



LPEFI[®] Installation Manual
For
2004 GM Medium Duty Trucks with 8.1 Liter Engine
Models: C5500
Family 2 & 3
Mono-Rail System



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Bi-Phase Technologies, LLC
Eagan, Minnesota, U.S.A.

Bi-Phase Technologies, LLC

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
2945 Lone Oak Drive, Suite 150
Eagan, MN 55121
(651) 681-4450
Tech. Support line
(888) 465-0571**

Bi-Phase Technologies, LLC

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Notes:

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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 in the installation or repair of any propane system



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.



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.

Safety



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



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.

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.

FACTS ABOUT PROPANE & PROPANE POWERED VEHICLES

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 per gallon of liquid at 60 degrees F., lb.	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 ₄ H ₈
Vapor pressure in psig	
70 degrees F	127
100 degrees F	196
105 degrees F	210

PRE-INSTALLATION INSPECTION**(Recommended)**

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

- Visually inspect the vehicle
 - 1) Is the malfunction indicator lamp illuminated?
 - 2) Does the engine start and run smooth?
 - 3) Are there any fluid leaks?
- Install a diagnostic scan tool and verify there are no DTC's (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 39 in this manual.

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	<p>Remove air filter box:</p> <ul style="list-style-type: none"> • Disconnect the battery first • Disconnect mass air flow sensor • Loosen clamp where the hose from the throttle plate 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>Note: On Family 2 chassis be careful removing the cover; the EGR valve electrical connector is at the rear of the engine and slightly interferes with the top of cover during removal</p>	
	<p>Remove oil filler tube:</p> <ul style="list-style-type: none"> • Remove 3 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>Note: Place a rag in the hole to prevent dirt, particles or other objects from entering the engine</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>

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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
- Remove the nut on the upper right hand corner of the electrical distribution box (located on passengers side of engine compartment & the nut is in the upper right corner, engine side of electrical distribution box)
- Install the filler tube here and tighten. The electrical harness may require re-positioning to make room for the filler cap access
- Re-install 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 re-installation of the fuel injector rail



Hacksaw



hacksaw
black spray paint

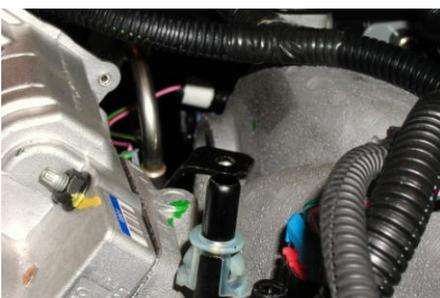


7/16" wrench
Socket & ratchet
13 mm wrench



Razor knife or hose
cutting pliers
pliers

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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 4 (6 mm) mounting studs and nuts holding the gasoline fuel rails to the intake manifold
- Place drain pan under drivers 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 & a 5/16" QD tool to disconnect the return fuel lines from the rail assembly. *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 and 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



10 mm socket & 1/4" drive ratchet



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



Pliers



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

- 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

- Remove drivers-side step. Step is bolted to the frame with four 5/8" bolts
- If equipped: The carbon canister is mounted inside on the step frame. It would be necessary to disconnect the hoses from the canister before removing the line.



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

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Right Rail



Left Rail

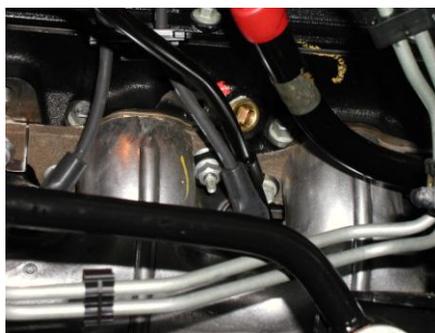


Prepare the LPEFI[®] fuel rails for installation:

- Remove the new fuel rails from the package. Retain the envelope with the rails. The envelope contains decals, owners information card and a warranty registration card. The warranty registration card, along with the post installation inspection form on page 39, must be filled in and returned to Bi-Phase Technologies for warranty to be valid. Label placement is described on page 35.

- 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
 - Passengers side:
Install bushings & clamps in the rear most mounting slots on the rail with the clamps positioned flat side down

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Installing 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
- Re-connect 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 re-connecting 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 re-install 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 $\frac{3}{4}$ " plug from drivers side cylinder head, using a $\frac{3}{8}$ " drive extension & ratchet


Clean motor oil


10 mm wrench or socket
& ratchet


Drain pan
 $\frac{3}{8}$ " extension & ratchet
teflon tape or thread
sealant

Installing LPEFI® system:**Engine Coolant Temperature Sensor:**

- To prevent the lose 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 drivers side bank & to the rear of No. 6 cylinder injector on the passenger side bank
- Secure the harness on the drivers 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.

