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## 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.

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 clean. Contaminants in diesel fuel are generally introduced in fuel storage systems through mixing, transferring, and storage.

Fuel filters naturally build resistance to the flow of fuel as they go about their job of removing unwanted 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 decreases, decreased performance of the fuel system and the engine will result. Fuel filters will become restricted or plugged over their life - this is an expected 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 tanks or from poor housekeeping practices. The effects of water in diesel fuel can be serious. Water can cause a tip to blow off an injector, or reduce the lubricity of the fuel which can cause seizure of close tolerance assemblies such as plungers.

Once in the system, water can be removed by using 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, fuel tanks should be kept well filled to prevent condensation, and fuel should be drawn from the top of a tank if possible, as water is heavier than diesel fuel and tends to settle to the bottom of tanks.

**Wax** — while desirable as a source of energy in fuel, 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 degrees Celsius (10° F) below the lowest outside temperature. Fuel suppliers blend diesel fuel based on local anticipated cold weather conditions. For example, fuel purchased in the West or South may not be suitable for operating conditions in the Midwest or North.

**Fungus and Bacteria** — these microorganisms live in water and feed on the hydrocarbons found in fuel. Called Humbugs for short, these active and multiplying colonies will spread through a fuel system and quickly plug a fuel filter. The fuel filter will have a slime coating over the entire surface of the media. Bacteria may be any color, but is usually black, green, or brown. Draining the fuel system will reduce microbial activity, but it 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.

**Asphaltenes** — are components of asphalt that are generally insoluble and are generally present to some extent in all diesel fuel. These black, tarry asphaltenes are hard and brittle, and are made up of long molecules. 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 cause problems. Most sediment can be removed by setting or filtration. Fuel filters designed for specific applications will remove these harmful contaminants before they cause further system wear and damage.

In no case should a more "open" filter be substituted to fix a perceived problem with premature plugging. Plugged filters will develop 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 more "open" filter may prolong a filter's life before plugging occurs, but it will also allow unwanted contaminants to pass downstream which will eventually affect the life of other, more expensive fuel system components.

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