

General Service Bulletin (GSB):	6.7L Diesel Fuel System Service Tips
<p>This GSB targets the diagnosis, inspection and repair of the 6.7L diesel fuel system.</p>	<p>Some 6.7L diesel vehicles may experience drivability concerns due to fuel system failures. Fuel system failures and/or metal debris are most commonly caused by fuel system contamination.</p>
<p>NOTE: This information is not intended to replace or supersede any warranty, parts and service policy, Work Shop Manual (WSM) procedures or technical training or wiring diagram information.</p>	



6.7L Diesel Fuel System Service Tips

A Guide to Properly Diagnose Contamination and Repair Diesel Fuel Systems

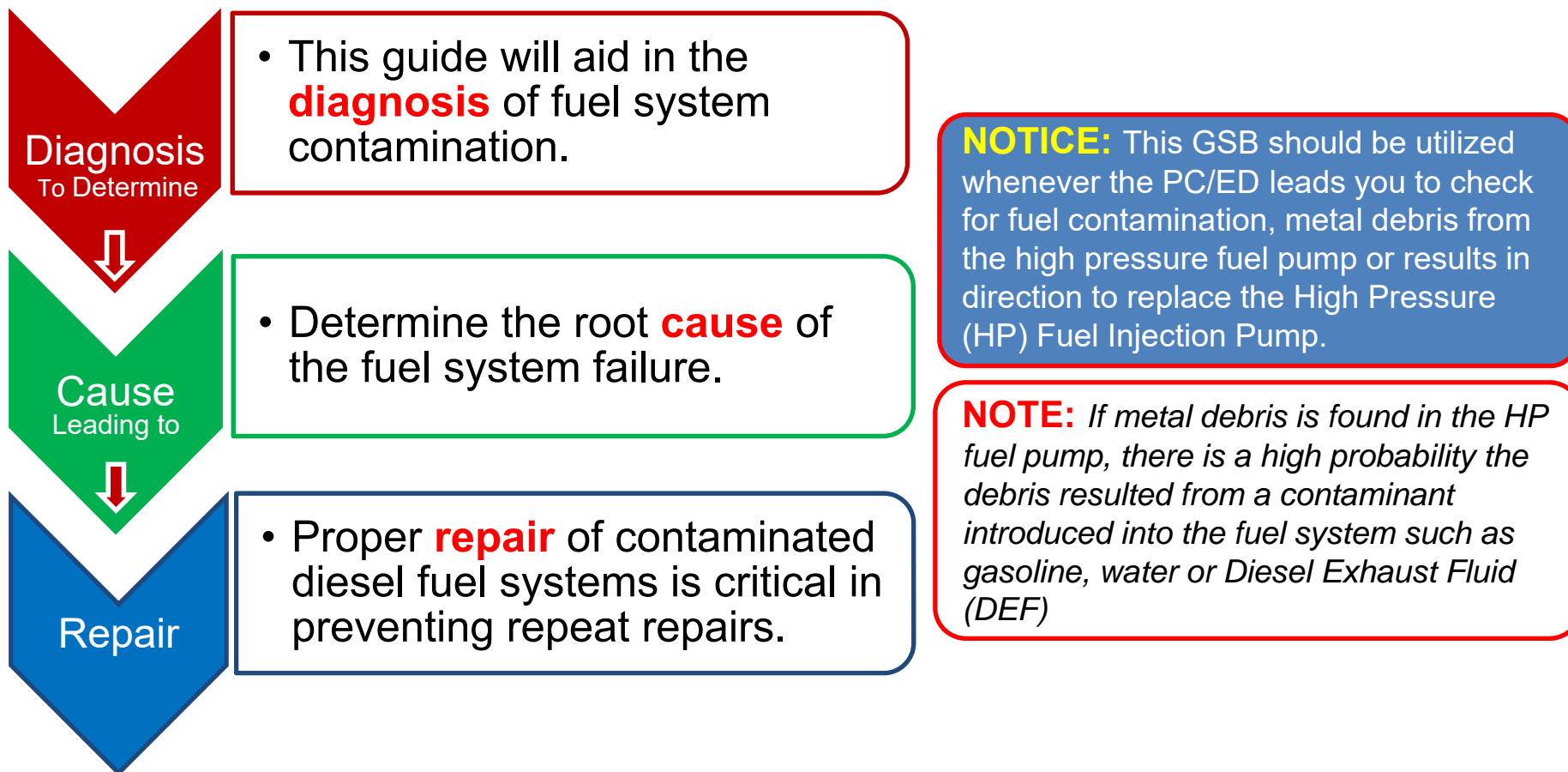
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Overview