Install 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



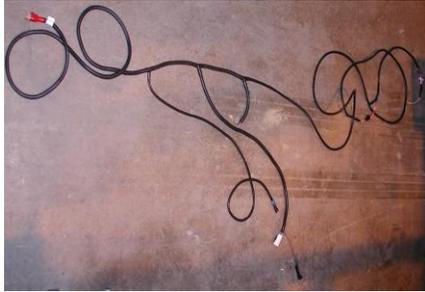
Nylon tie straps



Nylon tie straps



5/8" spark plug socket

Installation Manual, GM Medium Duty Trucks, 2004**Main wiring harness installation:**

- Route the main harness from the rear of the cabin along the inside of the chassis frame rail under the vehicle up to the area of the grommet in the firewall

- Pull grommet from the firewall, located on drivers side upper firewall

- Cut the nipple from the grommet and push the grommet over the single loomed white wire
- Push the wire and grommet up through the fire wall and seat the grommet into the hole on the firewall



cutters

Cont'

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Main wiring harness installation:

- Before completing the engine compartment wiring go to the harness connection at the back of the cab (*LPEFI*[®] harness) and the OEM harness connection (original fuel pump wiring) behind the cab at the cross member
- Before securing any of the harness make sure it is routed to meet the length requirement to reach the cross-member area
- There are four wires to connect together with the OEM original fuel pump/fuel level sending unit harness
- Route the original OEM harness up to the cross-member behind the cab, if the harness is too long trim it to fit. The original connector will not be used
- It is recommended that these four wires be soldered and heat shrunk for a good connection

Connections:

LPEFI[®] harness to OEM harness

Purple.....to.....14 g. **Purple**

Black.....to.....14 g. **Black**

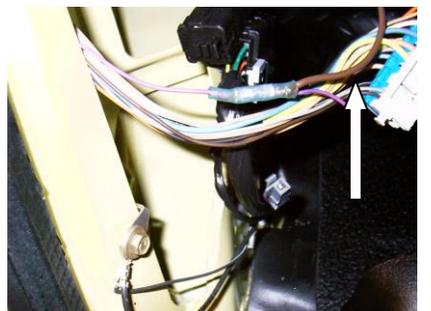
Orange... to.....18 g. **Black**

Pink.....to..... **Gray**

- Route *LPEFI*[®] harness across the inside of the cross-member to the body builder access connector located just behind the cross-member on the passenger side chassis frame rail close to the grounding terminals
- Route the *LPEFI*[®] harness across the cross member and secure it into a hole on the cross member on either side of the cross member.
- Make sure the jumper connector W3-115 is in place in the white connector on single tank vehicles
- Route the brown wire pigtail to the body builder connector
- Strip back the body builder connector harness' split loom and locate the brown wire, Pin F. Splice (solder & seal) the brown pigtail to this wire

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

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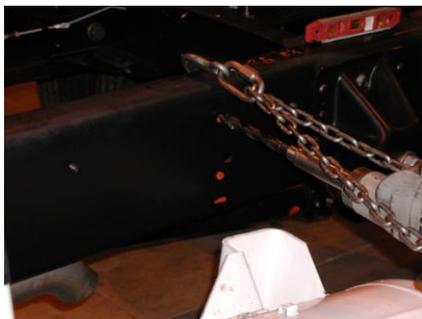


Main wiring harness installation:

- Secure the *LPEFI*[®] harness inside the cross-member with 2 nylon tie straps
- 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 drivers-side chassis frame rail. Pull up any slack in the harness and secure it with nylon tie straps
- Inside the cab find the wire previously routed through the grommet. Pull it in to take up any slack. Route it to the left drivers-side kick panel
- Remove the kick panel and find the large white and blue connector.
- Connect the white 16 gauge wire, previously routed, to the purple wire in Pin 1. We 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.
- The long harness remaining is an orange wire with a 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 passengers-side of the engine compartment
- Attach the orange wire to this terminal
- Replace the terminal cover
- Install the 4 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


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


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



Tank Installation:

- Remove cabin entry step on drivers side, if not previously removed
- Four 5/8" bolts hold the step to the chassis frame rail
- Remove the mud flap and (if equipped) the engine's block heater electrical connector
- Use a pre-prepared template or measure the tank to mark the holes to be drilled in the frame. The front tank support bolts in the same holes as the front cabin entry step mounting bracket and uses the same bolts taken out when the step was removed.
- The center tank support may or may not require drilling the chassis frame rail. Family 2 (84" cab to axle) will require drilling both the center tank support and rear. The Family 3 (102" cab to axle) will only require drilling the chassis frame rail for the rear tank support. Use a 11/16" drill bit and use the 5/8" bolts, washers & nuts provided in the kit.
- 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.

