9 ENGINE BACKFIRE

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1 VEHICLE CONDITION</td>
<td>9-3</td>
</tr>
<tr>
<td>9.2 BACKFIRE</td>
<td>9-4</td>
</tr>
<tr>
<td>9.3 PSV ASSEMBLY</td>
<td>9-5</td>
</tr>
<tr>
<td>9.4 SERIES 50G RECIRCULATION VALVE</td>
<td>9-16</td>
</tr>
<tr>
<td>9.5 SERIES 60G RECIRCULATION VALVE</td>
<td>9-19</td>
</tr>
<tr>
<td>9.6 SHUTDOWN</td>
<td>9-21</td>
</tr>
<tr>
<td>9.7 FUEL SYSTEM LEARN PROCEDURE</td>
<td>9-22</td>
</tr>
</tbody>
</table>
9.1 VEHICLE CONDITION

Obvious part and component problems may cause a backfire condition. The first step in diagnosing the engine is to check related vehicle conditions.

9.1.1 Troubleshooting the Vehicle

To ensure obvious part and component problems are not causing a backfire condition, troubleshoot as follows:

1. Check the vehicle controls.
   [a] Confirm the vehicle has natural gas in its tanks.
   [b] Confirm the ignition system is on.
   [c] Confirm the batteries are charged.
   [d] Confirm the manual gas valve is open during idle.
   [e] Confirm the fuel door is completely closed.
   [f] If the engine still backfires, go to step 2.
   [g] If the engine no longer backfires, troubleshooting is done.

2. Check electrical connections and electronic controls.
   [a] Confirm wiring harnesses at DDEC® are connected.
   [b] Confirm ground straps from engine to starter are connected.
   [c] Confirm wire 439 in DDEC power harness is not loose.
   [d] Confirm the PLC/Multiplex/Electrical System is getting power.
   [e] Confirm proper operation of the fire suppression system and the methane detection system. Refer to OEM Vehicle Manual.
   [f] Confirm proper operation of all tank valves and high pressure solenoid valve during cranking. Refer to OEM Vehicle Manual.
   [g] Confirm proper operation of fuel door magnetic switch. Refer to OEM Vehicle Manual.
   [h] Confirm proper operation of the Stop Engine Light (SEL).
   [i] Confirm proper operation of the Check Engine Light (CEL).
   [j] If the engine still backfires, go to step 3.
   [k] If the engine no longer backfires, troubleshooting is done.

3. Check the installation requirements for the electronic system.
   [a] Verify the installation requirements for the electronic system have been met. Refer to Chapter 8. If the engine installation requirements for the electronic system did not comply, repair as required.
   [b] If the engine still backfires, check for engine backfire. Refer to section 9.2.
   [c] If the engine no longer backfires, troubleshooting is done.
9.2 BACKFIRE

To determine if any ECM problems apply to the engine Backfire condition, perform the following:

1. Turn on the ignition. Plug the Diagnostic Data Reader (DDR) or the Diesel Diagnostic Data Link (DDDL) into the Diagnostic Connector.

NOTE:
Use the Pro-Link kit J 38500-H to connect the DDR. Use PC card J 38500-2300 installed in the computer to connect the DDDL.

2. Use the DDR or DDDL to display which ECM is on the engine.

3. Use the DDR or DDDL to confirm that the proper calibration is in the ECM.
   [a] If the improper calibration is in the ECM, call Detroit Diesel Technical Service.
   [b] If the proper calibration is in the ECM, go to step 4.

4. Determine whether the backfire is taking place during engine deceleration or during engine shutdown.
   [a] If the backfire occurs during engine deceleration, check Pulse Width Modulated Stepper Motor Valve (PSV) operation. Refer to section 9.3.1.
   [b] If the backfire occurs during engine shutdown, check the fuel line installation and low pressure valve shut off. Refer to section 9.6.
9.3 PSV ASSEMBLY

The PSV biases gas flow to the venturi mixer to control the air/fuel ratio. See Figure 9-1. The following PSV component procedures are used to diagnose a natural gas Series 50G or Series 60G DDEC Engine with a Backfire condition.

