READY TO REPLACE?

COVER STORY

Ed Cass, Paratherm, USA, outlines important things to consider when cleaning, flushing, draining and charging a thermal oil system.

When replacing fluid that has reached the end of its life, it is essential to consider how much time and money to spend performing this task. Important considerations include process down time (including cooling, draining and filling), labour (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, but one should check with the new fluid supplier to be sure.

Cold spots

A system cleaner should be considered if there are cold spots in the system. Completely plugged lines will probably have to be replaced or purged using very high pressure. 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. It is essential to ensure that the cleaner is compatible with the fluid.

Fluid removal

If drains are not located at all low points of the piping so that the fluid can be easily drained or pumped out, then one should 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. The heater should be shut down while the pump continues to run until the fluid has cooled to between 150°F and 180°F. At that point, the systems should be drained 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 two additional steps because the flushing fluid must be flushed out of the system to prevent premature degradation of the new heat transfer fluid. Fluid suppliers should be able to advise on whether or not flushing is necessary.

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. The heat transfer fluid's life will be reduced by incompletely flushing out the flushing fluid itself, not to mention the extra time and disposal costs.

Charging and initial run

The main circulating pump should not be used to charge the fluid since this can damage the seals. Instead, a stainless braided Teflon hose should be used to connect a small positive-displacement pump as close as possible to the main pump suction. All control and block valves and high point vents must be opened (ensure that a bucket is placed under the vents to catch fluid as it runs out, and that enough workers are on hand to monitor the vents). If the system does not have a deaerator, the warm-up valve to the expansion tank must be open. Add fluid until the expansion tank is about half full. If the expansion tank level 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 a quarter 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 through 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, and then add fluid to reach the proper level in the expansion tank.

Start-up

When it turns to steam, 7 oz of water will force 55 gal. of (possibly) very-hot fluid through the expansion tank vent. As such, 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 through the expansion-tank vent. The following are necessary for this to occur as quickly as possible:

- The expansion tank temperature must be maintained over 212°F.
- Condensation of the steam inside the tank must be minimised.

Warm-up/vent lines (which run from the heater outlet to the expansion tank) are the most effective setup. Deaerators do an excellent job of separating air and other non-condensing gases from fluid but do not effectively vent gases that condense (like steam).

Note

If one is unsure how to boilout a system, it is important to contact the heater or fluid manufacturer.

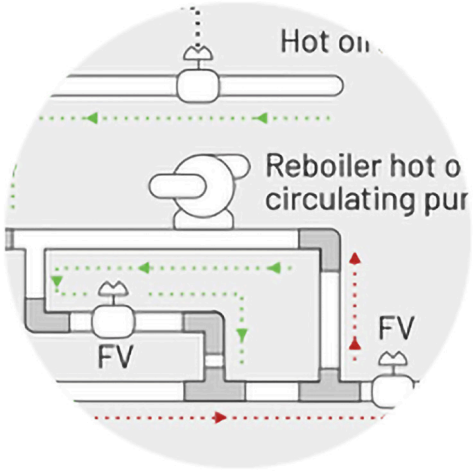

Figure 1. Reboiler system.

Things to do

Before replacing fluid, there are a number of important things to do:

1. If the expansion tank vent discharges into a catch tank, make sure that the end of the pipe is visible, and that the system catch tank is completely empty.
2. Open the manual valve on the expansion tank vent line.
3. If there is a nitrogen blanket on the tank, set the nitrogen inlet pressure control valve as low as possible to provide a continuous purge through 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 there is water in the fluid. At this point, steam should come 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 that may have been placed on top of the expansion tank. Drain some fluid from any low points in the expansion tank and/or thermal buffer tank, and check for water. If everything looks good, then the work is complete. T&T