ENGINE CONTROLS DIAGNOSIS (DTC P0171/P0174 TO DTC P0507 (TAC))

DTC P0171 OR P0174

Circuit Description

The powertrain control module (PCM) controls the air/fuel metering system in order to provide the best possible combination of driveability, fuel economy and emission control. Fuel delivery is controlled differently during Open and Closed Loop. During Open Loop the PCM determines fuel delivery based on sensor signals without oxygen sensor input. During Closed Loop the PCM adds oxygen sensor inputs and level of purge to calculate Short and Long Term fuel trim adjustments. If the oxygen sensors indicate a lean condition, fuel trim values will be above 0 percent. If the oxygen sensors indicate a rich condition, fuel trim values will be below 0 percent. The values for the Short Term fuel trim change rapidly in response to the heated oxygen sensor (HO2S) voltage signals. Long Term fuel trim makes coarse adjustments in order to maintain an Air/Fuel Ratio of 14.7:1. A block of cells contain information arranged in combinations of engine RPM and engine load for a full range of vehicle operating conditions. The long term fuel trim diagnostic is based on an average of cells currently being used. The PCM selects the cells based on the engine speed and engine load. If the PCM detects an excessively lean condition, DTC P0171 or P0174 sets.

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 and +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 air flow (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 supplying 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**
	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.			

2	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 and E85)** or **Alcohol/Contaminants-in-Fuel Diagnosis (with Special Tool)** . Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
5	1. Turn OFF the engine. 2. Inspect the heated oxygen sensor (HO2S) for proper installation. 3. Verify the electrical connectors and the wires are secure, and not contacting the exhaust system. 4. Test for continuity between the HO2S signal circuit and the low reference circuit. Refer to **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 - 4.8L, 5.3L, and 6.0L. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Symptoms - Engine Mechanical** in Engine Mechanical - 4.8L, 5.3L, and 6.0L
7	**IMPORTANT:** **After repairs, use the scan tool Fuel Trim Reset function in order to reset the Long Term Fuel Trim.** 1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 8**
8	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0172 OR P0175

Circuit Description

The powertrain control module (PCM) controls the air/fuel metering system in order to provide the best possible combination of driveability, fuel economy and emission control. Fuel delivery is controlled differently during Open and Closed Loop. During Open Loop the PCM determines fuel delivery based on sensor signals, without oxygen sensor input. During Closed Loop the PCM adds oxygen sensor inputs and level of purge to calculate Short and Long Term fuel trim adjustments. If the oxygen sensors indicate a lean condition, fuel trim values will be above 0 percent. If the oxygen sensors indicate a rich condition, fuel trim values will be below 0

percent. The values for the Short Term fuel trim change rapidly in response to the heated oxygen sensor (HO2S) voltage signals. Long Term fuel trim makes coarse adjustments in order to maintain an Air/Fuel Ratio of 14.7:1. A block of cells contain information arranged in combinations of engine RPM and engine load for a full range of vehicle operating conditions. The long term fuel trim diagnostic is based on an average of cells currently being used. The PCM selects the cells based on the engine speed and engine load. The fuel trim diagnostic will conduct a test to determine if a rich failure actually exists or if excessive vapor from the evaporative emission (EVAP) canister is causing a rich condition. If the PCM detects an excessively rich condition, DTC P0172 or P0175 sets.

Conditions for Running the DTC

- DTCs P0101, P0103, P0108, P0135, P0137, P0141, P0200, P0300, P0410, P0420, P0430, P0440, P0442, P0443, P0446, P0449, P0506, P0507 or P1441 are not set.
- The engine coolant temperature (ECT) is between 75-115°C (167-239°F).
- The intake air temperature (IAT) is between -20 to +90°C (+4 and +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 air flow (MAF) is between 5-90 g/s.
- The fuel level is more than 10 percent.
- The throttle position (TP) is less than 90 percent.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

emission related diagnostic.

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

Diagnostic Aids

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

Test Description

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

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

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

DTC P0172 or P0175

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **If any DTCs other than P0172 are set, refer to those DTCs before continuing.** 1. Install scan tool. 2. Start and idle the engine at the normal operating temperature in Closed Loop. 3. Record the long term fuel trim data. 4. Turn OFF the engine. 5. Turn ON ignition, with the engine OFF. 6. Review the Freeze Frame/Failure Records, and record the displayed data for this DTC. Does the scan tool indicate that the long term fuel trim is less than the specified value?	-13%	Go to **Step 3**	Go to Diagnostic Aids
3	1. Operate engine at idle. 2. Observe HO2S parameters with a scan tool.	200-800 mV		

	Does the scan tool indicate that the values are within the specified range and fluctuating?		Go to **Step 4**	Go to **Step 5**
4	1. Turn OFF engine. 2. Visually and physically inspect the following items: • The evaporative emissions (EVAP) lines and components for damage or blockage-Refer to **Evaporative Emissions (EVAP) Hose Routing Diagram** . • The inlet screen of the mass air flow (MAF) sensor for blockage. • The vacuum hoses for splits, kinks, and proper connections-Refer to **Emission Hose Routing Diagram** . • The air intake duct for being collapsed or restricted. • The air filter for being dirty or restricted. • Check for objects blocking the throttle body. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Step 6**
5	1. Turn OFF engine. 2. Inspect the heated oxygen sensor (HO2S) for proper installation. 3. Inspect to ensure that the electrical connectors and the wires are secure and not contacting the exhaust system. 4. Test for continuity between the signal circuit and the low reference circuit. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 7**	Go to **Fuel System Diagnosis**
6	Inspect for the following: • Excessive fuel in the crankcase. • Proper operation of the fuel pressure regulator - Refer to **Fuel System Diagnosis** . • All injectors are functioning properly - Refer to **Fuel Injector Coil Test** .	-		Go to **Symptoms -**

	Did you find and correct the condition?		Go to **Step 7**	**Engine Mechanical** in Engine Mechanical - 4.8L, 5.3L, and 6.0L
7	**IMPORTANT:** **After repairs, use the scan tool Fuel Trim Reset function in order to reset the Long Term Fuel Trim.** 1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 8**
8	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0200

Circuit Description

The control module enables the appropriate fuel injector pulse for each cylinder. Ignition voltage is supplied to the fuel injectors. The control module controls each fuel injector by grounding the control circuit via a solid state device called a driver. The control module monitors the status of each driver. If the control module detects an incorrect voltage for the commanded state of the driver, DTC P0200 sets.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

cycle that the diagnostic runs and fails.

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

Test Description

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

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

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

DTC P0200

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics Connector End View Reference: 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. Clear the DTCs with a scan tool. 2. Idle the engine at the normal operating temperature. 3. Monitor the misfire current counters with a scan tool. Are any of the misfire current counters incrementing?	Go to **Step 4**	Go to **Step 3**
	1. Observe the Freeze Frame/Failure Records for this		

3	DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Disconnect the injector which displays the highest number of misfire current counters. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the fuel injector with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to **Step 5**	Go to **Step 13**
5	1. Connect the **J 34730-405** Injector Test Lamp between the control circuit of the fuel injector and the ignition voltage circuit of the fuel injector. 2. Start the engine. Does the test lamp flash?	Go to **Step 6**	Go to **Step 7**
6	Did the DTC fail this ignition?	Go to **Step 12**	Go to **Step 10**
7	Does the test lamp remain illuminated?	Go to **Step 9**	Go to **Step 8**
8	Test the fuel injector control circuit for a short to voltage or for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 12**
9	Test the fuel injector control circuit for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 15**
10	Test for an intermittent and for a poor connection at the fuel injector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 11**
	1. Apply Dielectric compound GM P/N 12377900 (Canadian P/N 10953529) to the fuel injector electrical connector. 2. Reconnect the fuel injector connector.		

11	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 14**	Go to **Step 16**
12	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	Go to **Step 16**	Go to **Step 15**
13	**IMPORTANT:** **The INJ fuse also supplies voltage to the ignition coil modules. If the fuse is open, inspect all related circuits and components for a short to ground. Refer to Circuit Testing in Wiring Systems.** Repair the open or short to ground in the ignition 1 voltage circuit of the fuel injector.Is the repair complete?	Go to **Step 16**	-
14	Replace the fuel injector. Refer to **Fuel Injector Replacement** . Did you complete the replacement?	Go to **Step 16**	-
15	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 16**	-
16	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 17**
17	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0220

Circuit Description

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

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

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

Conditions for Running the DTC

- DTCs P2108 or U0107 are not set.
- The ignition switch is in the Crank or Run position.
- The ignition voltage is more than 5.23 volts.

Conditions for Setting the DTC

- The TP sensor 2 voltage is less than 0.28 volt or greater than 4.60 volts.
- The above condition is present for more than 1 second.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

- Inspect the TAC module connectors for signs of water intrusion. If water intrusion occurs, multiple DTCs may set without any circuit or component conditions found during diagnostic testing.
- When the TAC module detects a condition within the TAC system, more than one TAC system related

DTC may set. This is due to the many redundant tests run continuously on this system. Locating and repairing one individual condition may correct more than one DTC. Disconnecting components during testing may set additional DTCs. Remember this if you review the stored information in Capture Info.

- If this DTC is determined to be intermittent, refer to **Intermittent Conditions** .

