



LPEFI[®] Installation Manual
For
2012-2013 Isuzu NPR Trucks with 6.0 Liter Engine
Mono-Rail System

(Trinity Industries Tank Design)



274573 Rev. C

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Bi-Phase Technologies, LLC

Eagan, Minnesota, U.S.A.

REVISION HISTORY

<u>REV</u>	<u>DESCRIPTION</u>	<u>DATE</u>	<u>EWO</u>	<u>D.F.T.G</u>
A	CREATE PART NUMBER	5-20-13	48887	P.C.W
B	UPDATE MODEL YEAR, PRIMARY HOSE INSTALL	9-13-13		P.C.W
C	ADD SPEED LIMITER OPTION IN FLASHING INSTRUCTION	9-20-13		P.C.W

Bi-Phase Technologies, LLC

Introduction

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

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

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

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

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

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

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

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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.



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.

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

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: This kit contains all the components needed for a gasoline to LPEFI conversion, along with 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.

Removing the gasoline system



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

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

1. Disconnect the battery
2. Remove the evaporative emission system and fuel tank. Set aside all gasoline fuel system components with the specific vehicle. Use a drain pan to catch any fuel from the fuel lines.



Evap Tank



Fuel Tank

3. Drain all gasoline from the fuel tank
4. Remove Gasoline and EVAP hard lines and flex lines

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



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

5. Mark each injector plug to ensure proper re-installation to the new fuel rails. Unplug the injector wiring harness from each injector for use on the LPEFI[®] injectors.

6. Pull the retainer clip up 1 click and evenly squeeze the connector while simultaneously pulling up on the injector plug.

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

7. Place drain pan under driver side of bell housing to catch any gasoline spilled while disconnecting the fuel line
8. Carefully remove the fuel rails.

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

9. Remove the evaporative purge solenoid and cap the fitting on the intake manifold with the black stopper supplied in the kit.



LPEFI[®] fuel rail installation

1. Locate the 4 brass mounting studs from the hardware kit.
2. Apply 1 small drop of red loc tight provided in the kit to each stud. Install the 4 mounting studs into the 4 original fuel rail mounting locations. Torque to 12 NM (106 in-lbs)



3. Remove the new fuel rails from the conversion kit.

4. Place both rails on the bench as shown in the photo. The top fuel rail in the photo is the passenger side rail. The QD fittings face the rear of the vehicle. (remove protective caps from injectors and rail ends)



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



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

7. Carefully slide the fuel rails into place and secure with the 4 m6 nylok nuts provided. Torque to 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. (Push down on the rail during the tightening process)



8. Install original gasoline injector wiring harness and connect each connector to the proper cylinder. (Route the harness to original mfg specification)

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

Install the loop hose to the injector rails

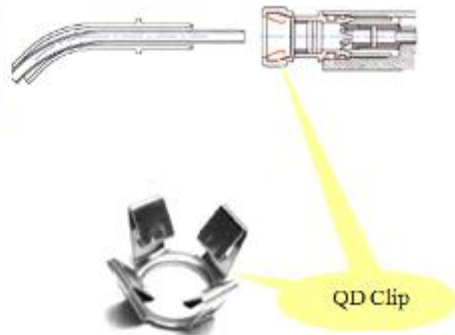
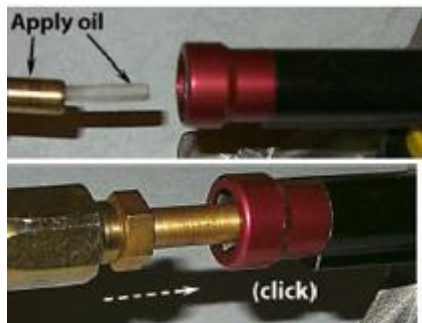


NOTICE: Take extreme care to center the nylon line into the rail end fitting and slowly push the line straight all the way in (turning the hose from side to side or twist it as you are pushing it in) or kinking of the nylon line may occur. Once the white inner line is completely in, push the entire fitting into the rail until it clicks and locks. *Visually inspect the fitting to ensure the 4 stainless clips engaged properly.*

1. The hose will be inserted so the loop of the hose is facing downward. The 90 degree fitting inserts to the driver's side fuel rail.



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



3. Install hose into the driver side fuel rail first then the passenger side
 - 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

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.*

4. Using a bright light look at the QD fittings and verify the four locking tabs are secured on the hose fittings
5. 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.*

6. Verify the hose is routed in a way that there is no interference with chassis components that could cause chaffing.
7. Secure the loop hose with a supplied P clamp. This will require the drilling of a .25" hole shown below.



LPDM Installation Procedure

- 1. Inspect overall exterior condition on tank***



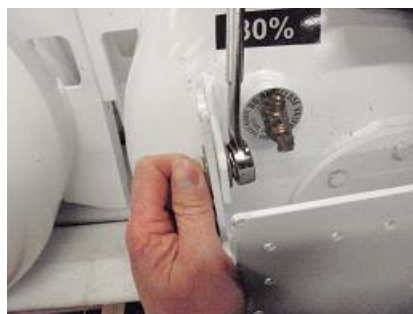
- 2. Open Liquid valve, and release any tank pressure. Open valve slowly. DO NOT continue until all pressure has been exhausted. Once tank pressure is exhausted, close valve and continue.***



- 3. Remove gauge and discard***



- 4. Remove Tank end Shield, save shield to be used later in the conversion. Discard hardware.***



LPDM Installation Procedure

5. ***Remove tank cover plate and oring, and discard***



6. ***Inspect internal tank condition, tank should be clean, free from debris and moisture (remove any moisture absorbing packets if included)***



7. ***Re-tap each mounting hole with 5/16-18 blunt nose tap and clean each mounting hole after tapping***

