

Why Common Rail Fuel Injectors Fail



Common rail diesel fuel injection systems produce greater power, efficiency, and cleaner operation than prior types of diesel fuel injection systems. One key to accomplishing these gains is a common rail system operates at pressures around 4 times that of traditional systems and with much tighter part clearances and tolerances.

The main causes of common rail injector failure are:

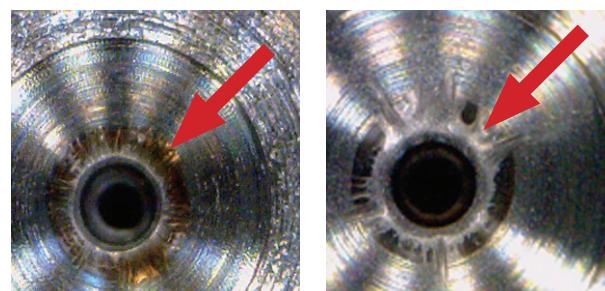
- Diesel fuel contamination
- Inadequate fuel filtration
- Water in the fuel system
- Debris in the fuel system
- Improper injector installation

DIESEL FUEL CONTAMINATION

The key component in the common rail injector is the control valve assembly. In this assembly, fuel under very high pressure passes through an orifice, which is sealed by a check ball around 1mm in diameter. An example of a new control valve body surface is pictured to the right. Note the uniform grinding of the orifice. Contamination from water and other debris has an abrasive effect on the orifice and can quickly lead to a poor seal between the valve and the check ball, resulting in poor injector



New Valve Surface



Valve Surfaces And Assembly Damaged By Contamination

performance including starting issues, poor fuel economy and performance, and rough running. Above are two examples of control valve bodies which have had check ball seat erosion. To the right is an example of a control valve body and plunger which have been exposed to water.

Water can be present in diesel fuel due to condensation of outside air in the vehicle fuel tank or bulk fuel storage. Debris flows through the system from deposits in the fuel tank or from other degrading engine parts. Debris can also be introduced into the fuel system during repairs if care is not taken. When replacing filters always use a micron rating equal to the OEM recommendation and



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keep up with scheduled filter maintenance. On the next page are two more examples of damage small debris in the fuel system can cause.

To the right are two more examples of fuel contamination. The left picture is a control valve assembly fuel inlet which has been completely blocked by small metal debris. This severely limits or completely restricts fuel flow to the injector. On the right side is the needle from an injector nozzle which has metallic debris embedded into the tip. Either instance will cause the injector nozzle to remain open, resulting in smoke, knocking, misfire, and no-start conditions along with the potential to severely damage the piston and / or cylinder. Following recommended maintenance procedures and intervals can help eliminate these occurrences.



Blocked Control Valve Fuel Inlet



Damaged Nozzle Needle



Excessive Combustion Residue

IMPROPER INJECTOR INSTALLATION

Another major cause of premature injector failure is improper injector installation. Missing or improperly installed seal rings or nozzle washers, along with incorrect injector torque, will result in poor injector performance, misfires, starting issues, and poor fuel economy with black smoke. Be aware of the nozzle washer falling off of the injector or not properly seating during installation. Be sure the prior nozzle washer is not in the cylinder when installing a new injector. A missing or incorrectly installed nozzle washer will allow combustion leakage past the nozzle washer and will be evidenced by excessive combustion residue on the injector when removed. Also, seal rings can roll out of their grooves during installation. On 5.9L injectors proper installation of the fuel inlet stud is critical. For injectors where electrical connectors are attached to stator studs, incorrect torque of the connectors can result in engine misfires and stator damage.

ACTION TO TAKE

When replacing fuel system components which did not give a normal service life it is critical to analyze what caused the failure of the parts you are replacing. When undertaking these repairs you should always replace fuel and air filters as well as check the quality of fuel coming from the fuel tank. Fuel systems showing characteristics of fuel contamination require a complete inspection and, if needed, replacement of components which may still contain contamination. Failure to do this can lead to subsequent failure of newly installed injectors.

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