

Installation Instructions

Monofuel CNG Fuel System MY2019 Ford F-59 6.8L V10 (UPS Specification)

Revision: C Date: 05-22-2023



Final Chassis Specification Sign-off



The following sign off acknowledges the final chass Loudon, TN on 1/10/2019:	is specification as agreed to at the cha	ssis pilot in
Paul Shaffer, Landi Renzo USA	Date	
Jim Konen, National Fleet Services	Date	
Larry Palmer, Morgan Olson	Date	
Jim Schreiber, Peach State Truck Center	 Date	

Landi Renzo Dedicated CNG System Installation



Welcome to the Landi Renzo USA installation process. This manual is not intended to replace or substitute a Landi Renzo certified installation training. It is intended to complement the installation training and serve as a guide for the conversion process.

Landi Renzo's training covers only the installation of Landi Renzo's fuel injection system. Installers must have basic mechanic skills, knowledge of computer-controlled fuel injection on Ford engines and knowledge of high pressure CNG installation regulations and safety precautions (including the latest edition of NFPA 52).

Installation of the Landi Renzo system may only be performed by authorized trained professionals and installation may not be performed by anyone not specifically trained by Landi Renzo.

Before you begin, review this manual completely as there may be new or updated information. The photos and figures are for reference only and may not represent your specific information. If you have any questions or need additional detail, contact your Landi Renzo representative before proceeding.

Please Quality Control all parts included in the kit prior to installation. Do not mix and match parts from other kits. If a part is missing, contact your Landi Renzo representative before proceeding. Complete an online Installation Assistance request form for any installation questions. The form can be found at: http://www.landiusa.com/service/





You must check whether the Ford F-Series vehicle you intend to convert is equipped with the factory option for a Gaseous Prep Package. If your vehicle is not so equipped, Landi Renzo will not warranty any components or systems installed on such a vehicle. Please refer to the Ford Motor Company Q-185 SVE Bulletin for more information. This is also a requirement of the Ford Motor Company Quality Vehicle Modifier Gaseous Fuels Unique Guidelines and Requirements. See standard G-D0410.

If you are unsure whether your vehicle is equipped with a Gaseous Prep Package, refer to the window sticker of the vehicle, or contact a Ford Dealer for assistance. For the Ford F-Series 6.8L, the sales order code referencing the Gaseous Prep Package is "98G". This code may change without prior notice, so ensure that you have the most recent version of Q-185, which may downloaded from: https://www.fleet.ford.com/truckbbas/





Please Note: Prior to any installation or disabling of gasoline operation, it is required that the gasoline (pre-conversion) portion of the data collection be completed using the MyCANIC-FD flash tool and sent to Landi Renzo. Data collection files can be submitted via internet or mailing SD cards.

Avoid problems down the road by following good general practices. Use heat shrink tubing and tape to seal off any exposed wires. Dielectric grease will help prevent corrosion or damage to exposed electrical terminals. Tie-wrap or otherwise secure all loose wires, hoses, and lines back out of harm's way assuring that vibration, heat, and relative movement will not ever wear them through. Leave no connection or wire unshielded from wet or corrosive environments.

Review each step of the installation for robust durability. Are any wires, fuel lines, tanks, and other components vulnerable to chafing, stress, or excessive heat? Rework as required to ensure a robust installation before moving on to the next step.

Complete an online Installation Assistance request form for any installation questions. The form can be found at: http://www.landiusa.com/service/



Tools and Consumables



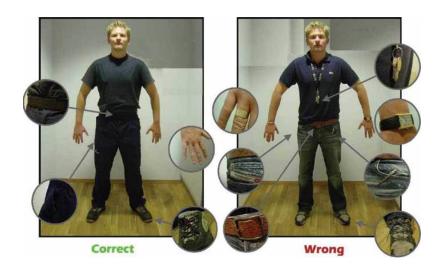
- Torque Wrenches, 30-250 ft-lb, 150 to 750 in.-lbs., 3/8-inch or 1/2-inch Drive
- Rivet Nut Tool, Air, 3/8-inch Blue Pneumatic ® BP-350Qc or Similar
 - Pliers for Constant Tension Hose Clamps
- Pliers, Hose Pinching, 10-inch Blue Point ® HCP10A or Similar
- Drill, Air, 3/8-inch Capacity Blue Point ® AT811 or Similar
- Soldering Iron
- Drill Bit Set, Cobalt, 1/16-inch to 1/2-inch Milwaukee ® 48-89-0026 or Similar
- Leak Detector, Liquid Swagelok ® MS-SNOOP, Nu-Calgon Cal-Blue, or Similar
- Pliers, Locking, C-Clamp, 12-inch Blue Point VGP22412 or Similar
- Engine Diagnostic Tool
- Wrench Set, Metric, 10mm 24mm
- Wrench Set, Standard, 3/8-inch 1-inch
- Socket Set, 10mm 19mm, 3/8-inch 3/4-inch
- Screwdriver Set. Phillips and Flathead
- Screwdriver Set, Miniature
- Hex Kev Set. Standard
- Tubing, Heat Shrink
- Tubing, Heat Shrink, Environmentally Sealed
- Zip Ties, 8-inch, Black
- Manufacturer Manuals
- Dielectric grease
- Portable Magnetic Drill with 1/2-inch, 3/4-inch bits
- Clean, non-synthetic, non-detergent engine oil for all O-ring lubrication (i.e. 30W engine oil)
- Adhesive, spray 3M Hi-Strength 90 or Similar
- Hydraulic Manual Lift Table Use ULINE or similar means of lifting fuel tank assembly
- Electrical tape 3M or similar
- MyCANIC-FD PCM Flash Tool (obtain from Landi Renzo USA)
- Nudi Terminal Removal Tool (Motorcraft P/N NUD900-002) or pick set
 - Combustible Gas Detector TIF 8900 or Similar
- OMB ESA Valve Installation Tool

Operator Clothing



To prevent damage to the vehicle and offer added protection for the Operator/Technician, the following should be observed with regard to clothing:

- · Belt buckle repositioned or removed
- Rings and other jewelry removed
- Clothing free of rivets or other sharp or protruding items
- Lanyards or other loose items removed
- Safety-shoes or other appropriate work footwear
- Eye protection for use when chiseling, drilling, grinding or hammering.



Vehicle Intake Check-In



- 1. Inspect the vehicle and record all data on NFS Vehicle Inspection Form.
- 2. Prior to any work on the vehicle, an OBDII system check must be performed. Pre-conversion gasoline data collection is to be completed using the MyCANIC-FD tool and submitted to Landi Renzo. If any codes are present, perform repair or take the vehicle to the nearest Ford Dealer or authorized facility before conversion. If no codes are present, continue with installation.

Refer to the separate guide on the Landi Renzo Service website on reading DTCs and data collection using the MyCANIC-FD.

Warranty Registration Form



Please fill out the Warranty Registration Form at http://www.landiusa.com/service/

NOTE:

- Multiple vehicle VINs can be registered using a single form submission.
- You will not receive the Vehicle Emission Control Information (VECI) label required to complete
 the installation of your CNG fuel system until the Warranty Registration Form has been submitted
 to Landi Renzo.

Disconnect Battery



- 1. Disconnect the negative (-) battery cable
- 2. Secure negative (-) terminal connector away from battery to avoid possible accidental reconnection.

Automotive batteries produce flammable gasses. Keep open flames and heating devices away from the area near the battery.

Automotive batteries contain sulfuric acid. Always wear eye protection when working on or near the

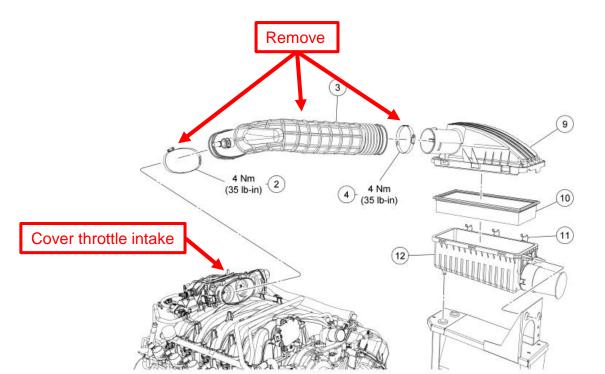
battery.



Remove Air Cleaner Outlet Assembly



- 1. Remove air cleaner outlet pipe following the Ford Motor Company procedure in the Ford Service Manual.
- 2. Cover throttle body intake from outside contaminants.



Remove Gasoline Fuel System & EVAP Components



- 1. Remove the following OEM gasoline fuel system components and EVAP canister components from the vehicle. Refer to the Ford F-Series service manual for the proper procedure. Cut off electrical connectors related to the removal of gasoline components, and cover wiring end with environmentally sealed heat shrink tubing.
- Release the Fuel System Pressure
- Disconnect Fuel Pump and Fuel Tank Pressure Sensor connectors.
- Remove and Drain Fuel Tank.
- Fuel Lines.
- EVAP canister and bracket, canister Purge Valve from engine compartment, and lines.
- Fuel Rail Assembly and injectors. Retain two attaching bolts from each side. They will be used to attach
 the new CNG fuel rail assemblies.
- 2. Cap purge valve-to-intake port on intake manifold using Dorman P/N 950-005 with 3/4" constant tension clamp.

