ROUSH CLEANTECH

2016-2020 F-53/F-59/F-450/F-550

Gen 4 Propane, 6.8L Ford V10

Service and Diagnostic Manual

2016-2020 F-53/F-59/F-450/F-550 Gen 4 Propane, 6.8L Ford V10

Revision History		
-AC	Update	10/2019
-AD	Update	06/2020
-AE	Updated wire drawings	11/2020
-AE.1	Added P1450 DTC	12/2020
-AE.2	Updated Test J	01/2021
-AE.3	Updated Test I and Added Evap Section	01/2021
-AE.4	Updated tests	02/2021
-AF	Added Tests S and T	03/2021
-AG	Updated Test P	05/2021
-AH	Added VBM Pinpoint Test, removed Evap Test	08/2001
-AJ	Minor updates	09/2021
-AK	Update Transfer Kit information	12/2021
-AL	Formating Updates	03/2023
-AM	Code updates	09/2024

SERVICE AND DIAGNOSTIC MANUAL
P19EB-01B001-AM

FOREWARD

This manual is intended to provide technicians with the procedures required to maintain and service the unique components of the ROUSH CleanTech Propane fuel system. Service procedures for other vehicle components may be referenced to, which can be found in the Ford Workshop Manual or Ford Powertrain/Emissions Diagnosis Service Manual.

CONTACTING ROUSH CLEANTECH

For Service

For emergency situations or if immediate technical assistance on the Gen 4 ROUSH CleanTech Propane fuel system, please contact the ROUSH CleanTech Customer Success Team at (800) 59-ROUSH (597-6874), Opt. 2.

For Training

For training on the Gen 4 ROUSH CleanTech Propane fuel system, please contact the Training Department in the ROUSH CleanTech Customer Success Team by visiting www.ROUSHCleanTech.com/service and selecting the Training tile on the main page.

For Publications

For inaccuracies or omissions in our service publications, or to provide general feedback or suggestions regarding the quality of the information presented in this manual, please contact the Publications Department in the ROUSH CleanTech Customer Success Team at publications@roushcleantech.com.

For the ROUSH Diagnostic Tool (RDT)

For assistance in setting up or using the ROUSH Diagnostic Tool, please contact RDT Support in the ROUSH CleanTech Customer Service Team at RDT-Support@ROUSH.com.

For Self-Service Help

ROUSH CleanTech has developed the ROUSH CleanTech Service Portal, which contains the ROUSH CleanTech Knowledge Base. Technicians can use the Knowledge Base to search for DTC codes, pinpoint tests, diagnostic help, and more. Please go to ROUSHCleanTech.com/service to utilize the Knowledge Base and Service Portal.

REFERENCE

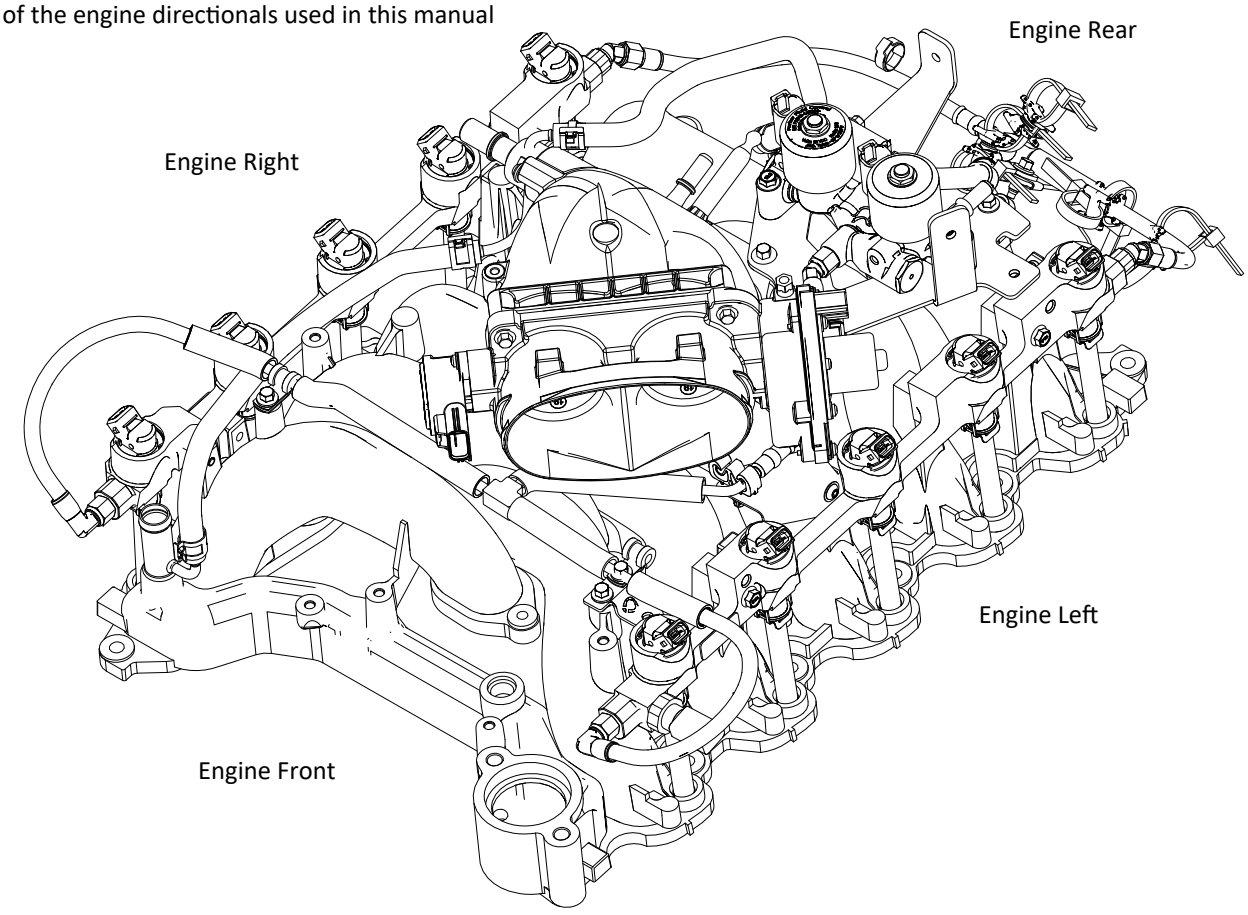
Commonly Used Acronyms

Acronym or Abbreviation	Description
BS	Bleed Solenoid
CAN	Controller Area Network
DTC	Diagnostic Trouble Code
DTE	Distance To Empty
ECU	Engine Control Unit
EFPR	Electronic Fuel Pump Relay
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
EVAP	Evaporative
FPCM	Fuel Pump Control Module
FCS	Flow Control Solenoid
FPTS	Fuel Pressure and Temperature Sensor
FRP	Fuel Rail Pressure
FRPCM	Fuel Rail Pressure Control Module
IPTS	Integrated Pressure Temperature Sensor
IVCM	Injector Voltage Booster Module (sometimes called a VBM)
KOEO	Key On Engine Off
KOER	Key On Engine Running
LPA	Liquid Petroleum Autogas

Acronym or Abbreviation	Description
MIL	Malfunction Indicator Lamp
MY	Model Year
NFPA	National Fire Protection Association
NFPA 58	Liquid Petroleum Gas Code from the NFPA
Nm	Newton Meter
OASIS	On-Line Service Information System
OBD	On-Board Diagnostic
OEM	Original Equipment Manufacturer
OPD	Overfill Protection Device
OTIS	One Touch Integrated Starting
PCM	Powertrain Control Module
PERC	Propane Education and Research Council
PID	Parameter Identification
PRV	Pressure Relief Valve
RDT	ROUSH Diagnostic Tool
SRM	Smart Relay Module
VBM	Voltage Booster Module
VECI	Vehicle Emission Control Information
WC	Water Capacity

Engine Overview

A quick reference of the engine directionals used in this manual



ALERT MESSAGES

The following alert messages appear from time to time in the appropriate places in this manual. Ensure that all personnel in the immediate area are aware of these reminders. Although propane is nontoxic, nonpoisonous, has the lowest flammability range of any alternative fuel, and dissipates quickly when released into the atmosphere, extreme care must be taken when working with the fuel and fuel system.

IMPORTANT SAFETY WARNINGS

⚠ DANGER

Propane Facts

Leaked or vented propane will expand quickly when no longer pressurized in the fuel system, expanding at a ratio of 1:270 when going from a liquid to vapor. Since propane vapor is heavier than air it will immediately seek the lowest point in the area where it is released.

Propane Flammability

Like all liquid fuel sources, propane is combustible. When the ratio of propane to air is between 2.2% and 9.6%, propane will burn in the presence of an ignition source at 940°F (504°C) or hotter. Keep at least 35ft away from heat, sparks, flames, static electricity, lighted smoking materials, or other sources of ignition when working with propane. Failure to heed this danger may result in severe personal injury or death.

Propane Vapor

The temperature of propane in its liquid state is -44°F (-42°C). When liquid propane is released from a pressurized vessel, it rapidly evaporates, creating a refrigeration effect that can cause frostbite. Wear non-porous, cold- safe gloves, eye protection, and ear protection during venting and repair operations. Keep moisture away from the valves**.** Failure to heed this warning can result in personal injury.

Fuel Lines

Propane fuel lines remain pressurized after engine shutdown. Keep away from heat, sparks, flames, static electricity, or other sources of ignition. Do NOT enter storage areas or confined space unless they are adequately ventilated. Failure to heed this danger may result in severe personal injury or death.

NFPA 58 Guidelines

Always follow all NFPA 58 guidelines. When working on the propane fuel system or refueling a vehicle, you must be in a well-ventilated area at least 35 ft away from heat, sparks, flames, static electricity, lighted smoking materials, or other sources of ignition. Failure to heed this danger may result in severe personal injury or death.

Battery

When working on the fuel system or any powered vehicle components, disconnect the battery ground at the battery to ensure that the vehicle electrical system has no current. Failure to heed this danger could result in severe personal injury or death.

IMPORTANT WARNINGS

⚠ WARNING

Training

Technicians working with or around any fuel system should be properly trained to utilize extreme care and caution at all times. Failure to exercise extreme caution and care may lead to serious accidents which can result in property damage, personal injury, and/or death.

Service and System Modification

Roush CleanTech does not approve of any additions to or modifications of this fuel system. This fuel system is designed and installed to meet federal standards and engine manufacturer's guidelines. The maintenance provider or modifier assumes all responsibility for the vehicle engine and fuel system if the fuel system is changed or modified. Some states require a special license to perform maintenance or work on propane powered vehicles. Check with local authorities or your state LP Gas Association for details. All fuel system components must be a minimum of 18 inches from any exhaust system component unless properly shielded. All service, maintenance and repairs performed on propane systems must be done by an authorized propane fuel system service technician.

Working on Tank Components

Before removing any components from the fuel tank, it is extremely important to verify that there is not any pressure remaining inside the tank. The technician that is removing a tank component should always be the one to verify it is empty and this should be done right before starting the repair. Failure to do so could result in severe personal injury or death and/or damage to property. Refer to the Tank Depressurization Verification Procedure before removing or working on any tank components.

Tank Maintenance

Never cut or weld on or near the propane fuel tank. Repairs to the fuel tank should only be made by a certified propane tank repair facility. Failure to observe this warning could result in serious bodily injury, death and/or serious property damage. Refer to the Tank Refinishing Procedure for more information.

INTRODUCTION

This manual is a supplement to the regular Ford Workshop Manual, covering the unique components of the Gen 4 ROUSH CleanTech Propane fuel system installed on the 6.8L V10 Ford engine.

Propane

Propane, which is commonly referred to as LPG or LP gas, is a by-product of the refining of petroleum and natural gas and exists as a gas in its natural state. Propane is colorless, odorless, and non-toxic, with ethyl mercaptan added during the manufacturing process to give it a distinct, recognizable odor. Like other combustible fuels, propane is a member of the hydrocarbon family.

When stored under pressure, propane turns into a liquid. Like most liquids, liquid propane expands as its temperature increases. This is why propane tanks are only filled to 80% of its water capacity. Even with an 80% fill capacity, due to liquid propane's expansion ratio of 1:270 (liquid propane to a gas by volume), and its high BTU rating, a large volume of energy can be stored in a relatively small tank under relative low pressure.

Propane also has a very narrow range of flammability with a 2.2% threshold on the low side and a 9.6% threshold on the high side. This means that if the propane-to-oxygen mixture is lower than 2.2% or higher than 9.6%, the mixture is noncombustible.

Propane is heavier than air; therefore, a leak in a propane fuel system can result in a gas accumulation in low places, such as sewers, drains, or service pits. This can create a fire and health hazard as the propane will displace oxygen, potentially resulting in suffocation. For this reason, additional safety precautions should be observed when working on or around propane-powered equipment or storage tanks.

Propane, like other fuels, must be handled safely with knowledge of its characteristics. Training in propane characteristics and handling is available through the Propane Education and Research Council (PERC), 1140 Connecticut Avenue, Washington, DC 20036. Their web address is www.propanecouncil.org.

ROUSH CleanTech Fuel System Overview

Unlike older propane-powered fuel systems that supply propane to the engine in a *vapor* form, the ROUSH CleanTech Propane fuel system delivers, meters, and injects *liquid* propane into the intake manifold.

Similar to a modern gasoline engine, the ROUSH CleanTech propane fuel system stores liquid propane in the fuel tank(s). Dual in-tank electric fuel pumps circulate propane through fuel rails to the fuel injectors that meter and inject liquid propane into each of the intake manifold. Fuel that is not used by the injectors will return to the fuel tank through a flow control solenoid.

The ROUSH CleanTech propane fuel system is fully integrated using Ford's one touch integrated start (OTIS) system. When the ignition key is turned to START and released to the ON position, the fuel system runs a purge process, followed by the starter engaging and the vehicle starting with no further action required from the operator.

The ROUSH CleanTech propane fuel system is a completely sealed system, so refueling a propane-powered vehicle is noticeably different than on a conventional fueled vehicle, beginning with the fuel nozzle. There are two (2) types of fill nozzles and valves used for propane: a screw-on type (also known as an ACME fill valve) and a quick-connect type (also known as "euro style"). When fueling with the screw-on type, turn connector clockwise to tighten, ensuring a good seal at the fill valve. With the quick-connect type, fully engage the nozzle to the valve, ensuring a good seal at the fill valve. The filling times should be comparable to that of gasoline or diesel fuel, but factors such as ambient temperature and filling station pressure settings can affect these filling times.

ROUSH CleanTech propane vehicles require HD-5 propane, which is rated for automotive use. Use of HD-10 or other substandard propane may result in excess contamination of the system and premature failure of the fuel pump, injectors, and in-tank filter.

Propane is stored in the vehicle fuel tank under pressure in liquid form. The fuel tank is equipped with an Overflow Protection Device (OPD), which only allows the tank to be filled to 80% of the water capacity, leaving room for the fuel to expand. At the 80% fill level the dash fuel gauge will read full. The pressure in the tank is determined by the temperature of the fuel, ranging from 0 psi at 0 psi at minus 44°F, to 375 psi approximately 161°F. The tank has a Pressure Relief Valve (PRV) which vents the tank at pressures over 375 psi.

SAFETY INFORMATION

The National Fire Protection Association (NFPA) publishes the NFPA 58, which is the industry benchmark standard for the safe storage, handling, transportation, and use of liquefied petroleum autogas. The NFPA 58 is revised as necessary and has been adopted as law in virtually every political subdivision in the United States. Check with your local authorities for regulations applicable to liquid propane.

Installation, Garaging, and Training

Chapters 11 and 12 of NFPA 58 applies to engine fuel systems using LPA in internal combustion engines, including containers, container appurtenances, carburetion equipment, piping, hose and fittings and their installation. Additionally, this chapter applies to garaging of vehicles and to the training of personnel.

Paragraph 11.2 specifies that each person engaged in "installing, repairing, filling, or otherwise servicing an LP-Gas engine fuel system shall be trained." Contact the Propane Education and Research Council (PERC) to learn more about their CETP E-Learning computer-based training program.

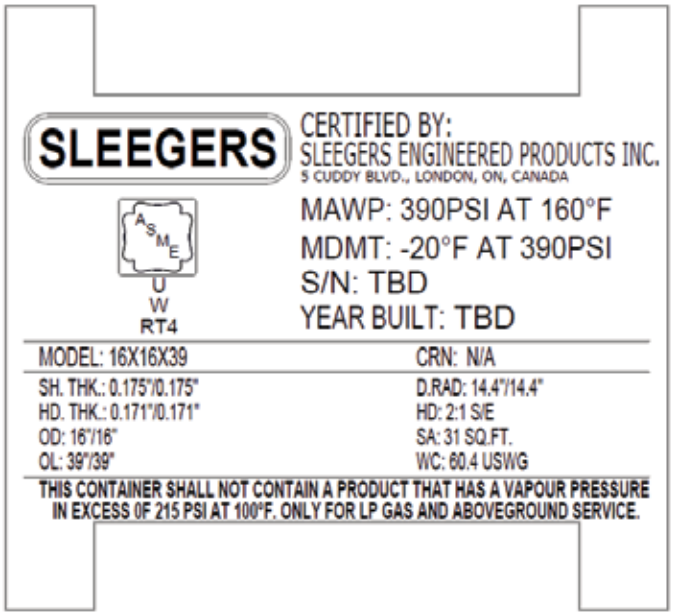
Purging and Venting (Tanks and Lines)

Venting of LP-Gas to the atmosphere is covered by paragraphs 7.3.1, General, and 7.3.2, Purging of NFPA 58, 2017 edition. Refer to NFPA 58, Local Codes and Proper Training for specific information relating to safe venting of LPA.

General Propane Tank Information

The most important aspect of filling a propane tank is safety. Understanding the properties, characteristics, and safe handling practices of the fuel is required before conducting any propane tank filling efforts.

Our propane-powered vehicle is equipped with a propane tank built and certified to the regulations of the American Society of Mechanical Engineers (ASME). These tanks have a data plate with pertinent information including the ASME stamp. This plate must be securely attached and legible or the tank should be taken out of service and replaced.


SLEEGERS
CERTIFIED BY:
SLEEGERS ENGINEERED PRODUCTS INC.
5 CUDDY BLVD., LONDON, ON, CANADA
MAWP: 390PSI AT 160°F
MDMT: -20°F AT 390PSI
S/N: TBD
YEAR BUILT: TBD
U
W
RT4
MODEL: 16X16X39
CRN: N/A
SH. THK.: 0.175"/0.175"
HD. THK.: 0.171"/0.171"
OD: 16"/16"
OL: 39"/39"
D.RAD: 14.4"/14.4"
HD: 2:1 S/E
SA: 31 SQ.FT.
WC: 60.4 USWG
THIS CONTAINER SHALL NOT CONTAIN A PRODUCT THAT HAS A VAPOUR PRESSURE IN EXCESS OF 215 PSI AT 100°F. ONLY FOR LP GAS AND ABOVEGROUND SERVICE.

There are no requirements for re-certifying ASME tanks, however, an inspection is required and maintenance is recommended if there are signs of corrosion. Propane tanks are filled to 80% water capacity to allow for the liquid fuel to expand and contract, depending on ambient temperatures. All tanks built for use on motor vehicles are equipped with an Overfill Prevention Device (OPD). The National Fire Protection Association (NFPA) requires motor vehicle propane tanks be equipped with an OPD to automatically prevent filling the tank beyond the maximum recommended capacity of 80% water capacity. This automatic stop fill system prevents overfilling of the fuel tanks. This requirement has been in effect since January 1, 1984.

Fill Stations

Propane is readily available anywhere in the United States. To locate the nearest station, check with www.afdc.energy.gov/afdc/locator/stations.

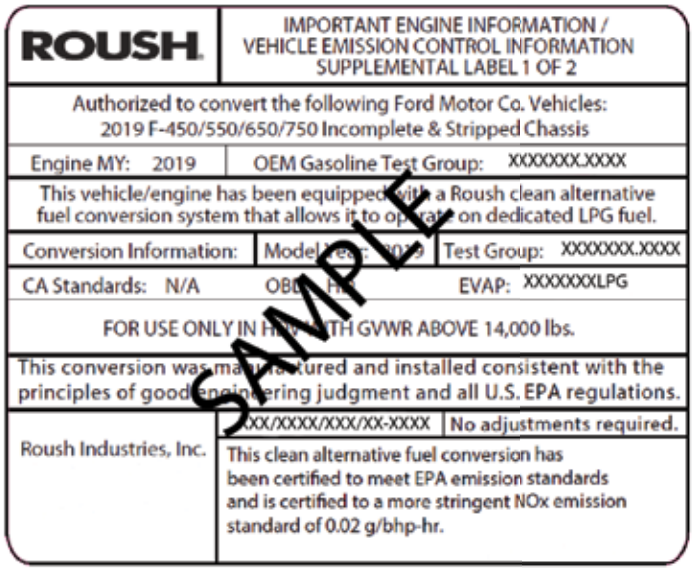
ROUSH CleanTech recommends facilities designed for automotive refueling. Other locations may have low-output pumps, resulting in slow or no fill, or low-quality fuel which can result in premature component failure.

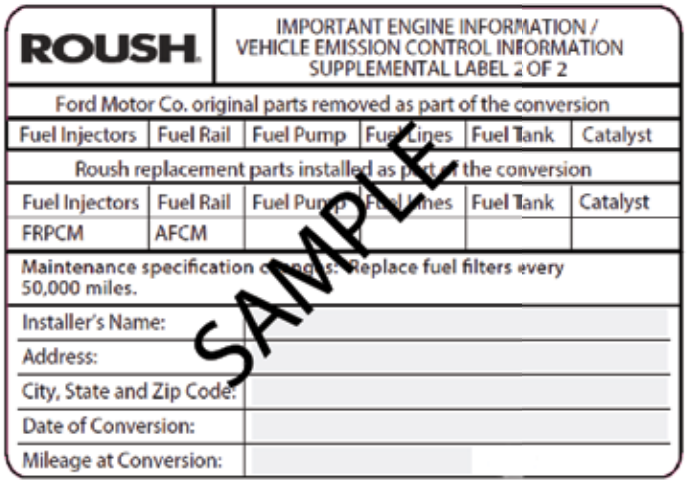
NOTE: Some fuel station pumps may have sufficient pressure to allow a small fuel flow into the tank even with the valves closed. The operator should stop the fill as soon the fuel flow drops noticeably.

VEHICLE INFORMATION

Build Data

ROUSH CleanTech emissions certification information is recorded on the Roush CleanTech Vehicle Emissions Control Information (VECI) labels. The labels are vehicle-specific and are required by law to be on the vehicle to which it is assigned along with the Ford VECI label.

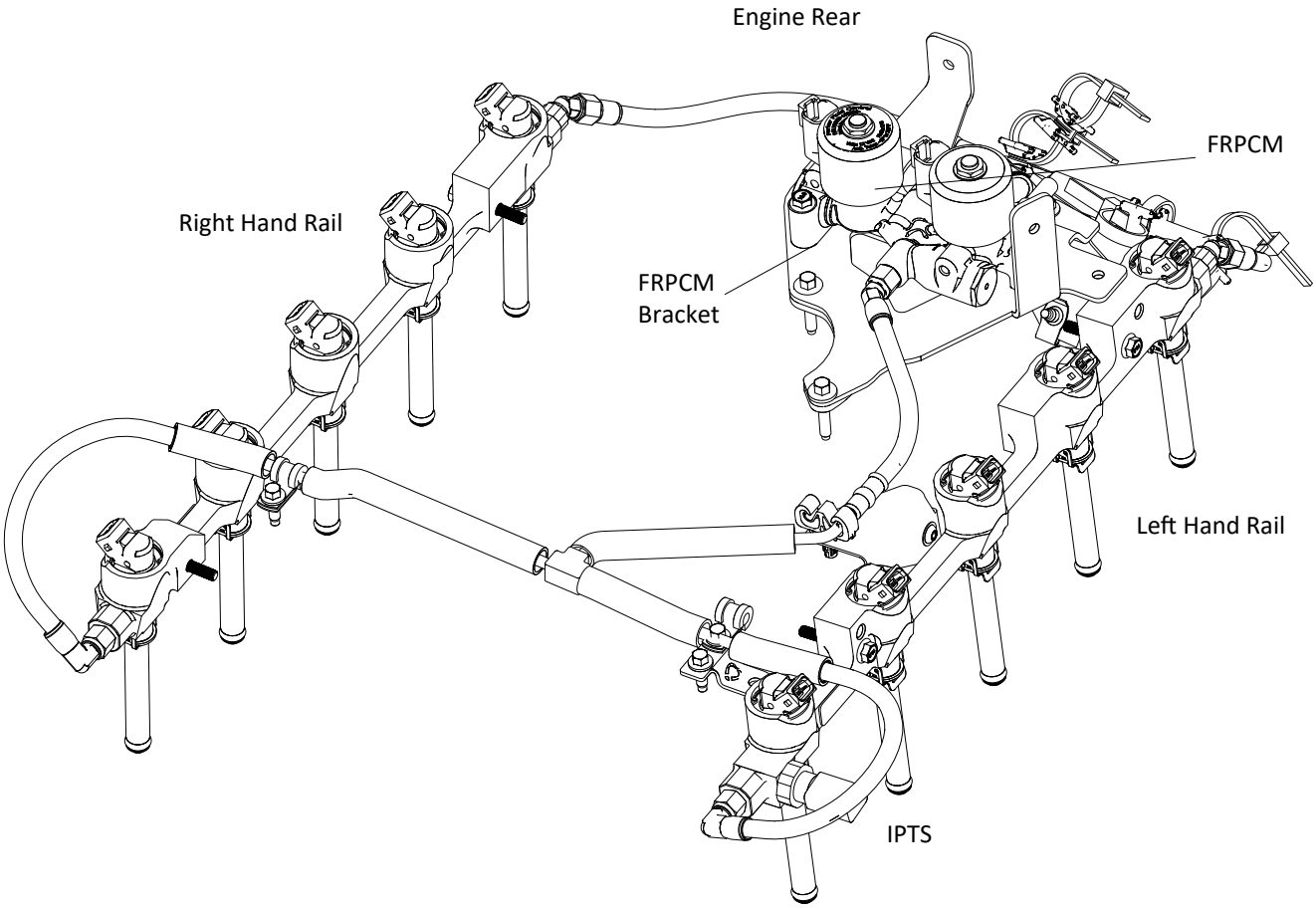

ROUSH
IMPORTANT ENGINE INFORMATION / VEHICLE EMISSION CONTROL INFORMATION SUPPLEMENTAL LABEL 1 OF 2
Authorized to convert the following Ford Motor Co. Vehicles:
2019 F-450/550/650/750 Incomplete & Stripped Chassis
Engine MY: 2019
OEM Gasoline Test Group: XXXXXXX.XXXX
This vehicle/engine has been equipped with a Roush clean alternative fuel conversion system that allows it to operate on dedicated LPG fuel.
Conversion Information:
Test Group: XXXXXXX.XXXX
CA Standards: N/A
EVAP: XXXXXXXLPG
FOR USE ONLY IN HEAVY VEHICLES WITH GVWR ABOVE 14,000 lbs.
This conversion was manufactured and installed consistent with the principles of good engineering judgment and all U.S. EPA regulations.
Roush Industries, Inc.
XXX/XXXX/XXX/XX-XXXX
No adjustments required.
This clean alternative fuel conversion has been certified to meet EPA emission standards and is certified to a more stringent NOx emission standard of 0.02 g/bhp-hr.
SAMPLE


ROUSH
IMPORTANT ENGINE INFORMATION / VEHICLE EMISSION CONTROL INFORMATION SUPPLEMENTAL LABEL 2 OF 2
Ford Motor Co. original parts removed as part of the conversion
Fuel Injectors | Fuel Rail | Fuel Pump | Fuel Lines | Fuel Tank | Catalyst
Roush replacement parts installed as part of the conversion
Fuel Injectors | Fuel Rail | Fuel Pump | Fuel Lines | Fuel Tank | Catalyst
FRPCM | AFCM
Maintenance specification changes: Replace fuel filters every 50,000 miles.
Installer's Name:
Address:
City, State and Zip Code:
Date of Conversion:
Mileage at Conversion:
SAMPLE

F-450/F-550 and F-53/F-59 Fuel Rails

Each fuel rail assembly is mounted to the intake manifold by three brackets, and is made up of the following components:

• Five (5) fuel injectors retained in the fuel rail by a C-clip. The injectors are connected to the main engine wiring harness. Fuel metering and injection is controlled by the engine PCM as the injectors are opened and closed by switching the ground internally in the PCM.
• Five (5) injector spacers sealed to the fuel rail and intake manifold injector ports by O-rings and retained to the fuel rail with a retention clip.
• An Injection Pressure Temperature Sensor (IPTS) is mounted on the left hand rail.



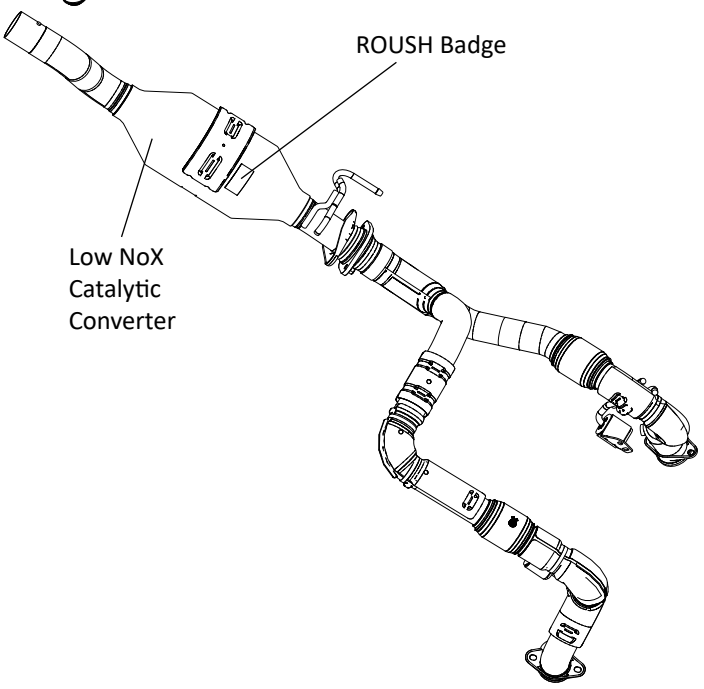
ROUSH CleanTech Optional Ultra Low NOx Catalyst

The optional ROUSH CleanTech Low NOx catalytic converter, along with an updated ROUSH CleanTech calibration, reduces the amount of nitrogen oxides (NOx) that is emitted from the fuel system to .02 grams per brake horsepower per hour (g/bhp-hr), which is well below the current required CARB rate of .2 g/bhp-hr.

All ROUSH CleanTech Gen 4+ propane powered vehicles, even without the ultra low NOx catalytic converter, are rated at .05 g/bhp-hr.

The ROUSH CleanTech Catalytic Converter looks much like a standard Ford model, but has a ROUSH CleanTech badge.

For removal and installation of the low NOx and ultra low NOx please refer to Ford service manual for this vehicle.ROUSH CleanTech Evaporative Emissions System



ROUSH CleanTech Evaporative System

The ROUSH CleanTech evaporative emissions system is used for multiple applications for this vehicle. The evaporative system incorporates most of the standard Ford evaporative system, including the evaporative or charcoal canister, but re-purposes them for a propane application. The canister is equipped with a sensor that will create trouble codes in the event of a system leak within the evaporative system.

The main components of the evaporative system are the vapor canister, which includes: the fresh air tube/vent solenoid and the FTPT sensor; the bleed port in the FRPCM, the Vapor Management Valve, or VMV, the RH fuel rail, and the vapor purge hose assembly. During regular vehicle operation, the vent solenoid will always be open and the VMV will remain closed.

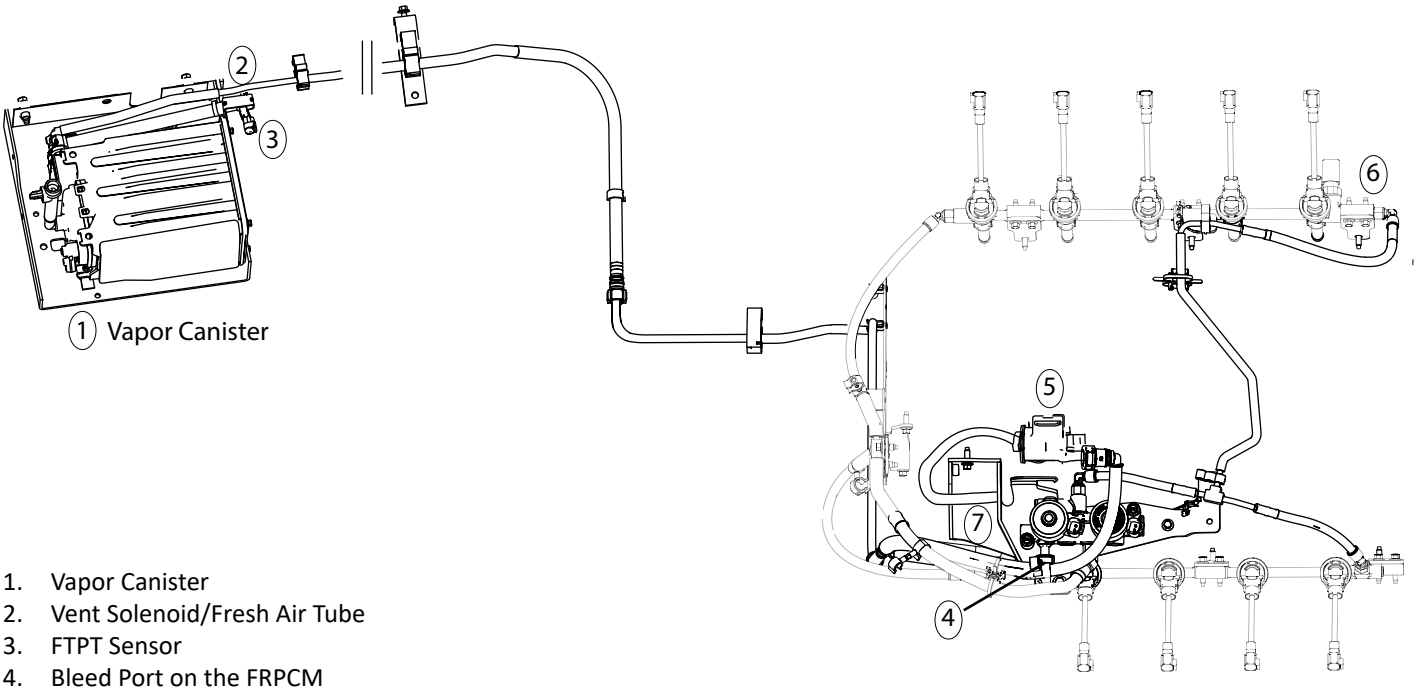
Bleeding Down of the Rails:
When the vehicle is keyed off, the fuel rail is still pressurized. Approximately 60-75 minutes after the vehicle has been keyed off, with the ambient temperature above 40°F (4°C) the bleed solenoid opens and the fuel in the rail becomes depressurized. The screen in the bleed port creates a restriction and allows the unused fuel to boil off into a vapor in the rails.

After the bleed down process occurs there may be some residual pressure in the fuel rails.

Purging Fuel from the Canister:
After the vehicle has exceeded approximately 35 mph, the VMV will open and will pull fuel vapors from the canister into the intake manifold to be burned off.

System Self Testing:
For self testing, the vent solenoid will close and the VMV will remain closed, creating a vacuum in the system for testing.