Note: Due to the OEM placement of the exhaust system a tank heat shield may be required

Family 2: Requires shield on secondary tank if used

Family 3: Requires shield on primary tank

See page 34 for specific information



15/16" socket & ratchet



13 mm socket & ratchet



15/16" wrench, socket & ratchet or impact

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Tank Installation:

Fill hose installation:

Note: This can be done before the tank is installed if you choose to prepare the tank for installation

- Install the remote fill valve on the vertical bracket that is welded to the tank just behind the cab
- Assemble on bench the fill hoses
25" fill hose - Install 90 degree hose end fitting to inlet side fill filter
39" fill hose – Install straight hose end fitting to outlet side of fill filter

Note: If the truck is scheduled to have a secondary transfer tank on the passenger side install the tee with the #8 swivel connector on the outlet side of the fill filter (see secondary tank installation & secondary tank kit)

- Place fill filter mounting clamp onto fill filter and sit the entire assembly on the tank, routing the 45 degree hose end fitting of the 25" hose to the remote fill valve previously mounted
- Bolt the fill filter mounting clamp to the bracket that is welded to the 14" diameter part of the tank (about 13" back from the front tank support & has a nut welded in). Tighten it parallel with the frame, routing the 39" fill hose parallel with the frame rail to the rear over the top of the center tank support to the rear most stop fill valve (*located between the tank and the frame rail between the center and rear tank supports*). Clock the stop fill valve elbow to 45 degrees to the rear of the tank.



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.*

- Install a rubber coated clamp on the fill hose and secure it at the 1/4" hole on the center tank support.

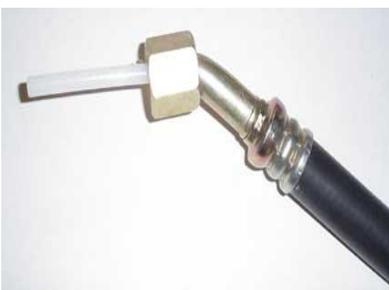
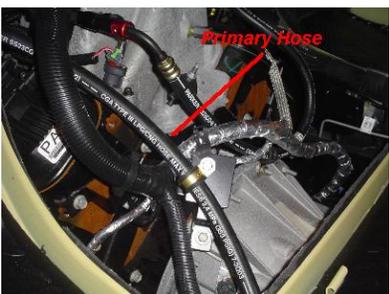
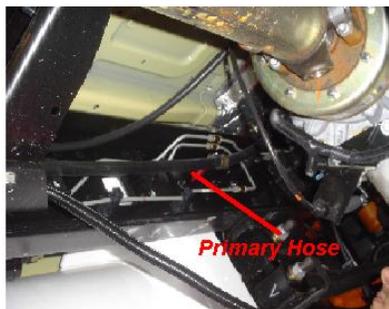
Note: On family 3 trucks do not mount this clamp at this time. This 1/4" hole on the center tank support will be used to support clamps for the primary hose on Family 3 trucks and on dual tank Family 3 trucks there will be a dual hose clamp securing 2 hoses & one single clamp holding the primary hose.

- This fill hose routing is the same for all Family 2 and Family 3 trucks


1 1/4" wrench


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

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Installing LPEFI System:

Primary hose installation

- 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.

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.

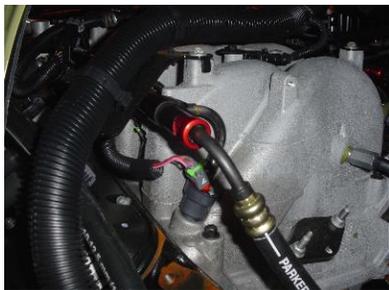
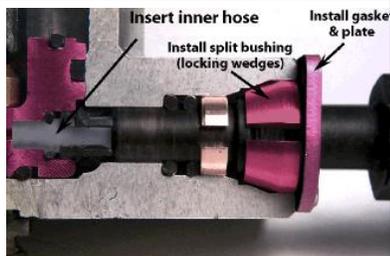
3) Continue to route the hose, and loop back towards the left injector rail behind the AC compressor.

Attach primary fuel hose to injector rail. See picture's 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.
- **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 tighten to 5-6 ft-lb)
- After tightening the flare nut, verify the hose does not come in contact with AC compressor or any components.