Test Description

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

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

DTC P0220

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. Turn OFF the ignition. 2. Remove the air inlet duct from the throttle body. 3. Disconnect the throttle body harness connector. 4. Connect jumper wires between the throttle position (TP) sensor 2 terminals of the throttle body harness connector and the corresponding TP sensor 2 terminals of the throttle body. 5. Turn ON the ignition, with the engine OFF. 6. Close the throttle blade by hand. 7. Observe the TP sensor 2 voltage with a scan tool. Is the TP sensor 2 voltage within the specified range?	0.28-0.81 V	Go to **Step 3**	Go to **Step 7**
3	1. Open the throttle blade to wide open throttle (WOT) by hand. 2. Observe the TP sensor 2 voltage parameter on the scan tool. Is the TP sensor 2 voltage parameter more than the specified value?	4.60 V	Go to **Step 7**	Go to **Step 4**

4	1. Disconnect the TP sensor harness connector. 2. Disconnect the throttle actuator control (TAC) module harness connector containing the TP sensor circuits. 3. Test the TP sensor low-reference circuit for a short to ground with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 5**
5	1. Turn OFF the ignition for 15 seconds. 2. Connect the TAC module harness connector. 3. Connect the throttle body harness connector. 4. Install the air inlet duct. 5. Turn ON the ignition, with the engine OFF. 6. Select the DTC Info option on the scan tool. 7. Lightly touch and move the related engine wiring harnesses and connectors for the TP sensor while observing the DTC Info. The DTC will set if an intermittent condition is present. Refer to **Connector Repairs** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 6**
6	1. Continue to observe the DTC Info. 2. Slowly depress the accelerator pedal to WOT, then slowly return the pedal to the released position 3 times. Does the scan tool indicate this DTC failed this ignition?	-	Go to **Step 25**	Go to Diagnostic Aids
7	1. Disconnect the TP sensor harness connector. 2. Measure the voltage at the TP sensor 2 signal circuit with a DMM connected to ground. Is the voltage within the specified range?	3.94-6.06 V	Go to **Step 12**	Go to **Step 8**
8	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the TP sensor 2 signal circuit for a short to voltage with a DMM. Refer to **Circuit Testing**	-		

	and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 30**	Go to **Step 9**
9	Test the TP sensor 2 signal circuit for an open or high resistance with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 10**
10	Test the TP sensor 2 signal circuit for a short to ground with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 11**
11	1. Disconnect the other TAC module harness connector. 2. Test for a short between the TP sensor 2 signal circuit and all other TAC module circuits with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 26**
12	Measure the voltage from the TP sensor 2 5-volt reference circuit to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage within the specified range?	4.54-5.21 V	Go to **Step 22**	Go to **Step 13**
13	Is the voltage more than the specified value?	5.21 V	Go to **Step 14**	Go to **Step 16**
14	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Turn ON the ignition, with the engine OFF. 4. Test the TP sensor 2 5-volt reference circuit for a short to voltage with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 15**
15	1. Turn OFF the ignition. 2. Disconnect the accelerator pedal position (APP) sensor harness connector. 3. Disconnect the other TAC module harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Test the APP sensor 2 5-volt reference circuit for a short to voltage with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 30**	Go to **Step 20**
16	Disconnect the APP sensor. Is the voltage less than the specified value?	4.54 V	Go to **Step 17**	Go to **Step 28**
17	1. Disconnect the TAC module harness connector containing the TP sensor circuits. 2. Test the TP sensor 2 5-volt reference circuit for an open or high resistance with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 18**
18	Test the TP sensor 2 5-volt reference circuit for a short to ground with a DMM. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 19**
19	Test the APP sensor 2 5-volt reference circuit for a short to ground with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 20**
20	Test for a short between the TP sensor 2 5-volt reference circuit and all other TAC module circuits with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 21**
21	Test for a short between the APP sensor 2 5-volt reference circuit and all other TAC module circuits with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 26**
22	1. Connect a fused jumper between the TP sensor 2 low-reference circuit and the TP sensor 2 signal circuit. 2. Observe the TP sensor 2 voltage parameter with a scan tool. Is the TP sensor 2 parameter near the specified value?	0 V	Go to **Step 24**	Go to **Step 23**
23	1. Turn OFF the ignition. 2. Disconnect the TAC module harness connector containing the TP sensor circuits. 3. Test the TP sensor 2 low-reference circuit for an open or high resistance with a DMM. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 26**

24	Inspect for an intermittent and for a poor connection at the throttle body harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 27**
25	Inspect for an intermittent and for a poor connection at the APP sensor harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 28**
26	Inspect for an intermittent and for a poor connection at the TAC module harness connector. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Repairing Connector Terminals** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 30**	Go to **Step 29**
27	Replace the throttle body assembly. Refer to **Throttle Body Assembly Replacement** . Did you complete the replacement?	-	Go to **Step 30**	-
28	Replace the APP sensor. Refer to **Accelerator Pedal Position (APP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 30**	-
29	Replace the TAC module. Refer to **Throttle Actuator Control (TAC) Module Replacement** . Did you complete the replacement?	-	Go to **Step 30**	-
30	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 31**
31	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0230

Circuit Description

The control module enables the fuel pump relay when the ignition switch is turned ON. The control module will

disable the fuel pump relay within two seconds unless the control module detects ignition reference pulses. The control module continues to enable the fuel pump relay as long as ignition reference pulses are detected. The control module disables the fuel pump relay within two seconds if ignition reference pulses cease to be detected and the ignition remains ON.

The control module monitors the voltage on the fuel pump relay control circuit. If the control module detects an incorrect voltage on the fuel pump relay control circuit, a fuel pump relay control DTC sets.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

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

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

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

DTC P0230

Step	Action	Yes	No
Schematic Reference: Engine Controls Schematics Connector End View Reference: 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. Turn ON the ignition, with the engine OFF. 2. Command the fuel pump relay ON and OFF with a scan tool. Does the fuel pump relay turn ON and OFF when commanded with a scan tool?	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Remove the fuel pump relay. 3. Turn ON the ignition, with the engine OFF. 4. Probe the control circuit of the fuel pump relay with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. 5. Command the fuel pump ON and OFF with a scan tool. Does the test lamp turn ON and OFF when commanded with a scan tool?	Go to **Step 5**	Go to **Step 6**
5	1. Connect a test lamp between the control circuit of the fuel pump relay and the ground circuit of the fuel pump relay. 2. Command the fuel pump relay ON and OFF with a scan tool.		

	Does the test lamp turn ON and OFF when commanded with a scan tool?	Go to **Step 9**	Go to **Step 11**
6	Does the test lamp remain illuminated?	Go to **Step 8**	Go to **Step 7**
7	Test the control circuit of the fuel pump relay for a short to ground or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
8	Test the control circuit of the fuel pump relay for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
9	Test for an intermittent and for a poor connection at the fuel pump relay. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
11	Test the ground circuit of the fuel pump relay for an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	-
12	Replace the fuel pump relay. Did you complete the replacement?	Go to **Step 14**	-
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 P0300

System Description

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

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P0116, P0117, P0118, P0125, P0128, P0220, P0315, P0335, P0336, P0341, P0342, P0343, P0502, P0503, P1114, P1115, P1120, P1258 are not set.
- The engine speed is between 450-5,000 RPM.
- The ignition voltage is between 10-18 volts.
- The engine coolant temperature (ECT) is between -7 and +130°C (+19 and +266°F).
- The fuel level is more than 10 percent.
- The throttle angle is steady within 1 percent.
- The anti-lock brake system (ABS) and the traction control system are not active.
- The transmission is not changing gears.
- The A/C clutch is not changing states.
- The PCM is not in fuel shut-off or decel fuel cut-off mode.
- The PCM is not receiving a rough road signal.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles that the diagnostic runs and does not fail.

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

Diagnostic Aids

- Excessive vibration from sources other than the engine could cause DTC P0300 to set. The following are possible sources of vibration:
  - Thickness variation of the brake rotors-Refer to **Symptoms - Hydraulic Brakes** in Hydraulic Brakes.
  - The drive shaft not balanced-Refer to **Vibration Analysis - Driveline** in Vibration Diagnosis and Correction.
  - Worn or damaged accessory drive belt-Refer to **Symptoms - Engine Mechanical** in Engine Mechanical - 4.8L, 5.3L and 6.0L
- There may be more or less cylinders actually misfiring than indicated by the scan tool.
- Spray water on the secondary ignition components using a spray bottle. Look and listen for arcing or misfiring.
- If there are multiple misfires on only one bank, inspect the fuel injector and ignition coil, power and ground circuits for that bank. Refer to **Engine Controls Schematics** .

Test Description

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

2: If the actual CKP variation values are not within the learned values, the misfire counters may increment.

DTC P0300

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **You must perform the crankshaft position (CKP) system variation learn procedure before proceeding with this diagnostic table. Refer to CKP System Variation Learn Procedure .** 1. Start the engine. 2. Allow the engine to idle or operate within the conditions listed in the Freeze Frame/Failure Records.	-		

	3. Monitor all of the Misfire counters with the scan tool. Are any of the Misfire current counters incrementing?		Go to **Step 3**	Go to Diagnostic Aids
3	Are any other DTCs set?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 4**
4	Can any abnormal engine noise be heard?	-	Go to **Symptoms - Engine Mechanical** in Engine Mechanical - 4.8L, 5.3L and 6.0L	Go to **Step 5**
5	Does the scan tool indicate that the heated oxygen sensor (HO2S) bank 1 sensor 1 or HO2S bank 2 sensor 1 voltage parameters are below the specified value?	200 mV	Go to **DTC P0131 or P0151**	Go to **Step 6**
6	Does the scan tool indicate that the HO2S bank 1 sensor 1 or HO2S bank 2 sensor 1 voltage parameters are fixed above the specified value?	900 mV	Go to **DTC P0132 or P0152**	Go to **Step 7**
7	Inspect the following components: • The vacuum hoses and seals for splits, restrictions, and improper connections - Refer to **Emission Hose Routing Diagram** . • The throttle body and intake manifold for vacuum leaks • The crankcase ventilation system for vacuum leaks - Refer to **Crankcase Ventilation System Inspection/Diagnosis** in Engine Mechanical - 4.8L, 5.3L and 6.0L. • The powertrain control module (PCM) grounds for corrosion and loose connections - Refer to **Ground Distribution Schematics** in Wiring Systems. • The exhaust system for restrictions - Refer to **Restricted Exhaust** in Engine Exhaust. • The fuel for contamination - Refer to **Alcohol/Contaminants-in-Fuel Diagnosis (without Special Tool and E85)** or **Alcohol/Contaminants-in-Fuel Diagnosis (with Special Tool)** .	-		

	Did you find and correct the condition?		Go to **Step 20**	Go to **Step 8**
8	**IMPORTANT:** **An erratic or inconsistent spark is considered a no spark.** 1. Turn OFF the ignition. 2. Disconnect the spark plug wire from the spark plug that corresponds to the Misfire Current counters that were incrementing. Refer to **Spark Plug Wire Replacement** . 3. Install the **J 26792** Spark Tester. 4. Start the engine. Does the spark jump the tester gap?	-	Go to **Step 10**	Go to **Step 9**
9	1. Remove the spark plug wire for the affected cylinders. Refer to **Spark Plug Wire Replacement** . 2. Inspect the spark plug wire. Refer to **Spark Plug Wire Inspection** . 3. Measure the resistance of the spark plug wire with a DMM. Is the spark plug wire resistance less than the specified value?	700 ohm	Go to **Electronic Ignition (EI) System Diagnosis**	Go to **Step 19**
10	1. Remove the spark plug from the cylinder that indicated a misfire. Refer to **Spark Plug Replacement** . 2. Inspect the spark plug. Refer to **Spark Plug Inspection** . Does the spark plug appear to be OK?	-	Go to **Step 11**	Go to **Step 12**
11	1. Exchange the suspected spark plug with another cylinder that is operating properly. Refer to **Spark Plug Replacement** . 2. Operate the vehicle under the same conditions that the misfire occurred. Did the misfire move with the spark plug?	-	Go to **Step 18**	Go to **Step 15**
	Is the spark plug oil or coolant fouled?		Go to **Symptoms - Engine Mechanical**	