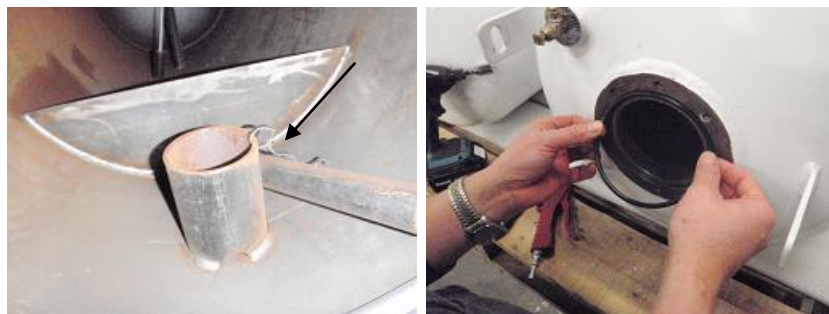


8. ***Obtain LPDM from conversion kit. Remove red protective cap and plastic coving from pump.***

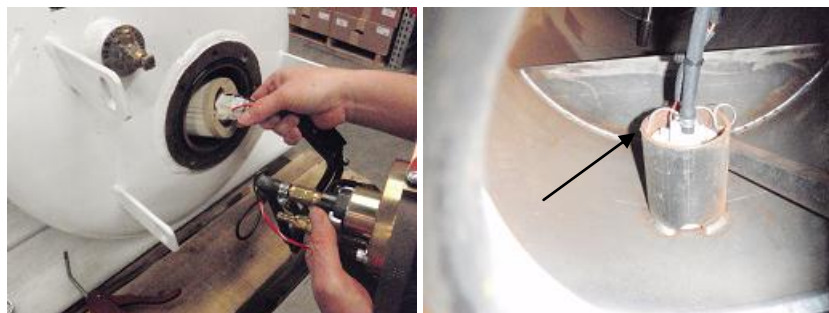


LPDM Installation Procedure

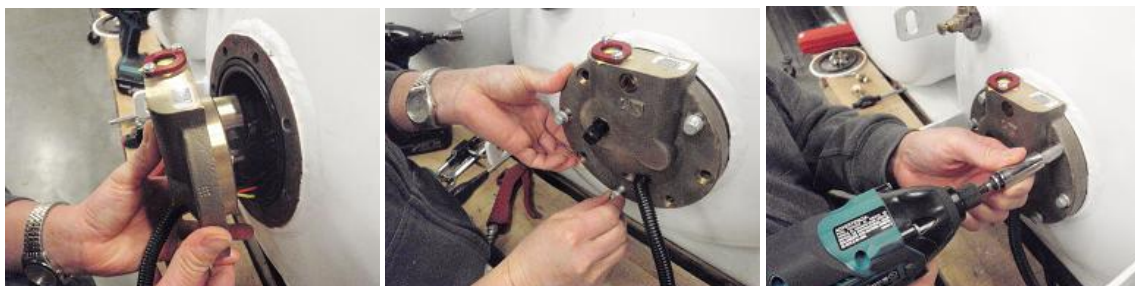
- 9. Insert pump hold down clip into pump canister and apply clean motor oil to oring and insert***



- 10. Install LPDM pump into tank canister and secure with clip***



- 11. Install and secure LPDM to tank (Note: make hose and wiring is pushed inside the tank with no kinks or sharp bends) Secure with 3/8" 12 point socket. Tighten bolts evenly, using a crisscross pattern***



- 12. Finish tightening the bolts in a crisscross pattern; torque the bolts to 20-25 foot pounds.***

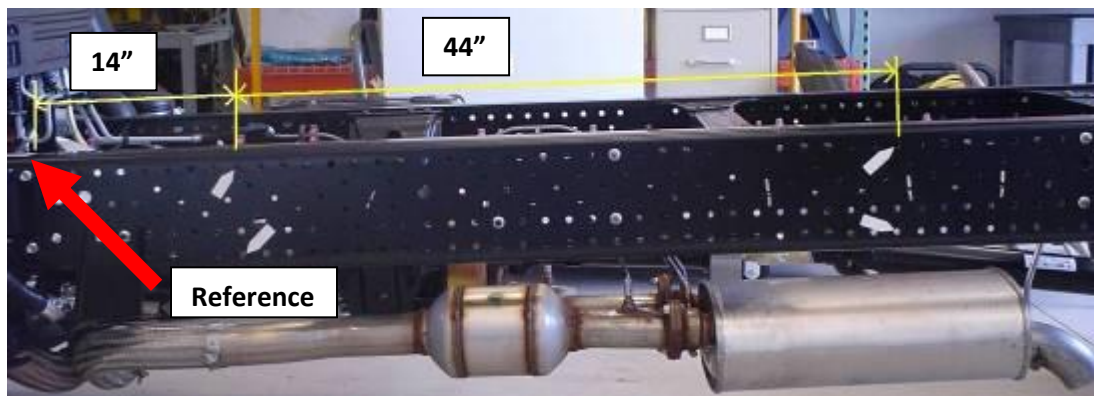


Fuel Tank Installation

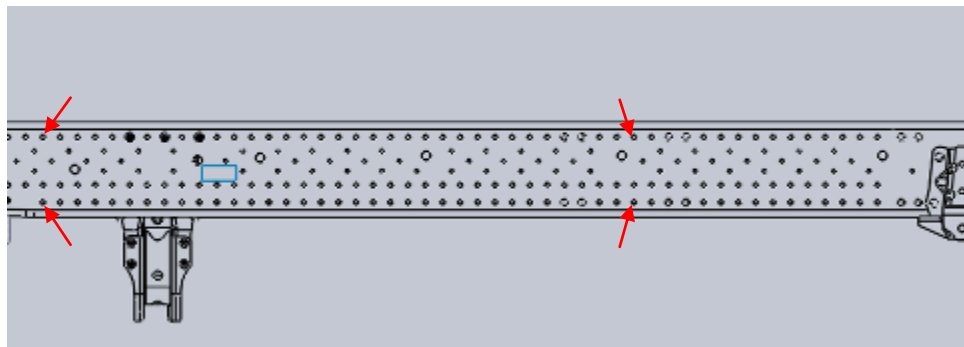
1. The LPG fuel tank is mounted on the driver's side frame rail. 4 holes will need to be reamed to 11/16" to mount the tank. This tank configuration can work with both 151" chassis and 134" Chassis.