Figure 9-1 Pulse Width Modulated Stepper Motor Valve and Fuel Mixer

9.3.1 PSV Operation Check

Check for proper PSV operation during cranking as follows:

1. Connect the DDR or DDDL and display PWM No. 3 position and Gas Valve position.
2. Crank the engine and read PWM No. 3 output and Gas Valve position.
3. If PWM No. 3 indicates 26–50 % and Gas Valve position indicates 50–80 %, check the operation of the Recirculation Valve. Refer to section 9.4 for the Series 50G engine or refer to section 9.5 for the Series 60G engine.
4. If PWM No. 3 position indicates 26–50 % and Gas Valve position is not moving or is less than 50 %, then check the PSV power and PWM No. 3 output as follows:
[a] Measure the voltage at the PSV connector with a voltmeter, see Figure 9-2. Connect positive lead to wire 446 (red, pin A) and negative lead to wire 150A (black, pin B).

![PSV Connector Diagram]

Figure 9-2 PSV Connector

[b] If the voltage is zero, check the Engine Sensor Harness (ESH) and PSV connector. Refer to DDEC III/IV Single ECM Troubleshooting Guide 6SE497. Repair or replace the ESH as necessary.

c] If there is a voltage, check the PWM No. 3 output. Connect the voltmeter positive lead to wire 910 (orange, pin H) and negative lead to wire 150A (black, pin B) in PSV connector, see Figure 9-2. With the DDR or DDDL, slew the PWM No. 3 output from 10–50 % and then to 90 %.

d] If there is a change in voltage, then troubleshoot the PSV assembly, refer to section 9.3.2.

e] If there is no change in voltage, then troubleshoot the ESH and PSV connector. Refer to DDEC III/IV Single ECM Troubleshooting Guide 6SE497. Repair or replace the ESH as necessary.

5. If the PWM No. 3 indicates 26–50 % and the Gas Valve moves but appears to have sluggish or erratic movement, check voltage at the PSV connector with a voltmeter. Connect positive lead to wire 446 (red, pin A) and negative lead to wire 150A (black, pin B), see Figure 9-2.

[a] If there is less than 10 volts, charge the batteries.

[b] If 10-12 volts are present during cranking, then troubleshoot the PSV assembly, refer to section 9.3.2.

6. If PWM No. 3 output does not change, check the output. Connect a voltmeter to the positive lead to wire 446 (red, pin A) and to the negative lead to 910 (orange, pin H), see Figure 9-2.

[a] If the voltage is zero, replace the ECM and then follow the Fuel System Learn Procedure. Refer to section 9.7.

[b] If there is a voltage, then troubleshoot the PSV assembly, refer to section 9.3.2.
9.3.2 PSV Assembly Troubleshooting

Troubleshoot the PSV assembly as follows:

1. Remove PSV from engine. Do not unplug electronic connector.
2. Remove 13 mm plug and install digital dial indicator (Mitutoyo® Digimatic Indicator, part No. 575-123 or equivalent).

   *Mitutoyo® is a registered trademark of Mitutoyo Manufacturing Co., LTD.*
3. Plug in DDR or DDDL and go to activate outputs. Input 0 % PWM to PWM No. 3.
4. Set digital indicator to 0 mm (0 in.).
5. Input values listed in Table 9-1 from column 1 to PWM No. 3 with the DDR or DDDL.

<table>
<thead>
<tr>
<th>PWM No. 3 Reading</th>
<th>Programmed Travel</th>
<th>Travel Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 %</td>
<td>0 mm (0 in.)</td>
<td>—</td>
</tr>
<tr>
<td>10 %</td>
<td>1 mm (0.04 in.)</td>
<td>0.9–1.1 mm (0.035–0.043 in.)</td>
</tr>
<tr>
<td>50 %</td>
<td>5 mm (0.20 in.)</td>
<td>4.9–5.1 mm (0.193–0.201 in.)</td>
</tr>
<tr>
<td>100 %</td>
<td>10 mm (0.39 in.)</td>
<td>9.9–10.1 mm (0.390–0.398 in.)</td>
</tr>
</tbody>
</table>

NOTE: Column 2 shows the programmed travel and column 3 shows the limits of acceptable travel.

Table 9-1 PWM No. 3 Input and Acceptable Travel

6. If the PSV assembly shows any of the following failure modes, then replace the PSV assembly (refer to section 9.3.3), and perform the Fuel System Learn Procedure (refer to section 9.7).

   [a] PSV remains at or below approximately 50% of travel.
   [b] PSV piston does not move (indicator reads zero throughout).
   [c] PSV moves slowly or does not move to the value listed in Table 9-1, Column 3.
   [d] PSV exhibits erratic operation.

