



LPEFI® Installation Manual
For
2006 GM Medium Duty Trucks with 8.1 Liter Engine
Models: C5500
Mono-Rail System



First Edition
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Manual # M4-120-06
Bi-Phase Technologies, LLC
Eagan, Minnesota, U.S.A.

Bi-Phase Technologies, LLC

Introduction

This instruction booklet shows how to convert a gasoline vehicle to run on clean burning propane utilizing our *LPEFI*[®] (*Liquid Propane Electronic Fuel Injection*) system.

The system is vehicle specific and installing a system on any vehicle that the kit was not designed for will void the warranty and may also violate emission laws.

Anyone who installs or repairs the *LPEFI*[®] system must be trained and certified. This must also include training in the safe handling and characteristics of propane. Bi-Phase Technologies provides such training upon request. Some states may require a license to work on propane vehicles. Consult your state or local authorities or your state propane gas association. Bi-Phase Technologies, LLC is not responsible for your oversight to comply with federal, state or local laws regulating the installation or repair of propane gas systems.

The *LPEFI*[®] system is a sequential multi-port fuel injection system that injects propane in a liquid state to the engine. It works much the same way as a modern sequential multi-port gasoline fuel injection system and can be diagnosed with the same diagnostic scanners used for gasoline vehicles.

The *LPEFI*[®] system is covered by U.S. and International patents. The *LPEFI*[®] system is also certified to the United States E.P.A. standards.

The information in this manual is believed to be accurate as of its date of publication, but it is subject to change. Up-to-date information and changes, if any, can be requested from Bi-Phase Technologies.

In the event of any safety-related changes Bi-Phase Technologies will notify all customers who returned the warranty registration card for the affected vehicles.

**For more information contact:
Bi-Phase Technologies, LLC
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(651) 681-4450
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Notes

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Propane Safety



This is a safety alert symbol. It is used through out this manual to alert you to potential hazards. Whenever you see this symbol, you should read and obey the safety warnings that follow. Failure to obey these warnings could result in serious personal injury or property damage.

Please read some of the Specific Warnings below before proceeding with the installation or repair of any propane system



Warning: Always unplug the LPEFI control box or disconnect the battery before you work on any part of the LPEFI system.

The LPEFI tank contains an electronic control box. Any time the driver door is opened, the LPEFI system could go into a purge mode, pumping liquid propane through the hoses and injectors. To prevent a sudden release of cold liquid propane, disconnect the power from the control box before you loosen any hose fittings. Failure to do this could cause personal injury and fire hazard.



Warning: Never loosen fittings or vent any propane unless you are wearing insulated PVC rubber gloves. Escaping liquid propane can cause frostbite and severe freeze burns.

Propane is stored as a liquid. When you release liquid propane, it tries to evaporate as quickly as it can, by absorbing heat from its surroundings. Everything it touches gets chilled to -44 degrees F (-42 deg. C). If liquid propane sprays on your fingers, it will freeze them-right down to the bone. Anyone who works with liquid propane must wear insulated PVC rubber gloves.



Danger: Do not remove any valves, bulkheads or fittings from a propane tank unless the tank has been properly drained (evacuated) completely. The pressure inside a propane tank can push a loosened bulkhead or valve out with enough force to cause injury. Release of propane in an uncontrolled situation will create a flammable/explosive mixture of air and propane, which could cause serious injury, death and property damage.

Propane is stored under pressure. When you remove a valve or bulkhead from the tank, all of the pressure is released at once, in a violent rush. Always drain the tank before you work on it. Failure to do this will result in damage to the tank or valves and can result in severe injury or death. You should drain the tank using a flare stack in an approved safe manner. Your propane supplier can help you with this.

(Cont'd)

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Propane Safety (cont'd)



Danger: Do not vent or release propane indoors or near sewers, pits or low lying areas. Propane can accumulate in low spots, creating a fire hazard. Propane can also displace oxygen, creating a suffocation hazard.

Propane is heavier than air. It can fill low, sheltered areas with flammable vapors. If these vapors are ignited, they can create a fire or explosion, causing severe property damage, injury or death. Never release propane near sewers, pits or indoors.



Warning: Keep all sources of ignition away from propane vehicles while the fuel system is being serviced. Even if the tank and fuel lines are empty, there may still be flammable vapors near the vehicle.

Do not allow smoking, sparks, flames, running vehicles or other sources of ignition near the vented propane. Failure to do this could result in fire or explosion, causing severe property damage, injury or death.



Warning: Do not disconnect any propane hoses unless they have been properly drained completely.

Propane in the hoses is kept under pressure, even when the engine is off. When you disconnect a hose, the internal pressure is released all at once. Always drain the fuel lines before you disconnect them. Failure to do this can result in damage to the hose fitting and possible injury.



WARNING: NO SMOKING OR OPEN FLAMES IN OR AROUND PROPANE VEHICLES DURING FUELING OR SERVICING.

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Facts about Propane & Propane Powered Vehicles

Propane gas is the most widely used alternative fuel, with nearly 4 million vehicles worldwide running on propane. More than 350,000 vehicles run on propane in the U.S., according to the U.S. Department of Energy's Alternative Fuels Data Center.

Propane powered vehicles offer the best combination of durability, performance and driving range.

The first propane powered vehicle ran in 1913.

Bi-Phase Technologies' *LPEFI*[®] (Liquid Propane Electronic Fuel Injection) system has surpassed other technologies today by introducing liquid fuel injection. This technology improves power, efficiency and operating characteristics. For more information call for our General Information and Training Manual.

Safety comes first is a motto you should always live by. Without knowledge of a product it is hard to follow this motto. In our manuals we try to stress the need for knowledge and provide warning signs to alert you.

It is your responsibility to know the law. NFPA, National Fire Protection Association, has manuals to help you understand safe handling of many products. We recommend that you obtain and read their NFPA #58, Standard for the Storage and Handling of Liquefied Petroleum Gases.

To further enhance the industry's safety and service, a number of training programs and efforts have been implemented throughout the country. The National Propane Gas Association has developed a Certified Employee Training Program (CETP), which provides service personnel with a complete technical training curriculum. We encourage you to contact your state propane gas association or the National Propane Gas Association for more information on how you can benefit from such programs. Visit www.propanesafety.com for more information.

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Approximate Properties of LP Gases

(Commercial Propane)

Specific gravity of liquid (water = 1) at 60 degrees F.	0.504
Initial boiling point at 14.7 psia, degrees F.	- 44.0
Weight in lbs per gallon of liquid at 60 degrees F	4.24
Specific heat of liquid, BTU/lb. at 60 degrees F.	0.630
Cubic ft. of vapor per gallon at 60 degrees F.	36.38
Cubic ft. of vapor per pound at 60 degrees F.	8.66
Specific gravity of vapor (air = 1) at 60 degrees F.	1.50
Ignition temperature in air, degrees F.	920 to 1120
Maximum flame temperature in air, degrees F.	3,595
Limits of flammability in air	
Percent of vapor in air/gas mixture	
a) Lower	2.15
b) Upper	9.60
Heating values	
a) BTU per cubic foot	2,488
b) BTU per pound	21,548
c) BTU per gallon	91,500
Chemical formula	C ₃ H ₈
Vapor pressure in psig	
a) 70 degrees F	127
b) 100 degrees F	196
c) 105 degrees F	210

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Pre-Installation Inspection

(Recommended)

If your '06 vehicle is equipped with a single gasoline fuel tank, and you will be installing a single propane fuel tank follow the procedure in this manual.