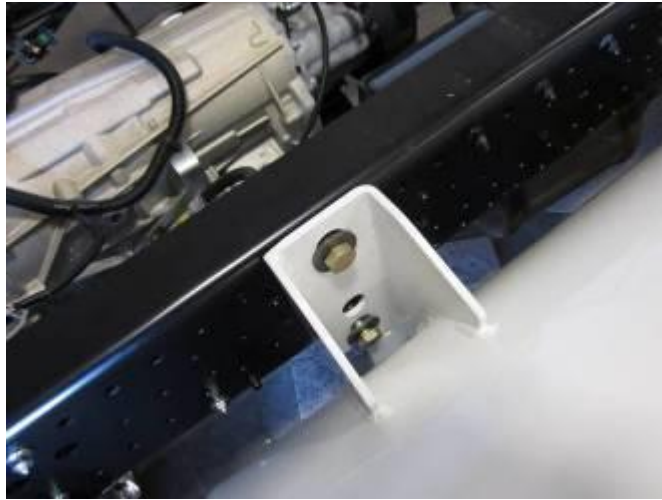
2. Shown below are the 4 holes that need to be reamed to mount the tank on the 134" chassis. The reference is the body builders "do not build past this line" marked on top of the frame rail.



3. The photo below shows the mounting holes needed to mount the tank on a 151" chassis. The 4 holes are moved 1 hole toward the front of the vehicle compared to the 134" chassis. The distance between mounting holes is still 44".



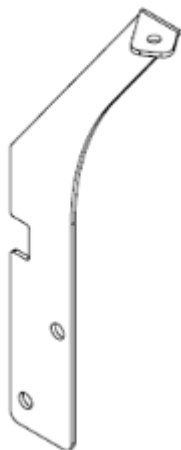
4. Raise the fuel tank into place and mount the tank with the supplied 5/8" belleville washers, grade 8 bolts, and lock nuts. Torque the hardware 185-190 ft-lbs. Mark all torqued hardware with a witness mark using a paint pen.



Primary Hose Brackets

Two brackets supplied in the kit will need to be installed to the engine to securely mount the primary fuel line. Supplied hardware is included in the kit.

1. Locate the front engine head bracket shown below. Install the bracket on the front of the passenger side engine head using the supplied M8 flange hardware. Holes are cut specific should line up as shown. Torque hardware to 18ft-lbs.



2. Locate the rear engine head bracket shown below. Install the bracket on the rear of the passenger side engine head using the supplied M8 flange hardware. Torque hardware to 18 ft-lbs.



Primary Hose Installation

1. Position the primary hose to be connected to the LPDM by routing the hose over the tank with the flare fitting connecting to the rails



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

2. Install the primary hose to the fuel rail first. Carefully center the white nylon line and gently push into the rail making sure the line engages the inner o-ring properly. The inner line is guided through the o-ring by a small finger bushing. Once fitting is started leave fairly loose and do not torque this at this time.
3. Torque the flare fitting on the primary hose to 33-38 ft-lb. Use a back-up wrench to tighten the hose to ensure the brass fitting stays stationary.



4. Remove retaining screws, plate, gasket and split collar retainers from LPDM
5. Install plate and gasket onto hose fitting on 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. Use extreme care when inserting fuel lines.
8. Insert split collar retainers and tighten screws until plate is flush with the LPDM.

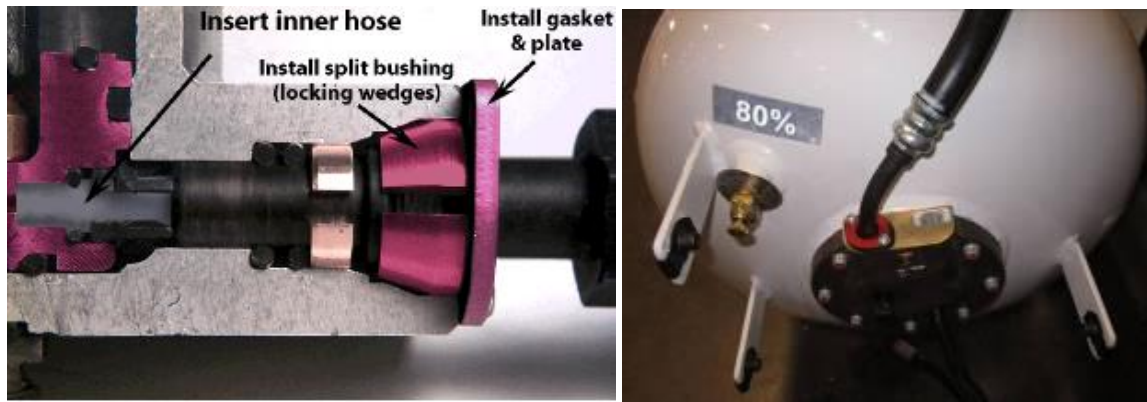
USE EXTREME CAUTION WHEN INSTALLING FUEL LINES!

CORRECT



WRONG – LOCKING RING EXPOSED!