Component During Self Test	When At Rest	When Power is Applied
Vapor Management Valve (VMV)	Closed	Open
Vent Solenoid	Open	Closed



1. Vapor Canister
2. Vent Solenoid/Fresh Air Tube
3. FTPT Sensor
4. Bleed Port on the FRPCM
5. Vapor Management Valve (VMV)
6. RH Fuel Rail
7. Vapor Purge Hose Assembly

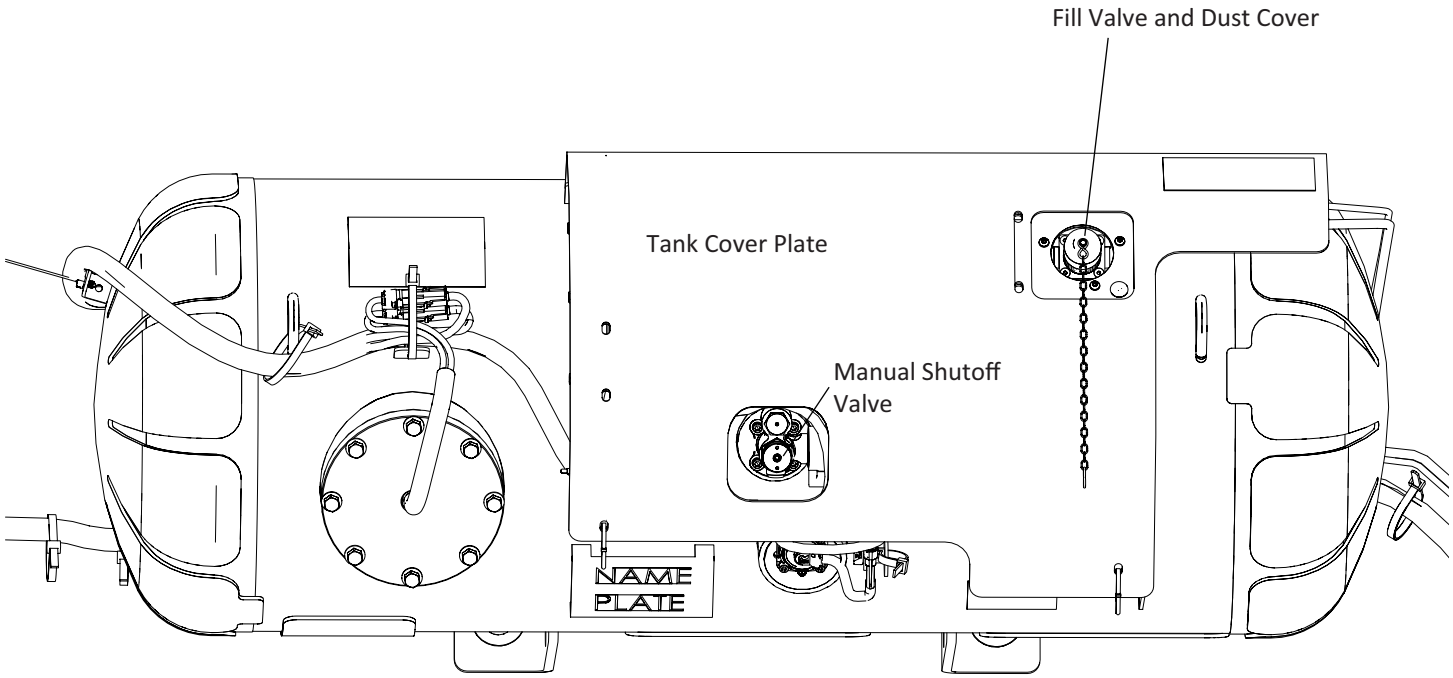
F-450/F-550 and F-53/F-59 Fuel Tanks

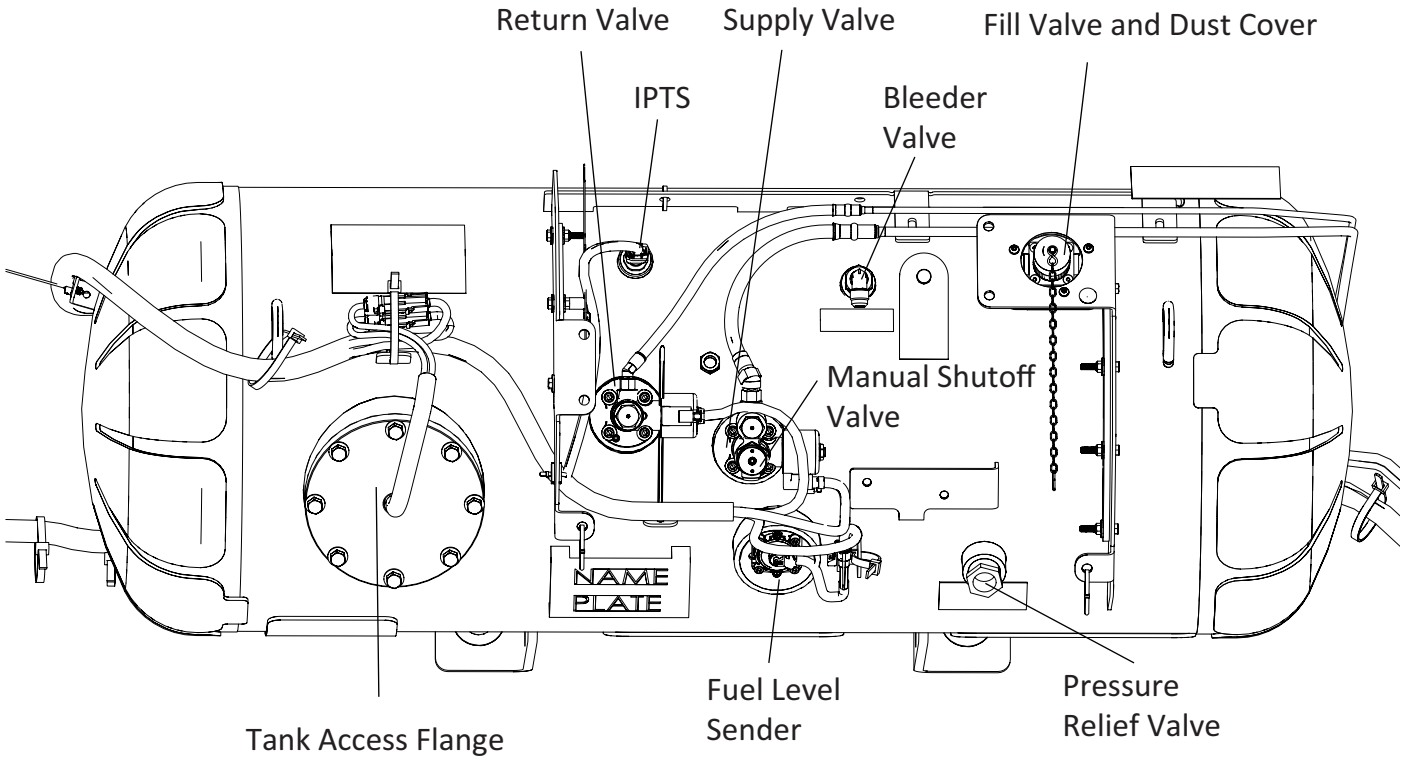
The F-450 and F-550 fuel tanks are available in 35, 52, and 65 gallon usable capacity applications.

The F-53 and F-59 fuel tanks are available in 45 and 65 gallon usable capacity applications.

The fuel tank(s) is located under the step on the driver side, with the second tank, if equipped, being located under the step on the passenger side. The following components are mounted to the outside of the fuel tank: Bleeder Valve (Fixed Liquid Level Gauge), Supply Circuit Assembly, Return Circuit Assembly, Pressure Relief Valve, fill port and check valve with OPD, and Fuel Level Sender.

The fuel tank is fitted with a service port flange for accessing the internals of the tank. The following components are located inside the fuel tank: dual electric Fuel Pumps with an inlet filter, fuel pump outlet filters, jet pump and a wiring harness.





OPD Inspection Procedure

Some companies or local or state governing bodies may require an annual Overfill Prevention Device (OPD) inspection on propane vehicles. This procedure tests that the OPD is stopping fuel fill at the correct 80% water capacity level.

NOTE: Test must be performed by a technician that has been trained to fill or service propane cylinders and can only be performed on vehicles with less than 50% fuel level, as indicated on the cluster.

1. Park the vehicle at a fill station or near a refueling truck on level ground. Place a level on the frame rail or tank to ensure it is level.
2. Locate the vehicle propane tank data plate and reference the tank volume, often listed as W.C. (water capacity).
3. Calculate 5% of the W.C.
4. Connect the fill nozzle to the vehicle fill valve.
5. Open the vehicle bleeder valve. You should have clear vapor emitting from the valve.

NOTE: Wear non-porous, cold- safe gloves, eye protection, and ear protection during venting and repair operations. Keep moisture away from the valves. Failure to heed this warning can result in personal injury.

NOTE: OPD might stop before white mist is visible at the bleeder valve. This is normal as long as fuel gauge at the instrument cluster reads Full. The tank may have stopped filling before consistent liquid was visible at the bleeder valve. This indicates normal operation.

6. Begin filling per the refueling station manufacturer's procedure.
7. Once liquid (seen as a white mist) is visible at the bleeder valve, note the number of gallons filled. Fueling should stop before the calculated 5% volume is reached. If additional 5% is reached, stop fueling as vehicle is over filling and contact ROUSH CleanTech Customer Success (800) 59-ROUSH (597-6874), Opt. 2.
8. Turn off the fuel pump and close the bleeder valve.
9. Disconnect the nozzle and replace the fill cap.

Example: A functioning OPD on a tank with a 100 gallon WC will stop before five (5) gallons (100 WC x .05 = 5) have been added after the mist is visible.

ROUSH CleanTech Fuel System Start Sequence

The ROUSH CleanTech propane fuel system is fully integrated using Ford's One Touch Integrated Start (OTIS) system. When the ignition key is turned to Start and released to the On position the ROUSH CleanTech fuel system will begin a purge process. Once the correct pressure and temperature is detected at the fuel rail, the starter engages and the vehicle starts with no further action required from the operator.

The full ROUSH CleanTech Fuel System start sequence is as follows:

1. CAN Bus Initialization
2. Bleed Diagnostic Pressure Read
3. Open Tank Solenoid
4. Open FRPCM Supply Solenoid
5. Flush the Fuel Rails
6. Fuel Rail Pressure Builds
7. Engine Cranks

SPECIAL TOOLS

Electronic Leak Detector or Leak Detecting Solution

If purchasing an electronic leak detector, it is recommended to use a tester capable of detecting down to 35 PPM of propane vapor. Leak detecting solution should be used to inspect seals and connections after servicing fuel system.

ROUSH CleanTech Transfer Kit

There are several fuel transfer kits available, including the ROUSH CleanTech transfer kit, which is built specifically to work with the ROUSH CleanTech fuel system and components. Information on the ROUSH CleanTech Transfer Kit is available at https://rctws.force.com/rct/s/article/Fuel-Transfer-Kit-Instructions.

Propane Flare

A propane flare can be used to burn off vented propane during servicing. If using a propane flare, use in accordance with NFPA58 and local laws and regulations related to dispensing propane autogas .

⚠ WARNING

Do not attempt to build your own propane flare. Failure to exercise extreme caution and care may lead to serious accidents which can result in property damage, personal injury, and/or death. Check with your local fire marshal or your local propane supplier prior to using a propane flare.

Laptop, J2534 Pass Through Device and the ROUSH Diagnostic Tool (RDT)

To access the electronic diagnostics for all Gen 3+ ROUSH CleanTech vehicles, you will need a PC laptop with Windows 7 or higher operating system, a J2534 Pass Through device, and a free copy of the ROUSH Diagnostic Tool. More information on RDT can be found in the RDT section of the manual.

Block Heaters

Because of the unique properties of propane and the ROUSH CleanTech fuel system, block heaters are not required to start propane vehicles in extreme cold conditions. If a Ford OEM block heater is going to be used, Ford recommends that the block heaters are only used in areas where the temperature drops to -20°F or lower.

PREPARATION FOR FUEL SYSTEM SERVICE

Manual Shutoff Valve

Description

This procedure ensures that no propane leaves the fuel tank during service procedures.

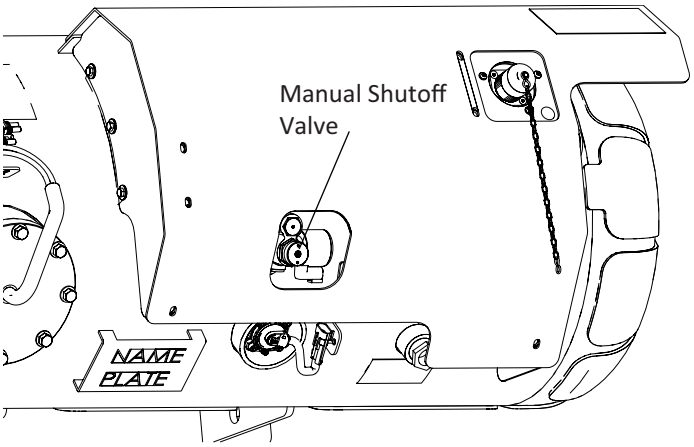
Closing the Manual Shutoff Valve

1. Locate the supply valve assembly on the tank.
2. Turn the manual shutoff valve on the supply valve assembly clockwise by hand until it stops to close it. Do not tighten with a tool.

Opening the Manual Fuel Shutoff

1. After fuel system service is completed, locate the manual shutoff valve on the tank and turn it counter-clockwise until it stops. Once the valve has fully opened, turn the knob 1/4 turn clockwise so that the so the valve is not sitting on the stop. This will assist in closing the valve in the future.
2. Re-install the tank cover plate if it had been removed.

NOTE: After all fuel service procedures are completed, follow the Fuel System Priming Procedure.



Fuel Line Purging/Depressurization

Clearing the propane out of the fuel lines (purging) is required before working on many fuel system components. Following the suggested techniques for purging the fuel lines will reduce the amount of vapor released harmlessly into the atmosphere and will produce the least risk to life and property.

1. Move the vehicle to a well-ventilated area at least 35 ft away from any potential ignition source.
2. Close the manual shutoff valve on the tank supply valve.
3. Disconnect the fuel pump electrical connectors at the fuel tank access cover.

NOTE: Operating the fuel pumps without fuel may lead to premature failure of fuel pumps.

4. Start the engine and let it run until it stalls. This purges the supply and return fuel lines of most of the liquid propane.

NOTE: This step may set fault codes to due to pump being unplugged and inability to build fuel rail pressure. These codes should be cleared before returning vehicle to service.

5. Turn off the ignition and disconnect the negative battery terminal.
6. Slowly loosen the fuel line connection at the outlet of the supply line filter located at the front of the fuel tank.

⚠ CAUTION

NOTE: Watch for liquid propane dripping from the line connection.

7. Slowly open the line at the return valve on the tank to allow the remaining fuel to bleed off.
8. Inspect O-ring on return line at the return valve. Replace the O-ring if damaged.

NOTE: Use an O-ring installation tool to limit potential damage to O-ring during installation.

9. Tighten fuel line fitting at the filter to 28 Nm (21 ft-lb) and the fuel line at the return valve to 31 Nm (23 ft-lb).
10. Reconnect the negative battery terminal.
11. Clear any fault codes set by this procedure.

⚠ CAUTION

NOTE: There may still be a small amount of propane vapor in the lines after running this procedure. Open the lines slowly and cautiously to bleed off any remaining propane.

SERVICE PROCEDURES

Fuel Tank Draining Procedure

⚠ DANGER

NOTE: Keep at least 35 ft away from heat, sparks, flames, static electricity, lighted smoking materials, or other sources of ignition when draining a tank. Failure to heed this danger may result in severe personal injury or death.

Overview

The fuel tank must be empty of propane before most tank components can be serviced or be transported by a carrier. There are three ways to evacuate fuel from the tank:

- Transferring the fuel to another vessel,
- Burning off the fuel through a flare tower, or
- Venting the fuel to atmosphere (verify this is legal in your area).

Preparing for Fuel Tank Transfer or Flare

1. Move the vehicle to an outdoor, well-ventilated area at least 35 ft from any external ignition sources.
2. Place the tank in which the fuel is to be captured close to the tank to be drained.
3. Purge the fuel lines by using the Fuel Line Purge Procedure.
4. Disconnect supply line from forward side of inline filter at front of fuel tank.

Using In-Tank Pumps to Transfer the Fuel

NOTE: This method will not completely drain the tank and a venting the tank to atmosphere will still be required. In some areas this is not allowed or may not be safe. In this case, the fuel must be burned off.

1. Connect the fuel transfer hose to the receiving tank fill valve.
2. Connect the transfer hose to the outlet side of the supply line filter on the transferring vehicle.
3. Connect the transfer kit connectors to the vehicle transferring fuel. This includes:
   - Disconnect the fuel pump wire harness at the tank access cover and connect the ROUSH CleanTech Fuel Transfer Kit harness to the fuel pump wire connectors.
   - Disconnect the transferring vehicle tank harness at the supply valve and connect the transfer kit connector.
   - Connect the two (2) power connectors on the transfer harness to a 12v power source.
4. Turn the switch on the jumper harness to the ON position.
5. Slowly open the manual supply valve on the tank to be drained. You should hear the pumps in the fuel tank running and fuel will begin to transfer the fuel.
6. Monitor the fuel transfer process and immediately turn off the fuel pumps when the transfer is complete. **Failure to turn the pumps off immediately can lead to pump damage.**
   Along with tracking the process via the twinsight, which gives and approximate reading of fuel level, there are two (2) ways to monitor the fuel transfer process:
   - Measuring amperage.
     Use a non-contact amp clamp over one of the fuel pump wires, noting the initial reading of the clamp when the transfer begins. When the amp clamp drops approximately two (2) amps, immediately turn the switch

to OFF to avoid damage to the pumps. Note, a large increase in amperage is a sign that the receiving tank may either be full or the Excessive Flow Valve (EFV) on the transferring tank may have tripped. If the EFV has tripped, turn off the switch on the harness, close the manual shutoff valve, and wait two (2) minutes before restarting the transfer.

- Listening for a tone change from the fuel pumps. When the tank is near empty there will be a tonal change in the fuel pumps. When the tone changes, immediately turn the switch to OFF to avoid damage to the pumps.

7. Close the manual supply valve on the transferring vehicle.
8. Loosen the fuel transfer hose and bleed off the remaining fuel pressure.

⚠ CAUTION

NOTE: Fuel will be under pressure in the transfer line; use caution when disconnecting the fittings, slowly loosen the fittings, and use gloves and protective eye wear.

9. The remaining fuel in the tank will now need to be evacuated through the bleed valve or a propane flare.
10. When the tank is no longer venting or burning off propane, perform the Verifying Tank Depressurization Procedure.

Draining the Tank Using a Propane Flare or Tower

⚠ CAUTION

Before starting this process, check with your local fire marshal or your local propane supplier about regulations preventing the use of a propane flare prior to using a propane flare.

For service centers equipped with a propane flare or tower, the ROUSH CleanTech Fuel Transfer Kit can aid in connecting to these devices. Liquid propane flares should be connected to the supply valve and vapor flares should be connected to the bleeder valve.

Use of a flare or tower should only be done by technicians who have received the proper training and should follow manufacturer's instructions for the specific propane flare or tower used.

Draining the Tank by Venting the Vapor to the Atmosphere

⚠ CAUTION

Before starting this process, check with your local fire marshal or your local propane supplier about regulations preventing propane venting prior to venting the tank.

NOTE: Wear non-porous, cold- safe gloves, eye protection, and ear protection during venting.
The slowest method to drain a propane tank is to vent the tank off to atmosphere. This is accomplished by opening the bleeder valve and releasing the propane vapor from the tank. It is recommended to attach a line to route the propane vapor and ethyl mercaptin smell away from the vehicle.

NOTE: If you have any questions or concerns or you feel unqualified to perform the process of venting the tank, contact your local propane provider or ROUSH CleanTech (800) 59-ROUSH (597-6874).

Verifying Tank De-pressurization

This procedure will test for pressure in the tank even if there is a component failure.

⚠ WARNING

NOTE: There may still be a small amount of propane in the tank prior to running this procedure.

NOTE: Before removing any components from the fuel tank, it is very important to verify there is not any pressure remaining inside. The technician that is removing a tank component should always be the one to verify it is empty. This should be done right before starting the repair. Failure to do so could result in severe personal injury or death and/or damage to property.

1. The tank should be depressurized using your preferred NFPA 58 approved method. Refer to the Fuel Tank Draining Procedure in this ROUSH CleanTech service manual.
2. Purge the fuel lines using the Fuel Line Purging Procedure found in this ROUSH CleanTech service manual.
3. Once the tank is empty, open the bleeder valve. Ensure that no fuel is escaping. Repeat 2 times, closing and opening the bleeder valve to ensure the valve is not stuck.
4. Check the sending unit external twin-site and ensure the needle is on E.
5. Key the vehicle to the On position. Using a capable OBD-II scan tool, monitor fuel rail pressure (FRP).
6. Open the manual shut-off valve.
7. Key the vehicle to the start position. Then after five seconds key it to OFF.
8. Key the vehicle to ON and measure fuel rail pressure.
9. If pressure is below 15 psi, components can be removed from the tank, following the replacement procedures in this ROUSH CleanTech service manual. NOTE: For components threaded into the tank, slowly loosen them. For components fastened to the tank with a flange, slowly loosen each bolt until the component can move freely, then the component can be removed from the tank.
10. If pressure is above 15 psi, repeat steps 2-8. If after the second attempt pressure is still above 15psi, contact ROUSH CleanTech at (800) 59-ROUSH (597-6874) for further instruction.

NOTE: For components threaded into the tank, slowly loosen them. For components fastened to the tank with a flange, slowly loosen each bolt until the component can move freely, then the component can be removed from the tank.

⚠ CAUTION

NOTE: After depressurizing, there will still be propane vapors in the tank. Keep tank away from any sources of ignition and only use hand tools inside the tank. A depressurized tank can re-pressurize itself if re-sealed.

Fuel Tank Purging Procedure

DANGER

Always follow all NFPA 58 guidelines (paragraphs 7.3.1 and 7.3.2) when working on the propane fuel system or refueling a vehicle, you must be in a well-ventilated area at least 35 ft from any ignition source and 35 ft from any activity that throws sparks or risk severe personal injury or death.

Description

The following procedure is required to purge the air from the fuel tank after servicing tank components. This is critical to prevent a combustible air/fuel mixture in the tank and ensure correct tank pressure.

The fuel tank can be purged by two methods: vacuum purging or vapor purging.

Vacuum Purging Procedure

1. Ensure that the tank is empty. If you did not empty the tank, perform the Fuel Tank Draining Procedure and Verifying Tank Depressurization Procedure.
2. Ensure that the negative battery terminal is disconnected to prevent ignition of a potentially combustible air/fuel mixture
3. Ensure that all loosened lines and fittings are re-torqued to their proper specifications.
4. Connect an explosion-proof vacuum pump to the tank bleeder valve.

NOTE: Only use an explosion-proof (pneumatic powered) vacuum pump to prevent ignition of a potentially combustible air/fuel mixture. Explosion-proof pumps are specially designed to enclose parts of the pump that could ignite vapors that may result in an explosion.

5. Turn off pump and ensure the tank holds vacuum for at least 15 minutes. Close the bleeder valve and remove the vacuum pump.
6. Slowly pressurize the tank with propane.

NOTE: This can be done with a vapor propane source or connecting to a fill station without turning on the fill station pump. This will pressurize the tank using the remaining fuel in the station fill line.

7. Leak check tank fittings and components using an electronic leak detector or leak detection solution.
8. Fill tank to approximately 1/3 full based on the gauge at the cluster.
9. Reconnect the negative battery terminal.
10. Key vehicle to start and slowly open manual fuel shutoff valve to pressurize the fuel lines
11. Ensure proper operation, the fill tank using the OPD Inspection Procedure.
12. Perform a final leak inspection at all fuel fill and fuel line connections that were serviced in this procedure.

Vapor Purging Procedure

1. Ensure that the tank is empty. If you did not empty the tank, perform the Fuel Tank Draining Procedure and Verifying Tank Depressurization Procedure.
2. Ensure that the negative battery terminal is disconnected to prevent ignition of a potentially combustible air/fuel mixture
3. Ensure that all loosened lines and fittings are re-torqued to their proper specifications.
4. Pressurize the tank through the fill valve with a small amount of propane, preferably from a propane vapor source, to approximately 20psi. Leak check tank fittings and components using an electronic leak detector or leak detection solution.

NOTE: If using a propane fill station, connect without turning on the fill station pump. This will pressurize the tank using the remaining fuel in the station fill line.

5. Open the bleeder valve and vent tank until propane venting begins to slow. Close the bleeder valve.
6. Repeat steps 4 and 5 a minimum of five (5) times.

NOTE: Leak checking is only required during the first time pressurizing the tank.

7. Fill tank to approximately 1/3 full based on the gauge at the cluster.
8. Leak check tank fittings and components using an electronic leak detector or leak detection solution.

NOTE: When filling an empty tank, start filling at a slow rate to build up pressure inside the tank. An initial fast fill may trip the OPD, creating a slow or no fill condition.

9. Reconnect the negative battery terminal.
10. Key vehicle to start and slowly open manual fuel shutoff valve to pressurize the fuel lines
11. Ensure proper operation.
12. Open bleeder valve and continue fueling using the OPD Inspection Procedure.
13. Perform a final leak inspection at all fuel fill and fuel line connections that were serviced in this procedure to ensure no leaks are present using an electronic leak detector or leak detection solution.

Fuel System Priming Procedure

Description

After performing any fuel system service work where the fuel lines were depressurized, the fuel system must be leak checked and primed. This will prevent the Excess Flow Valve from checking as fuel quickly fills the empty fuel lines.

1. Make sure the battery is connected.
2. Check to make sure there is fuel in the tank, manual fuel shutoff valve is closed, and the fuel pumps are connected.
3. Turn the key to the START position. When you hear the fuel pumps activate, slowly open the manual fuel shutoff valve.
4. If vehicle cranks but does not start, close the manual fuel shutoff valve and repeat the process.

FUEL SYSTEM SERVICE COMPONENTS AND PROCEDURES

The Gen 4 ROUSH CleanTech fuel system on a Ford F450/F-550 and F-53/F-59 utilizes a single cylindrical manifold tank assembly to store the liquid propane. The fuel tank is designed and certified to meet all applicable safety standards required for installation on a motor vehicle. The tank design includes structural mounting brackets, which are used for mounting the tank assembly between the frame rails. The tank assembly is secured to the chassis using specially coated and grade level fasteners.

In addition, the tank is fitted with a Pressure Relief Valve (PRV) that will open if tank pressure exceeds 375 psi, depending on application, protecting the integrity of the tank.

The following components are mounted to the outside of the fuel tank: fixed liquid level gauge (Bleeder Valve), Supply Valve Assembly, Return Valve Assembly, Pressure Relief Valve, Overfill Prevention Device, Fuel Pressure and Temperature Sensor (FPTS), and Fuel Level Sender. The propane fuel tank is fitted with a service port flange for accessing the internals of the tank. The following components are located inside the fuel tank: dual electric fuel pumps with an inlet filter, jet pump, and a wiring harness.

The tank components and their functions will be provided individually in this manual.

The following components are mounted to the outside of the fuel tank:

- Liquid Level Gauge/Bleeder Valve,
- Return Circuit Assembly,
- Supply Circuit Assembly,
- Pressure Relief Valve (PRV),
- Overfill Prevention Device (OPD),
- Fuel Pressure and Temperature Sensor (FPTS),
- Fuel Level Sender (FLS) and Twinsight.

The propane fuel tank is fitted with a service port flange for accessing the internals of the tank. The following components are located inside the fuel tank:

- Dual electric Fuel Pumps with an inlet filter,
- Jet pump,
- Wiring harness.

The tank components and their functions will be provided individually in this manual.

FUEL SYSTEM SERVICE PROCEDURES

Fuel Tank Removal and Replacement

CAUTION

NOTE: If the tank internal or external components of the tank do not need to be serviced and the tank will be removed with propane inside, verify that the manual shutoff valve or bleeder valve are securely closed.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Purge the fuel lines using the Fuel Line Purging Procedure.
3. If the tank is being replaced or will be opened for service, drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

4. Disconnect the supply and return line from the tank valves and unclip from retention points.
5. Remove the fill hose from the OPD.
6. Disconnect all tank electrical connections.
7. Obtain a hoist capable of safely lifting 1,000 lb (373 kg). Attach the hoist to the fuel tank using lifting straps. Support the tank while removing the tank mounting fasteners.
8. Remove the fasteners attaching the tank to the frame rails. Depending on the tank length, there will be four (4) or six (6) mounting points.

NOTE: Inspect and retain undamaged steel washers, rubber isolators, and crush limiters. Discard if damaged.

9. With the help of an assistant, lower the tank.

Replacement

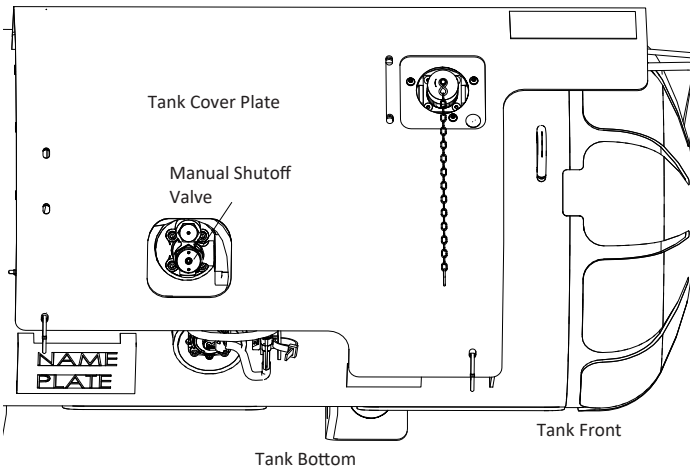
1. Using the hoist, carefully raise the fuel tank into position. Ensure the steel washers, rubber isolators, and crush limiters are installed in the order shown.

CAUTION

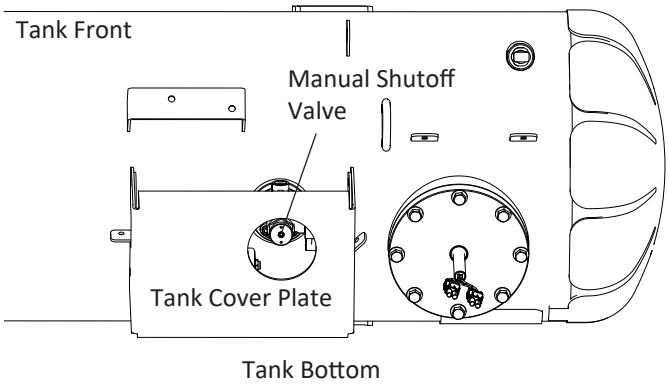
NOTE: Take care not to pinch fuel lines or wire harnesses.

2. Connect all wiring connections.
3. Install tank mounting fasteners. Torque to 105 Nm (77 ft-lb).
4. Connect the fuel supply line to the supply valve. Torque to 31 Nm (23 ft-lb).
5. Connect the return line to the return valve. Torque to 31 Nm (23 ft-lb).
6. If the tank was emptied, perform Fuel Tank Purging Procedure.
7. Leak check tank valves and line connections.
8. Perform Fuel System Priming Procedure.

Tank Cover Plate



F-450/F-550 Fuel Tank



F-53/F-59 Fuel Tank

Description

The Tank Cover Plate protects the supply and return valves. The cover plate has a small opening to allow access to the manual fuel shutoff valve without having to be removed.

The F-450/F-550 has either nine (9) or 13 fasteners, depending on tank size, as well as an equal amount of J-clips. The F-53/F-59 has four (4) fasteners and no J-clips.

Removal for the F-450/F-550

1. Remove all fasteners securing the tank cover plate to the tank. Verify that all J-clips are in good condition and still on the tank

Replacement for the F-450/F-550

1. Prior to inserting the fasteners, cover the threads in marine-grade anti-sieze. Align the tank cover plate and thread the half-way in, making it easier to install them.
2. Torque all fasteners to 10 Nm (88.5 in-lb).

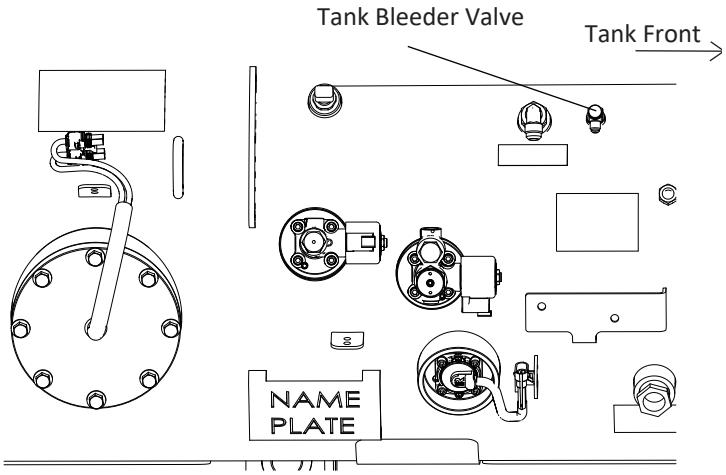
Removal for the F-450/F-550

1. Remove the securing the tank cover plate to the tank.

Replacement for the F-53/F-59

1. Prior to inserting the fasteners, cover the threads in marine-grade anti-sieze.
2. Torque fasteners to 10 Nm (88.5 in-lb).

Tank Bleeder Valve/Liquid Level Gauge



Description

The Tank Bleeder Valve is located on the bottom side of the tank and is connected to a steel tube that goes up to the 80% mark on the tank. The bleeder valve serves three (3) functions.

- -4 AN fitting where a pressure gauge can be connected to read tank pressure,
- A Liquid Level Gauge used in the OPD Inspection Procedure,
- A means of slowly bleeding the tank.

NOTE: Do not operate the bleeder valve without propane safe gloves.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

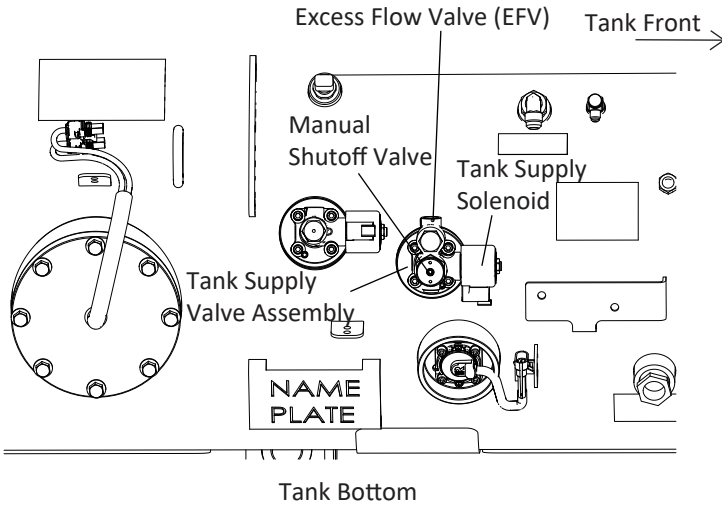
3. Remove the bleeder line from the bleeder Valve.
4. Remove the bleeder valve from the tank.

Replacement

1. Install the new bleeder valve assembly into the tank. Torque to 20 +/- 4.0 Nm minimum, plus orientation, reverse torque not permissible. Pipe thread sealant is pre-applied to the component. If sealant is needed, only use PLS-2 or Everseal 183.
2. Reinstall the bleeder line to the valve and torque to 18.5 +/- 3.0 Nm.
3. Purge the fuel tank using the Fuel Tank Purging Procedure.
4. Reconnect the battery.
5. Fill tank and leak check the fitting using an electronic leak detector or an approved leak detection solution.
6. Perform the Fuel System Priming Procedure.

NOTE: Sealant should not be required for installation of a new component. If pipe thread sealant is required, use only PLS-2 or Everseal 183.

Tank Supply Valve Assembly



Description

The Tank Supply Valve Assembly is mounted to the tank, behind the Tank Cover Plate, and connects to the Fuel Pumps and supply line. The Tank Supply Valve Assembly has three main components:

1. Tank Supply Solenoid,
2. Manual Shutoff Valve,
3. Excess Flow Valve (EFV)

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

3. Remove the supply line at the valve. Inspect O-Ring and replace if damaged.
4. Disconnect the tank supply solenoid electrical connection.
5. Slowly loosen the four (4) bolts evenly securing the valve to the tank until you can move the valve.
6. Remove the four (4) bolts securing the valve to the tank.
7. Pull the tank supply valve assembly away from the tank, **using caution that the supply line doesn't retract back into the tank.**
8. Disconnect the internal fuel pump supply line by depressing the colored tabs on either side of the quick connect fitting and pulling it off the stem.
9. Remove and discard the O-Ring from bottom of tank supply valve.

