

BI-PHASE TECHNOLOGIES

Making Alternative Fuel *Standard*

LPEFI[®] Installation Manual
For
2011-2013 Ford E van Trucks with 5.4 Liter Engine
Models: E450
Mono-Rail System



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Bi-Phase Technologies, LLC

Eagan, Minnesota, U.S.A.

REVISION HISTORY

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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
2945 Lone Oak Drive, Suite 150
Eagan, MN 55121
(952) 886-6450
Tech. Support line
(888) 465-0571

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**2010 Ford E van Trucks with 5.4 Liter Installation Manual Revision Changes:
Changes made between 1st Edition and 2nd Edition**

Item	Page #	Change or note
Loop Hose	20	1. Install hose into the driver side fuel rail first then the passenger side <ol style="list-style-type: none"> a. Align the white nylon inner line straight into the QD fitting pushing in while then aligning the metal hose straight in to the fitting until it clicks <p>IMPORTANT: Kinking the white nylon inner line will cause drivability issues!</p>
Air Box	11	IMPORTANT: When removing the air duct, note the opening for the air flap for reinstallation. Blocking this opening will call cause drivability issues
Injector Connectors	19	Note: After installing injector connector pull it back up to verify connector is latched. Loose or disconnected connector will cause drivability issues
Spitter Valves	18	1. Open the spitter valves attached to the cross over hose
Vehicle Post Installation Check List	35	Additional checks have been added to the vehicle check list and a drive test is required with a post vehicle inspection faxed to Bi-Phase
Tank Installation	14	Drill the 5/8" hole in the cross member off center to the rear 1/4"
Driver Side Fuel Rail	20	1. Route the throttle position sensor harness under the driver side fuel rail

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**2011 Ford E van Trucks with 5.4 Liter Installation Manual Revision Changes:
Changes made between 2nd Edition and 3rd Edition**

Item	Page #	Change or note
Secondary Tank	14	Additional 2 cylinder secondary tank has been added where original gasoline tank was located. This install includes new hardware, secondary wire harness, secondary fill and transfer hoses, fuel pump relay, module, and gauge.
Primary Tank	15	The new Primary tank has gone from 2 cylinders to 1 cylinder. Previous mounting hardware will not be necessary and has eliminated vapor crossover hose, old style tank shield, and mounting brackets.
Hoses	23	Additional hoses have been added for the secondary tank. This includes a secondary fill hose, secondary transfer hose, new style "T" fitting, and various hardware components.
Fuel Gauges	26	An additional fuel gauge has been added to the primary tank as well as a new gauge on the secondary tank. There are 2 different gauges in the kit and specific installation instruction is located on the page indicated. <i>NOTE: Make sure to install the fuel gauges in their proper locations. If specified procedure is not followed transfer system as well as dash gauge will not function properly!</i>
Secondary Harness	29	A new harness is included for the secondary LPDM and transfer system in the secondary tank.
Rear Tank Coating	34	The addition of a protective coating will be added to the valley of the secondary tank to protect from debris build-up and corrosion.
Tank Mud Flap	16	A new protective flap for the primary tank will be installed onto the tab located on the front of the primary tank.
Frame Edging	25	Additional protective edging is placed in specified locations on the frame rail to protect hoses and electrical wires.
Decals	36	Additional Decals are added to the kit as specified.

Notes

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



WARNING: Always unplug the LPEFI Liquid Propane Control Module (LPCM) 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 LPCM 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. Escaping liquid propane can cause frostbite and severe freeze burns. If liquid propane touches your skin, it causes a burn similar to frostbite. Wear insulated PVC rubber gloves resistant to propane. Wear goggles for protection against accidental release of pressurized products and thermal protective clothing when handling refrigerated liquids.

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.

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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 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 in this manual.*

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LPEFI[®] System Installation

Note: The kit contains all the components needed for conversion, decals, owner information card and a warranty registration card. The warranty registration card, along with the Post-Installation Inspection form, must be filled in and returned to Bi-Phase Technologies for warranty to be valid. Label placement is described later in this installation manual.

Removing the gasoline system



WARNING: Disconnect the battery before you work on any part of the LPEFI[®] system.

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

1. Disconnect the battery
2. Remove the evaporative emission system, fuel tank and fuel lines



Evap Tank



Fuel Tank

3. Remove the sensor from the evaporative tank and leave plugged into the OEM harness
4. Remove the fuel tank pressure sensor from the tank and leave it plugged into the OEM harness. The fuel pump connector will plug into the LPEFI[®] harness



5. Drain all gasoline from the fuel tank
6. Remove the fuel line from the fuel pump sending unit. Place drain pan under the line to catch gasoline spilled while disconnecting the fuel line

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

7. Remove the fuel tank from the chassis



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

8. Remove the air box and antifreeze reservoir

IMPORTANT: When removing the air duct, note the opening for the air flap for reinstallation. Blocking this air intake opening will call cause drivability issues.





9. Remove the seats, the bottom of the dash and dog house

10. Unplug injector wiring harness from each injector for use on the LPEFI[®] injectors

Note: When disconnecting or connecting injector connectors be careful and push in on connector (squeeze) to disconnect.

