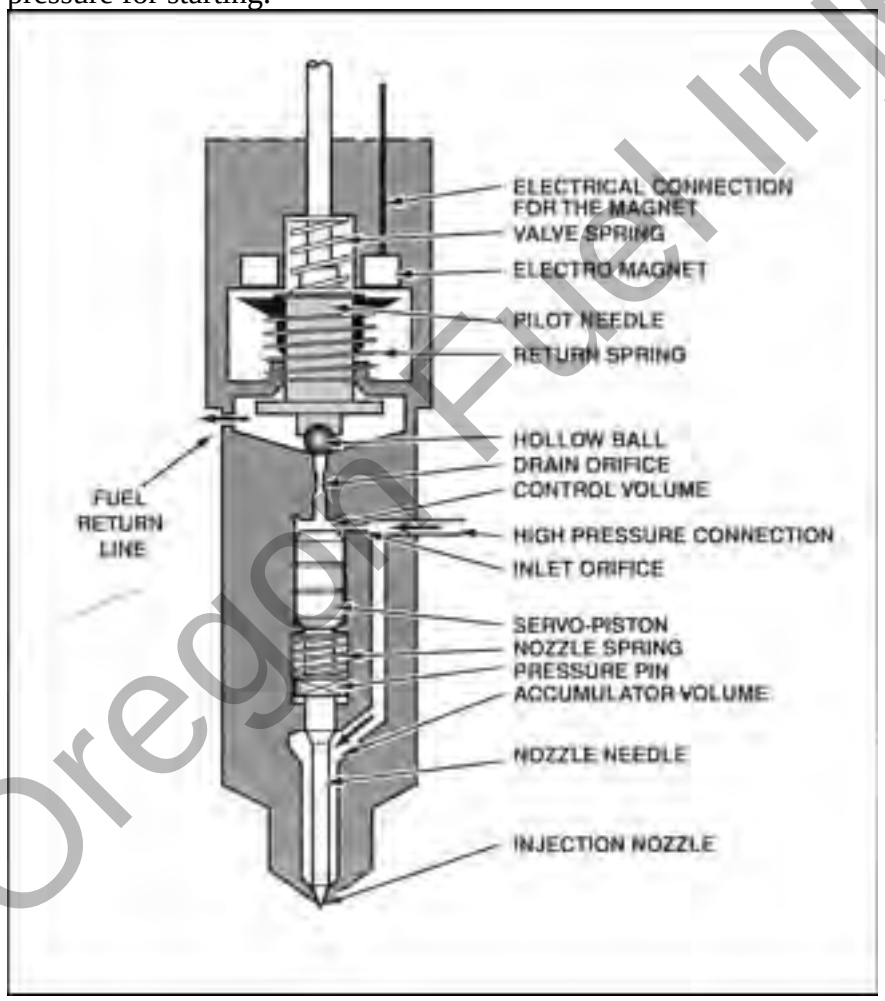
OREGON FUEL INJECTION, INC.

2013– 2017 Ram 6.7 L Diesel Diagnostics

In order to do proper diagnostics you will need a scan tool and some special tools available from Miller Special Tools http://mopar.snapon.com/ .
If you don't have service information you can buy a subscription online at alldatadiy.com or eAutorepair.net.

High Pressure Common Rail Basic Information

The high pressure pump builds the high pressure and delivers it to the fuel rail manifold where it flows through the injector lines and injector connector tubes to the injectors. The fuel pressure regulator (fuel control actuator) in the high pressure pump controls rail pressure. The injectors have a hollow check ball that holds rail pressure until the fuel solenoid is actuated by the ECM, this allows the check ball to rise off its' seat and an injection to take place. If the injector connector tubes, where they seat into the injectors, leak or the check ball in the injector is leaking or the high pressure limit valve then it will not build enough rail pressure to start the engine. It takes approximately 4000 PSI rail pressure for starting.



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https://oregonfuelinjection.com

CAUTION
The fuel system contains high pressure fuel up to 26,000 PSI. Do Not use you fingers to find leaks! High pressure fuel entering your bloodstream may result in amputation or loss of life.

Preliminary checks

1. Record and repair any active DTC, they may be related to complaint
2. Ensure that you have a good clean fuel supply and good supply pressure.
3. Check for available re-flash updates. There are several for these trucks related to common problems.