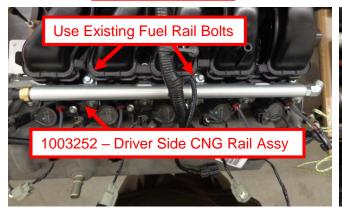


Install CNG Fuel Rail Assemblies



- Locate and remove the two intake manifold bolts as shown below from both the Driver side and Passenger side of the intake manifold. These will be used to secure the CNG Fuel Rail along with four OEM fuel rail assy. bolts.
- 2. Lubricate the lower injector O-rings on CNG fuel rail assemblies (P/N 1003252 and 1003253) with engine oil to prevent damage or shearing of O-rings. Use ONLY clean non-synthetic engine oil (i.e. 30W engine oil). CAUTION! DO NOT USE silicone grease or any other type of lubricant
- 3. Install CNG fuel rail assemblies until fully seated into intake manifold. Secure them to the vehicle using the original OEM fuel rail assembly bolts. Two Intake manifold bolts and two fuel rail bolts for each fuel rail. **Torque bolts to 89 lb. in. (10 Nm).**
- 4. Attach OEM injector harness to CNG injector jumpers and secure all OEM connectors as shown.

Driver Side Shown

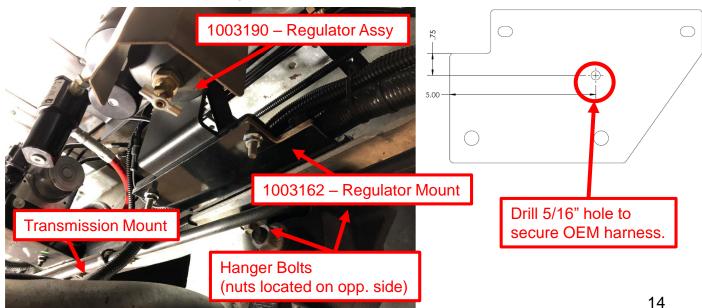




Install Regulator Assembly on Vehicle



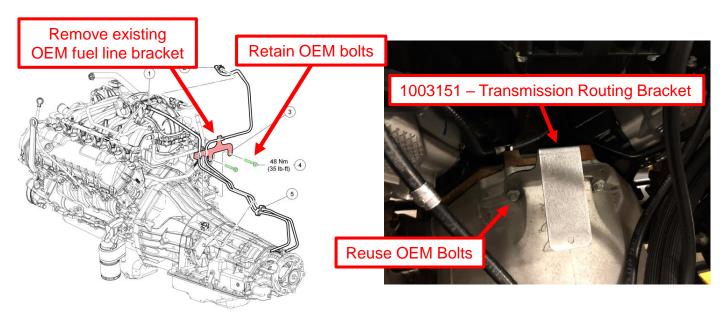
- 1. With vehicle on the ground, remove two (2) hanger nuts located on driver side near the transmission mount. Drill hole in regulator mount (P/N 1003162) to re-secure OEM harness.
- 2. Mount the regulator mount as shown below on the hanger bolts and secure using the hanger nuts previously removed. Torque nuts to 74 lb-ft (100 Nm) per Ford Workshop Manual.
- 3. Install regulator assembly **(P/N 1003190)** to regulator mount bracket using supplied hardware. Resecure main harness onto hanger bolts.



Install Transmission Routing Bracket



- 1. Remove existing OEM gasoline fuel line bracket. Retain two (2) mounting bolts for reuse.
- Install transmission fuel line support bracket (P/N 1003151) using existing two (2) OEM fuel line support bracket bolts. Torque bolts to 48 Nm (35 lb-ft).



Install Low Pressure Fuel Hoses



Warning! When installing the low pressure hoses, DO NOT USE Teflon tape or other pipe sealing method.

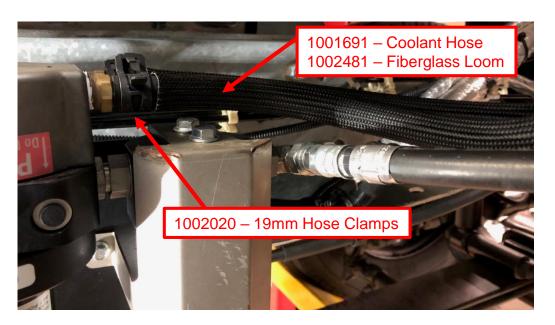
- Attach both hose fittings to the tee on the low pressure filter of the regulator assembly. Note that
 the longer (passenger side) hose (P/N 1003196) attaches to the center of the tee and the shorter
 (drivers side) hose (P/N 1002133) attaches to the front. (see photo) Do not tighten completely at
 this time.
- 2. Connect the low pressure hose assemblies to the fittings at the back of the fuel rails using the straight ends of the hoses. The longer hose (39" P/N 1003196) connects to the passenger side rail and the shorter hose (37" P/N 1002133) connects to the driver side rail. Do not tighten completely at this time.



Install Coolant Lines



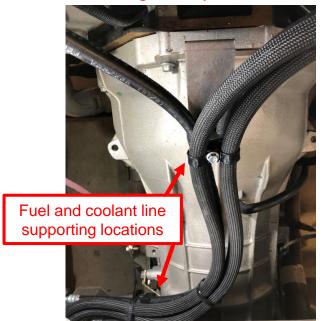
- Cut coolant hose (P/N 1001691) in half and install the protective fiberglass high temperature loom (P/N 1002481) over both hoses. Apply white tape at the end of the "Regulator In" coolant line to assist Morgan Olson with identify which coolant lines are In vs out.
- 2. Before installing regulator assembly attach hoses to regulator coolant fittings using two (2) 19mm constant tension clamps (P/N 1002020).

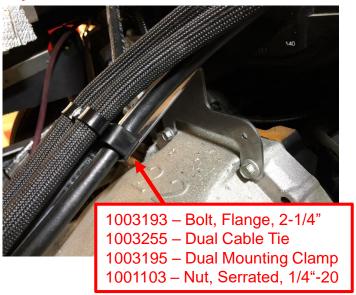


Route Low Pressure Fuel and Coolant Hoses



- 1. Route the fuel and coolant lines along the transmission housing as shown below, and secure on the transmission support bracket previously installed and Selector Lever Cable bracket using the hardware listed below (dual cable tie and clamps with associated hardware).
- 2. Secure the hoses together between supporting locations using cable ties (P/N 1003255). Be sure that the hoses are routed so that they are not contacting or rubbing anything to prevent wear and chafing. Use separators as necessary.

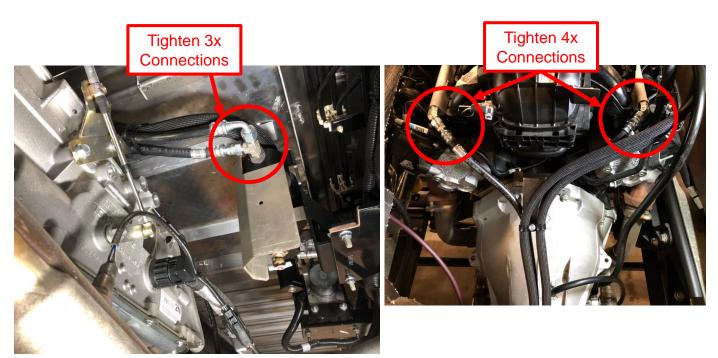




Route Low Pressure Fuel and Coolant Hoses



1. Once all hoses are routed properly and secure. Tighten all Low Pressure hose fittings at back of fuel rails and regulator assembly. Torque – 20 ft.-lb.



Install Regulator Coolant Lines



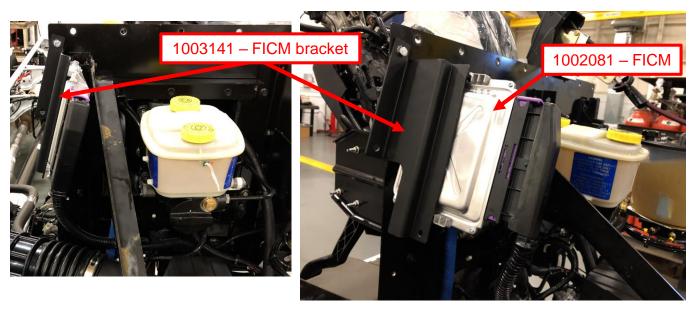
- Prepare vehicle heater hoses by cutting to accept two (2) coolant tees (P/N 1003180) at the two
 locations indicated below.
- 2. Install coolant tees into heater hoses using constant tensions clamps (P/N 1002021 24mm, P/N 1002494 27mm). Note: Two different size constant tension clamps have been included to accommodate different size heater hoses.
- Route coolant hose along the transmission tube and secure using cable ties, then cut regulator coolant hoses to proper length and attach the regulator coolant hoses to tees using constant tension clamps (P/N 1002020).



Install Landi Renzo Fuel Injection Control Module (FICM)



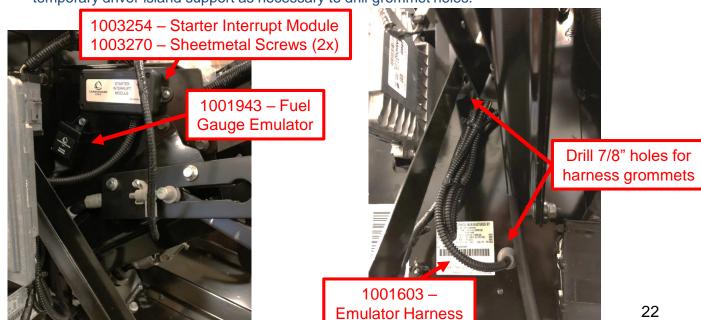
- 1. Install FICM bracket **(P/N 1003141)** to the driver's island bulk head in the temporary position shown next to OEM temporary driver's island support bracket.
- 2. Attach FICM **(P/N 1002081)** to FICM bracket studs using two (2) 1/4"-20 nuts **(P/N 1001103)**. Torque 40 in.-lb.



