



Paratherm OR[®] HEAT TRANSFER FLUID

Oxidation Resistant, Non-Fouling, Non-Toxic

ENGINEERING BULLETIN OR 101

Precise, Uniform Temperature Control™ in Closed-Loop Heat Transfer Systems

The Paratherm OR[®] oxidation-resistant heat transfer fluid combines *substantial* oxidation resistance with excellent thermal efficiency, high flash and fire points and extended service life. This zero-pressure fluid provides precise, uniform temperature control to 550°F in closed-loop thermal oil systems where the heat transfer fluid is more than occasionally exposed to air. The crystal-clear OR fluid is comprised of a unique high-stability base plus high-performance oxidation inhibitor/stabilizer. Performance of the OR fluid is particularly impressive under the same grueling conditions that quickly cause severe oxidation, fluid breakdown and sludge formation in conventional heat transfer fluids.

Oxidation

Heavy fluid oxidation occurs when supplies of fresh air come into intimate contact with hot heat transfer fluid (during frequent tool changeout, for example). The resulting reaction converts fluid molecules to organic acids. Soon the acids themselves begin to degrade thermally. The fluid becomes thicker, darker and more odorous, and its heat transfer capabilities drop dramatically.

Fouling

As an oxidized fluid becomes more viscous, it becomes more difficult to pump and more susceptible to overheating. Remaining in contact with the heated surfaces too long, the fluid picks up more heat than its chemical bonds can stand. As they break down, the fluid's molecules release their carbon forming an acidic, carbonaceous sludge that precipitates out and adheres to the system's interior surfaces. Much of this sooty, sticky carbon bakes on to the heated surfaces where it was produced.

The OR fluid contains an additive system that inhibits sludge and carbon formation. Even under prolonged exposure to air, the fluid won't foul heated surfaces.

Efficiency

Due to its low viscosity, the OR fluid provides unusually high thermal efficiencies — higher than most synthetics. The lower in viscosity (the thinner) a heat transfer fluid is, the less energy is required to pump it through the system. In addition a smaller pump and motor can be specified, and the lower power consumption will continue to produce savings year after year.

Environmental Safety

In the event of a release, the same simple clean-up procedures used for light lubricating oils can be employed. Once gathered, the OR fluid can be combined with spent lube oils and sent to the local oil recycler. The crystal-clear Paratherm OR fluid contains no chlorinated or aromatic hydrocarbons, heavy metals, or sulfur or nitrogen compounds.

Typical Properties*

Physical Properties

Feedstock		Hydrotreated Natural hydrocarbon
Color		Transparent, Water-White
Taste & Odor		None
Optimum Use Range		175°F–550°F (79°C–288°C)
Maximum Recommended Film Temperature		600°F (316°C)
Flash Point (coc)	ASTM D-92	350°F (177°C)
Fire Point (coc)	ASTM D-92	395°F (202°C)
Autoignition	ASTM E-659	630°F (332°C)
Atmospheric Boiling Point, 10% Fraction, Vapor Pressure, psia @ 500°F (260°C)	ASTM D-1160	631°F (333°C)
Pour Point	ASTM D-97	-35°F (-37°C)
Specific Gravity, 60/60	ASTM D-1298	0.8663
Thermal Expansion**		0.0004/°F 0.0007/°C
Density @ 75°F (24°C)	ASTM D-4052	7.23lb/gal
Viscosity @ 40°C	ASTM D-445	40.12 cSt
Average Molecular Weight	ASTM D-2502	360
Total Acid Number (TAN)	ASTM D-974	0.01
Heat of Vaporization, Calculated		93 BTU/lb

Electrical Properties

Dielectric Strength kV/cm (disk)	ASTM D-877	>35
Dissipation Factor @ 25°C, 60 Hz	ASTM D-924	.0002

* These are typical laboratory values, and are not guaranteed for all samples.

** Note: Normal practice is to size expansion tanks so that they are 1/4 to 1/3 full when the system is cold, and 2/3 to 3/4 full when the system is at the maximum normal operating temperature.

