



GENERAL SERVICE BULLETIN

6.7L Diesel Fuel System Service Tips

21-7061

15 July 2021

This bulletin supersedes 20-7091. Reason for update: Not Applicable

Summary

This article supersedes GSB 20-7091 to update the vehicle model years affected.

This document is intended to assist in determining when a complete 6.7L diesel fuel system should be replaced and provide how to check for poor fuel quality. There is also a frequently asked questions section at the end of this article. This article should be used when the Powertrain Control/Emission Diagnosis (PC/ED) Manual leads to checking the volume control valve (VCV), pressure control valve (PVC), or if poor fuel quality is suspect.

Service Information

NOTE: 2011-2016 vehicles use a low pressure fuel pump and filter assembly called a fuel conditioning module. Starting with 2017 vehicles, the 6.7L has the low pressure pump in the fuel tank and later use a fuel filter/water separator. The frame rail mounted device for both applications will be referred to as a fuel conditioning module for this article.

Symptoms of high pressure fuel injection pump drivetrain failure

- No start with/without P0087/P0088 and/or P2291.
- Following normal PC/ED led diagnostics before disassembling the high pressure fuel system.

NOTE: Debris found in fuel filters is not cause to pull the VCV. Fuel sample for debris check should not be collected from the fuel rail. Debris on the threads can be collected and give a false indication.

If the PC/ED leads to inspecting the VCV or other components for damage, the following checks should be made:

- Remove the VCV from the high pressure fuel injection pump. Check for large amounts of metal debris.
- When there is a high pressure fuel injection pump drivetrain failure, large amounts of metal debris will be visible when removing VCV.

NOTE: Large amounts of metal debris is formed when the high pressure fuel injection pump drivetrain fails due to lack of lubricity. Poor fuel quality or contaminates such as DEF, water, gasoline, aged/oxidized fuel, organic growth (bacteria, fungus), unapproved fuel additives or ethanol introduced into the fuel system typically cause this type of failure. It is crucial to check for contaminated/poor quality fuel when a large amount of metal debris is found in the VCV port.

Examples of high pressure fuel injection pump drivetrain failure - require complete fuel system replacement

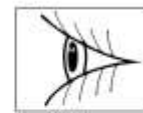
- VCV and VCV port contain a large amount of metal debris.
- Poor fuel quality/contamination is the most common cause of this type of failure. Fuel inspection and component inspection of evidence should be performed.
- Refer to the Workshop Manual (WSM) for proper repair procedures.

Figure 1 - VCV screen side view



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Figure 2 - VCV port in the high pressure fuel injection pump



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Figure 3 - VCV top view



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Examples where the high pressure fuel injection pump drivetrain has not failed - do not replace the complete fuel system

- The VCV and VCV port do not show evidence of large amount of metal debris. The high pressure fuel injection pump has not occurred a drivetrain failure.
- If the engine starts, the high pressure fuel injection pump cam and roller are not damaged as would be evident of a drivetrain failure.

- Continue to diagnose the condition using the PC/ED Manual.

Figure 4 - Single particle



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Figure 5 - No visible debris



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Figure 6 - Small particle in the VCV port



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Fuel System Verification

This section provides examples of poor fuel quality, what to look for on the various components and the symptoms related.

When directed by the PC/ED Manual to inspect the VCV and/or PCV, the components to be reviewed for evidence of poor fuel quality, the following will provide examples of what to look for.

When there is a drivetrain failure of the high pressure fuel injection pump, the VCV and PCV should be inspected for evidence of poor fuel quality.

