28 - DTC-Based Diagnostics / MODULE, Powertrain Control (PCM), 3.6L / Diagnosis and Testing

P0306-CYLINDER 6 MISFIRE

Special Tools: Click to display a list of tools used in this procedure

Theory of Operation

The PCM uses the Crankshaft Position (CKP) Sensor to detect and monitor the Crankshaft rotational speed. Normally, the Crankshaft rotational speed is fairly stable from cylinder to cylinder. When a misfire occurs in a cylinder, the Crankshaft speed changes abruptly for that cylinder. Therefore, anything that causes a sudden change in Crankshaft speed detected for a single cylinder is determined to be an engine misfire event. A misfire fault will usually occur due to poor fuel quality or metering, lack of spark, engine timing, low engine compression due to engine mechanical or valvetrain issues, a vacuum leak or coolant leak entering the engine intake air system. Though not as common, other factors such as severe wheel balance or braking vibration, a worn serpentine belt or belt driven accessory binding should also be considered when diagnosing a misfire fault.

Depending on the engine involved, there can be several systems and components that can contribute to a misfire. **In many cases, but not always, there will be other DTCs set related to these systems. If that is the case, the focus should be on following the diagnostics for the system that has DTCs set against it.** The different components or systems will affect misfire in different ways. Factors to consider when diagnosing a misfire are whether the misfire is a single cylinder or multiple cylinder misfire, and when does the misfire occur (idle, vehicle and engine speed, heavy engine load conditions, etc.). These factors can help in determining what components or systems should be focused on during diagnostics. **Typically a multiple cylinder misfire is an indication of timing, oil or coolant consumption, air handling, fuel supply or poor fuel quality issue that can affect multiple cylinders and not a single cylinder component such as a Fuel Injector, Ignition Coil or Spark Plug.**

NOTE: The effects that the components and systems have on misfire detection are described in more detail in the individual test steps below.

When Monitored and Set Conditions

When Monitored: This diagnostic runs continuously when the following conditions are met:

- Fuel level above 12%.
- Battery voltage above 10.9 volts.
- The adaptive numerator has been successfully learned.
- Ambient temperature above -23°C (-9.4°F).
- Coolant temperature at engine start is above -7°C (19.4°F). If start engine temperature is below threshold, enable monitor when engine temperature reaches 21°C (69.8°F).
- Engine speed between approximately 400 rpm and 6200 rpm.
    - Misfire monitor is disabled during a Decel Fuel Shutoff Event (DFSO).

Set Conditions:

- The variation in crankshaft speed between cylinders exceeds a calibrated value, based on engine speed and load.

Default Actions:

- The MIL light will illuminate or flash depending on severity of the misfire.
- During a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. When the engine rev counter has reached the calculated threshold the Fuel Injector is turned back on. If a misfire is still occurring, the injector is disabled again. This cycle will continue until the misfire has stopped.
- If the vehicle is equipped with the stop/start feature, the system will be disabled when this DTC is active.

Possible Causes
ENGINE VACUUM LEAK
EXCESSIVE CARBON BUILD-UP IN CYLINDER HEAD OR COMBUSTION CHAMBER
FAULTY FUEL INJECTOR
POOR FUEL QUALITY OR HIGH ETHANOL LEVEL
CRANKSHAFT POSITION SENSOR (CKP) OR TONE WHEEL ISSUES
FAULTY IGNITION COIL OR SPARK PLUG
COOLANT LEAKING INTO A CYLINDER
FAULTY CYLINDER HEAD GASKET
ENGINE MECHANICAL/LOW COMPRESSION
WORN CAMSHAFT LOBES, SPRINGS OR ROCKER ARMS
POWERTRAIN CONTROL MODULE (PCM)

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

1. CHECK FOR AN ACTIVE CONDITION

1. Turn the ignition on.
2. With the scan tool, read and record all DTCs and Freeze Frame information.
3. Operate the vehicle under conditions recorded in the Freeze Frame information when the DTC was set.

NOTE: During the test drive of the vehicle, note when the misfire condition is present for use later in this diagnostic test. Also monitor the Downstream O2 Sensor(s) when the misfire is occurring. O2 Sensor voltage readings that are consistently on the low side of the scale would indicate a lean condition. This could indicate a lack of fuel due to a plugged Fuel Injector or fuel system issue. O2 Sensor voltage readings that are consistently on the high side of the scale would indicate a rich condition. This could be caused by a lack of spark or a possible leaky Fuel Injector.