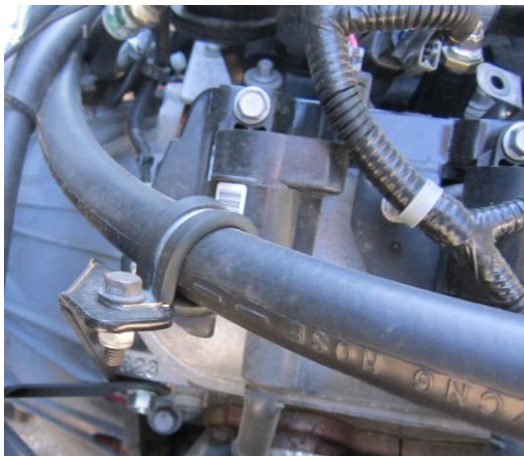
9. Route the hose from the LPDM over the top of the tank.
10. Fasten the hose to the top of the fuel tank using 4 #15 "P" clamps and 1/4"x1/2 bolts supplied in the kit



11. Attach the primary hose with 3 more #15 "P" clamps; one on each engine bracket, and one near the loop hose. Use the supplied 1/4" washers, loc nuts, and bolts to attach

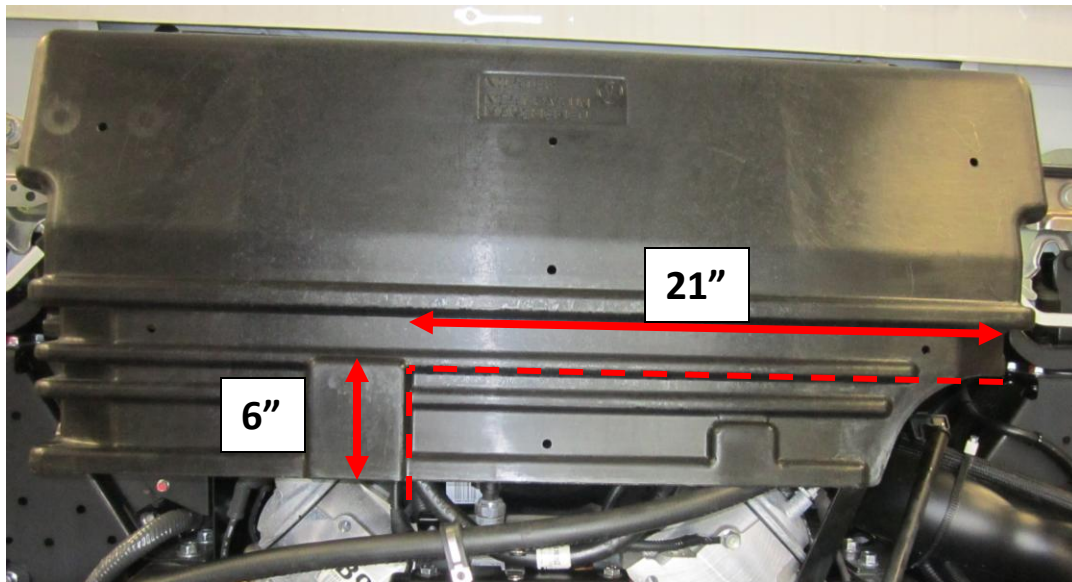


12. When installing “ P-Clamps” onto previously installed engine brackets ensure the clamps position hose towards the engine as shown in the picture below



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

13. Trim away part of the plastic engine cover as shown below. Lock engine cab into place and ensure **NO PARTS OF ANY HOSES/WIRES ARE RUBBING ONTO THE ENGINE COVER!**



Fill hose installation

1. Install the fill fitting to the fill bracket along with the Primary Fill Hose P/N 273886. Torque flare fittings to 19-22 ft-lbs. Mark torque hoses with paint pen



1. Install the fill filter to the frame rail using the (2) $\frac{1}{4}$ " x 1" bolts, $\frac{1}{4}$ " washers, and $\frac{1}{4}$ " lock nuts. (**NOTE FLOW DIRECTION ON FILTER!**)
2. Attach the fill hose P/N 273886 to the inlet of the fill filter. Torque fitting to 19-22 ft-lbs.



3. Install the fill hose P/N 274448 from the fill filter to the 80% stop fill valve on the tank Torque flare fittings to 19-22 ft-lbs. Mark all torque fittings with a paint pen.



Fuel gauge installation

When installing a fuel level gauge sending units always reset the sender using a small magnet to match the amount of fuel in the tank. The magnets on the back of the fuel card should mate with the magnets on the fuel gauge float assembly installed on the tank.

1. Install the supplied 40-240 ohm fuel card onto the tank using the (2) Phillip's screws.



Primary wire harness

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

Main LPEFI harness (to LPCM, relay and LPDM)

1. Lay out the main harness starting at the rear of the tank near the LPDM. The LPCM, and relay are both located at this location. Connectors at this location include 3 Deutsch connectors, and one Delphi connector.
2. Route over the top of the tank with the primary hose. Connect the fuel level card to the main harness.



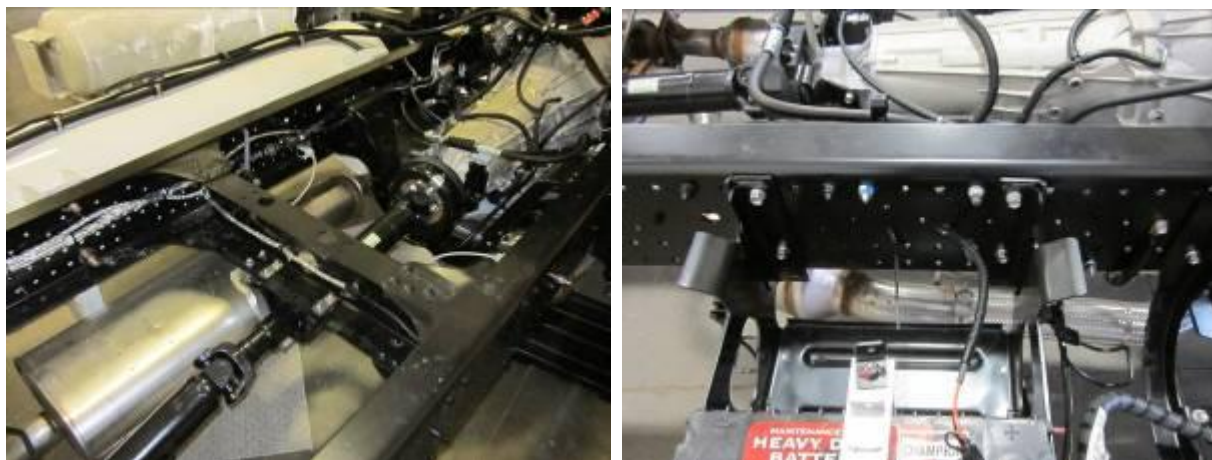
3. From the front of the tank the harness will cross over the driver's side frame rail. The fuel pump connector on the LPEFI harness will connect with the OEM pump connection located at the rear of the vehicle. Route the harness down the inside frame rail with the OEM harness.