A guide to properly diagnose contamination and repair diesel fuel systems



6.7L Diesel Fuel System Service Tips

Overview

Fuel System Contamination

Fuel contamination on a 6.7L diesel engine can damage fuel system components including the High Pressure (HP) fuel injection pump and fuel injectors. Engine operation on fuels and additives that do not meet the lubrication, cooling and anti-corrosion properties required by the HP fuel system components may cause symptoms including, but not limited to, the following:

- Crank No Start
- Long Crank/Hard Start
- Runs Rough
- Reduced Power
- Engine Knocking
- Exhaust Smoke
- Fuel Rail Pressure (FRP) slow to build

NOTICE: Failure to follow these procedures may result in fuel system and/or engine damage and may require vehicle warranty cancellation submission.

Repairs required due to the use of improper fluids and fuel are not covered by the New Vehicle Limited Warranty, Extended Service Plan (ESP), or Service Part Warranty (SPW). Refer to Warranty and Policy Manual and Customer Information Guide for details.

NOTE: *The most common sources of fuel contamination are:*

- *Vehicle-mounted auxiliary fuel tanks*
- *Lack of filter maintenance/unapproved filters*
- *Lack of WIF draining maintenance*
- *Municipal/Fleet storage tanks*
- *Infrequently used fuel sources*
- *Refueling errors (DEF or gasoline introduced into the fuel tank)*

NOTE: *The best course of action to avoid fuel system concerns is to ensure the vehicle is only fueled from sources with a known quality of diesel fuel verified to be free of water and other contaminants.*

6.7L Diesel Fuel System Service Tips

Overview

Contamination Reference Table

NOTE: Current fuel samples obtained from the vehicle may not be reflective of the vehicle's previous fuel quality and should not be used as the only indicator of fuel quality.

Contaminant	Symptom	Result	Indicator
Water	No start, reduced power, poor drivability	Premature HP pump and injector wear, metal debris, rust/corrosion	Fuel sample, rust/corrosion on HP system components
DEF	No start, reduced power, poor drivability	Premature HP pump and injector wear, metal debris, rust/corrosion, plugged injector return line	Fuel sample, odor, white crystal residue on dried components
Gasoline/Ethanol/Kerosene/Incorrect Additives	No start, reduced power, poor drivability, fuel knock	Premature HP pump and injector wear, metal debris	Fuel sample, odor, fuel aeration, DFCM noise
Excessive Biodiesel (greater than 20%)	Hard start, reduced power, poor drivability, low fuel pressure on Low Pressure (LP) and/or HP systems	Premature HP pump and injector wear, metal debris, rust/corrosion, bacterial/fungus growth	Fuel sample, waxing or gelling on primary filter, rust/corrosion on HP components
Lack of Filter Maintenance	No start/Hard start, reduced power, poor drivability, low fuel pressure on LP and/or HP systems	Premature HP pump and injector wear, LP or HP pump noise or failure, metal debris, Rust/corrosion, collapsed filters	Fuel sample, rust/corrosion on HP system components, DFCM noise, collapsed primary fuel filter

Diagnosis – Metal Debris

Testing for Metal Debris



Symptom

- No start with P0087/P0088 and/or P2291
- Start/stall
- Runs rough
- Low or slow to build Fuel Rail Pressure (FRP)
- Erratic FRP and/or LP fuel pressure

Diagnosis

- **Follow normal PC/ED diagnostics before disassembling the HP fuel system. If the PC/ED leads to inspecting the Volume Control Valve (VCV) for damage, the following checks should be made:**
- Remove VCV from HP Pump – Check for metal debris

NOTICE: Metal debris is formed when the HP Pump wears due to a lack of lubricity. Contaminates such as DEF, water, gasoline or ethanol introduced into the fuel system will cause the HP Pump to prematurely wear resulting in this failure mode. It is crucial to check for contaminated fuel if metal debris is found in the HP fuel system.

Diagnosis – Metal Debris

Inspecting for Metal Debris

- Inspecting for metal debris should only be performed when directed by a pinpoint test or service message.
- When there is a High Pressure Fuel Pump failure, metal debris will be visible when removing the Volume Control Valve (VCV).
- The High Pressure Fuel System should only be replaced when metal debris is found on the VCV or in the VCV port. (See next page)
- Refer to the repair/flushing procedures in the WSM when metal debris and/or fuel contamination is identified.

