Your Questions Answered (20)
Fuel Quality and Polishing

earth safe
Fuel Systems for Critical Power

18.1 Why is filtration / polishing needed?

Filtration / Polishing is used for emergency generator fuel storage to maintain fuel quality during the long storage life of the fuel. Most fuel system used for transportation, turn over their fuel on a regular basis, weekly or monthly. Generator fuel systems can have fuel storage that is present for many years. The large storage quantities needed for the design generator run times, dwarfs the amount of fuel used in testing, maintenance, and minor power interruptions.

As diesel fuel ages it degrades in 2 ways: particulate formation, and biological growth.

Particulates form as fuel ages, when certain components of the fuel start to come out of solutions and form solids. The particulates will increase the wear on engine components, and so filtering is needed. Engines typically have inlet filter units, however it is recommended that the gross particulate formation be removed at the tank, to extend the life of the engine filters, and to prevent the potential for a filter blockage.

Water enters a fuel tank from either (a) water from off-site fuel storage systems and delivery trucks, that are inadvertently introduced in to the tank, (b) water from condensation of air drawn into the tank as the fuel level is lowered.

Any water introduced into the tank will settle to the bottom of the tank. The fuel water interface at this point is a condition that promotes biological growth. This growth can be problematic especially because it can accelerate. Organic material from the fuel tank will very quickly plug the inlet filters at the engine.

Filtration / Polishing systems include water coalescers to remove water from that tank, and in this way minimize the potential for organic growth. Bio-cide additives to the fuel tank are still recommended.

18.2 How often is filtration needed?

Filtration frequency for fuel systems can range from continuous to annual. There are a couple of characteristics of new generator systems that are driving the need for more frequent filtration. The first is that new engines designed to minimize emissions are more sensitive to particulates in the diesel fuel. The second is that biological issues are likely to increase as bio-diesel components are added in part to standard diesel fuel supplies.

A minimum filtration schedule would be (a) annual fuel testing and biocide treatment, with (b) annual filtration of tank volume with a portable pump – filter unit.

A maximum filtration schedule would be using a continuously running pump-filter system for the tank, with monthly fuel testing and biocide treatment as needed. This method of filtration polishing has the benefit of minimizing the controls associated with fuel pump cycling.

Commonly tank filter systems are setup on an ON-OFF cycle to provide a full filtration of the tank contents weekly, bi-weekly, or monthly.

18.3 What is the recommended micron rating for filters?

Filters are commonly available with micron ratings of 1 to 25 microns. In our experience 10 micron is a recommended specification that balances high fuel quality with reasonable maintenance schedules for filter replacement.

18.4 Is biocide still needed if filtration / polishing is used?

Biocide is still required in addition to filtration / polishing systems. While the filtration / polishing system minimizes the amount of water in the fuel, any trace amounts will accumulate in the bottom of the tank. The filtration / polishing pump, whether a suction style or a submersible, will not be effective in removing fluid from the bottom 3-6 inches of the tank.

18.5 What accessory equipment is included with filtration / polishing units?

Pump accessories include: (a) inlet strainers, (b) outlet chaeck valves, (c) manual isolation valves, (d) pressure and vacuum gauges, (e) motor starter / disconnect with HOA selector and current sensor.

Filter accessories include: (a) isolation valves, (b) filter drain valve, (c) visual and / or electronic water sensor, (d) visual and / or electronic differential pressure sensors.

Control panels include monitoring functions for the filter and pump operation, and the operator interface for selecting operating modes and timer cycles.

18.6 What are typical problems with filtration polishing units?

The most critical problem with filtration polishing systems is that when a filtration unit is shared between multiple bulk storage tanks, then there is the potential of inadvertent transfer of fuel between tanks, causing a high level condition or overflow.

Other problems are related to excessive maintenance of filters, pumps, and piping systems that can be minimized by appropriate selection of components and sizing of equipment.

18.7 What are typical operating modes for filtration / polishing units?

Filtration / Polishing units are designed to accommodate a variety of operating modes:

(a) continuous operation
(b) manual operation start with auto stop based on programmable cycle time.
(c) automatic repeating operation based on a programmable ON and OFF cycle time.
(d) automatic repeating operation based on day-time start and ON cycle time.
(e) manual operation start with auto stop based on programmable filtered volume.
(f) automatic repeating operation based on day-time start and programmable filtered volume.

18.8 How are filter / polishing units used for multi-tank systems?

Our recommendation is to use an independent filtration – polishing system for each bulk tank. The system minimizes the risk of inadvertent fuel transfer between tanks. And typically it is more

economical than adding controls and valves for multiple tank filtration from a single filtration unit.