Install Fuel Level Emulator and Starter Interrupt Module



- The fuel level emulator (P/N 1001943) and starter interrupt module (P/N 1003254) are installed under the dash above the parking brake assembly. Both modules mounts above the parking brake with sheetmetal screws (P/N 1003270).
- 2. Drill and deburr two (2x) 7/8" holes in the firewall in the locations marked below and secure grommets on starter interrupt module and emulator harness (P/N 1001603). Remove and re-install temporary driver island support as necessary to drill grommet holes.



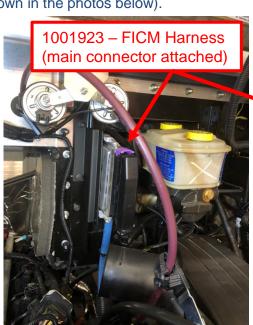
Install FICM Harness - 1 of 5



Begin FICM harness (**P/N 1001923**) installation on the driver side of engine compartment. In the following steps, route and secure the harness along OEM harnesses and use any clips previously used to secure OEM fuel lines.

NOTE: Prior to installation, wrap each <u>end</u> of wiring harness with **white tape** as a visual aid for system serviceability (not shown in the photos below).

- 1. Attach connector to FICM.
- Attach harness ground to existing bolt on driver's island.

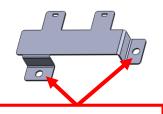




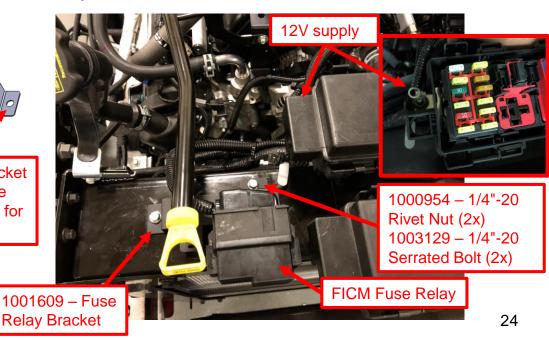
Install FICM Harness - 2 of 5



- 1. Using the fuse relay bracket (**P/N 1001609**) as a template, mark and drill two (2) 25/64" mounting holes and use rivet nut tool to install two threaded inserts (**P/N 1000954**) in locations shown below.
- 2. Install the fuse relay bracket as shown below using two 1/4"-20 serrated bolts (P/N 1003129).
- 3. Attach FICM harness fuse relay block to bracket, then attach harness to OEM 12V supply in adjacent main OEM fuse/relay block.



Use fuse relay bracket holes as a template for 25/64" in. holes for threaded inserts

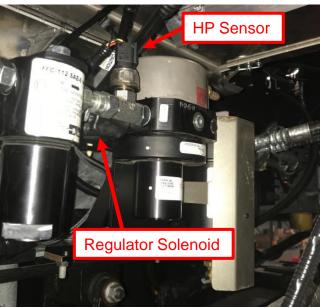


Install FICM Harness – 3 of 5



- 1. Connect to P/T (Pressure/Temperature) sensor on fuel rail.
- 2. Connect to HP (High Pressure) Sensor and Regulator Solenoid on regulator assembly. Route harness and secure along OEM harness on driver side frame rail.



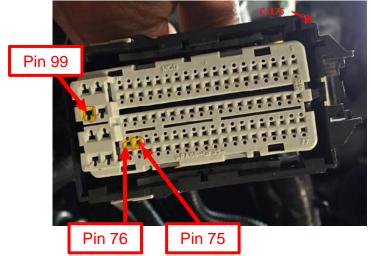


Install FICM Harness - 4 of 5



- 1. Unplug Ford PCM Connector C-175B and locate CAN and V-power wires pins 75, 76, and 99.
- 2. Splice FICM harness CAN and V-power wires into OEM wires. Do not cut PCM wires. Reconnect Ford PCM.
 - FICM Green wire to pin 75
 - FICM Orange wire to pin 76
 - FICM Blue V-power wire to pin 99



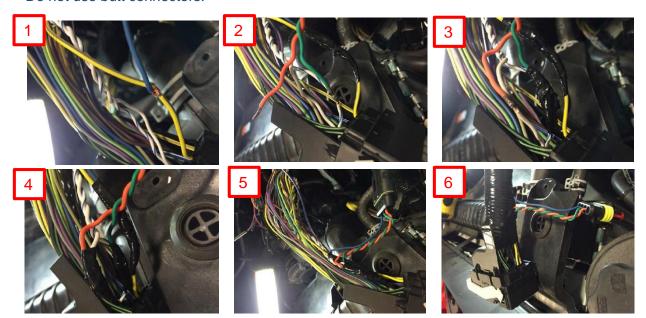


Install FICM Harness - 5 of 5



CAN Wire Connections

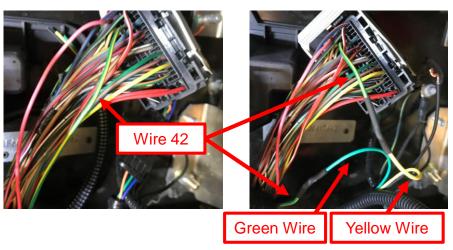
- Photos show proper CAN wire splicing (wire colors may vary from examples shown below).
 Wires must be spliced and soldered or loss of module communication may occur.
- · Seal spliced connections with electrical tape.
- Do not use butt connectors.



Install Starter Interrupt Harness – 1 of 1



- 1. Locate green/yellow wire in Ford PCM Connector C-175B position 42.
- 2. Splice and solder green and yellow wire from the Starter Interrupt Module to OEM wire as shown below (3.5 inches away from PCM connector). Seal splice with heat shrink tubing (ensure heat shrink tubing is inserted in wire before performing splicing procedure).
- 3. Complete wire connection by taping and reassembling harness before reconnecting to PCM.

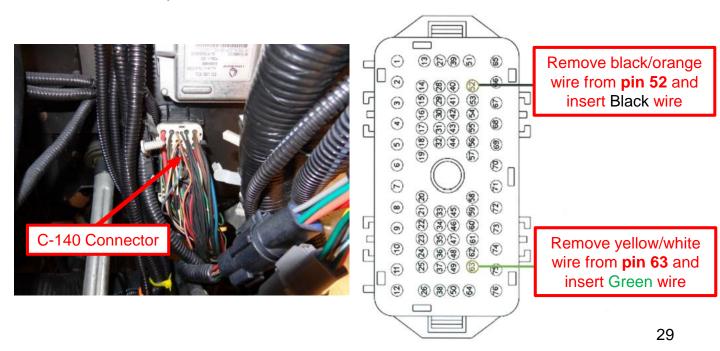




Install Fuel Level Emulator Harness - 1 of 2



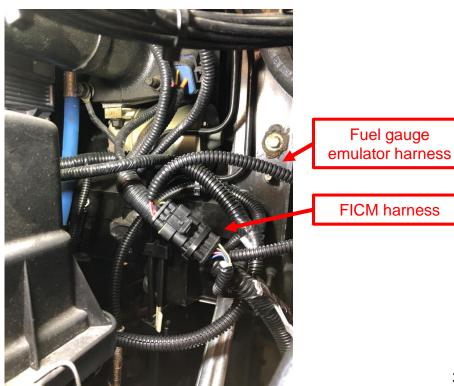
- Remove OEM bulkhead connector C-140.
- 2. Using a pick tool, remove black/orange wire from **pin 52** and insert emulator harness **black wire**.
- 3. Using a pick tool, remove yellow/white wire from pin 63 and insert emulator harness green wire.
- 4. Heat shrink and tape back the OEM wires removed from the bulkhead C-140 connector.



Install Fuel Level Emulator Harness - 2 of 2



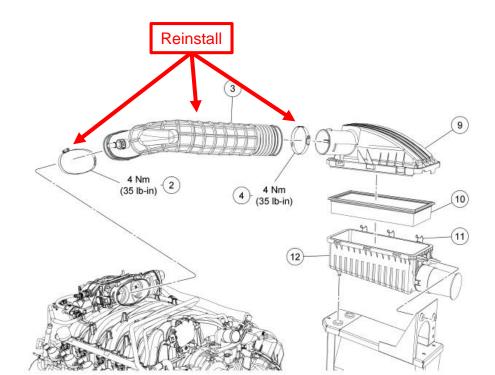
- 1. Reinstall OEM bulkhead connector.
- 2. Connect fuel gauge emulator harness to main FICM harness.



