6.7L Diesel Fuel System Contamination Diagnosis
and Service Procedure Job Aid
(Revised March, 2012)

Fuel contamination on 6.7L diesel engines 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
- Low Power
- Engine Knocking
- Exhaust Smoke
- Fuel Rail Pressure (FRP) slow to build

Follow the appropriate service procedure depending on whether the engine has been started with contaminated fuel, or not.

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. See Warranty and Policy Manual and Customer Information Guide for details.

NOTE: The most common sources of contaminated fuel are:
- Auxiliary vehicle mounted tanks
- Local storage tanks
- Other infrequently used fuel sources
- Refueling errors (i.e. Diesel Exhaust Fluid (DEF) or gasoline introduced into the fuel tank)

The best action that can be taken to avoid concerns with the fuel system is to ensure vehicle is only fueled from sources with known quality diesel fuels verified to be free from water and other contaminants.

Fuel Quality Verification/Indicators

1. Using an appropriate container, obtain a fuel sample from the Diesel Fuel Conditioning Module (DFCM) water drain. Refer to the vehicle Owner Guide for additional information, if necessary.

2. Let fuel sample sit for 10-15 minutes.

3. Visually inspect fuel sample to help determine type of contamination. Refer to the Fuel Contamination Table and Reference Photos to further aid in determining type of fuel contamination. See Figure 8 for an example of DEF-contaminated fuel.

4. Remove the DFCM fuel filter cover and the primary fuel filter element.

5. Allow both filter and cover to dry for 2 hours.

6. Visually inspect for formation of white crystals as listed below and as shown in the Reference Photos. White crystal formation is an indicator of DEF contamination.

   a) DFCM filter cover (Figures 9 and 10)
      - Separation of DEF and fuel upon DFCM cover removal (non-warrantable contamination example)
      - DEF crystal growth after 2 hours dry time (non-warrantable contamination example)
b) Primary Fuel Filter Element After 2 Hours Dry Time (Figure 11)
   DEF crystal growth (non-warrantable contamination example)

c) Secondary Fuel Filter Ports After 2 Hours Dry Time (Figure 12)
   DEF crystal growth on ports (non-warrantable contamination example)

d) DFCM Upper Housing After 2 Hours Dry Time (Figure 13)
   DEF crystal growth (non-warrantable contamination example)

**NOTICE:** If DEF contamination is found at the primary fuel filter, filter cap or housing, discontinue inspections and perform procedure A.

7. If fuel sample is acceptable and no white crystal formation is found, proceed to step 8—component inspections.

8. Component inspections for corrosion

   **NOTE:** Removal of fuel system components may be required to further determine contamination type and extent of system damage.

   a) Key Components and Locations (Figures 1 & 2)
      1 – Pressure Control Valve (PCV)
      2 – Volume Control Valve (VCV)
      3 – High Pressure Pump Outlet Ports
      4 – High Pressure Pump Overflow Valve

   b) PCV (Figure 3)
      A – PCV valve with corrosion (non-warrantable corrosion example)
      B – PCV valve with no corrosion (normal appearance)

   c) VCV (Figure 4)
      A – VCV with rust particle contamination (non-warrantable rust contamination example)
      B – Corrosion and rust on VCV outlet ring (non-warrantable corrosion example)
      C – Crystal growth from DEF contamination after 2-hour dry time (non-warrantable contamination example)

   d) High Pressure Pump Outlet Ports (Figure 5)
      Corrosion on high pressure pump outlet port bore (non-warrantable corrosion example)

   e) High Pressure Pump Overflow Valve (Figures 6 & 7)
      Corrosion on high pressure pump overflow valve ports (non-warrantable corrosion example)

9. If fuel tank has been contaminated with gasoline, Diesel Exhaust Fluid (DEF), or any other non-diesel fluid and engine has been started, perform 'Procedure A'.

10. If fuel tank has been contaminated with gasoline, or any other non-diesel fluid and engine has NOT been started, perform 'Procedure B'.

   **NOTICE:** If fuel tank has been contaminated with DEF (ignition turned to run/engine started or not started) perform ‘Procedure A’

11. Perform Fuel System Bleeding – Diesel Engine, in order to get the engine started. Refer to Workshop Manual (WSM), Section 310-00.

12. Change engine oil and replace oil filter.

13. Using a scan tool, perform High Pressure Fuel System Test to check system for leaks. Repair as necessary.
Procedure A – Fuel Contaminated, Engine Started

1. Drain fuel tank completely by removing the tank and cleaning to prevent the possibility of reintroducing contamination. (Dispose of contaminated fuel in accordance with local laws and regulations.)
2. Fill fuel tank with fresh, clean, good quality diesel fuel.

NOTE: Leave original fuel filters, HP injection pump, fuel lines, fuel rails and injectors in place until flushing procedure is completed to prevent contamination of replacement components.

3. Using an appropriate container, drain DFCM of any residual liquids.

NOTE: The DFCM must be inspected during filter replacement to verify no low pressure fuel system damage. If DEF contamination is present, the DFCM must be replaced.

5. Replace both fuel filters (primary and secondary).
6. Replace ALL High Pressure fuel system components;
   • High Pressure Fuel Pump
   • Engine mounted high pressure fuel lines
   • Both high pressure fuel rails
   • Eight fuel injectors
   • Low pressure fuel injector return hose assembly
   • Fuel delivery pressure switch (located on the engine low pressure line near the secondary fuel filter)

NOTE: All remaining low pressure fuel lines can be reused if no physical damage is present.

