

# ***UTILIMASTER***



**ALTERNATIVE *FUEL* SOLUTIONS**

**DRIVING INTELLIGENT  
VEHICLE SOLUTIONS**



## **Alternative Fuel Solutions**

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### **CNG System Training**

*A Spartan Motors Company*





# CNG 101

- Natural gas primarily consists of methane (90%), with small amounts of ethane, propane and other gases.
- Methane is the simplest gas molecule made up of one atom of carbon and four of hydrogen (CH<sub>4</sub>). It is lighter than air and burns almost completely, with by-products of combustion being carbon dioxide and water.
- CNG Engine greenhouse gas emissions are inherently lower than from gasoline or diesel engines.
- Natural gas decreases our reliance on foreign fuel sources (more 98% of the natural gas used in the US comes from North America)
- Natural gas costs less per energy unit than gasoline or diesel.

# CNG 101

## CNG Facts:

- ✓ When present in the environment, natural gas will dissipate into the atmosphere quickly, minimizing fire potential.
- ✓ Natural gas is lighter than air with a specific gravity of 0.5537.
- ✓ A gasoline gallon equivalent (GGE) of CNG contains the energy content of one gallon of gasoline.
- ✓ One CNG GGE is typically cheaper than gasoline by 30% or more.
- ✓ Has a very narrow flammability mix range: 5% to 15%.
- ✓ Auto-ignition temperature: 1,004°F