Reinstall Air Cleaner Outlet Assembly



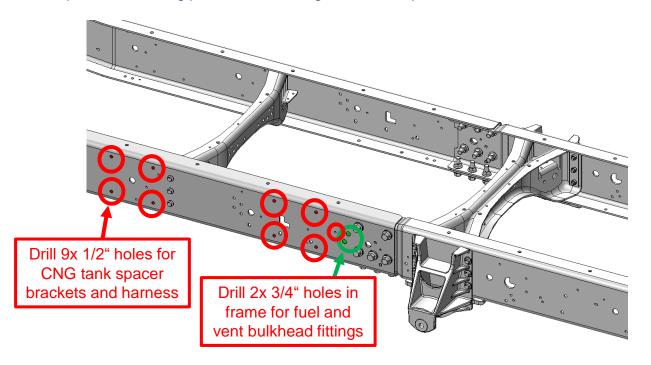
1. Reinstall the air cleaner outlet assembly following the Ford Workshop Manual for the proper procedures.



Drill Frame Holes for Tank Mounting and Bulkheads



- 1. On Driver Side of frame, use drill template to drill 9x 1/2" thru holes in the frame for tank spacer brackets and valve solenoid harness. Drill 2x 3/4" thru holes for fuel and vent fittings. Clean, deburr, and cold galv all holes.
- 2. Repeat above drilling process on Passenger Side. Hole pattern should mirror Driver Side.



Install Tank Spacer Brackets



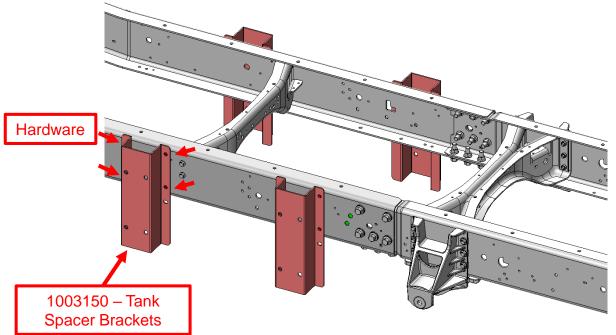
1. Install (4) frame spacer brackets (P/N 1003150) using the following hardware per bracket:

- **1000167** - Bolt, 1/2"-13 x 1-3/4" (Qty 4)

1000168 – Wide Washer, ½" x 1-3/8" (Qty 8)

- **1000143** – Nylon Locknut, 1/2"-13 (Qty 4)

Torque bolts to 75 lb-ft

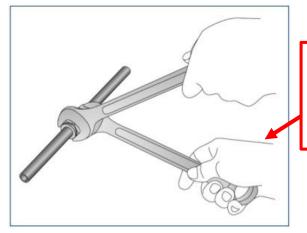


Fuel and PRD Vent Line Installation



Fuel and PRD Vent Line General Procedure

- 1. Use a touch of non-synthetic, non-detergent oil (i.e. 30W engine oil) to lubricate O-rings prior to installation. **CAUTION! DO NOT USE silicone grease or any other type of lubricant**
- 2. Per Parker recommendations, install all high pressure fittings, tubing, and hoses finger tight to ensure proper fitment before fully torqueing components. Torque values for fittings used in this installation is listed below. When tightening all connections, it is important to have a wrench applying equal opposite force on the fitting as a wrench tightens the nut to the fitting. Following Parker (fitting and tube) manufacturer instructions when assembling system (www.parker.com)
- 3. Ensure tubing and hoses do not make contact or rub on surrounding areas or components.



Note: When assembling a hose or stainless steel line to fittings, ensure that the fitting body is secured with a **back-up wrench** while tightening nut on tube or hose to proper torque spec.

Fuel and PRD Vent Line Installation



SAE J1926 O-Ring Boss (ORB) Fittings

Used On:

- LP Fuel Lines
- HP Fuel Lines
- PRD Vent Lines



Fig. S7 — Non-Adjustable Port End Assembly

SAE Straight Thread Port Assembly (SAE J1926)

				Assembly Torque (+10% -0)										
Ш			Non-Adjustables			Adjustables			Plugs					
Ш					Triple-	Lok			Triple-Lok		Hollow	w Hex Hex He		ead
					Ferul				Feru					
Ш			Seal-I		Adapt		Seal		Adapters		HP5ON-S		P5ON-S	
Ш			(Heavy			(Light Duty (Heavy Duty (Light Duty			(Light Duty SAE J1926-3)		(Light Duty SAE J1926-3)			
ш	SAE	Thread	SAE J19	926-2)	SAE J19	26-3)	SAE J1	926-2)	SAE J1	926-3)	SAE J1	926-3)	SAE J19	926-3)
ш	Dash	Size	ft.lbs.		ft.lbs.		ft.lbs.		ft.lbs.		ft.lbs.		ft.lbs.	
	Size	UN/UNF	(In. Ibs)	N-m	(ln. lbs)	N-m	(In. lbs)	N-m	(In. lbs)	N-m	(In. lbs)	N-m	(In. lbs)	N-m
	6	9/16-18	(420)	47	(350)	40	(420)	47	(350)	40	(350)	40	(350)	40
	8	3/4-16	(720)	81	(620)	70	(720)	81	(620)	70	(620)	70	(620)	70

Notes: Lubricate threads before assembly. Values in chart are for plated steel fittings in steel ports. For stainless steel fittings, use the upper limit of torque range. For brass and aluminum, decrease torque value by 35%.

Table S1 - SAE J1926 Straight Thread Port Assembly Torques

SAE J1453 O-Ring Face Seal Fittings (ORFS)

Used On:

- LP Fuel Lines
- HP Fuel Lines

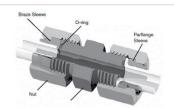


Fig. S15 – Seal-Lok Union cutaway with flanged and brazed assemblies

	O.D.		Tube Side	Asser	be Side	que	Wrench	ts from Resistance F.W.R.)
(in.)	(mm)	SAE Dash Size	Thread Size (UN/UNF)	inlb.	ftlb.	N-m	Tube Nuts	Swivel & Hose Ends
3/8	8, 10	-6	11/16-16	360	30	40	1/4 to 1/2	1/2 to 3/4

Table S14 – Seal-Lok and UPTC assembly torque and F.F.W.R. For brass, aluminum (and other soft metals) decrease torque value by 35%, however F.F.W.R. is the same.

SAE J514 JIC / 37° Flare Fittings

Used On:

- PRD Vent Lines

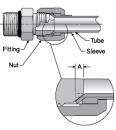


Fig. S26 — Tube length allow-

Tube O.D.	Thread		sembly * (+10% -0)	Tube Connection	Swivel Nut or Hose Connection
(in.)	Size	in. lb.	ft. lb.	FFWR	FFWR
1/2	3/4-16	505	42	2	1 1/2

Table S19 – Triple-Lok assembly torques and FFWR For brass and aluminum fittings, use approximately 65% of the torque values shown, unlubricated, however FFWR is same for all materials.

HP Fuel Line Installation – 1 of 8



- 1. Install the following components in existing opening in frame:
 - **1002514** Elbow, 90°, #6 MORFS, #6 MORB, SS (qty 1)
 - 1002175 Valve, 2 Way Ball, SS, MORFS #6 (qty 1)
 - 1003197 Hose, HP, PTFE, ORFS 3/8" FxFx 24", SS (qty 1)
- 2. Secure fuel hose to frame in existing 1/4" frame hole with the following:
 - 1003195 Clamp, Plastic Routing, Double, 5/8" ID (qty 1)
 - 1003193 Bolt, Hex, Serrated, 1/4"-20 x 2-1/4" (qty 1)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 1)

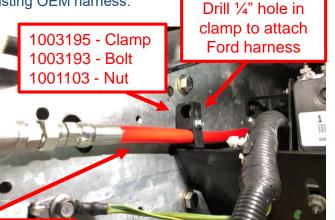
1002514 - Elbow

3. Drill 1/4" hole in upper clamp to secure fir tree on existing OEM harness.

Note handle orientation

← Chassis Front





1002175 - Ball Valve

1003197 – 24" HP Hose

HP Fuel Line Installation - 2 of 8



- 1. Install the following components:
 - 1003164 Tube, Manual Valve to CM Tee, F59 (qty 1)
 - 1003198 Union, Bulkhead, Run Tee, #6 ORFS (qty 1)
 - 1002507 Nut, Bulkhead, #6 ORFS, SS (qty 1)
 - Install bulkhead union tee thru existing crossmember hole, and use two (2) washers (P/N 1002206) on both sides of frame hole to secure bulkhead to crossmember.
- 2. Drill 1/4" hole under OEM support bracket (if OEM frame hole 2" forward of this location is present) and install the following hardware to secure the fuel line:
 - 1003103 Clamp, Plastic Routing, 3/8"ID (qty 1)
 - 1003227 Bolt, Hex, Serrated, 1/4"-20 x 1-1/2" (qty 1)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 1)



HP Fuel Line Installation - 3 of 8



- Install the following components (finger tight with crossmember bulkheads):
 - 1003165 Tube, CM Tee to CM Elbow, F59 (qty 1)
 - 1003199 Bulkhead, Union Elbow, #6 ORFS (gty 1)
 - 1002507 Nut, Bulkhead, #6 ORFS, SS (qty 1)
 - Install bulkhead union elbow thru existing crossmember hole, and use two (2) washers (P/N 1002206) on both sides of frame hole to secure bulkhead to crossmember.
- 2. Use two (2) existing crossmember holes to install the following hardware to secure the fuel line:
 - 1003202 Clamp, Plastic Routing, Double, 3/8" (qty 2)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (gty 2)
 - 1003227 Bolt, Hex, Serrated, 1/4"-20 x 1-1/2" (qty 2)
 - 1000818 Fender Washer, Zinc, 1/4" x 1" (qty 2)

