 13	—
13	Operate the system in order to verify the repair. Did you correct the condition?		System OK	Go to Step 3

HARD START

Inspection/Test	Action
DEFINITION: Engine cranks OK, but does not start for a long time. Does eventually run, or may start but immediately dies.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • Search for bulletins.
Sensor/System	• Verify that the engine coolant temperature (ECT) sensor is not shifted in value. Connect a scan tool. Compare the engine coolant temperature to the intake air temperature (IAT) on a cold engine. The ECT and IAT sensor values should be within ± 3°C (5°F) of each other. If the ECT sensor is out of range with the IAT sensor, measure the resistance of the ECT sensor. Refer to Temperature Versus Resistance for resistance specifications. • Inspect the mass air flow (MAF) sensor installation. A MAF sensor that is incorrectly installed may cause a hard start. Important: The embossed arrows on the MAF sensor indicate the direction of the intake air flow. The arrows must point toward the engine. Install the MAF in the proper direction. Refer to Mass Airflow Sensor/Intake Air Temperature Sensor Replacement . • Inspect the camshaft position (CMP) sensor for proper mounting and/or a bad connection. An extended crank occurs if the PCM does not receive a CMP signal.
Fuel System	• Inspect the fuel pump relay operation. The fuel pump should turn ON for 2 seconds when you turn ON the ignition. Refer to Fuel Pump Electrical Circuit Diagnosis . • A faulty in-tank fuel pump check valve allows the fuel in the lines to drain back to the tank after the engine stops. Refer to Fuel System Diagnosis . • Verify that both fuel injector fuses are not open. An open fuel injector fuse causes four injectors and four ignition coils not to operate. Inspect the injector circuits and the ignition coil circuits for an intermittent short to ground. Replace the fuse. Refer to Circuit Testing . • Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis .

Ignition System	• Verify that both fuel injector fuses are not open. An open fuel injector fuse causes four ignition coils and four fuel injectors not to operate. Inspect the ignition coil circuits and the fuel injector circuits for an intermittent short to ground. Refer to Circuit Testing . Replace the fuse. • Inspect for proper ignition voltage output with the J 26792 Spark Tester. Refer to Electronic Ignition (EI) System Diagnosis . • Remove the spark plugs and inspect for the following conditions: - Correct heat range - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • Determine the cause of the conditions before replacing the spark plugs. • Inspect for bare or shorted ignition wires. Refer to Spark Plug Wire Inspection . • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis .
Engine Mechanical	Inspect for the following conditions: • Excessive oil in combustion chamber or leaking valve seals--Refer to LINK . • Low cylinder compression--Refer to LINK . • Combustion chambers for excessive carbon buildup--Clean the chambers using top engine cleaner. Follow the instructions on the can. • Incorrect basic or worn engine parts--Inspect the following: - Cylinder heads - Camshaft - Pistons, etc. Refer to LINK .

Inspection/Test	Action
DEFINITION: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Inspect the powertrain control module (PCM) grounds for being clean, tight, and in the proper locations. Refer to Power and Grounding Component Views in Wiring Systems and Engine Controls Schematics . • Verify the driver understands the operation of the transmission torque converter clutch (TCC) and A/C compressor operation as explained in the owners manual. Inform the customer how the TCC and the A/C clutch operates.
Sensor/System	**Notice**: Refer to Silicon Contamination of Heated Oxygen Sensors Notice in Cautions and Notices. • Inspect the heated oxygen sensors (HO2S). The HO2S should respond quickly to different throttle positions. If they do not, inspect the HO2S for silicon or other contaminates from fuel or the use of improper RTV sealant. The sensors may have a white , powdery coating and result in a high but false signal voltage rich exhaust indication. The PCM will then reduce the amount of fuel delivered to the engine causing a severe driveability problem. • Inspect the mass air flow (MAF) sensor connections. Repair or replace damaged terminals. Refer to Connector Repairs .

Fuel System	• Test for incorrect fuel pressure. Refer to Fuel System Diagnosis .
	• Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis .
	• Verify that each injector harness is connected to the correct injector or cylinder. Relocate injector harnesses as necessary.
	• Inspect for the following that may cause the engine to run rich:
	Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.
	- Water intrusion in the HO2S connector
	- Engine oil contaminated by fuel
	- An EVAP canister purge condition
	- Incorrect fuel pressure--Refer to Fuel System Diagnosis .
	- Leaking fuel injectors--Refer to Fuel System Diagnosis .
	- An inaccurate mass air flow (MAF) sensor
	- Blockage on the inlet screen of the MAF sensor--Refer to Manifold Absolute Pressure Sensor Replacement .
	- Vacuum hoses that are split, kinked, or improperly connected
	- An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement .
	- An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement .
	• Inspect for the following conditions that may cause the engine to run lean:
	Notice: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.
	- Water intrusion in the HO2S connector
	- An exhaust leak between the HO2S and the engine--Refer to Exhaust Leakage .
	- Vacuum leaks
	- Incorrect fuel pressure--Refer to Fuel System Diagnosis .
	  - Restricted fuel injectors--Refer to Fuel System Diagnosis .
	- An inaccurate MAF sensor
	  - Fuel contamination--Refer to Alcohol/Contaminants-in-Fuel Diagnosis .
	  - Vacuum hoses that are split, kinked, or improperly connected