# Chassis Assembly

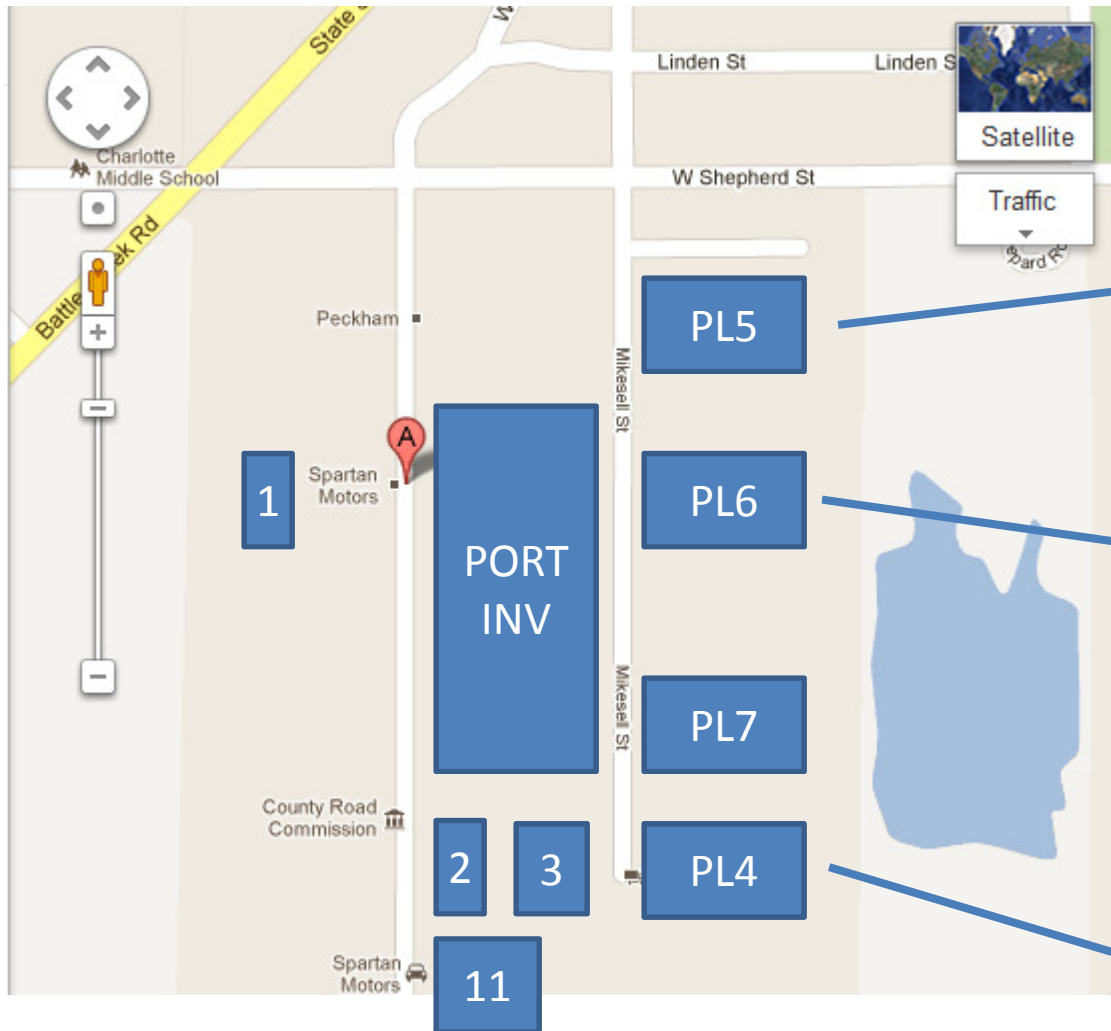


NPR Gas – cab set

Dyno verification



# Spartan Motors - Campus



Vehicle Modification  
Center



# Plant 4 – Vehicle Modification Center

## Isuzu PIO

(Port Installed Options)

- Mirrors
- Mud flaps
- Isuzu Badge
- Radio
- Chrome Wheels
- ..... etc

## Upfit:

- Propane Conversion
- CNG Conversion
- Custom Isuzu dealer requests - custom upfit





# Conversion Process



1. Remove Gasoline:
  - Fuel Rails w/Injectors
  - Fuel Lines
  - Evap System
  - Fuel Tank



2. Install CNG:
  - Fuel Rail w/Injectors
  - Tanks/Supply Lines/Fuel Gauge/Filters
  - Wiring Harnesses
  - Calibration Software
  - Add Fuel!

3. Perform Quality Checks:
  - Fuel Rail PSI
  - Pump/Evac system
  - IDSS Values
  - Drive Test



# The LandiRenzo CNG System



- The LandiRenzo CNG system is a direct replacement Compressed Natural Gas fuel injection system. It replaces the gasoline fuel injection system and works the same as a gasoline fuel injection system with the exception it injects CNG into the intake port. This is a dedicated CNG system.
- The electronic engine management system is still used to control the CNG system, just as with the gasoline injection system. Onboard diagnostics remain unchanged so the same scan tool and diagnostic approach can be used as a gasoline system.
- ECM program is proprietary to LandiRenzo but IS NOT interchangeable with the gasoline ECM program. If the gasoline ECM program is installed this will result in drivability issues on an CNG-equipped vehicle, and a re-flash back to the LandiRenzo software will be required.
- The CNG system consists of three main components: the tank, the fuel lines and the injectors. The tank is located behind the cab and the flexible fuel lines are routed forward to the CNG injector rail assemblies which are mounted on the engine in the same position as the original gasoline injector rails.

# LandiRenzo CNG Components



- **CNG Tanks:**
  - Two (2) Composite carbon fiber Type IV tanks installed, one per side of vehicle.
  - Automatic solenoid valves with thermal safeties for venting are installed in CNG tanks.
  - Protective shield installed around each tank to prevent damage from road debris or objects.
  - CNG Tanks require full inspection at 3 year/36,000 mile intervals. For more details, refer to: <http://www.cleanvehicle.org/technology/cylinder.shtml>
- **Fuel Rails and Injectors:**
  - Injector/rail combinations are application-specific in order to optimize performance & packaging.
  - Fuel rails include integrated pressure & temperature sensors for precise fuel metering under the broadest range of operating conditions.
  - Fuel injectors are designed exclusively for CNG and meter fuel flow according to processed signals from the engine controller.
- **Pressure Regulator:**
  - The CNG pressure regulator reduces fuel pressure from 3600 psi down to 50-150 psi depending on particular features of the specific application.
  - Engine coolant flows through an internal regulator jacket to maintain an even temperature and prevent freezing due to CNG expansion within the system.
  - Dual filters: Tank side (high pressure) & engine side (low pressure) of pressure regulator filter water & contaminants from fuel.
- **CNG Fuel Fill Box:**
  - The LandiRenzo USA filling receptacles are stainless steel construction and designed to be leak-free at low or high pressure, at any temperature.
  - An integrated check valve prevents gas flow when the fueling nozzle is disconnected
  - Receptacles can be used with any nozzle complying with the NGV1/ISO 14469-1 or -3 requirements.

# LandiRenzo CNG Components

## The Tank

- Fuel tanks are the lightest weight (Type IV) fiberglass-wrapped design and the fuel supply valve is directly attached. The pressure relief valve and fill valve are connected via hard lines.
- Each tank is enclosed in a protective shield to prevent tank damage.
- Standard conversion is two tanks (one on either side of chassis).