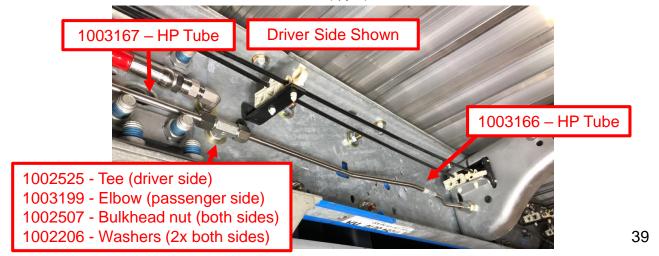




HP Fuel Line Installation – 4 of 8



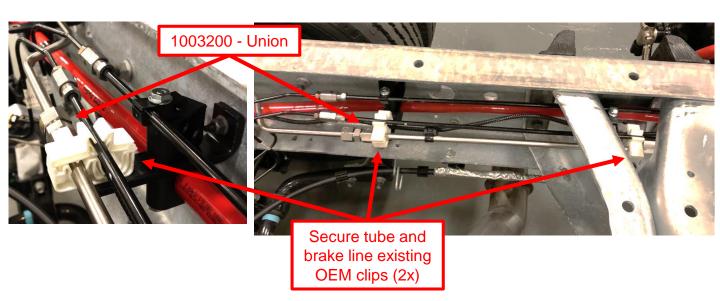
- 1. Install the following components on driver side and passenger side:
 - 1003166 Tube, Crossmember to Tank Tee, F59 (1x each on driver and passenger side)
 - 1002525 Tee, Bulkhead Branch, #6 ORFS x 3 (1x installed on driver side)
 - 1003199 Bulkhead, Union Elbow, #6 ORFS (1x installed on passenger side)
 - 1002507 Nut, Bulkhead, #6 ORFS, SS (1x each on driver and passenger side)
 - Install both bulkhead tee and elbow thru drilled frame holes with the longer threaded leg on outside of frame, and use two (2) washers (P/N 1002206) for each bulkhead on both sides of frame hole to secure bulkhead.
 - 1003167 Tube, Tank Tee to Union, F59 (qty 1)



HP Fuel Line Installation – 5 of 8



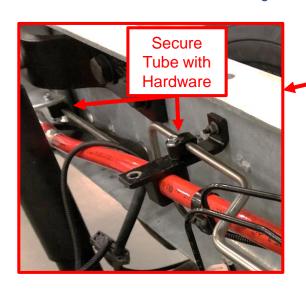
- 1. Install the following component: **1003200 –** Union, #6 ORFS, #6 ORFS (qty 1)
- 2. Reuse OEM fuel and brake line clip (beige colored) to secure the fuel line and brake line on crossmember and existing support bracket in two (2) places.

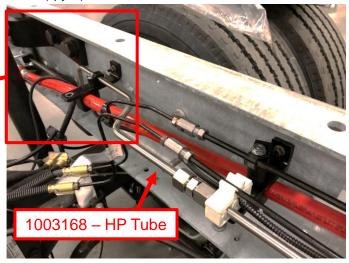


HP Fuel Line Installation – 6 of 8



- 1. Install the following components:
 - 1003168 Tube, Union to Check Valve Tee, F59 (qty 1)
- 2. Install the following hardware to secure the fuel line on crossmember and existing support bracket:
 - 1003103 Clamp, Plastic Routing, 3/8"ID (qty 2)
 - 1003228 Bolt, Hex, Serrated, 1/4"-20 x 1-3/4" (qty 1, support bracket)
 - 1003227 Bolt, Hex, Serrated, 1/4"-20 x 1-1/2" (qty 1, crossmember)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 2)

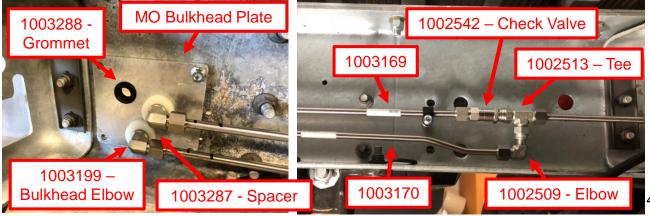




HP Fuel Line Installation – 7 of 8



- 1. Install the following components:
 - 1003169 Tube, Check Valve Tee to Fill Elbow, F59 (qty 1)
 - 1003170 Tube, Check Valve Tee to Gauge, F59 (qty 1)
 - 1002509 Elbow, Swvl, 90°, #6MORFS, #6 FORFS (qty 1)
 - 1002513 Tee, Union, #6 MORFS, #6 MORFS (qty 1)
 - 1002542 Check Valve, SS, HP, #6 MORFS, #6 FORFS, SS (qty 1)
- 2. Install Morgan Olson Bulkhead Plate as shown using one (1) 5/16"-18 x 1-1/4"L serrated bolt and matching nut thru existing frame hole. Drill additional (3) holes and install hardware to secure plate, then install the following:
 - 1003287 Spacer, Nylon, 3/4"ID x 1-1/2"OD x 3/8" (qty 2)
 - 1003288 Grommet, 7/8" ID, 5/8" OD, 1/4" Thk (qty 1)
 - 1003199 Bulkhead Union, Elbow, 90", ORFS/ORFS (qty 2)
 - 1002507 Nut, Bulkhead, #6 ORFS, SS (qty 2)

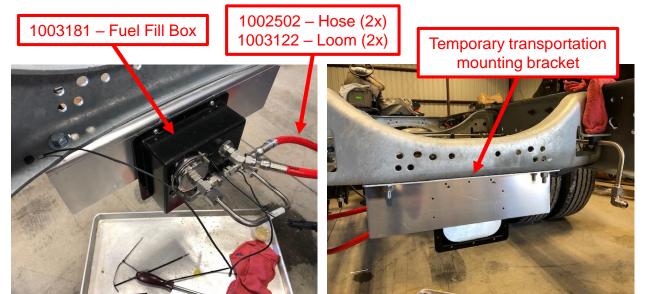


HP Fuel Line Installation – 8 of 8



Install flex lines (P/N 1002502) from elbows (P/N 1003199) in previous slide to the Fuel Fill Box (P/N 1003181) and mount on the chassis using temporary transportation bracket for shipment to Morgan Olson. Position and tighten fittings on fill box in a position such that line stress is minimized during shipment and final installation on the body.

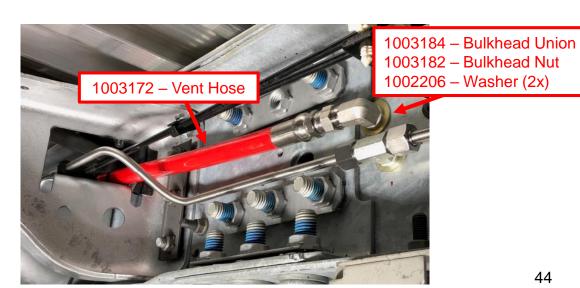
- 1003181 Fill Box Assembly, UPS, F59 (qty 1)
- **1002502** Hose, HP, PTFE, ORFS 3/8" FxFx 39",SS (gty 2)
- **1003122** Loom, Fiberglass, High Temp, 5/8" x 33" (qty 2)



PRD Vent Line Chassis Installation – 1 of 6



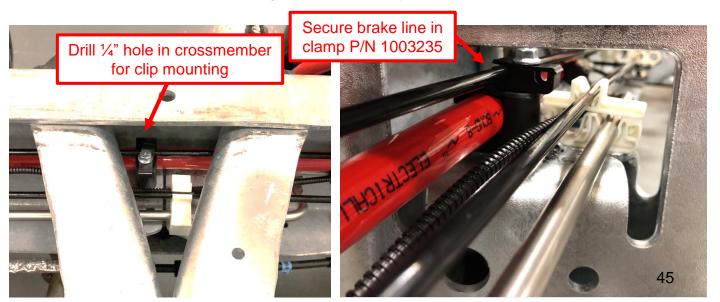
- 1. Install the following vent line components on driver and passenger side:
 - **1003172** Hose, PRD, Bulkhead Elbow to CM, F59 (qty 2)
 - **1003184** Union, Bulkhead, Elbow, #8 JIC (gty 2)
 - 1003182 Locknut, Bulkhead, #8 JIC (2)
 - Install bulkhead elbows thru drilled frame holes with the longer threaded leg on outside of frame, and use two (2) washers (P/N 1002206) for each bulkhead on both sides of frame hole to secure bulkhead.