NOTICE: If metal debris is found in the HP fuel pump, the next step is to check for the presence of contaminated fuel. Fuel contamination is the most common cause of HP fuel pump failure. Metal debris found in the HP fuel pump requires that the entire HP fuel system be replaced. See page 15 of this document for the proper repair direction.

Diagnosis – Metal Debris

Inspecting for Metal Debris

Examples of a VCV and VCV port after high pressure fuel pump failure



Side View: VCV screen



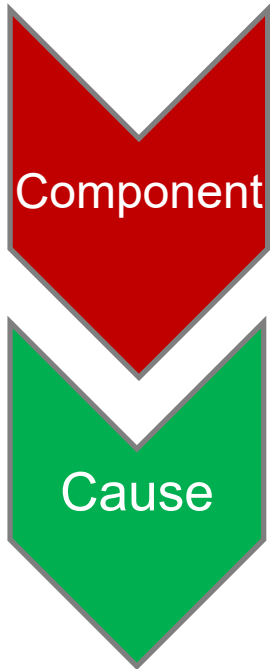
VCV port in the HP Fuel Pump



Top View: VCV

Diagnosis – Fuel System Contamination

Testing for Contaminants



- **Metal debris found in HP fuel pump**

- Obtain fuel sample – let separate
- Remove primary fuel filter – let dry
- Remove the VCV, PCV, FRP sensor – let dry

If metal debris is found in the HP fuel pump, the next step is to check for the presence of contaminated fuel. Fuel contamination is the most common cause of HP fuel pump failure. Metal debris found in the HP fuel pump requires that the entire HP fuel system be replaced. Refer to the WSM for the proper repair.

Fuel Quality Verification

1. Using an appropriate container, obtain a fuel sample from the Diesel Fuel Conditioning Module (DFCM) water drain. Refer to Section 4 (Diagnostic Subroutines) of the PC/ED for additional information.
2. Allow fuel sample to sit for 15 minutes.
3. Visually inspect fuel sample to determine the type of contamination. See pages 10-14 for examples of contamination.
4. Remove the primary filter element from the DFCM and allow the filter and DFCM cover to dry for 2 hours.
5. Visually inspect the filter and cover for evidence of DEF crystals.
6. If no DEF crystals are found, proceed to further inspect the HP fuel system for rust and/or corrosion.

Diagnosis – Fuel System Contamination

Diesel Exhaust Fluid (DEF)



Primary Fuel Filter (2017+)



Fuel Sample



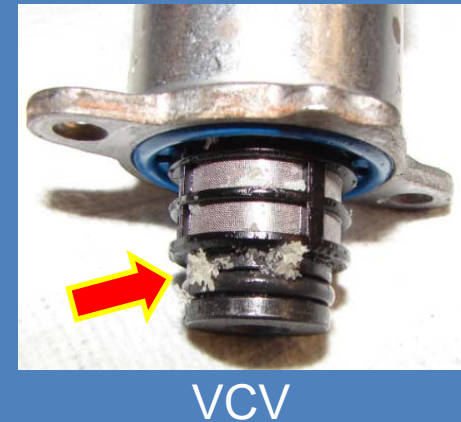
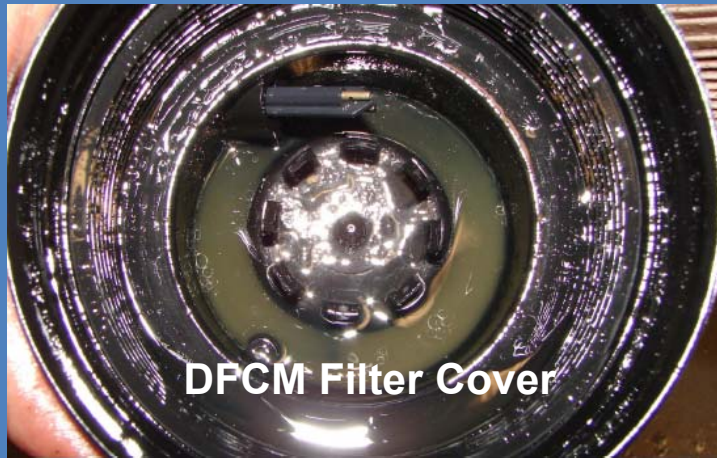
Primary Fuel Filter (2011-2016)

The above photos are of components contaminated with DEF and allowed to dry for 2 hours. Primary indication of DEF contamination can be found by obtaining a fuel sample as well as removing the primary fuel filter allowing it to dry for 2 hours. If white crystals form on any fuel system component, the system has been contaminated with DEF. The fuel sample above shows how DEF and fuel separate in a fuel sample (DEF is the darker cloudy substance).