Where multi-tank systems are required, we recommend the following: (a) actuated ball valves for flow controlwith position monitoring for open and closed position, (b) independent high level sensors for pump shutdown on high level, (c) use of the manual start mode as described in Item 9.07

The system operates to open a fuel supply and fuel return valve for the tank to be filtered, and assure that the valves for the other tanks are closed.

18.9 What maintenance and inspection is required for filtration systems?

Maintenance and inspection requirements include the following:

(a) daily visual inspection of the filter unit and piping for leaks.
(b) weekly inspection of the filter unit for water accumulation and high differential pressure.
(c) drain water from filter vessel when a high water condition is indicated.
(d) change filter elements when a high differential pressure (approximately 15 PSI) is indicated.

18.10 How does water get into a tank and why is it a problem?

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18.11 What are the biological issues for fuel tanks?

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Biological growth can also work to accelerate corrosion in the bottom of steel tanks.

18.12 What is recommended for biocide and fuel quality testing?

It is recommended that fuel tanks be tested at least annually for biological growth. Some mission critical facilities perform monthly sampling and testing.

Testing is typically performed by an outside service for sampling and testing. However test kits are available for sampling and testing to be performed by facility personnel.

Biocide recommendations are an initial treatment when fuel is first delivered to new tanks, with supplemental treatment based on sampling and testing results.

Biocides are hazardous materials and should be handled in accordance with manufacturer recommendations.

19.1 What happens to diesel fuel in cold weather?

In cold weather certain components of diesel fuel start to come out of solution as waxes. People use the term gelling for diesel fuel in cold weather, meaning that enough wax comes our of solution to make the diesel fuel a gel consistency. The temperature at which this happens in the pour point – the point at which diesel fuel will not readily flow through valves and devices.

The pour point would be approximately +0 to -10 degrees F for #2 diesel fuel and -25 to -30 degrees F for #1 diesel fuel.

Generally we are more concerned with a higher temperature known as the cloud point – the temperature at which wax starts to come out of solution. The reason is that the wax can clog filters that would block flow to the generators.

The cloud point would be approximately +5 to +10 degrees F for #2 diesel fuel and -10 to -30 degrees F for #1 diesel fuel.

19.2 What is a winter blend for fuel?

A winter blend is a mixture of #1 and #2 diesel fuel to provide a cloud point below the expected minimum ambient temperature. Winter blend is a standard fuel delivery in cold climates during winter months. For new generator placed in service during the summer, a winter blend can be ordered throughout the year form most fuel suppliers.

19.3 Does an aboveground tank need to be heated?

Tank heaters are available for heating of aboveground tanks in cold climates. However, many aboveground tanks are not heated if a winter blend of fuel is used.

Part of the thinking in not heating the aboveground tank is that the fuel will rise in temperature before it reaches the generator by: (a) movement through a pump, (b) movement through heat traced and insulated piping if used, and (c) storage within a day tank if the day tank is located within a heated room or enclosure.

19.4 Does aboveground piping need to be heat traced?

In cold weather climates there is a concern for maintaining the functionality of critical fuel systems in freezng weather. In general a winter blend of #1 and #2 diesel fuel will lower the cloud point to about -10 degrees F and the pour point to minus 30. However this may be borderline for many users, and for that reason exterior piping is often heat traced and insulated.

The problem with cold weather performance is often not the fuel itself, but any water that may be present in trace amounts in the fuel. This water can accumulate within the cavities of valves and other equipment, so it is important that these devices also be heat traced and insulated, or located within heated enclosures.

20.1 When is high fuel temperature a problem?

High temperatures for generator fuel occur because the engine returns 65-95% of the withdrawn fuel back to the day tank. This return fuel flow is at a temperature that is well over 100 degrees F, without cooling measures, and this can cause the temperature in the tank to rise to dangerous levels. The engines often require relatively cool fuel, usually less than 110 degrees F, as a means of cooling certain engine components. And heated fuel can become a safety concern if it is heated above its flash point temperature.

20.2 How is fuel cooled to avoid problems?

High temperature is not a common problem because most generators include a fuel cooling radiator to treat the return fuel before it is received by the day tank. The fuel cooling radiator is mounted as a slave to the generator engine coolant radiator, and utilizes the same engine fan.

The fuel cooling radiator on the engine may not be practical where the engine utilizes a remote radiator for its coolant system. In this case several methods of fuel cooling may be used:

(a) a dedicated fuel oil radiator and fan are installed at the day tank for return flow fuel from the engine.

(b) fuel return from the engine is directed to a gravity return flow pipe to a bulk storage tank. Since the engine consumption is only 1 / 3 of the engine fuel pump flow, the fuel supply to the day tank should be increased by about 3 times to accommodate the higher flow.

(c) A temperature sensor in the day tank activates a return flow pump to pump fuel back to the bulk storage tank, allowing the day tank to be re-filled with fuel at a lower temperature.

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