PRD Vent Line Chassis Installation - 2 of 6



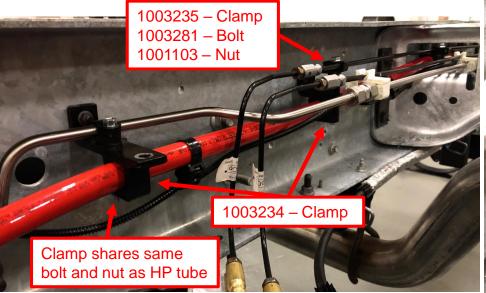
- Secure PRD hose and brake line (closest to driver side frame) on cross member with the hardware below. Drill 1/4" hole on crossmember in a position so that the mounted PRD hose avoids contact with the crossmember side.
 - 1003235 Clamp, Plastic Routing, Double, 1/4" ID (qty 1)
 - 1003234 Clamp, Plastic Routing, 7/8" ID (qty 1)
 - 1003193 Bolt, Hex, Serrated, 1/4"-20 x 2-1/4" (qty 1)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 1)



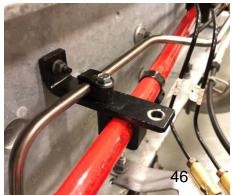
PRD Vent Line Chassis Installation - 3 of 6



- 1. On driver side, secure the vent hose along existing OEM bracket supports using:
 - 1003234 Clamp, Plastic Routing, 7/8" ID (qty 2)
 - 1003235 Clamp, Plastic Routing, Double, 1/4" ID (qty 1)
 - **1003281** Bolt, Hex, GR5, 1/4"-20 x 3-1/2" (qty 1)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 1)



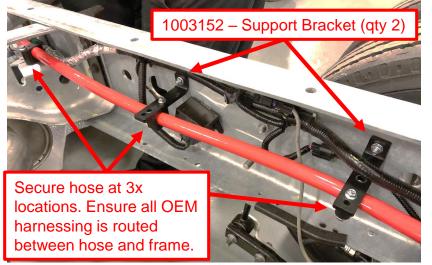




PRD Vent Line Chassis Installation - 4 of 6



- 1. On passenger side, install support brackets in existing frame holes:
 - 1003152 Bracket, PRD Vent Line, F59, 2018 (qty 2)
 - 1003231 Bolt, Hex, Serrated, 1/4"-20 x 1" (qty 2)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 2)
- 2. Secure vent hose on cross member and support brackets using the following hardware:
 - 1003234 Clamp, Plastic Routing, 7/8" ID (qty 3)
 - 1003228 Bolt, Hex, Serrated, 1/4"-20 x 1-3/4" (gty 3)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 3)
- Ensure all OEM harnessing is routed and tucked in-between the vent hose and frame.

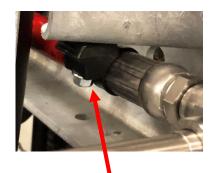




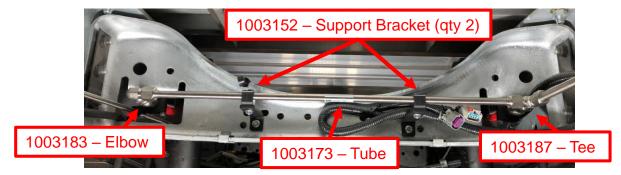
PRD Vent Line Chassis Installation - 5 of 6



- 1. On crossmember, install support brackets in existing frame holes:
 - 1003152 Bracket, PRD Vent Line, F59, 2018 (qty 2)
 - 1003231 Bolt, Hex, Serrated, 1/4"-20 x 1" (qty 2)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 2)
 - 1000818 Fender Washer, Zinc, 1/4" x 1" (qty 2)
- 2. Install the following vent line components:
 - 1003183 Elbow, Union, #8 JIC (gty 1)
 - 1003187 Tee, Union, #8 JIC (qty 1)
 - 1003173 Tube, PRD, CM Elbow to CM Tee, F59 (qty 1)
- 3. Secure components to support brackets using the following hardware:
 - 1003102 Clamp, Plastic Routing, 1/2" ID (qty 2)
 - 1003227 Bolt, Hex, Serrated, 1/4"-20 x 1-1/2" (qty 2)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 2)
- 4. Add butterfly ties (2x) to secure PRD lines to rear crossmember to ensure proper clearance and consistency in routing.



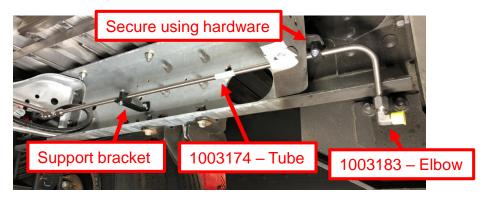
Add butterfly ties (2x) to secure PRD lines



PRD Vent Line Chassis Installation - 6 of 6



- 1. On passenger side frame, install support brackets in drilled frame hole as shown:
 - 1003152 Bracket, PRD Vent Line, F59, 2018 (qty 1)
 - 1003231 Bolt, Hex, Serrated, 1/4"-20 x 1" (qty 1)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 1)
- 2. Install the following vent line components, and cover elbow fitting end for shipment:
 - 1003174 Tube, PRD, CM Tee to Frame Rear, F59 (qty 1)
 - 1003183 Elbow, Union, #8 JIC (qty 1)
- 3. Secure the vent hose along support bracket and crossmember using:
 - 1003102 Clamp, Plastic Routing, 1/2" ID (qty 2)
 - 1003227 Bolt, Hex, Serrated, 1/4"-20 x 1-1/2"(qty 2)
 - 1001103 Nut, Serrated Flange, GR8, 1/4"-20 (qty 2)





Route Solenoid Tank and Starter Interrupt Harnesses



- Connect solenoid tank harness (P/N 1003201) to FICM harness, and starter interrupt ground harness (P/N 1003243) to starter interrupt connector near OEM PCM connector. Route harnesses along OEM harness securing every 8 inches with butterfly cable ties.
- 2. Install (4) grommets **(P/N 1002648)** in frame and cross members in locations shown below, and pull solenoid tank harness towards the tank valve.

3. Once the harness ends are pull to the outside of the frame, install terminals into SuperSeal connector (P/N 1001171) in preparation to connect to tank valve.



Install grommet on both sides (2x)

Install terminals into SuperSeal connector



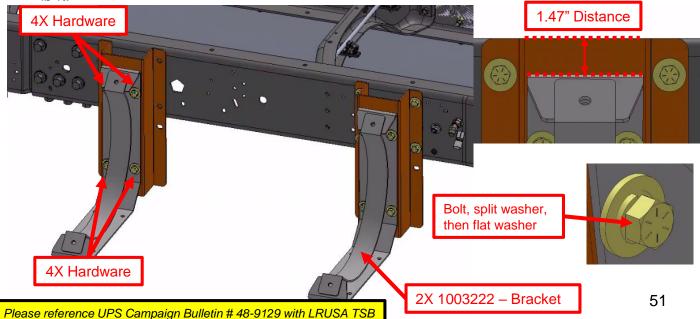
Secure harness using butterfly cable ties



Tank Installation and Plumbing – 1 of 5



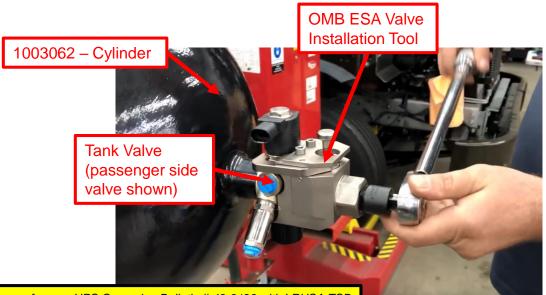
- 1. Install tank bracket on frame spacer brackets on both <u>driver and passenger side</u>:
 - 1003222 Bracket, Tank, 18", F59 (Qty 2. Each part # comes with four brackets)
 - 1000107 Bolt, Hex, GR8, 1/2"-13 x 1-1/2" (Qty 16)
 - 1000168 Washer, Flat, Wide, GR8, 1/2" x 1-3/8"(Qty 16)
 - 1000884 Washer, Lock, Split, GR8, 1/2"(Qty 16)
- 2. Ensure the top of tank brackets are 1.47" from the top of the frame spacer brackets. Torque to 75 lb-ft.



Tank Installation and Plumbing – 2 of 5



- Using the OMB ESA valve installation tool, install driver and passenger side valves on CNG tanks:
 - 1003062 Cylinder, Type 2, 450 x1524mm,191.0L (Qty 2)
 - 1003218 Valve, Tank, PRD RH, OMB ESA, 1-1/8" UNF (Qty 1 driver side)
 - 1003257 Valve, Tank, PRD LH, OMB ESA, 1-1/8" UNF (Qty 1 passenger side)
- Install valve per latest manufacturer instructions on OMB's website: http://www.omb-saleri.it/manuals/

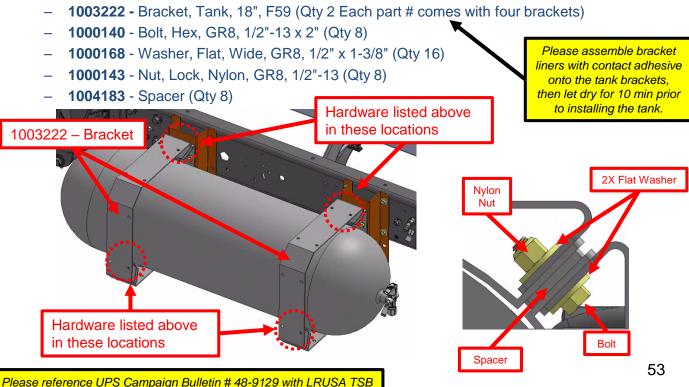


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Tank Installation and Plumbing – 3 of 5



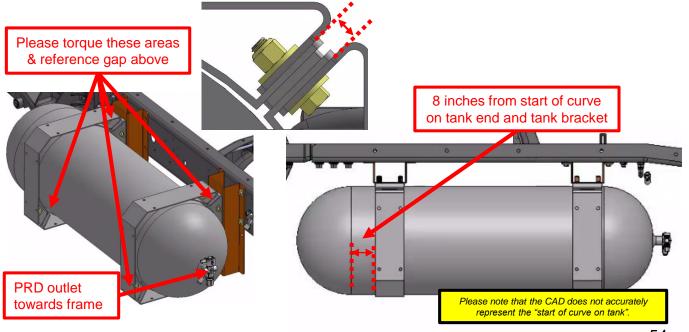
- Install tanks on both <u>driver and passenger side</u>:
 - 1003062 Cylinder, Type 2, 450 x1524mm,191.0L (Qty 2)
- Use the following components to secure the tanks (Not fully torqued):



Tank Installation and Plumbing – 4 of 5



- 1. Position tank such that PRD outlet is orientated towards the frame
- Position the tanks in the brackets as shown below before torqueing down bolts. Ensure the solenoids are oriented vertically upwards with the manual valve shut off oriented downwards.
- 3. Torque brackets to 90 ft.-lbs. and ensure gap is ~0.675" (See below).



