

6.7L Diesel Fuel System Contamination Diagnosis and Service Procedure Job Aid (Revised September, 2011)

Fuel system contamination on 6.7L diesel engines can damage the 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.

NOTE: *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 vehicles are 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)

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, DEF, or any other non-diesel fluid and engine has NOT been started, perform 'Procedure B'.
- 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.
4. Perform Fuel System Flush. Refer to **Procedure C**, below.

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).
5. Perform Fuel System Flush. Refer to Procedure C, below.)

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 key to activate the low pressure fuel pump to flush the lines.

Contamination Reference Table

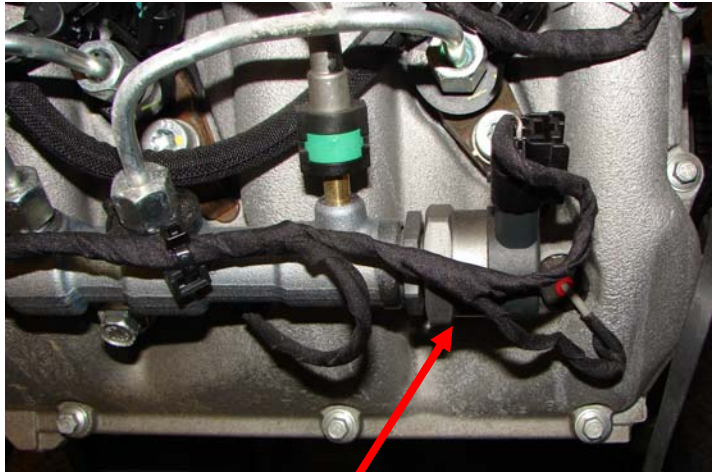
NOTE: Fuel contamination can be, but is not limited to, dirt/debris, water, biodiesel (greater than 20%), incorrect fuel additives, gasoline, kerosene, DEF, etc.

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.

Contaminant	Symptom	Effect	Indicator
Gasoline / Ethanol / Kerosene / Alternative Fuels	Crank no start, poor driveability, low fuel pressure on HP and/or low pressure (LP) side, engine combustion knock	Premature HP pump and fuel injector wear, debris, NO rust/corrosion, distortion of materials	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.
Water	Crank no start, reduced power mode, poor driveability	Premature HP pump and injector wear, debris, rust/corrosion	Fuel sample, corrosion as shown in Figures 3-7 (can have water damage throughout system if large enough quantity is ingested)
Excessive Biodiesel (Greater than 20%)	Low fuel pressure on HP and/or LP side, poor driveability	Premature HP pump and injector wear, debris, rust/corrosion, bacterial/fungus growth	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.
Incorrect Fuel Additives (alcohol based and other)	Low fuel pressure on HP and/or LP side, poor driveability	Premature HP pump and fuel injector wear, may have rust/corrosion, or only debris	Rust/Corrosion if water emulsifies and prevents fuel, water separation
Insufficient Maintenance of Fuel Filters	Crank no start, reduced power mode, poor driveability, low fuel pressure on HP and/or LP side	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	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
DEF	Crank no start, reduced power mode, poor driveability	Premature HP pump and fuel injector wear, debris, pitting/corrosion, distortion of materials, plugged fuel injector return line	Fuel sample, odor, white crystal residue on components when dried
Foreign Materials (sand, dirt, metallic particles, etc)	Crank no start, fuel pump noise	Low fuel pressure, HP or LP pump failure	Noise from DFCM, debris on VCV inlet screen or inside HP pump

