

# P0011, P0014, P0021, or P0024 Intake Camshaft Position (CMP) System Performance

## Circuit Description

The camshaft position (CMP) actuator system enables the engine control module (ECM) to change the timing of the camshafts while the engine is operating. The CMP actuator solenoid signal from the ECM is pulse width modulated (PWM). The ECM controls the CMP actuator solenoid duty cycle by controlling the amount of solenoid ON time. The CMP actuator solenoid controls the advance or the retard of each camshaft. The CMP actuator solenoid controls the oil flow that applies the pressure to advance or retard the camshafts. Ignition voltage is supplied directly to the CMP actuator solenoid. The ECM controls the solenoid by grounding the control circuit with a solid state device called a driver. If the ECM detects the desired camshaft position and the actual camshaft position angles are not within a calibrated value, this DTC sets.

## DTC Descriptors

This diagnostic procedure supports the following DTCs.

- DTC P0011 Intake Camshaft Position (CMP) System Performance Bank 1
- DTC P0014 Exhaust Camshaft Position (CMP) System Performance Bank 1
- DTC P0021 Intake Camshaft Position (CMP) System Performance Bank 2
- DTC P0024 Exhaust Camshaft Position (CMP) System Performance Bank 2

## Conditions for Running the DTC

- Before the ECM can report DTC P0011, P0014, P0021, or P0024 failed, DTCs P0010, P0013, P0020, P0023, P0342, P0343, P0347, P0348, P0367, P0368, P0392, P0393, P2088, P2089, P2090, P2091, P2092, P2093, P2094, and P2095 must run and pass.
- The engine must accelerate such that the CMP actuator system is commanded from the park position to the phased position. This is considered a cam control cycle. There must be a total of 5 cam control

cycles for at least 10 seconds each in the phased position.

- The engine speed is more than 1,000 RPM.
- The engine is operating for approximately 5 minutes.
- DTCs P0011, P0014, P0021, and P0024 run continuously once the above conditions are met for more than 1 second.

## Conditions for Setting the DTC

- The ECM detects the difference between the desired camshaft position and the actual camshaft position angles is more than 5 degrees. OR The ECM detects the difference between the actual camshaft angle and the locked position angle is more than 1 degree.
- The condition exists for more than 7 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 4 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

- Use the J 35616-C Connector Test Adapter Kit for any test that requires probing the ECM harness connector or a component harness connector.
- The lower connector of the ECM is connector C1 and the upper connector

of the ECM is connector C2. Refer to Engine Controls Component Views on page 6-1209.

- The engine oil condition has a major impact on the camshaft actuator system.
- A low oil level condition may set this DTC. The engine may require an oil change. Inquire with the customer when the last oil change was performed. You may also monitor the Engine Oil Life parameter with a scan tool. Advise the customer an oil change may be required.
- Inspect the engine for any recent engine mechanical repairs. An incorrectly installed camshaft, camshaft actuator, or timing chain can cause this DTC to set.
- For an intermittent condition, refer to Intermittent Conditions on page 6-1587.

## Test Description

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

2. This step determines if there is a condition with the CMP actuator system.
6. This step is testing the ignition 1 voltage circuit of the CMP actuator solenoid for high resistance. If the voltage at the test lamp probe is not B+, there is a high resistance condition with the circuit.
7. This step is testing the control circuit of the CMP actuator solenoid for high resistance. If the voltage at the test lamp probe is not less than the specified voltage, there is a high resistance condition with the circuit.
11. This step isolates the condition. If the condition follows the CMP actuator solenoid, there is a condition with the solenoid.

## DTC P0011, P0014, P0021, or P0024

Step	Action	Values	Yes	No
<b>Schematic Reference: Engine Controls Schematics on page 6-1196</b> <b>Connector End View Reference: Engine Control Module (ECM) Connector End Views on page 6-1220 or Engine Controls Connector End Views on page 6-1223</b>				
1	Did you perform the Diagnostic System Check–Engine Controls?	—	Go to Step 2	Go to Diagnostic System Check–Engine Controls

Step	Action	Values	Yes	No
2	<p><b>Important: The engine oil level and the oil pressure are critical to the correct operation of the Camshaft Position (CMP) Actuator System.</b></p> <p>Verify that the engine has the correct oil level and the correct oil pressure before continuing with this diagnostic. Refer to Fluid and Lubricant Recommendations on page 0-39 in Maintenance and Lubrication and Oil Pressure Diagnosis and Testing on page 6-77 in Engine Mechanical – 3.6L (LY7) for more information.</p> <ol style="list-style-type: none"> <li>1. Start the engine.</li> <li>2. Allow the engine to reach the normal operating temperature.</li> <li>3. Increase the engine speed to 1,500 RPM.</li> <li>4. Observe the appropriate CMP Angle parameter with a scan tool.</li> </ol> <p>Is the angle at the specified value?</p>	0.0°	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> <li>1. Observe the Freeze Frame/Failure Records for this DTC.</li> <li>2. Turn OFF the ignition for 30 seconds.</li> <li>3. Start the engine.</li> <li>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.</li> </ol> <p>Did the DTC fail this ignition?</p>	—	Go to Step 4	Go to Diagnostic Aids

Step	Action	Values	Yes	No
4	1. Allow the engine to idle. 2. Observe the DTC Information with a scan tool. Does the scan tool display that DTC P0016, P0017, P0018, P0019, P0335, P0336, P0338, P0341, P0342, P0343, P0346, P0347, P0348, P0366, P0367, P0368, P0391, P0392, P0393, P0521, P0522, or P0523 failed this ignition?	—	Go to Diagnostic Trouble Code (DTC) List on page 6-1246	Go to Step 5
5	1. Turn OFF the ignition. 2. Disconnect the CMP actuator solenoid. Refer to the appropriate procedure: <ul style="list-style-type: none"> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 1 (Right) Intake</li> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 1 (Right) Exhaust</li> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 2 (Left) Intake</li> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 2 (Left) Exhaust.</li> </ul> Measure the resistance of the camshaft actuator solenoid with a DMM. Is the resistance within the specified range?	7.0–7.6 W	Go to Step 6	Go to Step 14

Step	Action	Values	Yes	No
6	<p>1. Turn ON the ignition, with the engine OFF. Important: Use the J 35616-200 Test Lamp Kit for this test. If the J 35616-200 is not available, use a test lamp that measures more than 20 ohms.</p> <p>2. Connect a test lamp between the ignition 1 voltage circuit of the CMP actuator solenoid and the engine control module (ECM) housing.</p> <p>3. Measure the voltage between the probe of the test lamp and the ECM housing with a DMM. Refer to Measuring Voltage Drop in Wiring Systems. Is the voltage at the specified value?</p> <p>Important: Use the J 35616-200 Test Lamp Kit for this test. If the J 35616-200 is not available, use a test lamp that measures more than 20 ohms.</p>	B+	Go to Step 7	Go to Step 13

Step	Action	Values	Yes	No
7	<ol style="list-style-type: none"> <li>1. Connect a test lamp between the control circuit of the CMP actuator and battery positive.</li> <li>2. Start the engine.</li> <li>3. Command the appropriate CMP actuator solenoid from 0 to 40 degrees with a scan tool. Important: The voltage must be measured at the control side of the circuit.</li> <li>4. Measure the voltage between the probe of the test lamp and the ECM housing with a DMM. Refer to Measuring Voltage Drop on page 8-1186 in Wiring Systems.</li> <li>5. Observe the voltage on the DMM while the CMP actuator solenoid is commanded ON.</li> <li>6. Exit the CMP actuator solenoid output control. Important: The ignition must be turned OFF or the CMP actuator may not operate correctly after using the output control.</li> <li>7. Turn OFF the ignition. Is the voltage less than the specified value when commanded with a scan tool?</li> </ol>	1.0 V	Go to Step 9	Go to Step 8
8	<p>Test the control circuit of the CMP actuator solenoid for high resistance. Refer to Circuit Testing and Wiring Repairs in Wiring Systems.</p> <p>Did you find and correct the condition?</p>	—	Go to Step 17	Go to Step 12
9	<p>Test for an intermittent and for a poor connection at the CMP actuator solenoid. Refer to Testing for Intermittent and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?</p>	—	Go to Step 17	Go to Step 10

Step	Action	Values	Yes	No
10	<p>1. Remove the CMP actuator solenoid.</p> <p>2. Inspect the CMP actuator solenoid and mounting area for the following conditions:</p> <ul style="list-style-type: none"> <li>• For a torn, restricted, mis-positioned, or missing screens at the CMP actuator solenoid</li> <li>• For engine oil leaks between the oil sealing lands of the CMP actuator solenoid—Inspect the lands of the CMP actuator solenoid for nicks.</li> <li>• For oil seepage at the CMP actuator solenoid connector</li> </ul> <p>Did you find a condition with the CMP actuator solenoid?</p>	—	Go to Step 14	Go to Step 11
11	<p>1. Swap the suspected CMP actuator solenoid with a CMP actuator solenoid that is operating correctly.</p> <p>2. Start the engine.</p> <p>3. Allow the engine to reach the normal operating temperature.</p> <p>4. Increase the engine speed to 1,500 RPM.</p> <p>5. Observe the appropriate CMP Angle parameter with a scan tool.</p> <p>Is the angle at the specified value?</p>	0.0°	Go to Step 16	Go to Step 14
12	<p>Test for an intermittent and for a poor connection at the ECM. Refer to Testing for Intermittent and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?</p>	—	Go to Step 17	Go to Step 15
13	<p>Repair the high resistance in the ignition 1 voltage circuit of the CMP actuator solenoid. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you complete the repair?</p>	—	Go to Step 17	—



Step	Action	Values	Yes	No
14	<p>Replace the CMP actuator solenoid. Refer to the appropriate procedure:</p> <ul style="list-style-type: none"> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 1 (Right) Intake</li> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 1 (Right) Exhaust</li> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 2 (Left) Intake</li> <li>• Camshaft Position (CMP) Actuator Solenoid Replacement -Bank 2 (Left) Exhaust on page 6-1725 Did you complete the replacement?</li> </ul>	—	Go to Step 17	—
15	<p>Replace the ECM. Refer to Engine Control Module (ECM) Replacement on page 6-1648. Did you complete the replacement?</p>	—	Go to Step 17	—
16	<p>Replace the CMP actuator. Refer to the appropriate procedure:</p> <ul style="list-style-type: none"> <li>• Camshaft Position (CMP) Actuator Replacement -Bank 1 (Right) Intake on page 6-149 in Engine Mechanical – 3.6L (LY7)</li> <li>• Camshaft Position (CMP) Actuator Replacement -Bank 1 (Right) Exhaust on page 6-148 in Engine Mechanical – 3.6L (LY7)</li> <li>• Camshaft Position (CMP) Actuator Replacement -Bank 2 (Left) Intake on page 6-148 in Engine Mechanical – 3.6L (LY7)</li> <li>• Camshaft Position (CMP) Actuator Replacement -Bank 2 (Left) Exhaust on page 6-147 in Engine Mechanical – 3.6L (LY7)</li> </ul> <p>Did you complete the replacement?</p>	—	Go to Step 17	—

Step	Action	Values	Yes	No
17	<p>1. Clear the DTCs with a scan tool.</p> <p>2. Turn OFF the ignition for 30 seconds.</p> <p>3. Start the engine.</p> <p>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.</p> <p>Did the DTC fail this ignition?</p>	—	Go to Step 2	Go to Step 18
18	<p>Observe the Capture Info with a scan tool.</p> <p>Are there any DTCs that have not been diagnosed?</p>	—	Go to Diagnostic Trouble Code (DTC) List	System OK

LAUNCH