P06DD-00-ENGINE OIL PRESSURE CONTROL CIRCUIT PERFORMANCE/STUCK OFF

For a complete INTAKE AIR SYSTEM wiring diagram, **(refer to the Wiring Information)**.

Theory of Operation

The Dual Stage Engine Oil Pump uses vanes and a moving element that is controlled by an solenoid to produce oil pressure to the engine in two regulated pressure stages (Low/High). In low pressure mode, the oil pressure will increase naturally with engine speed. When switched to high pressure mode the oil pressure is increased and is fairly steady. The Oil Pump Solenoid, mounted on the pump, is used to vary the displacement of the oil pump. The Powertrain Control Module (PCM) controls the solenoid operation. When the solenoid is energized, a bypass oil circuit is opened. This changes the eccentricity of the mechanical pump and lowers the oil pressure. The Engine Oil Pump is operated in low mode during most operating conditions to reduce engine load, increasing the efficiency of the engine. The pump is switched to high mode when engine operating conditions require a higher oil pressure. This is achieved by de-energizing the solenoid.

The minimum engine oil pressure is 80 kPa (11.6 psi) actual gauge pressure, or 180 kPa (26.1 psi) as displayed by the scan tool. for any operating condition. Anything less than this pressure could result in damage to critical moving parts. The maximum engine oil pressure is limited to 1000 kPa (145 psi) by the pressure relief valve. The oil pressure in the main oil galley of the engine can be checked by monitoring the Engine Oil Pressure (EOP) Sensor on the scan tool or using a mechanical oil pressure gauge.

COMPONENT FUNCTIONAL DESCRIPTION - OIL PUMP SOLENOID

The mechanical Engine Oil Pump operates in two pressure modes described below. The Powertrain Control Module (PCM) switches the pump between modes based on the oil temperature, coolant temperature, and engine operating conditions.

- **Low Mode:** To operate the pump in low mode the PCM commands the High Side Driver (HSD) control on, energizing the Oil Pump Solenoid. The Engine Oil Pump is operated in low mode between idle and approximately 2800 RPM.
- **High Mode:** To operate the pump in high mode the PCM commands the HSD control off, de-energizing the Oil Pump Solenoid. The PCM will typically switch the pump from low to high mode when the engine speed increases over approximately 2800 to 3000 RPM.

See the oil pressure specifications in the table below:

2.0L GMET 4 (MULTIAIR ENGINE) OIL PRESSURE SPECIFICATIONS			
ENGINE SPEED	OIL PUMP MODE	Oil Pressure Range with Mechanical Gauge	Oil Pressure Range Displayed in WiTech
Idle Speed (750 RPM)	Low Pressure Mode (Solenoid on)	80 - 160 kPa (11.6 - 23.2 psi)	180 - 260 kPa (26.1 - 37.7 psi)
1000 RPM - 2800 RPM	Low Pressure Mode (Solenoid on)	110 - 200 kPa (16 - 29 psi)	210 - 300 kPa (30.5 - 43.5 psi)

2.0L GMET 4 (MULTIAIR ENGINE) OIL PRESSURE SPECIFICATIONS			
ENGINE SPEED	OIL PUMP MODE	Oil Pressure Range with Mechanical Gauge	Oil Pressure Range Displayed in WiTech
3000 RPM - 5800 RPM	High Pressure Mode (Solenoid off)	310 - 390 kPa (45 - 56.5 psi)	410 - 490 kPa (59.5 - 71 psi)

DIAGNOSTIC OVERVIEW - DUAL STAGE ENGINE OIL PUMP SOLENOID

The PCM performs multiple diagnostics for the Dual Stage Engine Oil Pump and solenoid. The HSD control circuit is monitored for opens and shorts. The PCM also performs diagnostics to detect if the pump is stuck in the high or low operating mode. The PCM checks the rationality of the Engine Oil Pressure Sensor before the Oil Pump Solenoid stuck on/off diagnostic runs. Typically a faulty EOP Sensor will set a fault and disable the Oil Pump Solenoid stuck on/off diagnostic.

- **Stuck off Diagnostic:** At idle, or lower engine speeds the PCM commands the Oil Pump Solenoid on (low mode) and monitors for the engine oil pressure to be too high.
- **Stuck on Diagnostic:** During higher engine speeds the PCM commands the Oil Pump Solenoid off (high mode) and monitors for the engine oil pressure to be too low.

