

TechTalk

with Kenneth



Kenneth Driggers
Technical Communications Manager

Welcome to the first edition of the *Riggs Cat Tech Talk*. This column is being written to cover some technical points of interest with Caterpillar® Machines and Engines that are sold and supported by Riggs Cat.

With the current price of diesel fuel and the complexity of the modern diesel engine, the fuel systems of Cat products are increasingly important. So we have chosen fuel systems as the first topic of Tech Talk.

Most modern engines capable of meeting today's performance, economy and emission demands use electronic fuel injection. These injection systems are precision devices that produce an injection pressure of more than 30,000 psi and complete an injection cycle in about 5/1,000ths of a second. They deliver precisely measured fuel quantities at exactly the right time. Their ability to maintain performance over millions of cycles requires very clean, highly filtered fuel with an adequate fuel supply pressure.

The evolution of Cat Fuel Injection systems:

Cat products manufactured prior the early 1980's, used a pump and line type of fuel system. This type consisted of an injection pump with a governor, and injection spray nozzles. The spray nozzles injected the fuel in the cylinder; high pressure fuel lines connected the injection pump with governor to the spray nozzles. In the early 1980's the fuel systems began to change. The MUI (Mechanical Unit Injector) was introduced. Another change in the late 1980's, introduced electronics. The EUI (Electronic Unit Injector) was used as Cat began to produce the fully electronic controlled engine. This injector used a rocker arm, driven off of the engine camshaft to operate the injector. The next evolution of Cat fuel systems, in the 1990's, was the HEUI (Hydraulic Electronic Unit Injector). This fuel system used high pressure engine oil produced by a high pressure pump to hydraulically operate the injector. And, more recently, the CCR (Cat Common Rail) fuel system was introduced. This fuel system uses an electronic nozzle with a high pressure pump that supplies high pressure fuel to a common rail. This fuel system is extremely sensitive to contamination. The EUI, HEUI, CCR fuel systems are all present in Caterpillar's ACERT (Advanced Combustion Emissions Reduction Technology) diesel engines. ACERT engines use a systematic approach to emission reduction. The systems are **Advanced Electronics, Precision Combustion, Air Management and Effective After Treatment.**

Filtration

In the 1980's most low pressure fuel systems contained a 150 micron primary filter and a single 10 to 15 micron secondary filter. Most filters had a nominal rating, meaning that they actually trapped about half of the particles at the rating size. For example, a filter with a 10 micron nominal rating would stop about half of the abrasive particles 10 microns and larger. Virtually all particles smaller than 10 microns pass through the filter. As injection pressures began to escalate so did the abrasive wear. The 2 micron high efficiency fuel filter was introduced in 1994. This filter removes 99% of particles 2 micron and larger.

Maintaining your Fuel Injection

There are 3 main factors that effect fuel system durability: Water, Abrasives and Supply Pressure.

Water: the fuel must be free of excess water. Water breaks down the protective film strength of the fuel and leads to plunger scuffing and seizure failures.

Abrasives: the fuel must be filtered to remove microscopic abrasive particles in order to prevent injector wear. Abrasives in the older low pressure fuel caused orifice tip wear. Two things indicate this kind of wear, increased horsepower and smoke. Abrasive wear in the newer fuel systems will have the opposite effect, loss of horsepower, due to internal leakage within the injector.

Filtration is key to keeping abrasives wear to a minimum.

Supply Pressure: fuel supply pressure must be maintained in order to achieve complete filling and proper operation of the injectors. Correct by pass flow is critical for proper cooling of the injector. The by pass flow is volume of the supply fuel not used by the injector and returned to the fuel tank.



The benefits of using clean fuel have been known for decades. Even in the 1930's it was cast into most fuel tank caps.

Send us your thoughts on 'Tech Talk' or your questions. If we use your questions or comments in our next edition, we'll send you an authentic Cat Jacket! You can contact us at: techtalk@jariggs.com.