

General Service Bulletin (GSB):	6.4L Diesel Water In Fuel GSB
This GSB targets the diagnosis, inspection and repair of the 6.4L diesel fuel system.	Some 6.4L 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.
<b>NOTE:</b> 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.	



## *6.4L Diesel Water In Fuel GSB*

A guide to properly inspect for water contamination of the 6.4L Diesel Fuel System

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# Introduction

A guide to properly inspect the 6.4L Diesel Fuel System for contamination

Returned 6.4L fuel system components have shown that water contamination is a major contributor to metal debris in the high and low pressure fuel systems. Water in fuel can cause rust and corrosion to form within the fuel systems. Customers may request that a fuel sample be taken from the fuel tank and analyzed to determine quality. Fuel sample testing only determines the quality of the fuel in the current tank. Studies have shown that rust and corrosion in the fuel system may have occurred from a prior tank of fuel. Therefore the system must be inspected to determine if water contamination has occurred. Fuel system failure due to water is not eligible for warranty coverage.

**NOTICE:** This GSB should be utilized whenever the PC/ED leads you to check any part of the HP fuel system for damage/contamination, or results in direction to replace the High Pressure (HP) Fuel Injection Pump.

**NOTE:** *If metal debris is found in the HP fuel system, there is a high probability the debris resulted from a contaminant introduced into the fuel system such as water, gasoline or alcohol based additives.*

# Overview

## A guide to properly inspect the 6.4L Diesel Fuel System for contamination

Fuel contamination on a 6.4L 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*
- *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.*

## 6.4L Diesel Water In Fuel GSB

# 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
<b>Water</b>	No start, reduced power, poor drivability	Premature HP pump and injector wear, metal debris, rust/corrosion	Fuel sample, rust/corrosion on HP system components
<b>DEF</b>	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
<b>Gasoline/Ethanol/Kerosene/Incorrect Additives</b>	No start, reduced power, poor drivability, fuel knock	Premature HP pump and injector wear, metal debris	Fuel sample, odor, fuel aeration, DFCM noise
<b>Excessive Biodiesel (greater than 20%)</b>	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
<b>Lack of Filter Maintenance</b>	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

# Water in Fuel Separation

The 6.4L diesel vehicle is equipped with a water separator designed to remove the normal amount of water found in diesel fuel when system maintenance is up to date. Water exceeding the ASTM standards may not be separated due to system capability even with proper maintenance being performed. If water is detected, the customer will be warned by the Water-In-Fuel (WIF) warning lamp/message. The WIF warning lamp/message function is based on water accumulation within the Horizontal Fuel Conditioning Module (HFCM) water reservoir triggering the WIF sensor. Water may overcome or bypass the water in fuel separator for the following reasons:

- Insufficient fuel filter maintenance
- Use of filters that do not meet or exceed Ford Motor Company specifications
- Insufficient WIF separator maintenance (Refer to Owner Guide, Diesel Supplement)
- Failure to act upon WIF warning light/message in the instrument cluster
- Use of non-approved fuels (e.g. bio-diesel exceeding 5%)
- Use of aftermarket fuel additives that do not meet or exceed Ford Motor Company specifications
- WIF content that exceeds American Society for Testing of Materials (ASTM) standards

**NOTICE:** If metal debris is found in the HP fuel system, the next step is to check for the presence of contaminated fuel. Fuel contamination is the most common cause of metal debris in the HP fuel system. Metal debris found in the HP fuel system requires that the entire HP fuel system be replaced. See page 19 of this document for a complete list of parts needed for proper repair.

# Message Center Operation



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## Overview

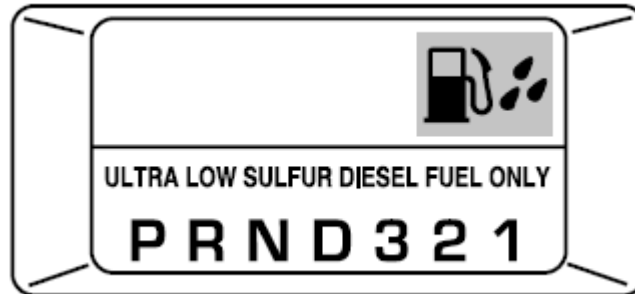
The Water-In-Fuel (WIF) warning monitors a level of water accumulated in the Horizontal Fuel Control Module (HFCM) using the WIF sensor. Water is separated within the HFCM by the primary fuel filter. The indication of an amount of water in the HFCM can take the form of a WIF light in the instrument cluster, or WIF warning message – depending on vehicle build level. The actual activation of the WIF warning (light or message) is controlled by the Powertrain Control Module (PCM) through an integrated strategy to prevent false Water in Fuel warnings due to normal fuel slosh in the HFCM.