No Start or Hard Start

- Injectors are the most likely cause for hard starting and extended cranking to start due to low rail pressure. It is a good idea to check the rest of the fuel system prior to assuming the injectors are bad, however.

1. Monitor rail pressure and see if you have over 4000 PSI during cranking, if not one or more injectors can cause a hard start, see injector section for further diagnostics. No smoke from the tailpipe after about 10 seconds of cranking means no fuel is getting into the cylinders. Buy 6.7 Cummins Injectors
2. No or low fuel supply, should be 10-15 PSI at idle, to the high pressure injection pump (CP3).
3. Injector high pressure connector tube (feed tube) not seated in injector, bad tube or improper torque (final 42 ft lbs) on nut. Buy 6.7 Cummins Injectors
4. Leaking high pressure limit valve, should not leak at all, especially at idle or during cranking. Buy 6.7 Cummins Relief Valve
5. Verify CP3 pump output volume (see high pressure pump info). You can also cap off all the injectors and see how quickly the rail pressure climbs. It takes about 4000 PSI rail pressure in order to start.
6. If rail pressure is ok while cranking, check for a shorted fan clutch. Unplug fan and try starting again, possible codes P0483 or P2509.
7. A turbo that is stuck completely closed can cause a start, die, no start complaint. Remove the EGR cross over tube from the EGR valve and try to start the engine. If the engine will start and idle, he turbo is stuck closed or the exhaust system is plugged.

Black Smoke

***Smoke may not be visible on DPF equipped trucks. The exhaust may need disconnected or a test pipe temporarily installed to diagnose smoking issues.**

1. If at idle, use the scan tool to cut out one cylinder at a time and see if the smoke disappears.
2. Dirty air filter

3. Exhaust leaks or Boost leaks, you can usually hear a boost leak as a high pitched squeal under load.
4. The VGT turbo sticking open or closed will cause black smoke. Buy 6.7 Cummins VGT Turbos
5. The intake throttle plate can stick closed under some driving conditions and cause a loss of power and black smoke. This seems to be most common on deleted trucks.

Miss

1. Use scan tool to isolate one cylinder at a time.
2. A bad or incorrect torque on an injector connector tube, missing or damaged chamber gasket, low compression or excessive valve lash could all cause a miss.
3. A bad dual-mass flywheel will cause the engine to shake and feel like a miss.

Knocks

1. Use scan tool to isolate one cylinder at a time
2. Use cap off tool 9864 to block off one injector at a time.

Surge at idle

1. Low or no fuel supply pump pressure to the high pressure pump
2. Actual versus desired too far apart, map the fuel pressure graph, may be a bad FCA (fuel control actuator). If you have a fluctuation over 500 PSI this can cause a surge. Buy 6.7 Fuel Control Actuator
3. Leaking relief valves may also cause a surge at idle and erratic rail pressure readings.
4. Poor battery connections or bad batteries. May also set P2509 code.

Slow Deceleration

If the engine hangs at higher rpm or is slow to decelerate, injector wear is what normally causes this problem due to excessive return. Injectors will need to be replaced. Buy Bosch Reman 6.7 Cummins Injectors

Blue-White smoke at idle when cold

***Smoke may not be visible on DPF equipped trucks. The exhaust may need disconnected or a test pipe temporarily installed to diagnose smoking issues.**

If the smoke clears in less than 1 minute, this would be normal depending on temperature and altitude. Blue white smoke that burns your eyes, is unburnt fuel, cold temperatures, high altitude and excessive idle time all mean cold combustion.

1. Possible bad injector, leaking at the nozzle tip. Use the scan tool to kill one injector at a time to isolate. However, this does not reduce rail pressure in the injector and the tip can still leak fuel. Cap off the rail one line at a time (cap is tool number 9864) to pinpoint injector. To be certain, the injectors should be removed and tested.

2. The intake air temperature, coolant temperature, inlet air temperature and battery temperature should all display normal ambient temperatures when cold. If not, repair as necessary.
3. Check intake heater operation when cold.
4. Check rail pressure when engine is off, it should be 0 PSI (+/- 500 PSI).
5. Low or no supply pressure, supply pump or fuel filter etc.
6. Excessive idle time can cause excess particulates when cold due to carbon build up on the injector tips. This can cause DPF restriction, plugging or more frequent regeneration cycles. More than 20% idle time is excessive.
7. Low compression in one or more cylinders.