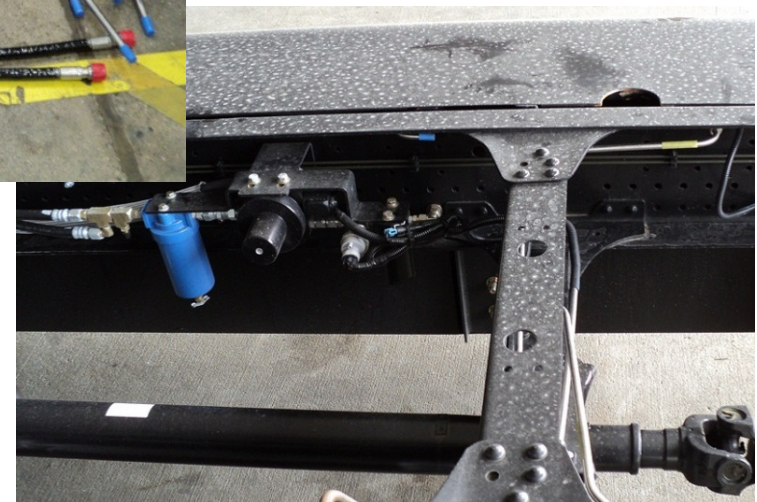
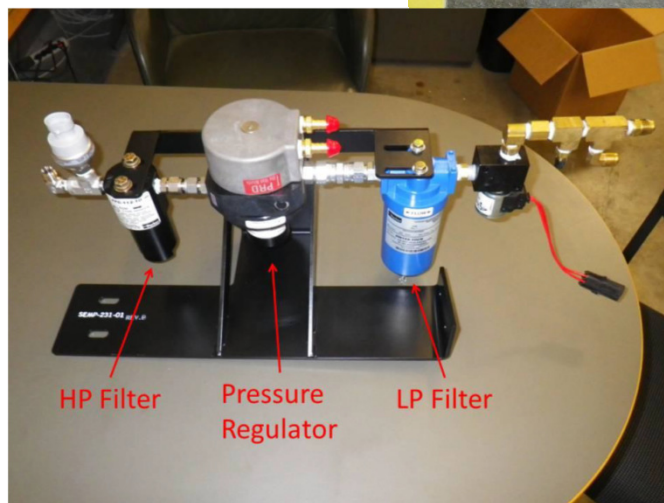
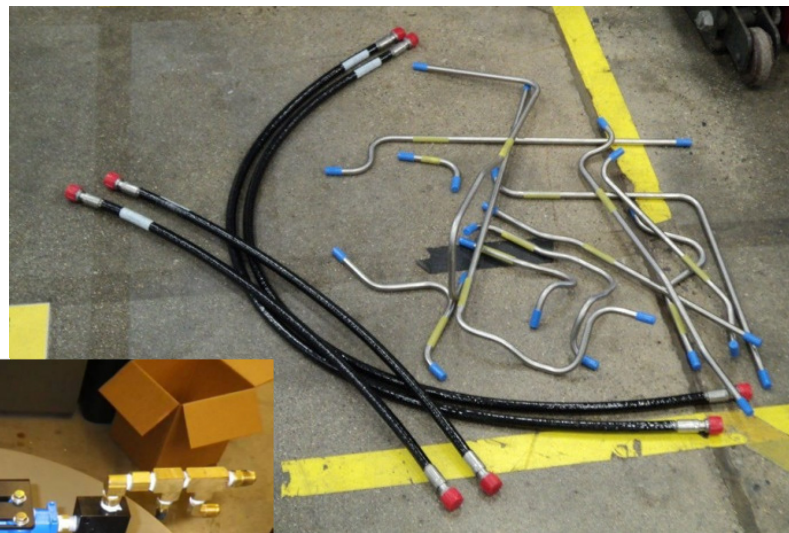




