

Bulletin No.: TSB-013

Date: June 2002

Subject: Engine Backfire and Related Driveability Issues

Models: 1999-2002 Chevrolet and GMC B7 School Bus Chassis, C6/C7 Conventional Cab Medium Duty Models with IMPCO/ QUANTUM Technologies LPG Fuel System

This bulletin is being issued to assist technicians in efficiently diagnosing and correcting backfire and other related driveability concerns.

When a vehicle is identified with a backfire it is recommended that the checks listed below be followed in the indicated order.

To properly diagnose and correct a backfire complaint, this bulletin MUST be used with GM Informational Bulletin #02-06-04-026A.

Preliminary Checks

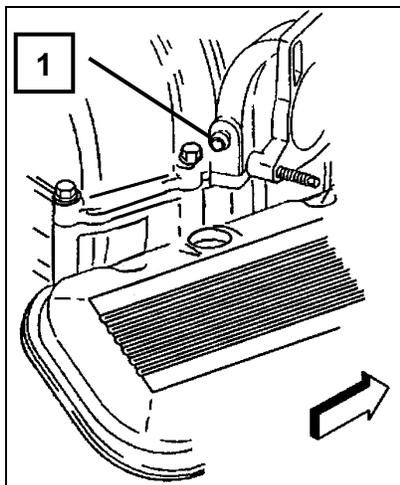
Perform a Diagnostic Circuit check on the vehicle. Verify that the MIL is functioning properly. If the MIL is illuminated, retrieve any DTCs from the PCM and follow the appropriate section of the GM Medium Duty Service Manual. In addition, retrieve any DTCs from the AF ECU by performing the *Alternative Fuel On-Board (AF OBD) System Check* in the IMPCO LPG Service Manual Supplement.

Important: For model year 1999 vehicles only, verify that the fuel control solenoid (FCS) has been updated with part number 100291 per IMPCO Technical Service Bulletin 99MD-TSB-002.

LPG Fuel System Checks

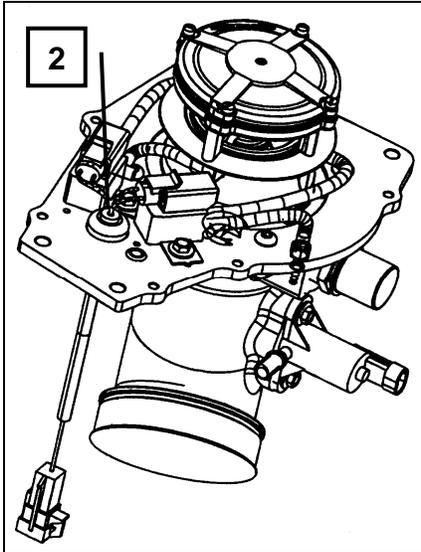
1. PCV Port Vacuum Cap (7.4L Only)

- Verify the ½" vacuum cap (1) is present. The cap is located on the intake manifold port behind the throttle body.
 - A backfire may dislodge the cap, creating a throttle vacuum leak that causes a lean condition that is becomes more noticeable as RPM increases. This may cause excessive crank time, hard starts and poor idle quality. This may also set a HO2S DTC in the PCM and the AF ECU.



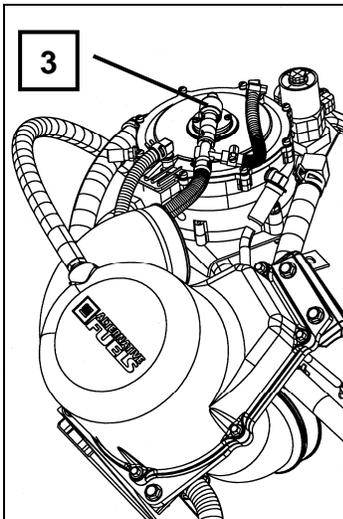
2. LPG Wire Harness Grommet (7.4L Only)

- Verify the LPG wire harness grommet (2) is properly seated in the fuel mixer (carburetor) baseplate.
 - A backfire may dislodge the grommet, creating an un-metered air leak between the MAF sensor and the throttle plate. This may also set a MAF DTC in the PCM and the AF ECU.
 - If necessary, secure the grommet using Loctite® 380 Black Max (P/N 38004) or equivalent.



3. Regulator Control Valve (RCV) (7.4L only)

- Check the RCV (3) for damage. The RCV is located on top center of the low pressure regulator (LPR).
 - A damaged or broken RCV may create a rich condition at idle. This may also set a HO2S DTC in the PCM and the AF ECU.
 - To verify RCV operation with the engine idling, disconnect the vacuum hose from the RCV and plug the RCV with a finger. If the HO2S cycle normally after the RCV is plugged, replace the RCV.



4. LPG Fuel System Operation

Perform a visual inspection of all LPG fuel system components. Verify that all vacuum and fuel hoses are secure and tight. Remove the fuel mixer cover and inspect the mixer posts for cracks or damage.