Symptoms related to poor fuel quality:

- Crank no start
- Long crank / hard start
- P2291
- P0087 / P0088
- Runs rough
- Reduced power
- Fuel pressure slow to build

The most common sources of poor fuel quality

- Auxiliary vehicle mounted fuel tanks
- Local storage tanks
- Infrequently used fuel sources
- Refueling errors (diesel exhaust fluid [DEF] or gasoline introduced into the fuel tank)

Contamination Reference Table

Contaminant	Symptom	Result	Indicator
Water	No start, reduced power, poor drivability	Premature high pressure pump and injector wear, metal debris, rust/corrosion	Fuel sample, rust/corrosion on high pressure system components
DEF	No start, reduced power, poor drivability	Premature high pressure 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 high pressure pump and injector wear, metal debris	Fuel sample, odor, fuel aeration, fuel conditioning module noise
Excessive Biodiesel (greater than 20%)	Hard start, reduced power, poor drivability, low fuel pressure on low pressure and/or high pressure systems	Premature high pressure pump and injector wear, metal debris, rust/corrosion, bacterial/fungus growth	Fuel sample, waxing or gelling on primary filter, rust/corrosion on high pressure components
Lack Of Filter Maintenance	No start/Hard start, reduced power, poor drivability, low fuel pressure on low pressure and/or high pressure systems	Premature HP pump and injector wear, low pressure or high pressure pump noise or failure, metal debris, rust/corrosion, collapsed filters	Fuel sample, rust/corrosion on high pressure system components, fuel conditioning module noise, collapsed primary fuel filter

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

Inspection Examples

Components contaminated by DEF - not warrantable

The below 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 and VCV allowing them to dry for 2 hours. If white crystals form on any fuel system component, the system has been contaminated with DEF. The fuel sample below shows how DEF and fuel separate in a fuel sample (DEF is the darker cloudy substance).

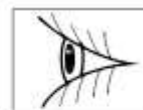
Figure 7 - Primary fuel filter (2017+)

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Figure 8 - Primary fuel filter (2011-2016)

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Item	Description
1	Diesel fuel
2	DEF

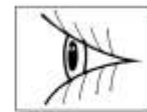
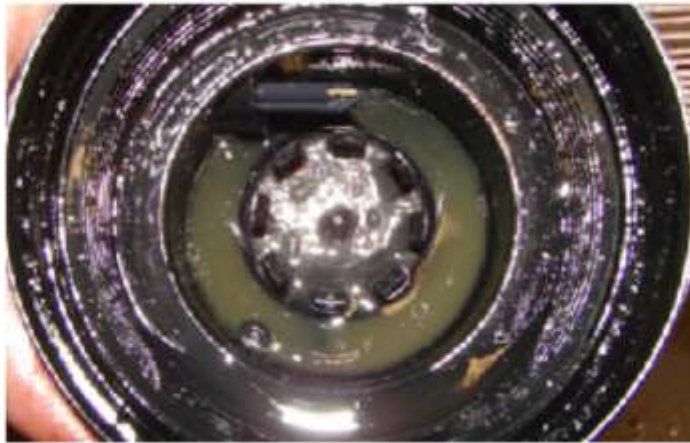
Figure 9 - DEF will separate from the fuel



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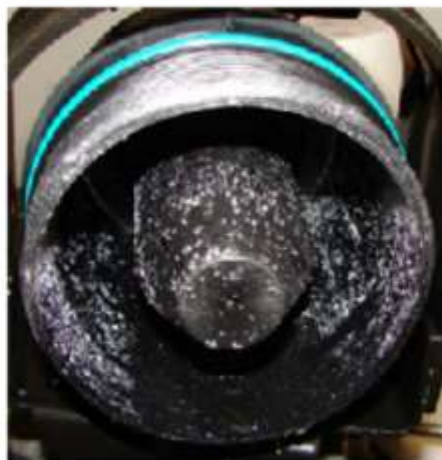
Further indicators of DEF contamination are the fuel conditioning module housing and engine mounted fuel filter. DEF contamination may be present in low pressure fuel lines and other high pressure system components as well. DEF crystals form as the DEF and fuel evaporate and is evident by the white crystals forming. (Figures 10-12)