If your '06 vehicle is equipped with dual gasoline fuel tanks, and you will be installing dual propane fuel tanks follow the procedure in this manual.

If your '06 vehicle is equipped with a single gasoline fuel tank, and you will be installing dual propane fuel tanks, contact Bi-Phase Technologies before installation.

If your '06 vehicle is equipped with dual gasoline fuel tanks, and you will be installing a single propane fuel tank, contact Bi-Phase Technologies before installation.

If the vehicle is new and has less than 1,500 miles we recommend the following:







- Visually inspect the vehicle
 - Is the malfunction indicator lamp illuminated?
 - Does the engine start and run smooth?
 - Are there any fluid leaks?
- Install a diagnostic scan tool and verify there are no DTCs (Diagnostic Trouble Codes) stored in the computer memory

If the vehicle is used and has more than 10,000 miles we recommend in addition to the above:

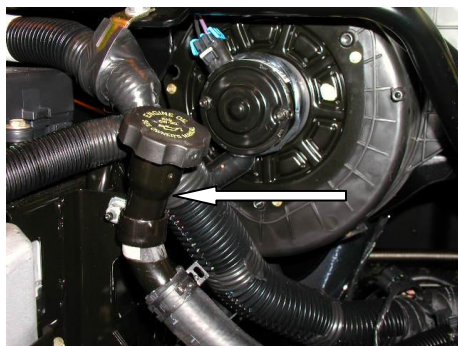
- Remove and examine the spark plugs and conduct a compression test
- During diagnostic scan mode document the following from the scan tool data stream:
 - Short term fuel trim, bank 1 & 2
 - Long term fuel trim, bank 1 & 2
 - IAC (idle air control %)
 - Oxygen sensor activity

Note: Proceed with the LPEFI[®] system installation if all conditions are acceptable. If any problems are discovered it is not recommended to install the LPEFI[®] system until the problems are repaired. After the installation is complete refer to the Post-Installation Inspection found on page 37 in this manual.

Installation Manual, GM Medium Duty Trucks, 2006

	<p>Remove air filter box:</p> <ul style="list-style-type: none"> • Disconnect the battery • Disconnect mass air flow sensor • Loosen clamp where the hose from the throttle body connects to the plastic tube from the air filter box • Remove one nut and one bolt • Remove air filter box assembly from engine compartment 	 <p>13 mm #2 Screwdriver</p>
	<p>Remove in-cab engine compartment cover:</p> <ul style="list-style-type: none"> • Release four latches to remove from the cabin 	
 	<p>Remove oil filler tube:</p> <ul style="list-style-type: none"> • Remove three bolts; one at top behind the oil filler cap & two on the intake manifold • Remove the oil filler tube assembly and retain for modifications <p><i>Note: Place a rag in the hole to prevent dirt, particles or other objects from entering the engine.</i></p> <ul style="list-style-type: none"> • Remove four bolts holding the wiring harness brackets to the manifold, this will give flexibility of the harness for the following steps 	 <p>13 mm 10 mm</p>

Installation Manual, GM Medium Duty Trucks, 2006



Modification & relocation of oil filler tube assembly for all models:

- Cut the metal tube about 2-3/4" from the bracket where it mounts into the engine, or at the first notch from that 90-degree bend
- Clean & smooth out the sharp edges after cutting
- Cut the original bracket from the oil filler tube, the bracket closest to the oil filler cap
- Grind any sharp edges and touch up with black paint
- Install the clamp, provided in the kit to the oil filler tube (as shown in photo at left)
- Reassemble the oil filler assembly with rubber hose
- Remove the nut on the upper right corner, engine side of the electrical distribution box, located on passenger side of engine compartment
- Install the filler tube here and tighten; the electrical harness may require re-positioning to make room for the filler cap access
- Reinstall the oil filler tube section into the engine
- Use the original hose, cut to proper length and install between the filler tube mounted on the engine and the oil fill cap end of tube; use the original hose clamps

Note: Position the hose clamp at the engine forward or horizontal. If left in the upward position the clamp may interfere with the reinstallation of the fuel injector rail.



Hacksaw



Hacksaw
Black spray paint



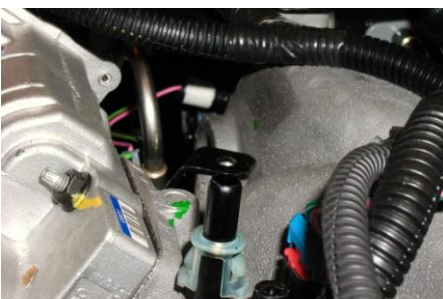
7/16" wrench
Socket & ratchet
13 mm wrench



Razor knife or hose
cutting pliers

Pliers

Installation Manual, GM Medium Duty Trucks, 2006



Remove gasoline fuel rails, fuel line, tank & evaporative emission system (if the vehicle is equipped with the EVAP components):

- Disconnect map sensor connector on top rear of intake manifold for wiring harness flexibility
- Disconnect injector wiring harness connector
- Remove fuel pressure regulator vacuum hose and install vacuum cap (supplied in kit) at the manifold vacuum port
- Remove four (6 mm) mounting studs and nuts holding the gasoline fuel rails to the intake manifold
- Place drain pan under driver side of bell housing to catch any gasoline spilled while disconnecting the fuel lines
- Using a 3/8" QD tool, disconnect the supply fuel line; use a 5/16" QD tool to disconnect the return fuel lines from the rail assembly

Note: Gasoline residue could drain out of the lines and rails when you disconnect.

⚠ Caution: Gasoline under pressure. Gasoline is flammable & toxic. Use extreme caution and eliminate all sources of ignition while handling. Wear gloves & goggles.

If equipped with EVAP

- Cut or disconnect the plastic clamps holding the evaporative emission line to the fuel rail and disconnect the line from the canister purge solenoid
- If necessary, install a vacuum cap (not supplied in kit) to the canister purge solenoid

(Cont'd)



10 mm socket &
1/4" drive ratchet



3/8" QD tool
5/16" QD tool



Pliers

Installation Manual, GM Medium Duty Trucks, 2006



Remove gasoline fuel rails, fuel line, tank & evaporative emission system – if the vehicle is equipped with the EVAP components (cont'd):

- Remove the gasoline fuel rails from the engine with harness attached, through the back of the engine compartment inside cab
- Remove injector wiring harness for use on the *LPEFI*® injectors



Caution: Gasoline under pressure. Gasoline is flammable & toxic. Use extreme caution and eliminate all sources of ignition while handling. Wear gloves & goggles.



- Disconnect electrical connector, hoses and remove temporary gasoline tank from frame rail

Note: These procedures may change if the vehicle was originally equipped with the larger permanent gasoline tank. This could also affect other procedures in this manual. Call Bi-Phase for information about this.