Component or system rationality diagnostics are typically designed to detect a mechanical failure in the component (solenoid, motor, actuator) or overall system performance issue. A circuit fault against a component or sensor being used to monitor the system should be diagnosed before a rationality fault. However, do not assume that the wiring or circuits are good if you do not have a circuit fault. In some circumstances a circuit issue could also cause a rationality fault to set without a circuit fault. Rationality faults are designed to catch any failure that could be missed in other diagnostics. An example could be a small amount of resistance in the power supply, control or ground circuit to a component, usually at the harness connector terminals, that could cause a component not to energize when commanded on. In many cases a few ohms of resistance at a connector may not cause a circuit fault to set. It is always a good practice to learn and understand how the rationality checks are performed and the faults are detected. Then check the connectors and circuits for the wiring conditions that could cause that failure mode (open or shorted circuit) before replacing any components.

NOTE: Since the Engine Oil Pump operates in high mode when the solenoid is not energized (off), it is more likely for a P06DD-Engine Oil Pressure Control Circuit Stuck Off fault to set due to a wiring or connector issue on this system. The P06DD fault detects a pump stuck in high mode failure.

When Monitored and Set Conditions

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

- Battery voltage above 11.0 volts.
- The Dual Stage Oil Pump circuit fault or stuck off fault are not active.
- There are no active Engine Oil Pressure Sensor, CKP Sensor, Coolant Temperature Sensor or ASD Relay faults.
- Engine coolant temperature is above 15°C (59°F).
- Engine oil temperature is above 20°C (68°F).
- The engine speed between approximately 1500 - 5500 rpm.
- Engine running and the Oil Pump Solenoid is commanded on (Low oil pressure mode requested).

Set Conditions:

- The PCM detects that the actual oil pressure is too high with the Oil Pump Solenoid commanded on (Low pressure mode) for 20.0 seconds.

Default Actions:

- This is a non MIL fault.

Possible Causes
POOR CONNECTION AT THE OIL PUMP SOLENOID HARNESS CONNECTOR
DUAL STAGE OIL PUMP SOLENOID STUCK OFF
DUAL STAGE OIL PUMP SPOOL VALVE STUCK OR PLUGGED

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

Diagnostic Test

1. CHECK FOR ANY SERVICE BULLETINS OR PCM SOFTWARE UPDATES

1. Check for any applicable Service Bulletins or Flash updates related to the DTC.

Are there any applicable Service Bulletins or Flash updates?

Yes

- Perform the applicable repair.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- Go To **2**

2. READ AND RECORD DTCS AND ENVIRONMENTAL DATA - ERASE DTCS AND CHECK FOR THE DTC TO RETURN

1. With the scan tool, read DTCs in all Electronic Control Units (ECUs) and record on the repair order.
2. For future reference, run and save a vehicle Scan Report and all related recorded data.
3. With the scan tool, erase all DTCs.
4. Turn the ignition off for a minimum of 10.0 seconds.
5. Turn the ignition on.
6. Using the When Monitored and Set Conditions above and recorded data, operate the vehicle in the conditions that set the DTC.
7. With the scan tool, read DTCs.

Did the DTC return?

Yes

- Go To **3**

No

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

3. CHECK FOR RELATED DTCS

1. Refer to the recorded DTCs.

Are any of the following related fault codes pending, active, or stored: P0520, P0521, P0522, P0523 or P06DA?

Yes

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

No

- Go To **4**

4. CHECK THE OIL PUMP SOLENOID CONNECTOR AND TERMINALS

1. Turn the ignition off.
2. Check the Oil Pump Solenoid harness connector for proper connection at the Oil Pump Solenoid.
3. Verify that the connector is completely plugged in and properly locked prior to disconnecting.
4. Disconnect the Oil Pump Solenoid harness connector and check for any pushed out, damaged or spread terminals.

Were any issues found with the connector or terminals?

Yes

- Repair the damaged terminal or properly connect and lock the Oil Pump Solenoid harness connector and retest for DTCs.
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).

No

- Go To **5**

5. CHECK THE ENGINE FOR EXCESSIVE SLUDGE

NOTE: Verify that the engine oil is clean and that an OEM specified oil filter is being used. Review the customers oil change history to make sure that the oil is being changed at the correct intervals and that the proper oil viscosity is being used.

1. Check the engine for excessive sludge build up before performing any repairs. Excessive sludge can block the bypass in the oil pump causing the pressure to too high.

Were any of the above conditions present?

Yes

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

No

- Replace the Dual Stage Oil Pump Assembly in accordance with the Service Information. (Refer to 09 - Engine/Lubrication/PUMP, Engine Oil/Removal and Installation) .
- Perform the POWERTRAIN VERIFICATION TEST. (Refer to 28 - DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure).