Donaldson
FILTRATION SOLUTIONS

Clean Fuel & Lubricant Solutions

Fuel Filter Plugging

WARNING SIGNS OF DIESEL FUEL QUALITY ISSUES

Do you have equipment stopping unexpectedly due to plugged engine fuel filters? Are the filters on your engine or fuel dispenser plugging? Are you experiencing downtime or injector damage? These are signs that you may have issues with the quality of your diesel fuel.

Has your fuel been tested using a visual ISO patch or filterability test? Donaldson Clean Solutions can help you do that. Our approach is to clean, protect, and polish fuel before it is pumped into your vehicle or equipment.

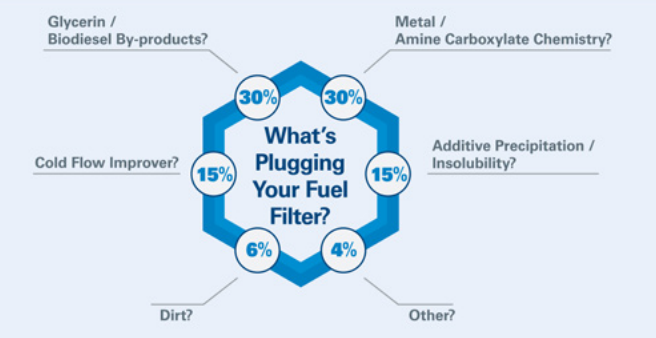
WHAT HAS CHANGED WITH FUEL FILTRATION AND WHY

Today's fuel filters have higher filtration efficiency, (tighter filtration) than the fuel filters found on older diesel engines. Now filters must protect sensitive high pressure common rail (HPCR) fuel system components. Older diesel injection systems could tolerate more dirt in the fuel compared to today's engines. Today's HPCR systems require fuel filters to do much more; they must remove debris 2 microns and larger. On-engine fuel filters are expected to remove 125 times more dirt than older engine filters while still meeting service interval expectations. In addition to the injector changes, diesel fuel itself has been modified with the removal of sulfur and addition of biodesel. It is important to note that fuel meeting all current D975 diesel and D6751 bio diesel bulk fuel industry standards at time of delivery can still cause operability issues in certain situations.

On-equipment fuel filter plugging issues typically appear in the newest, most heavily used equipment. Bulk fuel filter and on-engine fuel filter issues increase in cold conditions, at fuel blend seasonal changes, during fuel source changeover, and in poorly maintained fuel storage infrastructure.

FEATURES

Rapidly plugging filters are rarely, if ever, plugged by a high concentration of typical debris. An exception occurs if using poorly maintained and dirty mobile fueling systems, which can transfer a tremendous dirt load at times. Rapid filter plugging is almost always due to a massive increase in particulate less than 4-micron in size associated with fuel chemistry issues or environmental conditions.



GELLING AND WAXING

Gelling and Waxing are the only solid formations expected in fuel. Fuel gelling is caused when fuel cools to the point that longer hydrocarbons begin to form 100–300 micron solid waxes that quickly overwhelm fuel filters faster than usual. Diesel fuel for cold weather operation is characterized by its cloud point, which is the point that wax solids become visible and the fuel looks cloudy. At a temperature slightly above this point, waxes begin forming but are not yet making the fuel look cloudy. Fuel that is gelling even before you can visibly see it can plug high efficiency bulk or on-engine fuel filters. It can make fuel transfer or starting equipment difficult to impossible. Donaldson Clean Solutions recommends that fuel purchasers buy a blend of #1 winter diesel and #2 summer diesel to meet the temperature needs of their region and increase the blend rate as temperatures fall. Use 7-micron bulk anti-static winter filters to help mitigate the issue if needed, and recognize that some chemistry issues may make their way past the tanks.

COLD FLOW IMPROVER

Cold flow improver can load filters in cold conditions, because it creates solids as it functions and must initially be blended properly in warm fuel. If not, it can remain insoluble in fuel and load filters. Fuel may reach its coldest in storage or in equipment tanks, depending on the application. The Donaldson Clean Solutions approach to this situation includes proper cold flow additive use, housekeeping and blending methods. We also recommend switching to a blend of #1 and #2 diesel fuel to achieve the correct cloud point for your location. If bulk filters continue to plug, use 7-micron filters during winter.

AMINE CARBOXYLATES

Amine carboxylates are solids formed from organic amine fuel additive (nitrogen-based chemistry), water, and a common corrosion inhibitor additive. Fuel additives are often seasonal, occurring in winter fuel blends with some premium cold flow improvers. The Donaldson Clean Solutions approach for this situation includes limiting, stop adding or change your source of cold flow improver and switch to a blend of #1 and #2 diesel fuel to avoid the amine chemistry creating solids.

METAL CARBOXYLATES

Metal carboxylates are solids commonly found in fuel. They can cause premature filter plugging and injector deposits. They also sometimes plug high efficiency on-engine fuel filters very rapidly. They can be found in fuel that is well upstream in the distribution chain before it reaches the customer. Metal carboxylates appear as a massive increase in very fine particulate smaller than 4 microns. They are formed from salts (typically drying agents), low pH water, and corrosion inhibitor additive. The Donaldson Clean Solutions approach for this situation is to use high efficiency fuel filtration on the inlet to your bulk storage tank and continue monitoring. Often, this is an intermittent issue.

GLYCERIN / BIODIESEL BY-PRODUCTS

Glycerin, a by-product of biodiesel, can form solids and plug filters when the water content in the fuel increases and/ or the fuel cools. The Donaldson Clean Solutions approach for this situation includes lowering biodiesel content in winter, cleaning the fuel tank to remove free water, adding surfactant additive to increase glycerin solubility in fuel, and using 7-micron filters in winter. If removing or eliminating biodiesel in your area is not possible due to state mandates, then incorporate a reservoir air dryer after cleaning the tank to keep fuel dry enough to prevent glycerin from falling out of solution.

OTHER

Pipeline drag reducers can create solids that rapidly plug fuel filters. These reducers are materials put in fuel before pipeline transport to increase flow throughput in the pipeline and reduce energy costs. The chemistry is designed to shear and dissolve into the fuel as it is run through pumps. Occasionally, drag reducers do not dissolve and instead plugs filters very quickly. The additive is primarily used for summer fuel distribution, but it can form solids in storage if the fuel is cold cycled over winter, resulting in filter plugging. The Donaldson Clean Solutions approach to this issue is to continue high efficiency bulk tank filtration to prevent its movement into equipment and to work with the fuel supplier to remedy the situation. This tends to be a wide spread issue affecting many customers if it occurs.

High levels of traditional hard particulate **dirt** indicate fuel transfer and storage in a dusty environment caused by poorly maintained infrastructure. Donaldson Clean Solutions recommend storage tank clean out, installing breathers on the tank and filtering the fuel with bulk filtration upon delivery and dispensing or transferring fuel into operating equipment.

High levels of **water** are another indication of poor infrastructure maintenance. Donaldson Clean Solutions recommends tank clean out, adding breathers and possibly water absorbing filters on the dispensing and/or inlet side of the fuel tank.

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