4. Route the primary power supply (orange wire) to the battery by securing to the harness to the cross member and passenger frame rail. Harness will go through the passenger side frame rail to connect to the battery. **Do not make battery connection at this time!**



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. The white lead follows the frame rail forward toward the pivot point of the vehicle cab and into the cab through the OEM grommet.
6. Remove the front clip and headlight of the vehicle. The headlight is held in with 4 screws, 2 of which are accessed from the inside of the vehicle where the door connects. This will give you access to the OEM harness and grommet.



7. Route the white lead through the OEM wire harness grommet and tap into the yellow/red lead under the step panel.



8. Solder and shrink wrap joint. Secure the harness with zip ties every 8 inches.
9. Re-assemble headlight assembly and the front clip.
10. Tie-wrap the entire wire harness every 8-10 inches

Tank Plate Assembly

The LPEFI electronics must be assembled to the tank plate using the supplied #10 hardware.

1. Assemble the LPCM and relay as shown. The LPCM is mounted with 4 allen head bolts, 4 lock nuts, and 4 flat washers. The relay is assembled with 2 allen head bolts, 2 lock nuts, and 2 flat washers.
2. Attach the 3 supplied J-nuts to the 3 tank tabs as shown.



Completing Wire Harness Installation:

3. Connect main LPEFI harness connection to the LPCM, and Relay.
4. The tank plate mounts to the tank using the supplied 3/8 bolts, lock washers, flat washers. When mounting the tank plate make sure all wires are secure and inside the plate.
Note: tank plate should be left off at this time to perform Post Installation checks.
5. Check all electrical and fuel connections to ensure proper installation. Witness mark any torque hardware installed.

Install labels on the truck/registration

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

1. Install the EPA emissions label under the cab near the OEM label.
2. If the truck does not have a body installed, put the propane diamond in the glove box . If the body is installed on the truck, install the black "PROPANE" diamond on the back panel of the truck, toward the bottom right corner. **Note:** Do not install on the bumper
3. Install the Bi-Phase programmed ECM label just above the OBD II port.
4. Install the orange WARNING label on back of the tank plate and the back side of the cab near the OEM warning label.



Warning Label



Attention ECM



Decal Set



LPEFI Decal



EPA Emissions Label

5. Fill out vehicle warranty registration card and return to Bi-Phase Technologies along with the Post-Installation Inspection.
6. Place laminated owners information cab card in the glove box or door pocket with the OEM's owner's manual.
7. Program the PCM using the proper Laptop and interface module via the instructions below.

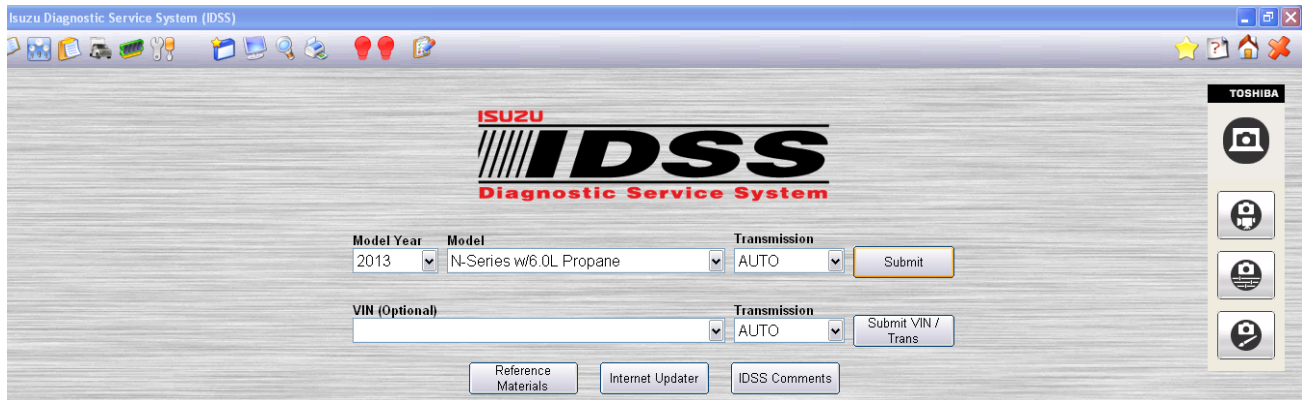
Isuzu NPR PCM Flash Procedure

Connect a battery charger to the vehicle battery to ensure the battery is fully charged to prevent connection interruption during the flashing procedure. Interruption during programming will lock the PCM.

