



Solution

Title (customer effect) Volvo Chassis - Diesel Exhaust Fluid (DEF) Contamination In Fuel System, Inspection And Repair - **US10 to US14 (Non-Common Rail Fuel System)**

Cause In cases where multiple Injector electrical faults and/or open or short circuits have occurred, a check for the DEF contamination will need to be performed.

Solution

Overview

DEF in the fuel system can cause a multitude of problems. DEF will also crystallize in fuel as it warms, which can result in blockages in several different locations of the fuel system. DEF is also corrosive and will cause damage to several different types of metal, including carbon steel, brass, aluminum, copper magnesium nickel and zinc. This includes electrical components that DEF comes into contact with. DEF passage through fuel injectors will cause misfires and short or open circuits as the internal components corrode and become clogged with crystallized DEF. If a chassis has electrical codes (voltage, open circuit, short circuit) logged for multiple injectors, DEF contamination should be one of the possible causes considered.

Repair

Check The Fuel Currently In The Tanks

Diesel fuel is less dense than DEF. When allowed to separate, diesel will float on top of DEF.

1. Using an appropriate clear container (a beaker is a good example), obtain a fuel sample from the bottom of the fuel tank.
2. Let the fuel sample sit for 10-15 minutes.
3. Visually inspect the fuel sample to see if separation is observed as shown in the picture below:
 - Putting a light behind the sample container can help highlight a separation line in the sample



4. Remove both the primary and secondary fuel filters. Allow them to dry for two hours.
5. Visually inspect the top of the filters at that time for white crystals.

Check The Fuel Injectors

1. Connect to the chassis with Premium Tech Tool (PTT) and confirm the codes.
2. Follow Guided Diagnostics through checking injector circuit resistances.
3. If resistances are found to be out of spec, the valve cover needs to be removed and resistance rechecked at the injector connector.
 - 4a. If the resistance is within specs when checked at the injector connectors, there is a poor connection or short in the Engine Harness that should be addressed first. Function will need to be rechecked after the harness is repaired or replaced.
 - 4b. If the same readings are observed at the injector connectors, the harness is not likely a problem and the injectors will need to be removed and physically inspected.
5. Once injectors are pulled, dry the lower portion of the injector that is in contact with fuel using a heat gun.
6. Check for the presence of DEF crystal or residue on the injector using a blacklight. DEF will fluoresce (glow) under blacklight as shown below.



Crystallization in Normal Light



Crystallization in UV Light (Blacklight)

If DEF Is Confirmed To Be Present In The Fuel

The following operations will need to be performed:

- The fuel tanks need to be completely drained and thoroughly flushed with water. The presence of pitting on the inside of the tank may require tank replacement. The tank will need to be inspected following cleaning.
- The complete fuel system will need to be thoroughly flushed.
- The system should be dried as thoroughly as possible prior to reassembly.

The following parts will need to be replaced:

- Fuel Injectors and sleeves
- Fuel pump
- Aftertreatment Hydrocarbon Injector (AHI) Module
- AHI nozzle
- AHI fuel/air supply line (line between AHI module and nozzle)
- Overflow valve in the cylinder head
- Fuel Filter base

- **Note that DEF in the fuel system is a non-warrantable failure.**

Solution visibility	Dealer distribution
Function(s)/component(s) affected	
Function affected	SNV , engine , fuel system , injectors , DEF Dosing , SCR , Diagnostic tool
Function Group	
Function Group	237 injector and delivery pipe , 254 catalytic converter; exhaust emission control equipment , 258 emissions after-treatment
Customer effect	
Main customer effect	stumble , regeneration , diagnostics/methodology , efficiency/abnormal behavior
Fluid problem	crystallisation , contamination
Fluid implicated	AdBlue , fuel
Road behaviour	driveability
Fault code(s)	
US10 Fault Codes	SPN 651 FMI 3 , SPN 651 FMI 5 , SPN 652 FMI 3 , SPN 652 FMI 5 , SPN 653 FMI 3 , SPN 653 FMI 5 , SPN 654 FMI 3 , SPN 654 FMI 5 , SPN 655 FMI 3 , SPN 655 FMI 5 , SPN 656 FMI 3 , SPN 656 FMI 5
OBD 2013 Diagnostic Trouble Codes	P020113 , P020213 , P020313 , P020413 , P020513 , P020613 , P026200 , P026500 , P026800 , P027100 , P027400 , P027700
Conditions	

Vehicle operating mode when driving , when stationary

Frequency of occurrence of problem always

Administration

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Last modified by RU4469V

Creation date 28-09-2016 17:09

Date of last update 06-02-2018 17:02

Status Published

NA_VOLVO_Vehicle_Range

NA_VOLVO_Vehicle_Range Conventional , VNR , VT , VNX , VNL , VNM , VHD , VAH
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Engine family

Engine family Volvo

Emission Standard

Emission Standard US16 , US15 , US10 , US13 OBD , US14 GHG