11. Place drain pan under driver side of bell housing to catch any gasoline spilled while disconnecting the fuel line

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

12. Remove evap lines (Note: exposed end after evap removal will be covered with the black cover from the Primary Hose).



Before

After

13. Remove four (6 mm) mounting studs and nuts holding the gasoline fuel rails to the intake manifold. Retain these bolts for use with LPEFI[®] fuel rails

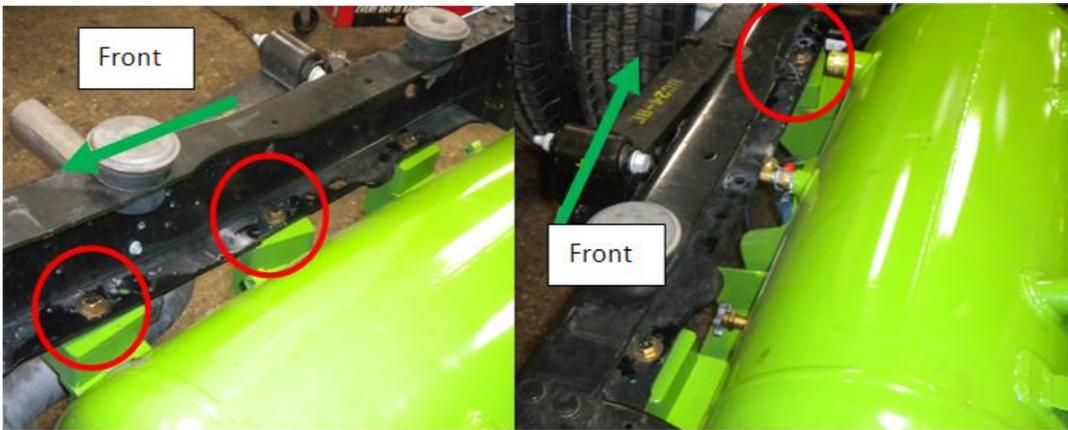
14. Remove the gasoline fuel rails from the engine and discard all components in an environmentally safe manner

Secondary Tank Installation

1. The Rear tank is placed where the OEM gas tank was removed. The tank is oriented so the LPDM is on the driver's side of the vehicle.



2. The Rear Tank requires 3 out of its 5 mounting holes to be reamed out to a 9/16" diameter. Holes that require reaming are pictured below.



Passenger Side

Drivers Side

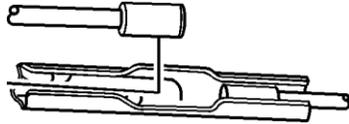
3. Install 5 spacers also shown in pictures above if required. (Early tanks will require these spacers.) The tank has 3 blocks on the passenger side and 2 blocks on the driver's side. The two blocks that are closest to the front on both sides will be smaller than the other blocks. (2 small blocks and 3 large blocks per truck) This is to account for a bend in the frame. Modification of rear exhaust hanger may be necessary.
4. Use supplied 1/2 inch hardware and Belleville washers and tighten to 119 lb-ft.

Primary Tank Installation

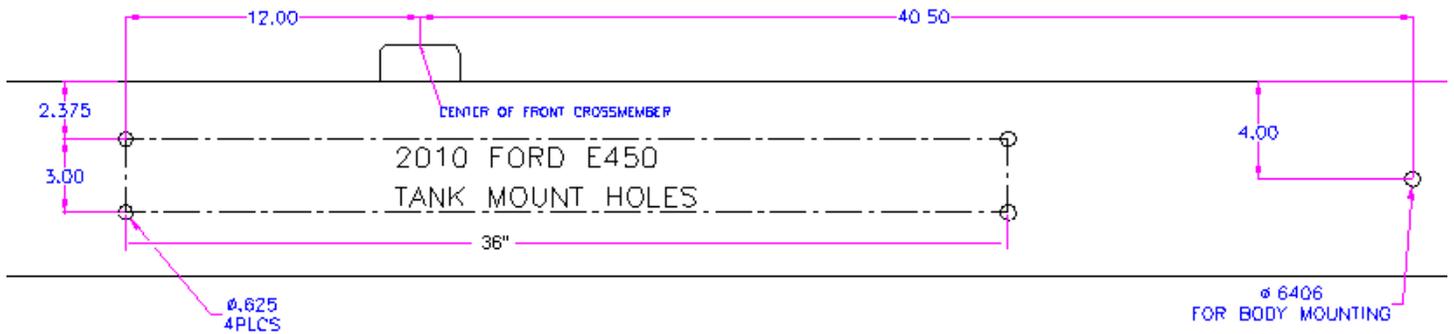
Primary tank is installed on the driver side

1. Remove the emergency brake cable bracket

2. Disconnect the front brake cable from the intermediate cable
 - a. Set the parking brake
 - b. Secure brake cable at the rear of the cable (vise grip)
 - c. Release the parking brake. Pull the rear brake cable and have another person secure the front of the cable (vise grip)



3. Drill a hole on the street side frame rail prior to mounting the propane tank (This hole is needed for the mounting the Johnson Truck Body to the frame rail)
 - a. Measure 40.5" back from the front cross member
 - b. Measure down the frame 4" and drill a 0.641" hole
4. Use a 5/8" drill bit to drill the tank mounting holes; use the 5/8" bolts, Belleville washers & nylock nuts provided in the kit to mount tank
5. Left set of holes are drilled 12.25" forward of the cross member, 2 3/8" down from the top of the frame and 3" apart. Second set of holes 36" apart. Reference diagram below



- Raise the tank into place and install the frame rail bolts. Tighten these four mounting bolts to 148 – 154 ft-lb. Slide the parking brake cable through the tank brackets and reconnect to the front cable as shown. Install mud flap to the front tank tab as shown.



LPEFI® fuel rail installation

- Remove the new fuel rails from the conversion kit.
- Place both rails on the bench as shown in the photo. The top fuel rail in the photo is the passenger side rail.



- The bushings and hold down clamps are not mounted on the rails and will need to be installed prior to installation on the engine.