Ignition System	• Soak the secondary ignition system with water from a spray bottle. Soaking the secondary ignition system may help locate damaged or deteriorated components. Look and listen for arcing or misfiring as you apply the water. • Test for proper ignition voltage output with the J 26792 Spark Tester . Refer to Electronic Ignition (EI) System Diagnosis . • Remove the spark plugs and inspect for the following conditions: - Correct heat range - Wet plugs - Cracks - Wear - Improper gap - Burned electrodes - Heavy deposits - Refer to Spark Plug Inspection . • An improper spark plug gap will cause a driveability problem. Gap the spark plugs using a wire gauge gap tool. Refer to Spark Plug Replacement . • Determine the cause of the fouling before replacing the spark plugs. • Monitor the Misfire Current Counters while driving the vehicle within the conditions that the misfire occurred. If a misfiring cylinder can be located, use the DTC P0300 table for diagnosis. Refer to DTC P0300 . • Inspect for loose ignition coil grounds. Refer to Electronic Ignition (EI) System Diagnosis .
Engine Mechanical	Verify that the engine coolant temperature (ECT) is not above 130°C (266°F). This condition causes the PCM to operate in Engine Coolant Over Temperature - Fuel Disabled Mode. While in Engine Coolant Over Temperature - Fuel Disabled Mode, the PCM turns fuel OFF to four cylinders at a time to keep engine temperatures from reaching damaging levels. The system perceives Engine Coolant Over Temperature - Fuel Disabled Mode as a lack of power, miss, or rough idle. If the vehicle operates in Engine Coolant Over Temperature - Fuel Disabled Mode, refer to Engine Overheating for diagnosis.
Additional Inspections	• Visually and physically inspect vacuum hoses for splits, kinks, and proper connections and routing as shown on the Vehicle Emission Control Information label. • Inspect the transmission torque converter clutch (TCC) operation. A TCC applying too soon can cause the engine to spark knock. Refer to Diagnostic Starting Point - Automatic Transmission .

LACK OF POWER, SLUGGISHNESS, OR SPONGINESS

Inspection/Test	Action
DEFINITION: Engine delivers less than expected power. Little or no increase in speed when the accelerator pedal is pushed down part way.	
Preliminary Inspections	• Refer to Important Preliminary Inspections Before Starting in Symptoms - Engine Controls . • Search for bulletins. • Verify that the powertrain control module (PCM) grounds are clean, tight, and in the proper locations. Refer to Power and Grounding Component Views and Engine Controls Schematics . • Remove the air filter element and inspect for dirt or for restrictions. Refer to Air Cleaner Element Replacement and replace as necessary.
Fuel System	• Inspect both injector fuses for being open. An open injector fuse causes four ignition coils and four injectors not to operate. Replace the fuse. Inspect the ignition coil circuits and the injector circuits for an intermittent short to ground. • Inspect for incorrect fuel pressure. Refer to Fuel System Diagnosis . • Inspect for a contaminated fuel condition. Refer to Alcohol/Contaminants-in-Fuel Diagnosis . • Inspect the fuel injectors. Refer to Fuel Injector Solenoid Coil Test . • Inspect for the following that may cause the engine to run rich: **Notice**: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices. - Water intrusion in the HO2S connector - Engine oil contaminated by fuel - An EVAP canister purge condition - Incorrect fuel pressure--Refer to Fuel System Diagnosis . - Leaking fuel injectors--Refer to Fuel System Diagnosis . - An inaccurate mass air flow (MAF) sensor - Blockage on the inlet screen of the MAF sensor--Refer to Manifold Absolute Pressure Sensor Replacement . - Vacuum hoses that are split, kinked, or improperly connected - An air intake duct that is collapsed or restricted--Refer Intake Air Resonator Replacement . - An air filter that is dirty or restricted--Refer to Air Cleaner Element Replacement . • Inspect for the following conditions that may cause the engine to run lean: **Notice**: Refer to Heated Oxygen and Oxygen Sensor Notice in Cautions and Notices.