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

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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

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's 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

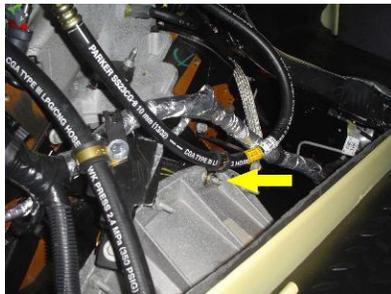
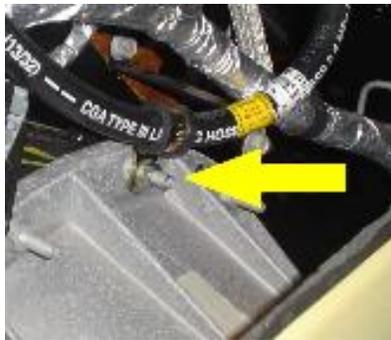


T-20 Torx driver
Clean motor oil



Clean motor oil

Installation Manual, GM Medium Duty Trucks, 2004



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

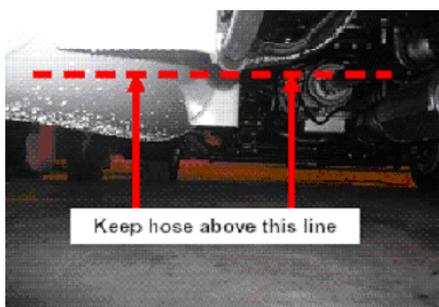
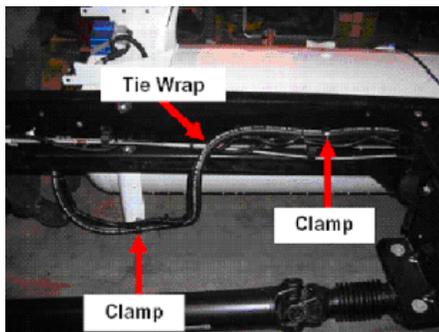

13 mm wrench or
Ratchet & socket

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. *See picture on left.*
- 1) 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*


13 mm wrench or
Ratchet & socket

Cont'd,



Secure the Primary Hose Cont'd:

- 2) 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.
- 3) 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.
- 4) 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, 2004



Wiring harness:

- Install fuel level sending unit in the tank
Note: If this is a single tank application use the 40-250 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 units needle should register zero or empty unless there is fuel in the tank.

Note: When an optional secondary tank is used the fuel level sending units have a different resistance value, 0-90 ohm. The primary tank sending unit, 40-250 ohms resistance, cannot be used with a dual tank transfer system and if used would cause a malfunction of the fuel transfer control

- Route remaining rear part of the wiring harness:
Family 2: Route inside the frame and use nylon wire ties to secure
Family 3: Route from the cross-member back under cab and secure with nylon tie strap, then route with the primary hose on top of the tank to the rear of the tank
- Connect pigtail for fuel level sending unit to the sending unit.

Note: Do not route the sending unit harness under the frame on Family 3 trucks. The connector should be disassembled and route the wires through a hole in the frame rail to the sending unit. Re-Install the connector and plug into the sending unit. Always be aware of routing, do not route near exhaust and always use split loom to prevent chaffing

- Prepare to install the LPDM protecting cover with the 5/16" bolts provided. At this time leave the bolts loose and do not connect the main wiring harness and the LPDM harness to the red electronic control box.



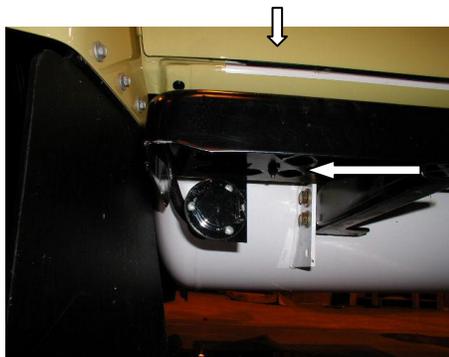
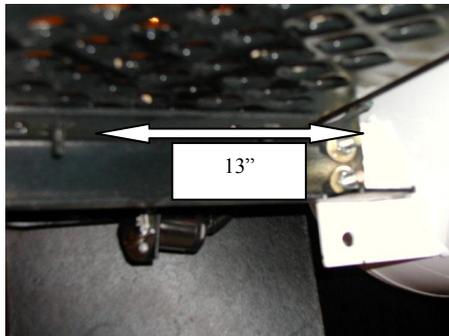
WARNING: Do not make the final electrical connections until the LPEFI system is completely sealed. Applying power could cause the valves in the tank to open, releasing fuel into the hoses.