NOTE: Keep in mind that during a severe misfire (MIL Light flashing) the PCM will disable the Fuel Injector of the affected cylinder(s) for a calibrated number of engine revolutions to prevent damage to the Catalytic Converter. This can cause a misfire that occurs only at high engine speed or heavy engine load to appear to continue when returning to idle. However this could be due to the Fuel Injector being disabled until the rev counter resets.

4. With the scan tool, view the Misfire Monitor to see which cylinders are effected.

Are there excessive misfires shown for this cylinder at this time?

Yes

- Go To **2**

No

- Perform the INTERMITTENT CONDITION diagnostic procedure. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

2. CHECK FOR OTHER DTCS

1. Refer to the recorded DTCs.

Are there any Service Bulletins or fuel system, ignition system component, air handling component, or VVT system DTCs active or pending?

Yes

- Perform the applicable diagnostic procedure(s). (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) /Diagnosis and Testing).

No

- Go To **3**

3. CHECK FOR MECHANICAL CONDITIONS THAT COULD CAUSE A MISFIRE

NOTE: Each of the following conditions can cause a misfire during most operating conditions with the exception of the out of balance tires or warped brake rotors.

1. Visually inspect the engine for any of the following conditions:

    - Worn, loose or slipping serpentine belt.
    - Binding or misaligned engine driven accessories: A/C Compressor, P/S Pump, Water pump, etc.
    - Improper mounting of the CKP Sensor or damaged target wheel.
    - Harmonic Balancer out of balance.
    - Extremely out of balance tires or warped brake rotors.

Were any of the above conditions present?

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. CHECK THE ENGINE OIL LEVEL AND CONDITION

NOTE: The oil level being low or the wrong oil filter or viscosity being used can cause Variable Valve Timing system operating issues. This could lead to a misfire condition.

NOTE: The following items should be checked before continuing with this procedure. Failure to do so may lead to misdiagnosis.

- **ENGINE MECHANICAL TOLERANCES OUT OF SPECIFICATION**
- **ENGINE OIL PRESSURE OUT OF SPECIFICATION**
- **LOW ENGINE OIL LEVEL**
- **INCORRECT ENGINE OIL FILTER (DOES NOT MEET OEM SPECIFICATIONS)**
- **DETERIORATED OR DIRTY OIL**
- **CONTAMINATED ENGINE OIL**
- **INCORRECT ENGINE OIL VISCOSITY**
- **AERATED ENGINE OIL**

1. If any of the above conditions are found, repair as necessary.

Were any of the above conditions present?

Yes

- Repair the engine oiling or mechanical condition (i.e. improper oil drain back, oil sludge, damaged oil pump, pick-up tube or seal, etc.).
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- Go To **5**

5. CHECK THE INTAKE SYSTEM FOR LEAKS

1. Check the engine and Intake Manifold for vacuum leaks.

NOTE: A vacuum leak can affect one or more cylinders depending on the location of the leak.

Were any leaks found with the intake system?

Yes

- Repair the leak in the intake system.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- Go To **6**

6. CHECK THE FUEL QUALITY

1. Check the fuel for the following:
    - Water in fuel
    - Correct type of fuel
    - Old or contaminated fuel

- Low fuel
- Perform the CHECK FOR PROPER ETHANOL LEVEL IN THE GASOLINE procedure. (Refer to 29 - Non-DTC Diagnostics/Drivability - Gas/Diagnosis and Testing) .

Were any problems found with the fuel?

Yes

- Replace the fuel and, if necessary, flush and clean the fuel system.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) /Standard Procedure).

No

- Go To **7**

7. CHECK FOR A CLOGGED OR LEAKING FUEL INJECTOR

NOTE: A Fuel Injector that is plugged and spraying too little fuel, or fouled and spraying too much fuel, will generally cause a misfire during any operating condition. One faulty Fuel Injector will usually cause a single cylinder misfire. However if the injector is spraying an excessive amount of fuel, the excess fuel could also affect the adjoining cylinders. In most cases there will be far more misfire counts on the cylinder with the faulty Fuel Injector than on the other affected cylinders.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.

