Technical Service Bulletin 95-1

Diesel Fuel Contamination and Fuel Filter Plugging

Fuel contamination is a fact of life. Preventing problems and equipment damage associated with contaminated fuel is primarily the responsibility of the end user. These responsibilities include the proper and timely replacement and servicing of the filters; selection of the fuel source, grade, and blend; and use of heaters, separators, and additives as required. (Refer to TSB 07-1 and TSB 07-2)

Fuel filters capture unwanted contaminants from the fuel. Left unchecked, these contaminants may cause serious and expensive damage to many system components including pumps, lines, and injectors. Fuel contaminants have many sources. Most sources are external to the fuel system itself, that is, most contaminants come with the fuel that is delivered to the fuel tank. As it comes from the refinery, diesel fuel is generally clean. Contaminants in diesel fuel are typically introduced in fuel storage systems through mixing, transferring, and storage.

Fuel filters, by design, become more restrictive to the flow of fuel as they go about their job of removing contaminants from the fuel system. Fuel systems, unlike lube systems, do not have the opportunity for bypass flow and consequently, as flow through the fuel filter becomes severely restricted or plugged, loss of engine power will result. A thorough investigation of the filter and the fuel source should be conducted anytime a fuel filter is suspected of delivering less than its expected life.

Some common contaminants found in today's fuels might include:

Water -- is the greatest concern because it is the most common form of contaminant. Water may be introduced into the fuel supply during fueling when warm, moisture laden air condenses on the cold metal walls of fuel storage tanks or from poor housekeeping practices. The effects of water in diesel fuel can be serious. Water can cause damage to injector components and reduce the lubricity of the fuel which can cause seizure of close tolerance components such as those found in fuel pump assemblies.

Water can be removed from diesel fuel by using in-line water separating filters or devices. Long term prevention of problems associated with water in fuel is best accomplished by obtaining fuel from reputable suppliers capable of providing high quality fuel. Further, tanks should be kept as full as possible to prevent condensation. Fuel should be drawn from the top of a storage tank if possible, as water is heavier than diesel fuel and tends to settle to the bottom of tanks. Tanks can also be kept free of water with continuous off-line or "kidney-loop" filtration/separation.

Fungus and Bacteria -- live in water and feed on the hydrocarbons found in fuel. Often called Humbugs for short, these active and multiplying colonies will spread throughout a fuel system and quickly plug a fuel filter. The fuel filter will have a slime-like coating over the surface of the media, dramatically reducing the service life of the filter. Bacteria may be any color, but are usually black, green or brown. Draining the system will reduce microbial activity, but will not eliminate it. The only way to eliminate microbial growth once it has started is to clean and treat the system with a biocide.

Wax -- is desirable as a source of energy in fuel, but control in cold weather operation is needed. Wax crystals form as a result of cold temperature precipitation of paraffin. Temperatures below a fuel's cloud point will result in wax precipitation and filter plugging. To prevent plugged filters due to wax formation, the cloud point of fuel must be at least +12° Celsius (+22°F) below the lowest outside temperature. Fuel suppliers blend diesel fuel based on local anticipated cold weather conditions. Particular attention should be given to diesel fuel purchased outside your local area. For example, fuel purchased in the West or South may not be suitable for operating conditions in the Midwest or North.

Asphaltenes -- are by-products of fuel as it oxidizes. Asphaltene particles are generally thought to be in the 0.5 – 2.0 micron range and are harmless to the injection system, as they are soft and deformable. As these tiny particles pass into the filter media they tend to stick to the individual fibers. If you were to examine the media of a fuel filter that had been exposed to asphaltenes (oxidized fuel), you would see a black, tarry substance on the dirty side of the element. Fuel with a high percentage of asphaltenes will drastically shorten the life of a fuel filter.

Sediment and other solids -- often get into fuel tanks and can cause problems. Most sediment can be removed by settling or filtration. Fuel filters designed for specific applications will remove these contaminants before they cause fuel system damage.

In no case should a less efficient filter be substituted to fix a perceived problem with premature plugging. Restriction will increase as the filter works to remove unwanted contaminants from the fuel system. Filter manufacturers design fuel filters to provide the level of filtration protection specified or required by the OEM manufacturer. Substitution of a less efficient filter may prolong a filter's life before plugging occurs, but it will also allow contaminants to pass downstream which will eventually impact the life of other, more expensive fuel system components. (Refer to TSB 89-5)

Clean fuel is essential for efficient, optimum engine performance. Remember, newly refined fuel is generally clean. Between the time the fuel leaves the refinery and enters the engine's fuel tanks, it should be handled carefully to avoid possible contamination that can prematurely plug fuel filters and cause even further, more serious damage within the engine's fuel system.

For additional information, contact:

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