- Lubricate the lower o-rings (green) on each injector and place each rail on the engine with the QD hose inlet connectors facing toward the front 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 and could damage the injector if not pre-positioned outward. Make sure there are no objects obstructing placement of the fuel rails.*

- Using the bolts you removed from the OEM fuel rails. Secure the *LPEFI*[®] injector rails to the intake manifold studs; tighten to a torque of 12 NM (106 in-lb). Visually inspect each installed injector to see they are properly seated. If you can see the green o-ring they are not properly installed.
- Route the throttle position sensor harness under the driver side fuel rail



Note: Always be aware of routing of the harness. Do not route over the top of the fuel rail.

- Install original gasoline injector wiring harness and connect each injector connector to the proper cylinder

Note: After installing injector connector pull it back up to verify connector is latched. Loose or disconnected connector will cause drivability issues

Install the loop hose to the injector rails

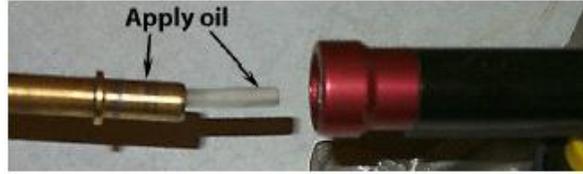


NOTICE: Take extreme care to center the nylon line into the rail end fitting and slowly push the line straight all the way in (turning the hose from side to side or twist it as you are pushing it in) or kinking of the nylon line may occur. Once the white inner line is completely in, push the entire fitting into the rail until it clicks and locks

- Install 21" hose heat sleeve over loop hose, zip tie each end to hold insulation in place.
- The hose will be inserted so the loop of the hose is facing upwards.



- Lubricate with O-lube the white nylon inner line of the two hose ends and insert into the injector rail



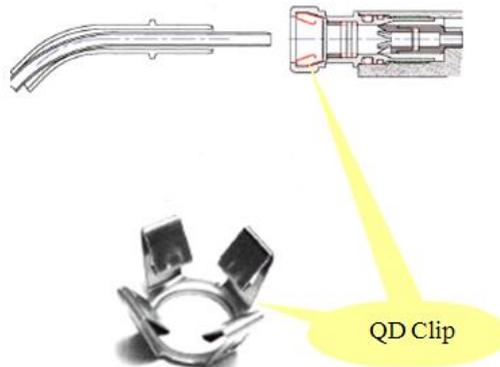
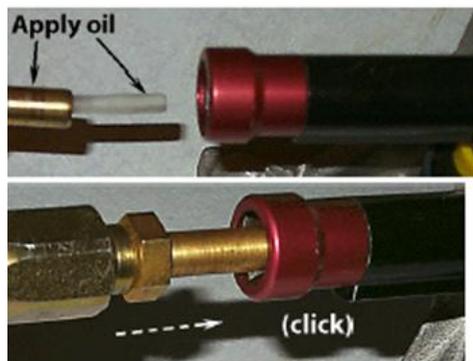
5. Install hose into the driver side fuel rail first then the passenger side
 - b. Align the white nylon inner line straight into the QD fitting pushing in while then aligning the metal hose straight in to the fitting until it clicks

IMPORTANT: Kinking the white nylon inner line will cause drivability issues! **USE EXTREME CAUTION WHEN CONNECTING FUEL LINES!**



WARNING: Improperly attached fuel lines could cause the release of propane causing personal injury.

6. Using a bright light look at the QD fittings and verify the four locking tabs are secured on the hose fittings
7. Gently pull on the on the hose ends to verify the fitting will not disconnect



IMPORTANT: After hearing the click of the line quick connecting, visually look and verify the 4 sides of the QD clip are over the locking ring.

8. Verify the hose is routed in a way that there is no interference with chassis components that could cause chaffing.
9. Install loop hose support bracket.
 - c. Use supplied hardware
 - d. Use the two existing holes in the manifold to mount the bracket to the intake
 - e. Attach #15 "P" clamp to the loop hose



10. Install WARNING label on the loop hose.



Primary Hose Installation

1. Position the primary hose to be connected to the LPDM by routing the hose over the tank
2. Install hose heat insulation over primary hose, zip tie each end to hold insulation in place.
3. The 5' long insulation is installed on the rail end of the primary hose.



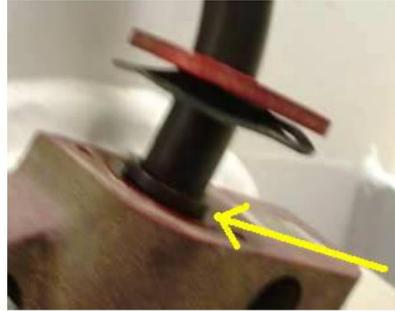
WARNING: *Improperly attached fuel lines could cause the release of propane causing personal injury.*

4. Remove retaining screws, plate, gasket and split collar retainers from LPDM
5. Install plate and gasket onto hose end fitting of primary hose
6. Lubricate with O-lube, the hose end fitting metal surface and white nylon inner line
7. Insert hose 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

CORRECT



WRONG – LOCKING RING EXPOSED!



8. Insert split collar retainers and tighten screws until plate is flush with the LPDM. USE EXTREME CAUTION WHEN INSTALLING FUEL LINES!

9. Install orange zip tie WARNING label to the hose as shown



Note: 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.

10. Route the hose from the LPDM over the top of the tank.
11. Fasten the hose to the top of the fuel tank using 3 “P” clamps; (2)#15 (1)#20



12. Attach the hose to the top of the frame rail just behind the cab with a #24 "P" clamp as shown. Make sure the hose routes on the outside of the body mount as shown.