- Remove all fuel lines and evaporative emission line from frame rail
- Drain all gasoline from the lines and discard in the proper environmental manner



15/16" socket & ratchet with same size wrench



3/8" QD tool

Right Rail



Left Rail



Prepare the LPEFI[®] fuel rails for installation:

- Remove the new fuel rails from the package; retain the envelope with the rails

Note: The envelope contains decals, owner information card and a warranty registration card. The warranty registration card, along with the Post-Installation Inspection form on page 37, must be filled in and returned to Bi-Phase Technologies for warranty to be valid. Label placement is described on page 33.

- The bushings and hold down clamps are not mounted on the rails and will need to be installed prior to installation on the engine
- Place both rails on the bench as shown in the photo at left
 1. Injector tubes turned to the inside
 2. Injector electrical connector positioned to face toward the rail
 3. The rails must be positioned on the bench with the **QD** inlet fittings to the rear as they will be installed on the engine
 4. Installing the bushings and clamps
 - Driver side
Install bushings & clamps in the forward most slots on the rail with the clamps positioned flat side down
 - Passenger side
Install bushings & clamps in the rear most mounting slots on the rail with the clamps positioned flat side down



Install LPEFI® system

Fuel Rails:

- Lubricate the lower o-rings (green) on each injector and place each rail on the engine with the **QD** hose inlet connector facing toward the rear of the engine

Note: The injector electrical connectors should be facing outward to allow clearance between injector & intake plenum. The electrical connector could interfere with the installation of the rail or the installation of the rail could damage the injector if not pre-positioned outward as shown in photos on page 14.

- Using the original 6 mm studs and nuts taken from the gasoline rail mounting bracket secure the LPEFI® injector rails to the intake manifold; tighten to a torque of 12 NM (106 in-lb)
- Install original gasoline injector wiring harness and connect each injector connector to the proper cylinder
- Reconnect the large harness connector as disconnected earlier

Note: When disconnecting or connecting injector connectors be careful and pull green locking tab up to disconnect and push in on connector (squeeze) to disconnect. After reconnecting push green locking tab down to lock connector. Be careful not to break this plastic tab and locking piece.

Engine Coolant Temperature Sensor:

- Remove radiator cap to relieve any system pressure and reinstall the cap to prevent losing too much coolant
- Place a catch pan under the engine to catch coolant
- Prepare the LPEFI® engine coolant temperature sensor for installation; use thread sealant or Teflon tape
- Remove 3/4" plug from driver side cylinder head, using a 3/8" drive extension & ratchet

(Cont'd)

Clean motor oil

10 mm wrench or socket
& ratchet

Drain pan
3/8" extension & ratchet
Teflon tape or thread
sealant

Install LPEFI® system**Engine Coolant Temperature Sensor (cont'd):**

- To prevent the loss of coolant immediately insert the LPEFI® engine coolant temperature sensor; when complete make sure to replace any lost coolant; the post-installation inspection will also remind you to check the coolant level
- Route wiring harness across top of engine, under the injector rails to the rear of No. 3 cylinder injector on the driver side bank & to the rear of No. 6 cylinder injector on the passenger side bank
- Secure the harness on the driver side bank to the main wiring harness with a nylon tie strap
- Unplug the OEM factory equipped ECT and plug in the LPEFI® harness to the OEM wiring harness and then to the OEM's ECT sensor harness; use the existing wiring harness bracket to secure the harness; a nylon tie strap may also be preferred

Note: If the vehicle is equipped with air brakes, a kit containing a pipe nipple, tee & instruction is available from Bi-Phase. This kit will be required to install the additional LPEFI® engine coolant temperature sensor. Call Bi-Phase to order this kit for air brake equipped vehicles.

New Spark Plugs:

- Replace the spark plugs with NGK #TR6 plugs. They should be set to the correct gap, which is 0.035" (0.89mm)



7/8" wrench



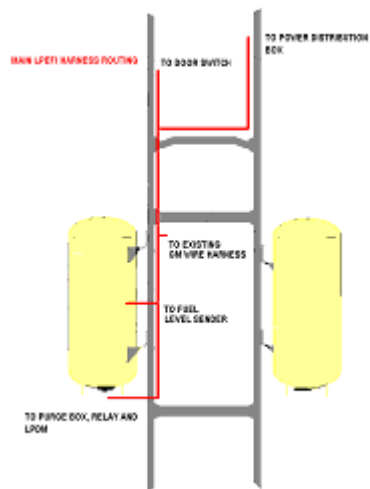
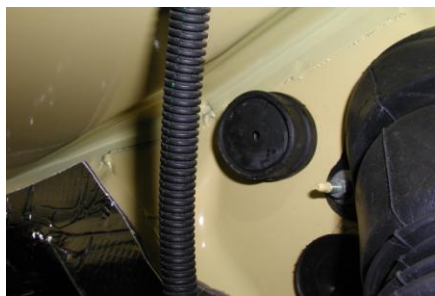
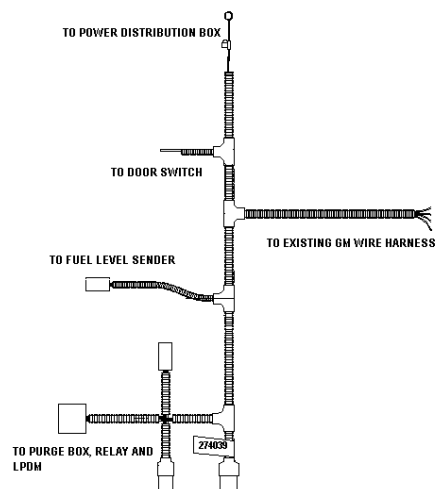
Nylon tie straps



Nylon tie straps



5/8" spark plug socket



Install LPEFI® system

Main wire harness:



Warning: Disconnect the battery before you work on any part of the LPEFI system.

Note: Route the main LPEFI® harness before completing any connections.

- Lay out the main harness with the orange lead with ring terminal toward the front of the truck
- Guide the main LPEFI® wiring harness (to door switch) branch, under the cab and along the drive side frame
- Pull grommet from the firewall, located on driver side upper firewall
- Cut the nipple from the grommet and push the grommet over the single loomed white wire (to door switch)
- Push the wire and grommet up through the fire wall and seat the grommet into the hole
- Route the main LPEFI® harness (to power distribution box) branch, across the cross member to the passenger side frame rail to the power distribution box
- Route the main LPEFI® harness (to existing GM wire harness) branch, along the driver side frame rail, to the OEM harness connection (original fuel pump harness)
- Route the remaining main LPEFI® harness along the driver side frame rail to the rear of the main tank.

Cutters

(Cont'd)

Install LPEFI® system**Main wire harness (cont'd):**

Warning: Disconnect the battery before you work on any part of the LPEFI system.

Note: Before securing any of the harness make sure it is routed to meet the length requirement to make each connection.

Main LPEFI® harness (to existing GM wire harness) branch

- There are four wires to connect together with the OEM original fuel pump/fuel level sending unit harness
- Route the LPEFI® harness (to existing GM wire harness) along the inside frame to the OEM harness. If the harness is too long trim it to fit. Cut off the OEM connector.

Note: The original connector will not be used.