NOTE: DEF contamination is non-warrantable.

Diagnosis – Fuel System Contamination

Diesel Exhaust Fluid (DEF)

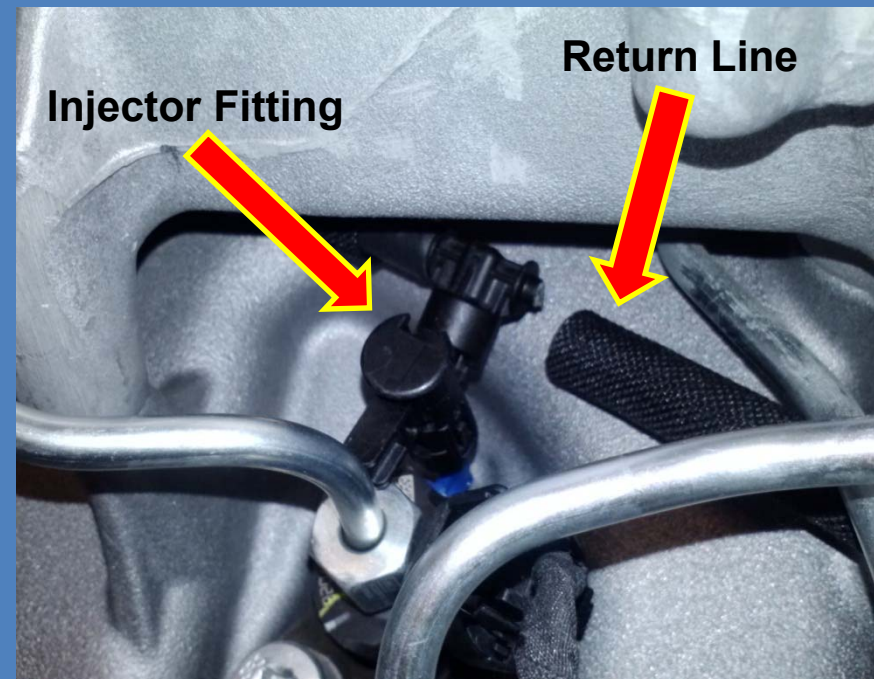


Further indicators of DEF contamination are the DFCM housing, VCV and engine-mounted fuel filter. DEF contamination may be present in Low Pressure (LP) fuel lines and other HP system components as well. DEF crystals form as the DEF and fuel evaporate and is evident by the white crystals that form.



Diagnosis – Fuel System Contamination

Diesel Exhaust Fluid (DEF)



Another indication that the fuel system may be contaminated with DEF is if a fuel injector return line breaks loose from the injector fitting or “T” fitting. If DEF enters the fuel injector return lines it can crystallize and cause increased line pressure resulting in the line disconnecting from the injector fitting and potentially breaking the barb as shown above. If a fuel injector return line is found disconnected/loose/damaged, check the fuel system for possible DEF contamination before proceeding with repairs.

Diagnosis – Fuel System Contamination

Fuel Contamination

* Rust between the O-ring and threads on the PCV is considered warrantable as this is outside of the fuel system.

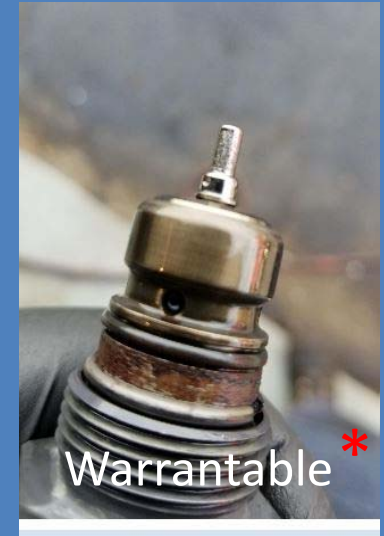


Non-Warrantable

Volume Control Valve (VCV)



Pressure Control Valve (PCV)