13. Attach the hose to the floor of the cab as shown with a #24 "P" clamp.



Inside Cab



Underneath Cab

Note: Insure that the hose is aligned so that no tension will be created on the fuel rail or the hold down clamps when installation is complete

14. Lubricate with O-lube, the hose end fitting metal surface and white nylon inner line for installation into the fuel rail



15. Carefully guide the inner line into the center of the rail and feel for the line to engage the internal o-ring. 2" of inner line must be inserted into the rail to make a proper connection. **USE EXTREME CAUTION WHEN INSTALLING FUEL LINES!**
16. 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). Install orange zip tie WARNING label to the hose as shown



Fill hose installation

1. Install the fill fitting to the fill bracket along with the Primary Fill Hose.



2. Install the fill filter to the front of the primary tank using two p clamps as shown. **(NOTE FLOW DIRECTION ON FILTER!)**



3. Install the supplied brass "T" fitting to the filter using the supplied adapter.



Tank Mudflap



1. Using the supplied hardware place the protective flap in position and secure with the supplied hardware.

Hose Layout Tutorial

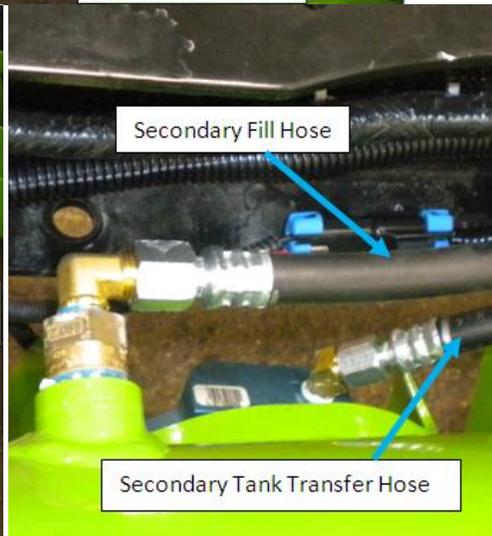
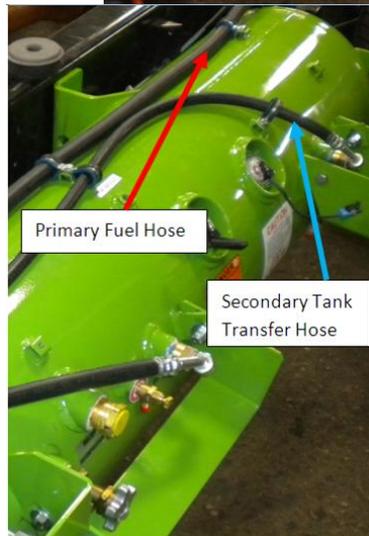
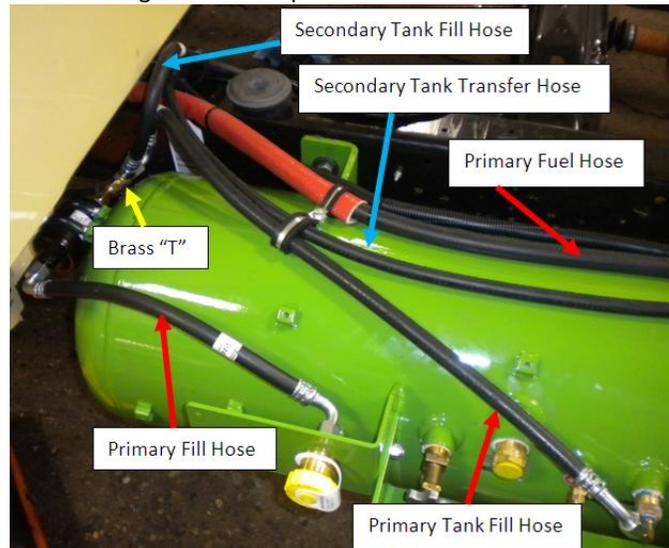
Primary Fill Hose: This hose connects to the fill adapter attached on the mounting plate and to the fuel filter.

Primary Tank Fill Hose: This hose connects to the brass "T" with a 90 degree fitting and to the forward 80% stop fill on the primary tank.

Secondary Tank Fill Hose: This hose connects to the brass "T" and goes over the frame rail through a #24 "P" clamp then inside the frame rail back to the 80% stop fill on the secondary tank.

Secondary Tank Transfer Hose: This hose connects to the 80% stop fill on the rearward portion of the primary tank with a 45 degree fitting and then routes over the frame rail through the same #24 "P" clamp. Then routes with the Secondary Tank Fill hose back to the Secondary LPDM 45 degree flare fitting.

Primary Fuel Hose: This hose is the main hose that moves fuel from the primary tank LPDM up to the fuel rails. This hose is connected to the primary LPDM and routes down the tank, up over the transmission and to the fuel rail. It is wrapped with a heat guard liner to protect the hose from exhaust heat.



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.

4. Install the Primary Tank fill hose with the 90 degree fitting attached to the brass "T" and the 45 degree fitting attached to the 80% stop fill valve closest to the cab on the primary tank. (See pictures)
5. Install the supplied (7) 4" pieces of vinyl edging inside the frame rail where the 4 cross members attach. Install the (1) larger 4" piece of vinyl edging shown in the 3rd picture.



6. Install Secondary tank fill hose by attaching the hose to the brass "T". This hose will go over the frame rail and route inside the Frame back to the secondary tank and attach to the 80% stop fill on the secondary tank. Route hose in a manner that it is not interfere with any brake lines, wires, or objects that may cause chaffing. (See pictures)



Pictured above is the rear cross member just behind the rear axle. Make sure hoses are routed **BELOW** the cross member as shown above. Wire harnesses go through the crossmember.