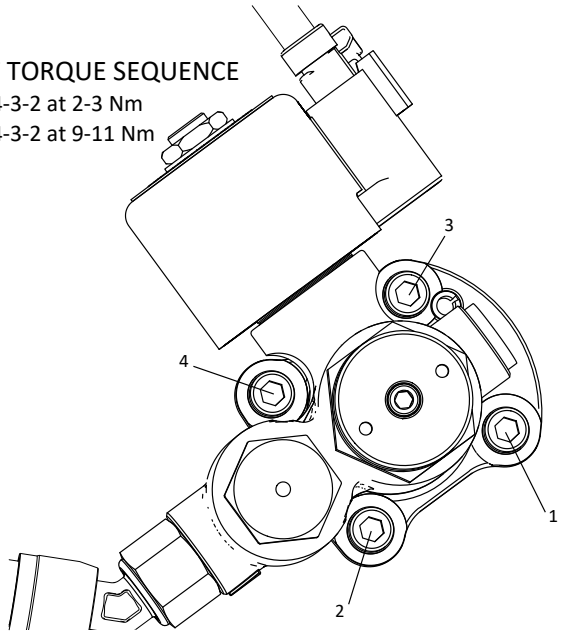
NOTE: When replacing the tank supply valve assembly, the tank seat O-ring must be replaced.

Replacement

1. Inspect the O-ring sealing surface and remove any debris.
2. Apply silicone O-ring lubricant (Parker Super Lube or equivalent) to the O-ring and install to the supply solenoid.
3. Lubricate the tip of the brass stem quick connect with a small amount of clean motor oil.
4. Connect the internal fuel pump supply line, push on until a “click” is heard, then tug to ensure it is secured.
5. Slide the tank supply valve assembly to the tank seat.
6. While holding the tank supply valve assembly, install the four (4) bolts and hand tighten.
7. Torque the bolts to an initial torque: Crossing pattern 2.5 Nm (22 in-lb). Refer to image for the correct torquing pattern.
8. Torque the bolts to a final torque: Crossing pattern 10 Nm (7.4 ft-lb). Refer to image for the correct torquing pattern.

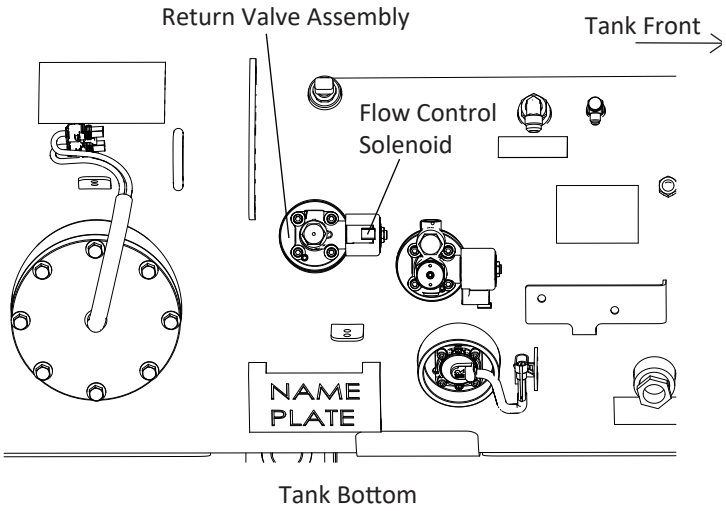
BOLT TORQUE SEQUENCE

1. 1-4-3-2 at 2-3 Nm
2. 1-4-3-2 at 9-11 Nm



9. Inspect the fuel line O-ring and install to the tank supply valve, torque to 31 Nm (23 ft-lb).
10. Connect the wiring harness to the solenoid coil.
11. Purge the fuel tank using the Fuel Tank Purging Procedure.
12. Check the tank supply valve and tank lines for leaks using an electronic leak detector or leak detection solution.
13. Reconnect the battery.
14. Perform the Fuel System Priming Procedure.

Return Valve Assembly



Description

The Return Valve Assembly is mounted to the tank, behind the tank cover plate, and incorporates a check valve that prevents fuel from flowing from the tank into the return line. The return valve assembly also contains the Flow Control Solenoid (FCS) which includes a small orifice to regulate fuel pressure in normal conditions as well as a bypass circuit to allow maximum fuel flow prior to engine starting or during extremely hot conditions.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

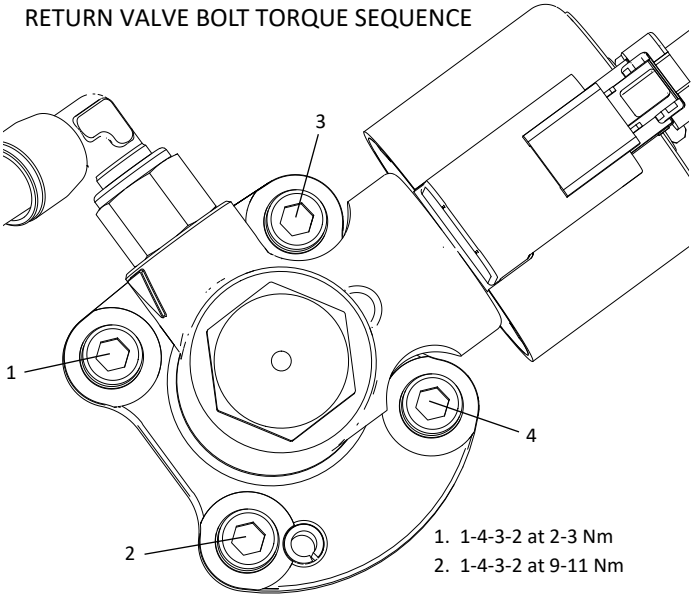
3. Remove the fuel return line from the return valve assembly. Inspect the O-Ring and replace if damaged.
4. Remove the fuel return line from the return valve assembly Inspect the O-ring and replace if damaged.
5. Slowly loosen the four (4) bolts evenly securing the valve to the tank until you can move the valve.
6. Remove the four (4) bolts securing the valve to the tank.
7. Carefully pull the valve outward so that you do not pull the return fuel line out of its in-tank retention clip.
8. Retain the hose with a small set of locking pliers. Take care not to kink or damage the hose.
9. Remove the return hose from the return valve assembly quick connect fitting.

NOTE: When replacing the tank return valve assembly, the tank seat O-ring must be replaced.

Replacement

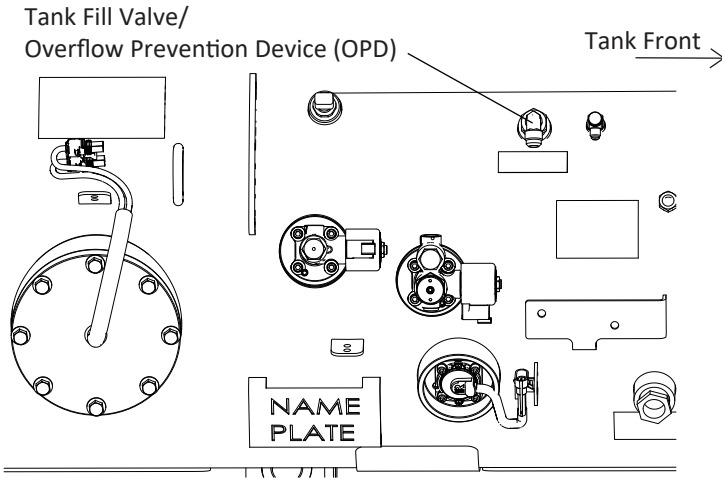
1. Inspect the O-ring sealing surface and remove any debris.
2. Apply silicone O-ring lubricant (Parker Super Lube or equivalent) to the O-ring and install to the return valve assembly.
3. Lubricate the tip of the brass stem quick connect with a small amount of clean motor oil.
4. Connect the internal return line, push on until a “click” is heard, then tug to insure it is secured. Take care not to let the hose fall back into the tank.
5. Slide the return valve assembly to the tank seat.
6. While holding the return valve assembly, install the four (4) bolts and hand tighten.
7. Torque the bolts to an initial torque: Crossing pattern 2.5 Nm (22 in-lb).
8. Torque the bolts to a final torque: Crossing pattern 10 Nm (7.4 ft-lb).

RETURN VALVE BOLT TORQUE SEQUENCE



9. Inspect the fuel line O-ring and install onto the return valve, torque to 31 Nm (23 ft-lb).
10. Connect the wiring harness to the return solenoid coil.
11. Purge the fuel tank using the Fuel Tank Purging Procedure.
12. Check the return valve assembly and tank lines for leaks using an electronic leak detector or leak detection solution.
13. Reconnect the battery.
14. Perform the Fuel System Priming Procedure.

Tank Fill Valve/Overfill Prevention Device (OPD)



Description

Located where fuel enters the fuel tank, the Fill Valve is opened mechanically by the refueling pump pressure during the fill process. It also incorporates a back-flow check valve and an OPD that stops the fill at 80% of the water capacity. The back-flow check valve closes when vehicle tank pressure is greater than pressure outside of the tank to prevent fuel from escaping.

The marking "Top" on the fill valve needs to face vertically upwards to work properly when installed.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Slowly loosen the fuel line connecting to the OPD.

WARNING

NOTE: This line will be pressurized with liquid propane. Follow all safety precautions described in this manual.

3. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

4. Remove the tank fill line and 90 degree fitting.
5. Remove the fill valve/OPD.

Replacement

NOTE: New Fill Valve/OPDs come with sealant already applied to the threads. If reusing an fill valve/OPD, clean the threads and apply Everseal PLS2 to the threads.

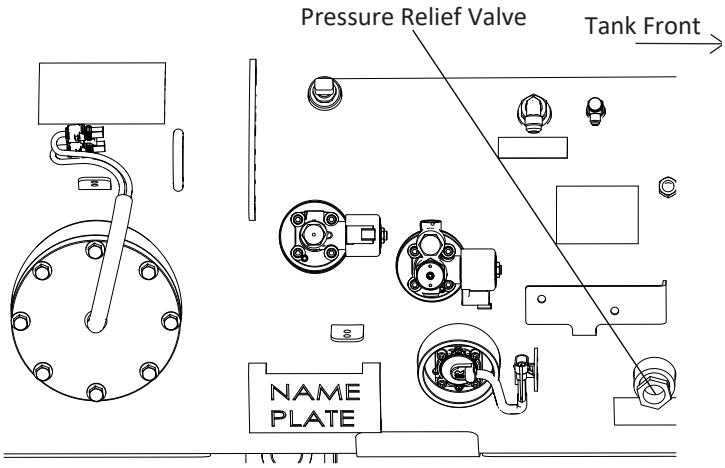
1. Take note of the "Top" mark on the face of the fill valve/OPD.
2. Install the fill valve/OPD and torque to 91 Nm (67 ft-lb).
3. Set a torque wrench to 130 Nm (96 ft-lb) and slowly rotate the Fill Valve/OPD clockwise until the "Top" mark is at the 12 o'clock position. Ensure the wrench does not exceed the torque. Do not turn the valve counter-clockwise if torque is exceeded.
2. Take note of the "Top" mark on the face of the Fill Valve/OPD.
3. Install the OPD and torque to 91 Nm (67 ft-lb).
4. Set a torque wrench to 130 Nm (96 ft-lb) and slowly rotate the fill valve/OPD clockwise until the "Top" mark is at the 12 o'clock position. Ensure the wrench does not exceed the torque. Do not turn the valve counter-clockwise if torque is exceeded.

CAUTION

NOTE: Do not exceed 130 Nm (96 ft-lb) as it could damage the part. If you achieve 130 Nm (96 ft-lb), remove and discard the Fill Valve/OPD. A new part will be required.

5. Connect the fuel fill line to the fill valve/OPD and torque to 45 Nm (33 ft-lb).
6. Purge the fuel tank using the Fuel Tank Purging Procedure.
7. Fill tank and leak check all components that have been serviced in this procedure using an electronic leak detector or an approved leak detection solution.
8. Perform the Fuel System Priming Procedure.

Fuel Tank Pressure Relief Valve (PRV)



Description

The PRV is a safety device that will vent propane vapor out of the tank if the tank exceeds the maximum rated pressure. This would occur if the tank was subjected to extreme temperatures (propane tank pressure changes with temperature) or the tank is overfilled. Depending on vehicle market, this valve is set to vent at 375 psi (approximately 161°F). The PRV activating would be noticed by a loud popping sound followed by a cloud of propane vapor. The valve will reseal once pressure is lowered.

NOTE: If the PRV activates, it must be replaced as the calibration of the spring may be compromised.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

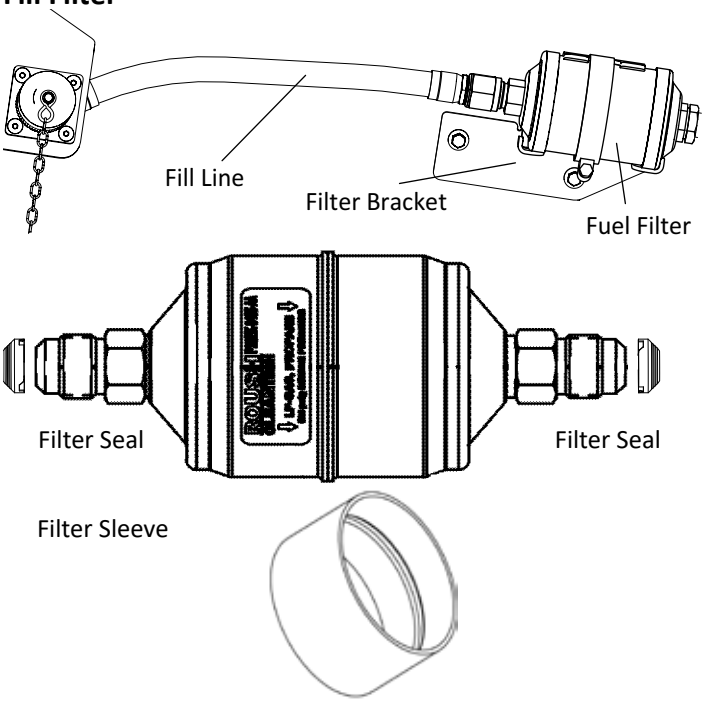
NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

3. Disconnect the fuel pressure relief hose from the pipe away fitting on the tank.
4. Remove pipe away fitting from the PRV.
5. Remove PRV from tank.

Replacement

1. Install the new PRV (thread sealant pre-applied) into the threaded coupling, torque to 120 Nm minimum plus 180-degrees rotation.
2. Purge the fuel tank using the Fuel Tank Purging Procedure.
3. Reconnect the fuel tank PRV hose and clamp.
4. Leak check the PRV using an electronic leak detector or leak detection solution.
5. Reconnect the battery.
6. Perform the Fuel System Priming Procedure.

Fill Filter



Description

The Fill Filter is located on the fill line and filters fuel going into the tank. It has a 5-micron filter element to capture particulates. It is non-bypassing and will slow refueling if it becomes clogged. This filter should be replaced every 50,000 miles and the supply line and fill filters are not interchangeable.

The filter requires a filter sleeve to be place over the filter to ensure a tight fit in the filter bracket, as well as two (2) filter seals that are to be placed on each end of the filter before re-attaching the lines.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Slowly loosen the fitting(s) at the filter to drain the fill lines.

WARNING

NOTE: This line will be pressurized with liquid propane. Follow all safety precautions described in this manual.

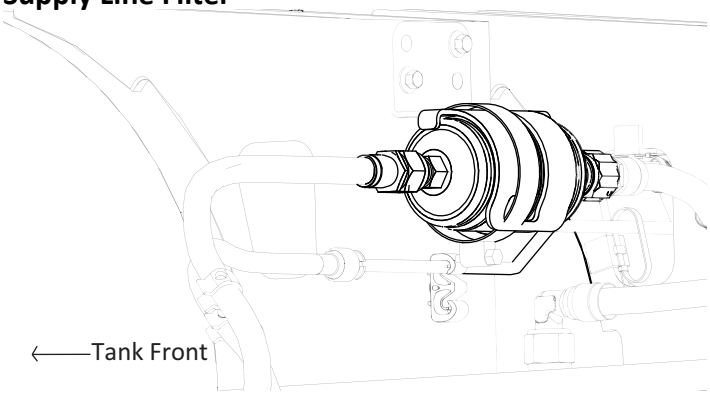
3. Disconnect the fuel fill line from the fuel filter inlet and outlet.
4. Remove the clamp retaining the fuel filter to the body. 5. Remove and discard the filter, sleeve, and filter seals.

NOTE: OPD on tank is back checked to prevent fuel leakage.

Replacement

1. Note filter orientation. There will be an arrow on the filter indicating the direction of flow. Mark the sleeve with the direction flow. Slide filter sleeve over the center of the filter and place the two (2) filter seals over each end of the filter.
2. Connect the fuel fill lines to the filter inlet and outlet and torque to 57 Nm (42 ft-lb).
3. Secure the fuel filter using the originally installed clamp.
4. If the bracket was removed, replace the bracket and install the two (2) mounting bolts. Torque to 10 Nm (7.4 ft-lb).
5. Connect fill valve to a fuel dispensing source to charge line.
6. Check all fittings for leaks using an electronic leak detector or leak detection solution.

Supply Line Filter



The Supply Line Filter is located on bottom of the tank mounted on the cross member. It has a 5 micron filter element, and filters fuel between the fuel tank and the fuel rails. The filter is directional and has arrows indicating fuel flow.

This filter must be replaced every 50,000 miles and whenever a fuel pump assembly is being replaced. A restricted supply line filter could cause driveability concerns. A new supply line filter will be included with every pump assembly. Do not reuse the old filter with a new fuel pump assembly.

NOTE: The supply line and fill filters are not interchangeable.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. De-pressurize the supply line using the Fuel Line Purging Procedure.

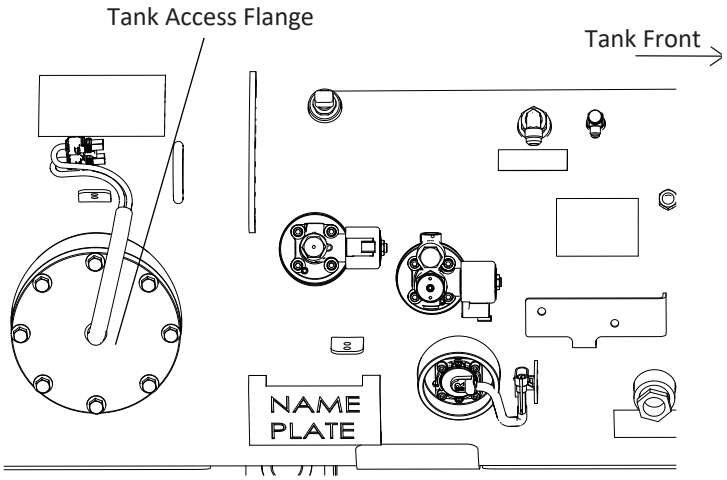
NOTE: You can omit the step where you loosen the fitting at the return valve as only the supply line needs to be depressurized.

3. Using two (2) wrenches, slowly loosen the fittings on the filter.
4. Loosen the filter mounting clamps.
5. Remove the filter from the bracket.

Replacement

1. Install the new supply line filter in the bracket.
2. Tighten the mounting clamps.
3. Install the two (2) fuel lines to the filter and hand-tighten.
4. Counter-brace the filter and torque the inlet line (the line between the filter and tank) to 57 Nm (42 ft-lb).
5. Counter-brace the filter and torque the outlet line (the line between the filter and FRPCM) to 28 Nm (21 ft-lb).
6. Leak check the filter and lines using an electronic leak detector or leak detection solution.
7. Perform the Fuel System Priming Procedure.

Tank Access Flange



Description

The Tank Access Flange serves as a wire pass-through for the fuel pumps and allows access into the tank.

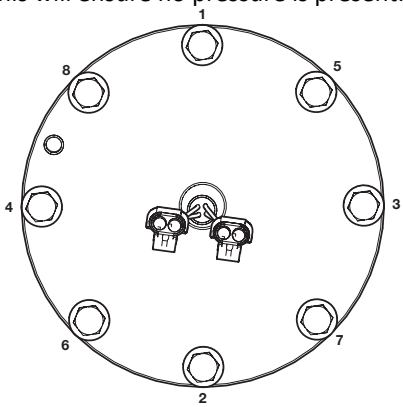
Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

3. Ensure the negative battery cable is disconnected.
4. Disconnect the external fuel pump connectors.
5. Slowly remove the access flange from the tank, loosening bolts in a star-pattern a small amount each time until the cover is loose. This will ensure no pressure is present.

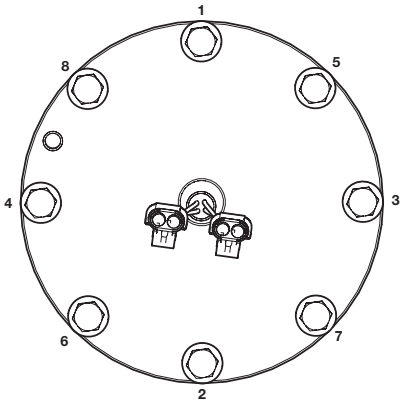


Tank Access Flange Bolt Removal and Installation Torquing Pattern

6. Remove bolts and carefully remove the access flange, taking care not to damage the connected wiring.
7. Reach into the fuel tank and disconnect the fuel pump electrical connectors.
8. Discard the access flange O-ring.

Replacement

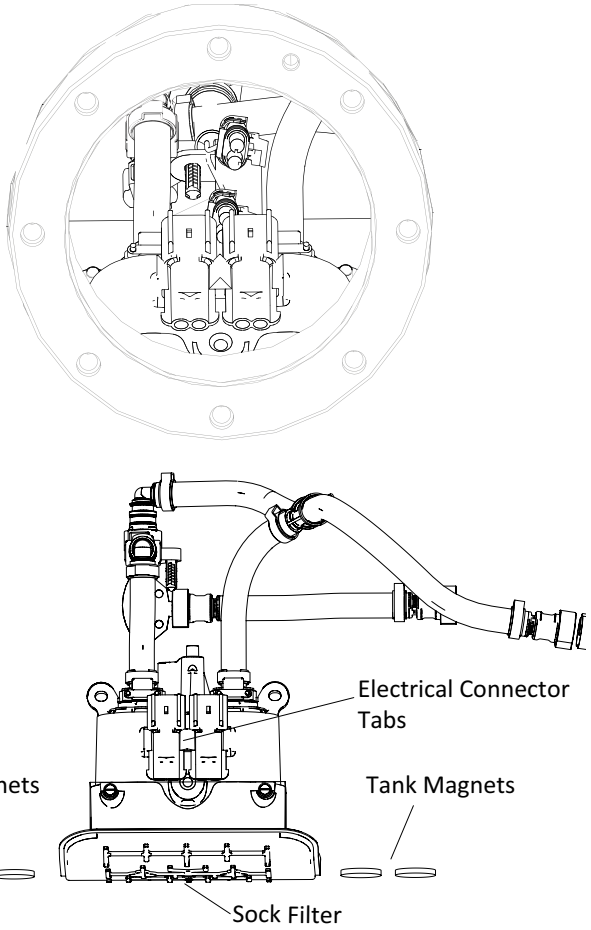
1. Inspect the access flange mounting surface on the tank and remove any debris.
2. Apply silicone O-ring lubricant (Parker Super Lube or equivalent) to the new O-ring and install into the groove in the access flange.
3. Move the access flange near the port and connect the internal fuel pump connectors.
4. Install the access flange on the tank and hand-tighten the eight (8) bolts.



Tank Access Flange Bolt Removal and Installation Torquing Pattern

5. Torque in a cross pattern to an initial torque of 3 Nm (26.5 in-lb). Refer to image for the correct torquing pattern.
6. Torque in a cross pattern to a final torque of 40.6 Nm (30 ft-lb). Refer to the image for the correct torquing pattern.
7. Connect the external fuel pump connectors.
8. Purge the fuel tank using the Fuel Tank Purging Procedure.
9. Leak check access flange and all valves and fittings for leaks using an electronic leak detector or leak detection solution.
10. Reconnect the battery.
11. Perform the Fuel System Priming Procedure.

Fuel Pump Assembly



Description

The ROUSH CleanTech fuel system utilizes two (2) 12-volt in-tank Fuel Pumps. The Fuel Pump assembly is mounted to brackets located in the bottom of the fuel tank. The pumps are serviceable through the service port opening on the bottom of the fuel tank.

The in-tank pumps receive a 12-volt supply when the ignition key is switched on and runs a purge cycle for up to 30 seconds. Each pump is controlled by an Electronic Fuel Pump Relay (EFPR), which are controlled by the PCM. The pump is provided with a constant ground signal. During operation the pump voltage will vary from 7 – 13.5V. The Fuel Pumps are serviced as an assembly.

There is one 15 micron sock filter inside the tank and a 1 micron in-line supply line outside the tank. The filter inside the tank is located on the bottom of the Fuel Pumps at the pump inlet ports. This filter is part of the Fuel Pump assembly and is non-serviceable on it's own. The filter on the outside of the tank is the in-line fuel filter and is located at the front end of the tank, in-line with the fuel supply line. It is recommended that this filter be replaced every 50,000 miles or whenever a Fuel Pump is serviced. The sock filter should last the lifetime of the fuel pump assembly and will not require replacing.

NOTE: For MY 2019 or older Gen 4 vehicles, if no check valve sticker is present on the access flange, attach the sticker from Fuel Pump kit to the outside of the Access Flange. For MY 2019 or newer, no sticker is required.
NOTE: The Fuel Pumps are serviced as an assembly.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

3. Ensure the negative battery cable is disconnected.
4. Remove the tank access flange using the Tank Access Flange Removal Procedure.

NOTE: Use caution when working inside the fuel tank. There could be a flammable mixture of propane and air inside the tank when it's open. Do not use electric tool inside or near an open tank.

5. Release the two (2) hose quick connects from the jet pump assembly by depressing the tabs on both sides of the fitting with your fingers.

NOTE: Use caution to prevent breaking the jet pump assembly.

6. Remove the center 8 mm bolt. Ensure the washer is removed with the fastener as they have a tendency to stick to the Assembly.
7. Remove the two (2) 10 mm nuts from the top corners of the Assembly .
8. Pull the full pump assembly forward off the studs, then lift slightly upward, and remove it from the tank bottom first.
9. Wearing protective gloves, remove the magnets from the bottom of the tank and discard.

NOTE: Slide the magnets to a seam to ease the removal.

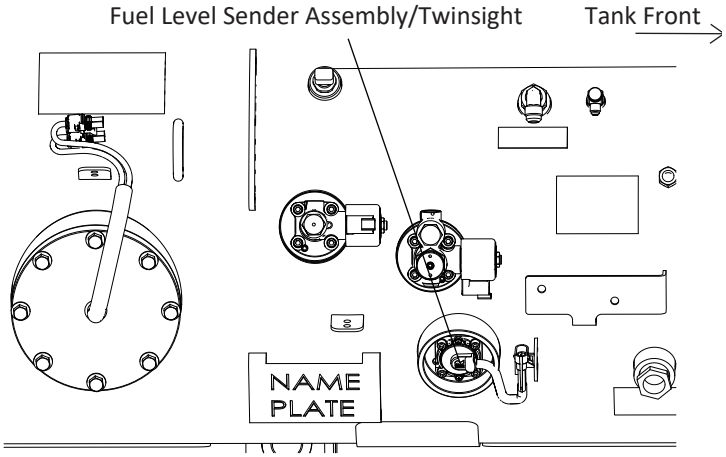
Replacement

1. Replace the Supply Line Filter using the Supply Line Filter Removal Procedure.
2. Install the four (4) magnets at the four corners of the Fuel Pump Assembly.
3. Place the new pump assembly on the two (2) mounting studs and connect the quick connect hoses to the jet assembly.
4. Connect the two (2) hose quick connects to the jet pump assembly. Gently pull on the hoses to ensure the quick connect fittings are fully engaged.
5. Install the center 8 mm bolt and washer and torque to 5.8 Nm (4.3 ft-lb) and washer.
6. Install the two (2) nuts on the bracket studs and torque to 8.5 Nm (6.3 ft-lb).
7. Connect the fuel pump electrical connectors.
8. Install the tank access flange using the Tank Access Flange Replacement Procedure.
9. Purge the fuel tank using the Fuel Tank Purging Procedure.

NOTE: During the Fuel Tank Purging Procedure, after filling with 15 gallons of fuel, stop fueling, close the Bleeder Valve, and start the vehicle. Check for adequate fuel rail pressure (25+ over tank), to ensure everything is connected in the tank. Then turn off vehicle and resume Fuel Tank Purging Procedure.

10. Check the access flange for leaks using an electronic leak detector or leak detection solution.
11. Perform the Fuel System Priming Procedure.

Fuel Level Sender Twinsight



Description

The Fuel Level Sender Twinsight is a Hall-effect sensor magnetically connected to the Fuel Level Sender body by two Phillips-head screws. It can be replaced independently of the fuel level sender.

NOTE: It is normal for the instrument cluster and the dial on the fuel level sender to differ from on another. Always use the fuel gauge on the cluster to more accurately determine the amount of remaining fuel.

Removal

1. Disconnect the twinsight electrical connection.
2. Remove the two (2) Phillips-head screws from the twinsight.

NOTE: Do not loosen or remove the four (4) hex screws as this will remove the fuel level sender assembly If you need to remove the entire sending unit assembly, follow the Fuel Level Sender Assembly Removal Procedure.

3. Remove the twinsight from the fuel level sender assembly.

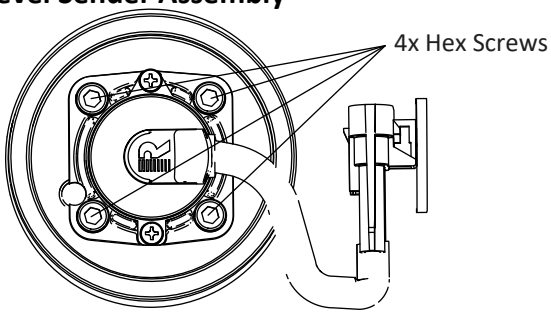
Replacement

1. Using a piece of magnetic metal, such as a socket or extension, (but not a magnet), move the sender needle to 1/2 by moving it along the back side of the twinsight.

NOTE: Failure to move sender needle to 1/2 will lead to incorrect operation and readings from the twinsight, which may lead to fuel transfer issues in dual tank applications.

2. Place the twinsight on the fuel level sender assembly, making sure that the indexing tabs (one square, one round) are installed correctly. The twinsight will sit flush against fuel level sender assembly unit face with no gap if installed correctly.
3. Install the two (2) Phillips-head screws.
4. Connect the twinsight electrical connection.

Fuel Level Sender Assembly



Fuel Level Sender Assembly

Description

The Fuel Level Sender (FLS) measures the liquid level in the fuel tank. It uses a 5V Hall-effect sensor to send a signal to the SRM.

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

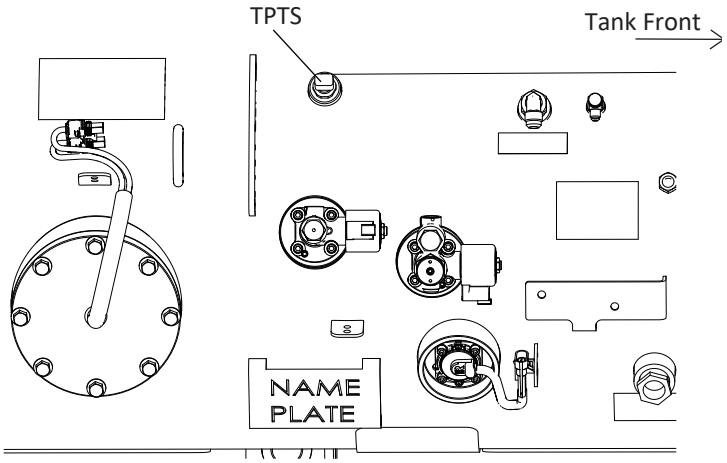
NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

3. Disconnect the sender electrical connection.
4. Slowly loosen the four (4) hex screws securing the sender in a cross pattern until the part can move.
5. Remove the four (4) hex screws.
6. Remove the sender from the fuel tank.

Replacement

1. Inspect sender boss on the fuel tank and remove any debris.
2. Apply silicone lubricant to the Sender O-ring.
3. Install the sender in the fuel tank with the four (4) hex screws. Hand-tighten the screws.
4. Torque the four (4) screws in a cross pattern to an initial torque of 2.5 Nm (22 in-lb).
5. Torque the four (4) screws in a cross pattern to a final torque of 10 Nm (7.4 ft-lb).
6. Connect the wiring to the sender.
7. Purge the fuel tank using the Fuel Tank Purging Procedure.
8. Leak check access flange and all valves and fittings for leaks using an electronic leak detector or leak detection solution.
9. Reconnect the battery.
10. Perform the Fuel System Priming Procedure.

Tank Pressure Temperature Sensor (TPTS)



Tank Bottom

Description

The Tank Pressure Temperature Sensor (TPTS) is a 5V reference sensor that measures both temperature and pressure in the fuel tank. The output from this sensor can be read using the ROUSH Diagnostic Tool (RDT).

Removal

1. Park the vehicle outside in a well-ventilated area.
2. Drain the fuel tank using the Fuel Tank Draining Procedure.

WARNING

NOTE: Be sure that the tank has been completely drained before removing the component from the tank. Refer to the Verifying Tank Depressurization Procedure. Failure to do so could result in severe personal injury or death and/or damage to property.

3. Disconnect the TPTS electrical connection.
4. Slowly remove the TPTS.

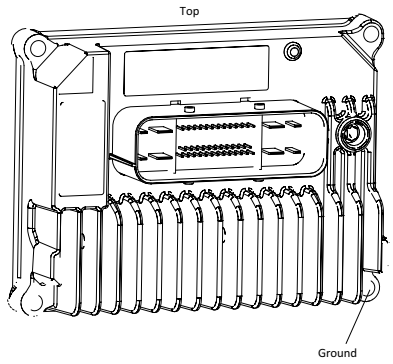
Replacement

1. Lubricate the TPTS O-ring using silicone lubricant.

NOTE: Do not get lubricant on the sensor element.

2. Install the TPTS in the tank and torque to 7 Nm (5.2 ft-lb).
3. Purge the fuel tank using the Fuel Tank Purging Procedure.
4. Leak check access flange and all valves and fittings for leaks using an electronic leak detector or leak detection solution.
5. Reconnect the battery.
6. Perform the Fuel System Priming Procedure.

Smart Relay Module (SRM)



Description

The SRM is an electronic control module that provides additional input/output features required for the propane fuel system via the vehicle's Controller Area Network (CAN) bus. The module is installed on the left front inner fender panel towards the front of the engine bay.

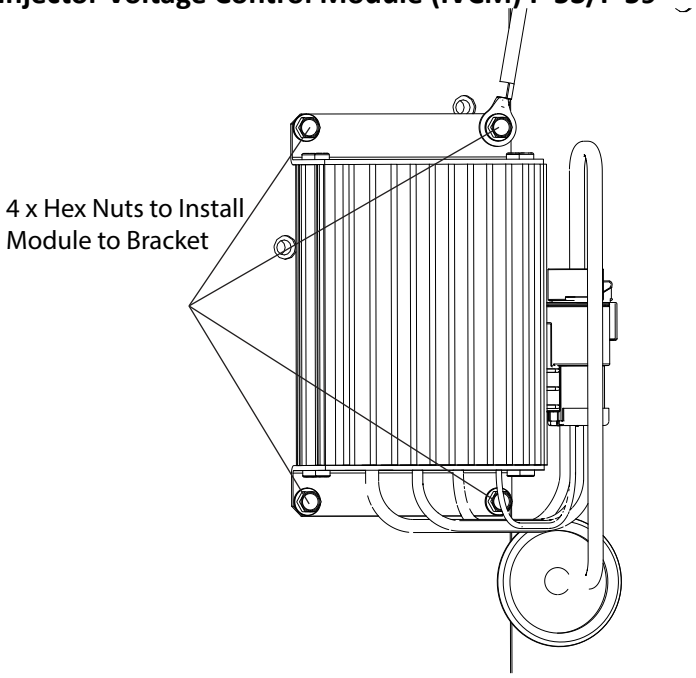
Removal

1. Disconnect the negative battery cable.
2. Disconnect the SRM electrical connector by pressing down the front tab, then pulling up on the connector lock and moving it to the other side of the connector. Carefully move the connector side-to-side when removing. Note connector orientation.
4. Remove the four (4) fasteners and case ground securing the SRM to the bracket and remove the SRM.

Replacement

1. Place the SRM on the bracket as shown, checking for orientation.
2. Install the four (4) mounting fasteners and single case ground and torque to 10 Nm (7.4 ft-lb).
3. Carefully install the SRM electrical connector and lock the connector lock. Push until the connector is fully seated, then carefully close the lever by pulling the lever to the left until it clicks.
4. Reconnect the battery.

Injector Voltage Control Module (IVCM) F-53/F-59



Description

The Injector Voltage Control Module (IVCM), also known as a Voltage Booster Module (VBM), is installed on the firewall on the drivers-side on the F-53/F-59. The IVCM will boost the voltage of the vehicles electrical system to increase fuel delivery through the fuel injectors in high ambient temperature situations.