7. If engine operates normally, troubleshooting is complete.
8. If engine is still backfiring, replace the throttle. Refer to section 9.3.3.
9.3.3 Replacing the Throttle for Models 6067–TKG8 and 6047–TKG8

Use the bolt loosening and tightening sequences and the throttle assembly procedure in the following sections when replacing the throttle. Refer to section 9.3.3.1 for the bolt loosening and tightening sequences and refer to section 9.3.3.2 for the throttle assembly procedure.
9.3.3.1 Bolt Tightening Sequence

Loosen the bolts using the following sequence.

1. Loosen the four bolts that attach the inlet elbow to the rear of the throttle.
2. Loosen the four bolts that attach the Mixer/PSV assembly to the front of the throttle.
3. Loosen the two bolts that attach the low pressure regulator to the inlet elbow.
4. Loosen the four bolts that attach the throttle to the throttle mounting bracket.

Tighten all the bolts using the following sequence:

**NOTE:**
Torque for all bolts is 30–38 N·m (22–28 lb·ft).

1. Tighten the two bolts from the throttle mounting bracket to the gear case.
2. Tighten the one bolt from the throttle mounting bracket to the cylinder head.
3. Tighten the four bolts from the Mixer/PSV assembly to the throttle.
4. Tighten the four bolts from the throttle to the inlet elbow.
5. Tighten the two bolts from the low pressure regulator.
6. Tighten the two bolts from the throttle mounting bracket to the inlet elbow.
7. Tighten the four bolts from the bottom of the throttle mounting bracket to the throttle.

9.3.3.2 Throttle Assembly Procedure

Replace the throttle assembly as follows:
1. Install the inlet elbow to the throttle body flange with the flow arrow on the throttle body pointing towards the inlet elbow. Attach with four bolts but do not tighten. See Figure 9-3.

2. Install mixer assembly and gasket to opposite flange with four bolts but do not tighten.

Figure 9-3  Assembling the Throttle for Models 6067–TKG8 and 6047–TKG8
3. Attach the PSV and O-ring to the mixer with four Allen head screws but do not tighten.
4. Lubricate O-rings used with fuel transfer tube with Lubriplate® prior to assembly.
5. Install O-rings to fuel transfer tube. Apply Teflon® liquid pipe sealant to threads.
6. Thread fuel transfer tube into regulator and tighten.

**NOTE:**
The fuel transfer tube must thread into the regulator just far enough so the O-ring seal does not bottom out in the PSV valve and cut the seal when the regulator is bolted to the inlet elbow.

7. Install the low pressure regulator and fuel transfer tube into the PSV. Bolt regulator to inlet elbow with two bolts but do not tighten.
8. Install throttle, PSV, mixer and inlet elbow to engine positioning inlet hose over inlet elbow and inlet manifold. Rest the throttle on the throttle mounting bracket. See Figure 9-4.

9. Install four bolts through the throttle mounting bracket into the bottom of the throttle and two bolts through the side of the throttle mounting bracket into the inlet elbow but do not tighten.

10. Tighten the four mixer-to-throttle bolts to 30–38 N·m (22–28 lb·ft) torque.
11. Tighten the four throttle to inlet elbow bolts to 30–38 N·m (22–28 lb·ft) torque.

12. Tighten the two bolts that hold the regulator to the inlet elbow and tighten the four screws that hold the PSV to the mixer.

13. Adjust the two bolts through the throttle mounting bracket to the inlet elbow and the four bolts through the bottom of the throttle mounting bracket to the throttle alternatively to ensure that there is no bind in the throttle. Tighten the two bolts to the inlet elbow to 30–38 N·m (22–28 lb·ft) and the four throttle mounting bolts to 30–38 N·m (22–28 lb·ft).

9.3.4 Replacing the Throttle for Model 6047–MKG8

Use the bolt loosening and tightening sequences and the throttle assembly procedure in the following sections when replacing the throttle. Refer to section 9.3.4.1 for the bolt loosening and tightening sequences and 9.3.4.2 for the throttle assembly procedure.

9.3.4.1 Bolt Tightening Sequence

Loosen the bolts using the following sequence.

