

2022 CHEVROLET CORVETTE SERVICE MANUAL

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Cylinder Deactivation (Active Fuel Management) System Description

To provide maximum fuel economy under light load driving conditions, the Engine Control Module (ECM) will command the cylinder deactivation system ON to deactivate engine cylinders 2, 3, 5, and 8, switching to a V4 mode. The engine will operate on 8 cylinders, or V8 mode, during engine starting, engine idling, and medium to heavy throttle applications.

The conditions listed below determine when cylinder deactivation is enabled.

- Engine has been running for greater than 30 s
- Engine speed is between 700 and 2800rpm
- Engine oil pressure is between 187 kPa (27 psi) to 455 kPa (66 psi)
- Engine coolant temperature is between 40°C (104°F) to 129°C (264°F)
- Engine oil temperature is between 16°C (61°F) to 128°C (263°F)
- Throttle angle is 6% or less
- Ignition voltage is greater than 11 V
- Transmission is not in first, second, or reverse gear
- Vehicle speed is greater than 25 kph (15.5 mph)
- Brake booster pressure is greater than 42.0 kPa (6 psi)
- Vehicle is not in fuel shut off mode
- Vehicle is not in heater performance mode
- Vehicle is not in tip in bump acceleration mode
- Vehicle is not in oil aeration mode

When cylinder deactivation is commanded, the ECM will determine what cylinder is firing and begin deactivation on the next closest deactivated cylinder in firing order sequence. Cylinder deactivation is accomplished by not allowing the intake and exhaust valves to open on the selected cylinders by using special valve lifters. The deactivation lifters contain spring loaded locking pins that connect the internal pin housing of the lifter to the outer housing.

Although both intake and exhaust valve lifters are controlled by the same Valve Rocker Arm Oil Control Valve, the intake and exhaust valves do not become deactivated at the same time. Cylinder deactivation is timed so that the cylinder is on an intake event. During an intake event, the intake cam lobe is pushing the valve lifter upwards to open the intake valve against the force of the valve spring. The force exerted by the valve spring is acting on the side of the lifter locking pins, preventing them from moving until the intake valve has closed. When the intake valve lifter reaches the base circle of the camshaft lobe, the valve spring force is reduced, allowing the locking pins to move, deactivating the intake valve. However, when cylinder deactivation is commanded ON, the exhaust valve for the deactivated cylinder is in the closed position, allowing the locking pins on the valve lifter to move immediately, and deactivate the exhaust valve.

By deactivating the exhaust valve first, this allows the capture of a burnt air/fuel charge, or exhaust gas charge, in the combustion chamber. The capture of exhaust gases in the combustion chamber will contribute to a reduction in oil consumption, noise and vibration levels, and exhaust emissions when operating in V4 mode cylinder deactivation mode.

During the transition from V8 to V4 mode, the fuel injectors will be turned OFF on the deactivated cylinders. To help prevent spark plug fouling, the ignition system secondary voltage or spark is still present across the spark plug electrodes on the deactivated cylinders. If all enabling conditions are met and maintained for cylinder deactivation operation, the ECM calibrations will limit cylinder deactivation to a cycle time of 10 minutes in V4 mode, then return to V8 mode for 1 minute.

Switching between V8 and V4 modes is accomplished in less than 250 milliseconds, making the transitions seamless and transparent to the vehicle

operator. The 250 milliseconds includes the time for the ECM to sequence the transitions, the response time for the valve lifter oil manifold solenoids to energize, and the time for the valve lifters to deactivate, all within 2 revolutions of the engine crankshaft.

Valve Lifter Oil Solenoid Valve

The cylinder deactivation system uses an electro-hydraulic actuator device called the valve lifter oil solenoid. The valve lifter oil solenoid is bolted to the top of the cylinder head valve covers. Each solenoid controls the application of engine oil pressure to the intake and exhaust valve lifters on the cylinders selected to deactivate. Engine oil pressure is routed to the valve lifter oil solenoid from an internal oil passages.

Both valve lifter oil solenoids are connected in parallel to a fused ignition 1 voltage circuit, supplied by the ignition relay. The ground or control circuit for each solenoid is connected to a low side driver internal to the Engine Control Module (ECM).

When all enabling conditions are met for cylinder deactivation, the ECM will ground each solenoid control circuit in firing order sequence, allowing current to flow through the solenoid windings. With the coil windings energized, the solenoid controls engine oil pressure through the valve lifter. When vehicle-operating conditions require a return to V8 mode, the ECM will turn OFF the control circuit for the solenoids, allowing the solenoid valves to close. With the solenoid valves closed, engine oil pressure in the control ports is exhausted through the body of the solenoids into the engine.

During service, use extreme care in keeping the valve lifter oil solenoid free of any contamination or foreign material.

Cylinder deactivation may be inhibited for many reasons including the following:

- Engine coolant temperature out of range for cylinder activation
- Engine vacuum out of range
- Brake booster vacuum out of range
- Transmission gear incorrect or shift in progress
- Accelerator pedal out of range or rate of pedal application too fast
- Engine oil pressure and temperature out of range
- Engine speed out of range
- Vehicle speed out of range
- Minimum time in V8 mode not met
- Maximum V4 mode time exceeded
- Decel fuel cutoff is active
- Reduced engine power is active
- Torque management is active
- Catalytic converter over temperature protection is active
- Piston protection is active, knock detected
- Cylinder deactivation solenoid driver circuit faults