12		-	in Engine Mechanical - 4.8L, 5.3L and 6.0L	Go to **Step 13**
13	Is the spark plug gas fouled?	-	Go to **Step 16**	Go to **Step 14**
14	Did the spark plug show any signs of being cracked, worn, or improperly gapped?	-	Go to **Step 17**	Go to **Step 15**
15	Perform the fuel injector coil test. Refer to **Fuel Injector Coil Test** . Did you find and correct the condition?	-	Go to **Step 20**	Go to **Symptoms - Engine Mechanical** in Engine Mechanical - 4.8L, 5.3L and 6.0L
16	Perform the fuel system diagnosis. Refer to **Fuel System Diagnosis** . Did you find and correct the condition?	-	Go to **Step 20**	Go to **Symptoms - Engine Mechanical** in Engine Mechanical - 4.8L, 5.3L and 6.0L
17	Replace or gap the spark plug. Refer to **Spark Plug Replacement** . Did you complete the action?	-	Go to **Step 20**	-
18	Replace the faulty spark plug. Refer to **Spark Plug Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
19	Replace the faulty spark plug wires. Refer to **Spark Plug Wire Replacement** . Did you complete the replacement?	-	Go to **Step 20**	-
20	Was the customer concern the malfunction indicator lamp (MIL) flashing?	-	Go to **Step 21**	Go to **Step 22**
21	1. Operate the vehicle at the specified value for 4 minutes. 2. Operate the vehicle within the Conditions for Running the DTC P0420 or P0430 as specified in the supporting text. Refer to **DTC P0420 or P0430** . Does the DTC run and pass?	2,500 RPM	Go to **Step 22**	Go to **DTC P0420 or P0430**
22	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.	-		

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

DTC P0315

Circuit Description

The crankshaft position (CKP) system variation learn feature is used to calculate reference period errors caused by slight tolerance variations in the crankshaft, and the CKP sensor. The calculated error allows the powertrain control module (PCM) to accurately compensate for reference period variations. This enhances the ability of the PCM to detect misfire events over a wide range of engine speed and load. The PCM stores the Crankshaft Position System Variation values after a learn procedure has been performed. If the actual crankshaft position variation is not within the Crankshaft Position System Variation compensating values stored in the PCM, DTC P0300 may set. If the CKP system variation values are not stored in the PCM memory, DTC P0315 sets.

Conditions for Running the DTC

DTCs P0335, P0336, P0341, P0342, or P0343 are not set.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

DTC P0315

Step	Action	Yes	No
1	Did you perform the Diagnostic System Check - Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Preform the crankshaft position (CKP) system variation learn procedure. Refer to **CKP System**		

	Variation Learn Procedure . Does the scan tool display Learned this ignition?	Go to **Step 4**	Go to **Step 3**
3	If the CKP system variation learn procedure cannot be performed successfully, check for the following conditions and correct as necessary: • Worn crankshaft main bearings • A damaged reluctor wheel • Excessive crankshaft runout • A damaged crankshaft • Interference in the signal circuit of the CKP sensor • Any foreign material passing between the CKP sensor and the reluctor wheel • A coolant temperature that is not within the Conditions For Running the DTC • The ignition switch is in the ON position until the battery is drained. • A powertrain control module (PCM) power disconnect with the ignition ON may erase the stored value and set the DTC P0315. Did you complete the inspection?	Go to **Step 4**	-
4	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 5**
5	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0325

Circuit Description

The knock sensors (KS) produce an AC signal under all engine operating conditions. When the engine is running, the powertrain control module (PCM) learns a minimum and maximum frequency of normal engine noise. The KS system monitors both knock sensors in order to determine if knock is present. If the KS system

determines that excessive knock is present, the PCM retards the spark timing based on the signals from the KS. The PCM continues to retard timing until no knock is present. If the PCM malfunctions in a manner that will not allow proper diagnosis of the KS system this DTC will set

Conditions for Running the DTC

- The engine run time is more than 10 seconds.
- The ignition voltage is more than 10 volts.

Conditions for Setting the DTC

- The PCM malfunctions in a manner that will not allow proper diagnosis of the KS system.
- The above condition is present for 12 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

DTC P0325

Step	Action	Yes	No
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**
	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds.		

2	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 **Intermittent Conditions**
3	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 4**	-
4	1. Start the engine. 2. 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 P0327 OR P0332

Circuit Description

The knock sensors (KS) produce an AC signal under all engine operating conditions. When the engine is running, the powertrain control module (PCM) learns a minimum and maximum frequency of normal engine noise. The KS system monitors both knock sensors in order to determine if knock is present. If the KS system determines that excessive knock is present, the PCM retards the spark timing based on the signals from the KS. The PCM continues to retard timing until no knock is present. If the PCM detects that the frequency is out of the normal range, DTC P0327 or P0332 will set.

Conditions for Running the DTC

- DTCs P0116, P0117, P0118, P0122, P0123, P0125, or P0128 are not set.
- The minimum noise level must be learned. The minimum noise level is learned when the following conditions are met:
  - The engine coolant temperature (ECT) is more than 60°C (140°F).
  - The engine RPM is between 475-975 for 10 seconds.
- The engine speed is between 1,500-3,000 RPM.
- The manifold absolute pressure (MAP) is less than 45 kPa.
- The engine run time is more than 10 seconds.
- The ignition voltage is more than 10 volts.

Conditions for Setting the DTC

The PCM detects that the affected KS signal is less than the expected amount for more than 9 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

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

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

DTC P0327 or P0332

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics Connector End View Reference: Engine Controls Component 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: **If an engine knock can be heard, repair the engine mechanical condition before proceeding with this diagnostic.**			

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 engine 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. Remove the intake manifold sight shield. Refer to **Engine Sight Shield Replacement (6.0L (LQ4))** in Engine Mechanical. 3. Disconnect the knock sensor (KS) inline harness connector. 4. Measure the resistance from the signal circuit of the affected KS to a good ground with a DMM. Is the resistance of the KS within the specified range?	93K-107K ohm	Go to **Step 4**	Go to **Step 6**
4	**IMPORTANT:** **Do not tap on any plastic engine components.** 1. Measure the AC voltage from the signal circuit of the affected KS to a good ground. 2. Tap on the engine block near the affected KS while observing the DMM. Does the voltage change on the DMM while tapping on the engine block near the KS?	-	Go to **Step 5**	Go to **Step 10**
5	Test the affected KS signal circuit between the PCM and the KS inline harness connector for the following conditions: • An open or a high resistance • A short to voltage • A short to ground Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 12**	Go to **Step 8**
6	1. Remove the intake manifold. Refer to **Intake Manifold Replacement** in Engine Mechanical. 2. Test the affected signal circuit between the KS inline harness connector and the affected KS connector for an open, high resistance or short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 7**
7	Test for an intermittent and for a poor connection at the affected KS. 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**
8	Test for an intermittent and for a poor connection at the KS inline 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 12**	Go to **Step 9**
9	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 12**	Go to **Step 11**
10	Replace the affected knock sensor. Refer to **Knock Sensor (KS) Replacement** . 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 as specified in the supporting text. You may also operate the vehicle within 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 P0335

Circuit Description

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

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

If the PCM detects there is no signal from the CKP sensor for 8 seconds, DTC P0335 sets.

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0341, P0342, or P0343 are not set.
- The camshaft position (CMP) sensor signal is incrementing.
- The mass air flow (MAF) is more than 3 g/s.
- The ignition switch is in the Crank position.

Conditions for Setting the DTC

The PCM detects there is no signal from the CKP sensor for 8 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

3: This step determines if the fault is present.

6: This step simulates a CKP sensor signal to the PCM. If the PCM receives the signal, the fuel pump will operate for about two seconds.

DTC P0335

Step	Action	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	Attempt to start the engine. Does the engine start and continue to run?	-	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn ON the ignition, with the engine OFF. 2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information. 3. Disconnect the crankshaft position (CKP) sensor harness connector. 4. Measure the voltage from the 12-volt reference circuit of the CKP sensor to a good ground with a DMM. Is the voltage within the specified value?	B+	Go to **Step 5**	Go to **Step 7**
5	Measure the voltage between the 12-volt reference circuit of the CKP sensor and the low reference circuit of the CKP sensor with a DMM. Is the voltage within the specified value?	B+	Go to **Step 6**	Go to **Step 8**

6	Momentarily connect a test lamp between the CKP sensor signal circuit and the 12-volt reference of the CKP sensor. Does the fuel pump operate when the test lamp is applied to the CKP sensor signal circuit?	-	Go to **Step 10**	Go to **Step 9**
7	Test the 12-volt reference circuit for the following conditions: • An open • High resistance • A short to ground Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct condition?	-	Go to **Step 16**	Go to **Step 12**
8	Test the low reference circuit for the following conditions: • An open • High Resistance • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 12**
9	Test the CKP sensor signal circuit for the following conditions: • High resistance • An open • A short to ground • A short to voltage Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 12**
	1. Remove the CKP sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . 2. Visually inspect the CKP sensor for the following conditions:			

10	• Physical damage • Loose or improper installation • Wiring routed too closely to the secondary ignition components 3. The following conditions may cause this DTC to set: • Excessive air gap between the CKP sensor and the reluctor wheel • The CKP sensor coming in contact with the reluctor wheel • Foreign material passing between the CKP sensor and the reluctor wheel • Insufficient fuel Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 11**
11	Visually inspect the CKP sensor reluctor wheel for the following conditions: • Physical damage • Excessive play or looseness Refer to **Crankshaft and Bearings Cleaning and Inspection** in Engine Mechanical. Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 14**
12	Test for poor connections at the CKP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 13**
13	Test for poor connections at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 15**
14	Replace the CKP sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 16**	-
15	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 16**	-
	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds.			

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

DTC P0336

Circuit Description

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

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

If the PCM detects that the CKP sensor signal is inconsistent for 2 seconds, DTC P0336 sets.

Conditions for Running the DTC

The engine is cranking or running.

Conditions for Setting the DTC

The PCM detects that the CKP sensor signal is inconsistent 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.

