Paratherm™ HEAT TRANSFER FLUIDS
A Division of Lubrizol

Oxidation in Heat Transfer Fluids

Rev. 716

Hydrocarbon liquids will oxidize when exposed to continuous supplies of fresh air. Many will oxidize at temperatures considerably below the normal operating temperature of thermal fluid systems. Starting at the fluid's smoke point, the rate of oxidation approximately doubles with each 20°F rise in fluid temperature. And the more mixing of fluid and air, the faster and quicker the degradation.

Oxidation Products

Hydrocarbon liquids smoke as they oxidize — like overheated vegetable oil in a skillet on the kitchen stove. The same, normal products of combustion are produced, typically carbon dioxide, carbon monoxide and water vapor.

Organic acids begin to form in the liquid and concentrate as the oxidation continues. The fluid becomes more viscous. This reduces the film coefficient and increases the pressure drop. Higher pressure drop reduces the flow rate which, when combined with lower film coefficients, significantly increases the film temperature inside the heater and accelerates fluid degradation.

As it degrades — usually at an accelerating rate — the fluid becomes less and less capable of efficiently carrying and transferring heat. Losing its ability to withstand high temperatures, the fluid becomes even more prone to degradation.

Oxidation Symptoms

Your heat transfer fluid will begin to darken and smell pungent ("acidy" or "vinegary"), as acidic carbonaceous sludge* is produced. Eventually, the sludge deposits on all surfaces in the system. Inside the heater these deposits harden and permanently reduce heat transfer. In the heat user these deposits can plug up lines.

Cleaning the System

This procedure will help remove the degraded fluid that contains acids and solid contaminants. The cleaner the system, the longer and more efficiently it will operate. And the fluid will last longer too.

1. Drain the existing fluid as completely as possible.
2. Remove solid matter from system. This may require chemical cleaning with oxidizing agents, circulating hydrocarbon solvents or manual scraping of surfaces.
3. Thoroughly flush with heat transfer fluid of the same type you will operate in the system.
4. Shortly after system startup, send a fluid sample to your thermal fluid supplier for analysis.

System Operation

To prevent oxidation, fluid in the expansion tank must be kept cool. If this cannot be done, consider "padding" the system with inert gas. Nitrogen is inexpensive and readily available. Run a line from your nitrogen source to the expansion tank's head space. The gas should flow from the source through an alarmed flow meter, regulator, check valve and into the expansion tank. Install a back-pressure control valve on the tank's vent line along with a relief valve. The back pressure valve will relieve system pressure during start-up. The relief valve should be properly sized to handle a sudden large pressure increase in the tank, such as water flashing to steam. It is not a good idea to use the relief valve to control the back pressure in the tank since the valve may not reseat properly. In addition to protecting the fluid from oxidation,

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the inert gas will prevent water from condensing in the fluid due to increased ambient temperature and dew point changes.

Note: *Some heat transfer fluids contain oxidation inhibitors. These inhibitors are sacrificial materials designed to prevent the fluid from oxidizing during incidental contact with air. They are not designed to take the place of good system design, maintenance and operation.*

Technical Support

Contact us by phone, fax or e- mail — or visit us on the web at **www.paratherm.com**. In the US and Canada you can call toll-free +1 800-222-3611. We'll spend the time necessary to insure your system gives you many hours of peak, trouble-free performance.

Questions? We'd like to hear from you. Call toll-free, +1 800-222-3611, or fax or e-mail us, or visit our website, **www.paratherm.com**.

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