- Strip a ½" of insulation from each wire.
- It is recommended that these four wires be soldered and heat shrunk for a good connection
- Make the following connections

<u>LPEFI® harness</u>	<u>to</u>	<u>OEM harness</u>
Purple	to.....	14 g. Purple
Black	to.....	14 g. Black
Orange ...	to.....	18 g. Black
Pink	to.....	Gray

- Leave the main trunk of the LPEFI® harness loose along the inside chassis frame rail to permit routing in the engine compartment
- Review the previous routing of the LPEFI® harness forward to the engine compartment; it should be routed inside the driver side chassis frame rail

Main LPEFI harness (to door switch) branch, it is a white 16-gauge wire

- Inside the cab find the white 16-gauge wire previously routed through the grommet; pull it in to take up any slack; route it to the left driver side kick panel

(Cont'd)

60/40 rosin core
solder
Solder flux
Heat shrink tubing
Soldering iron
Wire strippers
Heat gun
Nylon tie straps

Install *LPEFI*® system

Main wire harness (cont'd):

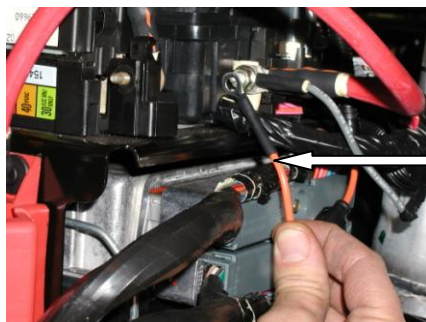


Warning: Disconnect the battery before you work on any part of the *LPEFI* system.

- Remove the driver side kick panel and locate the body connector
- Connect the white 16-gauge wire from the *LPEFI* harness to the violet wire (see 1st photo); it is recommend to solder and heat shrink this wire
- Tie strap the harness as needed and re-install the kick panel
- Inside the engine compartment make sure the harness is routed up from the chassis frame rail with an OEM harness; secure with nylon tie straps and confirm there is no interference with exhaust or any other components that could cause a problem

Main *LPEFI*® harness (to power distribution box) branch, is an orange wire with an in-line fuse and eyelet connector on the end

- Route it across the top of the engine with the OEM harness and secure with nylon tie straps
- Remove the small cover that protects a +12 volt terminal at the power distribution box located on the passenger side of the engine compartment
- Attach the orange wire to this terminal
- Replace the terminal cover
- Install the four bolts holding the OEM wiring harness brackets to the intake manifold (removed earlier) and make sure the map sensor is connected
- Replace the air filter box & connect the mass air flow sensor
- Completely secure main *LPEFI*® harness with ties; ties should be placed about 12" apart



Nylon tie straps
Pliers
Scotch lock
1/2" wrench or
socket & ratchet

10 mm & 13 mm
socket & 1/4" drive
ratchet
#2 screwdriver



Install LPEFI® system

Gauge:



Warning: Disconnect the battery before you work on any part of the LPEFI system.

- Install fuel level sending unit on the primary tank

Note: Use the 250-40 ohm resistance fuel level gauge sending unit supplied in the kit.

- When installing a fuel level gauge sending unit always reset the sender to zero using a small magnet; after installed on the tank the sending unit's needle should register zero or empty unless there is fuel in the tank

Note: When the secondary tank is used, the fuel level sending units have a different resistance value. Secondary tank sending unit has a 40-250 ohm resistance value.

Main LPEFI harness (to sending unit) branch, it is a black two pin connector

- Connect the main LPEFI harness (to sending unit) branch to the fuel level gauge; route inside the frame and use nylon wire ties to secure

Note: Always be aware of routing. Do not route near the exhaust and always use split loom to prevent chaffing.

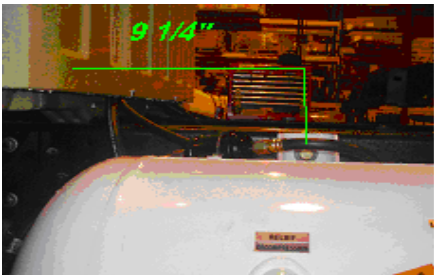






- Prepare to install the LPEFI® protecting cover with the 3/8" bolts provided; at this time leave the bolts loose and **do not** connect the main LPEFI® harness (to purge box, relay and LPDM), to the electronic control box and relay

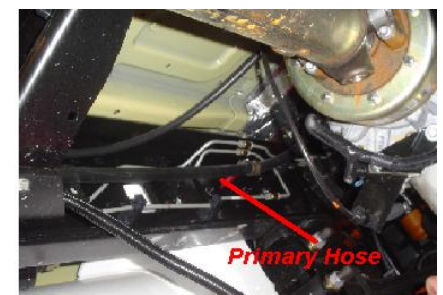


WARNING: Do not make the final electrical connections until the LPEFI system is completely sealed. Applying power could cause the valves in the tank to open, releasing fuel into the hoses.

Phillips
screwdriver
Wire connector tool
or equivalent
Magnet

9/16" wrench or
socket & ratchet

    	<p>Install LPEFI® system</p> <p>Tank:</p> <p>Primary tank is installed on the driver side</p> <ul style="list-style-type: none"> • Use a prepared template or measure the tank to mark the holes to be drilled in the frame; the front tank support mounting holes are located 9 1/4" from the most rear portion of the cab; measure rear mounting hole appropriate with the rear tank mounting bracket • Use an 11/16" drill bit to drill mounting holes; use the 5/8" bolts, washers & nuts provided in the kit to mount tank • Raise the tank into place and install the bolts, two bolts per support; tighten all the mounting bolts until the Belleville washers are flat or torque to about 52 ft-lb or 70 Nm <p><i>Note: Due to the OEM placement of the exhaust system a tank heat shield may be required.</i></p> <p>Fill hose installation</p> <p><i>Note: This can be done before the tank is installed if you choose to prepare the tank for installation.</i></p> <ul style="list-style-type: none"> • Install the remote fill valve on the vertical bracket that is welded to the tank just behind the cab <p>(Cont'd)</p>	 <p>11/16 drill bit and drill</p>  <p>15/16" wrench, socket & ratchet or impact</p>
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Installing LPEFI® system

Tank (cont'd):

If dual tank setups refer to page 27 before completing next step.

- Preassemble fill hoses to fill filter
25" fill hose – Install 90-degree hose end fitting to inlet side fill filter; tighten with 90-degree end point down (Torque to 44-48 ft-lb.)
39" fill hose – Install 90-degree hose end fitting to outlet side of the filter; tighten with 90-degree end point up (Torque to 44-48 ft-lb.)
- Place fill filter mounting clamp onto fill filter and mount entire assembly to step bracket with 1/4" bolt, washer and nut; mounting hole is located 8" from the frame on the bracket; tighten parallel with bracket
- Connect the other end of the 25" fill hose to the fill valve and tighten (Torque to 29-31 ft-lb.)
- Route the other end of the 39" hose across the tank toward the rear of the tank; clock the stop fill valve elbow to 90-degrees to the front of the tank; stop fill valve is located approx. 26" from the rear of the cab



Warning: Stop fill valve elbows are never tightened at the tank manufacturer. The fill valve is tight but the elbow must be tightened and clocked to the proper position. Do not allow the valve itself to move while tightening the elbow.