# LandiRenzo CNG Components

## The Fuel Lines

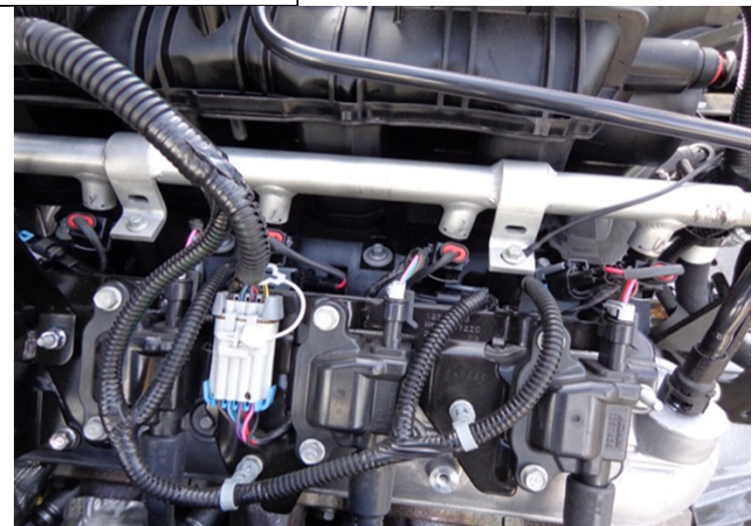
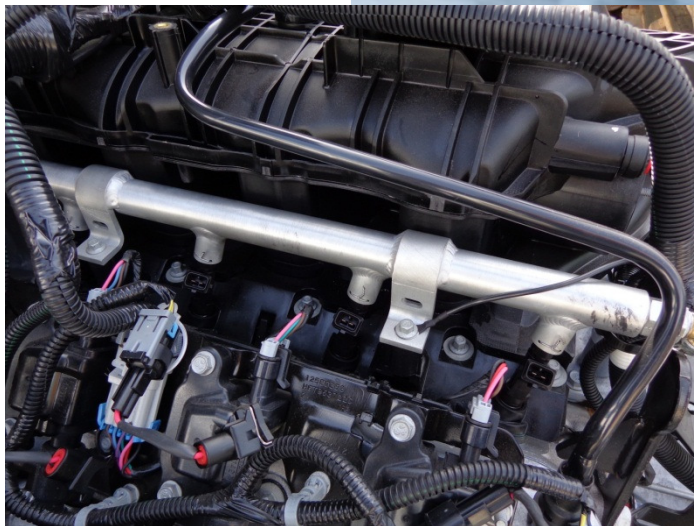
- The fuel lines consist of two parts:
  - High-pressure (hard) stainless steel lines from the tank to the high pressure filter on the pressure regulator, the pressure relief device, and the fuel fill box.
  - Low-pressure (flexible) lines from the low pressure filter on the pressure regulator to the fuel rails / injectors.



# LandiRenzo CNG Components

## The Injectors

- The CNG system injectors are commercially available and selected specifically for each CNG system. They emulate the gasoline fuel injectors that they replace.
- The CNG injector receives natural gas from the low pressure side of the regulator and delivers it to the intake port in the same manner a gasoline injector does, except natural gas is gaseous and gasoline is liquid.



# CNG Safety

- ⚠ Never loosen fittings or vent fuel. Escaping fuel can cause frostbite and severe freeze burns.
- ⚠ Wear insulated PVC rubber gloves resistant to fuel.
- ⚠ Wear Goggles for protection against accidental release of pressurized products and thermal protective clothing when handling refrigerated liquids.
- ⚠ Do not remove any valves, bulkheads, or fittings from a tank unless the tank has been drained completely. The pressure inside a propane tank can push a loosened bulkhead or valve out with enough force to cause injury or death.
- ⚠ Keep all sources of ignition away from 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.



# CNG Safety

- ⚠ Do not allow smoking, sparks, flames, recently run or running vehicles or other sources of ignition near when fueling, servicing and venting fuel. Failure to do this could result in fire or explosion, causing severe property damage, injury or death.
- ⚠ Do not disconnect any fuel hoses unless they have been properly and completely drained.
- ⚠ Do not vent or release fuel indoors.
- ⚠ CNG is lighter than air and will rise to the highest available inside location.

# Service Shop Modifications

- Are modifications required for my shop?
- Determine type of repairs performed in service area:
  - Major Repairs = Repairs involving fuel systems, open flames / welding, engine overhauls, painting, body work, and draining fuel systems.
  - Minor Repairs = All other repairs including lubrication, engine tune-ups, parts replacement, fluid changes, brake service, tire rotation, regular maintenance work.