DTC P0336

Step	Action	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:** **If DTC P0335 is also set, diagnose DTC P0335 before proceeding with this DTC.** 1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 3**	Go to **Intermittent Conditions**
3	Inspect all of the crankshaft position sensor (CKP) circuits for the following conditions: • Wiring routed too closely to secondary ignition wires or components • Wiring routed too closely to after-market add-on electrical equipment • Wiring routed to closely to solenoids, relays, and motors • Electromagnetic interference in the CKP sensor circuits Did you find and correct the condition?	Go to **Step 12**	Go to **Step 4**

4	Test the 12-volt reference circuit for an intermittent condition or shorted to other circuits. Refer to **Testing for Electrical Intermittents** and **Inducing Intermittent Fault Conditions** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 5**
5	Test the low reference circuit for an intermittent condition. Refer to **Testing for Electrical Intermittents** and **Inducing Intermittent Fault Conditions** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 6**
6	Test the CKP sensor signal circuit for an intermittent condition. Refer to **Testing for Electrical Intermittents** and **Inducing Intermittent Fault Conditions** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 7**
7	Test for an intermittent and for a poor connection at the CKP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 8**
8	Test for an intermittent and for a poor connection at the powertrain control module (PCM). Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 9**
9	1. Remove the CKP sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . 2. Inspect the CKP sensor for the following conditions: • Physical damage • Improper installation • Excessive play or looseness • Excessive air gap between the CKP sensor and the reluctor wheel • Foreign material passing between the CKP sensor and the reluctor wheel • Insufficient fuel Did you find and correct the condition?	Go to **Step 12**	Go to **Step 10**
10	Inspect the reluctor wheel for the following conditions: • Physical damage • Improper installation • Excessive endplay or looseness		

	Refer to **Crankshaft and Bearings Cleaning and Inspection** in Engine Mechanical. Did you find and correct the condition?	Go to **Step 12**	Go to **Step 11**
11	Replace the CKP sensor. Refer to **Crankshaft Position (CKP) Sensor Replacement** . Did you complete the replacement?	Go to **Step 12**	-
12	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 13**
13	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0341

Circuit Description

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

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

The CMP sensor 1 X signal is used by the PCM to determine if the cylinder at top dead center (TDC) is on the firing stroke or the exhaust stroke. The PCM can determine TDC for all cylinders by using the CKP sensor 24 X signal alone. The engine will start without a CMP signal as long as the PCM receives the CKP sensor 24 X signal. A slightly longer cranking time may be a symptom of this condition. The system attempts synchronization and looks for an increase in engine speed indicating that the engine started. If the PCM does not detect an increase in engine speed, the PCM assumes that the PCM incorrectly synchronized to the exhaust stroke and re-syncs to the opposite cam position. If the PCM detects that a CMP to CKP mis-match has occurred DTC P0341 sets.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

The following conditions may cause this DTC to set:

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

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

Test Description

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

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

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

DTC P0341

Step	Action	Yes	No

Schematic Reference: Engine Controls Schematics
Connector End View Reference: 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. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 3**	Go to Diagnostic Aids
3	1. Visually and physically inspect all circuits going to the CMP sensor for the following: • Being routed too close to secondary ignition wires or components • Being routed too close to after-market add-on electrical equipment • Being routed too close to solenoids, relays, and motors 2. If you find incorrect routing, correct the harness routing Did you find and correct the condition?	Go to **Step 9**	Go to **Step 4**
4	Test for an intermittent and for a poor connection at the CMP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 5**
5	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 6**
6	1. Remove the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . 2. Visually inspect the CMP sensor for the following conditions: • Physical damage		

	• Excessive wear of the sensor • Loose or improper installation Did you find and correct the condition?	Go to **Step 9**	Go to **Step 7**
7	1. Visually inspect the CMP sensor reluctor ring for damage. 2. If the CMP reluctor ring is damaged, Refer to **Camshaft and Bearings Cleaning and Inspection** in Engine Mechanical. Did you find and correct the condition?	Go to **Step 9**	Go to **Step 8**
8	Replace the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . Did you complete the replacement?	Go to **Step 9**	-
9	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 10**
10	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0342

Circuit Description

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

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

The CMP sensor 1 X signal is used by the PCM to determine if the cylinder at top dead center (TDC) is on the firing stroke or the exhaust stroke. The PCM can determine TDC for all cylinders by using the CKP sensor 24 X signal alone. The engine will start without a CMP signal as long as the PCM receives the CKP sensor 24 X signal. A slightly longer cranking time may be a symptom of this condition. The system attempts synchronization and looks for an increase in engine speed indicating that the engine started. If the PCM does not detect an increase in engine speed, the PCM assumes that the PCM incorrectly synchronized to the exhaust

stroke and re-syncs to the opposite cam position. If the PCM detects that a CMP signal is constantly low, DTC P0342 sets.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

The following conditions may cause this DTC to set:

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

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

Test Description

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

5: This step tests the CMP sensor signal circuit. Applying a voltage causes the CMP sensor high to low and low to high parameter to increase if the circuit and the PCM are operating properly.

DTC P0342

Step	Action	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 camshaft position (CMP) sensor high to low and low to high transition parameter with a scan tool. Does the scan tool parameter increment?	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Disconnect the CMP sensor. 3. Turn ON the ignition, with the engine OFF. 4. Probe the 12-volt reference circuit of the CMP sensor at the CMP sensor wire harness electrical connector with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	Go to **Step 5**	Go to **Step 6**
	1. Start the engine. 2. Observe the CMP sensor high to low and low to high transition parameters with the scan tool.		

5	3. Momentarily and repeatedly probe the signal circuit of the CMP sensor at the CMP sensor wire harness electrical connector with a test lamp that is connected to battery positive voltage. Does the CMP sensor high to low and low to high transition counters increment when the test lamp contacts the signal circuit?	Go to **Step 8**	Go to **Step 7**
6	Test the 12-volt reference circuit for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 9**
7	Test the CMP sensor signal circuit for an open or a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 9**
8	Test for an intermittent and for a poor connection at the CMP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
9	Test for an intermittent and for a poor connection at the 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**
10	1. Remove the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . 2. Visually inspect the CMP sensor for the following conditions: • Physical damage • Loose or improper installation • Wiring routed too close to the secondary ignition components Did you find and correct the condition?	Go to **Step 14**	Go to **Step 11**
11	1. Visually inspect the CMP sensor reluctor ring for damage. 2. If the CMP reluctor ring is damaged, refer to **Camshaft and Bearings Cleaning and Inspection** in Engine Mechanical. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
	Replace the CMP sensor. Refer to **Camshaft Position**		

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

DTC P0343

Circuit Description

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

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

The CMP sensor 1 X signal is used by the PCM to determine if the cylinder at top dead center (TDC) is on the firing stroke or the exhaust stroke. The PCM can determine TDC for all cylinders by using the CKP sensor 24 X signal alone. The engine will start without a CMP signal as long as the PCM receives the CKP sensor 24 X signal. A slightly longer cranking time may be a symptom of this condition. The system attempts synchronization and looks for an increase in engine speed indicating that the engine started. If the PCM does not detect an increase in engine speed, the PCM assumes that the PCM incorrectly synchronized to the exhaust stroke and re-syncs to the opposite cam position. If the PCM detects that the CMP signal is constantly high, DTC P0343 sets.

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

The following conditions may cause this DTC to set:

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

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

Test Description

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

5: This step tests the CMP sensor signal circuit. Applying a voltage causes the CMP sensor high to low and low to high parameter to increase if the circuit and the PCM are operating properly.

DTC P0343

Step	Action	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 camshaft position (CMP) sensor high to low and low to high transition parameter with a scan tool. Does the scan tool parameter increment?	-	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 4**	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Disconnect the CMP sensor. 3. Turn ON the ignition, with the engine OFF. 4. Probe the signal circuit of the CMP sensor with a test lamp that is connected to a good ground. Refer to **Probing Electrical Connectors** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 7** / Go to **Step 5**	
5	1. Start the engine. 2. Observe the CMP sensor high to low and low to high transition parameters with the scan tool. 3. Momentarily and repeatedly probe the signal circuit of the CMP sensor with a test lamp that is connected to battery voltage. Does the CMP sensor high to low and low to high transition counters increment when the test lamp contacts the signal circuit?	-	Go to **Step 6**	Go to **Step 10**
	1. Turn OFF the ignition. 2. Jumper the CMP circuits from the CMP sensor to the CMP sensor harness connector. Refer to **Using Connector Test Adapters** in Wiring			

6	Systems. 3. Turn ON the ignition, with the engine OFF. 4. Measure the Voltage Drop from the low reference circuit of the CMP sensor to a good ground with a DMM. Refer to **Circuit Testing** in Wiring Systems. Is the voltage more than the specified value?	0.2 V	Go to **Step 8**	Go to **Step 9**	
7	Test the CMP sensor signal circuit for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**		Go to **Step 10**
8	Test the 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 15**		Go to **Step 10**
9	Test for an intermittent and for a poor connection at the CMP sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**		Go to **Step 11**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**		Go to **Step 14**
11	1. Remove the CMP sensor. Refer to **Camshaft Position (CMP) Sensor Replacement** . 2. Visually inspect the CMP sensor for the following conditions: • Physical damage • Loose or improper installation • Wiring routed too close to the secondary ignition components Did you find and correct the condition?	-	Go to **Step 15**		Go to **Step 12**
12	1. Visually inspect the CMP sensor reluctor ring for damage. 2. If the CMP reluctor ring is damaged, refer to **Camshaft and Bearings Cleaning and Inspection** in Engine Mechanical Did you find and correct the condition?	-	Go to **Step 15**		Go to **Step 13**

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

DTC P0351-P0358

Circuit Description

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

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

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

Conditions for Running the DTC

The engine is operating.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

3: This step verifies the integrity of the IC circuit and the PCM output.

4: This step tests for a short to ground on the IC circuit.