Phillips
screwdriver
Wire connector tool
or equivalent



9/16" wrench or
socket & ratchet



Modify & install drivers side entry step:

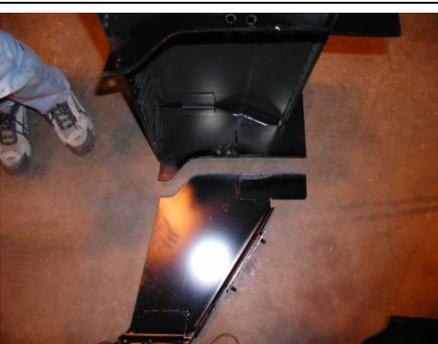
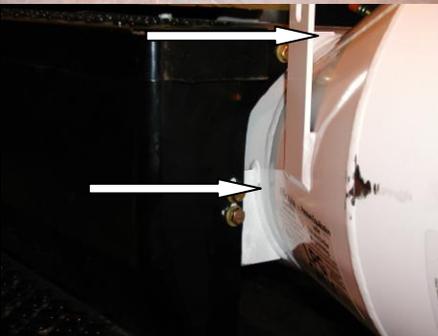
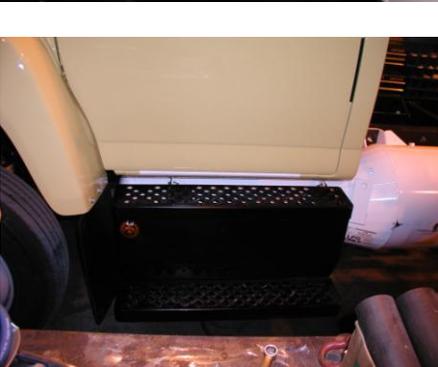
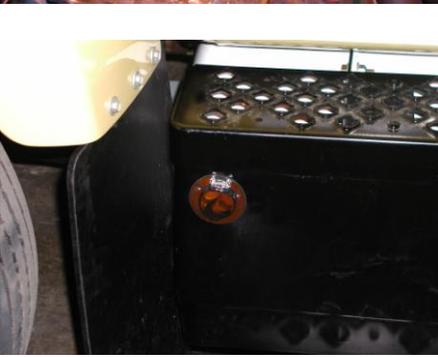
Family 2

- Cut original step brackets
- Cut 13 inches from outer end of bracket, clean sharp edges & paint
- Drill 5/8" holes in bracket at 1.5" centers for mounting to tank mounting lugs.
- Using 1/2" grade 8 bolts secure the step to the tanks mounting lugs and tighten firmly

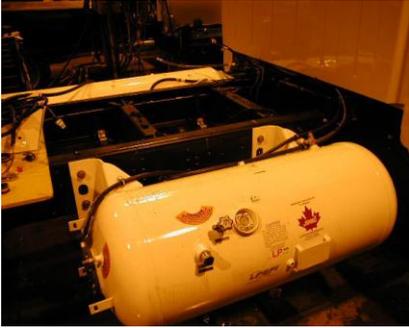
- If equipped with a engine block heater receptacle:
Bend or straighten bracket and mount to existing holes in forward part of step with 1/4x20x1" bolts
- Re-install mud flap


 Measuring tape
 Cutting tool
 (sawzall, plasma
 cutter)
 Hand held grinder
 Drill motor
 5/8" drill bit
 3/4" wrench, socket
 & ratchet
 7/16" wrench,
 socket & ratchet
 hammer

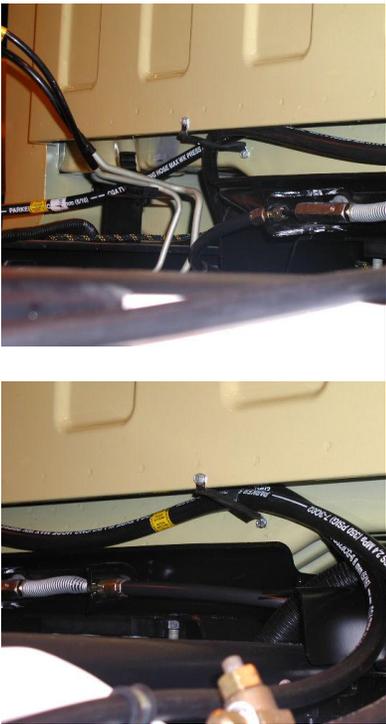
Installation Manual, GM Medium Duty Trucks, 2004

	<p>Modify & install drivers side entry step:</p> <p>Family 3</p> <ul style="list-style-type: none"> • Prepare template to cut original step bracket for re-installation to the propane tank mounting lugs 	 <p>Measuring tape Cutting tool (sawzall, plasma cutter) Hand held grinder Drill motor 5/8" drill bit 3/4" wrench, socket & ratchet hammer</p>
	<ul style="list-style-type: none"> • Cut the bracket and drill holes to mount step to tank 	
	<ul style="list-style-type: none"> • Using 6 1/2" bolts secure the step to the tank 	
	<ul style="list-style-type: none"> • Cut hole in step as shown in photo left for the relocation of the engine block heater receptacle. It will be necessary to drill 3 holes for the mounting screws. 	 <p>Hole saw Drill motor Screwdriver</p>