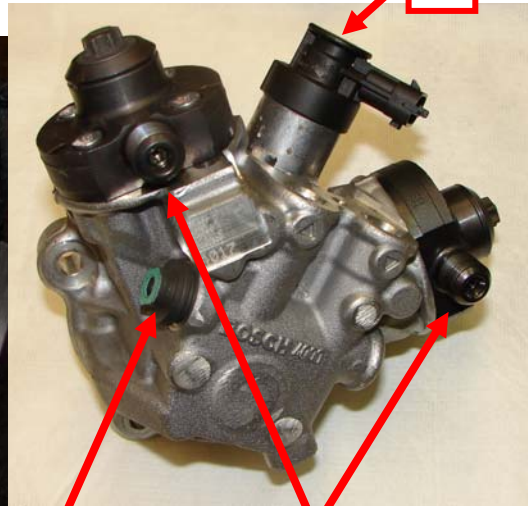
Location of Inspection Points

Figure 1



1

Figure 2

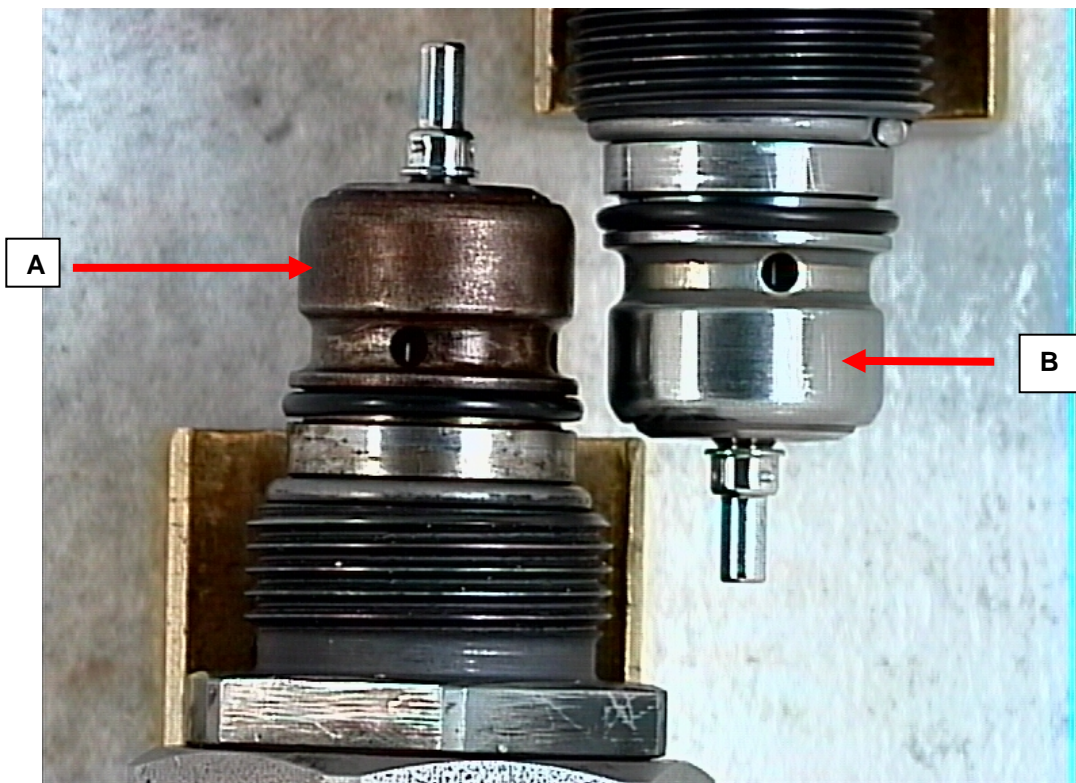