1. Install the Fuel Pressure Decay Tester 8978A to the fuel rail.
2. Turn the ignition on and allow the fuel pressure to reach maximum pressure and stabilize.

NOTE: The ignition may need to be cycled off and on a couple times to reach maximum fuel pressure in the rail.

3. Once the pressure reading has stabilized, record the fuel pressure. This is known as the “starting pressure”.
4. With the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire while monitoring the fuel pressure gauge.
5. Record the fuel pressure. This is known as the “ending pressure.”

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

6. Repeat sub-steps two through five with several other Fuel Injectors on cylinders that do not have a misfire. Make sure

to start the Fuel Injector actuation at the same starting pressure for each injector. Compare the ending pressures of the known good cylinders to the cylinder with the misfire condition.

Are the ending pressures about the same for all of the tested injectors?

Yes

- Go To **8**

No, the injector from the cylinder with the misfire stood out from the rest.

- If the pressure drop is too small, check for debris in the Fuel Rail or Fuel Injector and repair as necessary. If the pressure drop is too large, suspect a faulty or fouled Fuel Injector as the issue.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

8. CHECK FOR PROPER SPARK AT THE IGNITION COIL

1. Turn the ignition off and remove the Fuel Pressure Decay Tester and connect the fuel lines before continuing.

NOTE: A faulty Ignition Coil or Spark Plug can cause a misfire at idle but could also misfire only under a heavy load on the engine. One faulty Ignition Coil or Spark Plug will usually cause a single cylinder misfire.

2. Remove the Ignition Coil from the cylinder that is misfiring.
3. Connect the Ignition Coil harness connector.
4. Disconnect the Fuel Injector harness connector of the cylinder being tested.
5. Install a spark tester on the Ignition Coil.
6. While cranking the engine observe the spark coming from the spark tester.

Is a crisp blue spark present?

Yes

- Go To **9**

No

- Go To **14**

9. INSPECT THE SPARK PLUG AND CYLINDER

1. Turn the ignition off.
2. Remove the Spark Plug in accordance with the Service Information.
3. Inspect the Spark Plug for the following conditions:
    - Cracks
    - Carbon Tracking
    - Fouling due to oil, coolant or excess fuel in the cylinder
    - Gap size out of specifications
    - Loose or broken electrode
4. Check for signs of oil or coolant in the cylinder.

Were any of the above conditions present?

Yes

- Replace the Spark Plug. If oil or coolant were found in the cylinder or on the Spark Plug, diagnose and repair the cause.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- Go To **10**

10. CHECK THE ENGINE COMPRESSION TO CHECK FOR VALVETRAIN OR COMBUSTION CHAMBER ISSUES

NOTE: A cylinder compression or valvetrain issue will cause a misfire during all operating conditions. These types of failures will normally affect a single cylinder. However, depending on the type of failure incurred, other cylinders can also be affected and show misfires. In most cases there will be far more misfire counts on the cylinder with the issue than on the other affected cylinders.

1. Perform a cylinder compression test on several cylinders and compare the known good cylinders to the cylinder that was misfiring. (Refer to 09 - Engine/Diagnosis and Testing) .

Is the cylinder compression within specification?

Yes

- Go To **11**

No

- Perform a Cylinder Leak Down Test to determine if the cause is from the valvetrain or combustion chamber and repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

11. EXCHANGE SPARK PLUG AND CHECK FOR MISFIRE TO FOLLOW THE SPARK PLUG

1. Exchange the Spark Plug with a known good cylinder that was not indicating a misfire or replace the Spark Plug if it is difficult to access.
2. Start the engine and monitor the misfire monitor screen.

Did the misfire switch to the previously good cylinder or go away if the Spark Plug was replaced?

Yes

- Repair is complete if Spark Plug was replaced and misfire is gone, or replace the Spark Plug if it moved to the known good cylinder.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- Go To **12**

12. CLEAN THE CARBON FROM THE VALVETRAIN AND COMBUSTION CHAMBERS

NOTE: Carbon build up on the engine valves and guides can cause a misfire during all operating conditions but is usually more noticeable during cruising speeds or heavy engine load conditions. If carbon build up is becoming an issue it could set only a single cylinder misfire but usually will affect more than one cylinder and set multiple cylinder misfire as well.

