



New Engine Technology and Fuels Cause “Sticky” Injectors

Today’s Diesel Engines

Today’s diesel engines outperform the diesel engine technology of just a few years ago in many ways. Original Equipment Manufacturers’ (OEM) now incorporate sophisticated, electronically controlled fuel injection systems that inject diesel fuel into engine cylinders as many as seven times per injection cycle at pressures up to 30,000 psi. These new High Pressure Common Rail (HPCR) systems feature extremely tight tolerances between the fuel injector body and the injector plunger. Clearances can be as tiny as 1 -3 microns.

Problems Started to Occur

As early as 2008, Original Equipment Manufacturers (OEMs) began noticing injectors “sticking” in their HPCR systems. The affected engines seemed to operate fine at normal operating temperatures, but when shut down, they would be hard to start, run rough, or not start at all. At the time, there was little understanding of the problem, or what was causing it. They knew the problem wasn’t isolated to any one engine manufacturer, or specific fuel or biodiesel blend. The operating problems continued to become more prevalent in the field and outside of the OEM’s laboratories.

“Sticking” Injectors

In 2009, after much analysis, it was determined that white-gray, soapy, waxy deposits were the cause of the sticky injectors. Further analysis revealed the new deposits, now termed “Internal Diesel Injector Deposits” (IDID) consisted of carboxylate salts. Detergents that were historically effective at removing the carbonaceous deposits that form on injector tips and orifices exhibited only a limited effect on the new, waxy deposits. Even finer fuel filters were ineffective at preventing the problem.

So what was causing the new deposits?

It was discovered that carboxylate salt formation was related to the introduction of Ultra Low Sulfur Diesel (ULSD) fuel. Corrosion inhibitor chemistry, traditionally used to maintain pipeline integrity, combined with insoluble sodium found in the ULSD fuel. The resulting carboxylate salts had likely been present in fuel for years but only became a problem as the new HPCR technology became widely used in diesel engines.

Fixing the Issue

As a result, fuel additive manufacturers developed new, sophisticated detergent chemistry to address the problem. Recognizing the efficacy of the new chemistry, several OEMs now recommend fuels containing it or sell an additive product for operators to add to conventional #2 diesel fuel.

[Diesellex Gold from FS](#) has been reformulated to incorporate the improved detergency as well as several other performance upgrades. For more information, see your local FS Energy Specialist.