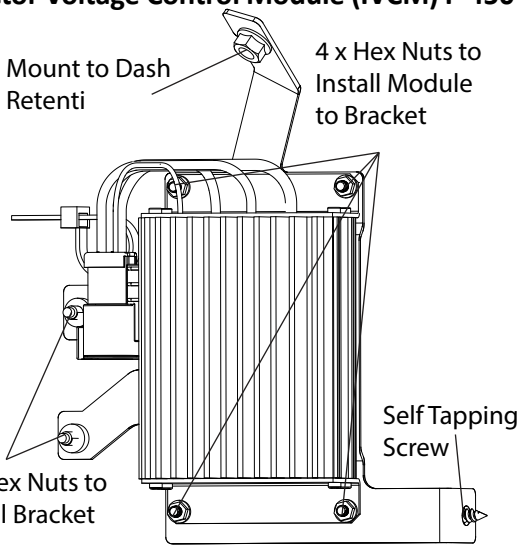
Removal

1. Disconnect the negative terminal of the battery.
2. Locate the IVCM, which is on the drive side near the factory Steering Island.
3. Carefully remove the module wiring harness, which will be located at the top of bracket.
4. Remove the IVCM from the IVCM Bracket by removing the four (4) lock nuts.

Installation

1. Place the new IVCM Module on the IVCM bracket, with the four (4) screw holes fitting over the studs on the bracket.
2. Fasten the four lock nuts. Torque to 5-6 Nm (3.7-4.4 ft-lb).
3. Reconnect the IVCM harness to the IVCM Module.
4. Reconnect the negative terminal of the battery.
5. Contact the ROUSH CleanTech Customer Success Team at 800.59.ROUSH to get a voucher code and family to flash the SRM.

Injector Voltage Control Module (IVCM) F-450 and F-550



The Injector Voltage Control Module (IVCM), also known as a Voltage Booster Module (VBM), is installed on the drivers-side fender on the F-450/F-550 (see above). The IVCM will boost the voltage of the vehicles electrical system to increase fuel delivery through the fuel injectors in high ambient temperature situations.

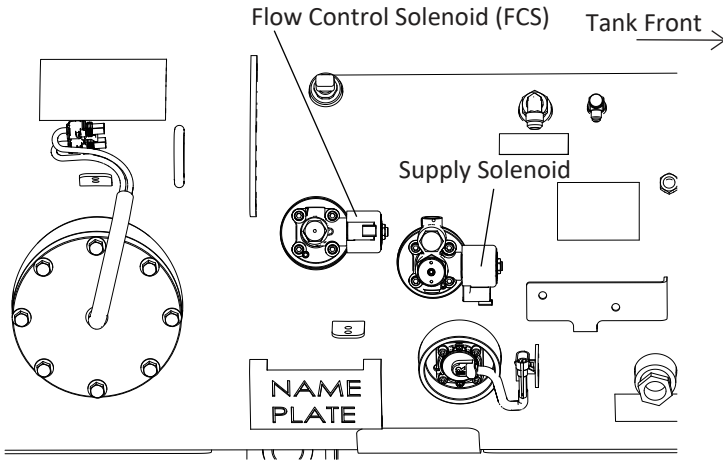
These removal and installation instructions are for the second general IVCM module. If you're vehicle has the first generation kit, please contact the ROUSH CleanTech Customer Success Team at 800.59.ROUSH.

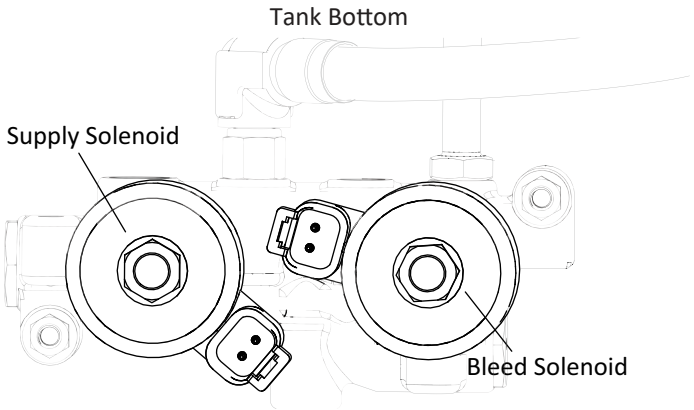
Removal

1. Disconnect the negative terminal of the battery.
2. Remove the driver side kick panel and scuff panel in the drivers footwell.
3. Fold down the knee bolster panel by pulling on the panel next to steering column.
4. Disconnect all electrical connections from the knee bolster panel. Remove the two (2) retaining bolts and remove the panel.
5. Remove the two bolts shown to remove the inner knee bolster.
6. Remove the parking brake release handle
7. Remove the three (3) 8mm bolts from the parking brake assembly and set the parking brake assembly off to the side. **NOTE: Do not disconnect the parking brake cable.**
8. Disconnect the electrical connections to the Trailer Brake Controller Module.
9. Remove the Trailer Brake Controller Module by depressing the tab on the under-side of the module.
10. Locate the IVCM and IVCM bracket. The IVCM itself will be facing towards the fender.
11. Carefully remove the module wiring harness, which will be located at the top of bracket.
12. At the top of the bracket, loosen the M8 nut that is attached to the Dash Retention bolt. **Do not remove the bolt, only loosen so that the bracket can slide out.**
13. Remove the remaining two (2) remaining mounting bolts and pull out the IVCM bracket and module.

NOTE: Save all screws and bolts and mark the mounting holes to ease re-installation. Replace if damaged.

Solenoid Coils





Description

The same Solenoid Coil is used on the Supply Valve, Return Valve, and FRPCM. It is a 12V coil that when energized, opens a valve. The Coils can be replaced independently of the valve assembly without depressurizing the fuel system.

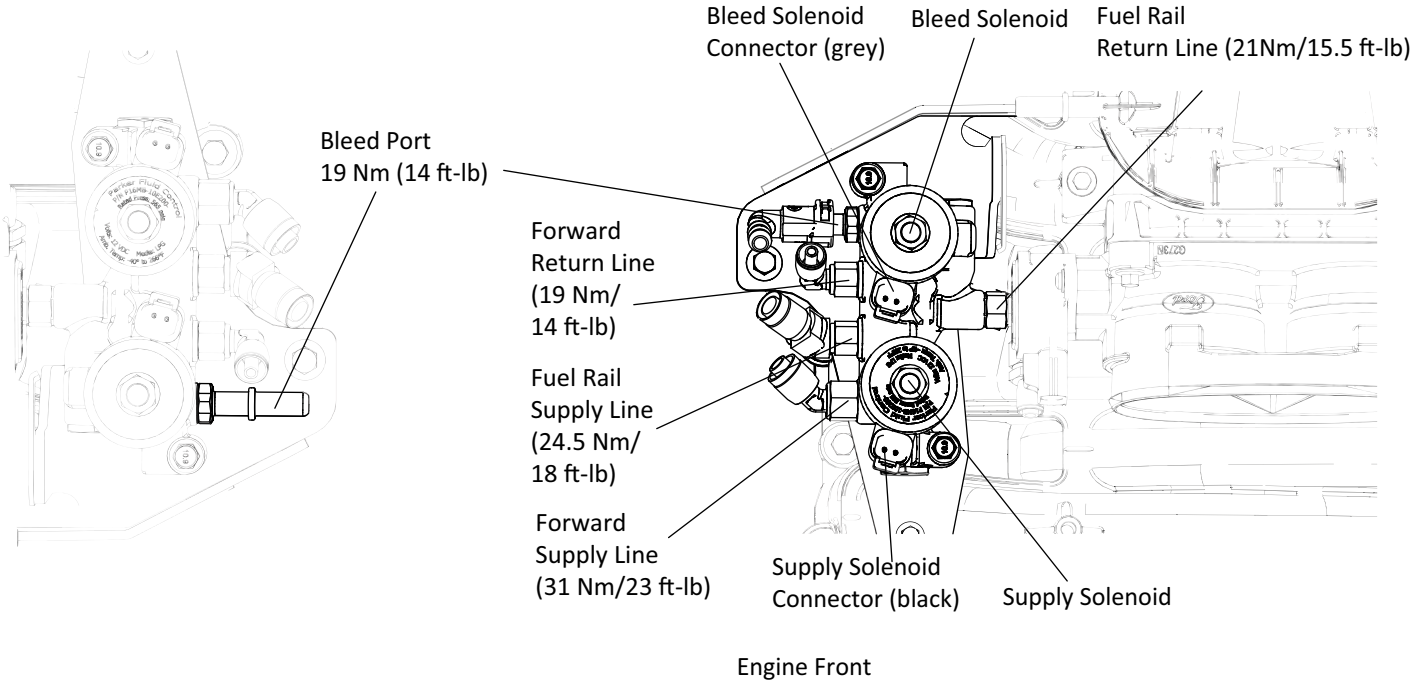
Removal

1. Disconnect vehicle battery and remove 2-pin connection from solenoid to be serviced.
2. Note the coil orientation.
3. Remove the nut, wave washer, and data tag holding the coil onto the solenoid post.
4. Slide coil off the post.

Replacement

1. Leak check and verify that post is clean. If post is not clean, carefully clean the post with mild soap and water solution (do not use corrosive cleaning solutions), ensuring that post is completely dried prior to continuing.
2. Slide new coil onto the post.
3. Position the coil in its original orientation. For the FRPCM, align the two (2) coil connectors with a straight edge.
4. Slide the data tag, wave washer, and nut onto the top of the coil on the solenoid post and torque to 5.4-5.5 Nm (47.5-48.5 in-lb).
5. Reconnect electrical connector to solenoid coil.
6. Reconnect vehicle battery.
7. Start vehicle and perform KOEO/KOER self- test to ensure vehicle is repaired and solenoid faults do not persist.
8. Check the base of the solenoid again post for leaks using an electronic leak detector or leak detection solution.

Fuel Rail Pressure Control Module (FRPCM) and FRPCM Bleed Port



Fuel Rail Pressure Control Module

Description

The FRPCM is a unit consisting of two (2) normally closed solenoids and a return check valve. The FRPCM is controlled directly by the SRM, which is governed by the PCM. Included in the FRPCM are the Supply Solenoid, Bleed Solenoid, Return Check Valve, and the FRPCM Bleed Port.

Removal

1. De-pressurize the fuel system using the Fuel Line Purge Procedure.
2. Disconnect the electrical connector for each FRPCM solenoid. Take note of the connector locations.
3. Remove the fuel lines from the FRPCM.
4. Inspect fuel line O-rings and replace if damaged.
5. Remove the vapor line by squeezing the release tabs on either side of the connector.
6. Remove the two (2) fasteners securing the FRPCM to the bracket.

Replacement

1. Install the FRPCM to the bracket and torque fasteners to 10 Nm (7.4 ft-lb).
2. Install fuel lines starting with the line closest to the bleed port, working forward with the following torque specifications:
   - Forward return line: 19 Nm (14 ft-lb)
   - Fuel rail supply line: 24.5 Nm (18 ft-lb)
   - Forward supply line: 31 Nm (23 ft-lb)
   - Fuel rail return line: 21 Nm (15.5 ft-lb)
3. Connect the wiring harness wiring connectors. Ensure correct connector locations or vehicle will not start.
4. Connect the vapor line.
5. Leak check all FRPCM connection using an electronic leak detector or leak detection solution.
6. Perform the Fuel System Priming Procedure.

FRPCM Bleed Port

Description

The FRPCM bleed port meters the rate that the bleed solenoid can depressurize the Fuel Rails after engine shutdown.

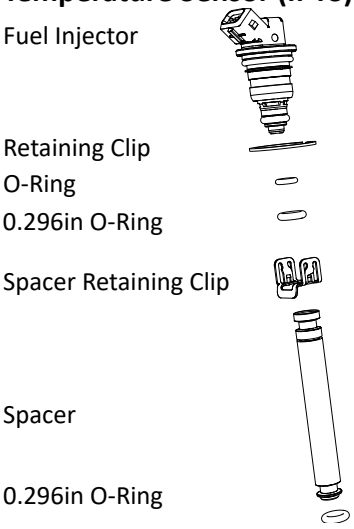
Removal

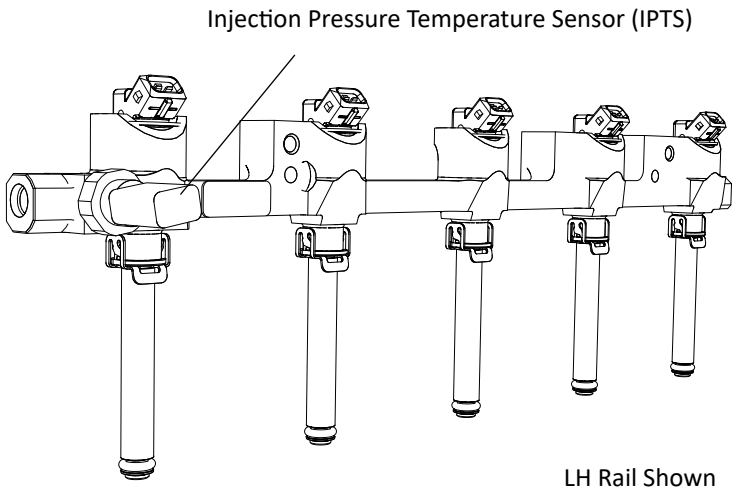
1. Remove the vapor line connecting to the FRPCM bleed port by squeezing the release tabs on either side of the connector.
2. Remove the FRPCM bleed port.

Replacement

1. Install the FRPCM bleed port and torque to 19 Nm (14 ft-lb).
2. Install the vapor line to the FRPCM bleed port.

Fuel Rail Assembly, Fuel Injectors, and Injection Pressure Temperature Sensor (IPTS)





Fuel Rail Assembly

Description

The Fuel Rail Assembly is made up of two Fuel Rails, each mounted to the intake manifold by three brackets. Each Fuel Rail consists of five (5) individual injectors, with the left rail also employing an Integrated Pressure Temperature Sensor.

CAUTION

When removing or replacing any fuel delivery components, which include: fuel rails, injectors, supply lines, thoroughly clean the area around the components to remove any debris or contaminants. Always ensure your hands are clean when handling components to prevent contaminating the fuel delivery system.

Fuel Rail Assembly Removal

1. Park the vehicle outside in a well-ventilated area.
2. Purge the fuel lines using the Fuel Line Purge Procedure.
4. Disconnect the IPTS electrical connection (left fuel rail only).
5. Disconnect all five (5) fuel injector connections.
6. Disconnect the fuel rail supply and return lines from the assembly. Inspect O-rings and replace if damaged.
7. Remove the two (2) bolts connecting the assembly to the intake manifold.
8. Lift upward to remove the Fuel Rail from the intake manifold.

Fuel Rail Assembly Replacement

1. Lubricate the injector spacer tube O-rings with clean engine oil or silicone O-ring lubricant.
2. Insert the Fuel Rail into the intake manifold, pushing down firmly to seat the O-rings.
3. Install the two (2) bolts connecting the fuel rail to the intake manifold, torque to 10 Nm (7.4 ft-lb).
4. Connect the fuel rail supply and return lines to the assembly.
5. Torque line fittings to 21 Nm (15.5 ft-lb).
6. Connect IPTS electrical connector (left Fuel Rail only).
7. Connect the fuel injector electrical connectors.
8. Perform the Fuel System Priming Procedure.
9. Leak check all spacer tubes and fuel lines connections on the fuel rail assembly using an electronic leak detector or leak detection solution.

Fuel Injectors

Description

The five (5) Fuel Injectors are mounted in each fuel rail and inject liquid propane into the intake manifold.

Fuel Injector Removal

1. Purge the fuel lines using the Fuel Line Purge Procedure.
2. Disconnect the fuel injector electrical connector.
3. Using snap-ring pliers, remove the C-clip retaining the injector.
4. Pull up firmly on the injector.

Replacement

1. Lubricate the new fuel injector O-ring with clean engine oil or silicone lubricant.
2. Install the injector into the fuel rail, pressing down firmly to fully seat the injector.
3. Install the retaining C-clip.

NOTE: Insure that the C-clip is fully seated.

4. Install the injector electrical connector.
5. Leak check the injector using an electronic leak detector or leak detection solution.
6. Perform the Fuel System Priming Procedure.

Integrated Pressure Temperature Sensor (IPTS)

Description

The IPTS is a 5V reference sensor mounted at the front of the left fuel rail. It measures pressure and temperature of fuel in the rail. The fuel rail pressure and temperature reading is important for the start sequence, injector pulse width, as well as other functions.

Removal

1. De-pressurize the fuel rail using the Fuel Line Purge Procedure.
2. Disconnect the IPTS electrical connector.
3. Remove the IPTS.

Replacement

1. Install the IPTS and torque to 7 Nm (5.2 ft-lb).
2. Connect the IPTS electrical connector.
3. Leak check the IPTS with an electronic leak detector or leak detection solution.
4. Perform the Fuel System Priming Procedure.

TORQUE CHART

Qty.	Component	Torque
FRPCM		
1	Bleed Port	19 Nm +/-1 (14 ft-lb)
1	Fuel Return Inlet	19 Nm +/-2 (14 ft-lb)
1	Fuel Rail Return Outlet	19 Nm +/-2 (14 ft-lb)
1	Fuel Rail Supply Outlet	24.5 Nm +/-2.5 (17.8 ft-lb)
1	Fuel Rail Supply Inlet	31 Nm +/-2 (23 ft-lb)
2	M6 Nuts (to weld studs)	5 Nm (3.7 ft-lb)
FRPCM Bracket		
2	Bracket Bolts (M6)	10 Nm (7.4 ft-lb)
1	Bracket Bolts (M8)	25 Nm (18.4 ft-lb)
Fuel Rail		
1	Supply Line Fitting	21 Nm (15.5 ft-lb)
IPTS		
1	IPTS	7 Nm (5.2 ft-lb)
Fuel Pump		
1	Center 8mm bolt	5.8Nm (4.3 ft-lb)
2	Nut on Bracket Studs	8.5 Nm (6.3 ft-lb).
External Tank Components		
	Tank Cover Plate	
4	Fasteners	10 Nm (7.4 ft-lb)
	Tank Bleeder Valve	
1	Bleeder Valve	20 Nm (15 ft-lb)
1	Bleeder Valve Line	18.5 Nm (13.5 ft-lb)
Tank Supply Valve		
4	Tank Supply Valve	10 Nm (7.4 ft-lb)
1	Fuel Line	31 Nm (23 ft-lb)
1	Nut (with washer and data tag)	5.5 Nm (47.5 in-lb)
Tank Return Valve		
1	Fuel Line	31 Nm (23 ft-lb)
4	Tank Return Valve	10 Nm (7.4 ft-lb)
1	Nut (with washer and data tag)	5.5 Nm (47.5 in-lb)
OPD		
1	OPD	91 + Orientation to 12 o'clock, not to exceed 130Nm
1	Fill Filter line	57 Nm (42 ft-lb)
PRV		
1	PRV	120 Nm (89 ft-lb), min +180 degree rotation

Qty.	Component	Torque
Tank Service Cover		
8	Bolts	Initial: 3 Nm (26.5 in-lb) Final: 40.6 Nm (30 ft-lb).
Fuel Level Sender Assembly		
4	Hex screws	2.5 Nm (22 in-lb)
4	Hex screws	10 Nm (7.4 ft-lb)
TPTS		
1	TPTS	7 Nm (5.2 ft-lb)
SRM		
4	Fasteners	10 Nm (7.4 ft-lb)
Fill Filter		
2	Fill Lines	57 Nm (42 ft-lb)
2	Bracket Mounting bolts	10 Nm (7.4 ft-lb)
Supply Line		
1	Inlet Supply Line	57 Nm (42 ft-lb)
1	Outlet Supply Line	28 Nm (21 ft-lb)

THE ROUSH DIAGNOSTIC TOOL

The Roush Diagnostic Tool (RDT) is a free desktop application available from ROUSH CleanTech for PCM and SRM calibration, performing advanced driveability diagnostics, relaying information directly to the ROUSH CleanTech hotline, DTC reading and clearing, and KOEO/KOER functions on Gen 3, Gen 4, Gen 5 vehicles.

Required Equipment to Use RDT

Performing electronic diagnostics on a ROUSH CleanTech vehicle using the ROUSH Diagnostic Tool (RDT) requires the use of:

- a laptop with Windows 7 or higher operating system,
- a reliable wifi or ethernet internet,
- a capable J2534 pass-thru OBD II device,

Downloading and Installing the ROUSH Diagnostic Tool

RDT is licensed per machine, so the software can only be used on the machine that it has been downloaded to.

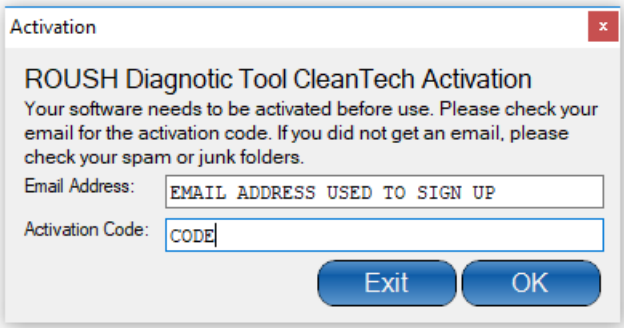
Prior to installing RDT, install all of the drivers required for the chosen J2534 pass-thru device. Consult the installation instructions for the chosen pass-thru device to ensure drivers are properly downloaded and installed.

To Download:

1. Access the ROUSH Diagnostic Tool page on the ROUSH CleanTech service website to start the download process. The Google Chrome browser works best for downloading RDT.
2. Complete all of the required fields and click "Submit".
3. Click on "ROUSH CleanTech Client" to download RDT for ROUSH CleanTech. The ROUSH Performance Client will not work with a ROUSH CleanTech Vehicle.

To Install:

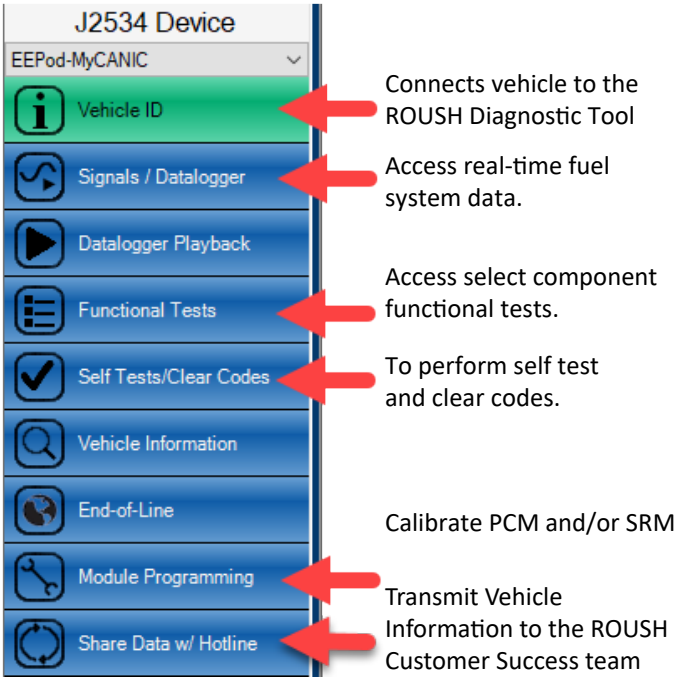
1. Locate the file that was downloaded and then click Run to start the installation process.
2. Review and agree to the licensing terms and begin the install, which may take several minutes depending on your internet speed.
3. Locate ROUSH Diagnostic Tool icon on the desktop and open the program. Read and Accept the warning.
4. Enter email address that was registered and software activation code from above.
5. After installation, close and re-start your laptop before first use.



Utilizing the ROUSH Diagnostic Tool

NOTE: A reliable internet connection is required at all times when working with RDT. Any disruptions in the internet signal may lead to potential component issues or requiring processes to be started over.

1. Verify that your laptop is connected to a reliable wifi signal or ethernet connection.
2. Locate the RDT icon on the desktop and open the program. If multiple pass-thru devices have been used, select the chosen device via the drop down menu. Follow any messages from RDT to finish the device selection process.
3. Select Vehicle ID and verify that the VIN and vehicle type are correct. This is required prior to use any functions within RDT.
4. Select the function that is required.
   - To access data on various vehicle functions through the use of RDT PIDs, click on Signals/Datalogger.
   - To access Output State Controls, the Fuel Pump Performance test, Fuel Transfer test, or Misfire test, select Functional Tests.
   - To Self Tests, KOEO and KOER tests, or remove DTC codes, select Self Tests/Clear Codes.
   - To calibrate the PCM or SRM, select Module Programming (see https://rctws.force.com/rct/s/article/What-is-the-ROUSH-Diagnostic-Tool-RDT for more information on PCM and SRM voucher codes)



For any other questions please contact ROUSH CleanTech Customer Success Team at (800) 59-ROUSH (597-6874), Opt. 2.

RDT PID List for Gen 4 Vehicles

Name	PCM Parameter
Fuel Tank Pressure (PsiA)*	**Rpr_pt_prs**
Fuel Rail Pressure (PsiA)*	**rpr_fr_prs**
Fuel Rail Target Pressure (PsiA)*	**rpr_fr_prs_tgt**
Fuel Pump Duty Cycle*	**rf_dc**
Fuel Rail Pressure (PsiA)	rf_ap_actual
Fuel Tank Pressure (volts)	rpr_pt_prs_volts
Fuel Tank Temperature (F)	rpr_pt_temp
Fuel Tank Temperature (volts)	rpr_pt_temp_volts
Fuel Rail Pressure (volts)	mux_rpr_rail_pres
Fuel Rail Temperature (F)	rpr_fr_temp
Fuel Rail Temperature (F)	ful_railtemp
Fuel Rail Temperature (volts)	mux_rpr_rail_temp
Propane State (unitless)	rpr_state
Adaptive Vapor Offset (PsiA)	rpr_vpr_prs_offset_flt_m
Adaptive Vapor Maturity Index	rpr_adap_vpr_offset_refuel_m_index
Fuel Rail Saturation Pressure Adapted (PsiA)	rpr_fr_adap_prs_sat_fnl
Fuel Rail Saturation Pressure (PsiA)	rpr_fr_prs_sat
Supply Solenoid 1 Command (Flag)	rpr_ss1_cmd
Supply Solenoid 2 Command (Flag)	rpr_ss2_cmd
Bleed Solenoid Command (Flag)	rpr_bs_cmd
Flow Control Solenoid Command (Flag)	rpr_fcs_cmd
Fuel rail target Pressure (PsiA)	rpr_fr_prs_tgt
Fuel Rail Bleed Status (SRM)	mux_rpr_bleed_status
Secondary Tank Pressure (PsiA)	mux_rpr_slv_tank_prs
Secondary Tank Transfer in Progress (Flag)	mux_rpr_reful_inprg
Supply Solenoid 1 Status (Bit map)	mux_rpr_ss1_status
Supply Solenoid 2 Status (Bit map)	mux_rpr_ss2_status
Supply Solenoid 3 Status (Bit map)	mux_rpr_ss3_status
Flow Control Solenoid Status (Bit map)	mux_rpr_fcs_status
Bleed Solenoid Status (Bit map)	mux_rpr_bs_status
SRM CALID	mux_rpr_srm_ver
SRM PRV setting (Psi)	mux_rpr_prv_max_prs
Fuel Rail Pressure After Bleed (PsiA)	mux_rpr_bleed_prs
Fuel Rail Temperature After Bleed (F)	mux_rpr_bleed_temp
Primary Tank Fuel level (Counts)	MUX_FUELLVL_ACTV_SIDE
Secondary Tank Fuel level (Counts)	MUX_FUELLVL_PSSV_SIDE
Supply Solenoid 1 fault bit (Flag)	MUX_RPR_SS1_FAULT
Supply Solenoid 2 fault bit (Flag)	MUX_RPR_SS2_FAULT
Supply Solenoid 3 fault bit (Flag)	MUX_RPR_SS3_FAULT
Bleed Solenoid fault bit (Flag)	MUX_RPR_BS_FAULT
Flow Control Solenoid fault bit (Flag)	MUX_RPR_FCS_FAULT

ROUSH Diagnostic Tool Datalogger/PID Seelction List

RPR_PT_PRS	RPR_PT_PRS_VOLTS	RPR_PT_TEMP	RPR_PT_TEMP_VOLTS	RPR_FR_PRS
RF_AP_ACTUAL	MUX_RPR_RAIL_PRES	RPR_FR_TEMP	FUL_RAILTEMP	MUX_RPR_RAIL_TEMP
RPR_STATE	RPR_FR_PRS_SAT	RPR_SS1_CMD	RPR_SS2_CMD	RPR_BS_CMD
RPR_FCS_CMD	RPR_FR_PRS_TGT	MUX_RPR_BLEED_STATUS	MUX_RPR_SLV_TANK_PRS	MUX_RPR_REFUL_INPRG
MUX_RPR_SS1_STATUS	MUX_RPR_SS2_STATUS	MUX_RPR_SS3_STATUS	MUX_RPR_FCS_STATUS	MUX_RPR_BS_STATUS
MUX_RPR_SRM_VER	MUX_RPR_PRV_MAX_PRS	MUX_RPR_BLEED_PRS	MUX_RPR_BLEED_TEMP	ACT
ECT	KAMRF[0]	KAMRF[1]	LAMBSE[0]	LAMBSE[1]
FADPT_COL[0][0]	FADPT_COL[0][1]	FADPT_COL[0][2]	FADPT_COL[0][3]	FADPT_COL[0][4]
FADPT_COL[1][0]	FADPT_COL[1][1]	FADPT_COL[1][2]	FADPT_COL[1][3]	FADPT_COL[1][4]
MUX_FUELLVL_ACTV_SIDE	MUX_FUELLVL_PSSV_SIDE	MUX_RPR_SS1_FAULT	MUX_RPR_SS2_FAULT	MUX_RPR_SS3_FAULT
MUX_RPR_BS_FAULT	MUX_RPR_FCS_FAULT	ENGINE_SPEED	LOAD	RF_DC
ESL_CTL_TG	FP_INPUT_VLT	RF_ADAPT[1][1]	RF_ADAPT[1][2]	RF_ADAPT[2][1]
RF_ADAPT[2][2]	AAT1_ENG	IAT11_ENG	IAT12_ENG	MCT
MAP	IMRCM2_VOLTS	IMRCM_VOLTS	IAT11_VOLTS	IAT12_VOLTS
MAP_VOLTS	TPP_FMEM	INJDC_AIRLMT	RF_DP_ACTUAL	RF_DPREF
ETC_FMM_MODE__A	MAP_STATUS	BP	CHT_ENG	INALT_VBATTERY
FLI_ENG1	RPR_FP_V_FLOWRATE	LAM_30MS[0]	LAM_30MS[1]	VBAT
MIS_RATE200	MIS_RATE1000	RPR_FP_DP_INJ_CLIP_FLG	RPR_FP_DP_INJ_MAX	INFAMB_KAM
RPR_SMR_TMR	RPR_FR_TEMP_TGT	SOAK_TIME	FLI_ENG	MUX_RPR_SLV_PUMP_FAULT

**RDT is routinely updated to optimize performance and bring on new features.
This screen is subject to change based upon updates and new features.

DIAGNOSTIC TROUBLE CODES

Code	Description
P0005	Fuel Shutoff Valve “A” Control Circuit/Open
P0090	Fuel Pressure Regulator Circuit/Open
P009B	Fuel Pressure Relief Control Circuit/Open
P009E	Fuel Pressure Relief Control Performance/Stuck Off
P009F	Fuel Pressure Relief Control Stuck On
P0148	Fuel Delivery Error
P0171	System Too Lean (Bank 1)
P0172	System Too Rich (Bank 1)
P0174	System Too Lean (Bank 2)
P0175	System Too Rich (Bank 2)
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance
P0182	Fuel Temperature Sensor “A” Circuit Low
P0183	Fuel Temperature Sensor “A” Circuit High
P019F	Fuel Vapor Pressure Excessive - Low
P0190	Fuel Rail Pressure Sensor Circuit (Bank 1)
P0192	Fuel Rail Pressure Sensor Circuit Low (Bank 1)
P0193	Fuel Rail Pressure Sensor Circuit High (Bank 1)
P01A0	Alternate Fuel Tank “A” Pressure Sensor Circuit Low
P01A1	Alternate Fuel Tank “A” Pressure Sensor Circuit High
P01A2	Alternative Fuel Tank “A” Pressure Sensor Circuit Intermittent/Erratic
P01AC	Alternate Fuel Tank Temperature Sensor Circuit Low
P01AD	Alternate Fuel Tank Temperature Sensor High
P01AE	Alternate Fuel Tank Temperature Sensor Circuit Intermittent/Erratic
P025A	Fuel Pump Module “A” Control Circuit/Open
P025B	Fuel Pump Module “A” Control Circuit Range/Performance
P027B	Fuel Pump Module “B” Control Circuit Range/Performance
P03xx	Misfire
P0442	EVAP System Leak Detected (small leak)
P0443	EVAP System Purge Control Valve “A” Circuit
P0446	EVAP System Vent Control Circuit
P0451	EVAP System Pressure Sensor/Switch Range/Performance
P0452	EVAP System Pressure Sensor/Switch Low
P0453	EVAP System Pressure Sensor/Switch High
P0454	EVAP System Pressure Sensor/Switch Intermittent
P0455	EVAP System Leak Detected (large leak)
P0456	EVAP System Leak Detected (very small leak)
P0461	Fuel Level Sender “A” Circuit Range/Performance
P0462	Fuel Level Sender “A” Circuit Low
P0463	Fuel Level Sender “A” Circuit High
P0627	Fuel Pump “A” Control Circuit Open
P064A	Fuel Pump Control Module “A”
P1070	Fuel Vapor Pressure Excessive - High

Code	Description
P116E	Fuel Pressure Relief Valve Actuated
P1378	Fuel Injector Control Module System Voltage Low
P1379	Fuel Injector Control Module System Voltage High
P1450	Unable to Bleed Up Bleed Fuel Tank Vacuum
P1453	Fuel Tank Pressure Relief Valve Malfunction
P1456	Fuel Tank Temperature Sensor Circuit Malfunction
P2195	Heated Exhaust Gas Oxygen Sensor Stuck
P2197	Heated Exhaust Gas Oxygen Sensor Stuck
P25B0	Fuel Level Sensor “A” Stuck
P2632	Fuel Pump “B” Control Circuit/Open
P2665	Fuel Shutoff Valve “B” Control Circuit/Open
P26B3	Fuel Shutoff Valve “A” Control Circuit Performance/ Stuck Off
P26B5	Fuel Shutoff Valve “B” Control Circuit Performance/ Stuck Off
P26EA	Fuel Pump Control Module “B”
U0108	Lost Communication with Alternative Fuel Control Module
U0109	Lost Communication with Fuel Pump Control Module “A”
U016C	Lost Communication with Fuel Pump Control Module “B”
U210B	Lost Communication Between Fuel Pump Control Module “A” and Restraint Control Module
U210C	Lost Communication Between Fuel Pump Control Module “B” and Restraint Control Module

DIAGNOSTIC TROUBLE CODES EXPLAINED

All diagnostic trouble codes (DTCs) known to be affected by the propane fuel system are covered in this manual. For all other DTCs, refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual.

P0005 — Fuel Shutoff Valve "A" Control Circuit Open	
Description	Tank solenoid circuit fault. The SRM monitors tank solenoid circuit for open and short circuit faults.
Possible Causes	• Blown fuse • Short to voltage • Water in the harness connector • Open power circuit • Open GND circuit • Low battery voltage • Corrosion • Incorrect connections • Damaged tank solenoid coil
Symptom	Vehicle does not start. The pumps run but no pressure builds in the fuel rail.
Diagnostic Aid	Check the FRPCM and SRM electrical connectors for damage, corrosion and water intrusion.
Action	Refer to the Tank Solenoid Electrical Check procedure in Diagnostic Tests and Procedures.

P0090 — Fuel Pressure Regulator Circuit Open	
Description	Flow Control Solenoid (FCS) circuit fault. SRM monitors FCS circuit for open and short circuit faults.
Possible Causes	• Blown fuse • Debris in flow control solenoid forcing open • Damaged Flow control solenoid coil (FCS) • Incorrect connections • Water in the harness connector • Ground circuit • Low battery voltage
Symptom	Fuel pressure in the rail does not change when commanded. Extended fuel rail flush time.
Diagnostic Aid	Check the flow control solenoid electrical connector for damage, corrosion and water intrusion.
Action	Refer to the Return Valve Procedure in Diagnostic Tests and Procedures.