Dilution- Fuel in Engine Oil

1. Upper injector o-ring, bad or not sealing.
2. Cracked injector, remove valve cover and inspect for leaks while the engine is running. A leak will often look like a fog or haze of fuel.
3. Leak at the high pressure pump drive shaft seal.

Fuel Supply Pump

All 6.7l engines use an in tank style supply pump like the later 5.9l engines. There are also supply pumps that mount on the frame rail and replace the in tank supply pumps, such as the FASS pump. Test the supply pressure at the inlet to the CP3 pump. Normal pressure is 10 PSI at idle and they typically drop close to zero PSI under load. Zero supply pump pressure will not damage the CP3 injection pump like it does the earlier Bosch VP44 pump on the 5.9.

High Pressure Injection Pump (CP3 Pump) Buy 6.7 CP3 Pump

1. Most starting problems due to low pressure are caused by bad (eroded check ball seat) injectors. You can unplug the fuel control actuator and the pressure should default to maximum (26,107 PSI), however if there is a leak in the injection system then the pump will not build enough pressure. If there has been a major contamination issue with dirt and or water then it is very likely that the high pressure pump will need to be replaced. The injectors are typically damaged first, but any contamination that got into the injectors also went through the CP3 pump.
2. Volume test; the CP3 pump should discharge 70 ml (at 150 rpm or 90 ml at 200 rpm), from the CP3 to rail manifold fuel line, in 3 10 second cranking intervals (total of 30 seconds cranking). Remove the discharge line from the CP3 pump to test out put.
3. If the cascade over flow valve is bad this can send fuel out the return line instead of to the charging circuit of the CP3 pump, resulting in low rail pressure. Buy Cascade Overflow Valve
4. There is a return specification for the CP3- Less than 1150 ml/min at idle.

5. The CP3 injection pump used on these engines must be “phased” when installed to reduce injector cackle. There is a timing procedure in the service information.

Injectors **Buy 6.7 Ram Injectors**

It takes about 4000 PSI rail pressure in order for the injectors to deliver fuel for starting.

1. Maximum allowable leakage for all injectors combined is 160 ml per minute: check when coolant temperature is above 180 degrees, 1200 rpm and fuel rail pressure is equal to 20,305 PSI. If using a scan tool that is capable, these conditions are met using the “Fuel Pressure Override Test”.
2. Any injector contributing more than 40 ml is excessive. IE: if total leakage is 200 ml and blocking off number one injector reduces the total leakage to 160 ml, cylinder number one injector has excessive leakage and is bad. Excessive leakage from the injector is returned to the fuel tank via the fuel return system, you will not see an external leak.
3. If you have a no start condition, maximum allowable return is 90 ml per minute at 200 rpm cranking speed, be careful not to over heat the starter during testing.
4. Damaged or loose high pressure injector connectors can cause excessive leakage. Make sure the nuts are torqued to 42 ft lbs.
5. Excessive leakage usually results in a starting issue, which could occur hot or cold, but usually occurs hot because the fuel is thinner when hot.
6. The 6.7l injectors have “IQA” codes on them, which are unique to the injector and must be programmed into the ECM when they are installed. The IQA codes give the ECM specific fuel flow quantity information so it can adjust delivery in the engine accordingly. Failure to program these codes may cause injector cackle, slight rough run, or excessive emissions. Some tuners may corrupt the IQA codes, or not allow programming of them without a re-flash. If you are unable to enter the IQA codes with your scan tool, because it errors out, you may need to update the ECM to the latest programming.

Diesel Particulate Filter

The diesel particulate filter traps soot from the exhaust to lower particulate emissions. During certain driving conditions the engine will perform a regeneration cycle, which will use additional fuel injections and the catalyst to heat up the exhaust temps to the point where the soot will be burnt out and form ash. Over time the DPF will become “ash loaded” and need replaced or cleaned.

Any engine drive-ability issues or fuel system failures will cause premature plugging or failure of the DPF. If the DPF is plugging repeatedly or requiring excessive regeneration cycles there is probably another problem with the engine, fuel system, or EGR system.

1. DO NOT reset the DPF timer unless the DPF has been replaced or cleaned (removed and cleaned, not regenerated in the vehicle). The ECM keeps track of fuel used, soot, and ash load. Excess soot and ash load will result if the timer is reset without replacing or cleaning the DPF.