7. Install the Secondary tank transfer hose by attaching the 45 degree fitting to the 80% stop fill on the rearward portion of the primary tank. Route the hose on top of the tank toward the front and feed over the frame through the same #24 "P" clamp that the Secondary tank fill hose follows. Feed inside the frame rail back to the secondary LPDM and attach to the 45 degree flare fitting. (See pictures)
8. Install 3 #20 "P" clamps around the two secondary hoses along the frame rail as shown specifically in the pictures below.



Rear: Just above axle



Center: Below Module



Near Front Tank Mounts

IMPORTANT: Verify the hoses are routed in a way that there is no interference with chassis components that could cause chaffing or wire harness interference.

Fuel gauge installation

1. When installing a fuel level gauge sending units always reset the sender to empty 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.



2. Install fuel level sending units on the primary and secondary tanks.

Note: There are **2 different types of gauges in the kit**; 1 being 180-10 ohm and the other 2 being 90-0 ohm. (Part numbers are different) Ohm range is also stamped on the back of the gauge. Install the 180 - 10 ohm fuel level gauge to the gauge mount location closest to the cab on the primary tank. Use the 2 90-10 ohm gauges in the remaining gauge mount location on the primary tank, and the other on the rear secondary tank. Secondary gauge mount is located on the passenger side cylinder of the rear tank in the lower portion of the cylinder.



Primary wire harness

Note: Before securing any of the harness make sure it is routed to meet the length requirement to make each connection. When you are prepared to secure the harness, tie wrap it every 8 inches.

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

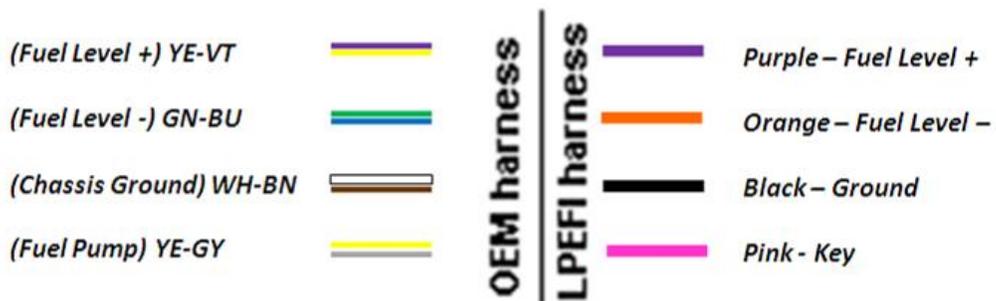
1. Lay out the main harness with the five connectors pointed toward the rear of the truck. Start the routing from the rear of the primary tank.
2. Route over the top of the tank with the primary hose



3. From the front of the tank the fuel pump harness connector will route over the frame rail and follow to the rear down the inside of the frame rail.
4. Route the OEM fuel pump harness forward down the inside driver side frame rail
5. Cut the 4 pin connector off the Ford OEM fuel pump harness



1. Install the connector supplied in the conversion kit to the OEM fuel pump harness. Insert wires per into the connector per the photo.



2. Plug the LPEFI[®] 4 pin connector to the new connector of the OEM fuel pump harness.

Note: The fuel pressure sensor will remain plugged into the OEM harness



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

3. Connect the main LPEFI harness (to sending unit) branch to the fuel level gauge; use wire ties to secure to the primary hose. Main Harness has Orange and black wires connecting to the fuel level gauge



4. Route the primary wire harness up along the existing Ford harness and up to the fuse box.

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

Secondary wire harness

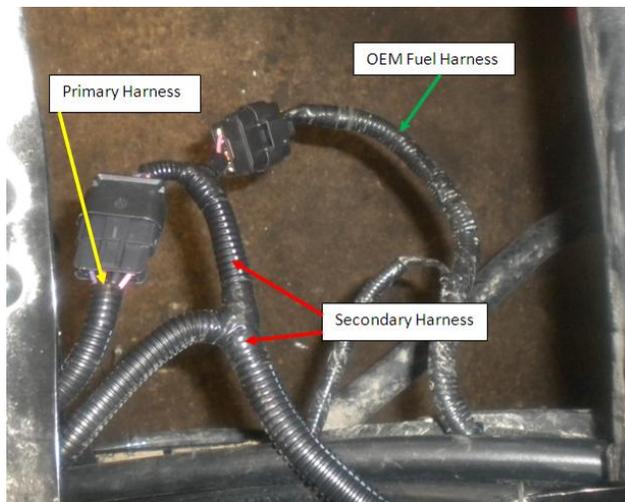
1. Using the supplied bracket hardware Mount the transfer module and secondary fuel pump relay to the rear cross member as shown.



2. Lay the secondary harness out in the same path inside the frame as the primary wiring harness. The lead for the remaining fuel level gauge will cross over the frame and on top of the tank in the same place the primary harness crosses.



3. Feed the harness along the inside of the frame and follow the existing ford harness back to the secondary LPDM, OEM fuel pump harness, secondary fuel pump relay, transfer module, and secondary fuel level gauge. Make all the proper connections. Note below how you connect the Primary Harness, Secondary Harness and OEM fuel harness.



4. Route the secondary harness by following the primary harness/Ford harness up to the fuse box.



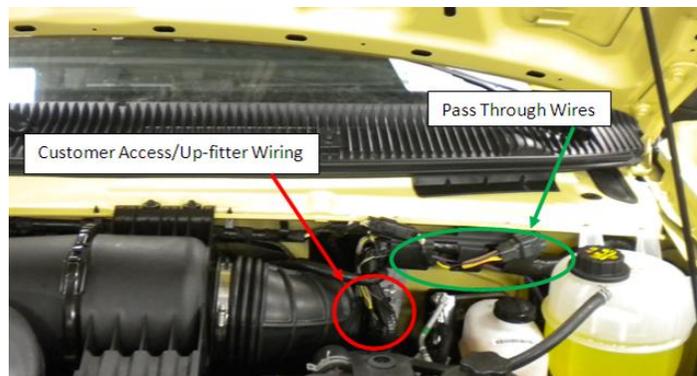
WARNING: Do not make the final electrical connections until the LPEFI system is completely sealed. Applying power could cause the valves in the tank to open, releasing fuel into the hoses.

