Analyzing Your Fluid

Rev. 700

Kept in good condition, your heat transfer fluid will provide excellent performance for an extended period of time. How-ever, if the fluid is contaminated, oxidized or thermally degraded (overheated), not only will fluid life be shortened, but your system could be damaged. Poor per-formance from your system and fluid can have a major impact on production quality and quantity.

Periodic laboratory analysis of your fluid can help pinpoint glitches before they turn into real problems.

Contamination

Contamination such as dust and dirt, protective lacquer coatings, quench oils and welding flux will reduce your fluid's thermal stability, its heat carrying capacity and its ability to transfer heat. Hard contamination like mill scale, minerals and welding slag and spatter can damage pumps, seals, control valves and other components.

The cleaner your thermal fluid system is, the better — and longer — it will run.

Oxidation

All organic heat transfer fluids oxidize when hot and in contact with continuous supplies of fresh air. As oxidation occurs, weak organic acids are formed—concentrating as the oxidation continues. The fluid thickens, and begins to lose its heat-carrying capacity and ability to transfer heat. As it degrades, it becomes more susceptible to *thermal* degradation.

Significant oxidation can occur in some fluids at temperatures below 150°F, but generally doesn't become a problem until temperatures of 225°F to 250°F are reached. Starting at the point your fluid begins to smoke, for every 20°F rise in temperature the oxidation rate approximately doubles. Thus, at 350°F the oxidation rate would be 32 times that of fluid in contact with air at 250°F.

If your system is equipped with a cold-seal tank, make sure that it is properly piped, valved and maintained. If you do not have a cold-seal tank, and the expansion tank must operate above 150°F continuously, you should consider inert gas blanketing (nitrogen is inexpensive and readily available).

Thermal Degradation

Thermal degradation occurs when the fluid's maximum bulk or film temperature is exceeded. As the film temperature is reached and exceeded, the smaller molecules begin to boil at the film surface and vaporize. The fluid thickens causing flows to decrease.

Each fluid molecule, now maintaining longer intimate contact with the heated surface, picks up excessive heat — and the fluid continues to degrade.

When the film temperature dramatically and quickly rises beyond the fluid's maximum, many of the fluid's chemical bonds break. Significant amounts of carbon come into solution. Some of this carbon becomes suspended in the fluid producing a mixture that can be considerably thicker. Some of this carbon adheres and immediately bakes onto the heated surfaces. Successive layers form thick, insulating carbon crust.

Note: The most common cause of overheating is reduction in fluid flow at the heated surfaces — not loss of input heat control. Reduced fluid flow can be caused by pump performance, plugged in-line strainers or filters, restrictions in return lines, malfunctioning valves, mis-set or faulty back-pressure relief valves, power "bumps" and failures and improper system shutdown, among others.

Fluid Analysis

In analyzing your fluid, we compare it with new fluid using three ASTM tests: **Total Acid Number (TAN),** change in **Kinematic Viscosity** and change in **Distillation.**

TAN (ASTM D-974) measures the acidity of the fluid, acidity produced when the fluid is oxidized. New Paratherm heat transfer fluid has a TAN of 0.01 or less (neutral). If the TAN of your fluid reaches 0.70, you should immediately check the system to determine the cause of air entry. At a TAN of 1.00 you should plan to change fluid at the next convenient opportunity. When the TAN reads 2.00, your fluid is becoming significantly acidic and corrosive and you should plan to change out ASAP. Once the TAN reaches 3.00 the fluid should immediately be changed.

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Kinematic Viscosity (ASTM D-445) is a measure of how thick (or thin) your fluid is. Your fluid's viscosity is compared with that of new fluid. Higher viscosities are produced when the fluid is oxidized, if it's been overheated (and some of the smaller molecules have boiled off) or if it contains significant amounts of suspended solid matter. A lower reading can mean that a less viscous fluid has been added to the system or that some of the fluid's molecules have been cracked (broken) into smaller ones.

The **Distillation** test (ASTM D-1160) compares the boiling temperatures of standard molecular sizes (fractions) of new fluid with those of used fluid. As heat transfer fluid overheats, some of the lighter fractions will vaporize and gas off. The average boiling temperatures of the remaining fractions (now comprised of larger molecules) will be higher. This percentage shift in boiling temperature reveals how much the fluid has been overheated and approximately how much life remains. A shift of 10% or more indicates that the fluid has been severely "bruised" and calls for an immediate change.

Taking the Sample For Analysis

Samples must be taken from a "live" part of the system. Good locations to sample from include any low-point drain near the pump or heater and the blow-down valve mounted on the Y-strainer. You'll normally find the Y-strainer in the return line just upstream of pump suction.

It's best to draw the sample after the system has been on standby (the pump's still running but the fluid has cooled down). Not only is this considerably safer than taking a hot sample, but cool fluid will not oxidize (smoke) as it flows out the drain valve. If the fluid smokes, the TAN test may show artificially high acid levels.

When you first crack the drain valve, allow some fluid to drain into a metal container. This flushing helps remove excess contaminants that have settled out. Make sure that the pump has been running so that the fluid you sample is truly representative of the fluid in your system.

Notes:

1. Samples taken from the expansion tank, or from a "dead leg" are not representative of your system's fluid.

2. The independent testing lab requires approximately 3/4 quart to properly conduct the analysis. Please fill the sample jar to this level.

Shipping the Sample

Paratherm stocks special sample kits. We will send one of these to you at no charge. To request one, call us toll-free at 800-222-3611.

Because all testing is performed by an outside ISO 9000 certified hydrocarbon lab, tests are invoiced. As soon as the test is completed and the report received, we will call you to discuss the results. A written report will follow, along with the laboratory's original certificate of quality. Please allow three weeks for the written report.

Questions? We'd like to hear from you. Call toll-free, 800-222-3611, or fax or e-mail us, or visit our website, **www.paratherm.com**