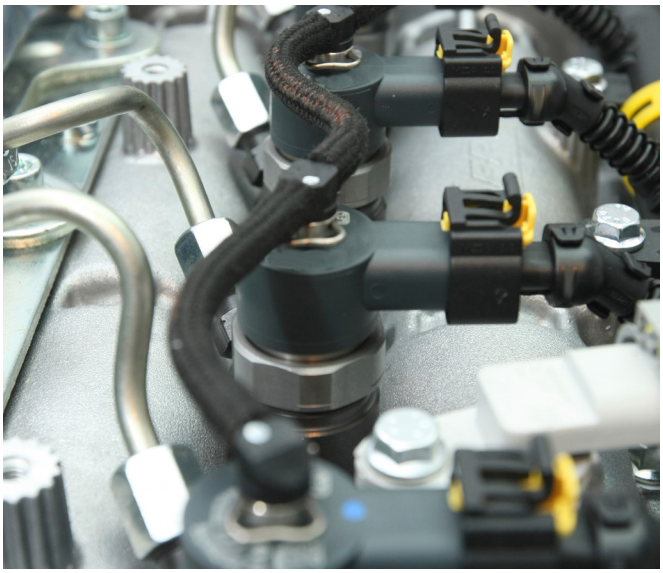
Donaldson
FILTRATION SOLUTIONS

Clean Fuel & Lubricant Solutions

Ensuring Uptime for Modern Diesel Engines in Cold Weather

DIESEL FUEL IN COLD WEATHER CONDITIONS



Tier III & IV high pressure common rail (HPCR) fuel systems are a technological marvel that entered the market over the last 10 years. During this time, some new equipment owners have experienced fuel related downtime and/or operability issues, especially in winter. Roughly 95% of the particulate typically found in diesel fuel was not a problem for older engines and simply passed through most of the filtration. New HPCR engines must be protected from nearly all those particles using highly efficient filtration. Particulate and solids formation in fuel are at the core of many cold weather operability issues.

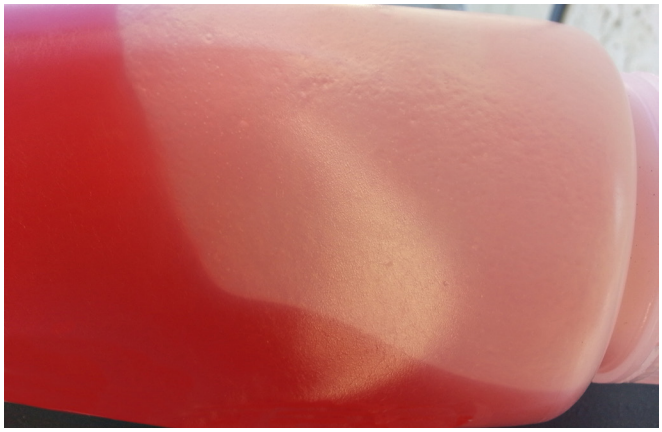
Fuel handling and chemistry practices of the past are often inadequate to maintain reliable cold weather operation for the newest equipment in a fleet.

DONALDSON RECOMMENDED STRATEGIES FOR OPERATING MODERN DIESEL ENGINES IN COLD WEATHER

1. Use the cloud point (temperature at which fuel becomes hazy) as your key indicator on how well your fuel will operate in cold conditions. The fuel itself begins to form filter plugging solids at about -15°C / 5°F above the natural cloud point.
2. Don't be fooled by the Cold Filter Plugging Point (CFPP). CFPP is not intended to determine if fuel will pass through the filter on a modern HPCR fuel system; it was historically intended to indicate if gelled fuel can pass through a coarse screen protecting the fuel dispenser pump.
3. Have a discussion with your fuel supplier to determine what blend of #1 (winter) and #2 (summer) fuel you need for the next two weeks of operation.
4. Don't purchase fuel in the fall and expect it work in January. Try to purchase only enough diesel for 2-3 weeks of operation. The further below the cloud point fuel gets, the more solids form that will likely plug filters.



Upper Midwest (United States) diesel fuels stored at -23°C / -9°F (left to right). #1 off-road, #2 off-road, and #2 on-road. Both #2 samples have been treated with cold flow additive and still show significant filterable paraffin-wax solid formation. See Strategy 1.



#2 Summer diesel at -29°C / -20°F with no cold flow improver. More than half the diesel became wax solid. Cold flow additive doesn't change the amounts of solids or temperature at which solids form. See Strategy 6.



Midwest (United States) produced Soy B100 stored at 4°C / 40°F. The solids in the bottom are glycerin fallout and would plug most any filter. See Strategy 9.

5. Housekeeping is key. Make sure your tank is free of water, sediment and microbes. Find a professional fuel tank cleaner. If tank cleaning is done improperly, it can cause more issues than it fixes. Water makes solids (ice crystals) in winter that plug filters. Full fuel tanks are less likely to form water.
6. If additional cold weather operability is required beyond your blend of #1 and #2 fuel, use cold flow additive sparingly to reach an acceptable cloud point for that week's weather. NEVER add cold flow improver to cold fuel or add more than manufacturer recommended. Try not to splash blend cold flow additive if at all possible.
7. Top-off / fill your vehicle's fuel tank at the end of the shift while it is still warm. This limits water condensation buildup in tanks.
8. NEVER switch to a more open (lower filtration efficiency) on-engine fuel filter with a modern HPCR system. If waxing is expected, take the fuel filters off the truck and move indoors for approximately 20 minutes – the wax should melt. If it doesn't melt, then you are experiencing a fuel chemistry filter plugging issue.
9. If you live in an area where biodiesel is not mandated, don't use it in the winter months if possible. Bio-blends have poor cold weather performance compared to #1 and #2 fuel. At 5% blend or less, biodiesel is considered a lubricity additive and often not identified.
10. Keep an extra set of on-engine fuel filters in the equipment or vehicle's cab.
11. A general rule is to use a filter with the same micron and beta rating at the dispenser as your secondary on-engine fuel filter. However, in winter months the single pass winter fuel filter (DBB8777) on your storage tank can be used to maintain flow. This will ensure any that any likely fuel quality issues are captured before the fuel enters the engine.

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