## Vehicles with calibrations from IDS release 71.04 and greater

If a WIF monitor condition is met and not addressed (within 60 minutes or 60 miles) by draining the HFCM, the vehicle will exhibit the following:

- Wrench light illumination
- Engine power will be reduced
- Instrument Cluster Displays "Reduced Engine Power"
- Once the WIF monitor condition is corrected, the vehicle will return to normal operation.
- A WIF monitor has been added to detect water build-up during extended idle (2-4 hours).
- If a WIF monitor condition is met, a visible warning (WIF light/WIF message/wrench light) will be displayed. The vehicle will then operate in a reduced Engine Power (reduced torque) mode.
- Once the WIF monitor condition is corrected, the vehicle will return to normal operation.

# Message Center Operation - Continued



### Vehicles with calibrations before IDS release 71.04

- The PCM monitors the WIF sensor and other inputs to determine that an amount of water is present in the HFCM.
- The PCM communicates with the instrument cluster to activate the WIF warning (light/message), and stores a P2269 code in continuous memory.
- There are no PCM directed changes to vehicle drivability if a Water in Fuel monitor condition is met.

**NOTE:** No changes were made to the water in fuel detection strategy. Updates include enhanced WIF light/message operation during extended idle and to reduce engine power when the WIF light/message is on for an extended period of time.



## Fuel System Inspection

### Preliminary Inspection Points

The following are recommended system inspection points for evidence of water in fuel.

***These preliminary inspections cannot be used as a sole indicator to determine fuel system warranty eligibility.***

- Secondary fuel filter housing showing rust and/or corrosion - filter removed (Figures 1-4)

**Figure 4**



**Figure 1**



**Figure 2**



**Figure 3**



# Fuel System Inspection

### Preliminary Inspection Points

- A sample of fuel should be taken per the Sufficient Clean Fuel Test in the PC/ED. Figures 5-6 show examples of water in fuel samples.
- Inspection of the primary and secondary filters can be an indicator of fuel quality and system maintenance. Figures 7-8 show filters that have exceeded their service interval.



Figure 5 – Water and Fuel Separated



Figure 6 – Water emulsified in fuel



Figure 7 – Dirty Filters



Figure 8 - Collapsed Filters

# Fuel System Inspection

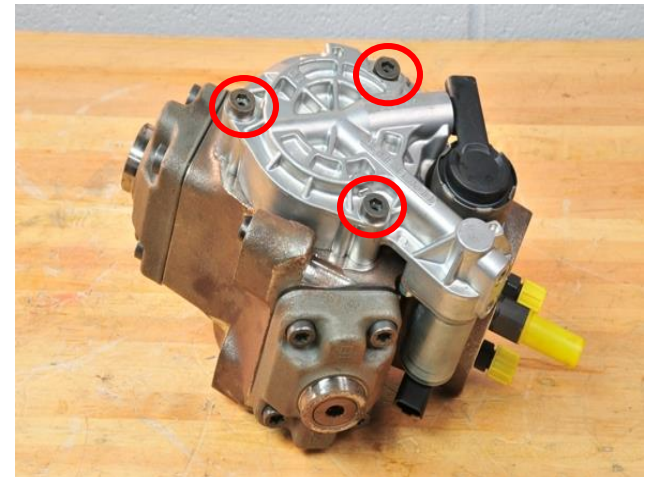
## Internal Transfer Pump Inspection

The Internal Transfer Pump (ITP) is located inside the High Pressure Fuel Injection Pump. Physical inspection of the ITP for rust or corrosion is required to determine fuel system warranty eligibility. Rust/corrosion within the ITP is confirmation of fuel system damage due to water/contaminated fuel. *Fuel system damage due to water/contaminated fuel is not eligible for warranty coverage.* Refer to Warranty and Policy Manual for additional information.