1. Loosen the four bolts that attach the throttle to the throttle bracket and the front of intake tube adaptor.
2. Loosen the two bolts that attach the low pressure regulator to the intake tube adaptor.
3. Loosen the three bolts that attach the bottom of the throttle to the throttle bracket.
4. Loosen the four bolts that attach the Mixer/PSV assembly to the front of the throttle.

Tighten all the bolts using the following sequence:

1. Tighten the two bolts from the throttle bracket to the gear case to 58–73 N·m (43–54 lb·ft) torque.
2. Tighten the one bolt from the throttle bracket to the cylinder head to 58–73 N·m (43–54 lb·ft torque).
3. Tighten the three bolts from the bottom of the throttle bracket to the throttle to 30–38 N·m (22–28 lb-ft) torque.
4. Tighten the four bolts from the Mixer/PSV assembly to the throttle to 30–38 N·m (22–28 lb-ft) torque.
5. Tighten the four bolts from the throttle to the throttle bracket and the front of intake tube adaptor to 30–38 N·m (22–28 lb-ft) torque.
6. Tighten the two bolts from the low pressure regulator to the intake tube adaptor to 13–16 N·m (10–12 lb-ft) torque.

9.3.4.2 Throttle Assembly Procedure

Replace the throttle assembly as follows:
1. Secure throttle flange and gasket to mixer assembly with four twelve-point bolts. Hand tighten bolts. See Figure 9-5.

![Diagram of throttle assembly]

Figure 9-5   Assembling the Throttle for Model 6047–MKG8

2. Place throttle assembly in throttle mounting bracket and place four twelve-point bolts and two gaskets (one on each side of the bracket intake flange) in flanges.

4. Install two O-rings to fuel transfer tube. Apply Teflon® liquid pipe sealant to threads.

5. Insert fuel transfer tube in low pressure regulator. Hand tighten.

6. Lubricate O-rings used with fuel transfer tube with Lubriplate® prior to assembly.

7. Install the low pressure regulator and fuel transfer tube regulator on the intake tube adaptor with two bolts. Hand tighten bolts. See Figure 9-5.

8. Place the regulator and tube adaptor on the fuel mounting bracket intake flange and secure with four bolts while aligning the fuel transfer tube with the PSV opening. Hand tighten bolts.

**NOTE:**
Ensure the two intake flange gaskets stay in proper alignment before tightening bolts.

9. Install throttle, PSV, mixer and inlet tube adaptor on the engine positioning the inlet hose over inlet elbow and inlet manifold. Secure to the cylinder head with one bolt and to gear case with two bolts. Hand tighten bolts.

10. Tighten the two bolts from the throttle mounting bracket to the gear case to 58–73 N·m (43–54 lb·ft) torque.

11. Tighten the one bolt from the throttle bracket to the cylinder head to 58–73 N·m (43–54 lb·ft torque).

12. Tighten the three bolts on the bottom of the throttle bracket to 30–38 N·m (22–28 lb·ft) torque.

13. Tighten the four bolts from the Mixer/PSV assembly to the throttle to 30–38 N·m (22–28 lb·ft) torque.

14. Tighten the eight bolts from the throttle to the throttle bracket and the front of intake tube adaptor to 30–38 N·m (22–28 lb·ft) torque.

15. Tighten the two bolts from the low pressure regulator to the intake tube adaptor to 13–16 N·m (10–12 lb·ft) torque.

16. Turn fuel transfer tube two to three more threads deeper from initial hand tightening.

17. Connect balance line to elbow in low pressure regulator and elbow in mixer assembly.
9.4 SERIES 50G RECIRCULATION VALVE

The turbocharger for the Series 50G coach engine is equipped with an integrally mounted compressor recirculation valve. See Figure 9-6. The recirculation valve is designed to prevent or significantly reduce engine air system pressure pulsation and turbocharger surging during engine throttling operations.

**Figure 9-6** Compressor Recirculation Valve for the Series 50G Engine

1. Gasket
2. Diaphragm and piston assembly
3. Cover
4. Spring
5. Diaphragm support
6. Screw (3)
7. Compressor housing
9.4.1 Removal of Series 50G Recirculation Valve

Remove the Recirculation Valve for the Series 50G engine as follows:

1. Remove the braided line that connects to the fitting on the top of the recirculation valve cover.
2. Remove the fitting from the valve cover.
3. Using a T30-Torx driver, loosen the three screws at the base of the valve cover. While pressing the cover down against the internal spring force, remove and save all three screws.