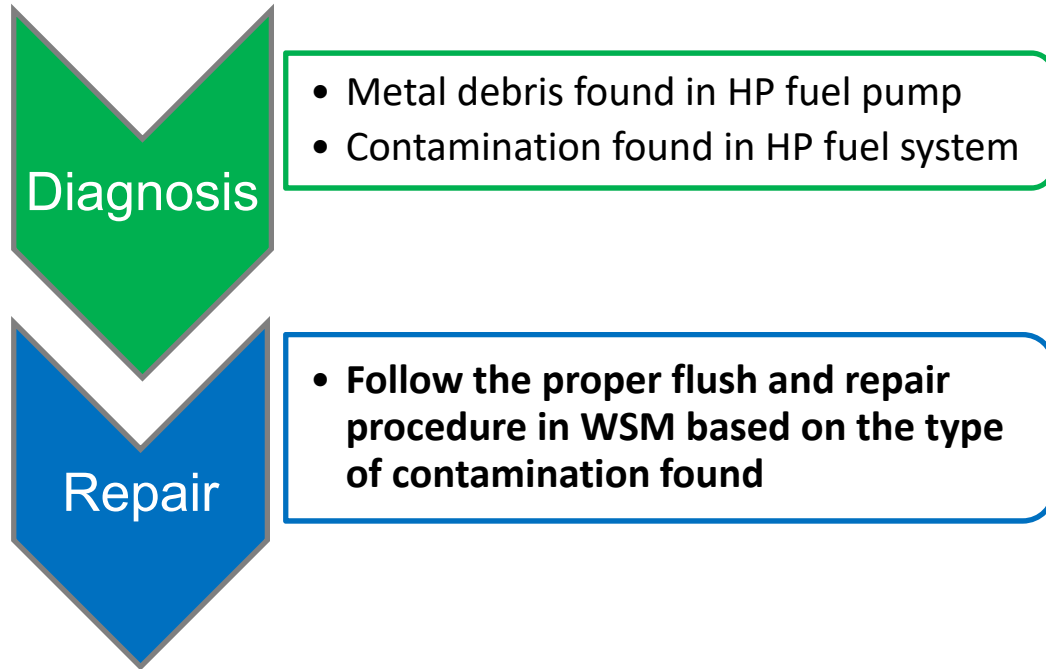
Warrantable *

The above photos are of components contaminated with water resulting in rust/corrosion. Primary indication of water contamination can be found by obtaining a fuel sample as well as removing the VCV and/or PCV and checking for rust and/or corrosion.

NOTE: Current fuel samples obtained from the vehicle may not be reflective of the vehicle's previous fuel quality levels and should not be used as the 'sole' indicator of fuel quality.

Repair – Fuel System

Repair of the HP fuel system



Repair Direction

If the fuel tank has been contaminated with DEF, gasoline, or any other non-diesel fluid and the ignition was turned to run or the engine started, perform the appropriate repair/flushing procedure in WSM.

If the fuel tank has been contaminated with DEF, gasoline, or any other non-diesel fluid and the ignition was **NOT** turned on and the engine **NOT** started, perform the appropriate repair/flushing procedure in WSM.

NOTICE: When metal debris is found in the HP Fuel Pump and/or fuel system contamination is found in the HP fuel system, it is extremely important to properly flush and replace all of the required components or repeat fuel system failure may occur.

Frequently Asked Questions

Q. What is poor quality or contaminated fuel?

A. Diesel fuel or Biodiesel fuel not meeting the specifications listed in the 6.7L Owner Manual Diesel Supplement. Some examples of fuel contamination are:

- Water content exceeding specification
- DEF (Diesel Exhaust Fluid)
- Fuel with high TAN (Total Acid Number) – acidic fuel
- Aged/oxidized fuel
- Organic growth (bacteria, fungus)
- Unapproved fuel additives

Q. What are some sources of poor quality or contaminated fuel?

A. Sources of poor quality or contaminated fuel may include:

- Fuel stations with fuel outside of ASTM specifications or contaminated fuel (improperly formulated, Biodiesel percentage too high or improperly produced Biodiesel, aged fuel, etc.)
- Auxiliary fuel tanks or above ground storage tanks (improper venting, aged fuel, temperature extremes)
- In ground tanks (flooding, leaking tanks, etc.)
- Non-recommended fuel additives (alcohol based, water emulsifiers, etc.)
- Incorrectly adding DEF to the fuel tank

Frequently Asked Questions

Q. What do the Water In Fuel (WIF) indicators (lights) or Message Center messages mean?

A. This means that the 6.7L Diesel Fuel Conditioning Module (DFCM) should be drained as soon as safely possible. The WIF light or message appears when enough water has been detected in the reservoir. Water in excess of the DFCM reservoir capacity will be passed through to the fuel system resulting in damage to the system. Refer to the 6.7L Owner Manual Diesel Supplement for DFCM capacities.