Figure 10



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Figure 11



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Figure 12



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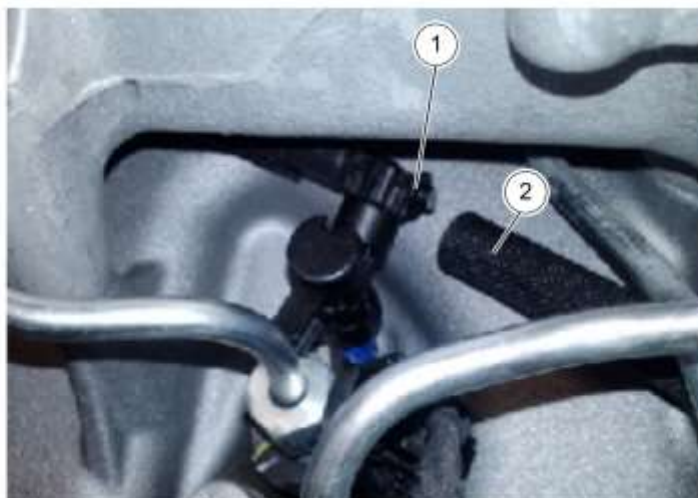
Another indication that the fuel system may be contaminated with DEF is if a fuel injector return line breaks loose from the quick connect fitting. If DEF enters the fuel injector return lines it can crystallize and cause increased line pressure resulting in the line disconnecting from the quick connect fitting potentially breaking the barb. If a fuel injector return line is found disconnected/loose/damaged it is recommended to check the fuel system for DEF contamination before proceeding with repairs. (Figures 13-14)

Figure 13



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Figure 14



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Item	Description

1	Injector fitting
2	Return line

Poor Fuel Quality - Not Warrantable

The below photos are of components contaminated due to poor fuel quality. Primary indication of poor fuel quality can be found by obtaining a fuel sample as well as removing the VCV and/or PCV and checking for contamination, organic growth, rust and/or corrosion.

Figure 15 - Contamination on the end of the VCV



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Figure 16 - Rust on the fuel side of the PCV



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Figure 17 - Rust staining on VCV screen



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Figure 18 - Bio growth on the end of the VCV



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Figure 19 - Contamination on the end of the VCV



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Rust on thread side of o-ring is caused by environment. Fuel is not on thread side of o-ring. Warranty should not be determined based on this portion of PCV. (Figure 20)

Figure 20





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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's Manual Diesel Supplement. Some examples of fuel contamination are:

- Water content exceeding specification
- DEF
- Fuel with high total acid number (TAN) – acidic fuel
- Aged/oxidized fuel
- Organic growth (bacteria, fungus)
- Unapproved fuel additives

NOTE: The above contamination is not warrantable.

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 American Society for Testing and Materials (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

Q: What do the water in fuel (WIF) indicators/lamps/message center messages mean?

A: This means that the 6.7L fuel condition module 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 fuel condition module reservoir capacity will be passed through to the fuel system resulting in damage to the system. Refer to the 6.7L Owner's Manual Diesel Supplement for fuel condition module capacities.

Q: How often should the 6.7L fuel condition module 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's Manual Diesel Supplement for fuel condition module draining intervals/procedures.

Q: Will the fuel condition module separate other contaminants in the fuel besides water?

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

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 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 unseparated non-aqueous (non-water) parts of the DEF entering the fuel system. Refer to WSM, Section 310-00 Fuel System – General Information 6.7L > General Procedures > Diesel Fuel System Contamination Repair/Flushing – Key Not Turned To Run Or Engine Not Started, or to Key Turned To Run Or Engine Started, depending on the scenario.

Q: What are the effects of oxidized, acidic or organic growth in fuel (diesel and 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 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's 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.

Q: Why do fuel system components show signs of contamination (such as rusted or corroded high pressure fuel system components) with no WIF related DTCs present or WIF lamp 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 original equipment manufacturer (OEM) specifications may not properly separate the water resulting in undetected water entering the fuel system. An unplugged WIF sensor or damaged circuit can result in undetected water in the fuel condition module 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.