Engine Controls Diagnostic (DTC P0068 To DTC P0174) - 5.7L - Corvette

DIAGNOSIS

DTC P0068

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

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

Diagnostic Aids

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

Test Description

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

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

DTC P0068

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

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

DTC P0101

Circuit Description

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

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

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

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

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

Diagnostic Aids

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

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

Test Description

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

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

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

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

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

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

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

DTC P0101

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

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

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

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

DTC P0102

Circuit Description

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

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

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

Test Description

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

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

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

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

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

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

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

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

DTC P0102

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

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

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

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

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

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

DTC P0103

Circuit Description

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

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

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

Test Description

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

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

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

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

DTC P0103

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

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

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

DTC P0106

Circuit Description

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

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

The powertrain control module (PCM) supplies 5 volts to the MAP sensor on the 5-volt reference circuit. The PCM, also, provides a ground on the low reference circuit. The MAP sensor provides a signal to the PCM on the MAP sensor signal circuit which is relative to the pressure changes in the manifold. The PCM should detect a low signal voltage at a low MAP, such as during an idle or a deceleration. The PCM should detect a high

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

4: This step tests the ability of the MAP sensor to correctly indicate BARO.

6: This step tests the ability of the MAP sensor to respond to an increase in engine vacuum.

8: This step tests for a proper MAP sensor pressure with an applied vacuum.

DTC P0106

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

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

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

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

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

DTC P0107

Circuit Description

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

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

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

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

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

Conditions for Running the DTC

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

OR

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0107

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

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

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

DTC P0108

Circuit Description

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

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

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

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

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

Conditions for Running the DTC

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

  Or

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

DTC P0108

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

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

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

DTC P0112

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

DTC P0112

Step	Action	Values	Yes	No

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

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

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

DTC P0113

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

Test Description

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

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

DTC P0113

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

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

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

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

Test Description

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

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

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

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

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

DTC P0116

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

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

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

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

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

DTC P0117

Circuit Description

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

Conditions for Running the DTC

The engine run time is more than 10 seconds.

OR

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

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

DTC P0117

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

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

DTC P0118

Circuit Description

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

Conditions for Running the DTC

The engine has been running for more than 60 seconds.

OR

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

DTC P0118

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

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

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

DTC P0120

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

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

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

Test Description

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

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

DTC P0120

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

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

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

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

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

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

DTC P0125

Circuit Description

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

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

DTC P0125

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

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

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

DTC P0128

Circuit Description

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

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

DTC P0128

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

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

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

DTC P0131 OR P0151

Circuit Description

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

Conditions for Running the DTC

Lean Test Enable:

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

Power Enrichment Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125,

P1258, P1514, P2102, P2108, P2135, U0107 are not set.

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

Conditions for Setting the DTC

Lean Test:

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

or

Power Enrichment Test:

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0131 or P0151

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

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

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

DTC P0132 OR P0152

Circuit Description

Heated oxygen sensors (HO2S) are used for fuel control and post catalyst monitoring. Each HO2S compares the oxygen content of the surrounding air with the oxygen content in the exhaust stream. The HO2S must reach operating temperature to provide an accurate voltage signal. Heating elements inside the HO2S minimize the

time required for the sensors to reach operating temperature. The powertrain control module (PCM) supplies the HO2S with a reference, or bias, voltage of about 450 mV. When the engine is first started the PCM operates in open loop, ignoring the HO2S voltage signal. Once the HO2S reaches operating temperature and closed loop is achieved, the HO2S generates a voltage within a range of 0-1,000 mV that fluctuates above and below bias voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. If the PCM detects an HO2S voltage that stays above a specified value, DTC P0132 sets for HO2S bank 1 sensor 1, or DTC P0152 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

Rich Test Enable:

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

or

Decel. Fuel Cutoff Test Enable:

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

Conditions for Setting the DTC

Rich Test:

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

or

Decel. Fuel Cutoff Test:

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0132 or P0152

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

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

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

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

DTC P0133 OR P0153

Circuit Description

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

voltage. High HO2S voltage indicates a rich exhaust stream; low HO2S voltage indicates a lean exhaust stream. This diagnostic will only run once per ignition cycle. The PCM monitors the rich-to-lean and lean-to-rich transition time. A transition is defined as, the HO2S voltage changes from above 625 mV to below 250 mV or from below 250 mV to above 625 mV. If the PCM detects that the transition time is too long, DTC P0133 sets for HO2S bank 1 sensor 1, or DTC P0153 sets for HO2S bank 2 sensor 1.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

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

Test Description

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

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

DTC P0133 or P0153

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

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

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

DTC P0134 OR P0154

Circuit Description

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0134 or P0154

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

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

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

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

DTC P0135, P0141, P0155, OR P0161

Circuit Description

The heated oxygen sensor (HO2S) must reach operating temperature to provide an accurate voltage signal. A heating element inside the HO2S minimizes the time required for the sensor to reach operating temperature. Voltage is provided to the heater by the ignition 3 voltage circuit through a fuse. With the engine running, ground is provided to the heater by the HO2S heater low control circuit, through a low side driver within the

powertrain control module (PCM). The PCM commands the heater ON or OFF to maintain a specific HO2S operating temperature range. The PCM determines the temperature by measuring the current flow through the heater. When the heater is in the ON state, the PCM will pulse the heater OFF for a duration of 50 ms, once per second. When the heater is in the OFF state, the PCM will pulse the heater ON for a duration of 50 ms, once per second. The PCM monitors the heater current with the engine running. The PCM also calculates the heater resistance on a cold start. Both diagnostics will only run once per ignition cycle. If the PCM detects that the heater current or the heater calculated resistance is not within the expected range, the following DTCs will set:

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

Conditions for Running the DTC

Heater Current Test

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

Heater Resistance Test

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

Conditions for Setting the DTC

Heater Current Test

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

- The above condition is met for 10 seconds.

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

Heater Resistance Test

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0135, P0141, P0155, or P0161

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

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

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

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

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

DTC P0136 OR P0156

Circuit Description

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

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

expected response from the HO2S, DTC P0136 will set for HO2S bank 1 sensor 2 or DTC P0156 will set for HO2S bank 2 sensor 2.

Conditions for Running the DTC

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

Passive Test

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

Intrusive Test

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

Conditions for Setting the DTC

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

        OR

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0136 or P0156

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

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

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

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

			(DTC) List	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.

Conditions for Running the DTC

Lean Test Enable:

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

or

Power Enrichment Test Enable:

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

Conditions for Setting the DTC

Lean Test

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

or

Power Enrichment Test

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0137 or P0157

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

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

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

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

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

DTC P0138 OR P0158

Circuit Description

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

Conditions for Running the DTC

Rich Test Enable:

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

or

Decel. Fuel Cutoff Test Enable:

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0200, P0220, P0300, P0410, P0442, P0446, P0452, P0453, P0455, P0491, P0492, P0496, P1125,

P1258, P1516, P2102, P2108, P2135, U0107 are not set.

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

Conditions for Setting the DTC

Rich Test

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

or

Decel. Fuel Cutoff Test

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0138 or P0158

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

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

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

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

DTC P0140 OR P0160

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- The control module illuminates the malfunction indicator lamp (MIL) on the second consecutive ignition

cycle that the diagnostic runs and fails.

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

DTC P0140 or P0160

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

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

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

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

DTC P0171 OR P0174

Circuit Description

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

Conditions for Running the DTC

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

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

.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

Test Description

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

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

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

DTC P0171 or P0174

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

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

			(DTC) List	System OK