DTC P0351-P0358

Step	Action	Values	Yes	No
Schematic Reference: Engine Controls Schematics Connector End View Reference: 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. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 3**	Go to **Intermittent Conditions**

3	1. Turn OFF the engine. 2. Disconnect the respective ignition coil. 3. Start the engine. 4. Measure the frequency at the IC circuit with the DMM set to DC Hertz. Refer to **Measuring Frequency** in Wiring Systems. Is the frequency within the specified range?	3-20 Hz	Go to **Step 7**	Go to **Step 4**
4	Measure the voltage from the IC circuit of the ignition coil to a good ground with the DMM. Is the voltage more than the specified value?	1 V	Go to **Step 13**	Go to **Step 5**
5	1. Turn OFF the ignition. 2. Disconnect the PCM connector. 3. Test the IC circuit between the ignition coil connector and the PCM connector for continuity with the DMM. Does the DMM indicate continuity?	-	Go to **Step 6**	Go to **Step 14**
6	Test the respective IC circuit for a short to ground. Refer to **Testing for Short to Ground** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 10**
7	1. Turn ON the ignition, with the engine OFF. 2. Probe the ignition 1 voltage circuit of the ignition coil with a test lamp that is connected to battery ground. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 8**	Go to **Step 11**
8	Probe the ground circuit of the ignition coil with a test lamp connected to battery voltage. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. Does the test lamp illuminate?	-	Go to **Step 9**	Go to **Step 12**
9	Test for an intermittent and for a poor connection at the ignition coil. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
10	Test for an intermittent and for a poor connection at the PCM. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems.	-		

	Did you find and correct the condition?		Go to **Step 17**	Go to **Step 16**
11	Repair the open in the ignition 1 voltage circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
12	Repair the open in the ground circuit for the ignition coil. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
13	Repair the IC circuit for a short to voltage. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
14	Repair open in the IC circuit. Refer to **Wiring Repairs** in Wiring Systems. Did you complete the repair?	-	Go to **Step 17**	-
15	Replace the ignition coil. Refer to **Ignition Coil(s) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
16	Replace the PCM. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 17**	-
17	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 18**
18	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0420 OR P0430

Circuit Description

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

to indicate the oxygen storage capacity of the catalyst. This determines the catalysts ability to effectively convert the exhaust emissions.

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

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

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

Conditions for Running the DTC

- DTCs P0068, P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0120, P0125, P0128, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0171, P0172, P0174, P0175, P0200, P0220, P0300, P0325, P0327, P0332, P0335, P0336, P0341, P0342, P0343, P0351-P0358, P0442, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0502, P0503, P0506, P0507, P1125, P1133, P1134, P1153, P1154, P1516, P2101, P2108, P2120, P2121, P2125, P2135 are not set.
- The engine has been running for more than 10 minutes.
- The intake air temperature (IAT) is between -7 to +85°C (+20 and +185°F).
- The barometric pressure (BARO) is more than 75 kPa.
- The engine coolant temperature (ECT) is more than 70-120°C (158-248°F).
- Since the end of the last idle period, the engine speed has been more than 900 RPM for 46 seconds.
- The engine must be at a stable idle speed, within 200 RPM of desired idle.
- The battery voltage is more than 10.7 volts.
- The Closed Loop fuel control is enabled.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

- The catalyst test may abort due to a change in the engine load. Do not change the engine load, ensure the AC is OFF, the coolant fan is not cycling, while a catalyst test is in progress.
- Driving the vehicle under the conditions outlined in the Inspection/Maintenance (I/M) section can verify whether the fault is present.
- These conditions may cause a catalytic converter to degrade. Inspect for the following conditions:
    - An engine misfire
    - High engine oil or high coolant consumption
    - Retarded spark timing
    - A weak or poor spark
    - A lean fuel mixture
    - A rich fuel mixture
    - A damaged oxygen sensor or wiring harness.
    - If an intermittent condition cannot be duplicated, the information included in Freeze Frame data can be useful in determining the vehicle operating conditions when the DTC was set.
- The catalyst may have been temporarily contaminated with a chemical from a fuel additive, fuel contamination or any of the above conditions.

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

Test Description

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

5: A catalytic converter which has been discolored may be due to an engine running rich, lean or had a previous misfire. Verifying the fuel trim percentages may be of assistance in determining if such a condition exists.

6: This steps inspects for conditions than can cause the TWC efficiency to appear degraded.

DTC P0420 or P0430

Step	Action	Values	Yes	No
1	Did you perform the Diagnostic System Check-Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	Review the DTC information on the scan tool. Are any other DTCs set?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	1. Start and idle the engine. 2. Allow the engine to reach operating temperature. 3. Increase the engine speed to 1,500 RPM for 1 minute. 4. Ensure Closed Loop operation is enabled. 5. Return the engine to a stabilized idle. 6. Observe the HO2S 2 voltage parameter on the scan tool for the applicable bank. Is the applicable HO2S 2 voltage parameter transitioning below the first specified value and above the second specified value?	350 mV 600 mV	Go to **Step 5**	Go to **Step 4**
4	1. Clear the DTCs with a scan tool. 2. Start the engine. 3. Operate the vehicle within the Conditions For Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did DTC P0420 or P0430 set?	-	Go to **Step 5**	Go to Diagnostic Aids
5	**IMPORTANT:** **Verify that the three-way catalytic converter (TWC) is a high quality part that meets the OEM specifications.** Visually and physically inspect the TWC for the following conditions: • Physical damage • Severe discoloration caused by excessive temperatures	-		

	• Internal rattles caused by loose catalyst substrate • Restrictions-Refer to **Restricted Exhaust** in Engine Exhaust. Did you find and correct the condition?		Go to **Step 10**	Go to **Step 6**
6	Visually inspect the exhaust system for the following conditions: • Leaks - Refer to **Exhaust Leakage** in Engine Exhaust. • Physical damage • Loose or missing hardware • The heated oxygen sensor (HO2S) 2 for the applicable bank for proper torque Did you find and correct the condition?	-	Go to **Step 10**	Go to **Step 7**
7	Visually inspect the HO2S 2 at the applicable bank for the following conditions: • The pigtail and wiring harness contacting the exhaust or any ground. • Road damage Did you find a condition?	-	Go to **Step 8**	Go to **Step 9**
8	Replace the applicable HO2S 2 sensor. Refer to **Heated Oxygen Sensor (HO2S) Replacement Bank 1 Sensor 2** or **Heated Oxygen Sensor (HO2S) Replacement Bank 2 Sensor 2** . Did you complete the replacement?	-	Go to **Step 10**	-
9	**NOTE:** **In order to avoid damaging the replacement three-way catalytic converter, correct the engine misfire or mechanical fault before replacing the three-way catalytic converter.** Replace the TWC. Refer to **Catalytic Converter Replacement (Right Hand)** in Engine Exhaust.Did you complete the replacement?	-	Go to **Step 10**	-
	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine.			

10	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 P0442

System Description

This diagnostic tests the evaporative emission (EVAP) system for a small leak when the key is turned OFF and the correct conditions are met.

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

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

Conditions for Running the DTC

- DTCs P0101, P0102, P0103, P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0125, P0335, P0336, P0443, P0446, P0449, P0452, P0453, P0455, P0496, P0500, P0502, P1106, P1107, P2610 are not set.
- The diagnostic runs once with a 10 hour minimum between tests after a fail.
- DTC P0455 must run and pass.
- The start up intake air temperature (IAT) is between 4-30°C (39-86°F).
- The start up engine coolant temperature (ECT) is less than 30°C (86°F).
- The start up IAT and ECT are within 8°C (15°F).
- The barometric pressure (BARO) is more than 74 kPa.
- The ambient air temperature is between 2-32°C (36-90°F).
- The engine run time minimum is 600 seconds.
- The odometer displays more than 10 miles.
- The vehicle has traveled more than 3 miles this trip.
- The ECT is more than 70°C (158°F).
- The fuel level is between 15-85 percent.

- The ignition is OFF.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

- To help locate intermittent leaks, use the **J 41413-200** Evaporative Emissions System Tester (EEST) to introduce smoke into the EVAP system. Move all EVAP components while observing smoke with the **J 41413-SPT** High Intensity White Light.
- A condition may exist where a leak in the EVAP system only exists under a vacuum condition. By using the scan tool PURGE/SEAL function to create a vacuum, seal the system and observe the FTP parameter for vacuum decay, this type of leak may be detected.
- To improve the visibility of the smoke exiting the EVAP system, observe the suspected leak area from different angles with the **J 41413-SPT** .
- For intermittent conditions, refer to **Intermittent Conditions** .

Test Description

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

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

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

DTC P0442

Step	Action	Yes	No
Schematic Reference:Emission Hose Routing Diagram			

1	Did you perform the Diagnostic System Check-Engine Controls?	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
2	**IMPORTANT:** **Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize.** 1. Turn the nitrogen/smoke valve to nitrogen. 2. Connect the nitrogen/smoke hose to the 0.5 mm (0.20 in) test orifice on the bottom-front of the **J 41413-200** Evaporative Emissions System Tester (EEST). 3. Activate the **J 41413-200** with the remote switch. 4. Align the red flag on the flow meter with the floating indicator. De-activate the **J 41413-200** with the remote switch. 5. Install the J 41415-40 Fuel Tank Cap Adapter or **GE-41415-50** Fuel Tank Cap Adapter to the fuel fill pipe. 6. Remove the nitrogen/smoke hose from the test orifice and install the hose onto the J 41415-40 or **GE-41415-50** . 7. Turn ON the ignition, with the engine OFF. 8. Command the evaporative emissions (EVAP) canister vent solenoid valve closed with a scan tool. 9. Introduce nitrogen and fill the EVAP system until the floating stabilizes with the remote switch. 10. Compare the flow meter's stable floating indicator position to the red flag. Is the floating indicator below the red flag?	Go to Diagnostic Aids	Go to **Step 3**
	IMPORTANT: **Ensure that the vehicle underbody temperature is similar to the ambient temperature and allow the surrounding air to stabilize before starting the diagnostic procedure. System flow will be less with higher temperatures.** 1. Turn OFF the ignition. 2. Connect the **J 41413-200** power supply clips to a known good 12-volt source. 3. Install the J 41415-40 or**GE-41415-50** to the fuel fill pipe. 4. Connect the **J 41413-200** nitrogen/smoke supply hose to the J 41415-40 or **GE-41415-50** .		