- Connect the straight end of the 39" hose to the stop fill valve and tighten (Torque to 25-39 ft-lb.)
- Install a rubber coated clamp around the two hoses and secure it at the 1/4" hole on the tank (located across from tank mounting bracket)

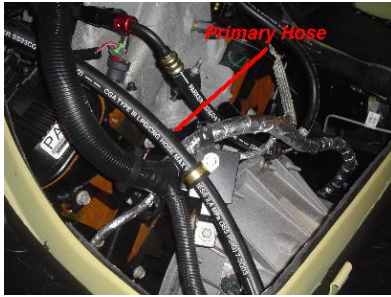
Primary hose:

- Route the primary fuel line with flare end fitting toward the front of the engine
 - 1) The hose will route from the LPDM, under the frame, and follow along the inside frame rail

(Cont'd)

1 1/4" wrench

7/8" wrench
3/4" wrench
7/16" wrench,
socket & ratchet
10" or 12" crescent
wrench

Install LPEFI System**Primary hose (cont'd):**

2) Turn the hose toward the transmission bell housing, it will run over the left side of the bell housing, then over the left engine rocker cover and under the main harness



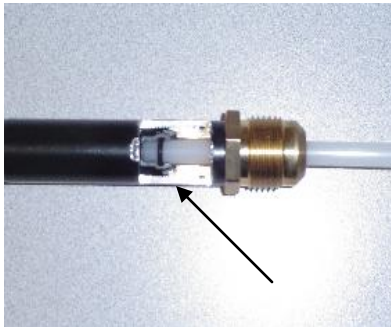
3) Continue to route the hose, and loop back towards the left injector rail behind the AC compressor

Attach primary fuel hose to injector rail

See photos on the left



- Pull out about 2-1/2 inches of the white inner hose out of the primary fuel line
- Lubricate inner line with clean motor oil



- Carefully guide the inner line into the center of the rail and feel for the line to engage the internal o-ring (see picture on left); 2" of inner line must be inserted into the rail to make a proper connection

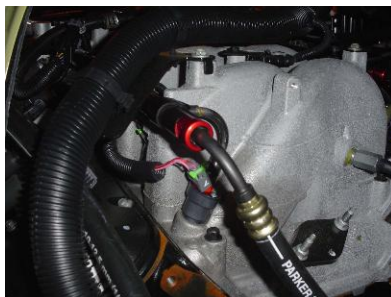
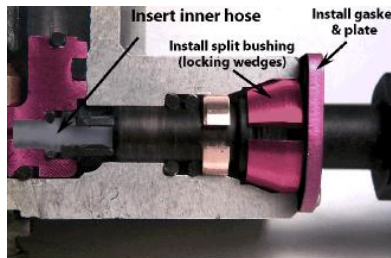
- Pull the outer hose onto the fitting on the end of the rail, tighten the flare nut (torque to 33-38 ft-lb); use a "backup wrench" on the rail to keep the brass fitting from turning as you tighten the flare nut; do not over tighten the flare nut; (brass fitting on the rail is tightened to 5-6 ft-lb)

- After tightening the flare nut, verify the hose does not come in contact with AC compressor or any components

(Cont'd)



7/8" open end wrench
1" open end wrench



Install LPEFI System

Primary hose (cont'd):

Attach the primary line to the LPDM

- Position the primary hose to be connected to the LPDM by routing the hose under the frame
- Remove retaining screws, plate, gasket and split collar retainers from LPDM
- Install plate and gasket onto hose end fitting of primary hose
- Lubricate hose end fitting metal surface and white nylon inner line
- Insert into center of LPDM port and push in slowly until metal hose end fitting is touching the top of the brass bushing in the port

Note: This end may be very difficult to push in all the way and may require slightly tapping in with a screwdriver and hammer. Do not damage the locking ring on the hose end fitting. Once it is inside the port 1/2" or more you can install the split collar retainers, screws, gasket, plate and tighten firmly, assuring that the plate is flush to the LPDM casting and the gasket is tight.

Attach the crossover hose to the injector rails

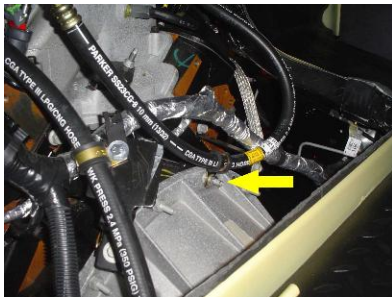
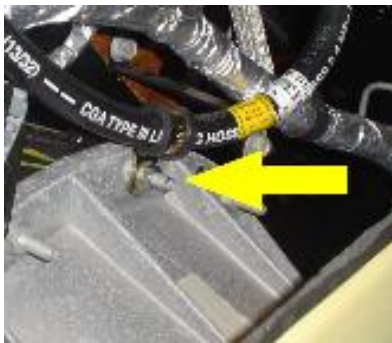
- Start with the 80-degree hose end on the crossover hose, lubricate the white nylon inner line and insert into injector rail on the driver side
- Lubricate white nylon inner line on the 45-degree hose end and insert into the injector rail

⚠ VERY IMPORTANT: Take extreme care to center the nylon line into the rail end fitting and slowly push the line all the way in (turn the hose from side to side or twist it as you are pushing it in). Once the white inner line is completely in, push the entire fitting into the rail until it clicks and locks.

(Cont'd)

T-20 Torx driver
Clean motor oil

Clean motor oil



Install *LPEFI* System

Primary hose (cont'd):

Secure the crossover hose

- Connect the crossover hose to the bell housing with a P-clamp and nut; use the existing bolt in bell housing along with P-clamp and nut from the kit to secure the hose
- Verify the hose is routed in a way that there is no interference with chassis components that could cause chaffing

Secure the Primary Hose

- Primary hose loop will determine how much slack is available to secure the primary hose; verify the primary hose is routed in a way that there is no interference with chassis components that could cause chaffing
- **Primary Hose Support: Make sure the flat fender washer is installed under the P-clamp resting on the A/C compressor boss and supporting the P-clamp.** Torque A/C compressor bolt to 37 ft lbs. Insure that the hose is aligned so that no tension will be created on the fuel rail or the hold down clamps.
- Remove bolt from bracket mounted on the transmission that holds the harness connector; insert the 8mm bolt from the kit, along with the P-clamp and washer, and attach the primary hose and harness connector to the bracket (see picture on left)

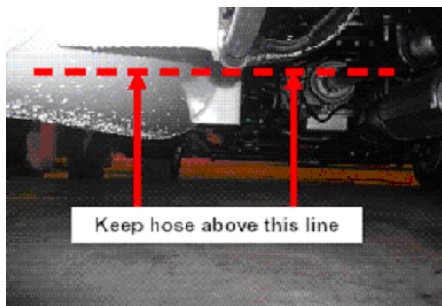
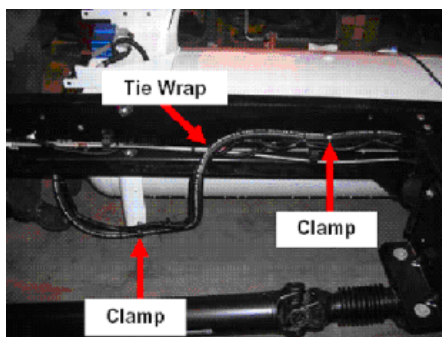
(Cont'd)



13 mm wrench or
Ratchet & socket





13 mm wrench or
Ratchet & socket


Install LPEFI System**Secure the Primary Hose (cont'd)**

- Secure the primary hose to the frame with 3" bolt, 2" spacer, P-clamp, washer and nylok provided in the kit; the mounting hole is located in the frame above the leaf spring and forward of the front tank mounting bracket
- Secure the primary hose to the frame with 3" bolt, 2" spacer, P-clamp, washer and nylok provided in the kit; the mounting hole is located in the frame between the middle and rear tank mounting bracket
- Secure the primary hose to the tank mounting bracket with 1/4-20 x1 bolt, P-clamp, washer and nylok provided in the kit.; the mounting hole is located on the rear tank mounting bracket, lower hole on the bracket.