2. If the DPF has been deleted, customers will have run-ability issues if they do not have the correct delete software. We have also seen EGR related issues that do not set codes with delete software installed. These problems may cause heavy smoke and low power, as well as some other symptoms.
3. A plugged DPF can cause a turbo failure by forcing exhaust under excess pressure around the turbine shaft seals. Low boost/low power complaints must be diagnosed properly and completely prior to repairs!
4. Excessive idle time will also cause DPF restriction due to particulate build up at idle. This will cause poor mileage (zero MPG when idling) due to more frequent regeneration events. Excess idle time could be defined as leaving the pick up running while hooking up a trailer.
5. Using Stanadyne Performance Formula fuel additive, which improves cetane, will reduce regeneration events and improve mileage around town. This is due to a better burn when cold and fewer particulates getting to the DPF. Buy Stanadyne Performance Formula

Diesel Exhaust Fluid

Diesel exhaust fluid (DEF), AKA reductant or urea, is injected into the exhaust gases prior to entering the SCR (selective catalyst reduction) stage. Within the SCR, No_2 (Nitrogen dioxide) is converted to nitrogen, carbon dioxide, and water vapor through a catalytic reduction fueled by the injected DEF.

DEF is a mixture of 66% deionized water and 34% urea and will freeze at temperatures below 32 degrees. There are 3 reductant heaters. Reductant heater 1 is in the reductant reservoir, reductant heater 2 is in the supply line to the reductant injector, and reductant heater 3 is at the reductant pump. The ECM monitors the reductant temperature sensor located within the reservoir in order to determine if reductant temperature is below its freeze point. If the ECM determines that the reductant may be frozen, it signals the Glow Plug Control Module (GPCM) to energize the reductant heaters.

Optimum NOx reduction occurs at SCR temperatures above 250°C (480°F). At temperatures below 250°C, the incomplete conversion of urea forms sulfates that can poison the catalyst. To prevent this poisoning, the ECM suspends DEF injection when exhaust temperature falls below a calibrated limit. Because of this, any issues with the EGT sensors will affect DEF system operation. **EGT sensor and DEF system codes set at the same time are likely related.**

EGR System

In the EGR system carbon will build up over time and cause intake restriction, sticky EGR valves, low power, etc. Cummins/Chrysler recommends servicing the EGR system every 65,000 miles to help minimize these issues. There is an EGR service procedure in the service information that pertains to EGR cooler cleaning. Buy 6.7 EGR Service Kit

VGT Turbocharger

The variable geometry turbocharger on the 6.7L engine has been somewhat troublesome. Like any other VGT type turbochargers, poor driving habits and other failed or failing components will cause excessive carbon build up and eventually turbo failure due to sticking vanes. The common failure symptoms for these turbochargers are: low/no boost under load, the exhaust brake sticking on or not working, and no power with black smoke. These symptoms are usually associated with a check engine light and a P2262 and/or P2563 codes. Buy 6.7 Ram Turbochargers

Ways to reduce carbon build up in the turbo;

1. Use of the exhaust brake, which cycles the turbo to a 100% closed position, can help reduce carbon build up.
2. Occasional hard acceleration, when the engine is warm, will help reduce carbon build up.
3. Reducing idle time. Examples of excess idle time would be leaving the engine running while hooking up a trailer, allowing the engine to idle long enough to warm up in the morning, or letting the truck idle while stopping at a convenience store.

*Use the following information regarding diagnostic trouble codes (DTC) in addition to the normal diagnostic procedures outlined in the service manual or technical service bulletins.

DTC P000F; fuel system over pressure relief valve activated

- Sets when fuel pressure deviates from the set-point at a rate higher than the calibrated amount (drops quickly).
- Often sets along with P0087.

1. Verify the ECM has the latest flash installed.
2. See P0087

DTC P003A; Turbocharger Boost Control Module Position Exceeded Learning Limit

1. If you have access to the OEM turbo cleaning equipment, solvent, and scan tool, a turbo cleaning can be attempted to see if the problem is solved. This seems to be a temporary fix at best however.
2. The turbo will likely need to be replaced. In some cases the actuator alone may fix the issue, but the turbo vane sleeve and linkage also needs to be checked for full range, ease of movement, and excessive wear prior to installing an actuator.

DTC P0049; turbocharger turbine over speed

1. Will set if turbine shaft speed exceeds 130,000 rpm. This can be caused by either a mechanical failure or electrical failure.
2. A charge air cooler hose blowing off under load will cause the turbo to temporarily over speed and may set this code.