Tank Installation and Plumbing – 5 of 5

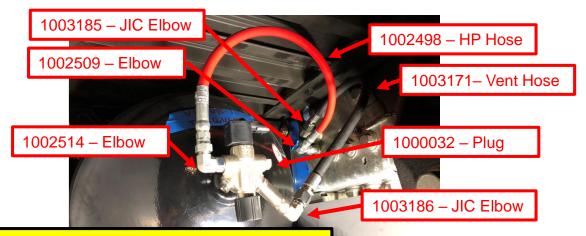


Make valve and frame connections as shown below on both <u>driver and passenger side</u>:

1000032 Plug, 9/16'-18, STB (Qty 2)
1002514 Elbow, 90°, #6 MORFS, #6 MORB, SS (Qty 2)
1002509 Elbow, Swvl, 90°, #6MORFS, #6 FORFS, SS (Qty 2)
1002498 Hose, HP, PTFE, ORFS 3/8" FxFx 26",SS (Qty 2)
1003171 Hose, PRD, Tank to Bulkhead Elbow, F59 (Qty 2)
1003186 Elbow, Straight Thread, #6 MORB, #8 JIC (Qty 2)

1003185 Elbow, Swivel Nut, #8 JIC (Qty 2)

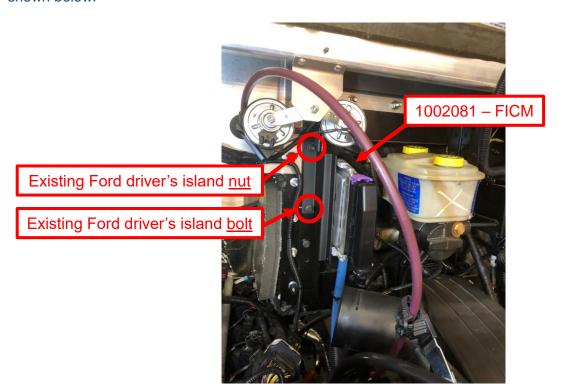
Connect solenoid harness to solenoid valve.



Install Landi Renzo FICM Bracket



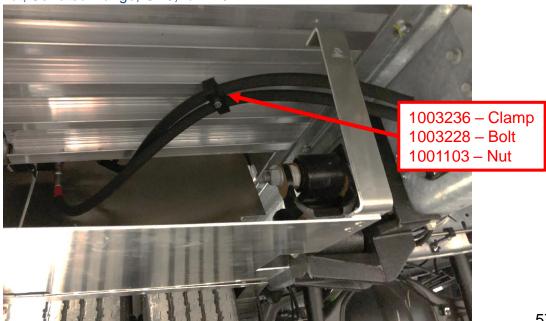
1. (Morgan Olson) During body installation when driver island brackets are removed, install FICM bracket with attached FICM to the bulk head using the existing ford driver's island nut and bolt as shown below.



Fuel Fill Box Line Routing



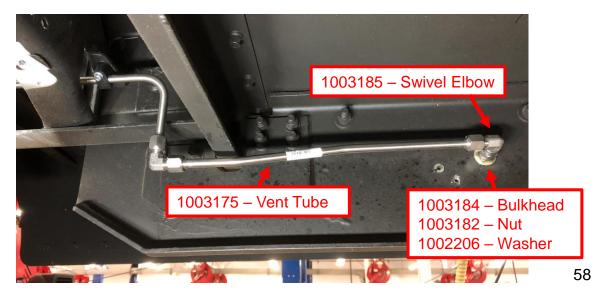
- 1. (Morgan Olson) After installation of fill box on body panel, route lines to body floor using the following hardware:
- 1003236 Clamp, Plastic Routing, Double, 3/4" ID
- **1003228** Bolt, Hex, Serrated, 1/4"-20 x 1-3/4"
- **1001103** Nut, Serrated Flange, GR8, 1/4"-20



PRD Vent Line Body Installation – 1 of 4



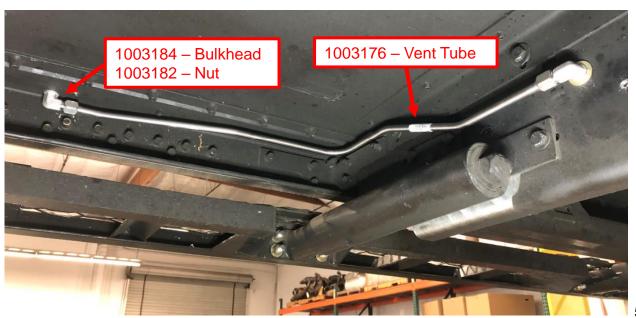
- Install the following vent components as shown below:
 - 1003175 Tube, PRD, Frame Rear to DF Bulkhead, F59 (qty 1)
 - 1003184 Union, Bulkhead, Elbow, #8 JIC (qty 1)
 - 1003185 Elbow, Swivel Nut, #8 JIC (qty 1)
 - 1003182 Locknut, Bulkhead, #8 JIC (qty 1)
- 2. Install bulkhead elbows thru drop floor frame hole with the longer threaded leg on <u>inside of frame</u>, and use two (2) washers (**P/N 1002206**) for on each side of frame hole to secure bulkhead.



PRD Vent Line Body Installation – 2 of 4



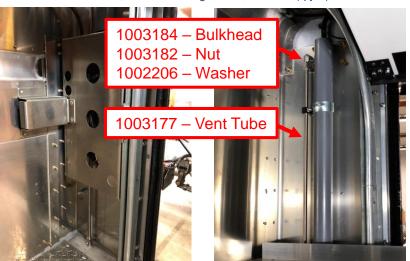
- 1. Install the following vent components as shown below:
 - 1003176 Tube, PRD, DF Bulkhd to Body Bulkhd, F59 (qty 1)
 - 1003184 Union, Bulkhead, Elbow, #8 JIC (qty 1)
 - 1003182 Locknut, Bulkhead, #8 JIC (qty 1)
- 2. Install bulkhead elbows thru body floor hole with the longer threaded leg in the body interior.



PRD Vent Line Body Installation – 3 of 4



- Install the following vent components as shown below:
 - 1003177 Tube, PRD, Body Bulkhd to Top Bulkhd,F59 (qty 1)
 - 1003184 Union, Bulkhead, Elbow, #8 JIC (qty 1)
 - 1003182 Locknut, Bulkhead, #8 JIC (qty 1)
- Install bulkhead elbows thru body hole with the longer threaded leg outside of body exterior, and use one (1) washer (P/N 1002206) on the interior to secure bulkhead.
- 3. Install the following hardware to secure vent tube with gray PVC clip in (3) locations:
 - 1003102 Clamp, Plastic Routing, 1/2" ID (qty 3)
 - 1003224 Screw, SS, Pan Head,5/16"-18 x 1-3/4"L (qty 3)
 - 1003194 Nut, Serrated Flange, GR8,5/16"-18 (gty 3)

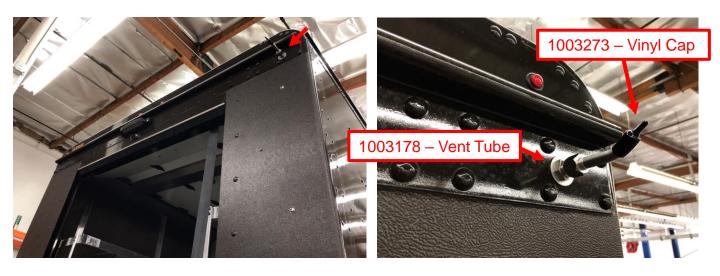




PRD Vent Line Body Installation - 4 of 4



- 1. Install the following vent components as shown below:
 - 1003178 Tube, PRD, Top Bulkhd to Top Outlet, F59 (qty 1)
 - 1003273 Cap, Vinyl, 1/2"-9/16" OD, 1" Inner Ht (qty 1)



Reconnect Battery



1. Reconnect the negative (-) battery cable.

Automotive batteries produce flammable gasses. Keep open flames and heating devices away from the area near the battery.

Automotive batteries contain sulfuric acid. Always wear eye protection when working on or near the battery.



Reinstall / Flash Ford PCM



1. Flash PCM using MyCANIC-FD tool. Refer to the separate guide on PCM flashing with the MyCANIC-FD located on the Landi Renzo Service website.

Perform Visual Inspection of Installation



1. Perform a visual inspection of installation to ensure all hoses, wiring and other components are in the correct position and securely fastened to the vehicle.