P009B — Fuel Pressure Relief Control Circuit Open	
Description	Bleed solenoid circuit fault. The SRM monitors the bleed solenoid circuit for open and short circuit faults.
Possible Causes	• Short to voltage • Water in the harness connector • Open power circuit • Open GND circuit • Low battery voltage • Corrosion • Incorrect connections • Damaged bleed solenoid coil
Symptom	Fuel rail bleed system does not operate correctly. There is a potential for fuel odor or hard start.
Diagnostic Aid	Check the FRPCM and SRM electrical for damage, corrosion and water intrusion.
Action	Refer to the Fuel Rail Pressure Control Module Electrical Check procedure in Diagnostic Tests and Procedures.

P009E/P26B3 — Fuel Pressure Relief Control Performance Stuck Off/Fuel Shutoff Valve "A" Control Circuit Performance Stuck Off	
Description	Fuel rail failed to bleed. The PCM measures fuel rail pressure on key-up to determine if fuel rail has been properly bled.
Possible Causes	• Blown fuse (P009E) • Bleed solenoid did not open (P009E) • Bleed port (bleed rate restrictor in outlet to VMV) clogged (P009E) • EVAP line kinked (P009E) • Low battery voltage (P009E) • FRPCM check valve leaked (P26B3) • FRPCM supply solenoid leaked (P26B3)
Symptom	Fuel pressure present in the fuel rail after bleed event should have occurred; this may result in hard starts.
Diagnostic Aid	Check that FRPCM bleeds fuel from rail. Leaks to FRPCM can also trigger a fault.
Action	Refer to the Fuel System Fails to Bleed procedure in Diagnostic Tests and Procedures.

P009F — Fuel Pressure Relief Control Circuit Stuck On	
Description	Bleed solenoid stuck open. While the engine is running, the PCM seals the EVAP system and checks for a rise in pressure. If pressure in the EVAP system exceeds the threshold, a fault is set.
Possible Causes	• Bleed Solenoid short to GND (ground) • Debris in bleed solenoid forcing open • Solenoid seal compromised
Symptom	There is a potential fuel odor. This is MIL setting fault to aid the technician in diagnosing a possible fuel system fault.
Diagnostic Aid	Evap lines are frosted when solenoid is stuck open.
Action	Refer to the Fuel Rail Pressure Control Module Electrical Check procedure in Diagnostic Tests and Procedures.

P0148 — Fuel Delivery Error	
Description	To maintain target fuel rail pressure increase, the fuel pump voltage has been increased to a maximum adaptive limit and the fuel trims have gone lean.
Possible Causes	• Tank manual shutoff valve not completely open • Fuel pump wiring or fuse faults • Severely restricted fuel filter • Severely restricted fuel supply line • Damaged or worn fuel pump • Excess flow valve tripped • Tank supply solenoid or FRPCM supply solenoid closed
Symptom	Vehicle hesitation or stall condition, accompanying misfire or cylinder misfire codes
Diagnostic Aid	This is a non-MIL setting DTC to aid the technician in diagnosing a possible fuel system fault. Do not diagnose if no symptoms or other fault codes are present.
Action	If other fault codes are present, diagnose those first. If symptoms are present, refer to diagnostic flow chart for that vehicle symptom.

P0171, P0174 — System Too Lean (Bank 1 and Bank 2 respectively)	
Description	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for more descriptive information.
Possible Causes	• The propane system was operated in the vapor region • Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for a list of other causes.
Symptom	—
Diagnostic Aid	Verify that no fuel system faults are present and then follow the Ford Powertrain Control/Emissions Diagnosis Service Manual procedure.
Action	Refer to the Engine Stumble, Stall, Rough Idle AND Fuel Pressure Drop procedure in Diagnostic Tests and Procedures.

P0172, P0175 — System Too Rich (Bank 1 and Bank 2 respectively)	
Description	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for more descriptive information.
Possible Causes	• The propane system was operated in the vapor region • Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for a list of other causes.
Symptom	—
Diagnostic Aid	Verify that no fuel system faults are present and then follow the Ford Powertrain Control/Emissions Diagnosis Service Manual procedure.
Action	Refer to the Engine Stumble, Stall, Rough Idle AND Fuel Pressure Drop procedure in Diagnostic Tests and Procedures.

P0181 — Fuel Temperature Sensor “A” Circuit Range/Performance	
Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Damaged Injection Pressure Temperature Sensor (IPTS) • CAN bus fault between the SRM and PCM • Injection Pressure Temperature Sensor (IPTS) failure • Incorrect harness connection • Wiring fault between Integrated Pressure Temperature Sensor (IPTS) and SRM • SRM failure
Symptom	—
Diagnostic Aid	Verify the fuel rail temperature PID value to determine open or short.
Action	Refer to the Injection Pressure Temperature Sensor Electrical Check procedure in Diagnostic Tests and Procedures.

P0182 — Fuel Temperature Sensor “A” Circuit Low	
Description	The SRM reads the IPTS and passes the voltage reading over the CAN to the PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Wiring fault between Integrated Pressure Temperature Sensor (IPTS) and SRM • Short to ground • VREF open or short • CAN bus fault between the SRM and PCM • Low ambient temperature operation • Incorrect harness connection • Integrated Pressure Temperature Sensor (IPTS) failure • SRM failure • Damaged IPTS (or FTS)
Symptom	—
Diagnostic Aid	Verify the fuel rail temperature PID value to determine open or short.
Action	Refer to the Injection Pressure Temperature Sensor Electrical Check procedure in Diagnostic Tests and Procedures.

P0183 — Fuel Temperature Sensor “A” Circuit High	
Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Incorrect harness connection • Wiring fault between IPTS and SRM • Open circuit • Short to power • CAN bus fault between the SRM and PCM • Low ambient temperature operation • Integrated Pressure Temperature Sensor (IPTS) failure • SRM failure • Damaged Integrated Pressure Temperature Sensor (IPTS)
Symptom	—
Diagnostic Aid	Verify the fuel rail temperature PID value to determine open or short.
Action	Refer to the Injection Pressure Temperature Sensor Electrical Check procedure in Diagnostic Tests and Procedures.

P0190 — Fuel Rail Pressure Sensor Circuit	
Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• CAN bus fault between the SRM and PCM • Wiring fault between IPTS and SRM • VREF open in harness • VREF open in sensor • Vacuum leaks • IPTS failure • SRM failure
Symptom	—
Diagnostic Aid	VREF should be between 4.5-5.5 volts.
Action	Refer to the Injection Pressure Temperature Sensor Electrical Check procedure in Diagnostic Tests and Procedures.

P019F— Fuel Vapor Pressure Excessive - Low	
Description	Tank pressure is lower than expected for current temperature.
Possible Causes	• Non HD-5 fuel in tank • Faulty tank pressure temperature sensors (TPTS)
Symptom	Check engine light.
Diagnostic Aid	Resolve any sensor faults prior to diagnosing this code.
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P0192 — Fuel Rail Pressure Sensor Circuit Low	
Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• CAN bus fault between the SRM and PCM • Wiring fault between IPTS and SRM • IPTS FRP signal short to SIG RTN or PWR GND • Damaged IPTS (or FRP) • IPTS failure • SRM failure
Symptom	—
Diagnostic Aid	A FRP PID value during ignition ON, engine OFF, or ignition ON, engine running is less than 0.3 volt. This indicates a concern is present.
Action	Refer to the Injection Pressure Temperature Sensor Electrical Check procedure in Diagnostic Tests and Procedures.

P0193 — Fuel Rail Pressure Sensor Circuit High	
Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Wiring fault between Integrated Pressure Temperature Sensor (IPTS) and SRM • Integrated Pressure Temperature Sensor (IPTS) FRP signal short to VREF or VPWR • Integrated Pressure Temperature Sensor (IPTS) or FRP open signal • Damaged Integrated Pressure Temperature Sensor (IPTS) or FRP • IPTS failure • SRM failure • CAN bus fault between the SRM and PCM
Symptom	—
Diagnostic Aid	Verify the fuel rail pressure PID (mux_rpr_rail_pres) to determine if value is high. Value should be near 5v.
Action	Refer to the Injection Pressure Temperature Sensor Electrical Check procedure in Diagnostic Tests and Procedures.

P01A0 — Alternate Fuel Tank "A" Pressure Sensor Circuit Low	
Description	The SRM reads the TPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Wiring fault between Tank Pressure Temperature Sensor (TPTS) and SRM • VREF open in harness • VREF open in sensor • TPTS failure • SRM failure • CAN bus fault between the SRM and PCM
Symptom	—
Diagnostic Aid	VREF should be between 4.5-5.5 volts.
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P01A1 — Alternate Fuel Tank "A" Pressure Sensor Circuit High	
Description	The SRM reads the TPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Wiring fault between Tank Pressure Temperature Sensor (TPTS) and SRM • VREF open in harness • VREF open in sensor • TPTS failure • SRM failure • CAN bus fault between the SRM and PCM
Symptom	—
Diagnostic Aid	Monitor fuel tank pressure PID (mux_rpr_tank_pres) to determine if value is high. Value should be near 5v.
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P01A2 — Alternative Fuel Tank "A" Pressure Sensor Circuit Intermittent/Erratic	
Description	The SRM reads the TPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Wiring fault between TPTS and SRM • TPTS Fuel Pressure signal short to SIG RTN or PWR GND • TPTS (or Fuel Pressure) open signal • Damaged TPTS • SRM failure • CAN bus fault between the SRM and PCM
Symptom	—
Diagnostic Aid	Monitor fuel tank pressure PID (mux_rpr_tank_pres) to determine if value is high. Value should be near 5v.
Action	Wiggle test while monitoring fuel tank temperature PID (mux_rpr_tank_pres) to determine fluctuation in value

P01AC — Alternate Fuel Tank Temperature Sensor Circuit Low	
Description	The SRM reads the TPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Wiring fault between Tank Pressure Temperature Sensor (TPTS) and SRM • Short to harness • VREF open or short • Short to ground • Incorrect harness connection • Damaged Tank Pressure Temperature Sensor (TPTS) • Tank Pressure Temperature Sensor (TPTS) failure • SRM failure • CAN bus fault between the SRM and PCM
Symptom	—
Diagnostic Aid	Verify the fuel rail pressure PID (mux_rpr_tank_pres) during ignition ON, engine OFF, or ignition ON, engine running is less than 0.1 volt. This indicates a concern is present.
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P01AD — Alternate Fuel Tank Temperature Sensor Circuit High	
Description	The SRM reads the TPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Wiring fault between TPTS and SRM • Open circuit • Short to voltage • Open or short to voltage in harness • Incorrect harness connection • Damaged Tank Pressure Temperature Sensor (TPTS) • Tank Pressure Temperature Sensor (TPTS) failure • SRM failure • CAN bus fault between the SRM and PCM
Symptom	—
Diagnostic Aid	Verify the Fuel Temperature PID value to determine open or short.
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P01AE — Alternative Fuel Tank Temperature Sensor Circuit Intermittent/Erratic	
Description	The SRM reads the Tank Pressure Temperature Sensor (TPTS) and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• Intermittent wiring fault between TPTS and SRM • TPTS Fuel Pressure intermittent signal short to SIG RTN or PWR GND • TPTS (or Fuel Pressure) intermittent open signal • VREF intermittent open in harness • VREF intermittent open in sensor • Vacuum leaks • Tank Pressure Temperature Sensor (TPTS) or Fuel Pressure intermittent open signal • Tank Pressure Temperature Sensor (TPTS) failure • SRM failure • CAN bus fault between the SRM and PCM
Symptom	—
Diagnostic Aid	Wiggle test while monitoring fuel tank temperature PID (mux_rpr_tank_temp) to determine fluctuation in value.
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P025A — Fuel Pump Module "A" Control Circuit/Open	
Description	The Fuel Pump Control Module (FPCM) A receives control commands from the PCM on a Fuel Pump Command (FPC) pin. The FPCM A passes diagnostic information on the CAN bus to the PCM. If the FPCM A does not receive a control command from the PCM on the FPC, it sends a corresponding signal to the PCM on the CAN bus and the fault is set.
Possible Causes	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for a list of other causes.
Symptom	Poor starts, rough idle, hesitation/surge.
Diagnostic Aid	—
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P025B — Fuel Pump Module "A" Control Circuit Range/Performance	
Description	The Fuel Pump Control Module (FPCM) A receives control commands from the PCM on a Fuel Pump Command (FPC) pin. The FPCM A passes diagnostic information on the CAN bus to the PCM. If the FPCM A receives an invalid control command from the PCM on the FPC, it sends a corresponding signal to the PCM on the CAN bus and the fault is set.
Possible Causes	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for a list of other causes.
Symptom	—
Diagnostic Aid	
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P027B — Fuel Pump Module "B" Control Circuit Range/Performance	
Description	The SRM receives the output of the second fuel pump monitor line and repeats the output over the CAN bus to the PCM. The PCM monitors the commanded output versus the monitor's feedback. If the monitor is out-of-range, a fault is set.
Possible Causes	• CAN bus fault between the SRM and PCM • Damaged SRM
Symptom	—
Diagnostic Aid	---
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P03xx — Misfire	
Description	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for more descriptive information.
Possible Causes	• The propane system was operated in the vapor region • Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for a list of other causes.
Symptom	—
Diagnostic Aid	Verify no fuel system faults present and follow the Ford Powertrain Control/Emissions Diagnosis Service Manual.
Action	Refer to the Engine Stumble, Stall, Rough Idle AND Fuel Pressure Drop procedure in Diagnostic Tests and Procedures.

P0442 - EVAP System Leak Detected (small leak)	
Description	The Ford PCM has detected a leak in the Evaporative Emissions System (EVAP).
Possible Causes	• Defective vapor management valve • Damaged EVAP canister • Leak in the EVAP system • Defective fuel tank pressure transducer
Symptom	Check engine light.
Diagnostic Aid	The fuel tank pressure transducer has been moved to a bracket near the EVAP canister. The system monitors the lines that go from the FRPCM bleed port to EVAP canister and purge valve. This system is used to de-pressurize the fuel rails after shutdown. The propane tank is sealed and is not part of this system.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0443 - EVAP System Purge Control Valve "A" Circuit	
Description	This DTC sets when the signal moves outside the minimum or maximum limit for the commanded state.
Possible Causes	• VPWR circuit open • EVAPCP circuit open • EVAPCP circuit short to ground • EVAPCP circuit short to voltage • Damaged EVAP purge valve • Damaged PCM
Symptom	Check engine light.
Diagnostic Aid	Purge control valve is located near the rear of the intake manifold. To verify normal function, monitor the EVMV PID or EVAPCP PID and the signal voltage (PCM control side). With the valve closed, the EVMV indicates 0 mA (0% duty cycle for EVAPCP) and voltage approximately equal to battery voltage. When the valve is commanded fully open, EVMV indicates 1,000 mA (100% duty cycle for EVAPCP) and a voltage drop of 3 volts minimum is normal.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0446 - EVAP System Vent Control Circuit	
Description	This DTC sets when the signal moves outside the minimum or maximum limit for the commanded state.
Possible Causes	• VPWR circuit open • KAPWR circuit open • CANV circuit open • CANV circuit short to ground • CANV circuit short to voltage • CANV circuit short to KAPWR • Damaged EVAP canister vent valve • Damaged PCM
Symptom	Check engine light.
Diagnostic Aid	Vent control circuit is in the EVAP canister. To verify normal function, monitor the EVAP canister vent valve signal PID EVAPCV and the signal voltage (PCM control side). With the valve open, EVAPCV indicates 0% duty cycle and a voltage approximately equal to battery voltage. When the valve is commanded fully closed, EVAPCV indicates 100% duty cycle, and a minimum voltage drop of 4 volts is normal.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0451 - EVAP System Pressure Sensor/Switch Range/Performance	
Description	This DTC sets when a fuel tank pressure (FTP) sensor range (offset) concern is detected. The FTP sensor output is offset by greater than 1.7 inches of water or less than -1.7 inches of water.
Possible Causes	• FTP circuit intermittent open • FTP circuit intermittent short • FTP sensor intermittent open • FTP sensor intermittent short • Contaminated FTP sensor • Damaged FTP sensor • Damaged PCM
Symptom	Check engine light.
Diagnostic Aid	The FTP sensor is located on a bracket near the EVAP canister. With the FTP sensor at atmospheric pressure, the FTP PID normally indicates 0 inches of water. Remove the quick connect hose at the canister that goes to the FTP sensor, wait one minute to allow the pressure to equalize with the ambient air pressure before accessing the PID.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0452 - EVAP System Pressure Sensor/Switch Low	
Description	This DTC sets when the fuel tank pressure (FTP) sensor signal average drops below a minimum allowable calibrated parameter.
Possible Causes	• Contamination internal to the FTP sensor connector • FTP circuit open • VREF circuit open • FTP circuit short to ground • FTP circuit short to SIGRTN • Damaged FTP sensor
Symptom	Check engine light.
Diagnostic Aid	The FTP sensor is located on a bracket near the EVAP canister. An FTP voltage PID reading less than 0.22 volt in ignition ON, engine OFF or ignition ON, engine running indicates a concern is present.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0453 - EVAP System Pressure Sensor/Switch High	
Description	This DTC sets when the fuel tank pressure (FTP) sensor signal average jumps above a maximum allowable calibrated parameter.
Possible Causes	• Contamination internal to the FTP sensor connector • FTP circuit open • VREF circuit open • FTP circuit short to ground • FTP circuit short to SIGRTN • Damaged FTP sensor
Symptom	Check engine light.
Diagnostic Aid	The FTP sensor is located on a bracket near the EVAP canister. An FTP voltage PID reading more than 4.85 volt in ignition ON, engine OFF or ignition ON, engine running indicates a concern is present.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0454 - EVAP System Pressure Sensor/Switch Intermittent	
Description	This DTC sets when the fuel EVAP system pressure changes greater than 14 inches of water in
	0.1 seconds.
Possible Causes	• Contamination internal to the FTP sensor connector • FTP circuit open • VREF circuit open • FTP circuit short to ground • FTP circuit short to SIGRTN • Damaged FTP sensor
Symptom	Check engine light.
Diagnostic Aid	The FTP sensor is located on a bracket near the EVAP canister. Monitor the FTP PID and note if it changes +/- 15 inches of water multiple times in 1 minute.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0455 - EVAP System Leak Detected (large leak)	
Description	The PCM monitors the complete evaporative emission (EVAP) control system for no purge flow, the presence of a large fuel vapor leak, or multiple small fuel vapor leaks. This DTC sets when no purge flow, which is attributed to fuel vapor blockages or restrictions, a large fuel vapor leak, or multiple fuel vapor leaks are detected by the EVAP running loss monitor test with the engine running, but not at idle.
Possible Causes	• Verify cap on FTP sensor is present and not damaged • Damaged fuel tank pressure (FTP) sensor • Damaged EVAP canister • Disconnected or cracked fuel EVAP canister tube, EVAP canister purge outlet tube, or EVAP return tube • EVAP purge valve stuck closed • Slow responding EVAP purge valve • Blockages or restrictions in the fuel vapor hoses or tubes • Loose fuel vapor hose or tube connections to the EVAP system components • EVAP canister vent valve stuck open
Symptom	Check engine light
Diagnostic Aid	The fuel tank pressure transducer has been moved to a bracket near the EVAP canister. The system monitors the lines that go from the FRPCM bleed port to EVAP canister and purge valve. This system is used to depressurize the fuel rails after shutdown. The propane tank is sealed and is not part of this system. Check for audible vacuum noise in the engine compartment or near the EVAP canister with engine running
Action	Please refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0456 - EVAP System Leak Detected (very small leak)	
Description	The Ford PCM has detected a leak in the Evaporative Emissions System (EVAP).
Possible Causes	• Very small holes or breaks in the fuel vapor hoses or tubes • Loose fuel vapor hose or tube connections to the EVAP system components • EVAP system component seals leaking • Damaged wiring to the EVAP purge control valve
Symptom	Check engine light.
Diagnostic Aid	The fuel tank pressure transducer has been moved to a bracket near the EVAP canister. The system monitors the lines that go from the FRPCM bleed port to EVAP canister and purge valve. This system is used to de-pressurize the fuel rails after shutdown. The propane tank is sealed and is not part of this system. Check for loose or damaged vapor hoses. Visually inspect the EVAP canister inlet port, EVAP canister vent valve filter, and EVAP canister vent hose assembly for contamination or debris.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0461 — Fuel Level Sender “A” Circuit Range/Performance	
Description	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for more descriptive information.
Possible Causes	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual. Causes are the same except that communication is between the sender and the SRM and not the IPC.
Symptom	—
Diagnostic Aid	The SRM reads fuel level sender input and broadcasts it to the IPC and PCM.
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P0462 — Fuel Level Sender "A" Circuit Low	
Description	This DTC sets when the Fuel Level Gauge signal is electrically less than the minimum allowable sender value.
Possible Causes	• Fuel level sender wiring shorted to ground • Damaged Fuel Level Sender • Smart Relay Module
Symptom	• P0462 — Fuel gauge may read empty all the time • P2067 — Fuel gauge will only show primary tank
Diagnostic Aid	Smart Relay Module (SRM) reads fuel level sender and broadcasts to the PCM and Instrument Cluster.
Action	Refer to the following tests located later in this manual. • Smart Relay Module Electrical Check • Fuel Level Sender Electrical Check

P0463 — Fuel Level Sender "A" Circuit High	
Description	This DTC sets when the Fuel Level Gauge signal is electrically less than the minimum allowable sender value.
Possible Causes	• Fuel level sender wiring is disconnected or shorted to above 5 volts • Damaged Fuel Level Sender • Smart Relay Module
Symptom	P0463 — Fuel gauge may read full all the time P2068 — Fuel gauge will only show primary tank
Diagnostic Aid	Smart Relay Module (SRM) reads fuel level sender and broadcasts to the PCM and Instrument Cluster.
Action	Refer to the following tests located later in this manual. • Smart Relay Module Electrical Check • Fuel Level Sender Electrical Check

P0627 — Fuel Pump "A" Control Circuit Open	
Description	The Fuel Pump Control Module (FPCM) A diagnoses faults of fuel pump A. The FPCM A passes diagnostic information on the CAN bus to the PCM. If the PCM receives a FPCM A signal indicating a fuel pump problem, the fault is set.
Possible Causes	• Wiring fault between FPCM A and fuel pump A • Open circuit • FPCM A fault • CAN fault • Faulty fuel pump
Symptom	—
Diagnostic Aid	
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P064A — Fuel Pump Control Module "A"	
Description	The Fuel Pump Control Module (FRPCM) A has its own internal diagnostics. The FPCM A passes diagnostic information on the CAN bus to the PCM. If the PCM receives a FPCM A signal indicating an internal problem, the fault is set.
Possible Causes	• FPCM A fault • CAN fault
Symptom	—
Diagnostic Aid	
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P1070 — Fuel Vapor Pressure Excessive - High	
Description	Tank pressure is higher than expected for current temperature.
Possible Causes	• Non HD-5 fuel in tank • Residual nitogen or air left in tank after fuel purge • Faulty tank pressure temperature sensors (TPTS)
Symptom	• Stumble stall and lack of power in high temperature operation • Slow refueling • Runs rough
Diagnostic Aid	Resolve any sensor faults prior to diagnosing this code.
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P116E — Fuel Pressure Relief Valve Actuated	
Description	Fuel Pressure Relief Valve Actuated - Maximum injection pressure reached. The PCM monitors fuel rail pressure and battery voltage. Based on these measurements, the PCM adjusts fuel pump speed to stay below the maximum operating pressure of the injectors.
Possible Causes	• Maximum injection pressure reached • Operating the vehicle in high ambient conditions • Vehicle operated in a low voltage condition • Vehicle operated in high ambient conditions without an IVCM or Fuel Chiller (2023+ for BB)
Symptom	Vehicle hesitation, stall, rough idle, misfire or no start.
Diagnostic Aid	The P116E code is meant as an indication that the fuel system was operated at the limits of the system. The customer may have experienced drive issues although the system is performing as expected.
Action	Inspect exhaust system for routing near the fuel tank without proper heat shielding, or improper exhaust outlet position where hot exhaust gases could be trapped under the vehicle near the fuel tank. Refer to the Pinpoint Test H: Maximum Pressure Check (Gen 3-5) procedure s if vehicle exhaust is routed correctly

P1378 — Fuel Injector Control Module System Voltage Low	
Description	When the Injection Volage Control Module (IVCM) is commanded on, fuel injector supply voltage is lower than expected.
Possible Causes	• Incorrect calibration with IVCM commands without a IVCM • Incorrect calibration lacks IVCM commands • Faulty IVCM
Symptom	• Potential stall • May set a P116E
Diagnostic Aid	Verify the calibration in the vehicle is set for a vehicle with a VBM Inspect Pin-16 of the VBM to verify wire is seated properly
Action	See the Pinpoint Test T: IVCM Pinpoint Test procedure in Diagnostic Tests and Procedures.

P1379 — Fuel Injector Control Module System Voltage High	
Description	When Injection Volage Control Module (IVCM) is commanded on, fuel injector supply voltage is higher than expected.
Possible Causes	• Not wired correctly to the PCM • Faulty IVCM • VBM is faulty
Symptom	• Injector Damage/Failure • CEL and MIL
Diagnostic Aid	Inspect Pin-16 of the IVCM to verify wire is seated properly
Action	See the Pinpoint Test T: IVCM Pinpoint Test procedure in Diagnostic Tests and Procedures.

P1450 — Unable to Bleed Up Bleed Fuel Tank Vacuum	
Description	This DTC results when there is excessive vacuum as sensed by the FTPS on the evap canister. The vacuum is generated from the intake manifold using the vapor management valve and is monitored by the sensor on the canister.
Possible Causes	• EVAP canister vent valve stuck partially or fully closed due to an obstruction • Damaged FTP sensor • Contaminated fuel vapor elbow on the EVAP canister • Restricted EVAP canister • Restricted EVAP canister vent valve filter • VREF circuit open
Symptom	The driver is alerted with a MIL light when this DTC occurs.
Diagnostic Aid	• Visually inspect the EVAP canister inlet port, EVAP canister vent valve filter, and EVAP canister vent hose assembly for contamination or debris. • Check EVAP purge valve for vacuum leak. • Check for blockages on lines from intake manifold. • Inspect FTPS
Action	Refer to the Ford Evaporative Emission (EVAP) System and Monitor pinpoint test in Ford PC/ED.

P1453 — Fuel Tank Pressure Relief Valve Malfunction	
Description	The SRM reads the TPTS and passes the voltage reading over the CAN bus to the PCM. If the pressure value of the propane fuel tank approaches the Pressure Relief Valve “pop-off” pressure, a fault is set.
Possible Causes	• High ambient temperature operation • Propane tank fill is contaminated with nitrogen or other constituents • Vehicle is parked over heat source • Tank Pressure Temperature Sensor shorted or reading higher than expected values • Overfill prevention device allowed tank to overfill
Symptom	The driver is alerted with a coolant gauge High setting until the fault condition clears.
Diagnostic Aid	Use mechanical pressure gauge to check tank pressure and an inferred temp gun to check tank temperature. Can also cause a P1285 to set due to failsafe cooling being on, diagnose P1453 first.
Action	Check for other diagnostic fault codes such as Tank Pressure or Temperature P01A1 or P01AD and correct them first. Refer to the Maximum Pressure Check procedure in Diagnostic Tests and Procedures.

P1456 — Fuel Tank Temperature Sensor Circuit Malfunction	
Description	Propane tank sensor when it is inconsistent with the Intake Air Temperature (IAT11_ENG), Rail Temperature (RF_RAILTEMP), and Tank Temperature (RPR_PT_TEMP) rationality check after six hour cold soak.
Possible Causes	• Wiring concerns • Defective tank pressure temperature sensor
Symptom	Check engine light possible. Possible engine performance issues.
Diagnostic Aid	—
Action	Refer to the Tank Pressure Temperature Sensor Electrical Check procedure in the Diagnostic Tests and Procedures.

P2195, P2197 — Heated Exhaust Gas Oxygen Sensor Stuck	
Description	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for more descriptive information.
Possible Causes	• The propane system was operated in the vapor region • Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for a list of other causes.
Symptom	—
Diagnostic Aid	Verify that no fuel system faults are present and then follow the Ford Powertrain Control/Emissions Diagnosis Service Manual procedure.
Action	Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for a list of other causes.

P25B0 — Fuel Level Sensor "A" Stuck	
Description	The SRM reads Fuel Level Sender (FLS) input and broadcasts it to the IPC and PCM. If the vehicle is driven a considerable distance and the FLS value doesn't change, the fault is set.
Possible Causes	• Wire fault between FLS and SRM • Defective fuel level sender or sender Twinsight • SRM fault
Symptom	The driver is unaware of a low fuel condition.
Diagnostic Aid	
Action	Refer to the Fuel Level Sender Electrical Check procedure in Diagnostic Tests and Procedures.

P2632 — Fuel Pump "B" Control Circuit/Open	
Description	The Fuel Pump Control Module (FPCM) B diagnoses faults of fuel pump B. The FPCM passes the information to the SRM on a dedicated circuit. The SRM then sends the diagnostic information to the PCM over the CAN network.
Possible Causes	• Wiring fault between FPCM A and fuel pump A • Open circuit • FPCM A fault • CAN fault • Faulty fuel pump
Symptom	—
Diagnostic Aid	—
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P2665 — Supply Solenoid Circuit Fault	
Description	FRPCM supply solenoid circuit fault. SRM monitors supply solenoid circuit for open and short circuit faults
Possible Causes	• Blown fuse • Damaged SS coil • Incorrect connections • Short to voltage • Water in the harness connector • Open power circuit • Low battery voltage • Corrosion
Symptom	Vehicle does not start. The pumps run but no pressure builds in the fuel rail.
Diagnostic Aid	Check the FRPCM and SRM electrical connectors for damage, corrosion and water intrusion.
Action	Refer to the Fuel Rail Pressure Control Module Electrical Check procedure in Diagnostic Tests and Procedures.

P26EA — Fuel Pump Control Module "B"	
Description	The Fuel Pump Control Module (FPCM) B diagnoses faults of fuel pump B. The FPCM passes the information to the SRM on a dedicated circuit. The SRM then sends the diagnostic information to the PCM over the CAN network.
Possible Causes	• FPCM B fault • Open fuel pump monitor 2 circuit (FPM2)
Symptom	—
Diagnostic Aid	Check connection between SRM and FPCM
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P26B3 — Fuel Shutoff Valve "A" Control Circuit Performance/Stuck Off	
Description	The SRM monitors fuel rail pressure before and after the start sequence is initiated. If the fuel rail pressure rise is below a threshold (25psi), the fault is set.
Possible Causes	• Blown fuse • Excess flow valve activated • Fuel pumps weak or inoperable • Manual shutoff valve not fully open • Tank Supply Solenoid not opening • FRPCM Supply Solenoid not opening • Restricted supply line filter • Kinked or restricted fuel lines • IPTS or TPTS signal inaccurate
Symptom	The vehicle will crank no start or start and run poorly. Start sequence will be extended and fuel pumps and supply solenoids will be commanded on and off multiple times, attempting to build rail pressure.
Diagnostic Aid	Check Measuring Fuel Rail and Fuel Tank Pressure procedure.
Action	Refer to the Engine Cranks, No Start procedure in Diagnostic Tests and Procedures.

P26B5 — Fuel Shutoff Valve “B” Control Circuit Performance/Stuck Off	
Description	The SRM monitors fuel rail pressure before and after the start sequence is initiated. If the fuel rail pressure rise is below a threshold, the fault is set.
Possible Causes	• Blown fuse • Manual shutoff valve not fully open • Excess flow valve activated • Fuel pumps weak or inoperable • Tank supply solenoid not opening • FRPCM Supply Solenoid not opening • Restricted supply line filter • Kinked or restricted fuel lines • IPTS or TPTS signal inaccurate
Symptom	The vehicle will crank no start or start and run poorly. Start sequence will be extended and fuel pumps and supply solenoids will be commanded on and off multiple times, attempting to build rail pressure.
Diagnostic Aid	Check Measuring Fuel Rail and Fuel Tank Pressure procedure.
Action	Refer to the Engine Cranks, No Start procedure in Diagnostic Tests and Procedures.

P26EA — Fuel Pump Control Module “B”	
Description	The Fuel Pump Control Module (FPCM) B diagnoses faults of fuel pump B. The FPCM passes the information to the SRM on a dedicated circuit. The SRM then sends the diagnostic information to the PCM over the CAN network.
Possible Causes	• FPCM B fault • Open fuel pump monitor 2 circuit (FPM2)
Symptom	—
Diagnostic Aid	Check connection between SRM and FPCM
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

P2665 — Supply Solenoid Circuit Fault	
Description	FRPCM supply solenoid circuit fault. SRM monitors supply solenoid circuit for open and short circuit faults
Possible Causes	• Blown fuse • Short to voltage • Water in the harness connector • Open power circuit • Open GND circuit • Low battery voltage • Corrosion • Incorrect connections • Damaged SS coil
Symptom	—
Diagnostic Aid	—
Action	Refer to the Fuel Pump Control Module Electrical Continuity Test procedure in Diagnostic Tests and Procedures.

U0108 — Lost Communication with Alternative Fuel Control Module	
Description	Lost communication with SRM. The PCM monitors CAN bus communication for missing messages from the SRM. If the messages are continuously missing, a fault is set.
Possible Causes	• Wiring between the SRM and PCM • SRM lacks power • Blown fuse • SRM loses power or ground
Symptom	Rough idle.
Diagnostic Aid	Check the FRPCM and SRM electrical connectors for damage, corrosion and water intrusion. Check for power at the SRM.
Action	Refer to the Smart Relay Module Electrical Check procedure in Diagnostic Tests and Procedures.

U0109/016C — Lost Communication With Fuel Pump Control Module "B"	
Description	Communication Lost Between CAN network and Blue Bird Multiplex.
Possible Causes	• Wire fault between the EFPR and SRM . • Wire fault between SRM and PCM • Faulty EFPR • Blown fuse • No power to the EFPR • SRM fault • Refer to the Ford PC/ED for a list of other causes.
Symptom	Crank, no start, rough idle or lack of power
Diagnostic Aid	—
Action	Contact a local Blue Bird Dealer or Service Center for assistance with this code.

U210B — Lost Communication Between Fuel Pump Control Module "A" and Restraint Control Module	
Description	The FPCM A constantly receives either an OK signal or a disable signal from the RCM on a dedicated "disable" wire. The FPCM A passes diagnostic information on the CAN bus to the PCM. If the FPCM A fails to receive a signal from the RCM, the FPCM A passes a signal, indicating it lost communication with the RCM, to the PCM and the fault is set.
Possible Causes	• Wire fault between EFPR "A" and RCM • Wire fault between SRM and PCM • **No** power to the EFPR "A" • SRM fault • CAN fault • Blown fuse • RCM failure • EFPR "A" failure
Symptom	—
Diagnostic Aid	—
Action	—

U210C — Lost Communication Between Fuel Pump Control Module "B" and Restraint Control Module	
Description	The FPCM B constantly receives either an OK signal or a disable signal from the RCM on a dedicated "disable" wire. The FPCM B passes diagnostic information on the CAN bus to the SRM. The SRM passes that diagnostic information on the CAN bus to the PCM. If the FPCM B fails to receive a signal from the RCM, the FPCM B passes a signal, indicating it lost communication with the RCM, to the SRM. The SRM passes that signal on the CAN bus to the PCM and the fault is set.
Possible Causes	• Wire fault between EFPR "B" and RCM • Wire fault between SRM and PCM • No power to the EFPR "B" • SRM fault • CAN fault • Blown fuse • RCM failure • EFPR "B" failure
Symptom	—
Diagnostic Aid	—
Action	—

General Information

Under normal operating conditions, fuel pumps will operate at variable speeds. Fuel pump duty cycle will vary to maintain liquid in the fuel rails under different temperatures and operating conditions.

The fuel pressure controls are designed to keep the rails at a certain pressure over tank pressure, therefore, it is important to measure tank pressure prior to collecting fuel rail pressure data. For example, if the fuel tank is at 150 psi (1034 kPa) and pressure in the rail is measured at 200 psi (1379 kPa), the rail is running at 50 psi (345 kPa) over tank.

Fuel rail pressure should maintain a minimum of 30 psi over tank under normal operating conditions, and will increase based on fuel system demand.