5. 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 LPCM, relay, ISD controller and LPDM), to the electronic control box (LPCM) and relay
Main LPEFI[®] harness and secondary harness (to 12 volt power) branch, is an orange wire with an in-line 20 amp fuse and (to 12 volt power to the ISD Controller) 2 amp fuse with the eyelet connectors on the end
6. Remove the nut from the 12 volt power on the power distribution and install the eyelets from the orange wires with the 20 amp and 2 amp fuses.



Main LPEFI harness (to park and neutral signal) branch, they are blue and purple 18 gauge wires

7. Locate the upfitter wiring loom



8. Attach the park signal, blue wire to the gray/brown wire of the upfitter wiring under the hood. Solder and shrink wrap all connections.
9. Attach the neutral signal, purple wire to the green/white of the upfitter wiring under the hood. Solder and shrink wrap all connections.
10. Place wires back with harness and secure with the plastic clips.



Main LPEFI harness (to door switch) branch, it is a white 16-gauge wire and to ignition signal) branch, it has two Pinks wires, 18 gauge wire

11. Guide the main LPEFI[®] wiring harness white wire (to door switch circuit) and pink wires to proper location

12. Route the white wire and pink wires through the firewall by drilling a ¼ inch hole and installing the grommet provided located on the driver's side of the firewall next to the existing ford grommet.
Note: If you are installing truck accessories, route the wires for them at this time

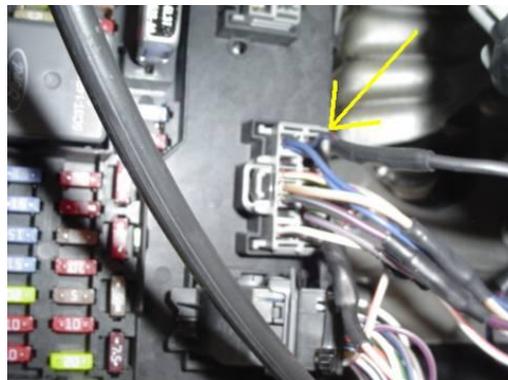


Antifreeze bottle removed

13. Connect white wire to the green/violet wire (door switch). Solder and shrink wrap all connections.



14. Cut the blue/red wire and attach the pink wires. Solder and shrink wrap all connections.



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.

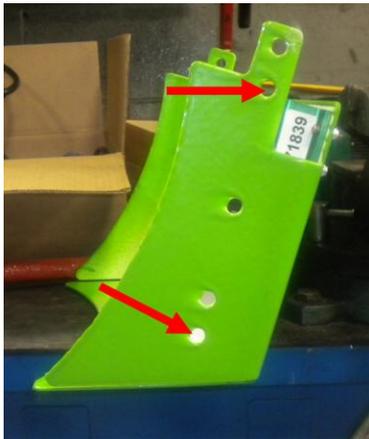
Completing Wire Harness Installation:

1. Connect main LPEFI harness connection to Idle Shut Down(ISD) Adapter, pump relay, LPCM and LPDM



2. Assemble tank guard to rear of the primary tank
 - a. Attach the 3 PAL nuts to the tank tabs
 - b. Use the 3/8" flat, lock washers and bolts to assemble the cover to the tank
 - c.

Note: Use the lower mounting holes as shown below so the cover plate is level with the bottom of the tank. Make sure there are **NO EXPOSED WIRES HANGING OUT OF THE PLATE!** Use supplied tie wrap to secure all wires.



3. Make sure to tie wrap all harnesses and wires with the supplied tie wraps. Tie-wrap harnesses every 8-12 inches.



Rear Tank Protective Coating

1. Prep the Valley of the Rear tank with by scuffing and cleaning the area to be coated. Apply 2-3 light coats of the protective coating to the valley of the rear tank.



Install labels on the truck/registration

1. Install one “LPEFI[®]” transparent label on each side of the cab

2. Install the EPA emissions label on the plate on top of the engine intake air box; once placed do not try to remove this label as it would be destroyed
3. If the truck does not have a box or body installed yet, put the propane diamond in the glove box for placement later. If the body is installed on the truck, install the blue "PROPANE" diamond on the back panel of the truck, toward the bottom right corner. **Note: Do not install on the bumper**
4. Install the Bi-Phase programmed ECM label just above the OBD II port.
5. Install the orange WARNING label on the center of the dog house
6. Install the yellow ATTENTION labels on the left side of the dash and on the primary tank above the LPDM



Warning Label



Attention (Idle Limiter)



Attention ECM



Decal Set



LPEFI Decal



EPA Emissions Label (Air Intake box)

7. Fill out vehicle warranty registration card and return to Bi-Phase Technologies along with the Post-Installation Inspection.
8. Place laminated owners information cab card in the glove box or door pocket with the OEM's owners manual & other GM information.
9. Program ECM using the ProCal II calibration flash tool.

IMPORTANT: Follow the ProCal II instruction sheet supplied with the tool carefully prior to installation!



10. Begin testing the installation and fill out the Post installation Report.

Testing the Installation

1. Visually inspect the tank, the hoses, the wiring and the engine compartment. Is everything assembled properly?
2. Fill the tank with 30 to 40 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. Check all fuel level gauges to make sure they are functioning properly.
4. Connect a fuel pressure test gauge to the Schrader valve on the LPDM
5. Fuel pressure should be 0 psi at first.
6. If the connections on the electronic purge control assembly have not been made connect at this time.
7. Connect the battery. You may hear a click at the tank.
8. 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 general diagnosis manual.
9. 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 Liquid Propane Control Module, evacuate the lines and repair. See the general diagnosis 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.
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 10.
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 recheck, and check the hoses and hose fittings.