Heated Oxygen Sensor (HO2S) Operation

- Monitor HO2S operation for normal switching and voltages at idle and at 2500 RPM.
 - An insufficient activity HO2S DTC (42 or 63) may indicate a rich HO2S signal, a lean HO2S signal, or a problem with the HO2S signal circuit.
 - A steady reading of 450 milli-volts may indicate a problem with the HO2S signal circuit.
 - A low HO2S reading at idle that improves when engine speed is raised to 2500 rpm may indicate an exhaust leak ahead of the HO2S.
- If voltages are not within specification:
 - Check the LPG fuel control system operation by performing *AF Fuel Control System Diagnosis* in the IMPCO LPG Service Manual Supplement.
 - Check the LPG fuel system pressures by performing *AF Fuel System Diagnosis* in the IMPCO LPG Service Manual Supplement. If a regulator or mixer is replaced, verify that HO2S readings and FCS duty cycle are within specifications at idle, 2500 rpm and full load.

Fuel Control Solenoid (FCS) Operation

- Monitor the FCS duty cycle. Refer to *AF Fuel Control System Diagnosis* in the IMPCO LPG Service Manual Supplement for duty cycle ranges and test connector locations. Check the duty cycle at idle, 2500 rpm, and full load.
- If the FCS duty cycle is not within the specified range (25% to 75%):
 - Perform *AF Fuel Control System Diagnosis* in the IMPCO LPG Service Manual Supplement.

5. AF ECM Grounds

- Remove the transmission tunnel cover in the cab and inspect the AF ECM ground terminal on the back of the right cylinder head. Verify the connection is clean and tight. Measure the voltage drop from AF ECM connector C001 (Clear) pins 21 through 24 to the negative battery terminal (8.1L). Measure the voltage drop from AF ECM connector C001 (Blue) pins 22 through 24 to the negative battery terminal (7.4L). Readings should not exceed 0.2 Volts DC.

6. Low LPG Fuel Level

- Check LPG fuel level and fuel gauge operation.
 - For proper LPG fuel system operation, the low pressure regulator (LPR) requires a steady supply of liquid fuel from the LPG fuel tank. If the vehicle is operated with a low fuel level, the pickup tube inside the tank may draw vapor instead of liquid. This condition may be most noticeable when traveling uphill, downhill or over rough roads.
 - Operation with low LPG fuel level may cause the vehicle to run poorly, hesitate, surge or backfire. This may also set a HO2S DTC in the PCM and the AF ECU.

7. LPG Fuel System Restriction

- Check the following components for external frosting or freezing:
 - LPG Fuel Tank Manual Shut-off Valve
 - LPG Fuel Lines (Underbody and Underhood)
 - LPG Fuel Filter. The filter has a recommended replacement interval of 12 months or 30,000 miles, whichever occurs first.
 - Low Pressure Regulator (LPR)
 - External frosting or freezing indicates a LPG fuel system restriction possibly caused by contamination, debris or a plugged LPG fuel filter. This may cause a fuel pressure drop. Operation with low fuel pressure may cause the vehicle to run poorly, hesitate, surge or backfire. This may also set a HO2S DTC in the PCM and the AF ECU.



8. Fuel Contamination or Poor Fuel Quality

- Check for LPG fuel contamination or poor fuel quality. During LPG refining, storage and transportation, the potential for contamination exists. This may be difficult to detect without having an outside lab test a fuel sample. The following contaminants may be found in LPG:
 - Water – May cause fuel system restriction that creates a lean condition, especially under high load and low ambient temperatures.
 - Sulfur – May cause deterioration of the HO₂S. This may send a false rich signal to the PCM and AF ECM, under-fueling the system, possibly causing the vehicle to run poorly, hesitate, surge or backfire.
 - Rust, Dirt or Hydrocarbon “Heavy Ends” – May contaminate and plug the LPG fuel filter, low pressure regulator (LPR), fuel mixer (carburetor) or control solenoids.

9. Bulk Propane Delivery Vehicles

Important: Quantum Technologies does not manufacture or install bulk LPG storage tanks, or endorse their installation unless completed in accordance with instructions found on the *Vehicle Emission Control Information* label located underhood. The following information is offered as a general guideline only.

- Special consideration should be given to propane delivery vehicles equipped with 2,000 gallon to 3,000 gallon bulk storage tanks.
 - Propane delivery vehicles may not use a separate LPG motor fuel tank. Instead, the LPG fuel system is supplied with fuel direct from the bulk tank. Bulk tanks typically have two fuel supply valves - a liquid outlet valve and a vapor outlet valve. Operating the vehicle with both valves open may create a lean condition. Fuel must be supplied by the liquid outlet valve ONLY. The vapor outlet valve must be closed.
 - A low fuel level in the bulk tank may also create the conditions and symptoms described above under *Low LPG Fuel Level*. On a bulk tank, the liquid pick-up is located on the bottom front of the tank. Although the fuel level in the bulk tank may appear adequate, fuel sloshing or driving uphill or over rough roads may cause liquid fuel starvation at the pick-up.
 - Because propane delivery vehicles are typically operated off the bulk tank, there is a greater potential for fuel contamination. The bulk tank is emptied and refilled at a greater frequency. These vehicles may require more frequent LPG fuel filter service to prevent the conditions and symptoms described above *Fuel Contamination and Poor Fuel Quality*.

For additional help, contact Quantum Technologies Technical Assistance at 1-800-861-8691.