Cleaning, Flushing, Draining and Charging Your Thermal Oil System

Rev. 0710

Replacing the Fluid

Replacing fluid that has reached the end of its life with the same brand or a different brand requires an important decision – how much time and money do you want to spend performing this task? Make sure to consider process down time (including cooling, draining and filling), labor (including personal protection equipment) and disposal costs as well as the cost of the new fluid. Many fluids are compatible enough that a simple drain and fill is all that is necessary. Check with the new fluid supplier to be sure.

Cold Spots

You should consider using a system cleaner if there are cold spots in the system. Completely plugged lines will probably have to be replaced since only water-based cleaners will unplug lines. If there is any flow through the affected area, non-aqueous cleaners will generally work. There are two types of cleaners. Additive cleaners are added to the existing fluid and clean while the system continues to operate. Once all of the lines are hot again, the system is drained and recharged. Other cleaners are designed for faster "off-line" cleaning but require an additional flushing step to remove the cleaner. Make sure the cleaner is compatible with your fluid.

Fluid Removal

If you're very lucky, there are drains located at all low points of the piping so that the fluid can be easily drained or pumped out. Otherwise, be prepared to break flanges, open pressure taps or remove valves, flex hoses, or other components from the piping to ensure complete fluid removal. Using compressed nitrogen to force the fluid out one end of an open loop is tricky to implement but effective.

Draining the system warm/hot will leave less fluid and solids in the lines than draining it cold. Shut the heater down and continue to run the pump until the fluid has cooled to between 150˚F and 180˚F and then drain as quickly as possible.

Flushing Fluids

Flushing fluids are typically high-solvent-content liquids whose only real purpose is to dilute existing fluid that is too viscous at ambient temperature to completely drain from the system. Unlike a cleaner, a flushing fluid will not remove system deposits. It also adds 2 additional steps because the flushing fluid must be flushed out of the system to prevent premature degradation of the new heat transfer fluid. Your new fluid supplier should be able to tell you whether or not you need to flush.

NOTE – *New systems rarely need to be flushed prior to filling. The main contaminants in any new system are typically leftovers such as welding slag, metal particles, shop rags, or other solids. These can be removed with a 60-mesh start-up strainer during initial circulation. In new piping, the amount of soluble contaminants such as lacquers, oils or other metal coatings present is very small relative to the system volume. You will reduce the heat transfer fluid's life more by incompletely flushing out the flushing fluid itself—to say nothing of the extra time and disposal costs.*

Charging & Initial Run

Do not use the main circulating pump to charge the fluid since this can damage the seals. Use a stainless braided Teflon hose to connect a small positive-displacement pump as close as possible to the main pump suction. Open all control and block valves and high point vents (make sure to place a bucket under the vents to catch fluid as it runs out, and that you have enough workers on hand to monitor the vents). If the system does not have a dearator, make sure the warm-up valve to the expansion tank is open. Add fluid until the expansion tank is about ½ full. If the expansion tank level

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is hard to determine, look for overflow from the expansion tank vent. Next almost completely close the main pump discharge block valve. Start the pump and open the block valve to ¼ of full flow. Add more fluid as needed when the low-level switch trips or the pump starts to cavitate. Once the fluid is circulating steadily thru the entire system, open the discharge valve another small increment, adding fluid as necessary. The system is full when the pump runs steadily with the block valve fully opened. Check all of the high level vents to make sure that the lines are filled. Add fluid to reach the proper level in the expansion tank.

Start-up

When it turns to steam, 7 ounces of water will force 55 gallons of possibly very-hot fluid through the expansion tank vent. So every cold start up (for new or existing systems) should be approached with the conviction that there is water somewhere in the system. While draining the low points on the piping can remove gross amounts of water, the only method that will completely remove all of the water is to flash it off as steam thru the expansion-tank vent. For this to occur as quickly as possible –

1. The expansion tank temperature must be maintained over 212˚F.
2. Condensation of the steam inside the tank must be minimized.

Warm-up/vent lines (which run from the heater outlet to the expansion tank) are the most effective setup. Dearators do an excellent job of separating air and other non-condensing gases from fluid but are almost worthless for venting gases that condense (like steam).

NOTE: Contact your heater or fluid manufacturer if you are unsure how to boilout your system.

Some things to do before you start:

1. If the expansion tank vent discharges into a catch tank, make sure that you can see the end of the pipe. Also make sure the system catch tank is completely empty.
2. Open the manual valve on the expansion tank vent line.
3. If you have a nitrogen blanket on the tank, set the nitrogen inlet pressure control valve as low as possible to provide a continuous purge thru the vent – this will prevent oxidation of the fluid and also speed up water removal.
4. Open all control valves.
5. Lay welding blankets on top of the expansion tank to reduce condensation.

Start the heater and increase the setpoint slowly to 220˚F. Pump noise or pressure fluctuations, crackling or popping noises and/or sudden level changes in the expansion tank are all signs that you have water in the fluid. At this point, steam should be coming out of the vent. When the steam stops, increase the outlet temperature another 3˚F and allow steam to vent. Continue to increase the temperature by 3˚F increments until the fluid temperature at the pump suction has reached 220˚F and the pressure is steady. Close the warm-up valve and slowly increase the heater temperature to the desired operating temperature. Check the fluid level in the expansion tank and close the vent if the tank has a nitrogen blanket. Remove any insulation you may have placed on top of the expansion tank. Drain some fluid from the any low points in the expansion tank and/or thermal buffer tank and check for water. If everything looks good, you are done.