# Service Shop Modifications

- If Major repairs are performed in the service area these fire code requirements apply:
  - Ventilation systems
  - Gas Detection systems
  - Ignition Source Temperature limits
  - Electrical Classification
- If only Minor repairs are performed in the service area, modifications to the service area are not required.
- For more details, refer to:  
<http://www.cleanvehicle.org/committee/technical/PDFs/GuidelinesDocumentFinal.pdf>



# Online Alternative Fuel Resources



[www.utilimaster.com/manuals](http://www.utilimaster.com/manuals)

- Diagnostic Manual
- Shop Safety
- Troubleshooting Guide
- Warranty Guide

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### TECHNICAL MANUALS

Utilimaster is with you for the life of your vehicle. Our Customer Product Support Group manages the creation of a variety of technical manuals to assist you in operating and servicing your vehicle. These manuals are in Adobe Acrobat PDF format for easy opening, maneuvering and printing.

Utilimaster has also created technical videos to assist with vehicle operation and component installation. Please check back frequently as our video library continues to grow.

### Video Support

### ALTERNATIVE FUELS

- CNG: Service - Shop Safety (Isuzu NPR Chassis)
- CNG: Service Tools (Isuzu Chassis)
- LPG: Diagnostic Manual
- LPG: Service - Shop Safety (Isuzu NPR Chassis)
- LPG: Troubleshooting Guide (Isuzu Chassis)
- LPG: Warranty Guide & Claim Form (Isuzu Chassis)
- CNG: Troubleshooting Guide (Isuzu NPR Chassis)
- CNG: System Service Manual
- CNG: System Owner's Manual

### OPERATORS GUIDES

- Operators Guide - All Products
- Operators Guide - Reach

### PARTS MANUALS

**Aeromaster**

- Parts - Aeromaster - Ford - 1997-2002

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# Common Service Solutions



- **ECM Reflash Is Required**
  - Programming is proprietary to Landi-Renzo and model year unique to the system installed on the Isuzu NPR 6.0L engine with gaseous prep package.
  - The CNG program is NOT interchangeable with the normal gasoline ECM program.
  - If vehicle is flashed with gasoline program, re-flash to CNG program is required.
  - Newest version of program includes improved cold weather starting ability.
  
- **Fuel Gauge Does Not Read or is Incorrect**
  - Check for line pressure leaks. If fuel lines or connections are leaking, pressure is not maintained and dash gauge will not operate at initial start-up.
  - Check for correct wiring colors between Fuel Gauge Driver Module & Fuel Gauge Transducer as shown in the CNG Service Manual, page 15.
  - If wiring is correct but Fuel Gauge always shows empty, check for a good power connection to Fuel Gauge Driver Module (connector with blue/black wire to orange wire, located on cross-member where vapor recovery canister is on a gasoline vehicle).
  - If all wiring is correct, check module connection to Orange, Black w/White, Purple, and Tan wires on other side of Fuel Gauge Driver Module as shown on schematic in CNG Service Manual, page 15.

# Service Intervals



## **SPECIFIC MAINTENANCE INTERVALS FOR CNG-AFFECTED COMPONENTS:**

- a. Oil changes- Refer to Isuzu NPR owner's manual, Maintenance section.
- b. Drain High & Low Pressure Filters \*\*– every 3,000 miles / 3 months
- c. Replace Low Pressure Filter\*\* – every 5,000 miles / 5 months
- d. Visual Inspection of CNG Hoses and Lines\*\* – every 7,500 miles / 7 months
- e. Visual Inspection of CNG Tank Shields\*\* – every 10,000 miles / 12 months
- f. Check PCM Data Stream for Correct Readings - every 12,000 miles / 12 months
  - 1. Long Term Fuel Trims
  - 2. Short Term Fuel Trims
  - 3. Oxygen Sensor Voltages
- g. Inspect Spark Plugs – every 25,000 miles
- h. Replace Spark Plugs / Inspect Wires – every 50,000 miles (Isuzu recommends OEM spark plugs to prevent corrosion seizing issues)
- i. Replace Oxygen Sensors– every 80,000 miles or as required by Isuzu
- j. Replace Ignition Coils – every 100,000 miles or as required by Isuzu
- k. Inspect fuel tank(s) - every 3 years / 36,000 miles. For inspector details, refer to:  
<http://www.cleanvehicle.org/technology/cylinder.shtml>