On a tank at ambient temperature conditions, the following pressures can be expected:

Temperature (°F)	Pressure (psi)		
	Min.	Nominal	Max.
0	15	25	35
5	19	29	39
10	23	33	43
15	28	38	48
20	33	43	53
25	38	48	58
30	43	53	63
35	49	59	69
40	55	65	75
45	62	72	82
50	69	79	89
55	77	87	97
60	84	94	104
65	93	103	113
70	102	112	122
75	111	121	131
80	121	131	141
85	131	141	151
90	142	152	162
95	153	163	173
100	165	175	185
105	178	188	198
110	191	201	211
115	205	215	225
120	219	229	239

NOTE: On vehicles that have been operated for extended periods of time, the tank (fuel) can be much warmer and so higher pressures are to be expected.

Measuring Fuel Tank Pressure

Method 1: Mechanical

1. Install a 0–500 psi (0–3447 kPa) fuel pressure gauge on the Bleeder Valve at the tank or to the remote Bleeder Valve location.
2. Open the valve to monitor the fuel tank pressure.
3. Record the value and close the valve.

Method 2: Using RDT

1. Follow Steps 1-3 from Accessing Functions in RDT.
2. After the vehicle information has been shown and verified, select the Signals/Datalogger tab.
3. Select the **Rpr_pt_prs** PID from the screen and click on Start and record the value.

Method 3. Ford IDS or generic scan tool in Mode 1 ODB-II data

1. Start vehicle and let run for ten (10) seconds.
2. Key vehicle off and then back to on.
3. Immediately monitor Fuel Rail pressure (FRP).

Measuring Fuel Rail Pressure

Method 1: Mechanical

1. Purge the fuel lines using the Fuel Line Purging Procedure.
2. Disconnect the fuel supply line at the rear of the RH fuel rail.
3. Install the ROUSH service port adapter between the fuel line and the fuel rail.
4. Attach 0–500 psi (0–3447 kPa) fuel pressure gauge to the service port on the adapter and record the value.

Method 2: RDT

1. Follow Steps 1-3 from Accessing Functions in RDT..
2. After the vehicle information has been shown and verified, select the Signals/Datalogger tab.
3. Select the **rpr_fr_prs** PID from the screen and click on Start.
4. Record the value.

Method 3. Ford IDS or generic scan tool in Mode 1 ODB-II data

1. Start vehicle and let run for ten (10) seconds.
2. Immediately monitor Fuel Rail pressure (FRP).

Measuring Fuel Rail Target Pressure

If using a generic scan tool, you won't be able to collect Fuel Rail Target Pressure. If using Ford IDS, Fuel Pump Duty Cycle needs to be multipled by 2.

1. Follow Steps 1-3 from Accessing Functions in RDT..
2. After the vehicle information has been shown and verified, select the Signals/Datalogger tab.
3. Select the **rpr_fr_prs_tgt** PID from the screen and click on Start.
4. Record the value.

Measuring Duty Cycle

1. Follow Steps 1-3 from Accessing Functions in RDT.
2. After the vehicle information has been shown and verified, select the Signals/Datalogger tab.
3. Select the **rf_dc** PID from the screen and click on Start.
4. Record the value.

Fuel Tank Pressure, Fuel Rail Pressure, Fuel Rail Target Pressure, and Duty Cycle Using the Roush Diagnostic Tool (RDT)

DIAGNOSTICS AND PINPOINT TESTS

Pinpoint Test A: No Fill

Step	Procedure	Action
1	**Verify that the vehicle is not full of fuel.** Does the fuel cluster show less than 3/4?	**Yes** — Continue to next step. **No** — Re-attempt when fuel is less than 3/4.
2	**Inspect fill filter to ensure correct orientation** Is the fill filter installed incorrectly?	**Yes** — Install Fill Filter with correct orientation and retest. If issue is still present, move to next step.. **No** — Go to step 7
3	**Check for sufficient fill station pressure.** a. Connect pressure gauge service tool to the vehicle fuel Tank Bleeder Valve and record pressure. Perform this on each tank if equipped with a secondary tank. b. Locate output pressure gauge on stations. c. Connect and attempt to fill vehicle. d. Ensure turning on station pump before opening nozzle. If not, station Excess Flow Valve (EFV) may be tripped. Is fill station pump pressure at least 25 psi (172 kPa) greater than tank pressure?	**Yes** — Continue to next step. **No** — Go to Step 8
4	**Check if fill valve O-ring is damaged or missing (threaded ACME fill valve only).** Is the O-ring damaged or missing?	**Yes** — Replace damaged or missing O-ring **No** — Continue to next step.
5	**Open the remote bleeder valve. The remote bleeder valve is located on the tank, near the pressure relief valve.** Is there a sustained liquid (opaque white mist) for more than 10 seconds? **Warning: When liquid propane is released from a pressurized vessel, it rapidly evaporates, creating a refrigeration effect that can cause frostbite. Wear non-porous, cold-safe gloves, eye protection, and ear protection during venting and repair operations. Keep moisture away from the valves. Failure to heed this warning can result in personal injury.**	**Yes** — Refer to Fuel Level Sender Electrical Check **No** — Continue to next step.
6	**Inspect vehicle to check for kinked fill lines.** Are fill lines kinked?	**Yes** — Replaced kinked fill lines **No** — Continue to next step.
7	**Inspect OPD for correct orientation. Correct installation of the OPD will find the "Top" mark at the 12 o'clock position. Perform this on each tank if equipped with a secondary tank.** Is the OPD installed incorrectly?	**Yes** — Replace the OPD. **No** — Call ROUSH CleanTech Customer Success at (800) 59-ROUSH (597-6874), Opt. 2.
8	**Check fuel station differential pressure (the pressure before and after the fuel station pump). The fuel station differential pressure should be below 125 psi.** Is the differential pressure greater than 125 psi?	**Yes** — Contact propane provider to adjust fuel station pump pressure. **No** — Continue to next step.
9	**Check fuel tank temperature** Using an infrared temperature gun to get the tank temperature, compare the tank temperature to the Tank Temperature Chart. Does the temperature and pressure differ from the chart?	**Yes** — Call ROUSH CleanTech Customer Success (800) 59-ROUSH (597-6874), Opt. 2. **No** — Allow vehicle to cool and then retest. If still no, contact ROUSH CleanTech Customer Success (800) 59-ROUSH (597-6874), Opt. 2.

Pinpoint Test B: Slow Fill

****If tank was service recently, proceed to the Maximum Pressure Check Pinpoint Test.**

Step	Procedure	Action
1	**Determine flow rate at which the vehicle fuel system fills.** a. Time the fill station pump for 10 seconds and record the number of gallons dispensed. b. Multiply the gallons dispensed by six to determine the flow rate in gallons per minute. Is the fill station pump flow rate at least six (6) gal (23 L) per minute?	**Yes** — System fill rate is OK; diagnostic is complete. **No** — Fill station is not providing enough pressure to fill vehicle tank. Continue to the next step.
2	**Measure and compare vehicle fuel tank and fill station pressures.** a. Connect a pressure gauge service tool to the fuel tank bleeder valve and record fuel tank pressure. b. Locate output pressure gauge on stations. c. With the dispensing pump on and dispensing nozzle open, measure and record fill station pump pressure. Is fill station pump pressure at least 50 psi (345 kPa) greater than fuel tank pressure?	**Yes** — Continue to the next step. **No** — Fill station is not providing enough pressure to fill vehicle tank. Continue to the next step.
3	**Check fuel fill valve; it may not be opening completely.** a. Loosen the fuel fill line connection at the fill valve or at the inlet to the fuel filter to relieve any pressure in the fill line. b. Attempt to push open the piston in the fill valve to determine if it is opening completely. Piston should travel 1/4 inch. Is the fill valve piston opening completely?	**Yes** — Continue to the next step. **No** — Replace fill valve and retest. If persists, move to next step.
4	**Inspect vehicle to check for kinked fill lines.** Are fill lines kinked?	**Yes** — Replaced kinked fill lines. **No** — Continue to the next step.
5	**Replace the filter in the fuel fill line.** Does the vehicle fuel tank fill at greater than six (6) gal (23 L) per minute?	**Yes** — Diagnostic is complete. **No** — Continue to the next step.
6	**Replace the overfill protection device (OPD) valve in the vehicle fuel tank.** **NOTE: Perform fuel tank purging procedure prior to testing. See Service Manual for vehicle for more information on the Fuel Tank Purging procedure.** Does the vehicle fuel tank fill at greater than six (6) gal (23 L) per minute?	**Yes** — Diagnostic is complete. **No** — Call ROUSH CleanTech Customer Success at (800) 59-ROUSH (597-6874), Opt. 2.
7	**Check fuel station differential pressure (the pressure before and after the fuel station pump). The fuel station differential pressure should be below 125 psi.** Is the differential pressure greater than 125 psi?	**Yes** — Contact propane provider to adjust fuel station pump pressure. **No** — Continue to the next step.
8	**Check fuel tank temperature** Using an infrared temperature gun to get the tank temperature, compare the tank temperature to the Tank Temperature Chart. Does the temperature and pressure differ from the chart?	**Yes** — Call ROUSH CleanTech Customer Success (800) 59-ROUSH (597-6874), Opt. 2. **No** — Allow vehicle to cool and then retest. If still no, contact ROUSH CleanTech Customer Success (800) 59-ROUSH (597-6874), Opt. 2.

Pinpoint Test C: OPD Test

NOTE: Test must be performed when the vehicle has less than 50% fuel level, as indicated on the cluster.

Step	Procedure
1	Locate the vehicle propane tank data plate and reference the tank volume, often listed as W.C. (water capacity).
2	Calculate 5% of the W.C. This is the number of gallons the tank can be filled once liquid is visible at the bleeder valve.
3	Park the vehicle at a fill station or near a refueling truck on level ground. Place a level on the frame rail or tank to ensure it is level.
4	Connect the fill nozzle to the vehicle Fill Valve.
5	Open the vehicle bleeder valve. You should have clear vapor emitting from the valve. **NOTE: Wear non-porous, cold- safe gloves, eye protection, and ear protection during venting and repair operations. Keep moisture away from the valves. Failure to heed this warning can result in personal injury.** **NOTE: OPD might stop before white mist is visible at the bleeder valve. This is normal as long as fuel gauge at the instrument cluster reads Full. The tank may have stopped filling before consistent liquid was visible at the bleeder valve. This indicates normal operation.**
6	Begin filling per the refueling station manufacturer's procedure.
7	Once liquid (seen as a white mist) is visible at the bleeder valve, note the number of gallons filled. Fueling should stop before the calculated 5% volume is reached. If additional 5% is reached, stop fueling as vehicle is over filling and contact ROUSH CleanTech Customer Success (800) 59-ROUSH (597-6874), Opt. 2.
8	Turn off the fuel pump and close the bleeder valve.
9	Disconnect the nozzle and replace the fill cap.

Example: A functioning OPD on a tank with a 100 gallon WC will stop before five (5) gallons (100 WC x .05 = 5) have been added after the mist is visible.

NOTE: OPD might stop before white mist is visible at the Bleeder Valve. This is normal as long as fuel gauge at the instrument cluster reads Full. The tank may have stopped filling before consistent liquid was visible at the bleeder valve. This indicates normal operation.

NOTE: If PRV is leaking or has been activated, replace PRV.

Some companies or local or state governing bodies may require an annual Overfill Prevention Device (OPD) inspection on propane vehicles. This procedure tests that the OPD is stopping fuel fill at the correct 80% water capacity level.
NOTE: Test must be performed by a technician that has been trained to fill or service propane cylinders and can only be performed on vehicles with less than 50% fuel level, as indicated on the cluster.

Pinpoint Test D: Engine Does Not Crank

Step	Procedure	Action
1	**Is the battery voltage above 12 volts?**	**Yes** — Refer to the Ford Powertrain Control/Emission Diagnosis Service Manual. **No** — Determine the cause of the low battery situation. Call ROUSH CleanTech Customer Success at (800) 59-ROUSH (597-6874), Opt. 2 if more assistance is needed.

Pinpoint Test E: Engine Cranks, No Start

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics.
NOTE: If vehicle will restart when cold, but won't restart after stall when hot, go to Pinpoint Test F

Step	Procedure	Action
1	**Perform a visual inspection to verify the following:** a. Is there is at least 1/8 tank of fuel or more? (add fuel if necessary). b. Is the tank supply manual shutoff valve fully open? c. Is battery voltage above 12.5 volts? d. Are the fuel lines free of kinks or damage? e. Inspect all of the fuses in both the Ford and ROUSH fuse boxes. Are any of the above not in working order?	**Yes** — Correct the fault and retry. **No** — Continue to next step.
2	**Record any Diagnostic Trouble Codes (DTCs).** Are any codes present?	**Yes** — If ROUSH circuit faults are set, refer to the Diagnostic Trouble Code list earlier in this manual. If non-fuel system related faults are set, refer to Ford Powertrain Control/ Emissions Diagnostics Service Manual and correct those condition(s) and retest. If symptom persists, go to step 3. **No** — Continue to next step.
3	**During start sequence, prior to crank.** **Using the ROUSH Diagnostic Tool (RDT), measure and record Fuel Tank Pressure, Fuel Rail Pressure, Fuel Rail Target Pressure, and Fuel Pump Duty Cycle at during start sequence.** Refer to Measuring and Recording Duty Cycle, Fuel Rail Pressure, Fuel Rail Target Pressure, and Duty Cycle to read these values. **NOTE: If using a generic scan tool, you won't be able to collect Fuel Rail Target Pressure. If using Ford IDS, Fuel Pump Duty Cycle needs to be multiplied by 2.**	**If Fuel Rail Pressure is equal or less than Tank Pressure** — Go to step 4. **If Fuel Rail Pressure is 0-55 psi over Tank Pressure** — Go to step 3b. **If Fuel Rail pressure is 55psi over Tank Pressure or greater** — Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual.
	b. Test rationality between Integrated Injection Pressure Temperature Sensor (IPTS) and Tank Pressure Temperature Sensor (TPTS) If you have the ROUSH Diagnostic Tool (RDT) or Ford IDS, use the Manual Solenoid Activation Procedure, open tank supply solenoid and FRPCM supply solenoid. Using RDT, read: • Fuel Tank Pressure (**Rpr_pt_prs**) • Fuel Rail Pressure (**rpr_fr_prs**) Are pressures within 8psi of each other?	**Yes** — Continue to the next step. **No** — Perform the Injection Pressure Temperature Sensor Electrical Check.
4	**a. Test Tank Supply Solenoid** During start sequence or with tank supply solenoid manually activated, disconnect tank supply solenoid electrical connector and load test connectors with a circuit load tester or headlight test bulb across Pin-A and Pin-B, frame harness side. Does it pass a load test or light a headlight test bulb?	**Yes** — Go to Step 4b. **No** — Find and repair wiring fault.
	b. Perform the Excess Flow Valve (EFV) Test Is Excess Flow Valve (EFV) functioning properly?	**Yes** — Continue to the next step. **No** — Replace the supply valve.
5	**Test FRPCM Supply Solenoid** During Start Sequence or with FRPCM supply solenoid manually activated, disconnect FRPCM supply solenoid electrical connector, load test connectors with a circuit load tester or headlight test bulb across Pin-A and Pin-B, frame harness side. Does it pass a load test or light a headlight test bulb?	**Yes** — Continue to the next step. **No** — Find and repair wiring fault.

6	**Test Fuel Pump Connectors** a. During start sequence, measure and record voltage across Pin-A and Pin-B of both Fuel Pump Electrical Connectors, harness side. Note, this may set DTCs. Is voltage greater than 5V?	**Yes** — Move to the 6b. **No** — Perform the Fuel Pump Control Module Electrical Continuity Test.
	b. During start sequence, load test same connectors with a Circuit Load Tester or Headlight Test Bulb (or similar). Does it pass a load test or light a headlight test bulb (or similar)?	**Yes** — Move to the 6c. **No** — Perform the Fuel Pump Control Module Electrical Continuity Test.
	c. With engine off, measure and record resistance across Pin-A and Pin-B of both Fuel Pump Connectors, tank pass-through side. Is the resistance value OL or greater than 5ohms?	**Yes** — Replace fuel pump assembly and retest. **No** — Refer to Ford Powertrain Control/Emissions Diagnostics Service Manual.
	d. Please record if possible: During starting sequence, Measure and record amp draw on the fuel pump connectors. Amp draw should be between 2 and 10amps at idle. Amperage should be similar between the two pumps.	

Pinpoint Test F: Engine Stumble, Stall, Rough Idle AND Fuel Pressure Drop

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics**.**

Step	Procedure	Action
1	**Perform a visual inspection to verify the following are in working order:** a. Is there is at least 1/8 tank of fuel or more? (add fuel if necessary). b. Is the tank supply manual shutoff valve fully open? c. Is battery voltage above 12.5 volts? d. Are fuel lines free of kinks or damage? e. Inspect all fuses. f. If vehicle has more than 50,000 miles, has Supply Line Filter been replaced within the last 50,000 miles? If not, change Supply Line Filter and retest. Are any of the above not in working order?	**Yes** — Correct the fault and retry. **No** — Continue to next step.
2	**Record any Diagnostic Trouble Codes (DTCs).** Are any codes present?	**Yes** — If ROUSH circuit faults are set, refer to the Diagnostic Trouble Code list earlier in this manual. If non-fuel system related faults are set, refer to Ford Powertrain Control/ Emissions Diagnostics Service Manual and correct those condition(s) and retest. If symptom persists, go to step 3. **No** — Continue to next step.
3	**Start the vehicle and let it idle for at least one (1) minute.**	
4	**During start sequence, use the ROUSH Diagnostic Tool (RDT) to measure and record:** • **Fuel Tank Pressure (Rpr_pt_prs)** • **Fuel Rail Pressure (rpr_fr_prs)** • **Rail Target Pressure (rpr_fr_prs_tgt)** • **Fuel Pump Duty Cycle (rf_dc)** Refer to Measuring and Recording Duty Cycle, Fuel Rail Pressure, Fuel Rail Target Pressure, and Duty Cycle to read these values. **NOTE: If using a generic scan tool, you won't be able to collect Fuel Rail Target Pressure.** **If using Ford IDS, Fuel Pump Duty Cycle needs to be multiplied by 2.**	**If Fuel Rail Pressure is equal or less than Tank Pressure** — Go to step 9 **If Fuel Rail Pressure is 1-55 psi over Tank Pressure** — Go to step 5 **If Fuel Rail pressure is 55psi over Tank Pressure or greater** — go to step 11
5	**Test Fuel Pump Connectors** a. With engine running, measure and record voltage across Pin-A and Pin-B of both Fuel Pump Electrical Connectors, harness side. Is voltage greater than 5V?	**Yes** — Continue to next step. **No** — Go to the Fuel Pump Control Module Electrical Continuity Test.
	b. With engine running, load test same connectors with a Circuit Load Tester or 1157 Headlight Test Bulb (or similar). Does it pass a load test or light a 1157 headlight test bulb (or similar)?	**Yes** — Continue to next step. **No** — Go to the Fuel Pump Control Module Electrical Continuity Test.
	c. With engine running, measure and record amp draw on the fuel pump connectors. Amp draw should be between 2 and 10amps at idle. Amperage should be similar between the two pumps. Is amp draw within specification?	**Yes** — Continue to the next step. **No** — Replace Fuel Pump Assembly.
	d. Turn off engine. Measure and record resistance across Pin-A and Pin-B of both Fuel Pump Connectors, tank pass-through side. Is the resistance value OL or greater than 10ohms?	**Yes** — Replace Fuel Pump Assembly and retest. **No** — Move to the next step. If you do not have Roush Diagnostic Tool (RDT), go to step 7.

6	**Test rationality between Integrated Injection Pressure Temperature Sensor (IPTS) and Tank Pressure Temperature Sensor (TPTS).** If you have the ROUSH Diagnostic Tool (RDT) or Ford IDS, use the Manual Solenoid Activation, open tank supply solenoid and FRPCM supply solenoid. Using RDT, read Fuel Tank Pressure (**Rpr_pt_prs**) and Fuel Rail Pressure (**rpr_fr_prs**). Are pressures within 8psi of each other?	**Yes** — Continue to next step. **No** —Go to Injection Pressure Temperature Sensor Electrical Check.
7	**Test Tank Supply Solenoid.** During Start Sequence or with tank supply solenoid manually activated, disconnect tank supply solenoid electrical connector and load test connectors with a Circuit Load Tester or 1157 Headlight Test Bulb across Pin-A and Pin-B, frame harness side. Does it pass a load test or light a 1157 headlight test bulb?	**Yes** — Continue to next step. **No** — Find and repair wiring fault
8	**Test FRPCM Supply Solenoid.** During Start Sequence or with FRPCM supply solenoid manually activated, disconnect FRPCM supply solenoid electrical connector, load test connectors with a Circuit Load Tester or 1157 Headlight Test Bulb across Pin-A and Pin-B, frame harness side. Does it pass a load test or light a 1157 headlight test bulb?	**Yes** — Continue to next step. **No** — Find and repair wiring fault
9	**Test Fuel Pump Duty Cycle** At idle is fuel pump duty cycle at 100% (1.0) **AND** fuel rail pressure less than 55psi over tank pressure?	**Yes** — Replace Fuel Pump Assembly. **No** — Continue to next step.
10	**Perform** Excess Flow Valve (EFV) Test Is Excess Flow Valve (EFV) functioning properly?	**Yes** — Refer to Ford Powertrain Control/Emissions Diagnostics Service Manual, correct those condition(s), and retest. **No** — Replace Supply Valve.
11	**Return Line Restriction Test** Are P0148 or P116E codes set AND Fuel Rail Pressure is greater than 80psi over tank AND problem occurs after heavy duty cycle operation?	**Yes —** Replace Return Valve Assembly. **No** — Refer to Ford Powertrain Control/Emissions Diagnostics Service Manual.

Pinpoint Test G: Excess Flow Valve Check

The Excess Flow Valve (EFV) is designed to restrict fuel exiting the tank if the pump is energized while the fuel lines are not connected to the fuel tank. Under normal circumstances, the EFV should not trip. The EFV will reset itself after the fuel pumps have been off for about one minute.

It is common to trip the EFV after the fuel lines have been serviced and contain no pressure. If the EFV trips, turn the vehicle off, wait one minute, and restart. This may take more than one attempt. If the fuel lines have not been serviced recently and the problem persists, there may be a leak in the supply side fuel line. If the problem is only present after the vehicle has been sitting for a length of time, but not present during a short soak, or there is a propane odor when the vehicle is running, refer to the Fuel Line Leak Detection procedure in the service manual for the vehicle in question.

To manually reset the EFV, with the vehicle off, close the manual shutoff valve and wait one minute. Then key the vehicle to start and slowly open the manual shutoff valve. When the EFV resets there will be an audible click.

Step	Procedure	Action
1	**Inspect EFV for checking.** If both fuel pumps and supply valves are operating properly and fuel rails have a near 0psi increase over tank, the EFV may be checking. When the EFV resets there will be an audible click. **NOTE: Vehicle may cycle pumps multiple times during start up flush sequence if the desired rail pressure increase is not achieved, a P26B5 fault code can be set.** Is EFV continuously checking during normal operation?	**Yes** — Replace the tank supply valve. **No** — No action needed.

Pinpoint Test H: Maximum Pressure Check

The propane fuel system operates over a wide range of pressures depending on ambient temperature, driving mode, etc. When the vehicle is subjected to a severe drive cycle in high ambient temperatures, the fuel rail pressure can rise to the limit of the injectors capabilities. This limit is a function of injector voltage and fuel rail pressure. The PCM protects for this condition by reducing the fuel pump speed when the condition is sensed, however, there still may be drive concerns. When the PCM starts reducing fuel pump duty cycle, a P116E code is set. While this condition can occur in a normally functioning vehicle, it can also be exacerbated by several factors. If the fuel tank was not properly bled during the first fill, trapped air in the vapor space can increase tank pressure. In this condition there is often only a faint smell of propane when the Bleeder Valve is opened. The tank should be vented until there is a strong propane odor coming from the Bleeder Valve. The tank pressure should be confirmed against the expected pressure.

Allow the fuel tank to cool to ambient temperature before performing the following procedure.

Step	Procedure	Action
1	**Measure tank pressure and tank surface temperature.** Refer to pressure temp chart below. Is tank pressure more than 15 psi (103 kPa) over expected tank pressure?	**Yes** — Vent the tank until pressure is within the expected range. If the issue persists please contact ROUSH CleanTech Customer Success (800) 59-ROUSH (597-6874), Opt. 2. **No** — Vehicle is working properly; inform and explain operating characteristics to customer.

Temperature (°F)	Pressure (psi)		
	Min.	Nominal	Max.
0	15	25	35
5	19	29	39
10	23	33	43
15	28	38	48
20	33	43	53
25	38	48	58
30	43	53	63
35	49	59	69
40	55	65	75
45	62	72	82
50	69	79	89
55	77	87	97
60	84	94	104
65	93	103	113
70	102	112	122
75	111	121	131
80	121	131	141
85	131	141	151
90	142	152	162
95	153	163	173
100	165	175	185
105	178	188	198
110	191	201	211
115	205	215	225
120	219	229	239

Pinpoint Test I: Fuel System Fails to Bleed

Step	Procedure	Action
1	**Check for diagnostic trouble codes (DTC)** Are both DTC 26B3 and P009E present?	**Yes** — Both are present, go to Step 9. **No** — Continue to the next step.
2	**Check for oil contamination at bleed port/EVAP line** a. Disconnect EVAP line from vapor port. Is oil present in EVAP line or vapor port?	**Yes** — Replace bleed port and continue to the next step. **No** — Continue to the next step.
3	**Determine if fault condition repeats** a. START the engine and allow it to run for one (1) minute. b. Turn OFF the engine and wait one (1) minute. c. Measure and record the fuel rail pressure, fuel rail temperature and fuel tank pressure with the Key ON Engine OFF (KOEO). d. Energize the Bleed Solenoid. Refer to the Manual Solenoid Activation Procedure. e. With the engine OFF, monitor fuel rail pressure for 15 minutes. Does the fuel rail pressure drop 20psi in 15 minutes?	**Yes** — Continue to the next step. **No** — Go to Step 5.
4	**Monitor fuel rail pressure.** With the fuel rails still depressurized, monitor the fuel rail pressure for ten (10) minutes to see if the pressure increases. Does fuel rail pressure rise more than 10 psi (69 kPa)?	**Yes** — Close Bleed Solenoid. Replace the FRPCM. **No** — Close Bleed Solenoid. Go to Step 8.
5	**Verify bleed port function** a. Disconnect the EVAP line from the FRPCM port. b. Energize the Bleed Solenoid. Energize the Bleed Solenoid. Refer to the Manual Solenoid Activation Procedure. Is there propane flowing from the port?	**Yes** — Close Bleed Solenoid, Go to Step 8. **No** — Close Bleed Solenoid, Continue to the next step.
6	**Verify bleed solenoid function** a. Remove the bleed port. b. Energize the bleed solenoid. Energize the Bleed Solenoid. Refer to the Manual Solenoid Activation Procedure. Is the bleed solenoid operating properly?	**Yes** — Replace bleed port and repeat Step 3. **No** — Continue to the next step.
7	**Verify that wiring is in good condition and functioning** Verify 12v power and ground to the at the bleed solenoid. Energize the Bleed Solenoid. Refer to the Manual Solenoid Activation Procedure. Does the solenoid activate and propane flow from FRPCM with 12v power and ground present?	**Yes** — Check resistance of the solenoid coil. If resistance value is outside of 6-11 ohms, replace solenoid coil and retest. If the resistance is within spec, replace FRPCM. **No** — Repair wiring and repeat Step 3.
8	**Check for a kinked EVAP line** Inspect the EVAP line between the FRPCM and EVAP canister. Are there kinks in the line?	**Yes** — Close Bleed Solenoid. Replace the kinked EVAP line and then repeat Step 3. **No** — Close Bleed Solenoid. Potential intermittent fault. Call ROUSH CleanTech Customer Success at (800) 59-ROUSH (597-6874), Opt. 2 fore more assistance.

9	**Check for leaks to the FRPCM** a. START the engine and allow it to run for a few minutes. b. Turn OFF the engine. c. Measure and record fuel rail pressure. d. Activate bleed solenoid to bleed pressure from fuel rail until fuel pressure drops more than 50 psi (345 kPa). Energize the Bleed Solenoid. Refer to the Manual Solenoid Activation Procedure. e. De-energize Bleed Solenoid. f. Disconnect the FRPCM and wait 120 minutes. g. Measure fuel rail pressure and fuel tank pressure. Does fuel rail pressure rise more than 10 psi (69 kPa)?	**Yes** — FRPCM is leaking at either supply solenoid or return check valve. Replace FRPCM. **No** — Potential intermittent fault. Call ROUSH CleanTech Customer Success at (800) 59-ROUSH (597-6874), Opt. 2 fore more assistance.

Pinpoint Test J: Tank Solenoid Electrical Check

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics.

Step	Procedure	Action
1	**Unplug the solenoid harness connector C7 from the tank solenoid. Using a multimeter, measure resistance of the solenoid.** Is the measured resistance within 6-11 ohms?	**Yes** — Continue to the next step. **No** — Replace the tank solenoid coil.
2	**Using a multimeter, measure voltage at the tank solenoid as follows:** a. With the ignition key ON, check for voltage present at Pin-1, connector C7 (tank harness). Use the body as the reference ground. Is battery (B+) voltage present?	**Yes** — Power circuit OK. Proceed to Step 7. **No** — Continue to the next step.
3	**Check fuse (E3-E4, 20A) in auxiliary fuse box.** Is fuse blown?	**Yes** — Replace fuse and locate the short. **No** — Fuse OK; Continue to the next step.
4	**Check Relay A, or primary fuel pump relay.** Is relay functioning properly?	**Yes** — Continue to the next step. **No** — Replace relay.
5	**Check supply circuit continuity from solenoid harness to fuse box.** a. Check continuity between: • Pin-1, connector C7 and Pin-10, connector C1 (tank harness) • Pin-1, connector C6 and Pin-10, connector C1 (rear frame harness) • Pin-1, connector C2 and cavity A5, fuse box (underhood harness) Is there good continuity in the circuit?	**Yes** — Continue to the next step. **No** — Repair supply circuit wiring.
6	**Check ground circuit continuity from tank harness to Smart Relay Module (SRM) connector.** a. Check continuity between: • Pin-2, connector C7 and Pin-7, connector C1 (tank harness) • Pin-7, connector C6 and Pin-7, connector C1 (rear frame harness) • Pin-7, connector C2 and Pin-1, connector C1 (underhood harness) Is there good continuity in the circuit?	**Yes** — Refer to the Smart Relay Module Electrical Check procedure in Diagnostic Tests and Procedures. **No** — Repair ground circuit wiring.

Pinpoint Test K: Return Valve Procedure

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics**.**

Step	Procedure	Action
1	**Unplug the solenoid harness connector C4 from the return solenoid. Using a multimeter, measure the resistance of the solenoid.** Is the measured resistance within 6-11 ohms?	**Yes** — Continue to next step. **No** — Replace the return solenoid coil.
2	**Using a multimeter, measure the voltage at the tank solenoid as follows:** a. With the ignition key ON, check for voltage present at pin-1, connector C4 (tank harness). Use the body as the reference ground. Is battery (B+) voltage present?	**Yes** — Supply circuit OK. Proceed to step 5 **No** — Continue to next step.
3	**Check fuse (F1-F2, 10A) in auxiliary fuse box.** Is fuse blown?	**Yes** — Replace the fuse **No** — Fuse OK. Go to next step.
4	**Check supply circuit continuity from the solenoid harness to the fuse box.** a. Check continuity between: • Pin 1, connector C4 and Pin 12, connector C1 (tank harness). • Pin 12, connector C2 and Cavity F2, fuse box (underhood harness). Is there good continuity in the circuit?	**Yes** — Continue to next step. **No** — Repair supply circuit wiring
5	**Check ground circuit continuity from the tank harness to the Smart Relay Module (SRM) connector.** a. Check continuity between: • Pin 2, connector C4 and Pin 11, connector C1 (tank harness). • Pin 11, connector C2 and Pin 30, connector C1 (underhood harness). Is there good continuity in the circuit?	**Yes** — Refer to the Smart Relay Module Electrical Check procedure **No** — Repair ground circuit wiring

Pinpoint Test L: Fuel Rail Pressure Control Module Electrical Check

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics.

For the Supply Solenoid

Step	Procedure	Action
1	**Unplug the supply solenoid connector, C5. Using a multimeter, check the resistance of the solenoid coil.** Is the measured resistance within 6-11 ohms?	**Yes** — Continue to the next step. **No** — Replace supply solenoid coil.
2	**Using a multimeter, measure the voltage at the FRPCM supply solenoid coil as follows:** a. With the ignition key ON, check for voltage present at Pin-1, connector C5 to fuse 2. Is voltage present?	**Yes** — Power circuit OK. Continue to the next step. **No** — Continue to the next step.
3	**Check ground circuit continuity from the underhood harness to the Smart Relay Module (SRM) connector.** a. Check continuity between: • Pin 2, connector C5 and Pin-32, connector C1. Is there good continuity between the two pins?	**Yes** — Refer to the Smart Relay Module Electrical Check procedure in Diagnostic Tests and Procedures. **No** — Repair ground circuit wiring.

For the Bleed Solenoid

Step	Procedure	Action
1	**Unplug the bleed solenoid connector, C6. Using a multimeter, check the resistance of the solenoid coil.** Is the measured resistance within 6-11 ohms?	**Yes —** Continue to the next step. **No** — Replace bleed solenoid coil.
2	**Using a multimeter, measure the voltage at the FRPCM bleed solenoid as follows:** a. With the ignition key ON, check for voltage present at Pin-1, connector C6 to fuse 2. Is voltage present?	**Yes** — Power circuit OK. Continue to the next step. **No** — Continue to the next step.
3	**Check ground circuit continuity from the underhood harness to the Smart Relay Module (SRM) connector.** a. Check continuity between: • Pin-2, connector C6 and Pin-33, connector C1 Is there good continuity between the two pins?	**Yes** — Refer to the Smart Relay Module Electrical Check procedure in Diagnostic Tests and Procedures. **No** — Repair ground circuit wiring.

Pinpoint Test M: Injection Pressure Temperature Sensor (IPTS) Electrical Check

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics**.**
Only perform this test with the vehicle at ambient room temperature (20–30°C, 68–86°F).

Step	Procedure	Action
1	**Unplug the connector C3 (underhood harness) to the IPTS. Check resistance of the injection pressure temperature sensor (IPTS).** a. **With vehicle at ambient room temperature (20–30°C, 68–86°F)** and using a multimeter, measure resistance across the IPTS terminals (between Pin-1 and Pin-3). Is the resistance value between 8K–12K ohms?	**Yes** — Continue to next step. **No** — Replace the IPTS.
2	**Check circuit continuity between the IPTS and the Smart Relay Module (SRM).** a. Using a multimeter, check continuity in the underhood harness between: • Pin-1, connector C3 and Pin-40, connector C1 • Pin-2, connector C3 and Pin-20, connector C1 • Pin-3, connector C3 and Pin-18, connector C1 • Pin-4, connector C3 and Pin-25, connector C1 Is there good continuity in the circuits?	**Yes** — Refer to the Smart Relay Module Electrical Check procedure. **No** — Repair circuit wiring.

Pinpoint Test N: Tank Pressure Temperature Sensor (TPTS) Electrical Check

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics**.**
Only perform this test with the vehicle at ambient room temperature (20–30°C, 68–86°F).

Step	Procedure	Action
1	**Unplug connector C3 (fuel tank harness) to the TPTS. Check resistance of the TPTS.** a. **With vehicle at ambient room temperature (20–30°C, 68–86°F)** and using a multimeter, measure resistance across the FPTS terminals (between pin-1 and pin-3). Is the resistance value between 8K–12K ohms?	**Yes** — Continue to next step. **No** — Replace the TPTS.
2	**Check circuit continuity between the TPTS and the Smart Relay Module (SRM).** a. Using a multimeter, check continuity in the underhood harness between: • Pin-1, connector C3 and Pin-40, connector C1 • Pin-2, connector C3 and Pin-21, connector C1 • Pin-3, connector C3 and Pin-19, connector C1 • Pin-4, connector C3 and Pin-25, connector C1 Is there good continuity in the circuits?	**Yes** — Continue to next step. **No** — Repair circuit wiring.
3	**Verify the calibration is up-to-date.** Call ROUSH CleanTech Customer Success at (800) 59-ROUSH (597-6874), Opt. 2 to verify the calibration is up-to-date. Is the calibration up-to-date?	**Yes** — Refer to the Smart Relay Module Electrical Check procedure for more diagnostics. **No** — Update the calibration.

