Solution

Title (customer effect)	Diesel Exhaust Fluid (DEF) Contamination In Fuel System, Inspection And Repair; Engine Misfire, No-Start, Uneven Operation, Multiple Injector Codes, Fuel Pressure Codes - US17 And Newer (Common Rail Fuel System)
Cause	In cases where multiple Injector electrical and/or open or short circuit, or high and/or low fuel pressure Diagnostic Trouble Codes (DTC) have logged, DEF contamination is a possible cause that should be considered.

Solution

An eService case should be opened for all repairs made on common rail-equipped chassis that experience DEF contamination in the fuel system following completion of repairs. A copy of the invoice should be attached to the case to document the repairs performed.

Overview

DEF in the fuel system can cause a multitude of problems. DEF can 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 normally 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. The corrosion and buildup of crystal can also cause fuel pressure issues in both high and low pressure circuits as valves clog or stick in position due to damage caused by the DEF.

For the common rail fuel system, DEF presence in the fuel rail can lead to no-start conditions. Often, low pressure system pressure will be within spec, but there may or may not be pressure present in the high pressure system. In addition, it is possible for DEF contamination to be present **without any accompanying DTCs,** and the possibility should not be eliminated because of a clear DTC readout if there are symptoms present.

Inspection

There are several locations where the effects of DEF contamination can be observed.

Fuel Tanks

Diesel fuel is less dense than DEF. When allowed to separate, diesel will float on top of DEF which prevents direct visual confirmation. A sample will need to be taken from the tank.

1. Allow the truck to sit on a reasonably level surface with the engine off for at least one hour to give fuel tank contents a chance to settle.

2. Using an appropriate clear container (a beaker is a good example), obtain a fuel sample from the bottom of the fuel tank.

- The depth the sample is taken from is important. Both of the samples in the picture below were taken from the same tank. A sample taken from the middle or top of the tank (left) may not show an issue, when a sample taken from the bottom of the tank (right) does.

3. Allow the sample to settle. In many cases there will be a visible separation of DEF and fuel as shown below:

- Shining a light through the sample can help highlight the separation, as seen in the photo.
- Although clear separation may not be present, discoloration or cloudiness of the sample may still indicate contamination, as seen in the right sample in step 2.

Fuel Filters

1. Remove both fuel filters from the housing.

2. Check for the presence of crystal buildup or corrosion on the filter face as seen below:

Crystal buildup and corrosion/rust present on primary filter

Corrosion/rust on secondary filter

- If the filters are allowed to dry, white crystal residue may be observed on the filter face.

Fuel Injectors

If there are DTCs or symptoms that lead to injector inspection, the Common Rail Injector Electrical Test should be performed prior to injector removal. If DEF presence is confirmed from another of the checks the test is not necessary, as the injectors will need to be replaced regardless of the test results.

The low pressure fuel port in the side of the injector may show presence of pitting or crystal deposits as shown below:

NOTE: When checking for DEF presence on earlier verisons of fuel injectors, it was common to observe a white haze on the injector body after drying. Common Rail injectors **may or may not** display this condition with DEF contamination present, and this check should not be used by itself to conclude that the fuel system is free of DEF.

Fuel Supply Pump

Corrosion and crystal buildup may be observed in the fuel supply pump as shown below:

Repair

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 thorougly 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 supply pump
- Fuel Filter base
- High pressure fuel supply tubes
- Fuel rail
- Fuel rail pressure sensor
- Fuel rail pressure relief valve
- Fuel return line (from cylinder head to filter housing) assembly
- Aftertreatment Hydrocarbon Injector (AHI) Module
- AHI nozzle
- AHI fuel/air supply line (line between AHI module and nozzle)
- Any other fittings where corrosion or clogging is observed.

- **NOTE: DEF in the fuel system is a non-warrantable failure.**

Solution visibility	Dealer distribution

Function(s)/component(s) affected

Function affected	fuel supply , fuel system , Fuel Dosing

Function Group

Function Group	23 fuel system, excluding gas propulsion , 284 control system, fuel supply

Customer effect

Main customer effect	stumble , regeneration , diagnostics/methodology , efficiency/abnormal behavior , fault code/display , judder
Fluid problem	crystallisation , contamination , priming/loss of prime
Fluid implicated	AdBlue , fuel

Fault code(s)

OBD 2013 Diagnostic Trouble Codes	P016F , P1036 , P228F , P0087 , P020113 , P020213 , P020313 , P020413 , P020513 , P020613 , P0256-14 , P0259-00 , P026200 , P026500 , P026800 , P027100 , P027400 , P027700 , P2A16-14 , P2A19-00 , P2A1E-14 , P2A21-00

Conditions

Vehicle operating mode	when driving , when stationary
Frequency of occurrence of problem	random

Administration

Author	RU4469V
Dealer ID	RU4469V
Last modified by	RU4469V
Creation date	26-01-2018 16:01
Date of last update	06-02-2018 17:02
Review date	02-02-2019 00:02
Status	Published

NA_MACK_Vehicle_Range

NA_MACK_Vehicle_Range	LR , MRU , Anthem , CHU , CXU , GU

NA_VOLVO_Vehicle_Range

NA_VOLVO_Vehicle_Range	VNR , VNL , VHD , VAH

Engine family

Engine family	11L Engine , 13L Engine , MP7 , MP8

Emission Standard

Emission Standard	US17 GHG