**NOTICE:** Removal of the ITP cover will cause permanent High Pressure Pump damage. The ITP cover should *only* be removed for inspection when debris is found in the High Pressure Fuel System (PC/ED > Section 4 Diagnostic Subroutines > Hard Start/No Start > Step 28). Debris in the High Pressure System indicates High Pressure Pump Failure.

## ITP Inspection Procedure

1. Remove the High Pressure Fuel Injection Pump. Refer to WSM, Section 303-04.
2. Place the pump assembly on a bench with the ITP cover facing up.
3. Remove the 3 fasteners (6mm hex) and the ITP cover.
4. Inspect the surfaces under the ITP cover for evidence of rust/corrosion to determine if the pump has been damaged by water/contaminated fuel.



## Fuel System Inspection

### Internal Transfer Pump Inspection

Shown here are all examples of rust and corrosion under the ITP which is non-warrantable. Any amount of rust/corrosion is an indication that water has entered the HP fuel system (see figures 9-12).

Figure 9 – Rust on the ITP

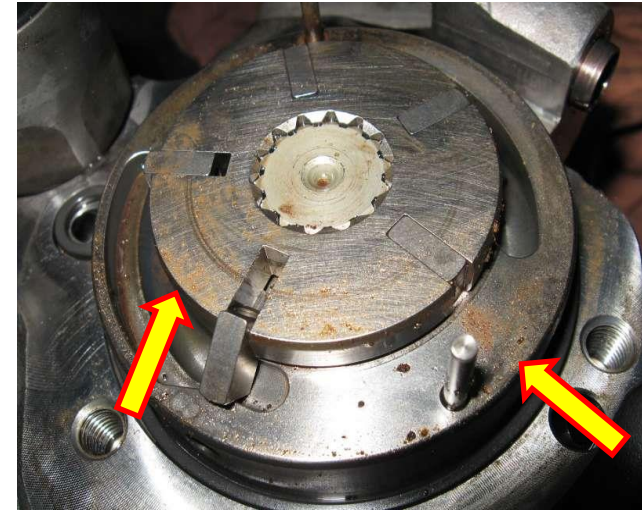


Figure 10 – Rust under ITP

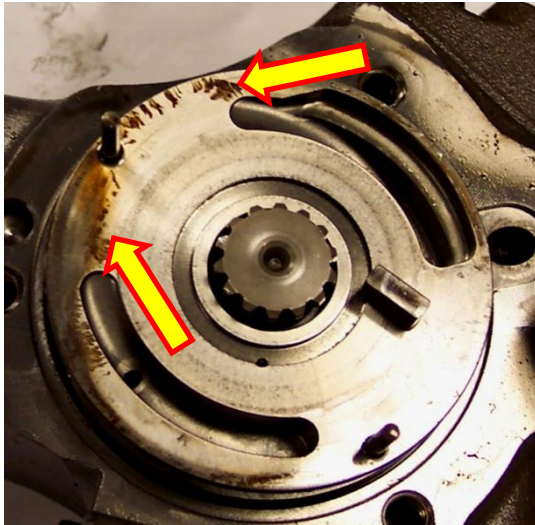


Figure 11 – Rust and Corrosion under ITP

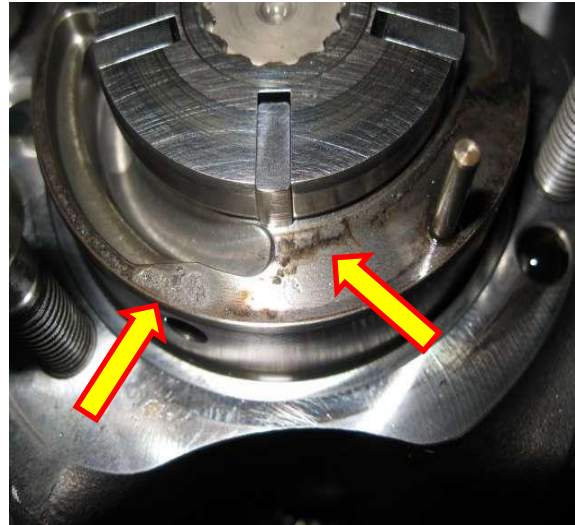
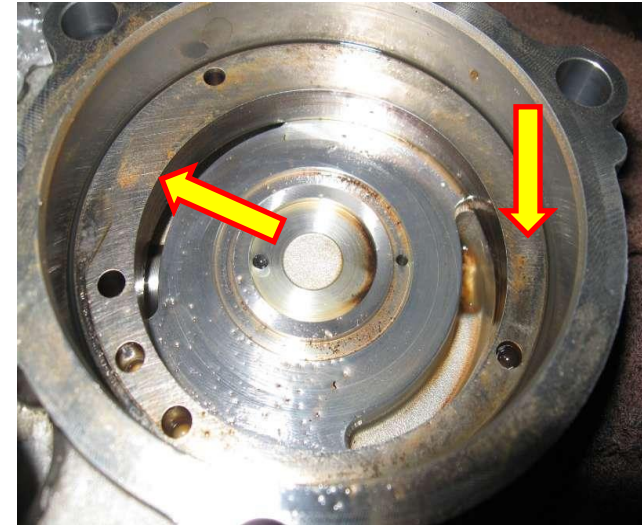


Figure 12 – Rust on ITP case



## Fuel System Inspection

### Internal Transfer Pump Inspection

Shown here are all examples clean Internal Transfer Pumps (figures 13-16). When good quality fuel is used and the filters are maintained properly, the inside of the pump will not have signs of rust or corrosion.

Figure 13 – Clean ITP cover



Figure 14 – Clean ITP

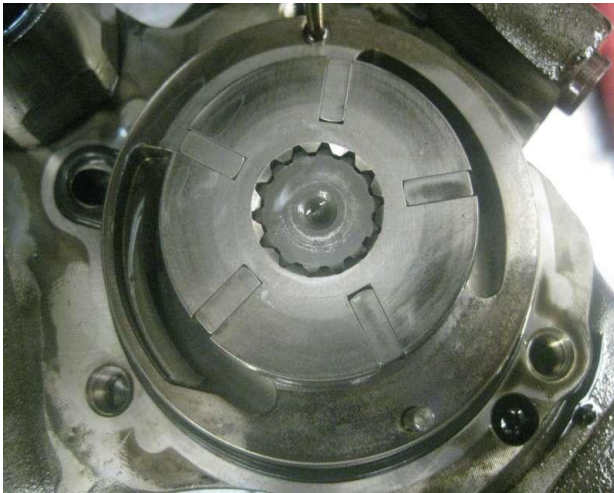


Figure 15 – Clean ITP



Figure 16 – Clean ITP