1. Using Mopar Combustion cleaner, de-carbon the engine.
2. After driving and clearing the combustion cleaner from the engine, erase DTCs with the scan tool.
3. Test drive the vehicle in accordance with the Freeze Frame data.
4. With the scan tool, view the Misfire Monitor.

Did the misfire return?

Yes

- Go To **13**

No

- Cleaning the valves and combustion chambers repaired the fault.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

13. CHECK THE CAMSHAFT LOBES, ROCKER ARMS AND SPRINGS

NOTE: Worn Camshaft Lobes, worn or broken Rocker Arms or springs may sometimes but not always be detected during a compression test. The misfire can occur at different operating conditions depending on which component is worn and the severity of the wear on the component.

1. Visually inspect the Camshaft, Rocker Arms or springs for excessive wear or broken parts.

Were any issues found with the Camshaft, Rocker Arms or springs?

Yes

- Perform the appropriate repair 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 **18**

14. CHECK THE ASD RELAY (F344) OUTPUT CIRCUIT

1. Turn the ignition off.
2. Disconnect the Ignition Coil harness connector.
3. Turn the ignition on.
4. With a scan tool, actuate the ASD Relay.
5. Using a 12-volt test light connected to ground, probe the ASD Relay (F344) Output circuit at the Ignition Coil harness connector.

Does the test light illuminate brightly?

Yes

- Go To **15**

No

- Stop all scan tool actuations and repair the open or short to ground in the ASD Relay (F344) Output circuit between the PDC and Ignition Coil harness connector.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

15. CHECK THE IGNITION COIL CONTROL CIRCUIT

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.

1. Using a 12-volt test light connected to a 12 volt source, back probe the Coil Control circuit at the Ignition Coil harness connector.
2. Crank the engine for 5 seconds while observing the test light.

What was the condition of the test light while cranking the engine?

Blinking brightly

- Replace the Ignition Coil in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

ON constantly

- Go To **16**

OFF constantly

- Go To **17**

16. CHECK THE COIL CONTROL CIRCUIT FOR A SHORT TO GROUND

1. Turn the ignition off.

2. Disconnect the PCM C2 harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.

3. Connect the Adapter, GPEC Diagnostic 10436 to the engine harness side of the PCM C2 harness connector.
4. Check for continuity between ground and the Coil Control circuit at the Ignition Coil harness connector.

Is there continuity between ground and the Coil Control circuit?

Yes

- Repair the Coil Control circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- Go To **18**

17. CHECK THE COIL CONTROL CIRCUIT FOR AN OPEN

1. Turn the ignition off.
2. Measure the resistance of the Coil Control circuit between the Ignition Coil harness connector and the GPEC Adaptor.

Is the resistance below 3.0 Ohms?

Yes

- Go To **18**

No

- Repair the Coil Control circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

18. CHECK RELATED PCM AND COMPONENT HARNESS CONNECTIONS

1. Disconnect all PCM harness connectors.
2. Disconnect all related in-line harness connections (if equipped).
3. Disconnect the related component harness connectors.
4. Inspect harness connectors, component connectors, and all male and female terminals for the following conditions:

    - Proper connector installation.
    - Damaged connector locks.
    - Corrosion.
    - Other signs of water intrusion.
    - Weather seal damage (if equipped).
    - Bent terminals.
    - Overheating due to a poor connection (terminal may be discolored due to excessive current draw).
    - Terminals that have been pushed back into the connector cavity.
    - Check for spread terminals and verify proper terminal tension.

    Repair any conditions that are found.
5. Connect all PCM harness connectors. Be certain that all harness connectors are fully seated and the connector locks are fully engaged.
6. Connect all in-line harness connectors (if equipped). Be certain that all connectors are fully seated and the connector locks are fully engaged.
7. Connect all related component harness connectors. Be certain that all connectors are fully seated and the connector locks are fully engaged.
8. With the scan tool, erase DTCs.
9. Test drive or operate the vehicle in accordance with the when monitored and set conditions.
10. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. (Refer to 08 - Electrical/8E - Electronic Control Modules/MODULE, Powertrain Control/Removal) .
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- The wiring or poor connection problem has been repaired.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).