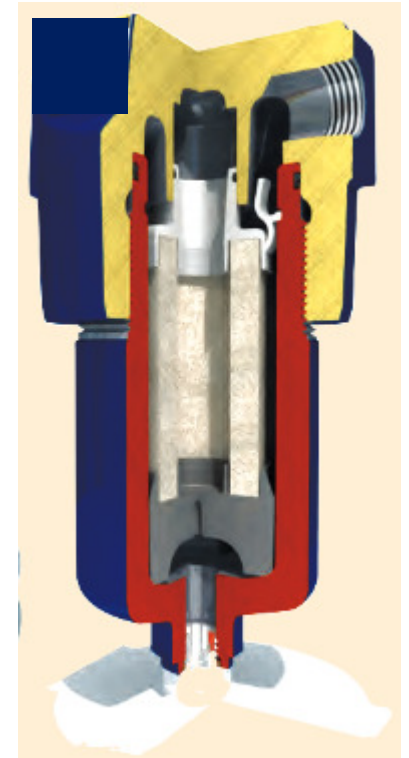
\*\* must be serviced by a certified CNG technician.



# Service Intervals

## Replace Low Pressure Filter Element – Change every 5,000 miles/5 months

- 1) Place Shut-Off Valve in the 'Off' position prior to performing any low pressure diagnosis or repairs.
- 2) Loosen drain plug on lower half of Low Pressure Filter & remove lower housing bowl.
- 3) Remove old seal from Filter head.
- 4) Remove old Low Pressure Filter Element from housing.
- 5) Install new Low Pressure Filter element on housing.
- 6) Install new seal onto Filter head.
- 7) Apply lubricant (supplied) to new seal
- 8) Install lower housing bowl and tighten bowl to required torque.
- 9) Check lower housing bowl for looseness.
- 10) Install plug.
- 11) Return Shut-Off Valve to the 'On' position.



# Warranty



- **If Warranty Service or Parts are Required** Customer or dealer should call **Utilimaster Technical Support** at **(800)237-7806** and select option for Customer Product Support/Warranty. Utilimaster will coordinate parts delivery.
- **Components Covered:**
  - Fuel cylinders (tanks)
  - Fuel pressure regulator
  - Automatic solenoid shutoff valve
  - Manual quarter turn valve
  - Low and high pressure fuel lines and hose
  - Electronically controlled multipoint fuel injectors
  - Fuel rails
  - Wiring harnesses
  - Note that maintenance items such as filters are not covered under this warranty. Maintenance items are at the owner's expense.
- **5 Year/75,000 mile limited warranty**

# Warranty Policy



## **Step 1: Request Customer Support or Service**

Call Utilimaster's Customer Support Group at 800-237-7806 to request support or service. Utilimaster Product Support will log the issue and provide resolution for basic issues and will flag the vehicle for a pending labor invoice (if within warranty period). LandiRenzo requires that service be performed by trained CNG technicians, and prefers certification on LandiRenzo systems.

## **Step 2: Request Parts**

Utilimaster warrants system installation and LandiRenzo warrants parts design and quality. A service parts request is issued by Utilimaster Product Support to LandiRenzo. Utilimaster provides purchase order request for warranty parts to LandiRenzo. Utilimaster is able to provide free expedited shipping for parts on vehicles which are not functional.

## **Step 3: Return Parts**

LandiRenzo requires that defective parts be returned for warranty review, and includes a return shipping label with each warranty shipment. LandiRenzo may charge customer if defective parts are not returned. In special cases, Destroy in Field parts will be identified as such by Utilimaster or LandiRenzo.

## **Step 4: Submit Invoice**

Utilimaster's Customer Support Group reimburses for labor and part replacement cost on approved warranty claims related to installation. Approved warranty claims related to defective design or parts will be paid by LandiRenzo.

# Service Tools



## 1. Special Tools Required:

- a. A unique socket tool is required to remove or replace the OMB Lyra tank valve, and is available through special order.
- b. Call Utilimaster at (800) 237-7806 and select the option for Customer Product Support.

## 2. Recommended Regular Service Tools:

- a. Tech 2 scanner for maintenance of the CNG system.
- b. A CANdi module for Tech 2 is required to communicate with the CAN interface.
- c. Crimp tool for GM weatherpack terminals (Sargent 3138 CT DELPHI 12014254 WEATHER-PACK CRIMP TOOL).
- d. Extractor for GM weatherpack terminals.
- e. Torque wrench(s) to measure range from 100-250 lb-ft.
- f. Basic mechanic tool kit.
- g. A 2 ½" socket to accept the tank valve socket tool.



# Replacement Parts



- Contact Utilimaster Product Support at (800) 237-7806.

# Contact Information



## Vehicle Modification Center Hotline:

574.848.2201

## Technical Support Hotline:

800-237-7806

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# Questions?