3	5. Turn ON the ignition, with the engine OFF. 6. Command the EVAP canister vent solenoid valve closed with a scan tool. 7. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to SMOKE. 8. Use the remote switch to introduce smoke into the EVAP system. 9. Use the **J 41413-VLV** EVAP Service Port Vent Fitting to open the EVAP service port. 10. Remove the **J 41413-VLV** once smoke is observed. 11. Continue to introduce smoke into the EVAP system for an additional 60 seconds. 12. Inspect the entire EVAP system for exiting smoke with the **J 41413-SPT** High Intensity White Light. 13. Continue to introduce smoke at 15 second intervals until the leak source has been located. Did you locate and repair a leak source?	Go to **Step 5**	Go to **Step 4**
4	1. Disconnect the J 41415-40 or **GE-41415-50** from the fuel fill pipe. 2. Install the fuel fill cap to the fuel fill pipe. 3. Connect the **J 41413-200** nitrogen/smoke supply hose to the EVAP service port. 4. Use the remote switch to introduce smoke into the EVAP system. 5. Inspect the entire EVAP system for exiting smoke with the **J 41413-SPT** . 6. Continue to introduce smoke at 15 second intervals until the leak source has been located. Did you locate and repair a leak source?	Go to **Step 5**	Go to Diagnostic Aids
	IMPORTANT: **Larger volume fuel tanks and/or those with lower fuel levels may require several minutes for the floating indicator to stabilize.** 1. Turn the nitrogen/smoke valve to nitrogen. 2. Connect the nitrogen/smoke hose to the 0.50 mm (0.20 in) test orifice on the bottom-front of the **J 41413-200** . 3. Use the remote switch to activate the **J 41413-200** . 4. Align the red flag on the flow meter with the floating		

5	indicator. Use the remote switch to de-activate the **J 41413-200** . 5. Install the J 41415-40 or **GE-41415-50** to the fuel fill pipe. 6. Remove the nitrogen/smoke hose from the test orifice and install the hose onto the J 41415-40 or **GE-41415-50** . 7. Turn ON the ignition, with the engine OFF. 8. Command the EVAP canister vent solenoid valve closed with a scan tool. 9. Use the remote switch to introduce nitrogen and fill the EVAP system until the floating stabilizes. 10. Compare the flow meter's stable floating indicator position to the red flag. Is the floating indicator below the red flag?	Go to **Step 6**	Go to **Step 2**
6	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0443

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

2: This step tests if the concern is active. The EVAP canister purge solenoid valve is PWM. You should hear a clicking sound when the EVAP canister purge solenoid valve is commanded to 50 percent. The clicking sound should stop when the EVAP canister purge solenoid valve is commanded to 0 percent. The rate at which the valve cycles should increase when the commanded state is increased, and decrease when the commanded state is decreased.

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

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

DTC P0443

Step	Action	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. Turn ON the ignition, with the engine OFF. 2. Command the evaporative emission (EVAP) canister purge solenoid valve to 50 percent, then to 0 percent with a scan tool. Does the EVAP canister purge solenoid valve respond to the commanded state?	Go to **Step 3**	Go to **Step 4**
	1. Observe the Freeze Frame/Failure Records for this		

3	DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the EVAP canister purge solenoid valve harness connector. 3. Turn ON the ignition, with the engine OFF. 4. Probe the ignition 1 voltage circuit of the EVAP canister purge solenoid valve with a test lamp that is connected to a good ground. Does the test lamp illuminate?	Go to **Step 5**	Go to **Step 11**
5	1. Connect a test lamp between the control circuit of the EVAP canister purge solenoid valve and the ignition 1 voltage circuit of the EVAP canister purge solenoid valve. 2. Command the EVAP canister purge solenoid valve to 0 percent with a scan tool. Does the test lamp illuminate?	Go to **Step 8**	Go to **Step 6**
6	Command the EVAP canister purge solenoid valve to 50 percent with a scan tool. Does the test lamp illuminate or pulse when the EVAP canister purge solenoid valve is commanded to 50 percent?	Go to **Step 9**	Go to **Step 7**
7	Test the control circuit of the EVAP canister purge solenoid valve for an open or for a short to voltage. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
8	Test the control circuit of the EVAP canister purge solenoid valve for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
9	Inspect for poor connections at the harness connector of the EVAP canister purge solenoid valve. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**

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

DTC P0446

System Description

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

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

DTC P0446

Control Module	EVAP Canister Purge Solenoid	EVAP Canister Vent Solenoid

Command	Valve	Valve
ON	Open	Closed
OFF	Closed	Open

Conditions for Running the DTC

- DTCs P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0220, P0442, P0443, P0449, P0452, P0453, P0455, P0502, P0503, P1111, P1112, P1114, P1115, P1121, P1122, P1125, P2135 are not set.
- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is more than 75 kPa.
- The fuel level is between 15-85 percent.
- The engine coolant temperature (ECT) is between 4-30°C (39-86°F).
- The intake air temperature (IAT) is between 4-30°C (39-86°F).
- The start up ECT and IAT are within 9°C (16°F) of each other.

Conditions for Setting the DTC

- The fuel tank pressure sensor is less than - 10 inches H2O.
- The above condition is present for more than 30 seconds.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Diagnostic Aids

- An intermittent condition could be caused by a damaged EVAP vent housing, a temporary blockage at the

EVAP canister vent solenoid valve inlet, or a pinched vent hose. A blockage in the vent system will also cause a poor fuel fill problem.

- For intermittent conditions, refer to **Intermittent Conditions** .
- An EVAP canister, vent hose or vent solenoid valve that has restricted flow may cause this DTC to set. Using purge solenoid valve command with a scan tool, will allow vacuum to be applied to the system instead of pressure. With the EVAP canister vent solenoid valve open and the EVAP canister purge solenoid valve commanded to 100 percent, vacuum should not increase to more than 9 inches H2O.

DTC P0446

Step or	Action	Values	Yes	No	
Schematic Reference:Evaporative Emissions (EVAP) Hose Routing Diagram					
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**	
2	Inspect the evaporative emission (EVAP) system for the following conditions: • A damaged EVAP canister vent solenoid valve - Refer to **Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement** . • A pinched EVAP vent hose • A damaged EVAP canister - Refer to **Evaporative Emission (EVAP) Canister Replacement** . Did you find and correct the condition?	-	Go to **Step 15**		Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the purge line from the EVAP canister purge solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . 3. Turn ON the ignition, with the engine OFF. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 in H2O	Go to **Step 4**	Go to **Step 9**	
	IMPORTANT: **DO NOT exceed the specified value in this step. Exceeding the specified value may produce incorrect test results.**				

4	1. Turn OFF the ignition. 2. Connect the EVAP purge pipe. 3. Connect the **J 41413-200** Evaporative Emissions System Tester (EEST) power supply clips to a known good 12-volt source. 4. Install the J 41415-40 Fuel Tank Cap Adapter or **GE-41415-50** Fuel Tank Cap Adapter to the fuel fill pipe. 5. Connect the fuel fill cap to the J 41415-40 or **GE-41415-50** . 6. Connect the **J 41413-200** nitrogen/smoke supply hose to the J 41415-40 or **GE-41415-50** . 7. Turn ON the ignition, with the engine OFF. 8. Command the EVAP canister vent solenoid valve closed with a scan tool. 9. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to NITROGEN. 10. Use the remote switch to pressurize the EVAP system to the first specified value. 11. Observe the fuel tank pressure sensor in H2O with a scan tool. 12. Command the EVAP canister vent solenoid valve open with a scan tool. Is the fuel tank pressure sensor parameter less than the second specified value?	5 in H2O 1 in H2O	Go to **Step 5**	Go to **Step 7**		
5	1. Connect the NITROGEN/SMOKE hose to the EVAP service port. 2. Remove the J 41415-40 or**GE-41415-50** . 3. Install the fuel fill cap to the fuel fill pipe. 4. Start the engine. 5. Allow the engine to idle. 6. Use the PURGE/SEAL function to seal the system, with a scan tool. 7. Command the EVAP canister purge solenoid valve to 30 percent. 8. Observe the VACUUM/PRESSURE gauge on the **J 41413-200** and the FTP parameter on the scan tool.	1 in H2O				

	9. Allow the vacuum to increase on the gauge of the **J 41413-200** , until it reaches approximately 16 inches H2O. 10. Use the PURGE/SEAL function to seal the system, with a scan tool. Is the difference between the FTP parameter on a scan tool and the VACUUM/PRESSURE gauge on the **J 41413-200** within the specified value, until the vacuum reached the abort limit on a scan tool?		Go to **Step 6**	Go to **Step 9**
6	Did the FTP parameter on a scan tool display more than the specified value?	3.2 V	Go to Diagnostic Aids	Go to **Step 12**
7	Disconnect the EVAP vent hose from the EVAP canister vent solenoid valve. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 13**	Go to **Step 8**
8	Disconnect the EVAP vent hose from the EVAP canister. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 11**	Go to **Step 14**
9	Test for an intermittent and for a poor connection at the fuel tank pressure (FTP) sensor. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 10**
10	Test the low reference circuit of the FTP sensor for an open or high resistance. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 15**	Go to **Step 12**
11	Repair the pinched or restricted EVAP vent hose. Did you complete the repair?	-	Go to **Step 15**	-
12	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
13	Replace the EVAP canister vent solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
14	Replace the EVAP canister. Refer to **Evaporative Emission (EVAP) Canister Replacement** . Did you complete the replacement?	-	Go to **Step 15**	-
	1. Turn OFF the ignition.			

15	2. Disconnect the purge line from the EVAP canister vent solenoid valve. 3. Turn ON the ignition, with the engine OFF. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 in H2O	Go to **Step 16**	Go to **Step 2**	
16	**IMPORTANT:** **DO NOT exceed the specified value in this step. Exceeding the specified value may produce incorrect test results.** 1. Turn OFF the ignition. 2. Reconnect all disconnected components. 3. Connect the **J 41413-200** to the fuel fill pipe. 4. Turn ON the ignition, with the engine OFF. 5. Command the EVAP canister vent solenoid valve closed with a scan tool. 6. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to NITROGEN. 7. Use the remote switch to pressurize the EVAP system to the first specified value. 8. Observe the fuel tank pressure sensor in H2O with a scan tool. 9. Command the EVAP canister vent solenoid valve open with a scan tool. Is the fuel tank pressure sensor parameter less than the second specified value?	5 in H2O 1 in H2O	Go to **Step 17**	Go to **Step 2**	
17	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK	

DTC P0449

Circuit Description

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

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

DTC P0449

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

2: Listen for a click when the valve operates. Verify that both the ON and the OFF states are commanded.

