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2007 GMC Truck Sierra - 2WD

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Camshaft Actuator System Description

Camshaft Position (CMP) Actuator System

The camshaft (CMP) actuator system is an electro-hydraulic operated device used for a variety of engine performance and operational enhancements. These enhancements include lower emission output through exhaust gas dilution of the intake charge in the combustion chamber, a broader engine torque range, and improved fuel economy. The CMP actuator system accomplishes this by, changing the angle or timing of the camshaft, relative to the crankshaft position. The CMP actuator simply allows earlier or later intake and exhaust valve opening, during the four stroke engine cycle. The CMP actuator cannot vary the duration of valve opening, or the valve lift.

During engine OFF, engine idling conditions, and engine shutdown, the camshaft actuator is held in the park position. Internal to the CMP actuator assembly is a return spring and a locking pin. During non-phasing modes of the camshaft, the return spring rotates the camshaft back to the park position, and the locking pin retains the CMP actuator sprocket to the camshaft. For the Gen IV small block engines, the park position for the CMP actuator and camshaft is, 8.5 degrees before top dead center (BTDC), which is equal to 17 crankshaft degrees BTDC, to the next cylinder in firing order. The engine control module (ECM) can only command the CMP actuator to retard the valve timing from the park position, or advance the valve timing back to the park position. The total range of valve timing authority is 31 degrees of camshaft rotation, which is equal to 62 degrees of crankshaft rotation. The control range is from the park position of 8.5 degrees camshaft, or 17 degrees of crankshaft BTDC, to 22.5 degrees camshaft, or 45 degrees crankshaft, after top dead center (ATDC).

CMP Actuator System Operation

The camshaft position (CMP) actuator system is controlled by the engine control module (ECM). The ECM sends a pulse width modulated, 12-volt signal to the CMP actuator solenoid to control the amount of pressurized engine oil, into the CMP actuator. A low reference circuit, or ground wire between the CMP actuator solenoid and the ECM completes the electrical circuit. The frequency of the pulse width modulated signal is fixed at 150 Hz. To regulate the pressurized engine oil into the CMP actuator, the solenoid uses electromagnetic force on the solenoid pintle to pulse the oil control spool valve. The pressurized engine oil is sent to unseat the locking pin, and to the vane and rotor assembly of the CMP actuator, to either retard or advance the valve timing. The ECM will control the amount of ON time applied to the solenoid, through the 12-volt signal from the ECM.

The ECM uses the following inputs before assuming control of the CMP actuator, and to calculate the optimum valve timing.

- Engine speed
- Manifold absolute pressure (MAP)
- Throttle position angle
- Camshaft position sensor (CMP)

- Crankshaft position sensor (CKP)
- Crankshaft/camshaft correlation
- Engine coolant temperature (ECT)
- Closed loop fuel control
- Engine oil pressure (EOP)
- Engine oil level
- CMP actuator solenoid circuit state

CMP Actuator Solenoid Circuit Diagnostics

The engine control module (ECM) monitors the control circuit of the camshaft position (CMP) actuator solenoid for electrical faults. The control module has the ability to determine if a control circuit is open, shorted high, or shorted low. If the control module detects a fault with the CMP actuator solenoid control circuit, DTC P0010 will set.

CMP Actuator System Performance Diagnostic

The engine control module (ECM) monitors the performance of the camshaft position (CMP) actuator system by monitoring the calibrated desired position, and the actual position of the camshaft, through the 4X signal of the CMP sensor. If the difference between the actual and desired position is greater than a calibrated angle, for more than a calibrated amount of time, DTC P0011 will set.

For the system descriptions covering the hydraulic/mechanical part of the CMP actuator refer to Camshaft Position Actuator and Solenoid Valve Description .

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