P0016-CRANKSHAFT/CAMSHAFT TIMING MISALIGNMENT

For a complete wiring diagram Refer to the Wiring Information.

- **When Monitored:**
  
  With the engine speed between 480 and 6816 RPM and no CMP or CKP sensor DTCs detected.

- **Set Condition:**
Powertrain Control Module detects an error when the camshaft position is out of phase with the crankshaft position. One Trip Fault. Three good trips to turn off the MIL.

### Possible Causes

<table>
<thead>
<tr>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERRATIC CAM POSITION SENSOR SIGNAL</td>
</tr>
<tr>
<td>CAMSHAFT POSITION SENSOR TONE WHEEL/PULSE RING</td>
</tr>
<tr>
<td>ERRATIC CRANKSHAFT POSITION SENSOR SIGNAL</td>
</tr>
<tr>
<td>CRANKSHAFT POSITION SENSOR TONE WHEEL/PULSE RING</td>
</tr>
<tr>
<td>TIMING SPROCKET ALIGNMENT</td>
</tr>
<tr>
<td>CAMSHAFT POSITION SENSOR</td>
</tr>
<tr>
<td>CRANKSHAFT POSITION SENSOR</td>
</tr>
</tbody>
</table>

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

1. **ACTIVE DTC**
   1. Turn the ignition on.
   2. With the scan tool select View DTCs.
   3. Record the related Freeze Frame data.
   4. With the scan tool clear DTCs.
   5. Start the engine and allow it to reach operating temperature.

**WARNING:** When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

6. With the scan tool select View DTCs.

**NOTE:** If the DTC does not reset it may be necessary to test drive the vehicle.

**Is the DTC Active at this time?**

**Yes**  
• Go To 2

**No**  
• Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

2. **CAMSHAFT POSITION SENSOR CIRCUIT WIRING OR CONNECTORS**
   1. Turn the ignition off.
   2. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).
   3. Look for any chafed, pierced, pinched, or partially broken wires.
   4. Look for broken, bent, pushed out or corroded terminals.
   5. Inspect the Camshaft Position Sensor for conditions such as loose mounting screws, damage, or cracks.
Were any problems found?

Yes
  • Repair as necessary.
  • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No  • Go To 3

3. CAMSHAFT POSITION SENSOR CIRCUIT WIRING OR CONNECTORS
1. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).
2. Look for any chafed, pierced, pinched, or partially broken wires.
3. Look for broken, bent, pushed out or corroded terminals.
4. Inspect the Camshaft Position Sensor for conditions such as loose mounting screws, damage, or cracks.

Were any problems found?

Yes
  • Repair as necessary.
  • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No  • Go To 4

4. CRANKSHAFT, TONE WHEEL OR FLEX PLATE
1. Turn the ignition off.
2. Remove the Crankshaft Position Sensor.
3. Inspect the Crankshaft Position Sensor and mounting area for any condition that would result in an incorrect signal, such as damage, evidence of foreign material, or excessive movement.

Were any problems found?

Yes
  • Repair as necessary in accordance with the Service Information.
  • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No  • Go To 5

5. CAMSHAFT, TONE WHEEL OR PULSE RING
1. Turn the ignition off.
2. Remove the Camshaft Position Sensor.
3. Inspect the Camshaft Position Sensor and mounting area for any condition that would result in an incorrect signal, such as damage, evidence of foreign material, or excessive movement.

Were any problems found?

Yes
  • Repair as necessary in accordance with the Service Information.
  • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).
6.  TIMING SPROCKET ALIGNMENT
1. Turn the ignition off.
2. Verify proper timing sprocket alignment in accordance with the Service Information.

Were any problems found?

Yes  •  Repair as necessary in accordance with the Service Information.
      •  Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No  •  Go To  7

7.  CAMSHAFT POSITION SENSOR IRREGULAR SIGNAL
1. Turn the ignition off.
2. Install any previously removed components. Connect all connectors.
3. Using a lab scope and the Miller special tool # 6801, backprobe the (K44) CMP Signal circuit in the Camshaft Position Sensor harness connector.
4. Turn the ignition on.
5. Wiggle the related wire harness and lightly tap on the Camshaft Position Sensor while monitoring the lab scope screen.
6. Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

7. Monitor the Camshaft Position Sensor signal on the lab scope screen.

Were any Camshaft Position Sensor signals irregular or missing?

Yes  •  Go To  9

No  •  Go To  8

8.  CRANKSHAFT POSITION SENSOR IRREGULAR SIGNAL
1. Turn the ignition off.
2. Using a lab scope and the Miller special tool # 6801, backprobe the (K24) CKP Signal circuit in the Crankshaft Position Sensor harness connector.
3. Turn the ignition on.
4. Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor while monitoring the lab scope screen.
5. Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

Were any Crankshaft Position Sensor signals irregular or missing?

Yes     • Go To  10

No      • Go To  11

9.  CAMSHAFT POSITION SENSOR
1. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).
2. Look for any chafed, pierced, pinched, or partially broken wires.
3. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes     • Repair as necessary.
         • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No      • Replace the Camshaft Position Sensor in accordance with the Service Information.
         • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

10. CRANKSHAFT POSITION SENSOR
1. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Crankshaft Position Sensor and the Powertrain Control Module (PCM).
2. Look for any chafed, pierced, pinched, or partially broken wires.
3. Look for broken, bent, pushed out or corroded terminals.

Were any problems found?

Yes     • Repair as necessary.
         • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No      • Replace the Crankshaft Position Sensor in accordance with the Service Information.
         • Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

11. POWERTRAIN CONTROL MODULE (PCM)
1. Ignition on, engine not running.
2. With the scan tool clear DTCs.
3. Start the engine.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

4. Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.
5. Turn the ignition off.
6. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM) and between the Camshaft Position Sensor and the Powertrain Control Module (PCM).

7. Look for any chafed, pierced, pinched, or partially broken wires.

8. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the Sensor and Control Module connectors.

9. Look for the data to change or for the DTC to reset during the wiggle test.

10. Refer to any Technical Service Bulletins that may apply.

**Were any problems found?**

**Yes**
- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

**No**
- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).