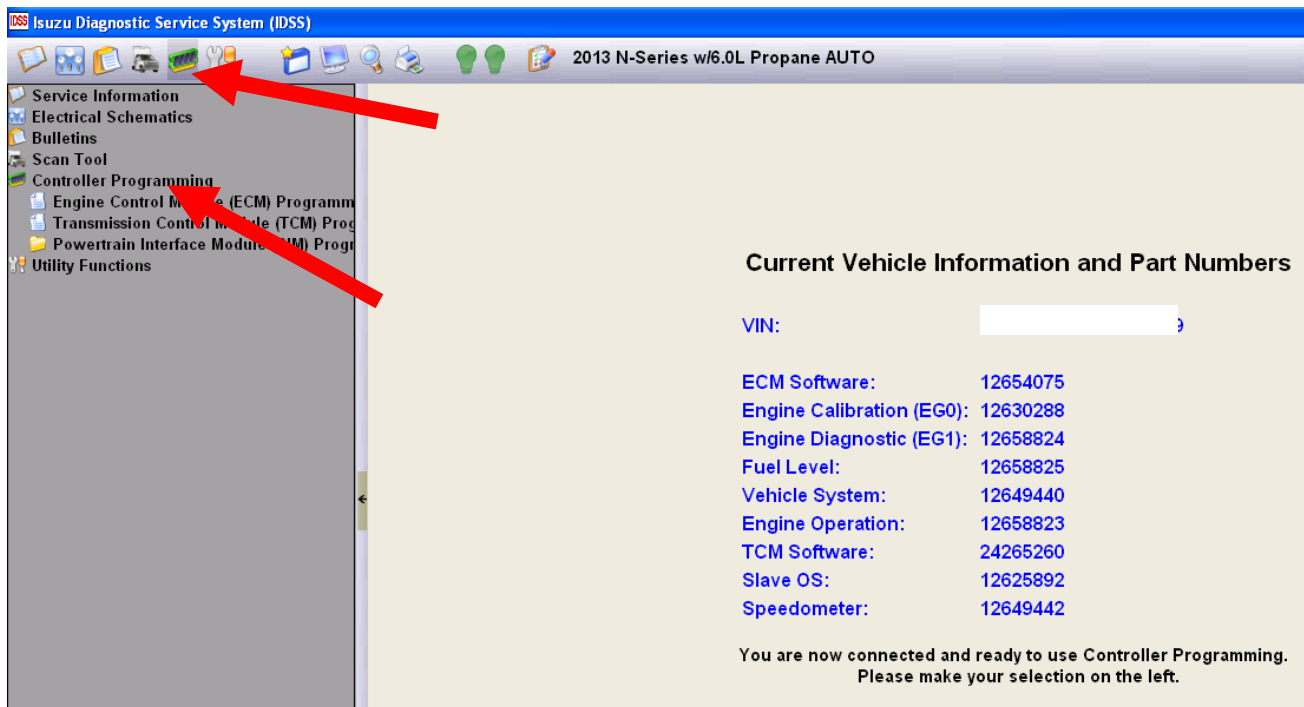
1. Plug in the Isuzu/Bi-Phase Laptop to an appropriate power source and ensure the battery is fully charged.
2. Power up the Laptop and use the appropriate username and password provided to log onto the computer.
3. Plug the Isuzu IDSS module into the laptop through the USB port located on the left side of the laptop.
4. Plug the OBD II connector from the IDSS module into the OBD II port on the vehicle. The OBD II port on the vehicle is located under the dash just left of the steering column.
5. Set the parking brake and turn the key to the key on engine off position.
6. Locate the IDSS icon on the desktop. Open the IDSS software.