3. The turbine shaft speed sensor in the turbo center section can fail and cause this code. The sensor should ohm between 600-1200 ohms across its two wires.

DTC P0087; Fuel Rail Pressure Too Low

1. Verify the ECM has the latest flash installed.
2. Can be caused by low fuel supply pressure.
3. Restricted or plugged fuel filter.
4. Any leaks on the high pressure side fuel system such as injectors, high pressure connector tubes, etc. Note: connector tubes or bad injectors will not show up as an external leak, the leak will be excess fuel return, which returns to the tank.

DTC P049D; EGR control position exceeded learning limit

- Most commonly caused by soot accumulation in the EGR valve, causing the valve pintle to not move and/or seat properly. We recommend replacing the valve because cleaning is not always a successful repair.

1. Verify the ECM has the latest software
2. Check and clean the Exhaust Gas Recirculation (EGR) valve and passages.
3. Recheck after cleaning the valve. If the codes reset, the EGR valve should be replaced.

DTC P0148; high pressure common rail check-sum, this is a deviation between the fuel pressure set point and the actual fuel pressure.

1. Verify the ECM has the latest flash installed.
2. FCA, check for rust on the fuel control actuator, which could indicate other fuel system problems caused by water contamination.
3. Fuel rail pressure sensor
4. Lift pump or fuel supply issues, check fuel supply pressure and fuel filter condition.
5. Cascade over flow valve (in high pressure pump)
6. Pressure limit valve leaking out return
7. Injectors, excessive return, see injectors
8. High pressure pump (CP3)
9. ECM re-flash.

DTC P0191 Fuel Rail Pressure Sensor Circuit Performance

- Even though the code description identifies this code as a circuit code, the code can be triggered by actual rail pressure being too low.

1. Verify the ECM has the latest calibration
2. Monitor actual vs. desired rail pressure under heavy load. If rail pressure deviates more than 1000 PSI from desired, diagnose the low pressure and high pressure fuel system.
3. Check the fuel rail pressure sensor voltage at key on engine off. It should be about 0.5 volts.

4. If the fuel rail pressure sensor does not output the correct voltage, verify the 5 volt reference is present at the sensor. To check the ground wire, check for voltage by back probing the connector with it connected. There should be less than 50 mV on the sensor ground.
5. If all of the above checks OK, replace he sensor.

DTC P0201 – P0206 Injector control circuit

1. Pass through connectors open
2. Check injector resistance, should be less than 1 ohm and greater than zero ohms (zero ohm meter leads before test).

DTC P0217; Coolant Temperature Too High

1. Check ECT sensor
2. Restricted air flow (caked dirt and bugs) through the intercooler and radiator.
3. Thermostat
4. Fan clutch

DTC P0300 Multiple Cylinder Misfire

1. Low fuel supply pressure
2. Fuel contamination
3. Check contribution rates of each injector
4. Valve train failure
5. Check compression

DTC P0336; Crank Position Sensor (CKP) Sensor Performance

1. Excessive cranking with a no start condition
2. CKP sensor
3. CKP wiring issue

DTC P0471; Exhaust Pressure Sensor 1 Performance

1. With a scan tool, compare available pressure parameters with the key on, engine off. If the exhaust pressure sensor is skewed, replace it and retest.
2. If the sensor reads within .5 PSI of the others, check the tube, passages, and sensor for carbon build up or restriction. Clean and replace as needed.

DTC P1451; Diesel Particulate Filter System Performance

- Usually the result of improper driving habits, such as excess idle time, not enough full load (towing), too few highway miles, excessive short trips, or fuel system issues.

1. The ECM will set this fault if it has detected that the soot level has exceeded the normal desoot trigger threshold by a sufficient amount to require driver intervention.
2. Typically sets if the truck has not been able to perform an active regeneration

due to light/no load operating conditions, such as idling or short trips.
3. Often sets in conjunction with P242F.
4. May require stationary regeneration or removal and cleaning of DPF.

DTC P1507; Crankcase Filter Restriction

1. Typically sets when the crankcase vent filter needs changed.
2. Can also be set if the CDR valve or vent tubes are restricted, or if the engine has excessive blow bye.
3. If the vent filter is completely plugged it can force oil around the turbine shaft seals in the turbocharger and cause blue-white smoke.