# Fuel System Replacement

Fuel system components to be replaced when rust/corrosion is found during ITP inspection

Part/Kit Common Name	* Kit contains
High Pressure Pump assy	N/A
High Pressure Pump gasket kit	<ul style="list-style-type: none"> <li>▪ High pressure pump gaskets</li> <li>▪ High pressure pump-to-fuel rail manifold fuel lines</li> </ul>
Fuel Cooler assembly	N/A
Fuel Injectors (All 8 must be replaced)	<ul style="list-style-type: none"> <li>▪ 1 Fuel injector</li> <li>▪ 1 Jumper tube</li> <li>▪ 1 Fuel injector gasket set</li> </ul>
LH and RH Fuel Rail Manifold kit	<ul style="list-style-type: none"> <li>▪ LH fuel rail manifold</li> <li>▪ RH fuel rail manifold</li> </ul>
Fuel Filter kit	<ul style="list-style-type: none"> <li>▪ Primary fuel filter</li> <li>▪ Secondary fuel filter</li> </ul>
Fuel Pressure Sensor	N/A
Fuel supply line	N/A
Secondary fuel filter housing	N/A

**NOTE:** The HFCM is to be inspected and replaced if there is visible metal debris in the HFCM during filter replacement or visible metal debris in the fuel tank

**NOTE:** Low pressure lines are to be flushed unless rust is found within the line. Rust inside a low pressure line requires line replacement.

# Frequently Asked Questions

**Q. What can cause rust or corrosion in a fuel system?**

**A.** Poor quality or contaminated fuel

**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. 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 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 procedures A or B in the 6.7L Diesel Fuel Contamination Diagnosis and Service Procedure Job Aid for proper repair procedures depending on if the engine has been started or not.

### 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 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.