Installation Manual, GM Medium Duty Trucks, 2004

	<h3>Optional Secondary/Transfer Tank Installation Tank</h3>	 15/16" wrench, socket & ratchet or impact tape measure
	<h3>Hoses</h3> <ul style="list-style-type: none"> • Use a pre-prepared template or measure the tank to mark the holes to be drilled in the frame • In relation to the back of the cab install the tank so that the vertical surface of the forward tank head is even with to 2 inches from the back of the cab +/- 1". This is not a critical measurement but the tank should be mounted on a flat surface of the chassis frame rail with no interference with cross members. • Install the flare tee with the flare swivel provided in the secondary tank installation kit to the outlet side of the fuel fill filter • Connect the No. 8 x 91" long fill hose. Position the straight hose end to the tee and 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 (<i>located between the tank and frame rail between the tank mounting supports</i>) 	 7/8" wrench 3/4" wrench 10" crescent wrench
	<hr/> <p>⚠ 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.</p> <hr/>	
	<ul style="list-style-type: none"> • Clock the stop fill valve elbow to about a 10:00 position (to the rear of the tank) before installing the hose • Leave hose under cab loose at this time. It will be positioned and secured in procedures to follow • 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 	
	<p>Note: Always verify the fittings in the tanks are tight and sealed. Re-check for leaks during the post installation inspection</p>	
	<ul style="list-style-type: none"> • Route the hose forward on top of the secondary tank. Route it up into the channel under the rear of the cab across to the primary tank. Route it on top of the primary tank to the front stop fill valve, (located between the tank and the frame rail between the center and rear tank supports) 	

Installation Manual, GM Medium Duty Trucks, 2004

	<p>Optional Secondary/Transfer Tank Installation</p> <p>Hoses</p> <ul style="list-style-type: none"> Remove the flare elbow in the stop fill valve on the primary tank Install the flare elbow supplied in the kit, it is a No. 6 flare, smaller than the one that is shipped on the tank <hr/> <p>⚠ Warning: Do not allow the stop fill valve to turn in the tank. When tightening the elbow into the stop fill valve back it up using a wrench. Clock this elbow to about the 10:00 position (to the front of the tank)</p> <hr/> <ul style="list-style-type: none"> Connect the transfer hose to the stop fill 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 photos left. Using the two clamps and 4 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. 	 <p>10" crescent wrench</p>  <p>Leak detection fluid or electronic leak detector</p>  <p>5/16" socket & extension & ratchet Drill motor or electric screw driver</p>
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Optional Secondary/Transfer Tank Installation

Wiring

- Remove single tank jumper plug W3-115 from main wiring harness (located at passengers side of cross member behind cab)
- Verify the brown wire from the *LPEFI*[®] main harness was spliced into the brown wire (pin F) of the body builders connector
- Connect the secondary wiring harness provided in the kit to this connector

- Remove empty ground terminal connector at grounding block located on passenger side chassis frame rail
- Install ground wire terminal from secondary wiring harness into the terminal connector previously removed
- Re-connect ground wire from secondary wiring harness to the ground block terminal

- Route the single power wire with the inline fuse holder under the vehicle along the inside of the right chassis frame rail and connect the eyelet to the fuse block where the main harness was previously connected on page 19.
- Route and secure the single power wire along the chassis with nylon tie straps and protect from chaffing or heat interference

- Route the long secondary wiring harness (which has terminals to connect to the new in-dash fuel gauge) across the cross member and forward along the inside of the left chassis frame rail (route with the main wiring harness previously installed on page 17)
- Route the harness inside the cab using the same pass through (rubber grommet) previously used to route the door switch wire on page 17.

 13 mm wrench

Optional Secondary/Transfer Tank Installation

Wiring

Note: The original fuel level gauge cannot be used when the dual tank transfer option is installed. Because the original fuel level gauge is not the same resistance as the fuel transfer system fuel level calculations a new gauge must be installed

- Remove the trim panel in the center of the dash
- Remove one of the 2 1/16" blank gauge plugs in the trim panel and install the new fuel level gauge provided with the kit
- Pull all excess wiring harness through the rubber grommet in the firewall. Route the harness under the dash and up to the trim panel area
- Connect the harness to the fuel level gauge

Purple wire to terminal S

Brown wire to terminal +

Black wire to terminal –

- Also connect the gauge light bulb to the positive and negative terminals on the gauge
- Re-install the dash trim panel
- Verify the harness is secured and does not interfere with anything under the dash
- Use nylon tie straps to secure the harness along its entire routing
- Route the secondary wiring harness on top of the secondary tank along the same route as the transfer hose and secure with nylon tie straps
- Connect the secondary wiring harness connectors to the fuel level balance module and transfer relay on the protective tank guard
- Connect the wiring harness from the secondary tank LPDM (blue) to the harness connector pigtail that comes out of the fuel level balance module
- Install the protective tank guard to the tank mounting lugs using the hardware (bolts, washers and speed nuts) provided in the kit



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.



pliers or small wrench

9/16" wrench or socket & ratchet

Optional Secondary/Transfer Tank Installation

Wiring

- Connect the fuel level gauge sending units on both primary and secondary tanks.