Procedure B – Fuel Contaminated, Engine NOT Started

1. Drain fuel tank completely by removing the tank and cleaning to prevent the possibility of reintroducing contamination. (Dispose of contaminated fuel in accordance with local laws and regulations.)
2. Fill fuel tank with fresh, clean, good quality diesel fuel.
3. Using an appropriate container, drain DFCM of any residual liquids.

NOTE: The DFCM must be inspected during filter replacement to verify no low pressure fuel system damage.

4. Replace both fuel filters (primary and secondary).

Procedure C – Fuel System Flush

1. Remove the rear Fuel Cooler Line that returns to the fuel tank at the fuel cooler.
2. Install a 3-foot length of 3/8-inch diameter fuel hose over the fuel cooler nipple.
3. Place the open end of the hose into a suitable container.
4. Use Scan Tool Active Commands or cycle the ignition key to RUN to activate the low pressure fuel pump to flush the lines.
<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Symptom</th>
<th>Effect</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline / Ethanol / Kerosene / Alternative Fuels</td>
<td>Crank no start, poor driveability, low fuel pressure on HP and/or low pressure (LP) side, engine combustion knock</td>
<td>Premature HP pump and fuel injector wear, debris, NO rust/corrosion, distortion of materials</td>
<td>Fuel sample, odor, fuel aeration. Note: The elastomeric valves in the tank Diesel fuel Delivery Module (DDM) can distort with aggressive fuels (aggressive biodiesel, gasoline or ethanol blends) and result in increased air in fuel and poor low fuel level system performance.</td>
</tr>
<tr>
<td>Water</td>
<td>Crank no start, reduced power mode, poor driveability</td>
<td>Premature HP pump and injector wear, debris, rust/corrosion</td>
<td>Fuel sample, corrosion as shown in Figures 3-7 (can have water damage throughout system if large enough quantity is ingested)</td>
</tr>
<tr>
<td>Excessive Biodiesel (Greater than 20%)</td>
<td>Low fuel pressure on HP and/or LP side, poor driveability</td>
<td>Premature HP pump and injector wear, debris, rust/corrosion, bacterial/fungus growth</td>
<td>Rust/corrosion as shown in Figures 3-7 due to increased water content (excessive biodiesel decreases water separation capability), bacterial/fungus growth, aeration. Note: The elastomeric valves in the tank DDM can distort with aggressive fuels (aggressive biodiesel, gasoline or ethanol blends) and result in increased air in fuel and poor low fuel level system performance.</td>
</tr>
<tr>
<td>Incorrect Fuel Additives (alcohol based and other)</td>
<td>Low fuel pressure on HP and/or LP side, poor driveability</td>
<td>Premature HP pump and fuel injector wear, may have rust/corrosion, or only debris</td>
<td>Rust/Corrosion if water emulsifies and prevents fuel, water separation</td>
</tr>
<tr>
<td>Insufficient Maintenance of Fuel Filters</td>
<td>Crank no start, reduced power mode, poor driveability, low fuel pressure on HP and/or LP side</td>
<td>Premature HP pump and fuel injector wear, HP or LP pump noise or failure, debris, may have rust/corrosion, decreased efficiency of water separation/plugged filters/collapsed filters</td>
<td>Rust/corrosion as shown in Figures 3-7 due to increased water content, HP pump damage due to debris, factory filters installed beyond service interval (TIP: Factory secondary filter is a 3-port type. Service replacement is a 2-port type), collapsed or water-laden primary filter</td>
</tr>
<tr>
<td>DEF</td>
<td>Crank no start, reduced power mode, poor driveability</td>
<td>Premature HP pump and fuel injector wear, debris, pitting/corrosion, distortion of materials, plugged fuel injector return line</td>
<td>Fuel sample, odor, white crystal residue on components when dried</td>
</tr>
<tr>
<td>Foreign Materials (sand, dirt, metallic particles, etc)</td>
<td>Crank no start, fuel pump noise</td>
<td>Low fuel pressure, HP or LP pump failure</td>
<td>Noise from DFCM, debris on VCV inlet screen or inside HP pump</td>
</tr>
</tbody>
</table>
Location of Inspection Points

Figure 1

Figure 2

Figure 3
6.4L/6.7L 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 6.4L/6.7L Owner Guide Diesel Supplements. 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.

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

A. This means that the 6.7L Diesel Fuel Conditioning Module (DFCM) or the 6.4L Horizontal Fuel Conditioning Module (HFCM) 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 HFCM/DFCM reservoir capacity will be passed through to the fuel system resulting in damage to the system. Refer to the 6.4L/6.7L Owner Guide Diesel Supplements for HFCM/DFCM capacities.

**Q. How often should the 6.4L Horizontal Fuel Conditioning Module (HFCM) or the 6.7L Diesel Fuel Conditioning Module (DFCM) be drained?**

A. Monthly or when the WIF light turns on or message appears (whichever occurs first). Refer to the 6.4L/6.7L Owner Guide Diesel Supplements for HFCM/DFCM draining intervals/procedures.

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

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

**Q. What happens if I accidently 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 (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, too high of Biodiesel percentage 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 fuel tank

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 6.4L/6.7L Owner Guide 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.

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 DTC’s 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.