CNG System Leak Check, Fill, and DTC Check



Notes on Leak Checking:

- Check all assembled fittings and connections for leaks using leak detection solution. Always give at least 60 seconds for each connection.
- When a leak is present, bubbles will be present in the solution. Also examine for icing around tubing or fittings at point of leak for signs of damage to tubing.

CNG System Leak Check, Fill, and Post-Conversion Check

- 1. NFS installs CNG cylinder valves.
- Cylinders transported to Metroweld.
- 3. Metroweld pressure tests each tank with Nitrogen to 3600 psi and checks for leaks at valve to tank joint with solution.
- 4. Nitrogen evacuated via defueling port on cylinder valve until equal with atmosphere
- Tanks transported back to NFS.
- Tanks installed on vehicle by NFS.
- 7. NFS pressure tests all fuel connections (both low and high pressure) with tank valves closed using Nitrogen to 3600 psi w/ key ON using solution INSIDE the building.
- 8. Connect MyCANIC-FD and check for DTC codes. Any CNG-related codes can be seen with key ON without running the engine. The key should be on for 2 minutes before checking codes.
- 9. NFS opens defuel port to evacuate Nitrogen to atmosphere.
- 10. Both cylinders filled to 1500 psi CNG on-site at NFS by Metroweld OUTSIDE the building.
- 11. Final leak test performed on all fuel connections (both low and high pressure) after filling is complete and the unit is running for 5-8 minutes using solution and sniffer OUTSIDE the building. Ensure quarter-turn ball valve and tank valves are open.
- Post-conversion data to be collected at this time. The vehicle should be running at least 2 minutes before checking codes.

Perform Vehicle Road Test



- 1. Check all cylinders to ensure that all valves are in the "open" position.
- 2. Perform road test to determine if vehicle performs properly.
- 3. Inspect vehicle for any fluid leaks.
- 4. Correct any deficiencies in performance and fluid leaks.

Perform 2nd Vehicle Leak Check



- 1. Ensure quarter turn ball valve and tank valves are open.
- 2. With vehicle running, check system for any CNG leaks using combustible gas detector.
- 3. If leaks are present, determine source of leak using leak detection solution and stop engine.
- 4. Correct source(s) of any CNG leaks and restart engine to confirm there are no additional leaks.
- 5. Perform second road test to confirm any previous issue have been resolved.

Complete Documentation



- 1. (NFS) Record Post Conversion Data.
- (NFS) Retain file copies of all intake documentation for future reference in accordance with Ford Motor Company and Landi Renzo USA Corporation policies. Send quality inspection report and SD card files to Landi weekly.

Perform Final Quality Inspection (NFS/MO)



1. Perform quality inspection on vehicle exterior and interior to ensure all components and trim removed during installation process have been correctly reinstalled to their original positions.

<u>IMPORTANT</u>: Verify minimum 1/2 inch clearance around cylinders and at least 3/8 inch from shield. Ensure shields and drain holes are free of debris.

1. Complete NFS/MO Quality Check Sheet.

Label Placement - 1 of 5



Position labels in the following locations listed below. Labels with blank fields should be filled out as appropriate, and placed conspicuously to provide proper notice and aid in inspection.

CHASSIS (NFS):

- Place in engine compartment:
 - 1003282 VECI Label over Ford VECI label on Passenger Side Valve Cover
 - 1001566 Label, EPA Installer on driver's island bulkhead

1001566 – EPA Installer Label





Label Placement - 2 of 5



CHASSIS (NFS):

- Place on chassis frame to the right of CNG manual shutoff valve:
 - 1000071 Label, Manual CNG Shut-Off



Label Placement - 3 of 5



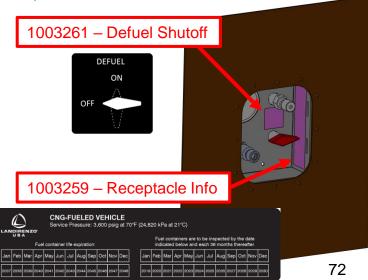
CHASSIS (NFS):

- Place on tank near valves facing downward for inspection:
 - 1001837 Label, Defueling Information, NFPA 52
 - 1003260 Label, Cylinder Information, UPS
- Place in fill box in locations near defueling receptacle:
 - 1003261 Label, Defuel Shutoff, Fill Box (between defuel receptacle and ball valve)
 - 1003259 Label, Tank Inspection and Expiration Information, Fill Box

1001837 – Defueling Info Label

1003260 – Cylinder Info Label





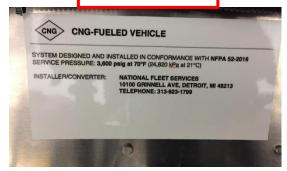
Label Placement - 4 of 5

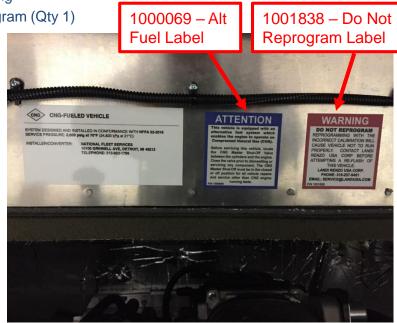


BODY (MO):

- Place in engine compartment body bulkhead as shown:
 - NFS CNG bulkhead Label
 - 1000069 Label, Alt Fuel Warning
 - 1001838 Label, Do Not Reprogram (Qty 1)

NFS CNG Bulkhead Label





Label Placement - 5 of 5



BODY (MO):

- Place on exterior body panel in front of manual valve, indicating location of valve:
 - 1003264 Label, Manual Shutoff Valve, UV
- Place on exterior body panel next to PRD vent outlet:
 - 1003116 Label, CNG Vent Hazard Warning
- Place on exterior body panel on lower right rear of vehicle, not on the bumper:
 - 1003263 Label, CNG Blue Diamond, Class 6+, UV





1003116 – CNG Vent Label

Label Placement – 5 of 5



BODY (MO):

- Place on exterior body as detailed in photos below:
 - Label, CNG Blue Diamond, Class 6+, UV (qty 3) 1003263

Side of Body (2 places)



In the Horizontal: Centered between DOT decal and rivet.

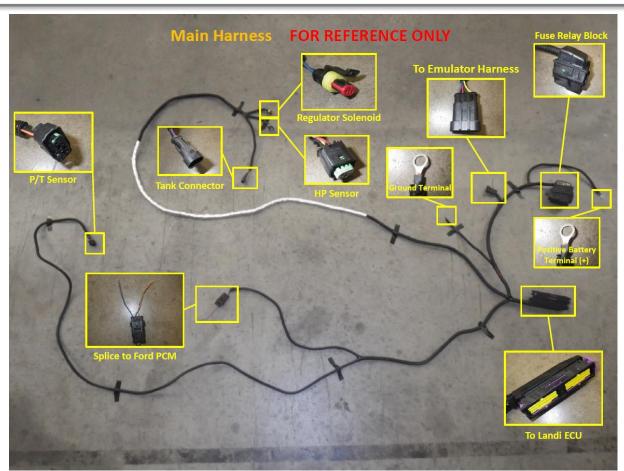
In the Vertical: Centered so that CNG letters are centered with DOT numbers.

Rear (1 place)



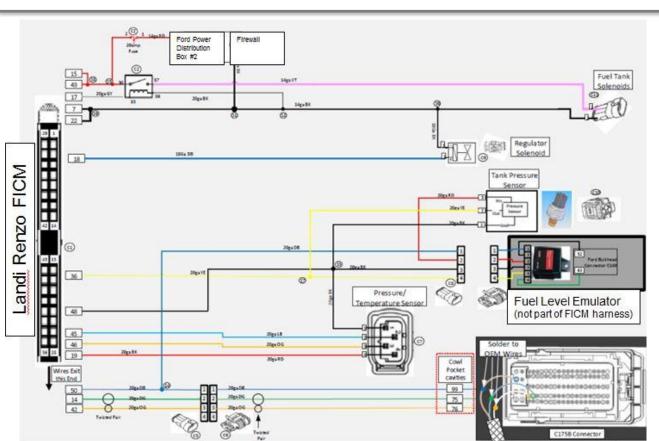
Landi Renzo Main FICM Harness Overview





Landi Renzo Main FICM Harness Wiring Diagram

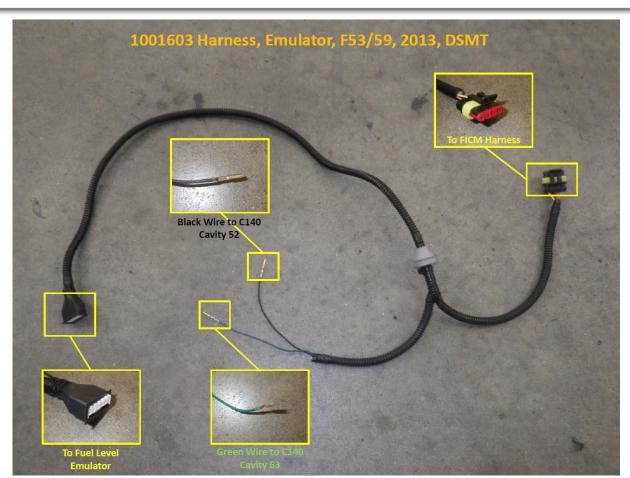




Ford PCM

Fuel Level Emulator Harness Overview





Starter Interrupt Installation Wiring Diagram