Q. How often should the 6.7L Diesel Fuel Conditioning Module (DFCM) be drained?

A. Monthly at minimum or when the WIF light turns on or message appears (whichever occurs first). Refer to the 6.7L Owner Manual Diesel Supplement for DFCM draining intervals/procedures.

Q. Will the DFCM separate other contaminants in the fuel besides water?

A. The DFCM separates water from the fuel. Water droplets in the fuel are grouped and removed by the various filter components and collected in the DFCM reservoir. The DFCM is not designed to separate organic growth, oxidized fuel, acidic fuel, or other chemicals. Fuel additives that emulsify water reduce the effectiveness of the DFCM to separate water and must not be used.

Frequently Asked Questions

Q. What happens if I accidentally put DEF in the fuel tank?

A. DO NOT turn the ignition key to RUN or start the vehicle. Turning the key to RUN will send the DEF into the high pressure fuel system and damage the system. Disconnect the batteries if the key needs to be turned on to unlock the steering column for vehicle towing due to fuel system DEF contamination. DEF is an aqueous solution of 32.5% high quality urea and 67.5% de-ionized water. DEF contamination may cause the WIF light to turn on, but damage will already be done due to either the amount of DEF or the un-separated non-aqueous (non-water) parts of the DEF entering the fuel system. Refer to Workshop Manual Section 310-00 for proper repair procedures depending on if the engine has been started or not.

Q. How does water affect the high pressure fuel system?

A. Modern High Pressure Common Rail (HPCR) fuel systems have very tight tolerances required to develop high system pressures (up to 30,000 psi). Fuel is used to lubricate the fuel pump. Water in the fuel can reduce the lubrication of the pump causing wear, and can cause the highly machined surfaces of the pump to rust or corrode. Water is also a catalyst for acid formation and acts as a host for organic growth, which can damage the fuel system.

Frequently Asked Questions

Q. What are the effects of Oxidized, Acidic or Organic Growth in fuel (Diesel & Biodiesel)?

A. Fuel contaminated with organic growth such as bacteria or fungus may cause similar effects on fuel systems (rust or corrosion) as excessive water content. The effects can be accelerated as the fuel ages and/or the TAN (acidity or oxidation) increases, which may be more severe on fuel system components than water. These contaminants may also coat the Water in Fuel (WIF) sensor pins and prevent the detection of water.

Q. What are the potential effects of Biodiesel concentration above specifications?

A. Biodiesel concentrations above the specified amounts may cause fuel filter restrictions, which may result in a lack of power and or damage to fuel system components. Biodiesel not meeting 6.7L Owner Manual Diesel Supplement specifications can cause bacterial/fungus growth, increased water content, chemical attack of fuel system, and premature fuel filter plugging/fuel starvation due to cold temperature fuel gelling.

Q. What are the effects of non-recommended fuel additives?

A. Alcohol based additives or other chemicals that cause water to disperse/emulsify will cause damage to the fuel system. Chemicals that disperse/emulsify the water in the fuel will not allow the filters to properly separate the water and pass it through to the fuel system. Alcohol based additives also decrease the lubricity of the fuel, which can damage the high pressure fuel system.

Frequently Asked Questions

Q. Why do fuel system components show signs of contamination (e.g., rusted or corroded high pressure fuel system components) with no Water in Fuel related DTCs present or Water in Fuel light or message present?

A. Water is not the only contaminant that can cause fuel system damage. Bacteria, fungus, oxidized or aged fuel, and other chemicals/additives will not be separated from the fuel resulting in fuel system damage if passed through to the fuel system. Dispersed/emulsified water due to unapproved additives may not be separated from the fuel resulting in fuel system damage if passed through to the fuel system. Fuel filters not meeting OEM specifications may not properly separate the water resulting in undetected water entering the fuel system. An unplugged Water in Fuel Sensor or damaged circuit can result in undetected water in the HFCM or DFCM reservoir.

Q. What are the effects of not changing fuel filters per the recommended maintenance intervals or when directed by the vehicle message center?

A. Degradation in filter performance and water separation performance, which can result in damage to the fuel system. Fuel filters not meeting OEM specifications may not properly separate the water resulting in undetected water entering the fuel system.