7. Once the IDSS software is loaded, select the correct year, model, and transmission. Click Submit.

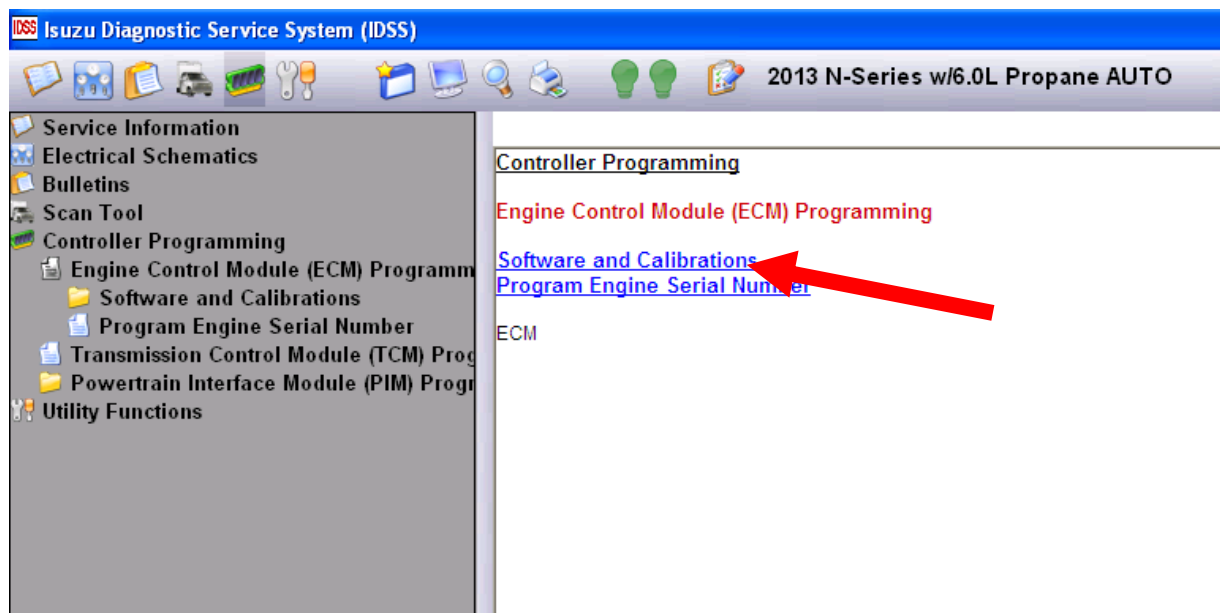


8. Once communication is established between the vehicle and the IDSS click on the **COMPUTER PROGRAMMING** icon.

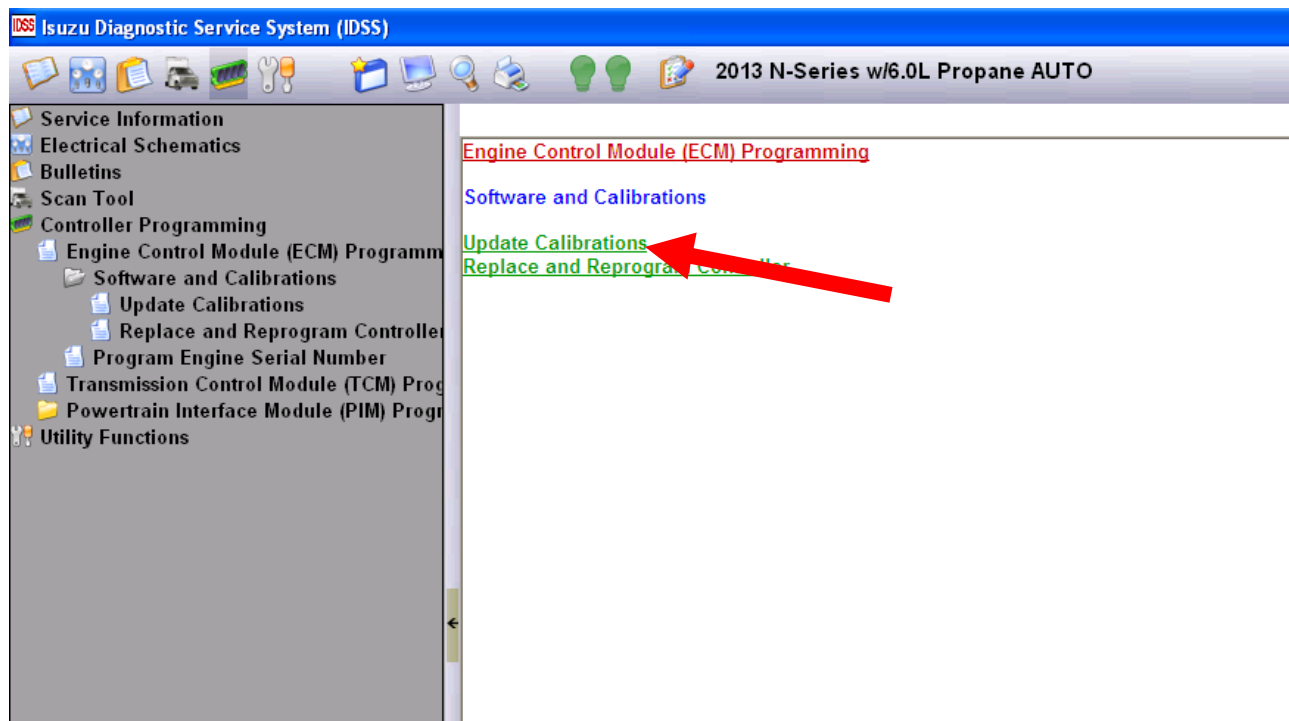


9. Once communication is established click on the **ENGINE CONTROL MODULE PROGRAMMING** tab.

10. Next click on the **SOFTWARE CALIBRATIONS** Tab.



11. Next click on the **UPDATE CALIBRATIONS** Tab.



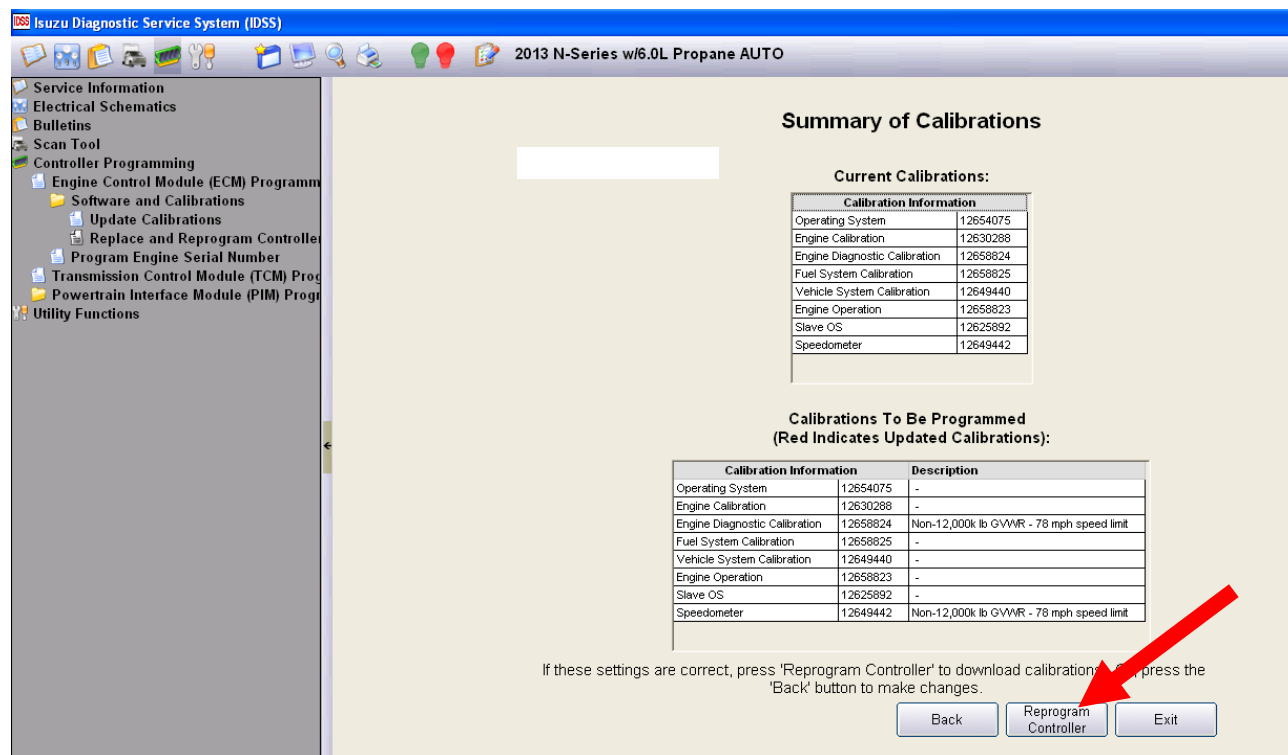
12. Verify the correct VIN shown to the VIN on the vehicle. When the correct VIN is confirmed click the **NEXT** icon.