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

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

DTC P0449

Step	Action	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. Turn ON the ignition, with the engine OFF. 2. Command the evaporative emission (EVAP) canister vent solenoid valve ON and OFF with the scan tool. Do you hear or feel a click from the EVAP canister vent solenoid valve when the valve is commanded ON and OFF?	Go to **Step 3**	Go to **Step 4**
3	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 4**	Go to **Intermittent Conditions**
4	1. Turn OFF the ignition. 2. Disconnect the EVAP canister vent solenoid valve. 3. Turn ON the ignition, with the engine OFF. 4. Probe the batter positive voltage circuit of the EVAP canister vent solenoid valve with a test lamp connected to a good ground. Refer to **Troubleshooting with a Test Lamp** in Wiring Systems. Does the test lamp illuminate?	Go to **Step 5**	Go to **Step 11**
5	1. Connect a test lamp between the control circuit of the EVAP canister vent solenoid valve and battery positive voltage circuit of the EVAP canister vent solenoid valve at the EVAP canister vent solenoid valve harness connector. 2. Command the EVAP canister vent solenoid valve ON		

	and OFF with a scan tool. Does the test lamp turn ON and OFF with each command?	Go to **Step 9**	Go to **Step 6**
6	Does the test lamp remain illuminated with each command?	Go to **Step 8**	Go to **Step 7**
7	Test the control circuit of the EVAP canister vent solenoid valve for a short to voltage or an open. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
8	Test the control circuit of the EVAP canister vent solenoid valve for a short to ground. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 10**
9	Inspect for poor connections at the harness connector of the EVAP canister vent solenoid valve. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 12**
10	Inspect for poor connections at the harness connector of the control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	Go to **Step 14**	Go to **Step 13**
11	**IMPORTANT:** **If the fuse is open, inspect all related circuits for a short to ground.** Repair the open or short to ground in the battery positive voltage circuit. Refer to **Wiring Repairs** in Wiring Systems.Did you complete the repair?	Go to **Step 14**	-
12	Replace the EVAP canister vent solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Vent Solenoid Valve Replacement** . Did you complete the replacement?	Go to **Step 14**	-
13	Replace the control module. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	Go to **Step 14**	-
14	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records.		

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

DTC P0452

Circuit Description

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

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

DTC P0452

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

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

- The control module turns OFF the malfunction indicator lamp (MIL) after 3 consecutive ignition cycles

that the diagnostic runs and does not fail.

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

Test Description

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

5: This step tests for the proper operation of the circuit in the high voltage range.

DTC P0452

Step	Action	Value (s)	Yes	No
Schematic Reference: Engine Controls Schematics **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. Idle the engine for 1 minute. 2. Monitor the diagnostic trouble code (DTC) information with a scan tool. Did DTC P0641 or P0651 fail this ignition?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	Observe the fuel tank pressure sensor parameter with the scan tool. Does the scan tool indicate that fuel tank pressure sensor parameter is less than the specified value?	0.1 V	Go to **Step 5**	Go to **Step 4**
4	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to **Intermittent Conditions**
	1. Turn OFF the ignition. 2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General			

5	Information. 3. Disconnect the fuel tank wiring harness at the fuel tank harness connector. 4. Connect a 3-amp fused jumper wire between the 5-volt reference circuit of the FTP sensor and the signal circuit of the FTP sensor. 5. Turn ON the ignition, with the engine OFF. 6. Observe the fuel tank pressure sensor voltage with a scan tool. Is the fuel tank pressure sensor parameter more than the specified value?	4.8 V	Go to **Step 8**	Go to **Step 6**
6	Test the 5-volt reference circuit of the FTP sensor for an open between the fuel tank harness connector and the control module. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 7**
7	Test the signal circuit of the FTP sensor for a short to ground, or an open between the fuel tank harness connector and the control module. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 9**
8	1. Remove the fuel tank. Refer to **Fuel Tank Replacement** . 2. Inspect the fuel tank wiring harness for the following: • Damaged wiring • Poor connections • Broken wires inside the insulation-Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 10**
9	Inspect for poor connections at the harness connector of the control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 12**	Go to **Step 11**
10	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-
11	Replace the control module. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 12**	-

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

DTC P0453

Circuit Description

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

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

DTC P0453

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

Conditions for Running the DTC

The engine is running.

Conditions for Setting the DTC

- The fuel tank pressure (FTP) sensor voltage is more than 4.9 volts.
- All conditions are present for more than 5 seconds.

Action Taken When the DTC Sets

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

cycle that the diagnostic runs and fails.

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

Conditions for Clearing the MIL/DTC

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

Test Description

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

2: If DTC P0641 or P0651 is set, the 5-volt reference circuit may be shorted to a voltage.

DTC P0453

Step	Action	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. Idle the engine for 1 minute. 2. Monitor the diagnostic trouble code (DTC) information with the scan tool. Did DTC P0641 or P0651 fail this ignition?	-	Go to **Diagnostic Trouble Code (DTC) List**	Go to **Step 3**
3	1. Turn ON the ignition, with the engine OFF. 2. Observe the fuel tank pressure sensor voltage with a scan tool. Is the fuel tank pressure sensor parameter more than the specified value?	4.3 V	Go to **Step 5**	Go to **Step 4**
	1. Observe the Freeze Frame/Failure Records for this DTC.			

4	2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 5**	Go to **Intermittent Conditions**
5	1. Turn OFF the ignition. 2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information. 3. Disconnect the fuel tank wiring harness at the fuel tank harness connector. 4. Turn ON the ignition, with the engine OFF. 5. Observe the fuel tank pressure sensor voltage with a scan tool. Does the scan tool indicate that the fuel tank pressure sensor parameter is more than the specified value?	1 V	Go to **Step 6**	Go to **Step 7**
6	Test the signal circuit of the FTP for a short to voltage between the fuel tank harness connector and the control module. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
7	Probe the low reference circuit of the FTP sensor at the fuel tank harness connector with a test lamp connected to battery voltage. Refer to **Circuit Testing** in Wiring Systems. Did the test lamp illuminate?	-	Go to **Step 9**	Go to **Step 8**
8	Test the low reference circuit of the FTP sensor for an open between the fuel tank harness connector and the control module. Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 10**
9	1. Remove the fuel tank. Refer to **Fuel Tank Replacement** . 2. Disconnect the FTP sensor harness connector. 3. Inspect the fuel tank wiring harness for the following: • Damaged wiring	-		

	• Poor connections • Broken wires inside the insulation - Refer to **Circuit Testing** and **Wiring Repairs** in Wiring Systems. Did you find and correct the condition?		Go to **Step 13**	Go to **Step 11**
10	Inspect for poor connections at the harness connector of the control module. Refer to **Testing for Intermittent Conditions and Poor Connections** and **Connector Repairs** in Wiring Systems. Did you find and correct the condition?	-	Go to **Step 13**	Go to **Step 12**
11	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
12	Replace the control module. Refer to **Powertrain Control Module (PCM) Replacement** . Did you complete the replacement?	-	Go to **Step 13**	-
13	1. Observe the Freeze Frame/Failure Records for this DTC. 2. Turn OFF the ignition for 30 seconds. 3. Turn ON the ignition, with the engine OFF. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	-	Go to **Step 2**	Go to **Step 14**
14	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0455

System Description

The control module tests the evaporative emission (EVAP) system for a large leak. The control module monitors the fuel tank pressure (FTP) sensor signal to determine the EVAP system vacuum level. When the conditions for running are met, the control module commands the EVAP canister purge solenoid valve open and the EVAP canister vent solenoid valve closed. This allows engine vacuum to enter the EVAP system. At a calibrated time, or vacuum level, the control module commands the EVAP canister purge solenoid valve closed, sealing the system, and monitors the FTP sensor input in order to determine the EVAP system vacuum level. If the system is unable to achieve the calibrated vacuum level, or the vacuum level decreases too rapidly, this DTC sets.

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

DTC P0455

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

Conditions for Running the DTC

- DTC P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0125, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0220, P0442, P0443, P0449, P0452, P0453, P1111, P1112, P1114, P1115, P1125, P2135 are not set.
- The engine is running.
- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is more than 75 kPa.
- The fuel level is between 15-85 percent.
- The engine coolant temperature (ECT) is between 4-65°C (39-149°F).
- The intake air temperature (IAT) is between 4-75°C (39-167°F).
- The start-up ECT and IAT are within 9°C (16°F) of each other.

Conditions For Setting the DTC

The EVAP system is not able to achieve or maintain vacuum during the diagnostic test.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

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

Diagnostic Aids

- To help locate intermittent leaks, use the **J 41413-200** Evaporative Emissions System Tester (EEST) to introduce smoke into the EVAP system. Move all EVAP components while observing smoke with the **J 41413-SPT** High Intensity White Light. Introducing smoke in 15 second intervals will allow less pressure into the EVAP system. When the system is less pressurized, the smoke will sometimes escape in a more condensed manner.
- A temporary blockage in the EVAP canister purge solenoid valve, purge pipe or EVAP canister could cause an intermittent condition. Inspect and repair any restriction in the EVAP system.
- To improve the visibility of the smoke exiting the EVAP system, observe the suspected leak area from different angles with the **J 41413-SPT** .
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.
- For intermittent conditions, refer to **Intermittent Conditions** .

Test Description

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

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

5: This step verifies proper operation of the fuel tank pressure (FTP) sensor.

6: A normal operating FTP sensor should increase above 5 inches of H2O and stop between 6 inches of H2O and 7 inches of H2O.

DTC P0455

Step	Action	Values	Yes	No
Schematic Reference: Emission Hose Routing Diagram				
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
	1. Inspect the evaporative emission (EVAP) system for the following conditions: • Loose, missing, or damaged service port schrader valve • Loose, incorrect, missing, or damaged fuel fill cap • A damaged EVAP canister purge solenoid			

2	valve 2. Raise the vehicle on a hoist. Refer to **Lifting and Jacking the Vehicle** in General Information. 3. Inspect the EVAP system for the following conditions: • Disconnected, improperly routed, kinked, or damaged EVAP pipes and hoses • A damaged EVAP canister vent solenoid valve or EVAP canister Did you find and correct the condition?	-	Go to **Step 16**	Go to **Step 3**	
3	**IMPORTANT:** **Ensure that the vehicle underbody temperature is similar to the ambient temperature and allow the surrounding air to stabilize before starting the diagnostic procedure. System flow will be less with higher temperatures.** 1. Turn OFF the ignition. 2. Connect the **J 41413-200** Evaporative Emissions System Tester (EEST) power supply clips to a known good 12-volt source. 3. Install the **GE-41415-50** Fuel Tank Cap Adapter to the fuel fill pipe. 4. Connect the **J 41413-200** nitrogen/smoke supply hose to the **GE-41415-50** . 5. Turn ON the ignition, with the engine OFF. 6. Command the EVAP canister vent solenoid valve closed with a scan tool. 7. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to SMOKE. 8. Use the remote switch to introduce smoke into the EVAP system. 9. Use the **J 41413-VLV** EVAP Service Port Vent Fitting to open the EVAP service port. 10. Remove the **J 41413-VLV** once smoke is observed. 11. Continue to introduce smoke into the EVAP system for an additional 60 seconds. 12. Inspect the entire EVAP system for exiting smoke with the **J 41413-SPT** High Intensity White Light. 13. Continue to introduce smoke at 15 second	-			

	intervals until the leak source has been located. Did you locate and repair a leak source?		Go to **Step 16**	Go to **Step 4**
4	1. Disconnect the **GE-41415-50** from the fuel fill pipe. 2. Install the fuel fill cap to the fuel fill pipe. 3. Connect the **J 41413-200** nitrogen/smoke supply hose to the EVAP service port. 4. Use the remote switch to introduce smoke into the EVAP system. 5. Inspect the entire EVAP system for exiting smoke with the **J 41413-SPT** . 6. Continue to introduce smoke at 15 second intervals until the leak source has been located. Did you locate and repair a leak source?	-	Go to **Step 16**	Go to **Step 5**
5	1. Use the remote switch to stop introducing smoke. 2. Install the **GE-41415-50** to the fuel fill pipe. 3. Connect the **J 41413-200** nitrogen/smoke supply hose and vehicle fuel fill cap to the **GE-41415-50** . 4. Command the EVAP canister vent solenoid valve open with a scan tool. 5. Compare the fuel tank pressure sensor parameter with a scan tool to the**J 41413-200** pressure/vacuum gauge. Is the difference between the two gauges less than the specified value?	1 in H2O	Go to **Step 6**	Go to **Step 12**
6	1. Seal the EVAP system using the EVAP Purge/Seal function with a scan tool. 2. Turn the nitrogen/smoke valve on the **J 41413-200** control panel to NITROGEN. 3. Use the **J 41413-200** to pressurize the EVAP system to the first specified value. Is the fuel tank pressure sensor parameter more than the second specified value?	13 in H2O 5 in H2O	Go to **Step 7**	Go to **Step 12**
7	1. Stop introducing nitrogen into the EVAP system with the remote switch. 2. Increase the EVAP canister purge solenoid valve to 100 percent.	1 in H2O		