Pinpoint Test O: Fuel Pump Control Module Electrical Continuity Test

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics.

Step	Procedure	Action
1	**Check Ford FPCM circuit continuity to Ford harness.** a. Disconnect rear frame harness connectors C10 and C11. b. Check for continuity in the rear frame harness across: • Pin-1, connector C10 and Pin-1, connector C11 • Pin-3, connector C10 and Pin-3, connector C11 • Pin-4, connector C10 and Pin-4, connector C11 • Pin-6, connector C10 and Pin-6, connector C11 • Pin-7, connector C10 and Pin-7, connector C11 Is there good continuity in each circuit?	**Yes** — Continue to next step. **No** — Repair circuit wiring
2	**Check FPCM circuit continuity to Ford harness.** a. Disconnect rear frame harness connector C9. b. Check wire VPWR (V+) for continuity across: • Pin-1, connector C9 (rear frame harness) and Pin-1, connector C6 (rear frame harness) • Pin-1, connector C2 (underhood harness) and cavity-A5, fuse box (underhood harness) • Cavity-A3, fuse box (underhood harness) and cavity-E4, fuse box (underhood harness) Is there good continuity in each circuit?	**Yes** — Continue to next step. **No** — Repair circuit wiring
3	**Check fuse condition (E3-E4).** Is the fuse blown?	**Yes** — Inspect for shorted wire and replace fuse **No** — Continue to next step.
4	**Check ROUSH CleanTech FPCM circuit continuity to Ford harness.** a. Check for continuity in the rear frame harness across: • Pin-1, connector C6 and Pin-1, connector C9 • Pin-4, connector C10 and Pin-4, connector C9 • Pin-1, connector C1 and Pin-5, connector C9 • Pin-6, connector C10 and Pin-6, connector C9 • Pin-9, connector C1 and Pin-8, connector C9 • Pin-15, connector C6 and Pin-7, connector C9 Is there good continuity in each circuit?	**Yes** — Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for functional testing of the FPCM **No** — Repair circuit wiring

Pinpoint Test P: Smart Relay Module Electrical Test

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics.

Step	Procedure	Action
1	**Disconnect the Smart Relay Module (SRM) connector C1 (underhood harness).**	
2	**Check for battery voltage (B+) to the SRM.** a. Using a multimeter, check for B+ voltage at pin-2, connector C1. Use a body ground for reference. Is there voltage (B+)?	**Yes** — Go to Step 5. **No** — Continue to the next step.
3	**Check for battery voltage (B+) to the SRM.** a. Check circuit continuity between pin-2, connector C1 and cavity E2, auxiliary fuse box. Is there good continuity in the circuit?	**Yes** — Continue to the next step. **No** — Repair circuit wiring.
4	**Check for battery voltage (B+) to the SRM.** a. Check condition of SRM power fuse (E1-E2, 5A) in the auxiliary fuse box. Is the fuse blown?	**Yes** — Replace fuse. **No** —Continue to the next step.
5	**Check the SRM ground circuit for continuity.** a. Using a multimeter, check ground at pin-31, connector C1 (Underhood harness). Use a body ground for reference. Is there good continuity in the circuit?	**Yes** — Continue to the next step. **No** — Repair circuit wiring.
6	**Check CAN and underhood harness continuity.** a. Check CAN-H(+) continuity across: • Pin-28, SRM connector C1 (Underhood harness) and pin-1, connector C23 (Underhood Harness) • Pin-1, connector C2 (CAN harness) and pin-6, connector C1 (CAN harness) Is there good continuity in the circuits?	**Yes** — Continue to the next step. **No** — Repair circuit wiring.
7	**Check CAN and underhood harness continuity.** a. Check CAN-H(-) continuity across: • Pin-43, SRM connector C1 (underhood harness) and pin-2, connector C23 (underhood harness) • Pin-2, connector C2 (CAN harness) and pin-14, connector C1 (CAN harness) Is there good continuity in the circuits?	**Yes** — Refer to the Ford Powertrain Control/Emissions Diagnosis Service Manual for functional testing of the CAN bus. **No** — Repair circuit wiring.

Pinpoint Test Q: Fuel Level Sender Electrical Check

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics**.**

NOTE: The fuel level indication system is calibrated to the voltage output from the fuel level sender. The needle position on the sending unit Twinsight is a raw reading of the sender arm position and is not an accurate representation of the fuel level in the tank. The fuel level gauge on the cluster should display the correct fuel level. All continuity (OHMS) readings should be less than 0.5 OHMS.
NOTE: It is normal for the gauge on the cluster and the gauge on the FLS to differ from one another.

Step	Procedure	Action
1.	**Perform a visual inspection to verify the following are in working order:** a. Inspect all fuses in both the Ford and ROUSH fuse boxes. b. Perform wiring checks of the Underhood harness and FLS connector. c. Verify that the twinsight is installed correctly and properly seated.	**Yes** — If everything is in working order, go to Step 2. **No** — Repair any issues and move go to Step 2.
2	**Check for DTCs** If any SRM DTCs are present go to Pin Point test and resolve those faults prior to diagnosing the Fuel Level Sender (FLS) fault. Correct any CAN BUS communication faults if present.	**Yes** — Refer to the Smart Relay Module Electrical Check procedure in Diagnostic Tests and Procedures. **No** — Go to Step 3.
3	**Perform Wiggle test on connector while monitoring Fuel Level Indicator parameter for a change in value.** Does the fuel level value change erratically?	**Yes** — Repair connector or wiring and retest. **No** — Go to Step 5.
4	**Check 5v reference on Fuel Level Sender** Turn key to on position. Check for 5-volt reference present across pin-A and pin-C harness side of the FLS connector. Is 5v power present?	**Yes** — Go to Step 7. **No** — Go to Step 5.
5	**Check for other sensors affecting 5v network.** Unplug these sensors and recheck for 5v reference: • Coolant level sensor • Tank Pressure Temperature Sensor • Injection Pressure Temperature Sensor Is there still no 5v reference at the FLS after unplugging the sensors?	**Yes** — Go to Step 6. **No** — Replace faulty sensor(s).
6	**Check for continuity of harness for 5v vref circuit and ground circuit of Fuel Level Sender.** a. Check for continuity from FLS pin-A frame side harness to Pin-25 of SRM connector: Continuity present - **Yes**, go to Step 3b. b. Check for continuity from FLS pin-C frame harness at FLS and pin-40 of SRM connector. Is there good continuity in each circuit?	**Yes** — Go to Step 7. **No** — Locate and repair open circuit or replace harness.
7	**Check for power on SRM** With KOEO, with SRM connected, check voltage across Pin-25 and Pin-40 of the SRM connector. Is voltage present?	**Yes** — If no resolution, contact ROUSH CleanTech Customer Success at (800) 59-ROUSH (597-6874), Opt. 2. **No** — Replace SRM.
8	**Perform output voltage check.** a. With harness fully connected and KOEO, place the universal probes into Pin-B and Pin-C of sending unit connector and monitor for voltage. Is voltage present?	**Yes** — Go to Step 7. **No** — Replace electronic portion of sending unit.

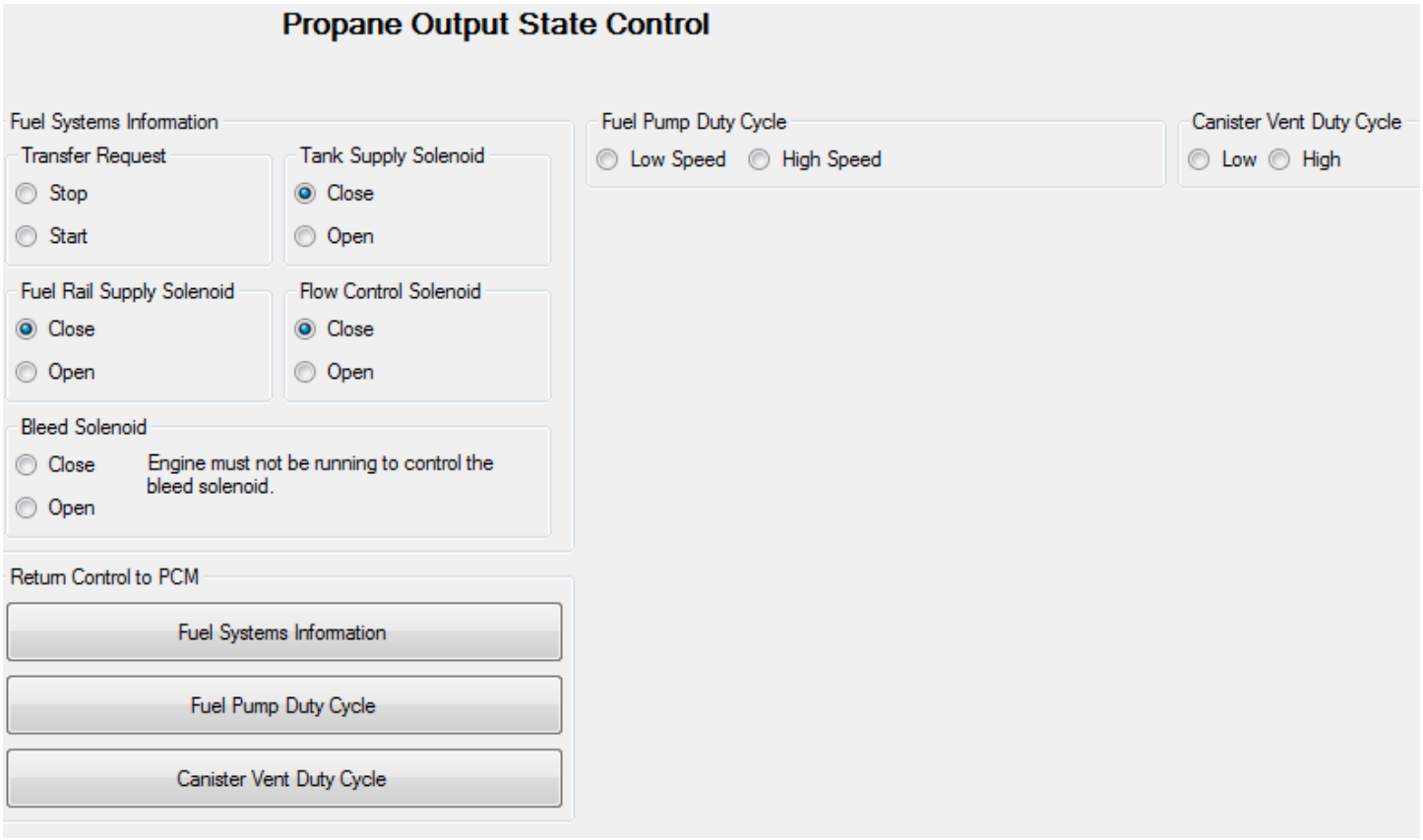
9	**Perform sending unit range voltage test.** a. Remove sending dial. **Do not remove the four hex screws.** Using a non-magnetic socket or other steel/iron object, move sender from full to empty. Make sure the voltage smoothly changes between 0.1 volts min. to 4.98 volts max. Does the sensor pass the range voltage range output test?	**Yes** — Go to Step 8. **No** — Replace electronic portion of sending unit clear faults and test.
10	**Test continuity of the signal wire.** Test from Pin-4 of the SRM to Pin-b of the FLS harness. Is there continuity?	**Yes** — Refer to Ford Powertrain Control/Emissions Diagnostics Service Manual for ... properly, re... **No** — Repair wiring concern.

Pinpoint Test R: Manual Solenoid Activation Procedu

For harness and connector layout diagrams and system electrical schema

Manual Activation	
Step	**Procedure**
1	Turn ignition to off. Disconnect the Smart Relay Module (SRM) wi
2	Energize the individual solenoids by providing a ground to the foll **NOTE: Use caution not to damage SRM connector terminals. Alw** • Pin-33 – Bleed Solenoid • Pin-32 – Supply Solenoid • Pin-30 – Flow Control Solenoid **NOTE: The tank supply solenoid cannot be actuated from the SR connector.**

Activation with the Roush Diagnostic Tool (RDT)		
Step	**Procedure**	
1	Refer to the Utilizing the Roush Diagnostic Tool section of the Dia	
2	Select Functional Tests from the left side menu.	
3	Select the PIDS required to gain solenoid control (see below). The PIDs required are: RPR_PT_PRS, RPR_FR_PRS, RPR_SS1_CMD (see PIDs list for descriptions of each PID).	
4	To open or close selected solenoids, click on the radio button for t on screen during each test (see below for an example). *The Bleed Solenoid cannot be activated if the vehicle is running	
5	When solenoid activation and tests have been completed, return Close for each solenoid. **NOTE: Failing to do this will impair future vehicle operation and**	
6	After returning the solenoids to the closed position, key the vehic (1) minute before restarting the vehicle to allow the PCM to rega	


Propane Output State Control
Fuel Systems Information
Transfer Request
Stop
Start
Tank Supply Solenoid
Close
Open
Fuel Rail Supply Solenoid
Close
Open
Flow Control Solenoid
Close
Open
Bleed Solenoid
Close
Open
Engine must not be running to control the bleed solenoid.
Fuel Pump Duty Cycle
Low Speed
High Speed
Canister Vent Duty Cycle
Low
High
Return Control to PCM
Fuel Systems Information
Fuel Pump Duty Cycle
Canister Vent Duty Cycle


RPR_PT_PRS
RPR_PT_PRS_VOLTS
RPR_PT_TEMP
RPR_PT_TEMP_VOLTS
RPR_FR_PRS
RF_AP_ACTUAL
MUX_RPR_RAIL_PRES
RPR_FR_TEMP
FUL_RAILTEMP
MUX_RPR_RAIL_TEMP
RPR_STATE
rpr_vpr_prs_offset_flt_m
rpr_adap_vpr_offset_refuel_m_index
rpr_fr_adap_vpr_prs_sat_fnl
RPR_FR_PRS_SAT
RPR_SS1_CMD
RPR_SS2_CMD
RPR_BS_CMD
RPR_FCS_CMD
RPR_FR_PRS_TGT
MUX_RPR_BLEED_STATUS

Pinpoint Test S: Injection Voltage Control Module Pinpoint Test

For harness and connector layout diagrams and system electrical schematics, refer to Wiring Diagrams and Electrical Schematics**.**

Step	Procedure	Action
1	Using RDT, verify the current PCM calibration is the correct calibration for a vehicle with a VBM. a. Using RDT, take note of the PCM calibration id. For more information on getting calibration information in RDT, please see How Do I Identify the Calibration in a ROUSH CleanTech Vehicle? b. Contact ROUSH CleanTech Technical Support at 800-59-ROUSH to verify that the calibration is current. Is the calibration correct?	**Yes —** Continue to the next step. **No** — Update the PCM calibration using the calibration voucher code and family received from ROUSH CleanTech Technical Support. When complete, perform the 'Key On Engine Off Test' in RDT to verify that the codes have been remedied. a. If all VBM codes are removed, the procedure is complete. b. If any VBM codes remain after this test, continue to the next step.
2	Perform a visual inspection of the VBM unit. Remove dash trim and visually inspect the VBM for a. Debris b. Physical damage Are there any physical issues that can be seen on the VBM?	**Yes** — Fix and retest. If the issue cannot be fixed, replace the VBM. **No** — Continue to the next step.
3	Inspect connection at the SRM. a. Disconnect and inspect the connection into cavity 16 of the SRM and verify that the terminal is seated. b. When complete, perform the Key On Engine Off Test test to verify that the codes have been remedied. Are there any DTCs remaining?	**Yes** — Replace the VBM and retest for codes. If any codes remain, contact ROUSH CleanTech Technical Support at 800-59-ROUSH. **No** — If the VBM codes are removed, the procedure is complete.

Reference Charts

Sensor Voltage Reference Chart

Vout	PSIA
0.5	-0.0
0.6	12.7
0.7	25.5
0.8	38.2
0.9	51.0
1	63.7
1.1	76.5
1.2	89.2
1.3	102.0
1.4	114.7
1.5	127.5
1.6	140.2
1.7	153.0
1.8	165.7
1.9	178.5
2	191.2
2.1	204.0
2.2	216.7
2.3	229.5
2.4	242.2
2.5	255.0
2.6	267.7
2.7	280.5
2.8	293.2
2.9	306.0
3	318.7
3.1	331.5
3.2	344.2
3.3	357.0
3.4	369.7

Rmin	Rmax	degC	degF
301,183	331,179	-40	-40
162,304	175,994	-30	-22
90,938	97,349	-20	-4
52,781	55,836	-10	14
31,290	32,738	0	32
19,346	20,036	10	50
12,315	12,633	20	68
9,900	10,100	25	77
7,977	8,182	30	86
5,282	5,462	40	104
3,585	3,737	50	122
2,474	2,598	60	140
1,744	1,844	70	158
1,250	1,330	80	176
909.6	974.0	90	194
671.3	723.1	100	212
504.0	545.9	110	230
382.6	416.6	120	248
294.6	322.3	130	266
258.6	283.9	135	275

Tank Temperature Pressure Chart

Temperature (°F)	Pressure (psi)		
	Min.	Nominal	Max.
0	15	25	35
5	19	29	39
10	23	33	43
15	28	38	48
20	33	43	53
25	38	48	58
30	43	53	63
35	49	59	69
40	55	65	75
45	62	72	82
50	69	79	89
55	77	87	97
60	84	94	104
65	93	103	113
70	102	112	122
75	111	121	131
80	121	131	141
85	131	141	151
90	142	152	162
95	153	163	173
100	165	175	185
105	178	188	198
110	191	201	211
115	205	215	225
120	219	229	239

2016-2017 Calibration Release OBD Summary Chart

NOTE: For any DTCs not specific to the ROUSH CleanTech fuel system, please reference the Ford Powertrain Control/Emissions Diagnosis Service Manual.

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
Code	**Description**	**2016/2017**	**2016/2017**	**2016/2017**
c05d7		N/A	N/A	non-MIL
P0005	Fuel Shutoff Valve “A” Control Circuit/Open	non-MIL	non-MIL	non-MIL
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	MIL	MIL	MIL
P0036	HO2S Heater Control Circuit (Bank 1 Sensor 2)	MIL	MIL	MIL
P0040	Oxygen Sensor Signals Swapped Bank 1 Sensor 1 / Bank 2 Sensor 1	non-MIL	non-MIL	non-MIL
P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	MIL	MIL	MIL
P0068	MAP / MAF - Throttle Position Correlation	MIL	MIL	MIL
P0090	Fuel Pressure Regulator Control Circuit/Open	non-MIL	non-MIL	non-MIL
P009B	Fuel Pressure Relief Control Circuit/Open	MIL	MIL	MIL
P009E	Fuel Pressure Relief Control Performance / Stuck Off	MIL	MIL	MIL
P0100	Mass or Volume Air Flow Sensor “A” Circuit	MIL	MIL	MIL
P0102	Mass or Volume Air Flow Sensor “A” Circuit Low	MIL	MIL	MIL
P0103	Mass or Volume Air Flow Sensor “A” Circuit High	MIL	MIL	MIL
P0104	Mass or Volume Air Flow Sensor “A” Circuit Intermittent	MIL	MIL	MIL
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 1)	MIL	MIL	MIL
P0112	Intake Air Temperature Sensor 1 Circuit Low (Bank 1)	MIL	MIL	MIL
P0113	Intake Air Temperature Sensor 1 Circuit High (Bank 1)	MIL	MIL	MIL
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	MIL	MIL	MIL
P0122	Throttle/Pedal Position Sensor “A” Circuit Low	MIL	MIL	MIL
P0123	Throttle/Pedal Position Sensor “A” Circuit High	MIL	MIL	MIL
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	MIL	MIL	MIL
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	MIL	MIL	MIL
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	MIL	MIL	MIL
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	MIL	MIL	MIL
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	MIL	MIL	MIL
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	MIL	MIL	MIL
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	MIL	MIL	MIL
P0148	Fuel Delivery Error	non-MIL	non-MIL	non-MIL
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	MIL	MIL	MIL
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	MIL	MIL	MIL
P0155	O2 Sensor Heater Circuit (Bank 2 Sensor 1)	MIL	MIL	MIL
P0171	System Too Lean (Bank 1)	MIL	MIL	MIL
P0172	System Too Rich (Bank 1)	MIL	MIL	MIL
P0174	System Too Lean (Bank 2)	MIL	MIL	MIL
P0175	System Too Rich (Bank 2)	MIL	MIL	MIL
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance	non-MIL	non-MIL	non-MIL
P0182	Fuel Temperature Sensor “A” Circuit Low	MIL	MIL	MIL
P0183	Fuel Temperature Sensor “A” Circuit High	MIL	MIL	MIL
P0192	Fuel Rail Pressure Sensor Circuit Low (Bank 1)	MIL	MIL	MIL

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
		2016/2017	2016/2017	2016/2017
P0193	Fuel Rail Pressure Sensor Circuit High (Bank 1)	MIL	MIL	MIL
P01A0	Alternate Fuel Tank “A” Pressure Sensor Circuit Low	non-MIL	non-MIL	non-MIL
P01A1	Alternate Fuel Tank “A” Pressure Sensor Circuit High	non-MIL	non-MIL	non-MIL
P01A2	Alternative Fuel Tank “A” Pressure Sensor Circuit Intermittent/Erratic	non-MIL	non-MIL	non-MIL
P01AC	Alternate Fuel Tank Temperature Sensor Circuit Low	non-MIL	non-MIL	non-MIL
P01AD	Alternate Fuel Tank Temperature Sensor High	non-MIL	non-MIL	non-MIL
P01AE	Alternate Fuel Tank Temperature Sensor Circuit Intermittent/Erratic	non-MIL	non-MIL	non-MIL
P0201	Cylinder 1 Injector “A” Circuit/Open	MIL	MIL	MIL
P0202	Cylinder 2 Injector “A” Circuit/Open	MIL	MIL	MIL
P0203	Cylinder 3 Injector “A” Circuit/Open	MIL	MIL	MIL
P0204	Cylinder 4 Injector “A” Circuit/Open	MIL	MIL	MIL
P0205	Cylinder 5 Injector “A” Circuit/Open	MIL	MIL	MIL
P0206	Cylinder 6 Injector “A” Circuit/Open	MIL	MIL	MIL
P0207	Cylinder 7 Injector “A” Circuit/Open	MIL	MIL	MIL
P0208	Cylinder 8 Injector “A” Circuit/Open	MIL	MIL	MIL
P0209	Cylinder 9 Injector “A” Circuit/Open	MIL	MIL	MIL
P0210	Cylinder 10 Injector “A” Circuit/Open	MIL	MIL	MIL
P0217	Engine Coolant Over Temperature Condition	non-MIL	non-MIL	non-MIL
P0218	Transmission Fluid Temperature Sensor “A” Over Temperature Condition	non-MIL	non-MIL	non-MIL
P0219	Engine Overspeed Condition	non-MIL	non-MIL	non-MIL
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	MIL	MIL	MIL
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	MIL	MIL	MIL
P025A	Fuel Pump Module “A” Control Circuit/Open	non-MIL	non-MIL	non-MIL
P025B	Fuel Pump Module “A” Control Circuit Range/Performance	non-MIL	non-MIL	non-MIL
P027B	Fuel Pump Module “B” Control Circuit Range/Performance	non-MIL	non-MIL	N/A
P0297	Vehicle Overspeed Condition	non-MIL	non-MIL	non-MIL
P0298	Engine Oil Over Temperature Condition	non-MIL	non-MIL	non-MIL
P03xx	Misfire	non-MIL	non-MIL	non-MIL
P0339	Crankshaft Position Sensor “A” Circuit Intermittent	MIL	MIL	MIL
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or single sensor)	MIL	MIL	MIL
P0351	Ignition Coil “A” Primary Control Circuit/Open	MIL	MIL	MIL
P0352	Ignition Coil “B” Primary Control Circuit/Open	MIL	MIL	MIL
P0353	Ignition Coil “C” Primary Control Circuit/Open	MIL	MIL	MIL
P0354	Ignition Coil “D” Primary Control Circuit/Open	MIL	MIL	MIL
P0355	Ignition Coil “E” Primary Control Circuit/Open	MIL	MIL	MIL
P0356	Ignition Coil “F” Primary Control Circuit/Open	MIL	MIL	MIL
P0357	Ignition Coil “G” Primary Control Circuit/Open	MIL	MIL	MIL
P0358	Ignition Coil “H” Primary Control Circuit/Open	MIL	MIL	MIL
P0359	Ignition Coil “I” Primary Control Circuit/Open	MIL	MIL	MIL
P0360	Ignition Coil “J” Primary Control Circuit/Open	MIL	MIL	MIL
P03xx	Misfire	non-MIL	non-MIL	non-MIL

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
		2016/2017	2016/2017	2016/2017
P0443	EVAP System Purge Control Valve “A” Circuit	MIL	MIL	MIL
P0460	Fuel Level Sensor “A” Circuit	N/A	non-MIL	N/A
P0461	Fuel Level Sensor “A” Circuit Range/Performance	non-MIL	non-MIL	non-MIL
P0462	Fuel Level Sensor “A” Circuit Low	non-MIL	non-MIL	non-MIL
P0463	Fuel Level Sensor “A” Circuit High	non-MIL	non-MIL	non-MIL
P0504	Brake Switch “A”/”B” Correlation	non-MIL	non-MIL	non-MIL
P0505	Idle Control System	non-MIL	non-MIL	non-MIL
P0506	Idle Control System - RPM Lower Than Expected	MIL	MIL	MIL
P0507	Idle Control System - RPM Higher Than Expected	MIL	MIL	MIL
P0532	A/C Refrigerant Pressure Sensor “A” Circuit Low	non-MIL	non-MIL	non-MIL
P0533	A/C Refrigerant Pressure Sensor “A” Circuit High	non-MIL	non-MIL	non-MIL
P0562	System Voltage Low	non-MIL	non-MIL	non-MIL
P0563	System Voltage High	non-MIL	non-MIL	non-MIL
P0572	Brake Switch “A” Circuit Low	non-MIL	non-MIL	non-MIL
P0573	Brake Switch “A” Circuit High	non-MIL	non-MIL	non-MIL
P0579	Cruise Control Multi-Function Input “A” Circuit Range/Performance	non-MIL	N/A	non-MIL
P0581	Cruise Control Multi-Function Input “A” Circuit High	non-MIL	N/A	non-MIL
P0600	Serial Communication Link	MIL	MIL	MIL
P0602	Powertrain Control Module Programming Error	MIL	MIL	MIL
P0604	Internal Control Module Random Access Memory (RAM) Error	MIL	MIL	MIL
P0605	Internal Control Module Read Only Memory (ROM) Error	MIL	MIL	MIL
P0607	Control Module Performance	MIL	MIL	MIL
P060A	Internal Control Module Monitoring Processor Performance	MIL	MIL	MIL
P060B	Internal Control Module A/D Processing Performance	MIL	MIL	MIL
P060C	Internal Control Module Main Processor Performance	MIL	MIL	MIL
P060D	Internal Control Module Accelerator Pedal Position Performance	non-MIL	non-MIL	non-MIL
P0610	Control Module Vehicle Options Error	MIL	MIL	MIL
P061A	Internal Control Module Torque Performance	non-MIL	non-MIL	non-MIL
P061B	Internal Control Module Torque Calculation Performance	MIL	MIL	MIL
P061C	Internal Control Module Engine RPM Performance	MIL	MIL	MIL
P061D	Internal Control Module Engine Air Mass Performance	MIL	MIL	MIL
P0620	Generator Control Circuit	non-MIL	non-MIL	non-MIL
P0625	Generator Field/F Terminal Circuit Low	non-MIL	non-MIL	non-MIL
P0626	Generator Field/F Terminal Circuit High	non-MIL	non-MIL	non-MIL
P0627	Fuel Pump “A” Control Circuit Open	non-MIL	non-MIL	non-MIL
P062F	Internal Control Module EEPROM Error	N/A	non-MIL	N/A
P0630	VIN Not Programmed or Incompatible - ECM/PCM	N/A	MIL	N/A
P0642	Sensor Reference Voltage “A” Circuit Low	MIL	MIL	MIL
P0643	Sensor Reference Voltage “A” Circuit High	MIL	MIL	MIL
P0645	A/C Clutch Relay Control Circuit	non-MIL	non-MIL	non-MIL
P064A	Fuel Pump Control Module “A”	non-MIL	non-MIL	N/A

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
		2016/2017	2016/2017	2016/2017
P064D	Internal Control Module O2 Sensor Processor Performance (Bank 1)	MIL	MIL	MIL
P064E	Internal Control Module O2 Sensor Processor Performance (Bank 2)	MIL	MIL	MIL
P0657	Actuator Supply Voltage “A” Circuit/Open	MIL	MIL	MIL
P065B	Generator Control Circuit Range/Performance	non-MIL	non-MIL	non-MIL
P06B8	Internal Control Module Non-Volatile Random Access Memory (NVRAM) Error	MIL	MIL	MIL
P06E4	Control Module Wake-up Circuit Performance	N/A	non-MIL	N/A
P06E9	Engine Starter Performance	non-MIL	non-MIL	non-MIL
P0701	Transmission Control System Range/Performance	non-MIL	non-MIL	non-MIL
P0702	Transmission Control System Electrical	non-MIL	non-MIL	non-MIL
P0706	Transmission Range Sensor “A” Circuit Range/Performance	MIL	MIL	MIL
P0707	Transmission Range Sensor “A” Circuit Low	MIL	MIL	MIL
P0708	Transmission Range Sensor “A” Circuit High	MIL	MIL	MIL
P0710	Transmission Fluid Temperature Sensor “A” Circuit	non-MIL	non-MIL	non-MIL
P0711	Transmission Fluid Temperature Sensor “A” Circuit Range/Performance	MIL	MIL	MIL
P0712	Transmission Fluid Temperature Sensor “A” Circuit Low	MIL	MIL	MIL
P0713	Transmission Fluid Temperature Sensor “A” Circuit High	MIL	MIL	MIL
P0715	Input/Turbine Shaft Speed Sensor “A” Circuit	MIL	MIL	MIL
P0717	Input/Turbine Shaft Speed Sensor “A” Circuit No Signal	non-MIL	non-MIL	non-MIL
P0718	Input/Turbine Shaft Speed Sensor “A” Circuit Intermittent	MIL	MIL	MIL
P0720	Output Shaft Speed Sensor Circuit	MIL	MIL	MIL
P0722	Output Shaft Speed Sensor Circuit No Signal	non-MIL	non-MIL	non-MIL
P0729	Gear 6 Incorrect Ratio	non-MIL	non-MIL	non-MIL
P0731	Gear 1 Incorrect Ratio	non-MIL	non-MIL	non-MIL
P0732	Gear 2 Incorrect Ratio	non-MIL	non-MIL	non-MIL
P0733	Gear 3 Incorrect Ratio	non-MIL	non-MIL	non-MIL
P0734	Gear 4 Incorrect Ratio	non-MIL	non-MIL	non-MIL
P0735	Gear 5 Incorrect Ratio	non-MIL	non-MIL	non-MIL
P0740	Torque Converter Clutch Solenoid Circuit/Open	MIL	MIL	MIL
P0741	Torque Converter Clutch Solenoid Circuit Performance/Stuck Off	MIL	MIL	MIL
P0742	Torque Converter Clutch Solenoid Circuit Stuck On	MIL	MIL	MIL
P0743	Torque Converter Clutch Solenoid Circuit Electrical	non-MIL	non-MIL	non-MIL
P0744	Torque Converter Clutch Solenoid Circuit Intermittent	MIL	MIL	MIL
P0748	Pressure Control Solenoid “A” Electrical	non-MIL	non-MIL	non-MIL
P0750	Shift Solenoid “A”	MIL	MIL	MIL
P0751	Shift Solenoid “A” Performance/Stuck Off	MIL	MIL	MIL
P0752	Shift Solenoid “A” Stuck On	MIL	MIL	MIL
P0753	Shift Solenoid “A” Electrical	non-MIL	non-MIL	non-MIL
P0754	Shift Solenoid “A” Intermittent	MIL	MIL	MIL
P0755	Shift Solenoid “B”	MIL	MIL	MIL
P0756	Shift Solenoid “B” Performance/Stuck Off	MIL	MIL	MIL

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
		2016/2017	2016/2017	2016/2017
P0757	Shift Solenoid “B” Stuck On	MIL	MIL	MIL
P0758	Shift Solenoid “B” Electrical	non-MIL	non-MIL	non-MIL
P0759	Shift Solenoid “B” Intermittent	MIL	MIL	MIL
P0760	Shift Solenoid “C”	MIL	MIL	MIL
P0761	Shift Solenoid “C” Performance/Stuck Off	MIL	MIL	MIL
P0762	Shift Solenoid “C” Stuck On	MIL	MIL	MIL
P0763	Shift Solenoid “C” Electrical	non-MIL	non-MIL	non-MIL
P0764	Shift Solenoid “C” Intermittent	MIL	MIL	MIL
P0765	Shift Solenoid “D”	MIL	MIL	MIL
P0766	Shift Solenoid “D” Performance/Stuck Off	MIL	MIL	MIL
P0767	Shift Solenoid “D” Stuck On	MIL	MIL	MIL
P0768	Shift Solenoid “D” Electrical	non-MIL	non-MIL	non-MIL
P0769	Shift Solenoid “D” Intermittent	MIL	MIL	MIL
P0770	Shift Solenoid “E”	MIL	MIL	MIL
P0771	Shift Solenoid “E” Performance/Stuck Off	MIL	MIL	MIL
P0772	Shift Solenoid “E” Stuck On	MIL	MIL	MIL
P0773	Shift Solenoid “E” Electrical	non-MIL	non-MIL	non-MIL
P0774	Shift Solenoid “E” Intermittent	MIL	MIL	MIL
P0882	TCM Power Input Signal Low	MIL	MIL	MIL
P0883	TCM Power Input Signal High	MIL	MIL	MIL
P0885	TCM Power Relay Control Circuit /Open	non-MIL	non-MIL	non-MIL
P0960	Pressure Control Solenoid “A” Control Circuit/Open	MIL	MIL	MIL
P0961	Pressure Control Solenoid “A” Control Circuit Range/Performance	MIL	MIL	MIL
P0962	Pressure Control Solenoid “A” Control Circuit Low	MIL	MIL	MIL
P0963	Pressure Control Solenoid “A” Control Circuit High	MIL	MIL	MIL
P0973	Shift Solenoid “A” Control Circuit Low	MIL	MIL	MIL
P0974	Shift Solenoid “A” Control Circuit High	MIL	MIL	MIL
P0976	Shift Solenoid “B” Control Circuit Low	MIL	MIL	MIL
P0977	Shift Solenoid “B” Control Circuit High	MIL	MIL	MIL
P0979	Shift Solenoid “C” Control Circuit Low	MIL	MIL	MIL
P0980	Shift Solenoid “C” Control Circuit High	MIL	MIL	MIL
P0982	Shift Solenoid “D” Control Circuit Low	MIL	MIL	MIL
P0983	Shift Solenoid “D” Control Circuit High	MIL	MIL	MIL
P0985	Shift Solenoid “E” Control Circuit Low	MIL	MIL	MIL
P0986	Shift Solenoid “E” Control Circuit High	MIL	MIL	MIL
P1001	KOER Not Able to Complete, KOER Aborted	non-MIL	non-MIL	non-MIL
P1002	KOER Not Able to Complete, KOER Aborted	N/A	non-MIL	N/A
P1101	Mass Air Flow Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1124	Throttle Position Sensor “A” Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1127	Exhaust Temperature Out of Range, O2 Sensor Tests Not Completed	non-MIL	non-MIL	non-MIL
P115E	Throttle Actuator Control Throttle Body Air Flow Trim at Max Limit	non-MIL	non-MIL	non-MIL