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



Testing the Installation (cont'd)

15. If there are no leaks reassemble the air box and install the doghouse and seats.
16. Start the engine.
17. Connect a diagnostic scan tool to the vehicle.
18. 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 general diagnosis manual.
19. 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).
20. Turn the key off and follow the testing procedures described in the Post-Installation Inspection
21. Fill out the Post-Installation Inspection completely.
22. Turn off the engine and disconnect the fuel pressure gauge set. Be sure to reinstall the dust cap on the Schrader valve.



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

23. Drive the vehicle for at least 15 minutes, if possible. Drive under various conditions and a variety of speeds.
24. 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%.
25. 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.
26. If there are no leaks, no DTCs and the engine runs well (smooth idle, smooth acceleration, good power), the vehicle is ready to use.
27. If you did not fill out the warranty registration card in the Installing Labels Procedure 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.

Testing the Idle Shut Down (ISD) and Auto Purge functions of the LPCM

1. Testing the Idle Shut Down and Auto Purge control assembly (LPCM).
Note: Temperature must be above 50F
2. Open the door, the purge cycle should initiate and run for 12 to 15 seconds.
3. When the purge cycle stops turn the ignition key to the on position. The purge cycle should initiate again.
4. Close the door.
5. Start the engine, the engine should start.
6. Before 30 seconds has passed turn the engine off. The purge cycle should initiate.
7. Re-start the engine again and let it run 60 seconds. After 60 seconds place your foot on the brake and place the vehicle in Drive then back into park. Leave the engine running.
8. 3 minutes after the vehicle was placed back into park the engine will shut off.
9. 90 seconds after the engine has shut off, an Auto Purge will occur.
10. If the system works as described, you have completed the tests of the ISD and Auto Purge functions.
11. If it does not work as described check all wire connections, battery voltage and contact Bi-Phase Technical Hotline at (888) 465-0571.

Post-Installation Inspection

Installation & test date _____

VIN _____

Make _____ Model _____

Installer company name _____

Tank Mfg. _____ Primary tank serial number _____ Secondary tank serial number _____

Fuel Rail Serial Numbers _____ & _____

Quantity of propane _____ gallons

Loop hose engaged with audible click? Yes No

Primary hose installed correctly into LPDM? (Hose collar should not be visible, refer to installation manual) Yes No

Open driver door. Does purge cycle initiate? Yes No

Start Vehicle

Leak test tank & LPEFI[®] system complete (refer to installation manual for test procedure) Yes No

Leaks found & repaired Yes No

Where _____

Any stored DTCs in computer memory? Yes No

List all codes: _____

If any DTCs found (other than the codes listed in the BPT Installation manual for the specific vehicle), repair all codes and retest

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

Does vehicle engine idle smoothly? Yes No

Does Idle Shut Down test properly? (refer to installation manual for test procedure) Yes No

Vehicle Comments: _____

<u>Tank Temps & Operating Pressures @ LPDM</u>	<u>Scan Tool DataStream</u>									
Tank temperature (bottom of tank) _____°F	PCM Flash performed _____									
Room temperature _____°F	ECT/Temperature _____°F									
<u>Pump Pressures with 3 Switch Box</u>	Fuel Trims at Idle:									
Tank pressure (Supply & Return Valves on) _____ psi Example: 100 psi Answer 100 psi	<table><thead><tr><th></th><th><u>Bank 1</u></th><th><u>Bank 2</u></th></tr></thead><tbody><tr><td>STFT</td><td>_____</td><td>_____</td></tr><tr><td>LTFT</td><td>_____</td><td>_____</td></tr></tbody></table>		<u>Bank 1</u>	<u>Bank 2</u>	STFT	_____	_____	LTFT	_____	_____
	<u>Bank 1</u>	<u>Bank 2</u>								
STFT	_____	_____								
LTFT	_____	_____								
Pump boost pressure (Supply & Pump on) _____ psi Note: Pump boost is calculated by how much the pressure increases from tank pressure (Pump acceptable boost is min 35 psi) Example: 140 psi (140 psi – 100 psi = 40psi) Answer 40 psi	Note: Fuel trims range from 0 to -17% and shouldn't differ between bank by more the 10%									
Purge reduction pressure (Supply & Return and Pump on) _____ psi Note: Purge reduction is calculated by how much the pressure increases from tank pressure (Purge reduction range is 0 to 15 psi or tank pressure) Example: 110 psi (110 psi – 100 psi = 15 psi) Answer 15 psi <i>*Note: If specifications are out of range reference page 21 and 29 of the Bi-Phase LPEFI Diagnostic Manual</i>	<i>*Note: If specifications are out of range reference page 21 and 29 of the Bi-Phase LPEFI Diagnostic Manual</i>									

Technician Name: _____

This inspection form must be returned to Bi-Phase Technologies. Fax 651-681-4441

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.