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4

3

Figure 3



A

B

Figure 4

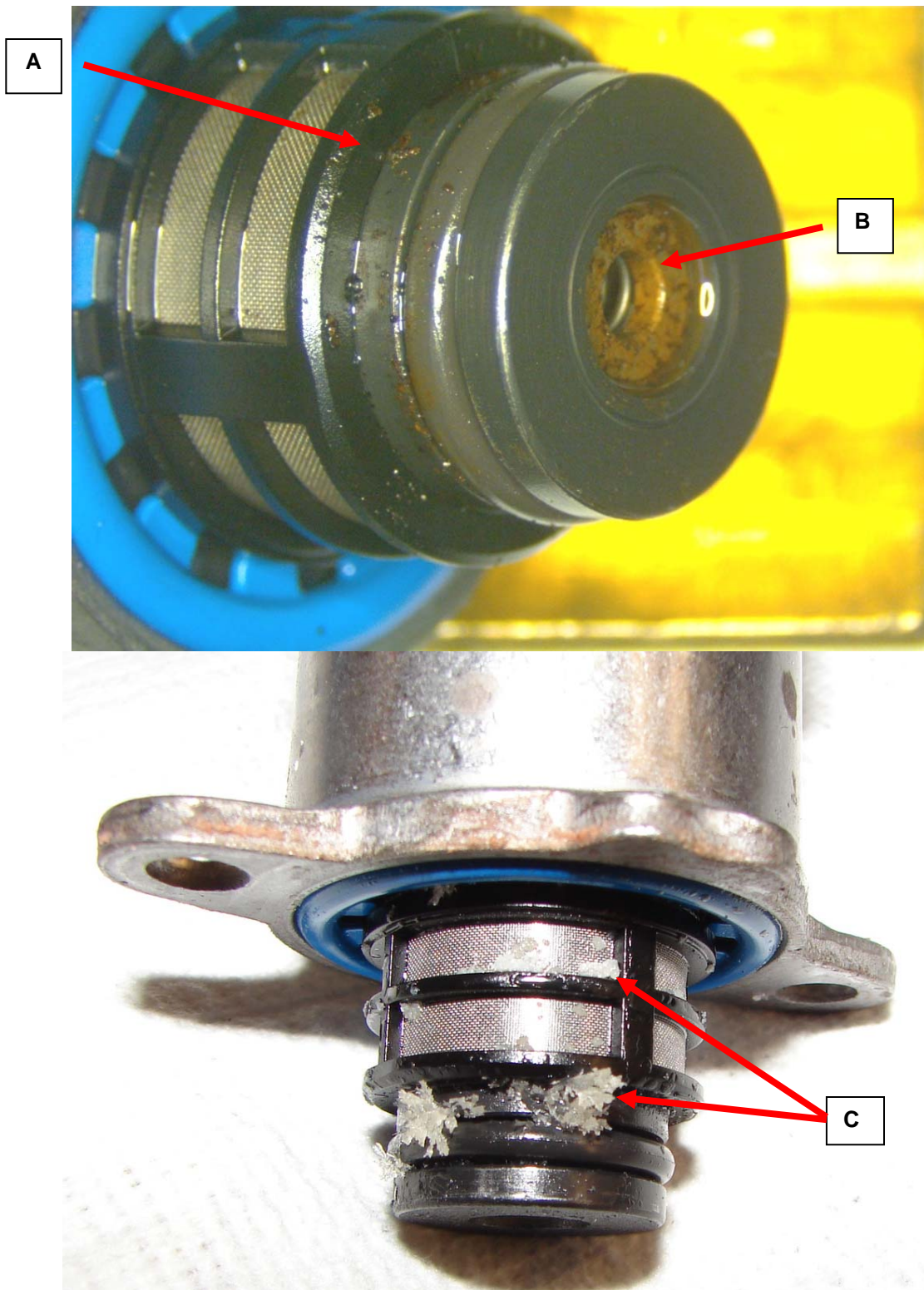


Figure 5



Figure 6



Figure 7