Note: The hose must not extend below the bottom of the tank.


1/2" wrench,
Ratchet & socket


1/2" wrench,
Ratchet & socket


7/16" wrench,
Ratchet & socket

Installation Manual, GM Medium Duty Trucks, 2006

Secondary Tank/Transfer System:

Tank

- Follow the same procedures as on page 21 for mounting the tank to the frame

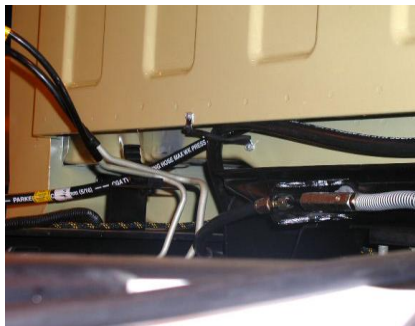
Hoses

- Install the flare tee with the flare swivel provided in the secondary tank installation kit to the outlet side of the fuel fill filter (Torque to 25-31 ft-lb.)
- Connect the No. 8 x 91" long fill hose; position the straight hose end to the tee and tighten (Torque to 25-31 ft-lb.); route the hose back and up over the chassis frame into the channel (rear bottom of the cab) under the back of the cab; cross the chassis and route it back down to the rear along the top of the secondary tank to the stop fill valve (located between the tank and frame rail between the tank mounting supports)

Warning: Stop fill valve elbows are never tightened at the tank manufacturer. The valve is tight but the elbow must be tightened and clocked to the proper position. Do not allow the valve itself to move while tightening the elbow.

- Clock the stop fill valve elbow to about a 10:00 position (to the rear of the tank) before installing the hose
- Connect the 90-degree end to the stop fill valve and tighten (Torque to 25-31 ft-lb.)
- Leave hose under cab loose at this time.; it will be positioned and secured in procedures to follow

(Cont'd)



15/16" wrench,
socket & ratchet or
impact
Tape measure

7/8" wrench
3/4" wrench
10" crescent
wrench

Secondary Tank/Transfer System:

Hoses (cont'd)

- Connect the No. 6 x 130" transfer hose to the secondary tank LPDM as shown in photo left; connect the 90-degree hose end to the flare fitting on the LPDM and tighten

Note: Always verify the fittings in the tanks are tight and sealed. Recheck for leaks during the post-installation inspection.

- Route the hose forward on top of the secondary tank, through the channel under the rear of the cab, across to the primary tank, on top of the primary tank to the one-way check valve
- Verify the flare elbow in the one-way check valve on the primary tank is tight and clock at the 10:00 position



Warning: Do not allow the one-way check valve to turn in the tank. When tightening the elbow into the one-way valve, back it up using a wrench. Clock this elbow to about the 10:00 position (to the front of the tank).


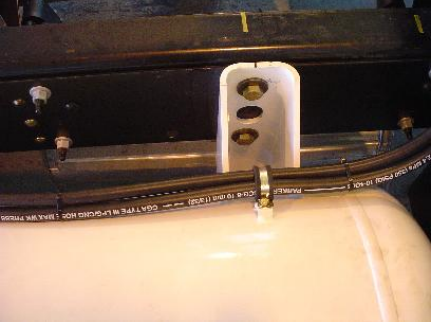
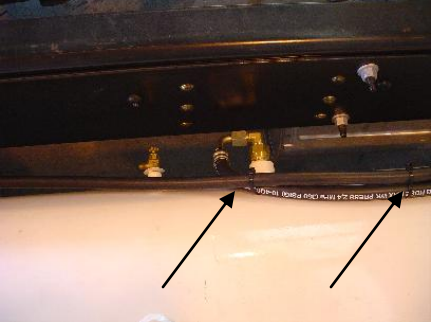




- Connect the transfer hose to the one-way check valve and tighten
- At this time verify routing of the transfer hose and the fill hose and tighten all the hose end flare nuts; all connections must be leak tested with an approved leak detection fluid or an electronic leak detector
- Using two clamps provided in the kit, straighten the clamps as shown in photo on the left; using the two clamps and four self-tapping screws mount the clamps as shown to secure the hoses up inside the channel under the rear of the cab; install the clamps so the opening in the rubber protector is facing down or so the hoses are sitting on the solid rubber side of the clamp; use necessary nylon tie straps to secure the hoses together and aid in the proper routing; the hoses should be routed not to interfere with future body installation or other pieces of the body or chassis that could cause chaffing

(Cont'd)

10" crescent wrench

Leak detection fluid or electronic leak detector

5/16" socket & extension & ratchet
Drill motor or electric screw driver

   	<p>Secondary Tank/Transfer System:</p> <p>Hoses (cont'd)</p> <ul style="list-style-type: none"> Secure transfer hose from the secondary LPDM to the tank thread standoff, (in front of rear tank support bracket) using clamps, 1/4" bolt and washer provided in kit Secure the transfer and fill hose to the tank thread standoff, (in front of front tank support bracket) using clamps, 1/4" bolt and washer provided in kit Secure the supply and fill hoses together using nylon ties; the nylon ties should be spaced about a foot apart Make sure all hose end fittings are tightened at this point 	 <p>7/16" socket & ratchet</p>  <p>7/16" socket & ratchet</p>  <p>Nylon tie straps</p>
--	--	---



Secondary Tank/Transfer System:

Wiring



Warning: Disconnect the battery before you work on any part of the LPEFI system.

- Route the secondary LPDM harness through the small hole in the frame near the end of the tank
- Continue routing the harness along the right frame rail toward the rear of the vehicle
- Locate OEM secondary fuel pump connector; route secondary LPDM harness to connector
- Remove blank plug from OEM secondary fuel pump connector (Some trucks will not use this plug, contact Bi-Phase Technologies for correct installation)
- Install secondary LPDM wire harness terminals into blank connector (terminal placement, A = Black, B = Red)
- Connections

<u>LPEFI Sec. LPDM</u>	to	<u>OEM harness</u>
Red	to	Green
Black	to	Black
- Plug connectors together

Install fuel level sending unit on the tank

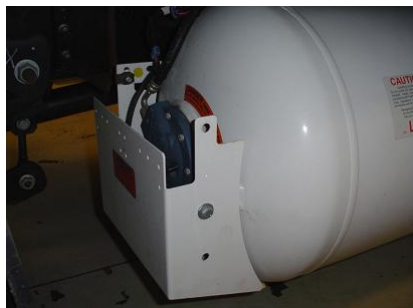
Note: Use the 40-250 ohm fuel level sending unit supplied in the kit.

