



# Solving Winter Diesel Fuel / Fuel Filter Problems

### Engine Power Loss

Diesel engine power loss during winter operation is a common occurrence and source of complaint. Unless there is a component failure within the engine, the problem can usually be traced back to paraffin crystal formation in the fuel which restricts flow through fuel filters. Freezing temperatures can also cause any emulsified water to form a fuel/ice slush, further restricting filters. Frequently, fuel filters are blamed for the problem when, in fact, the problem is caused by the effect of cold weather on summer grade #2 diesel. (Refer to FAQ: Heavy Duty – Diesel Fuel Filtration)

**The Cloud Point** is the temperature at which paraffin, which is naturally present in #2 diesel fuel, begins to form cloudy wax crystals. When the fuel temperature reaches the cloud point, these wax crystals flowing with the fuel coat the filter element and quickly reduce the fuel flow, starving the engine. Typical cloud point temperatures range from: -18°F (-28°C) to +20°F (-7°C), but may occasionally be as high as +40°F (4.4°C). #1 diesel fuel (or kerosene) contains very little paraffin, and therefore has cloud and pour points near -40°F (-40°C).

**The Pour Point** is the temperature at which the paraffin in the fuel has crystallized to the point where the fuel gels and becomes resistant to flow. Pour points also vary but they usually occur from 10°F (5.6°C) to 20°F (11.1°C) below the cloud point.

### Solving the Problem

As long as #1 diesel or a winterized diesel blend is used during winter conditions, most fuel related winter problems can be avoided. However, encountering poor quality or unconditioned fuel is inevitable, so some precautions should be made when operating in cold weather. Depending on the severity of winter operating conditions, many operators may choose to protect their equipment through the use of fuel additives, fuel heaters, and fuel water separators.

**A Word of Caution:** Never add gasoline or alcohol to diesel fuel to help with cold weather operation. The practice creates an explosion danger and will damage the fuel injection system.

### Cold Flow Improvers

The only way to actually lower the cloud point temperature is to dilute #2 diesel with #1 diesel or kerosene. However, this lowers the fuel heat value and can be an expensive solution. Alternately, widely available cold flow improvement additives may help delay filter plugging. They lower the pour point of diesel fuel several degrees, but do not change the cloud point temperature. Instead, cold flow improvers work by altering the paraffin crystal shapes to needle-like forms.

More of the needle-shaped crystals can pass through the filter element, slowing the plugging process.

### **Fuel Heaters**

Heating diesel fuel above the cloud point can help avoid winter engine power loss. There are three common sources of heat energy that are available for fuel heating: electric heaters, engine coolant and return fuel heaters.

**Electric Heaters** come in two types, Positive Temperature Coefficient (PTC) and resistance. Because of on-vehicle power limitations, electric heating cannot sufficiently heat high fuel flows. However, if paraffin wax begins to plug the fuel filter, the flow through the filter begins to slow until the flow rate is low enough for the fuel heater to be effective, and the filter can still pass sufficient fuel to allow the engine to run and warm. This flow may not be sufficient to run the engine under load.

PTC heaters use disc-shaped heating elements that are attached to a heat sink plate which transfers the generated heat to the flowing diesel fuel. They are most effective when fuel is constantly moving over them to take the heat away. When flow stops and/or the temperature rises, PTC heaters will self regulate to a lower current draw.

Resistance heaters are like the heating elements used in kitchen ranges. These produce constant heat whether the fuel is moving or not. Blanket or wrap-around supplemental heaters are available that can be fastened to the outside of filter housings for severe weather conditions. These, however, are only energized when the vehicle is parked. They operate on 110 VAC along with engine block and tank heaters and allow easy start up in cold weather.

**Engine Coolant** is another source of heat energy that, through the use of a heat exchanger, can transfer excess cooling system heat to the fuel. In conjunction with electric heat at engine startup, a coolant/fuel heat exchanger can supply an enormous amount of heat to the fuel, effectively eliminating any chance of cold fuel filter plugging.

**Return Fuel Heaters** work by allowing the engine heated "return fuel" to enter back to the inlet side of the filter instead of directly back to the fuel tank. The warm return fuel makes up a major portion of the inlet fuel, reducing the amount of cold fuel supplied from the tank. A thermally controlled valve diverts all the return fuel to the fuel tank when the fuel in the tank is warm.

For additional information, contact:

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