Rev. 500

Fire Prevention in Thermal Oil Heat Transfer Systems

Thermal oil systems have proven **exceptionally** safe over the many years they have served industry. Like any other industrial system however, the proper design, installation and main-tenance of these systems is critical to their smooth functioning and extended operating life.

With the exception of rare, freakish situations, the limited number of fires that do occur in thermal oil systems occur in insulation. Fluid leaking from valves, gasketing, welds or instrument ports finds its way into porous insulation and wicks through. Remaining as hot as the system itself, the fluid comes into intimate contact with the air in the insulation's millions of pockets.

As it enters each pocket, the fluid oxidizes and decomposes—in the process using up the existing air and creating heat. Confined within the insulation, the heat has little chance of escaping. The continued oxidation causes temperatures to rise. In some cases temperatures may exceed the autoignition point of the fluid.

Should the insulation be opened up when the system is hot, fresh air will immediately enter. Coming into contact with the hot, partially oxidized fluid, fresh air can cause spontaneous ignition resulting in a smoldering fire, or a flash.

Note: Thermal oil *vapors* leaking from a system can be highly flammable. You should take immediate action.

Let's review component selection, installation and maintenance.

Component Selection

We strongly recommend that the use of threaded fittings be minimized. With the large degree of thermal expansion and contraction in high temperature systems, and the limited temperature range of many pipe sealants, leakage is almost guaranteed.

In leak-prone areas—near valves, pumps, flanges and instrument ports, for example—use *only* high temperature *closed-cell* insulation. Or remove insulation entirely at these sites.

For valve stems (or "packed" pumps), we suggest packing sets consisting of end rings of braided carbon or graphite fiber, and middle rings of pre-formed (pressed) graphite foil. Good choices for flanges are spiral-wound carbon or graphite-filled gaskets (you may want to investigate a Teflon® material called Gore-Tex Joint Sealant®).

When installing gasketing, be sure to closely follow the manufacturer's recommended torquing and tight-ening sequence. In valves, seat each packing ring fully, and tighten gland nuts slowly while moving the handle back and forth. You should consider specifying bellows-type valves and seal-less magnetic drive pumps. These will give you good performance.

Installation

During construction and installation, four areas should be addressed: system cleanliness, component orientation, system tightness and allowance for thermal expansion and contraction.

System Cleanliness

Care must be taken to assure that the system is clean and dry. Both the "hard" and "soft" contamina-tion are best removed as the system is being assembled.

Hard contamination such as mill scale, weld spatter/slag, and dirt can cause restrictions that sig-nificantly alter fluid flow. Result-ing low fluid velocity through the heater may cause overheat con-ditions. Overheating of the fluid can lead to "coking" (carbon deposits in heater tubes), thermal stress on the heater tubing, and possible tubing rupture.

Soft contamination such as quench oil, welding flux and protective lacquer coatings can dissolve in the fluid. Carried through the heater, these materials degrade at much lower temperatures than the fluid itself, and can form carbon crust on heated surfaces (particularly the heater tubing). The coke build-up prevents the fluid from removing heat from the tubing, and results in thermal stress of that tubing.

Component Orientation

Expansion tanks should be located far enough above heaters so that they run at no more than 150°F in atmospheric vented systems. Warm-up valves should normally be closed. If run hot, and in contact with air, the fluid can severely oxidize. Valves should be mounted stem sideward so that

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leakage from the stem or from bonnet gasketing is less likely to enter insulation. Gaskets should be of the type that can flex with the system's thermal expansion. Porous insulation should be kept away from potential leak points.

System Tightness
We strongly suggest that the system be charged with inert gas once construction is completed. Not only will corrosion be prevented, but the system can be pressure-tested using simple soap-bubble detection at potential leak points. And, when the system is charged with heat transfer fluid, dissolved gas will be inert, virtually eliminating start-up oxidation of the heat transfer fluid.

Expansion and Contraction
The average hot oil system experiences wide temperature swings. Metals expand and contract significantly, with different metals expanding and contracting at different rates. If allowances are not made, piping and welds may not hold up for long, and can result in a shower of hot fluid when it's least expected.

Note: *During initial operation and run-in, all joint areas should be left free of insulation so that leaks can be easily detected and corrected.*

Maintenance

The proper operation and maintenance of your thermal oil system is the most important means you have to reduce the potential for problems. A program of daily or weekly system checks can assist in keeping the system running at its best. As you walk the system, examine each potential leak point for signs of fluid leakage. Closely observe valves, flanges, weldments, instrument ports and threaded fittings. A “smoking” system is a dead giveaway that fluid is leaking.

Check the system vent. Mist or steam coming from the vent can signal water in the system or decomposition of the fluid itself. Check the catch container at the end of the line running from the expansion tank's relief valve or vent line. It should be empty. If it contains liquid, you will want to know why (hot fluid splashing into a drum partially filled with water can create a cloud of hot oil mist—*the hot mist can be ignited*).

Note: Thermal oil *vapors* leaking from a system can be highly flammable. We strongly recommend you immediately respond to this problem.

While walking the system, note any unusual vibration or unusual smells. Like your car, each system has its own sounds, smells and feels. If the system doesn't seem “right” to you, chances are that it is not.

While potential for fire exists in most plants, strong preventive maintenance programs and common sense can work together to reduce the *chance* of fire. We encourage you to call us with any question, no matter how insignificant it seems.

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.**

Rev. 500