Remember: The primary tank fuel level sending unit must be replaced. Also the fuel level gauge sending units must be reset to zero with a small magnet as explained earlier on page 34

Protective Heat Shields

*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 in. (20cm) of the engine or exhaust systems, it shall be shielded against direct heating"*

On the GM 560's 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 91"
 Sec. tank 9" X 48"

Family 2:
 Requires heat shield installed on optional secondary tank when used

Family 3:
 Requires heat shield installed on primary tank



Heat shield mounted to lower tank supports using 6 1/4" bolts on the primary tanks or 4 on the secondary tanks. Use pre-existing holes in the lower part of the tank supports.


 Phillips screwdriver

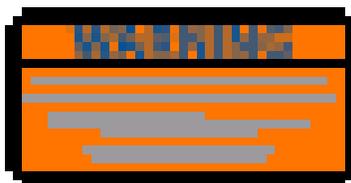

 Galvanized sheet metal & cut to fit, see recommended dimensions
 1/4" bolts, washers & nuts
 7/16" wrench, socket & ratchet

Installation Manual, GM Medium Duty Trucks, 2004

Install labels on the truck & register

- Fill out vehicle warranty registration card and return to Bi-Phase Technologies along with the Post Installation Inspection
- Place laminated owners information card in the glove box with the OEM's owners manual & other GM information

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, then use a rubber squeegee to force out the air and water.



 rubber squeegee

- Install 1 “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 along side the OEM emissions information. Once placed do not try to remove this label; it would be destroyed.
- Install orange warning label on air filter cover facing driver's side of engine compartment. 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 black “PROPANE” diamond on the back panel of the truck, toward the bottom right corner. Do not install on the bumper. For vehicles registered in Texas, you should use a blue label. If you know this is a Texas truck when ordering your kit ask Bi-Phase to add a blue diamond decal. The blue background diamond complies with Texas.

Installation Manual, GM Medium Duty Trucks, 2004

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 10 to 20 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 pre-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. If equipped with a secondary transfer tank verify the fuel level balancing module, relay and (blue) LPDM is connected at this time.
7. Connect the battery. You may hear a click at the tank.
8. Open the driver's 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.
9. Simultaneously with the preceding step you should inspect all hose connections, the wye, 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.
10. 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 41 explains the purge strategy.
11. 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.
12. Turn the key off, then on again to start another purge cycle.
13. While the pump is running, observe the fuel pressure. It should be 35 to 55 psi higher than it was in step 11.
14. 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 re-check and check the hoses and hose fittings. On dual tank trucks check all of the hoses



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.

- between the tanks too.
15. If there are no leaks, start the engine.
 16. Connect a diagnostic scan tool to the vehicle. (The connector is usually under the bottom of the dash)
 17. With the engine running, check the diagnostic trouble codes (DTC's). Correct any problems you find. If the engine is not running smoothly, refer to the LEFI service manual.
 18. If there are no codes and the engine is running smoothly let the vehicle run until it is to full operating temperature.

Testing the Installation, continued

19. Turn the key off and follow the testing procedures described in the Post Installation Inspection on page
 20. Fill out the Post Installation Inspection complete
 21. Turn off the engine and disconnect the fuel pressure gauge set. Be sure to re-install the dust cap on the Schrader valve.
-



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

22. Drive the vehicle for at least 15 minutes if possible. Drive under various conditions and various speeds.
23. After the drive notice the long-term fuel trims as noted in the post inspection. The long-term fuel trims should not be about the same as they were before the drive. The long-term fuel trims should not be more than + or – 20%.
24. After driving and inspecting the vehicle turn it off and let it sit with the hood and doors closed for 20 minutes. After 20 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.
25. If there are no leaks, no DTC's and the engine runs well (smooth idle, smooth acceleration, good power), the vehicle is ready to use.
26. If you did not fill out the warranty registration card in the previous procedure on page 41 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, 2004

