

There are a number of common reasons for plugged diesel fuel filters. Contaminants that inhibit optimum fuel filter performance originate from both internal and external sources. Some are the result of exposure to extreme high or low temperatures while others are introduced to the fuel system during transfer of the fuel from refinery to storage tanks. POLARIS Laboratories recommends the following tests to identify common fuel filter plugging issues.

## Changes in Physical Properties

### Thermal Stability (modified ASTM D6468)

Thermal stability measures a fuel's tendency to form asphaltenes – black, tar-like particles that develop when diesel fuel is exposed to high temperatures. As they build up, these particles accumulate in the fuel filter eventually plugging it.

Thermal stability is measured by heating the fuel then filtering it through a patch once it has cooled. The amount of light reflected from the patch is then measured. According to ASTM D6468 fuels with a reflectance of greater than 80% should not cause issues. Fuels with a reflectance of 60-80% are considered marginal and fuels with a reflectance less than 60% will reduce filter life. Poor thermal stability can be treated by adding an asphaltene conditioner to the fuel.

In cold weather filter plugging may be due to the fuel's low temperature properties. One of the components of diesel fuel is wax. Normally the wax is suspended in the fuel, but if the fuel gets cold enough the wax begins to solidify. Cloud Point, Pour Point and Cold Filter Plug Point determine the fuel's ability to perform at low temperatures.

### Cloud Point (ASTM D2500)

Cloud point is the temperature at which fuel begins to form wax crystals. When the atmospheric temperature is at or below the cloud point, the wax in the fuel can plug filters. A vial of fuel is submerged in a bath and is cooled until the cloud point is reached.

### Pour Point (ASTM D97)

Pour point is the temperature at which fuel will no longer flow. Again, a vial of fuel is submerged in a bath and is cooled until the pour point is reached. When the atmospheric temperature is at or below the pour point temperature, the fuel is no longer fluid and will not pass through filters.

### Cold Filter Plug Point (ASTM D6371)

Cold filter plug point measures the temperature at which the fuel will no longer pass through a wire mesh filter. The fuel is cooled until enough wax crystals have formed that it will no longer pass through the test filter or until the wax formation sufficiently slows the passage of the fuel through the filter.

These fuel properties are critical to cold weather performance. When operating equipment at or near any of these temperatures, watch carefully for evidence of filter plugging. Cold weather fuel performance can often be improved with a fuel additive. Consult your fuel supplier for more information.

### **Particulate Contamination**

#### **Bacteria, Fungi and Mold (manufacturer method)**

Biological growth – bacteria, fungi, mold – is likely due to the presence of water in the fuel. Condensation and poor storage practices are often the cause. As water is heavier than fuel it settles to the bottom of storage tanks and becomes an immediate breeding ground for microbial growth. By dipping a slide with nutrient enriched agarose gel into the fuel and then placing the slide into an incubator, the amount of growth can be measured after a specific amount of time has elapsed.

To treat a bacteria, fungi or mold problem it is recommended to first ensure that the fuel is free of water. Then the fuel can be treated with a biocide to kill the growth. The fuel should then be filtered after treatment to prevent any dead bacteria from plugging fuel filters.

#### **Particle Count (ISO 11500)**

Particle count measures the amount of particulate suspended in the fuel, by running the fuel through a laser optical particle counter. Contamination from excess dirt and debris shortens fuel filter life. Filtering the fuel before putting it into service should provide sufficient removal.

**Note:** Particle Count results become invalid if water contamination is above 500ppm.

Knowing why fuel filters become plugged and how to treat these common causes will lengthen the life of fuel filters and the fuel system as a whole. These tests can provide a solid foundation for making more informed decisions about diesel fuel care and treatment.