FLUID DEGRADATION CAUSES AND CURES

Paratherm™
HEAT TRANSFER FLUIDS

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TYPES OF DEGRADATION

There are two ways that heat transfer fluids degrade.

Oxidation occurs when hot fluid comes in contact with air for a long period of time. The acids formed have poor thermal stability and will further degrade at relatively low operating temperatures (400°F). Severe oxidation will result in sludge, heater buildups and extremely high viscosity (fluid gets thicker) at ambient temperature.

Overheating occurs when a fluid is heated above the maximimum film temperature (the fluid temperature on the inside wall of the heater tube or the surface of the electric element) that the fluid manufacturer has specified. The high temperature causes the fluid molecules to break apart (or crack) which decreases the viscosity (fluid gets thinner). Such cracking also can cause pump cavitiaiton. If there is severe overheating, solid carbon particles will form.

An annual fluid analysis is the most effective way to determine if your heat transfer fluid is degrading. The analysis should include an Acid Number to measure oxidation and a Distillation Range (or Boiling Point) test to measure the amount of cracked molecules (Low Boilers). Once the problem is identified, the causes and cures are pretty straightforward.

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Hot Expansion Tank/Reservoir

Oxidation only occurs in the expansion tank (or reservoir). It is normal for the tank to get hot during start-up as the fluid expands into it. Once the system reaches operating temperature, the tank should be cool enough to place a hand on it (for most people the threshold of pain is around 140°F). Smoke from the vent or a popping sound from inside are also signs that the tank is too hot. Make sure that all of the warm- up/boilout lines running into the tank are valved off when the heater outlet temperature reaches 250°F. There should only be one line connecting the tank to the main loop during normal operation. If the system has a combination deaerator/expansion tank, make sure to follow the manufacturer's instructions regarding what to insulate. When all else fails, install a nitrogen blanket on the tank head space.

Burner Problems

One common cause of overheating is flame impingment.

In most fired heaters, the radiant zone (the coil surface that actually faces the flame) is less than 30% of the total heated surface area

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but accounts for 50% to 70% of the total heat transfer. This high heat-to- surface-area ratio produces the highest film temperature in the heater. If the burner is not aligned properly or if the flame disperser is corroded, flame may impinge directly onto the coils surface. This causes an extremely high film temperature that can exceed the maximum recommended film temperature for the fluid. Heater tube failure can result if the problem is not corrected promptly.

Low Flow

Reduction in flowrate through the heater is another cause of overheating. Low flow affects the heat transfer from the heater tube wall (or electric element surface) in two ways:

1. There is less volume of fluid to remove the heat so the overall temperature of the fluid increases.
2. Reduction in turbulent flow also reduces the mixing of the hot fluid, at the tube wall or element surface, with the cooler fluid. This results in an increase in film temperature.

Some of the more common causes of low flows are plugged y-strainers and malfunctioning or improperly set bypass valves.

Degradation: Special Case

Contamination of thermal fluid systems is always self-inflicted. It happens when a fluid with poor thermal stability (hydraulic fluid and glycol are prime suspects since they are often stored in drums in the same area) is added by mistake. An immediate reaction may be pump cavitation or a “geyser” from the expansion tank vent. Many times, however, the only indication that contamination has ocurred is an increase in the amount of carbon solids in the fluid.