**NOTE:**
Pressing the cover down against the internal spring force will facilitate backing out the three Torx screws.

4. Slowly release the pressure and let the cover rise up from the base.
5. Reach below the cover and hold the internal assembly at the plastic diaphragm support. Lift assembly off and turn it over.
6. Remove the gasket between the cover and the compressor housing. Discard gasket.
7. Clean the mating cover and compressor housing surfaces of all gasket material or other foreign particles.

9.4.2 Disassembly of Series 50G Recirculation Valve

Disassemble the Recirculation Valve for the Series 50G engine as follows:

1. With the assembly upside down, lift off the diaphragm support and lay it aside.
2. Inspect the diaphragm for damage and proper seating.
   - [a] If there are no cracks or tears and the diaphragm is seated properly, go to step 4.
   - [b] If there are cracks, tears, or the diaphragm is not seated properly, go to step 3.
3. Discard the damaged diaphragm, piston assembly, and a gasket and replace them with the DDC\textsuperscript{®} Recirculation Valve Kit for GT35 Turbocharger.
4. Lift off the diaphragm and piston assembly.
5. Clean off any foreign particles from the cover and the spring.
6. With the cover upside down, insert the spring. Drop the diaphragm and piston assembly over the spring. Place the cleaned diaphragm support over the diaphragm and piston assembly.

**NOTE:**
The diaphragm support must squeeze the diaphragm against the upper shoulder in the cover after it is fully assembled and seated against the compressor housing base.
9.4.3 Installation of Series 50G Recirculation Valve

Install the Recirculation Valve for the Series 50G engine as follows:

<table>
<thead>
<tr>
<th>NOTICE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both surfaces must be clean and free of any gasket or other foreign particles before a new gasket can be installed during assembly or improper sealing will result.</td>
</tr>
</tbody>
</table>

1. Lightly coat the base of the cover with a non-hardening grease, just enough to hold the new gasket in place on the piston and diaphragm assembly when it is turned over during installation.

2. Position the gasket so it lines up with the rim of the cover and the three holes.

3. Hold the assembly loosely together and position it over the mounting base of the compressor housing.

4. Check for proper orientation and compress the assembly against the spring force. Install the three Torx screws. With continuous pressure on the cover, completely tighten the screws in an easy and even manner to 1.47-1.58 N·m (13-14 lb·in).

5. After the cover has seated, tighten the screws evenly to 5.9-6.6 N·m (52-58 lb·in).

6. Lightly coat the fitting threads with sealant. Install fitting in the valve cover.

7. Attach braided steel line to fitting and tighten to 8.13 N·m (6 lb·ft) of torque.

8. Once the recirculation valve has been completely checked, replace the Low Pressure Regulator, refer to section 9.3.3, and follow the Learn Procedure, refer to section 9.7.
9.5 SERIES 60G RECIRCULATION VALVE

The Series 60G turbocharger requires a boost recirculation valve to reduce air system pressure pulsations and turbocharger surging during engine throttling operations. The recirculation valve is remote-mounted by the OEM and routes air from the high-pressure boost side back to the air inlet side during deceleration. The recirculation valve is a large solenoid valve that is triggered to open by DDEC through a digital output pin of the ECM. See Figure 9-7 for recirculation valve.

1. Recirculation Valve Body
2. 12V Coil
3. 2-pin Connector
4. Bracket

**Figure 9-7** Series 60G Recirculation Valve

9.5.1 Testing of Series 60G Recirculation Valve Operation

Confirm proper operation of the Series 60G recirculation valve as follows:

1. Perform a Stall Test as follows (repeat as necessary):
   [a] Accelerate the engine in low gear, brakes applied.
   [b] Slowly increase the engine rpm from idle to stall (0 to 100% throttle).
   [c] Once stall rpm is reached, immediately let the throttle go back to 0%.

2. As the throttle goes back to 0%, listen for a "whooosh" sound.
   [a] If there is a "whooosh" sound, then replace the Low Pressure Regulator and follow the Learn Procedure, refer to section 9.7.
[b] If there is no “whooosh”, then plug the Diagnostic Data Reader (DDR) or the Diesel Diagnostic Data Link (DDDL), J 47500, into the Diagnostic Connector. Repeat step 1 and read the Y-3 digital output as the throttle goes back to 0%.

c] If the Y-3 digital output is not triggering the valve to open, then check vehicle wiring. Refer to the vehicle OEM service manual.

d] If the Y-3 digital output is triggering the valve to open, then replace the Series 60G recirculation valve. Refer to section 9.5.2.