POST INSPECTION FORM AND ROAD TEST

VIN # _____

Injector Electrical Connectors Are Seated Yes No

Verify Idle Shut Down Wiring (Firewall Wiring color coded) Yes No

Any IP Warning lights on Yes No

↓
→ Repair: Yes Problem Found _____

Comments _____

Road test instructions

1. Bring truck to operating temperature >190 Degrees
2. Verify smooth idle
3. Drive truck to 65mph
4. Verify smooth operating performance at all speeds

Road test completed Yes No

Comment below on any performance issues:

Inspected By: _____ Date: _____

**Place (1) Copy In Cab of Truck
Fax (1) Copy to Bi-Phase (651) 681-4441**

Idle Shut Down (ISD) Functions

● Idle shut Down Modes

- **3 Minute** - ISD after 3 minutes of idle, the engine will shut off
 - If the truck has been run in the past 30 minutes or if the truck has been moved (meaning if the Drive selector is moved from the Park position)
- **15 Minute** - ISD after 15 minutes of idle, the engine will shut off
 - If the truck has been shut off for over 30 minutes it will go into this ISD mode
 - This will allow for morning warm ups (Defrost windshield, etc)
 - Moving the gear select from the Park position will change the idle shut down mode to 3 minute mode when the truck is placed back into Park

● Auto Purge

- Quicker engine start ups in warm weather
- Auto purge will run the pump after the truck is shut off (either by key or ISD) at approximately 1.5 minutes – 3 minutes – 6 minutes – 12 minutes and one last time in 24 minutes
- Auto Purge is disabled below the temperature of 50 degrees
 - So no drain on the battery will occur

● Tampering Mode

- ANY tampering with the ISD components will shut off the fuel pump in the propane tank; the engine will shut off and may result in a **3 minute reset process or indefinitely if the tampering is not corrected**. The truck will not start within this 3 minutes
 - Tampering may include items like trying to remove or bypass components from the idle shutdown system or having the truck in drive with the parking brake on

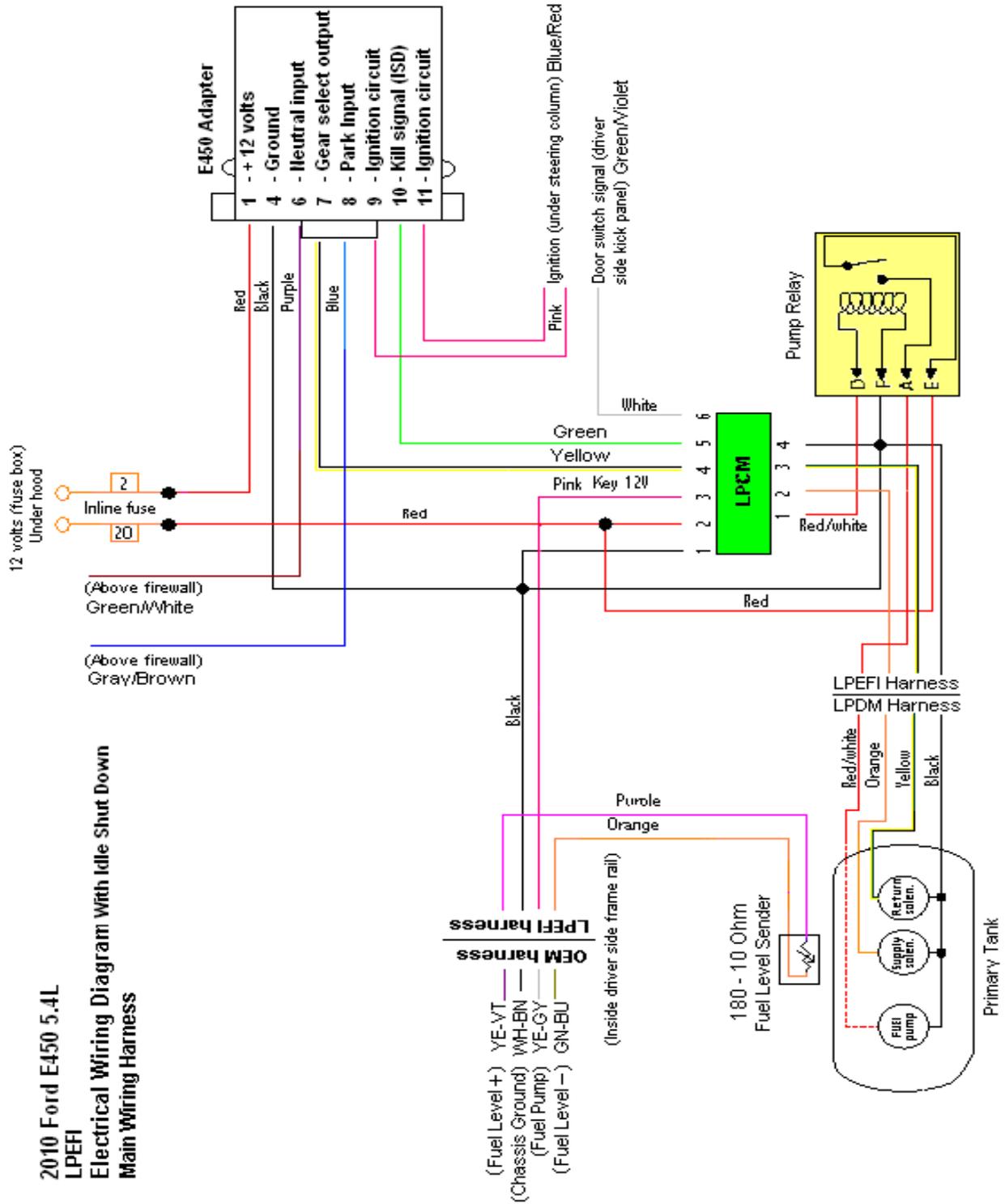
● Other notes

- The ISD will not turn off any lights, fan motor, etc
- A weak battery may be more evident with the ISD installed

2010 Ford E450 5.4L

LPEFI

Electrical Wiring Diagram With Idle Shut Down
Main Wiring Harness



LPEFI
 Electrical Wiring Diagram
 Secondary Tank Wiring
 2011 Ford E450