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
		2016/2017	2016/2017	2016/2017
P116E	Fuel Pressure Relief Valve Actuated	non-MIL	non-MIL	non-MIL
P1260	Theft Detected, Vehicle Immobilized	non-MIL	N/A	N/A
P1285	Cylinder Head Over Temperature Condition	non-MIL	non-MIL	non-MIL
P1288	Cylinder Head Temperature Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1289	Cylinder Head Temperature Sensor Circuit High	MIL	MIL	MIL
P1290	Cylinder Head Temperature Sensor Circuit Low	MIL	MIL	MIL
P1336	Crankshaft/Camshaft Sensor Range/Performance	non-MIL	non-MIL	non-MIL
P1397	System Voltage Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1453	Fuel Tank Pressure Relief Valve Malfunction	non-MIL	non-MIL	non-MIL
P1464	A/C Demand Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1501	Vehicle Speed Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1561	Brake Line Pressure Sensor Circuit	non-MIL	N/A	non-MIL
P1575	Pedal Position Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1594	Forced Engine Shutdown - Remote Start System Fault, No Unattended Vehicle Timeout	N/A	non-MIL	non-MIL
P1595	Forced Engine Shutdown - Remote Start System Fault, Transmission Range Not In Park Position	N/A	non-MIL	non-MIL
P1602	Immobilizer/ECM Communication Error	non-MIL	N/A	N/A
P160A	Control Module Vehicle Options Reconfiguration Error	N/A	non-MIL	N/A
P161A	Incorrect Response from Immobilizer Control Module	N/A	non-MIL	N/A
P1622	Immobilizer ID Does Not Match	non-MIL	N/A	N/A
P162E	Internal Control Module PTO Control Performance	non-MIL	non-MIL	non-MIL
P162F	Starter Motor Disabled - Engine Crank Time Too Long	non-MIL	non-MIL	non-MIL
P1633	Keep Alive Power Voltage Too Low	non-MIL	N/A	non-MIL
P1635	Tire/Axle Out of Acceptable Range	non-MIL	N/A	non-MIL
P1636	Inductive Signature Chip Communication Error	MIL	MIL	MIL
P1639	Vehicle ID Block Corrupted, Not Programmed	N/A	non-MIL	N/A
P1646	Linear O2 Sensor Control Chip (Bank 1)	MIL	MIL	MIL
P1647	Linear O2 Sensor Control Chip (Bank 2)	MIL	MIL	MIL
P1674	Control Module Software Corrupted	MIL	MIL	MIL
P1702	Transmission Range Sensor Circuit Intermittent	non-MIL	non-MIL	non-MIL
P1703	Brake Switch Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1705	Transmission Range Circuit Not Indicating Park/Neutral During Self Test	non-MIL	non-MIL	non-MIL
P1711	Transmission Fluid Temperature Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL
P1744	Torque Converter Clutch Solenoid Circuit Performance	non-MIL	non-MIL	non-MIL
P177F	Unable To Fully Engage Neutral	non-MIL	non-MIL	non-MIL
P1780	Transmission Control Switch (O/D Cancel) Circuit Out Of Self Test Range	non-MIL	N/A	non-MIL
P1783	Transmission Overtemperature Condition	non-MIL	non-MIL	non-MIL
P1921	Transmission Range Signal	non-MIL	non-MIL	non-MIL
P1934	Vehicle Speed Signal	N/A	MIL	N/A
P193E	A/C Clutch Request Signal	N/A	non-MIL	N/A
P2067	Fuel Level Sensor “B” Circuit Low	N/A	non-MIL	N/A

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
		2016/2017	2016/2017	2016/2017
P2068	Fuel Level Sensor “B” Circuit High	N/A	non-MIL	N/A
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	MIL	MIL	MIL
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	MIL	MIL	MIL
P2098	Post Catalyst Fuel Trim System Too Lean (Bank 2)	MIL	MIL	MIL
P2099	Post Catalyst Fuel Trim System Too Rich (Bank 2)	MIL	MIL	MIL
P2101	Throttle Actuator “A” Control Motor Circuit Range/Performance	MIL	MIL	MIL
P2107	Throttle Actuator “A” Control Module Processor	MIL	MIL	MIL
P2111	Throttle Actuator “A” Control System - Stuck Open	MIL	MIL	MIL
P2112	Throttle Actuator “A” Control System - Stuck Closed	MIL	MIL	MIL
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low	non-MIL	non-MIL	non-MIL
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High	non-MIL	non-MIL	non-MIL
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low	non-MIL	non-MIL	non-MIL
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High	non-MIL	non-MIL	non-MIL
P2135	Throttle/Pedal Position Sensor/Switch “A”/”B” Voltage Correlation	MIL	MIL	MIL
P2138	Throttle/Pedal Position Sensor/Switch “D”/”E” Voltage Correlation	non-MIL	non-MIL	non-MIL
P2195	Heated Exhaust Gas Oxygen Sensor Stuck	MIL	MIL	MIL
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	MIL	MIL	MIL
P2197	Heated Exhaust Gas Oxygen Sensor Stuck	MIL	MIL	MIL
P2198	O2 Sensor Signal Biased/Stuck Rich (Bank 2 Sensor 1)	MIL	MIL	MIL
P219A	Bank 1 Air-Fuel Ratio Imbalance	N/A	MIL	MIL
P219B	Bank 2 Air-Fuel Ratio Imbalance	N/A	MIL	MIL
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1 Sensor 1)	MIL	MIL	MIL
P2240	O2 Sensor Positive Current Control Circuit/Open (Bank 2 Sensor 1)	MIL	MIL	MIL
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1 Sensor 1)	MIL	MIL	MIL
P2247	O2 Sensor Reference Voltage Circuit/Open (Bank 2 Sensor 1)	MIL	MIL	MIL
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1 Sensor 1)	MIL	MIL	MIL
P2254	O2 Sensor Negative Current Control Circuit/Open (Bank 2 Sensor 1)	MIL	MIL	MIL
P2535	Ignition Switch Run/Start Position Circuit High	non-MIL	non-MIL	non-MIL
P25B0	Fuel Level Sensor “A” Stuck	non-MIL	non-MIL	non-MIL
P25B1	Fuel Level Sensor “B” Stuck	N/A	non-MIL	N/A
P2610	ECM/PCM Engine Off Timer Performance	MIL	MIL	MIL
P2632	Fuel Pump “B” Control Circuit/Open	non-MIL	non-MIL	N/A
P264F	Engine Serial Number Not Programmed or Incompatible	MIL	MIL	MIL
P2665	Fuel Shutoff Valve “B” Control Circuit/Open	non-MIL	non-MIL	non-MIL
P2669	Actuator Supply Voltage “B” Circuit/Open	MIL	MIL	MIL
P26B3	Fuel Shutoff Valve “A” Control Circuit Performance/Stuck Off	non-MIL	non-MIL	non-MIL
P26B5	Fuel Shutoff Valve “B” Control Circuit Performance / Stuck Off	non-MIL	non-MIL	non-MIL
P26EA	Fuel Pump Control Module “B”	non-MIL	non-MIL	N/A
P2700	Transmission Friction Element “A” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL
P2701	Transmission Friction Element “B” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL
P2702	Transmission Friction Element “C” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL

		6.8L 2V LPG E450 Custom Body	6.8L 3V LPG F650 (dual tank)	6.8L 3V LPG F53/F59
		2016/2017	2016/2017	2016/2017
P2703	Transmission Friction Element “D” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL
P2704	Transmission Friction Element “E” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL
P2705	Transmission Friction Element “F” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL
P2758	Torque Converter Clutch Pressure Control Solenoid Stuck On	MIL	MIL	MIL
P2760	Torque Converter Clutch Pressure Control Solenoid Intermittent	MIL	MIL	MIL
U0108	Lost Communication with Alternative Fuel Control Module	MIL	MIL	MIL
U0109	Loss of Communication on Fuel Pump Control Module “A”	non-MIL	non-MIL	non-MIL
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	non-MIL	non-MIL	non-MIL
U0140	Lost Communication With Body Control Module		non-MIL	
U016C	Loss of Communication on Fuel Pump Control Module “B”	non-MIL	non-MIL	N/A
U0212	Lost Communication With Steering Column Control Module	N/A	non-MIL	N/A
U0300	Internal Control Module Software Incompatibility	MIL	MIL	MIL
U0415	Invalid Data Received from Anti-Lock Brake System (ABS) Control Module	N/A	non-MIL	N/A
U0422	Invalid Data Received from Body Control Module	N/A	non-MIL	N/A
U210B	Lost Communication Between Fuel Pump Control Module “A” and Restraint Control Module	non-MIL	N/A	N/A
U210C	Lost Communication Between Fuel Pump Control Module “B” and Restraint Control Module	non-MIL	N/A	N/A

2018-2019 Diagnostic Codes

N/A and OFF = Code not present
non MIL = DTC – non MIL
MIL = DTC – MIL (two trips)

NOTE: For any DTCs not specific to the ROUSH CleanTech fuel system, please reference the Ford Powertrain Control/Emissions Diagnosis Service Manual.

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
B1342	ECU is Faulted	non-MIL	non-MIL	N/A	OFF	N/A
C05D7		N/A	N/A	N/A	non-MIL	N/A
P0005	Fuel Shutoff Valve “A” Control Circuit/Open	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0036	HO2S Heater Control Circuit (Bank 1 Sensor 2)	MIL	MIL	MIL	MIL	MIL
P0040	Oxygen Sensor Signals Swapped Bank 1 Sensor 1/Bank 2 Sensor 1	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0041	Oxygen Sensor Signals Swapped Bank 1 Sensor 2 / Bank 2 Sensor 2	non-MIL	OFF	OFF	OFF	OFF
P0050	HO2S Heater Control Circuit (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0056	HO2S Heater Control Circuit (Bank 2 Sensor 2)	MIL	OFF	OFF	OFF	OFF
P0068	MAP/MAF - Throttle Position Correlation	MIL	MIL	MIL	MIL	MIL
P0071	Ambient Air Temperature Sensor Circuit “A” Range/Performance	N/A	N/A	MIL	N/A	N/A
P0072	Ambient Air Temperature Sensor Circuit “A” Low	N/A	N/A	MIL	N/A	N/A
P0073	Ambient Air Temperature Sensor Circuit “A” High	N/A	N/A	MIL	N/A	N/A
P0090	Fuel Pressure Regulator Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P009B	Fuel Pressure Relief Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P009E	Fuel Pressure Relief Control Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P009F	Fuel Pressure Relief Control Performance/Stuck On	MIL	MIL	MIL	MIL	MIL
P0100	Mass or Volume Air Flow Sensor “A” Circuit	MIL	MIL	MIL	MIL	MIL
P0102	Mass or Volume Air Flow Sensor “A” Circuit Low	MIL	MIL	MIL	MIL	MIL
P0103	Mass or Volume Air Flow Sensor “A” Circuit High	MIL	MIL	MIL	MIL	MIL
P0104	Mass or Volume Air Flow Sensor “A” Circuit Intermittent	MIL	MIL	MIL	MIL	MIL
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 1)	MIL	MIL	MIL	MIL	MIL
P0112	Intake Air Temperature Sensor 1 Circuit Low (Bank 1)	MIL	MIL	MIL	MIL	MIL
P0113	Intake Air Temperature Sensor 1 Circuit High (Bank 1)	MIL	MIL	MIL	MIL	MIL
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	non-MIL	non-MIL	MIL	MIL	MIL
P0122	Throttle/Pedal Position Sensor “A” Circuit Low	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P0123	Throttle/Pedal Position Sensor “A” Circuit High	MIL	MIL	MIL	MIL	MIL
P0125	Insufficient Coolant Temp For Closed Loop Fuel Control	MIL	MIL	MIL	MIL	MIL
P0128	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	MIL	MIL	MIL	MIL	MIL
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	MIL	MIL	MIL	MIL	MIL
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	MIL	MIL	MIL	MIL	MIL
P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 2)	MIL	MIL	MIL	MIL	MIL
P013C	O2 Sensor Slow Response - Rich to Lean (Bank 2 Sensor 2)	MIL	OFF	OFF	OFF	OFF
P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	MIL	MIL	MIL	MIL	MIL
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	MIL	MIL	MIL	MIL	MIL
P0148	Fuel Delivery Error	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P014A	O2 Sensor Delayed Response - Rich to Lean (Bank 2 Sensor 2)	MIL	OFF	OFF	OFF	OFF
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0155	O2 Sensor Heater Circuit (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	MIL	OFF	OFF	OFF	OFF
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	MIL	OFF	OFF	OFF	OFF
P0161	O2 Sensor Heater Circuit (Bank 2 Sensor 2)	MIL	OFF	OFF	OFF	OFF
P0171	System Too Lean (Bank 1)	MIL	MIL	MIL	MIL	MIL
P0172	System Too Rich (Bank 1)	MIL	MIL	MIL	MIL	MIL
P0174	System Too Lean (Bank 2)	MIL	MIL	MIL	MIL	MIL
P0175	System Too Rich (Bank 2)	MIL	MIL	MIL	MIL	MIL
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance	MIL	MIL	MIL	MIL	MIL
P0182	Fuel Temperature Sensor “A” Circuit Low	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P0183	Fuel Temperature Sensor “A” Circuit High	MIL	MIL	MIL	MIL	MIL
P0192	Fuel Rail Pressure Sensor Circuit Low (Bank 1)	MIL	MIL	MIL	MIL	MIL
P0193	Fuel Rail Pressure Sensor Circuit High (Bank 1)	MIL	MIL	MIL	MIL	MIL
P019F	Alternative Fuel Tank “A” Pressure Sensor Range/Performance	MIL	MIL	MIL	MIL	MIL
P01A0	Alternate Fuel Tank “A” Pressure Sensor Circuit Low	MIL	MIL	MIL	MIL	MIL
P01A1	Alternate Fuel Tank “A” Pressure Sensor Circuit High	MIL	MIL	MIL	MIL	MIL
P01A2	Alternative Fuel Tank “A” Pressure Sensor Circuit Intermittent/ Erratic	MIL	MIL	MIL	MIL	MIL
P01A9	Alternative Fuel Rail/System Pressure - Too High	MIL	MIL	MIL	MIL	MIL
P01AC	Alternate Fuel Tank Temperature Sensor Circuit Low	MIL	MIL	MIL	MIL	MIL
P01AD	Alternate Fuel Tank Temperature Sensor High	MIL	MIL	MIL	MIL	MIL
P01AE	Alternate Fuel Tank Temperature Sensor Circuit Intermittent/Erratic	MIL	MIL	MIL	MIL	MIL
P0201	Cylinder 1 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0202	Cylinder 2 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0203	Cylinder 3 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0204	Cylinder 4 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0205	Cylinder 5 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0206	Cylinder 6 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0207	Cylinder 7 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0208	Cylinder 8 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0209	Cylinder 9 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0210	Cylinder 10 Injector “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0217	Engine Coolant Over Temperature Condition	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0218	Transmission Fluid Temperature Sensor “A” Over Temperature Condition	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0219	Engine Overspeed Condition	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	MIL	MIL	MIL	MIL	MIL
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	MIL	MIL	MIL	MIL	MIL
P025A	Fuel Pump Module “A” Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P025B	Fuel Pump Module “A” Control Circuit Range/Performance	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P027B	Fuel Pump Module “B” Control Circuit Range/Performance	MIL	MIL	MIL	MIL	MIL
P0297	Vehicle Overspeed Condition	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0298	Engine Oil Over Temperature Condition	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0300	Random Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0301	Cylinder 1 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0302	Cylinder 2 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0303	Cylinder 3 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0304	Cylinder 4 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0305	Cylinder 5 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0306	Cylinder 6 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0307	Cylinder 7 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0308	Cylinder 8 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0309	Cylinder 9 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0310	Cylinder 10 Misfire Detected	MIL	MIL	MIL	MIL	MIL
P0313	Misfire Detected With Low Fuel	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0315	Crankshaft Position System Variation Not Learned	MIL	MIL	MIL	MIL	MIL
P0316	Misfire Detected On Startup (First 1000 Revolutions)	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0339	Crankshaft Position Sensor “A” Circuit Intermittent	MIL	MIL	MIL	MIL	MIL
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or single sensor)	MIL	MIL	MIL	MIL	MIL
P0351	Ignition Coil “A” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0352	Ignition Coil “B” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0353	Ignition Coil “C” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0354	Ignition Coil “D” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0355	Ignition Coil “E” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0356	Ignition Coil “F” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0357	Ignition Coil “G” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0358	Ignition Coil “H” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0359	Ignition Coil “I” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0360	Ignition Coil “J” Primary Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	MIL	OFF	OFF	OFF	OFF
P0442	EVAP System Leak Detected (small leak)	OFF	MIL	MIL	MIL	MIL
P0443	EVAP System Purge Control Valve “A” Circuit	MIL	MIL	MIL	MIL	MIL
P0446	EVAP System Vent Control Circuit	MIL	MIL	MIL	MIL	MIL
P0451	EVAP System Pressure Sensor/Switch Range/Performance	MIL	MIL	MIL	MIL	MIL
P0452	EVAP System Pressure Sensor/Switch Low	MIL	MIL	MIL	MIL	MIL
P0453	EVAP System Pressure Sensor/Switch High	MIL	MIL	MIL	MIL	MIL
P0454	EVAP System Pressure Sensor/Switch Intermittent	MIL	MIL	MIL	MIL	MIL
P0455	EVAP System Leak Detected (large leak)	MIL	MIL	MIL	MIL	MIL
P0456	EVAP System Leak Detected (very small leak)	MIL	OFF	OFF	OFF	OFF
P0460	Fuel Level Sensor “A” Circuit	N/A	N/A	N/A	N/A	non-MIL
P0461	Fuel Level Sensor “A” Circuit Range/Performance	MIL	OFF	OFF	OFF	OFF
P0462	Fuel Level Sensor “A” Circuit Low	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0463	Fuel Level Sensor “A” Circuit High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0496	EVAP System High Purge Flow	MIL	N/A	N/A	N/A	N/A
P0504	Brake Switch “A”/”B” Correlation	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0505	Idle Control System	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0506	Idle Control System - RPM Lower Than Expected	MIL	MIL	MIL	MIL	MIL
P0507	Idle Control System - RPM Higher Than Expected	MIL	MIL	MIL	MIL	MIL
P050A	Cold Start Idle Control System Performance	MIL	MIL	MIL	MIL	MIL
P050B	Cold Start Ignition Timing Performance	MIL	MIL	MIL	MIL	MIL
P050E	Cold Start Engine Exhaust Temperature Too Low	MIL	MIL	MIL	MIL	MIL
P0532	A/C Refrigerant Pressure Sensor “A” Circuit Low	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0533	A/C Refrigerant Pressure Sensor “A” Circuit High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0562	System Voltage Low	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0563	System Voltage High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0572	Brake Switch “A” Circuit Low	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0573	Brake Switch “A” Circuit High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P0579	Cruise Control Multi-Function Input “A” Circuit Range/Performance	non-MIL	non-MIL	N/A	non-MIL	N/A
P0581	Cruise Control Multi-Function Input “A” Circuit High	non-MIL	non-MIL	N/A	non-MIL	N/A
P0600	Serial Communication Link	MIL	MIL	MIL	MIL	MIL
P0602	Powertrain Control Module Programming Error	MIL	MIL	MIL	MIL	MIL
P0604	Internal Control Module Random Access Memory (RAM) Error	MIL	MIL	MIL	MIL	MIL
P0605	Internal Control Module Read Only Memory (ROM) Error	MIL	MIL	MIL	MIL	MIL
P0607	Control Module Performance	MIL	MIL	MIL	MIL	MIL
P060A	Internal Control Module Monitoring Processor Performance	MIL	MIL	MIL	MIL	MIL
P060B	Internal Control Module A/D Processing Performance	MIL	MIL	MIL	MIL	MIL
P060C	Internal Control Module Main Processor Performance	MIL	MIL	MIL	MIL	MIL
P060D	Internal Control Module Accelerator Pedal Position Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0610	Control Module Vehicle Options Error	MIL	MIL	MIL	MIL	MIL
P061A	Internal Control Module Torque Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P061B	Internal Control Module Torque Calculation Performance	MIL	MIL	MIL	MIL	MIL
P061C	Internal Control Module Engine RPM Performance	MIL	MIL	MIL	MIL	MIL
P061D	Internal Control Module Engine Air Mass Performance	MIL	MIL	MIL	MIL	MIL
P0620	Generator Control Circuit	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0625	Generator Field/F Terminal Circuit Low	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0626	Generator Field/F Terminal Circuit High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0627	Fuel Pump “A” Control Circuit Open	MIL	MIL	MIL	MIL	MIL
P062C	Internal Control Module Vehicle Speed Performance	OFF	OFF	non-MIL	OFF	OFF
P062F	Internal Control Module EEPROM Error	N/A	N/A	non-MIL	N/A	non-MIL
P0630	VIN Not Programmed or Incompatible - ECM/PCM	N/A	N/A	non-MIL	N/A	non-MIL
P0642	Sensor Reference Voltage “A” Circuit Low	MIL	MIL	MIL	MIL	MIL
P0643	Sensor Reference Voltage “A” Circuit High	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P0645	A/C Clutch Relay Control Circuit	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P064A	Fuel Pump Control Module “A”	MIL	MIL	MIL	MIL	MIL
P064D	Internal Control Module O2 Sensor Processor Performance (Bank 1)	MIL	MIL	MIL	MIL	MIL
P064E	Internal Control Module O2 Sensor Processor Performance (Bank 2)	MIL	MIL	MIL	MIL	MIL
P0657	Actuator Supply Voltage “A” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P065B	Generator Control Circuit Range/ Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P068A	ECM/PCM Power Relay De-Energized - Too Early	MIL	MIL	MIL	MIL	MIL
P06B8	Internal Control Module Non-Volatile Random Access Memory (NVRAM) Error	MIL	MIL	MIL	MIL	MIL
P06E4	Control Module Wake-up Circuit Performance	OFF	OFF	non-MIL	OFF	non-MIL
P06E9	Engine Starter Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0701	Transmission Control System Range/ Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0702	Transmission Control System Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0706	Transmission Range Sensor “A” Circuit Range/Performance	MIL	MIL	MIL	MIL	MIL
P0707	Transmission Range Sensor “A” Circuit Low	MIL	MIL	MIL	MIL	MIL
P0708	Transmission Range Sensor “A” Circuit High	MIL	MIL	MIL	MIL	MIL
P0710	Transmission Fluid Temperature Sensor “A” Circuit	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0711	Transmission Fluid Temperature Sensor “A” Circuit Range/ Performance	MIL	MIL	MIL	MIL	MIL
P0712	Transmission Fluid Temperature Sensor “A” Circuit Low	MIL	MIL	MIL	MIL	MIL
P0713	Transmission Fluid Temperature Sensor “A” Circuit High	MIL	MIL	MIL	MIL	MIL
P0715	Input/Turbine Shaft Speed Sensor “A” Circuit	MIL	MIL	MIL	MIL	MIL
P0717	Input/Turbine Shaft Speed Sensor “A” Circuit No Signal	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0718	Input/Turbine Shaft Speed Sensor “A” Circuit Intermittent	MIL	MIL	MIL	MIL	MIL
P0720	Output Shaft Speed Sensor Circuit	MIL	MIL	MIL	MIL	MIL
P0721	Output Shaft Speed Sensor Circuit Range/Performance	OFF	OFF	MIL	OFF	OFF

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P0722	Output Shaft Speed Sensor Circuit No Signal	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0729	Gear 6 Incorrect Ratio	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0731	Gear 1 Incorrect Ratio	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0732	Gear 2 Incorrect Ratio	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0733	Gear 3 Incorrect Ratio	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0734	Gear 4 Incorrect Ratio	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0735	Gear 5 Incorrect Ratio	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0740	Torque Converter Clutch Solenoid Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0741	Torque Converter Clutch Solenoid Circuit Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P0742	Torque Converter Clutch Solenoid Circuit Stuck On	MIL	MIL	MIL	MIL	MIL
P0743	Torque Converter Clutch Solenoid Circuit Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0744	Torque Converter Clutch Solenoid Circuit Intermittent	MIL	MIL	MIL	MIL	MIL
P0748	Pressure Control Solenoid “A” Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0750	Shift Solenoid “A”	MIL	MIL	MIL	MIL	MIL
P0751	Shift Solenoid “A” Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P0752	Shift Solenoid “A” Stuck On	MIL	MIL	MIL	MIL	MIL
P0753	Shift Solenoid “A” Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0754	Shift Solenoid “A” Intermittent	MIL	MIL	MIL	MIL	MIL
P0755	Shift Solenoid “B”	MIL	MIL	MIL	MIL	MIL
P0756	Shift Solenoid “B” Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P0757	Shift Solenoid “B” Stuck On	MIL	MIL	MIL	MIL	MIL
P0758	Shift Solenoid “B” Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0759	Shift Solenoid “B” Intermittent	MIL	MIL	MIL	MIL	MIL
P0760	Shift Solenoid “C”	MIL	MIL	MIL	MIL	MIL
P0761	Shift Solenoid “C” Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P0762	Shift Solenoid “C” Stuck On	MIL	MIL	MIL	MIL	MIL
P0763	Shift Solenoid “C” Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0764	Shift Solenoid “C” Intermittent	MIL	MIL	MIL	MIL	MIL
P0765	Shift Solenoid “D”	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P0766	Shift Solenoid “D” Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P0767	Shift Solenoid “D” Stuck On	MIL	MIL	MIL	MIL	MIL
P0768	Shift Solenoid “D” Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0769	Shift Solenoid “D” Intermittent	MIL	MIL	MIL	MIL	MIL
P0770	Shift Solenoid “E”	MIL	MIL	MIL	MIL	MIL
P0771	Shift Solenoid “E” Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P0772	Shift Solenoid “E” Stuck On	MIL	MIL	MIL	MIL	MIL
P0773	Shift Solenoid “E” Electrical	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0774	Shift Solenoid “E” Intermittent	MIL	MIL	MIL	MIL	MIL
P0882	TCM Power Input Signal Low	MIL	MIL	MIL	MIL	MIL
P0883	TCM Power Input Signal High	MIL	MIL	MIL	MIL	MIL
P0885	TCM Power Relay Control Circuit /Open	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P0960	Pressure Control Solenoid “A” Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P0961	Pressure Control Solenoid “A” Control Circuit Range/Performance	MIL	MIL	MIL	MIL	MIL
P0962	Pressure Control Solenoid “A” Control Circuit Low	MIL	MIL	MIL	MIL	MIL
P0963	Pressure Control Solenoid “A” Control Circuit High	MIL	MIL	MIL	MIL	MIL
P0973	Shift Solenoid “A” Control Circuit Low	MIL	MIL	MIL	MIL	MIL
P0974	Shift Solenoid “A” Control Circuit High	MIL	MIL	MIL	MIL	MIL
P0976	Shift Solenoid “B” Control Circuit Low	MIL	MIL	MIL	MIL	MIL
P0977	Shift Solenoid “B” Control Circuit High	MIL	MIL	MIL	MIL	MIL
P0979	Shift Solenoid “C” Control Circuit Low	MIL	MIL	MIL	MIL	MIL
P0980	Shift Solenoid “C” Control Circuit High	MIL	MIL	MIL	MIL	MIL
P0982	Shift Solenoid “D” Control Circuit Low	MIL	MIL	MIL	MIL	MIL
P0983	Shift Solenoid “D” Control Circuit High	MIL	MIL	MIL	MIL	MIL
P0985	Shift Solenoid “E” Control Circuit Low	MIL	MIL	MIL	MIL	MIL
P0986	Shift Solenoid “E” Control Circuit High	MIL	MIL	MIL	MIL	MIL
P1001	KOER Not Able to Complete, KOER Aborted	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1002	Fuel shutoff valve “C” Control Circuit/Open	OFF	OFF	OFF	OFF	non-MIL
P1070		non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1101	Mass Air Flow Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1124	Throttle Position Sensor “A” Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P1127	Exhaust Temperature Out of Range, O2 Sensor Tests Not Completed	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P115E	Throttle Actuator Control Throttle Body Air Flow Trim at Max Limit	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P116E	Fuel Pressure Relief Valve Actuated	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1260	Theft Detected, Vehicle Immobilized	non-MIL	non-MIL	N/A	OFF	N/A
P1285	Cylinder Head Over Temperature Condition	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1288	Cylinder Head Temperature Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1289	Cylinder Head Temperature Sensor Circuit High	MIL	MIL	MIL	MIL	MIL
P1290	Cylinder Head Temperature Sensor Circuit Low	MIL	MIL	MIL	MIL	MIL
P1299	Cylinder Head Over Temperature Protection Active	MIL	MIL	MIL	MIL	MIL
P1336	Crankshaft/Camshaft Sensor Range/Performance	MIL	MIL	MIL	MIL	MIL
P1397	System Voltage Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P143D	A/C Clutch Relay Control “B” Circuit	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1450	Unable to Bleed Up Fuel Tank Vacuum	N/A	MIL	MIL	MIL	MIL
P1453	Fuel Tank Pressure Relief Valve Malfunction	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1456	Fuel Tank Temperature Sensor Circuit	MIL	MIL	MIL	MIL	MIL
P1464	A/C Demand Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1501	Vehicle Speed Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1561	Brake Line Pressure Sensor Circuit	non-MIL	non-MIL	N/A	non-MIL	N/A
P1575	Pedal Position Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1594	Forced Engine Shutdown - Remote Start System Fault, No Unattended Vehicle Timeout	OFF	OFF	OFF	OFF	OFF
P1595	Forced Engine Shutdown - Remote Start System Fault, Transmission Range Not In Park Position	OFF	OFF	non-MIL	non-MIL	non-MIL
P1602	Immobilizer/ECM Communication Error	non-MIL	non-MIL	N/A	OFF	N/A
P160A	Control Module Vehicle Options Reconfiguration Error	N/A	N/A	non-MIL	N/A	non-MIL
P161A	Incorrect Response from Immobilizer Control Module	N/A	N/A	non-MIL	N/A	non-MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P1622	Immobilizer ID Does Not Match	non-MIL	non-MIL	N/A	OFF	N/A
P162E	Internal Control Module PTO Control Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P162F	Starter Motor Disabled - Engine Crank Time Too Long	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1633	Keep Alive Power Voltage Too Low	non-MIL	non-MIL	OFF	non-MIL	OFF
P1635	Tire/Axle Out of Acceptable Range	non-MIL	non-MIL	N/A	non-MIL	N/A
P1636	Inductive Signature Chip Communication Error	MIL	MIL	MIL	MIL	MIL
P1639	Vehicle ID Block Corrupted, Not Programmed	MIL	MIL	non-MIL	MIL	non-MIL
P163E	Transmission Control Module Programming Error	MIL	MIL	MIL	MIL	MIL
P163F	Transmission ID Block Corrupted, Not Programmed	MIL	MIL	MIL	MIL	MIL
P1646	Linear O2 Sensor Control Chip (Bank 1)	MIL	MIL	MIL	MIL	MIL
P1647	Linear O2 Sensor Control Chip (Bank 2)	MIL	MIL	MIL	MIL	MIL
P166A	Restraints Deployment Communication Circuit	N/A	N/A	non-MIL	N/A	N/A
P1674	Control Module Software Corrupted	MIL	MIL	MIL	MIL	MIL
P1702	Transmission Range Sensor Circuit Intermittent	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1703	Brake Switch Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1705	Transmission Range Circuit Not Indicating Park/Neutral During Self Test	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1711	Transmission Fluid Temperature Sensor Out Of Self Test Range	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1744	Torque Converter Clutch Solenoid Circuit Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P177F	Unable To Fully Engage Neutral	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1780	Transmission Control Switch (O/D Cancel) Circuit Out Of Self Test Range	non-MIL	non-MIL	OFF	non-MIL	OFF
P1783	Transmission Overtemperature Condition	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1921	Transmission Range Signal	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P1934	Vehicle Speed Signal	OFF	OFF	MIL	OFF	MIL
P193C	Steering Wheel Angle Signal	OFF	OFF	non-MIL	OFF	OFF
P193E	A/C Clutch Request Signal	OFF	OFF	non-MIL	OFF	non-MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P2067	Fuel Level Sensor “B” Circuit Low	OFF	OFF	OFF	OFF	non-MIL
P2068	Fuel Level Sensor “B” Circuit High	OFF	OFF	OFF	OFF	non-MIL
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	MIL	MIL	MIL	MIL	MIL
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	MIL	MIL	MIL	MIL	MIL
P2098	Post Catalyst Fuel Trim System Too Lean (Bank 2)	MIL	MIL	MIL	MIL	MIL
P2099	Post Catalyst Fuel Trim System Too Rich (Bank 2)	MIL	MIL	MIL	MIL	MIL
P2101	Throttle Actuator “A” Control Motor Circuit Range/Performance	MIL	MIL	MIL	MIL	MIL
P2107	Throttle Actuator “A” Control Module Processor	MIL	MIL	MIL	MIL	MIL
P2111	Throttle Actuator “A” Control System - Stuck Open	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2112	Throttle Actuator “A” Control System - Stuck Closed	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2119	Throttle Actuator “A” Control Throttle Body Range/Performance	MIL	MIL	MIL	MIL	MIL
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2135	Throttle/Pedal Position Sensor/Switch “A”/”B” Voltage Correlation	MIL	MIL	MIL	MIL	MIL
P2138	Throttle/Pedal Position Sensor/Switch “D”/”E” Voltage Correlation	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2195	Heated Exhaust Gas Oxygen Sensor Stuck	MIL	MIL	MIL	MIL	MIL
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2197	O2 Sensor Signal Biased/Stuck Lean (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2198	O2 Sensor Signal Biased/Stuck Rich (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P219A	Bank 1 Air-Fuel Ratio Imbalance	MIL	MIL	MIL	MIL	MIL
P219B	Bank 2 Air-Fuel Ratio Imbalance	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P2237	O2 Sensor Positive Current Control Circuit/Open (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2240	O2 Sensor Positive Current Control Circuit/Open (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2243	O2 Sensor Reference Voltage Circuit/Open (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2247	O2 Sensor Reference Voltage Circuit/Open (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2251	O2 Sensor Negative Current Control Circuit/Open (Bank 1 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2254	O2 Sensor Negative Current Control Circuit/Open (Bank 2 Sensor 1)	MIL	MIL	MIL	MIL	MIL
P2535	Ignition Switch Run/Start Position Circuit High	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P25B0	Fuel Level Sensor “A” Stuck	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P25B1	Fuel Level Sensor “B” Stuck	OFF	OFF	OFF	OFF	non-MIL
P2610	ECM/PCM Engine Off Timer Performance	MIL	MIL	MIL	MIL	MIL
P2632	Fuel Pump “B” Control Circuit/Open	MIL	MIL	MIL	MIL	MIL
P264F	Engine Serial Number Not Programmed or Incompatible	MIL	MIL	MIL	MIL	MIL
P2665	Fuel Shutoff Valve “B” Control Circuit/Open	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2669	Actuator Supply Voltage “B” Circuit/Open	MIL	MIL	MIL	MIL	MIL
P26B3	Fuel Shutoff Valve “A” Control Circuit Performance/Stuck Off	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P26B5	Fuel Shutoff Valve “B” Control Circuit Performance/Stuck Off	MIL	MIL	MIL	MIL	MIL
P26EA	Fuel Pump Control Module “B”	MIL	MIL	MIL	MIL	MIL
P2700	Transmission Friction Element “A” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2701	Transmission Friction Element “B” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2702	Transmission Friction Element “C” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2703	Transmission Friction Element “D” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2704	Transmission Friction Element “E” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2705	Transmission Friction Element “F” Apply Time Range/Performance	non-MIL	non-MIL	non-MIL	non-MIL	non-MIL
P2758	Torque Converter Clutch Pressure Control Solenoid Stuck On	MIL	MIL	MIL	MIL	MIL

Code	Description	2018 E-350	2018 E-450	2018 F-450/ F-550	2018 F53/ F59	2018 F-650/ F-750
P2760	Torque Converter Clutch Pressure Control Solenoid Intermittent	MIL	MIL	MIL	MIL	MIL
U0108	Lost Communication with Alternative Fuel Control Module	MIL	MIL	MIL	MIL	MIL
U0109	Loss of Communication on Fuel Pump Control Module “A”	MIL	MIL	MIL	MIL	MIL
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	non-MIL	non-MIL	non-MIL	OFF	non-MIL
U0126	Lost Communication With Steering Angle Sensor Module	N/A	N/A	non-MIL	N/A	N/A
U0140	Lost Communication With Body Control Module	OFF	OFF	non-MIL	OFF	non-MIL
U016C	Loss of Communication on Fuel Pump Control Module “B”	MIL	MIL	MIL	MIL	MIL
U0212	Lost Communication With Steering Column Control Module	N/A	N/A	non-MIL	N/A	non-MIL
U0300	Internal Control Module Software Incompatibility	MIL	MIL	MIL	MIL	MIL
U0415	Invalid Data Received from Anti-Lock Brake System (ABS) Control Module	OFF	OFF	non-MIL	OFF	non-MIL
U0422	Invalid Data Received from Body Control Module	N/A	N/A	non-MIL	N/A	non-MIL
U210B	Lost Communication Between Fuel Pump Control Module “A” and Restraint Control Module	MIL	MIL	OFF	OFF	OFF
U1012	Invalid Internal COntrol Module Monitoring Data Received from Anti-Lock Brake System (ABS) Control Module	OFF	OFF	non-MIL	OFF	OFF
U210C	Lost Communication Between Fuel Pump Control Module “B” and Restraint Control Module	MIL	MIL	OFF	OFF	OFF

Wiring Diagram and Electrical Schematics