LPEFI Purge logic

Vehicle Operating mode	Sequence of conditions	Resulting LPEFI function	Tank outputs		
			Supply valve	Return valve	Pump
Normal purge:	1. Engine off 2. Truck sitting longer than 5 minutes 3. Open the door →	Purge for 15 seconds	open	open	on
Starting:	1. Crank engine →	Pump fuel while cranking	open	closed	on
Running:	1. Engine running →	Pump fuel while running	open	closed	on
Failed start re-purge:	1. Turn key on 2. Crank engine 3. Stop cranking within 30 seconds →	Purge for 15 seconds	open	open	on
Cancel purging:	1. Purging 2. Turn key on →	Stop purging; Pump fuel for 2 seconds	open	closed	on
Key-on:	1. Turn key on →	Pump fuel for 2 seconds	open	closed	on
Re-purge:	1. Turn key on 2. Turn key off →	Purge for 15 seconds	open	open	on
Re-purge:	1. Turn key on 2. Leave key on more than 2 seconds →	Purge for 15 seconds	open	open	on
Parked:	1. Engine off 2. Finished purging →	Close valves & stop pump	closed	closed	off

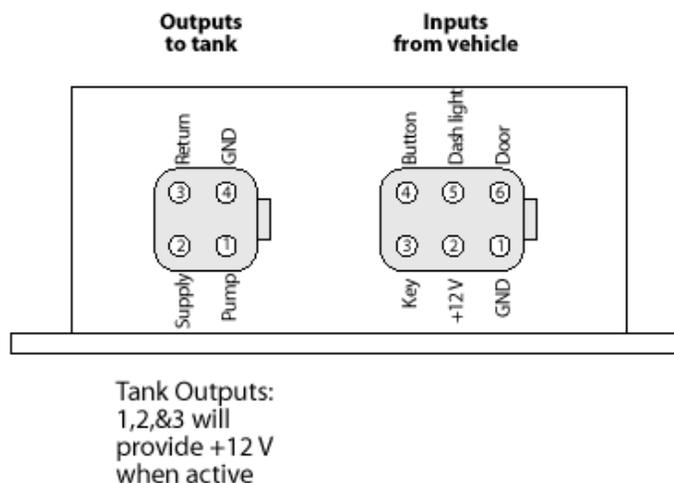
Control box diagnostic codes

The tank control box has a built-in diagnostic system. It will flash a code on the external purge light. Most GMC trucks do not have the external purge light connected, but you could connect a temporary test light between ground and pin #5 in the larger connector on the box. Count the number of consecutive flashes that you see. The cycle repeats every 12 seconds. The codes are listed in the table to the right.

Flashes	Cause
many	Normal purging
2	Supply open circuit
4	Return open circuit
6	Pump open circuit

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Tank control box wiring



Vehicle Inputs:

- 1 must be grounded; do not rely on box mounting screws.
- 2 +12V batt (always on) through a 15 A fuse
- 3 looks for +12V when engine is running
- 4 ground to activate manual purging
- 5 +12 V output to indicator lamp
- 6 GM boxes: ground to start purge cycle
Ford boxes: +12 V to start purge cycle

Post Installation Inspection

Installation & Test Date: _____
 VIN _____ Engine Size _____ Mileage _____
 Make _____ Model _____ Mfg date _____
 Customer Name: _____ Address: _____
 City: _____ State: _____ Zip: _____ Phone: _____

Installers Company Name: _____ Phone: _____
 Tank Mfg. _____ Primary tank s/n _____ 2nd 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 full operating temperature and all air has purged from the cooling system.

<u>Tank & Operating Pressures</u>	<u>Datastream</u>
Static Pressure (tank pressure) _____ p.s.i.g.	ECT/Temperature _____
Static + supply valve & pump _____ p.s.i.g.	At Idle: Bank 1 _____ Bank 2 _____
Static + supply valve + return valve + pump _____ p.s.i.g.	STFT _____
Pressure taken at: LPDM <input type="checkbox"/> Wye <input type="checkbox"/>	LTFT _____
	At 2000 R.P.M.
	STFT _____
	LTFT _____
	Does the engine idle smooth?
	Yes _____ No _____

Diagnostic Trouble Codes

Any DTC's in computer memory: Yes No
 List all codes: _____

If any DTC's found, repair all codes and retest
 Comments: _____

Turn off vehicle & let it sit for 20 minutes with hood and doors closed.
 Return to vehicle, open drivers door. Does purge cycle initiate? Yes No
 Does vehicle restart easily after purge cycle is complete? Yes No

Technician Name: _____
 Technician Signature: _____

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

The technician's signature warrants that the system has no fuel leaks and the vehicle performs good...i.e. idles smooth, accelerates smoothly and restarts after a 20 to 30 minute hot soak 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 number's

Attach sticker from injector rail assembly