- When installing a fuel level gauge sending unit always reset the sender to zero using a small magnet (refer to page 20); after installed on the tank the sending unit's needle should register zero or empty unless there is fuel in the tank
- Route the secondary fuel level sending unit harness through the same small hole as is the secondary LPDM harness (1st photo on this page)
- Continue routing the harness along the right frame rail toward the rear of the vehicle
- Locate the OEM secondary fuel level connector.

(Cont'd)

13 mm wrench

60/40 rosin core
solder
Solder flux
Heat shrink tubing
Soldering iron
Wire strippers
Heat gun
Nylon tie straps



Secondary Tank/Transfer System:

Wiring (cont'd)

- The OEM secondary fuel connector has two leads from the connector that are spliced together; cut the splice to separate the two leads, but leave the connector plug in; there should be about 4" of wire remaining (Some trucks will not use this connector, contact Bi-Phase Technologies for correct installation)

- Route the secondary fuel level harness to the OEM secondary fuel connector
- It is recommended that these two leads be soldered and heat shrunk for a good connection

Connections

LPEFI harness to OEM harness

Blue.....to.....Blue

Black.....to.....Black

- Use nylon tie straps to secure the *LPEFI* harness along its entire routing
- Install the protective tank guard to the tank mounting lugs using the hardware (bolts, washers and speed nuts) provided in the kit



Side cutters



Pliers or small
wrench
Nylon tie straps



9/16" wrench or
socket & ratchet



Heat shield mounted to lower tank supports using six 1/4" bolts on the primary tanks or four on the secondary tanks. Use pre-existing holes in the lower part of the tank supports.



Completing Wire Harness Installation:

Primary tank side

Main LPEFI harness (to purge box, relay and LPDM branch, is 4 connectors on 4 branches, tied together.

- Connect main LPEFI harness connection to electronic purge box and relay and LPDM
- Assemble cover plate to rear of the primary tank
- Secure hardware to cover plate and tank



WARNING: Do not make the final electrical connections until the LPEFI system is completely sealed. Applying power could cause the valves in the tank to open, releasing fuel into the hoses.

Protective heat shield:

Note: Per the requirements of the National Fire Protection Association, LP Gas Code Handbook #58 & Handbook #52, Natural Gas Code Handbook #58 Chapter 8

"If the fuel container is installed within 8" (20cm) of the engine or exhaust systems, it shall be shielded against direct heating."

On the GM 560s, depending on the chassis, the exhaust is routed on one side or the other and the propane tank depending on the chassis may require a heat shield. The heat shield is not included in the kit. It is the responsibility of the installer to install a heat shield where required and in compliance with the National Fire Protection Associations LP Gas Code Handbook #58.

The heat shield can be constructed from light sheet metal preferably galvanized for corrosion resistance. The shield can be easily mounted to the lower part of the tank supports. There are two 1/4" holes in the lower portion of the tank supports. After the tank is mounted the holes are visible just below the chassis frame rail.

Recommended dimensions

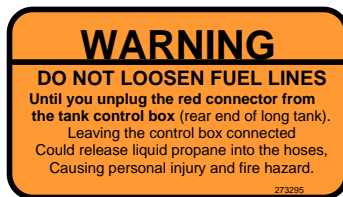
Primary tank	9" X 60"
Secondary tank	9" X 60"

Phillips
screwdriver
Small magnet

Galvanized sheet
metal & cut to fit
see recommended
dimensions
1/4" bolts, washers
& nuts
7/16" wrench,
socket & ratchet




8.1 LITERS 5BP1TH00.1G01 D80H CERTIFIED	IMPORTANT ENGINE INFORMATION BI-PHASE TECHNOLOGIES LLC #FHWG007W0	CATALYST #FHWG007W0
NO ADJUSTMENTS NEEDED SEE SERVICE MANUAL OR OWNERS MANUAL FOR MORE INFORMATION	BAR CODE HERE	DATE LABEL
THIS ENGINE IS CERTIFIED TO OPERATE ON PROPANE. THIS ENGINE CONFORMS TO US EPA AND CALIFORNIA REGULATIONS APPLICABLE TO 2005 MODEL YEAR RULES HEAVY-DUTY OTTO CYCLE ENGINES AND IS CERTIFIED FOR SALE IN CALIFORNIA.		



Install labels on the truck/registration:

Note: For best results when applying labels, dip the label in soapy water before you apply it to the truck. Slide the label into position, and then use a rubber squeegee to force out the air and water.

- Install one “LPEFI®” transparent label on each fender under the GM model identification as shown in photo left.
- Install the EPA emissions label in the engine compartment on the left side headlamp panel; once placed do not try to remove this label as it would be destroyed.
- Install orange warning label on the inside of the doghouse cover; this label warns not to remove any hoses unless the system has been properly prepared
- If the truck does not have a box or body installed yet, put the propane diamond in the glove box for later placement
- After the body is installed on the truck, install the blue “PROPANE” diamond on the back panel of the truck, toward the bottom right corner; do not install on the bumper.
- Attach Temp. sensor to temp sensor harness
- Fill out vehicle warranty registration card and return to Bi-Phase Technologies along with the Post-Installation Inspection
- Place laminated owners information cab card in the glove box with the OEM’s owners manual & other GM information

 Rubber squeegee

Testing the Installation

1. Visually inspect the tank(s), the hoses, the wiring and the engine compartment. Is everything assembled properly?
2. Fill the tank with 20 to 30 gallons of propane. It is recommended that you purge the tank with propane vapor and check all the fittings on the tank for leaks before filling the tank completely. Use an approved leak detection fluid or an electronic leak detector to verify there are no leaks. If any leaks are found stop and repair the leaks. The battery should not be connected at this time. (If the tank was filled before installation it should have been checked for leaks at that time.)
3. Connect a fuel pressure test gauge to the Schrader valve on the LPDM (rear end of the main tank, red cover) or on the wye located on the chassis frame rail.
4. Fuel pressure should be 0 psi at first.
5. If the connections on the electronic purge control assembly have not been made connect at this time.
6. Connect the battery. You may hear a click at the tank.
7. Open the driver door to start a purge cycle. You should hear the solenoid valves click and the pump running inside the tank. If not, check the electrical connections and refer to the troubleshooting section in the service manual.
8. Simultaneously with the preceding step you should inspect all hose connections, the LPDM, the fuel rail connections and the injectors for leaks. If any leaks are found you should disconnect the electronic purge control assembly, evacuate the lines and repair. See the service manual for procedures.
9. When the purge cycle ends, listen for leaking fuel near the hoses and around the entire system. If you do not hear any obvious hissing or smell propane, turn on the ignition key but do not start. This will start the fuel pump, followed by a purge cycle. The chart on page 36 explains the purge strategy.
10. When you hear the fuel pump stop running notice the fuel pressure on the test gauge. This pressure should be anywhere from 30 psi in cold weather to 180 psi in hot weather.
11. Turn the key off, then on again to start another purge cycle.
12. While the pump is running, observe the fuel pressure. It should be 35 to 55 psi higher than it was in step 11.
13. Turn the key off and check for leaks at every hose fitting on the vehicle. Apply an approved leak detection fluid (similar to soapy water) or use an electronic propane leak detector. The tank, tank valves, fuel injectors and fuel rails have been tested at the factory but you must recheck, and check the hoses and hose fittings. On dual tank trucks check all of the hoses between the tanks, too.