9.5.2 Removal of Series 60G Recirculation Valve

Remove the Series 60G Recirculation Valve as follows:

**NOTE:**
The recirculation valve is a non-serviceable component and should be replaced as a unit. No adjustment is required.

1. Disconnect the inlet and outlet hoses from the recirculation valve.
2. Disconnect the two-pin electrical connector.
3. Remove the two bolts that attach the recirculation valve to the mounting surface.

| NOTICE: |
The valve has a mounting bracket attached to its body. Do not remove the bolts in the valve body to gain access to the valve. Removal of these bolts can expose the valve diaphragm and cause permanent damage.

4. If replacing the unit, remove the inlet and outlet fittings from the valve.

9.5.3 Installation of Series 60G Recirculation Valve

Install the Series 60G Recirculation as follows:

1. If replacing the unit, install the inlet and outlet fittings removed from the old valve.
2. Position the valve on the mounting surface and secure it in place with the two mounting bolts.

**NOTE:**
The arrow on the base of the valve should correspond with the flow of air from the turbo outlet side to the turbo inlet side.

3. Connect the inlet and outlet hoses to the valve fittings.
4. Connect the two-pin electrical connector.
5. Start the engine and check for any leaks in the system. Repair leaks as required.
9.6  SHUTDOWN

Backfire at engine shutdown is often caused by excess natural gas in the fuel lines.

1. Measure the fuel line between the low pressure shutoff valve and the low pressure regulator.
   [a] If the fuel line is longer than 46 cm (18 in.), replace the fuel line with a shorter line.
       If the engine now operates normally, troubleshooting is done.
   [b] If the fuel line is not longer than 46 cm (18 in.), go to step 2.

2. Listen to the low pressure shutoff valve for additional fuel flow after the engine has been turned off.

NOTE:
The low pressure shutoff valve may not be completely closing upon engine shutdown. This condition allows the small amount of fuel left in the fuel line to continuously flow to the engine and may cause a backfire.

   [a] If the valve continues to flow fuel to the engine after shutdown, replace the fuel shutoff valve. Refer to section 9.3.3.
   [b] If the valve is in proper working order and a "backfire" condition is still occurring, contact the Detroit Diesel Technical Service.
9.7 FUEL SYSTEM LEARN PROCEDURE

Fill in the Air Fuel Ratio (AFR) table for the Fuel System follows:

NOTE:
Use a chassis dynamometer to apply loads to the engine whenever appropriate as an alternative to on-highway vehicle operation.

1. Fill in the AFR table values from idle to No Load speed for the unloaded portion as follows:
   [a] Reset the AFR table with the DDR or DDDL.
   [b] Slowly increase the engine speed from idle to No Load (0–100 % throttle) and then slowly decrease the speed back to idle (100–0 % throttle) over one minute.
   [c] Repeat step 1[b] two times.

2. Fill in the AFR table values from idle to stall speed for the loaded portion as follows:
   [a] With an applied load, slowly increase the engine speed from idle to stall speed (0–100 % throttle) and then slowly decrease the speed back to idle (100–0 % throttle) over one minute.
   [b] Repeat step 2[a] two times.

3. Fill in the AFR table above the stall speed for the unloaded portion as follows:

   NOTE:
The engine must operate in this speed/boost range for a moderate length of time. The AFR table will not completely fill in just passing through this range.

   NOTE:
The best method to apply a load through stall speed to 2100 rpm is to drive the vehicle up a hill, locked into a lower gear to prevent transmission shifting. If a hill is not available, lock the vehicle in low gear and accelerate from a stop to 2100 rpm full load.

   [a] Slowly operate the engine from stall speed to 2100 rpm with an applied load.
   [b] Repeat step 3[a] until the engine runs smooth through this speed range.

4. Road test the vehicle as follows:
   [a] Operate the engine through a variety of speed and loads while looking for any misfires.
   [b] If a particular rpm/manifold pressure range still experiences misfire, then operate the engine around that point by running through that range slowly.
   [c] Repeat step 4[a] and step 4[b] until the engine runs smooth without any lean misfires. A smooth-running engine means the Fuel System Learn Procedure is complete.