	Is the fuel tank pressure sensor parameter less than the specified value?		Go to Diagnostic Aids	Go to **Step 8**
8	Disconnect the EVAP purge pipe from the EVAP canister purge solenoid valve. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 13**	Go to **Step 9**
9	Disconnect the EVAP purge pipe at the EVAP canister. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 14**	Go to **Step 10**
10	Disconnect the EVAP vapor pipe at the EVAP canister. Is the fuel tank pressure sensor parameter less than the specified value?	1 in H2O	Go to **Step 15**	Go to **Step 11**
11	Repair the pinched or obstructed EVAP vapor pipe. Did you complete the repair?	-	Go to **Step 16**	-
12	Replace the FTP sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 16**	-
13	Replace the EVAP canister purge solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . Did you complete the replacement?	-	Go to **Step 16**	-
14	Repair the restriction in the EVAP purge pipe. Refer to **Evaporative Emission (EVAP) System Hoses/Pipes Replacement (Engine Compartment EVAP Pipe)** or **Evaporative Emission (EVAP) System Hoses/Pipes Replacement (Chassis EVAP Pipe)** or **Evaporative Emission (EVAP) System Hoses/Pipes Replacement (EVAP Vent Pipe)** or **Evaporative Emission (EVAP) System Hoses/Pipes Replacement (Rear EVAP Fuel Tank Pipe)** . Did you complete the repair?	-	Go to **Step 16**	-
15	Replace the EVAP canister. Refer to **Evaporative Emission (EVAP) Canister Replacement** . Did you complete the replacement?	-	Go to **Step 16**	-
16	**IMPORTANT:** **DO NOT exceed the specified value in this step. Exceeding the specified value may produce incorrect test results.** 1. Connect the **J 41413-200** to the fuel fill pipe. 2. Turn the nitrogen/smoke valve to NITROGEN. 3. Seal the EVAP system using the EVAP Purge/Seal function with a scan tool. 4. Pressurize the EVAP system to the specified	5 in H2O		

	value. 5. Observe the **J 41413-200** pressure/vacuum gauge for 5 minutes. Does the **J 41413-200** pressure/vacuum gauge remain constant?		Go to **Step 17**	Go to **Step 3**	
17	Observe the fuel tank pressure sensor parameter with a scan tool. Is the scan tool fuel tank pressure parameter within the specified value of the **J 41413-200** pressure/vacuum gauge?	1 in H2O	Go to **Step 18**	Go to **Step 5**	
18	1. Observe the **J 41413-200** pressure/vacuum gauge. 2. Increase the EVAP canister purge solenoid valve to 100 percent. Does the pressure decrease?	-	Go to **Step 19**		Go to **Step 8**
19	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK	

DTC P0496

System Description

This DTC tests for undesired intake manifold vacuum flow to the evaporative emission (EVAP) system. The control module seals the EVAP system by commanding the EVAP canister purge solenoid valve Closed and the EVAP canister vent solenoid valve Closed. The control module monitors the fuel tank pressure (FTP) sensor to determine if a vacuum is being drawn on the EVAP system. If vacuum in the EVAP system is more than a predetermined value within a predetermined time, this DTC sets.

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

DTC P0496

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

Conditions for Running the DTC

- DTCs P0106, P0107, P0108, P0112, P0113, P0116, P0117, P0118, P0120, P0121, P0122, P0123, P0125,

P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0140, P0141, P0151, P0152, P0153, P0154, P0155, P0156, P0157, P0158, P0160, P0161, P0220, P0442, P0443, P0449, P0452, P0453, P0455, P0502, P0503, P1111, P1112, P1114, P1115, P1121, P1122, P1125, P2135 are not set.

- The ignition voltage is between 10-18 volts.
- The barometric pressure (BARO) is more than 75 kPa.
- The fuel level is between 15-85 percent.
- The engine coolant temperature (ECT) is between 4-30°C (39-86°F).
- The intake air temperature (IAT) is between 4-30°C (39-86°F).
- The start up ECT and IAT are within 9°C (16°F) of each other.

Conditions for Setting the DTC

- A continuous open purge flow condition is detected during the diagnostic test.
- The fuel tank pressure decreases to less than -11 inches H2O.

Action Taken When the DTC Sets

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

Conditions for Clearing the MIL/DTC

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

DTC P0496

Step	Action	Values	Yes	No
Schematic Reference: Emission Hose Routing Diagram				
1	Did you perform the Diagnostic System Check - Engine Controls?	-	Go to **Step 2**	Go to **Diagnostic System Check - Engine Controls**
	1. Start the engine. 2. Seal the evaporative emission (EVAP) system using the Purge/Seal function			

2	with a scan tool. 3. Increase the engine idle to 1,200-1,500 RPM. 4. Observe the fuel tank pressure sensor in H2O with a scan tool. Is the fuel tank pressure sensor parameter within the specified value?	-1 to +1 in H2O	Go to **Intermittent Conditions**	Go to **Step 3**
3	1. Turn OFF the ignition. 2. Disconnect the EVAP purge pipe from the EVAP purge solenoid valve. 3. Turn ON the ignition, with the engine OFF. 4. Observe the fuel tank pressure sensor in H2O with a scan tool. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 in H2O	Go to **Step 4**	Go to **Step 5**
4	Replace the EVAP purge solenoid valve. Refer to **Evaporative Emission (EVAP) Canister Purge Solenoid Valve Replacement** . Did you complete the replacement?	-	Go to **Step 6**	-
5	Replace the fuel tank pressure (FTP) sensor. Refer to **Fuel Tank Pressure Sensor Replacement** . Did you complete the replacement?	-	Go to **Step 6**	-
6	1. Connect all EVAP hardware that was previously disconnected. 2. Seal the EVAP system using the Purge/Seal function with a scan tool. 3. Start the engine and idle at 1,200-1,500 RPM. 4. Observe the fuel tank pressure sensor parameter with a scan tool. Is the fuel tank pressure sensor parameter within the specified range?	-1 to +1 in H2O	Go to **Step 7**	Go to **Step 2**
7	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	-	Go to **Diagnostic Trouble Code (DTC) List**	System OK

DTC P0506 (TAC)

Circuit Description

The electronic throttle control (ETC) system uses various inputs from the powertrain control module (PCM). This system uses the inputs to control the idle speed through serial data circuits to the throttle actuator control (TAC) module. The DC motor, which is located on the throttle body, activates the throttle plate. In order to decrease idle speed, the TAC module commands the throttle closed, reducing air flow into the engine, and the idle speed decreases. In order to increase the idle speed, the TAC module commands the throttle plate open, allowing more air in order to bypass the throttle plate. If the actual idle RPM does not match the desired idle RPM within a calibrated time, this DTC will set.

Conditions for Running the DTC

- DTCs P0101-P0103, P0107, P0108, P0112, P0113, P0117, P0118, P0125, P0171, P0172, P0174, P0175, P0200, P0300, P0440, P0442, P0443, P0500, P0502, P0503, P1120, P1220, P1221, P1441 are not set.
- The engine is running for greater than 60 seconds.
- The engine coolant temperature (ECT) is greater than 60°C (140°F).
- The intake air temperature (IAT) is greater than -10°C (+14°F).
- The barometric pressure (BARO) is greater than 65 kPa.
- The system voltage is between 9-18 volts.
- The vehicle speed is less than 1.7 km/h (1 mph).
- The accelerator pedal position (APP) sensor is at 0 percent.

Conditions for Setting the DTC

- The actual idle speed is 100 RPM less than the desired idle speed.
- The above condition is present 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 numbers below refer to the step numbers on the diagnostic table.

2: This test determines if the engine can achieve the commanded RPM.

DTC P0506 (TAC)

Step	Action	Yes	No
Schematic Reference:Engine Controls Schematics **Connector End View Reference:Engine Controls Component 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. Set the park brake and block the drive wheels. 2. Start the engine. 3. Turn OFF all accessories. 4. Command the engine RPM to 1,500 RPM, to 500 RPM, and back to 1,500 RPM with the RPM control function of the scan tool. 5. Exit the RPM Control function. Did the engine speed stay within 100 RPM of the commanded RPM during the above test?	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. Use the following information to operate the vehicle under the conditions which set the DTC: • The data in the Freeze Frame/Failure Records • The parameters listed in the Conditions for Running in the DTC Does the DTC set?	Go to **Step 4**	Go to **Intermittent Conditions**
4	Inspect for the following conditions: • Deposits in the throttle body • Objects which are blocking the air intake system • Energy-draining load on the engine, such as transmission conditions		

	Did you find and correct the condition?	Go to **Step 5**	-
5	1. Clear the DTCs with a scan tool. 2. Turn OFF the ignition for 30 seconds. 3. Start the engine. 4. Operate the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions that you observed from the Freeze Frame/Failure Records. Did the DTC fail this ignition?	Go to **Step 2**	Go to **Step 6**
6	Observe the Capture Info with a scan tool. Are there any DTCs that have not been diagnosed?	Go to **Diagnostic Trouble Code (DTC) List**	System OK