WARNING: Do not use an open flame to check for leaks.
If you smell propane, it is from a leak. The LPEFI system uses sealed fittings and lined hoses, and there should never be a propane odor from an LPEFI vehicle.



14. If there are no leaks, start the engine.
15. Connect a diagnostic scan tool to the vehicle. (The connector is usually under the bottom of the dash.)
16. With the engine running, check the diagnostic trouble codes (DTCs). Correct any problems you find. If the engine is not running smoothly, refer to the LPEFI service manual.
17. If there are no codes and the engine is running smoothly let the vehicle run until it is to full operating temperature (190° F on your Scan tool).
18. Turn the key off and follow the testing procedures described in the Post-Installation Inspection on page 37.
19. Fill out the Post-Installation Inspection completely.
20. Turn off the engine and disconnect the fuel pressure gauge set. Be sure to reinstall the dust cap on the



WARNING: The pressure test hose may contain cold liquid propane.
Wear insulated rubber gloves and goggles.

Shrader valve.

21. Drive the vehicle for at least 15 minutes, if possible. Drive under various conditions and a variety of speeds.
22. After the drive notice the long-term fuel trims as noted in the post-inspection. The long-term fuel trims should not be the same as they were before the drive. The long-term fuel trims should not be more than + or – 20%.
23. After driving and inspecting the vehicle turn it off and let it sit with the hood and doors closed for 15 minutes. After 15 minutes return to the vehicle, open the door to initiate a purge and start the engine. If the engine starts easily, 3 seconds or so, the vehicle is ready to use.
24. If there are no leaks, no DTCs and the engine runs well (smooth idle, smooth acceleration, good power), the vehicle is ready to use.
25. If you did not fill out the warranty registration card in the Installing Labels Procedure on page 33 do so now. Also complete the Post-Installation Inspection and return both to Bi-Phase Technologies to establish the warranty start date for your vehicle.

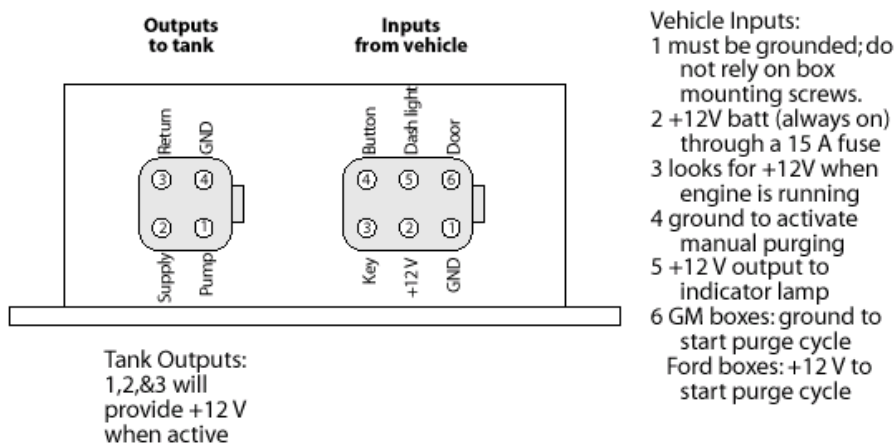
Installation Manual, GM Medium Duty Trucks, 2006

LPEFI® PURGE LOGIC						
Vehicle Operating Mode	Sequence of condition	LPEFI® function	Results	Supply valve	Pump	Return valve
Door purge*	1) Engine Off 2) Door closed longer than 10 minutes 3) open the door	Purge for 15 seconds	Liquid propane is delivered to the injectors and propane vapor is return to the tank	open	running	open
Key Purge**	1) Engine off 2) key to on position	Purge for 15 seconds	Liquid propane is delivered to the injectors and propane vapor is return to the tank	open	running	open
Starting	crank engine	fuel is delivered to the injectors	injectors open to deliver fuel to the cylinders	open	running	closed
Running	Engine running	fuel is delivered to the injectors	injectors open to deliver fuel to the cylinders	open	running	closed
Engine off Parked Key off	Engine off	Valves closed, pump stops	No fuel is delivered to the injectors	closed	off	closed

* The door opening feature will only initiate a purge after the door has been closed for more than 10 minutes.

** A purge can always be initiated by turning the ignition key to the on position. A purge will be begin and complete within 12 to 15 seconds. If another purge is desired turn the ignition key off and on again.

Tank control box wiring



Post-Installation Inspection

Installation & test date _____
 VIN _____ Engine size _____ Mileage _____
 Make _____ Model _____ Mfg date _____
 Customer name _____ Address _____
 City _____ State _____ Zip _____ Phone _____

Installer company name _____ Phone _____

Tank mfg. _____ Primary tank s/n _____ Secondary tank s/n _____
 Purge & fill propane tank Yes ☐ No ☐
 Quantity of propane _____ gallons
 Leak test tank & LPEFI® system complete Yes ☐ No ☐
 Leaks found & repaired Yes ☐ No ☐
 Where _____

Before starting engine check and top off coolant level. After starting engine observe coolant level and heater operation until engine is at 190°F on the scan tool and all air has purged from the cooling system.

<p><u>Tank Temps & Operating Pressures @ LPDM</u></p> <p>Tank temperature (bottom of tank) _____ °F</p> <p>Room temperature _____ °F</p> <p>Static pressure (tank pressure) _____ p.s.i.g.</p> <p><u>Pump Pressures with Engine Running</u></p> <p>Static + supply valve + pump _____ p.s.i.g.</p> <p>Static + supply valve + return valve + pump _____ p.s.i.g.</p>	<p><u>DataStream</u></p> <p>ECT/Temperature _____</p> <table> <tr> <td>At Idle:</td> <td><u>Bank 1</u></td> <td><u>Bank 2</u></td> </tr> <tr> <td>STFT</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>LTFT</td> <td>_____</td> <td>_____</td> </tr> </table> <p>Does the engine idle smoothly?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p>	At Idle:	<u>Bank 1</u>	<u>Bank 2</u>	STFT	_____	_____	LTFT	_____	_____
At Idle:	<u>Bank 1</u>	<u>Bank 2</u>								
STFT	_____	_____								
LTFT	_____	_____								

Transfer System

Any faults found using transfer system inspection tool? Yes ☐ No ☐
 If yes describe fault/repair _____

Diagnostic Trouble Codes

Any DTCs in computer memory? Yes ☐ No ☐
 List all codes: _____

If any DTCs found, repair all codes and retest

Comments: _____

Turn off vehicle & let it sit for 15 minutes with hood and doors closed.

Return to vehicle, open driver door. Does purge cycle initiate? Yes ☐ No ☐

Does vehicle restart easily after purge cycle is complete? Yes ☐ No ☐

Technician Name: _____

This inspection form must be returned to Bi-Phase Technologies.

Any problems found must be noted in the comment section and if a problem cannot be resolved Bi-Phase Technologies must be contacted at 1-888-465-0571.

LPEFI Serial numbers

Attach sticker from injector rail assembly