The screenshot shows the Isuzu Diagnostic Service System (IDSS) interface. The title bar reads "Isuzu Diagnostic Service System (IDSS)" and "2013 N-Series w/6.0L Propane AUTO". The left sidebar contains a tree view with the following items: Service Information, Electrical Schematics, Bulletins, Scan Tool, Controller Programming, Engine Control Module (ECM) Programming, Software and Calibrations, Update Calibrations, Replace and Reprogram Controller, Program Engine Serial Number, Transmission Control Module (TCM) Programming, Powertrain Interface Module (PIM) Programming, and Utility Functions. The main area is titled "Current Vehicle Information" and displays the following data: VIN: (empty field), Model Year: 2013, Make: Isuzu, Model: NPRHD, Engine: 6.0L Gas, Transmission: AUTO, and GVWR: 14,001 - 16,000 lb. Below this information, a text prompt reads: "Verify VIN shown below is correct. If this VIN is not correct for this vehicle, please enter the correct VIN." Below the prompt is a text input field labeled "VIN:" followed by a dropdown menu showing the number "9". A red warning message is displayed below the input field: "Please ensure that your laptop battery is fully charged before starting controller programming. Also, go to Start->Settings->Control Panel->Power Options and ensure that your 'System Standby' and 'System Hibernates' settings are set to 'After 15 minutes' or greater. Failure to do this could cause controller programming to fail." At the bottom right, there is a "Next" button.

13. Select the correct speed limiter calibration. (65mph for Schwan Vehicles) (OEM default is 78MPH)

The screenshot shows the "Verify Speed Calibration" screen. The title is "Verify Speed Calibration". Below the title, it says "Current Speed Calibration is:" followed by "12649442 - Non-12,000k lb GVWR - 78 mph speed limit". Below this, there is a section titled "Select Speed Calibration" with a dropdown menu. The dropdown menu is open, showing the selected option: "12649444 - Non-12,000k lb GVWR - 65 mph speed limit". At the bottom right, there are two buttons: "Back" and "Next".

14. Verify all connections are secure and click the **REPROGRAM CONTROLLER** icon.



15. After reprogramming is complete check for any DTC's. If any found record the DTC and clear. Close out of the Computer Programming Tab in the IDSS software.

Testing the Installation

*Tools for testing the system are available by contacting Bi-Phase Technical Support
(888-465-0571)*

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. Connect the "3 switch box" to the LPDM, and connect the alligator clips to a 12V source.
7. Cycle the supply valve switch 10-12 times to purge the primary hose with propane.
8. Open the supply valve and observe the pressure. This is the static tank pressure. (Record the observed pressure to be documented later in the Post Installation Form. Tank pressure will vary depending on ambient temperature. 40psi @20°F - 160psi @95 °F.
9. Check all connections for leaks. 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. If any leaks are found stop and repair the leak.



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.

10. With the supply valve open turn on the pump switch. Observe the pressure. This is the pump boost pressure. (Record the observed pressure to be documented later in the Post Installation Form. Pump boost can range from 45-65 psi.
11. With the supply valve open and the pump on depress the return valve button. Observe the pressure. This is the purge reduction pressure. (Record the observed pressure to be documented later in the Post Installation Form. Purge reduction pressure can range from 8-12 psi.
12. Disconnect the "3 switch box" and pressure gauge set once all pressures are recorded.



WARNING: The pressure test hose may contain cold liquid propane.

Wear insulated rubber gloves and goggles.

Testing the Installation (cont'd)

13. Connect the LPDM to the main wire harness, along with all the LPCM, and relay.
14. Re-install the Electronics plate to the tank.
15. Connect the battery. You may hear a click at the tank.
16. 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.
17. 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.
18. Turn the key off, then on again to start another purge cycle.
19. If there are no leaks start the engine.
20. Connect a diagnostic scan tool to the vehicle.
21. 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.
22. 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).
23. Turn the key off and follow the testing procedures described in the Post-Installation Inspection
24. Fill out the Post-Installation Inspection completely.
25. Drive the vehicle for at least 15 minutes, if possible. Drive under various conditions and a variety of speeds.
26. 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%.
27. 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.
28. If there are no leaks, no DTCs and the engine runs well (smooth idle, smooth acceleration, good power), the vehicle is ready to use.
29. 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 Auto Purge functions of the LPCM

1. With the door closed allow vehicle to sit for at least 15 minutes.
2. Open the door; the pump 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 normally.
6. Before 30 seconds has passed turn the engine off. The purge cycle should initiate again.
7. 90 seconds after the engine has shut off, an Auto Purge will occur. Additional purges will occur 3, 6, 12, and 24 minutes after the truck has been shut off.
8. If the system works as described, you have completed the tests of the Auto Purge function.
9. If it does not work as described check all wire connections, battery voltage and contact Bi-Phase Technical Hotline at (888) 465-0571.

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

Post-Installation Inspection

Installation & test date _____

VIN _____

Make _____ Model _____

Installer company name _____

Tank Mfg. _____ Primary 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 ☐

Check fuel gauge operation, does tank gauge and dash gauge correspond? Yes ☐ No ☐

With the truck running, remove tank gauge from main tank (2 Phillips screws), but leave connected to the harness. With a magnetic sweep the needle to full, check the dash gauge for full, check it at ½ and empty. Each position should correspond.

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 on) _____ psi Example: 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: 135 psi	Note: Fuel trims range from 0 to -17% and shouldn't differ between bank by more the 10%									
Purge reduction pressure (Supply, Pump on & Return) _____ psi Note: Purge reduction is calculated by how much the pressure decreases from pump boost pressure (Purge reduction range is 1 to 15 psi or tank pressure) Example: 125 psi *Note: If specifications are out of range reference page 21 and 29 of the Bi-Phase LPEFI Diagnostic Manual	*Note: If specifications are out of range reference page 21 and 29 of the Bi-Phase LPEFI Diagnostic Manual									

Technician Name: _____

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

POST INSPECTION FORM AND ROAD TEST

VIN # _____

Injector Electrical Connectors Are Seated 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

LPEFI
Electrical Wiring Diagram
Main Wiring Harness
Isuzu W series Medium Duty