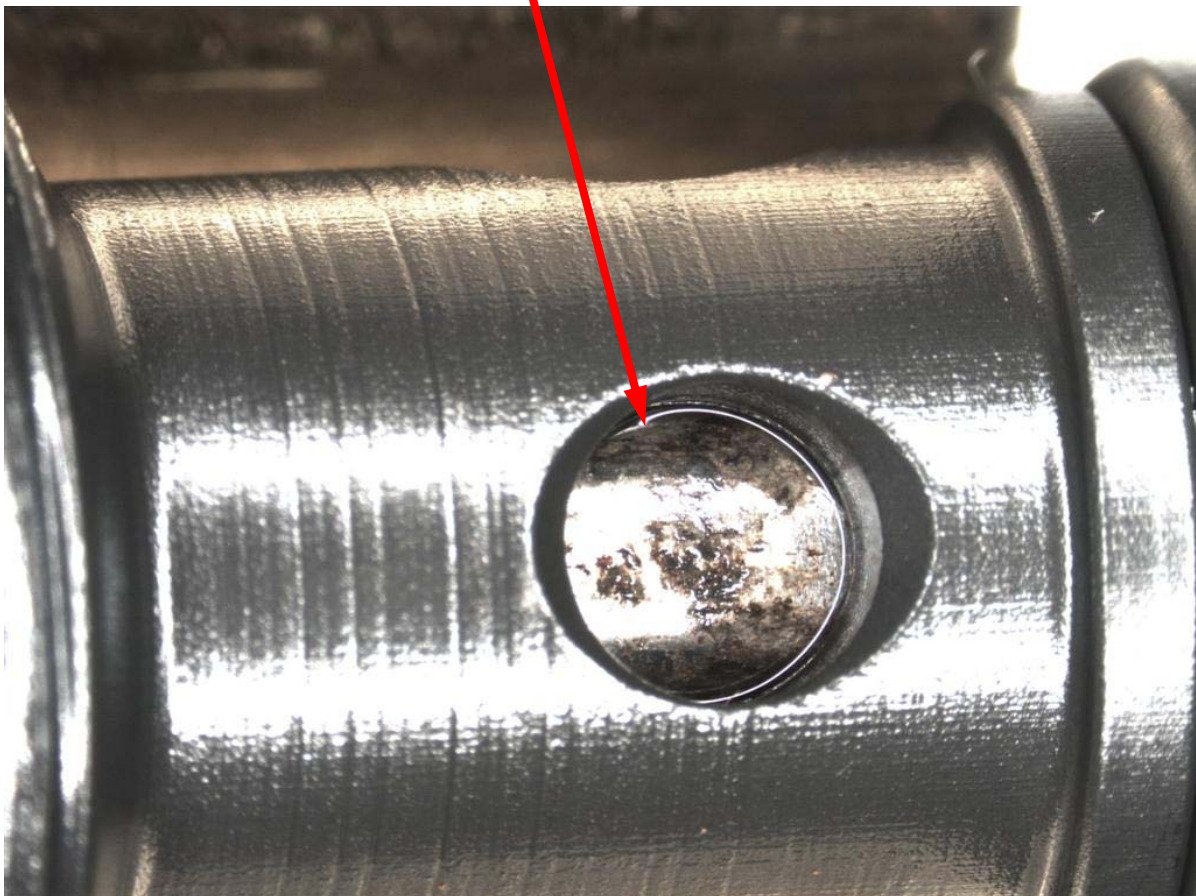


Figure 8



Figure 9

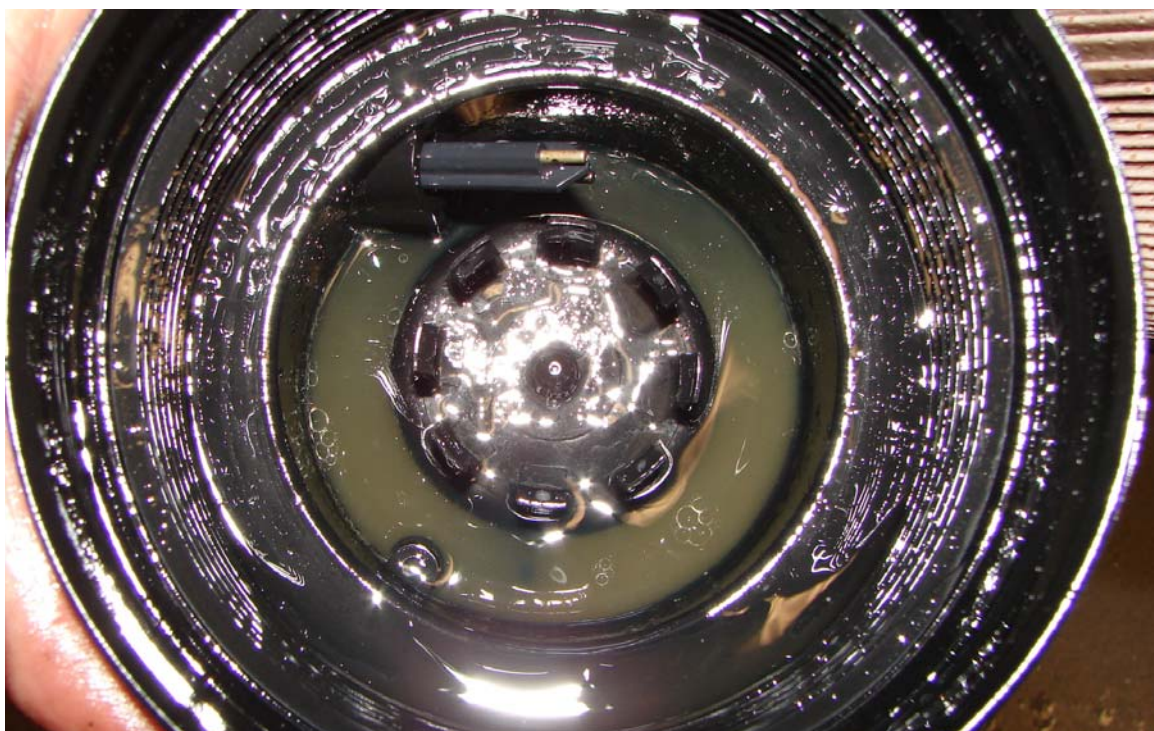


Figure 10



Figure 11



Figure 12



Figure 13