DTC P2BAC; NOx Exceedance- Deactivation of EGR

- Commonly sets in conjunction with P049D

1. The PCM monitors the engine's fault code status to determine if any fault codes critical to successful engine operation are active. If there are such codes, this code will also set. The other codes must be addressed to clear this fault.

DTC P2002; DPF Filter Efficiency Below Threshold

- The PCM monitors the efficiency of the DPF soot level using data received from the Exhaust Differential Pressure Sensor, which monitors the restriction across the DPF. The PCM monitors the restriction in the DPF at various engine speeds/loads and will set the fault if the restriction is below a calibrated threshold minimum value. Any failures or modifications that reduce pressure ahead of the DPF may cause this code to set.

1. Inspect the exhaust system for any signs of leakage or modification, including the exhaust manifold and EGR system.
2. Inspect the entire air intake system, before and after the turbo, for any modifications or leaks.
3. Verify that the DPF pressure sensor is at or very near 0.0 key on, engine off. Also, if the sensor was recently replaced, make sure it is plumbed properly.
4. An internal DPF failure causing a reduction in restriction will cause this code to set.

DTC P20EE; SCR NOX Catalyst Efficiency Below Threshold

- Often sets in conjunction with P207F

1. There are several Technical Service Bulletins for these codes involving ECM software updates. Update the ECM as necessary
2. Continue diagnosis as outlined in the service information if the trouble codes return.

P20E8; Reductant Pressure Too Low

1. Verify the ECM has the latest flash installed.

2. If the code continues to set after the ECM software is updated, test the Diesel Exhaust Fluid for hydrocarbons (fuel) using test strips. Also test the DEF with a refractometer. If the DEF fails either of these tests, replace it with fresh DEF.
3. Check reductant pump pressure with a scan tool. It should be above 75 PSI. If not, the pump assembly will need replaced.

DTC P207F; Reductant Quality Performance

- Often sets in conjunction with P20EE

1. There are several Technical Service Bulletins for these codes involving ECM software updates. Update the ECM as necessary
2. Continue diagnosis as outlined in the service information if the trouble codes return.

DTC P242F; Diesel Particulate Filter Restriction, Ash Accumulation

1. Usually just what it says, excessive restriction due to soot and/or ash.
2. Other problems need to be diagnosed with the fuel system, EGR system, and/or engine if this is a reoccurring problem. Excess soot from any system failures will cause premature DPF plugging.

P2509; PCM Power Input Signal Intermittent

- Loose and/or corroded battery terminals are usually at fault for this code. The engine may surge or intermittently stall when the code sets.

1. Unplug the fan clutch wiring to see if the code and the symptoms are gone. If yes, replace the fan clutch.
2. Check the voltage drop between the positive posts of the batteries. It should be less than 0.2 volts when the alternator is charging. If more than that, replace the cable between the positive posts of the batteries.
3. Check and clean all battery cables at both ends.
4. Load test each battery separately.
5. Check all power feed circuits to the Engine Control Module (ECM). B+ feeds are pins 1, 25, 26, 27 and 28. All are Red wires fed from fuse #22.

DTC P2563; Turbocharger Boost Control Position Sensor Performance

1. Basically indicates that the VGT actuator is not making a full sweep in during the key on/engine off self test.
2. This code is almost always caused by either a bad VGT actuator or sticky turbo vanes.

Other Notes:

-The 6.7L engines tend to have more head gasket failures then he 5.9L engines. The symptoms of a head gasket failure are typically coolant venting from the coolant overflow bottle and excess coolant temperature.

-Manual transmission equipped trucks with failing dual-mass flywheels commonly have other symptoms that are associated with engine balance, such as miss-fire codes and poor balance rates. We have seen fan clutch wiring get caught in the radiator fan due to the engine shaking badly, and also transmission bell housings broken on the upper driver's side.

– Some vehicles will display a "Perform Service" message in the dash or overhead display when the vehicle reaches factory pre-determined service intervals, commonly around 65,000 miles. The service indicator may be for EGR system service, crank case vent filter, cooling system service, ETC. In order to reset these messages once the service is performed, follow these steps:

1. Turn the ignition on, but do not start the engine.
2. Depress and release the brake pedal two times.
3. Fully depress and release the accelerator pedal slowly two times within 10 seconds.
4. Turn the ignition switch to the OFF/Lock position.
5. If the message comes back on when you turn the key back on, the indicator did not reset. This procedure may need to be repeated a few times to get the indicator to reset.