Fluid Toxicity

The Paratherm OR fluid is non-toxic and non-hazardous. If the fluid is ingested in any quantity, it may act as a laxative. We strongly recommend that you do not breathe vapor mists of *any* fluid. See the Material Safety Data Sheet for further information on these, and other conditions.

Vapor Pressure

The OR fluid has extraordinarily low vapor pressure — a fraction of an atmosphere at its maximum operating temperature of 550°F — thus expensive system pressurization is not required. Low vapor pressure combined with the fluid's exceptionally low pressure drop permits the designer broader latitude in the choice of lower-cost equipment.

Corrosion

The OR fluid is manufactured from natural US feedstocks and offers the same superb metal-coating and lubricating properties as the finest natural oils. The corrosion and wear common with steam and water systems rarely occurs in thermal oil systems containing Paratherm heat transfer fluids. Chemically inert, the Paratherm OR will not attack high temperature seals and gasketing.

Water in the System

Because the OR fluid is immiscible with water and is slightly less dense, system water can be easily removed via the system's low point drain

valves. Crack each low-point valve and allow fluid to drain into a beaker or clear water glass. If you see a phase separation (one liquid "floating" on top of the other), continue to drain until no separation is observed.

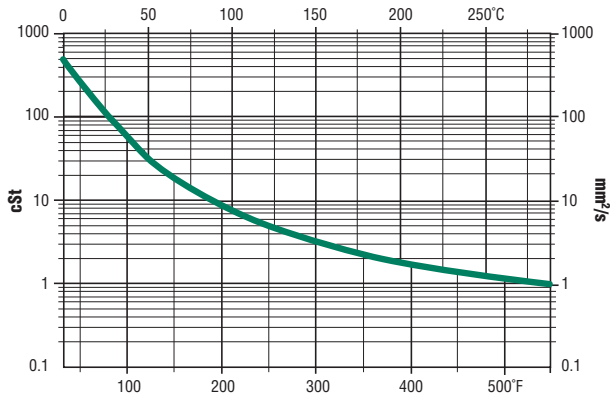
Storing Your Fluid

Containers of heat transfer fluid should be kept in non-hazardous dry areas only. Until ready for use, the container's tamper-evident safety seals *must* remain intact. Liquids should not be allowed to pool on the tops of steel drums. In the afternoon and evening when temperatures decrease, the heat transfer fluid will cool and contract slightly. A partial vacuum is created in the drum. If the bung's elastomeric seal is not perfect, liquid standing on the top of the drum can be drawn through, contaminating the fluid. If drums must be temporarily stored outside, store them on their *sides*.

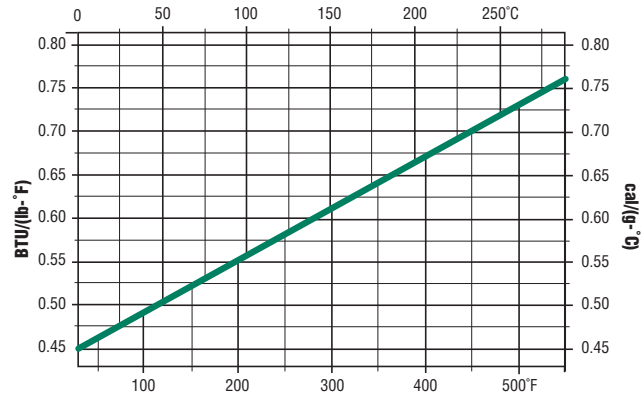
Pre-Cleaning the System

For optimal performance of your system and its heat transfer fluid, thoroughly clean all piping, valves and components before installation. Mill scale, weld spatter and slag, quench oils, protective lacquer and varnish coatings, and dust and dirt will degrade the fluid, and can damage pumps and valves. Lodging in restrictions, these contaminants can easily create low-flow conditions that cause premature failure of systems and fluid.

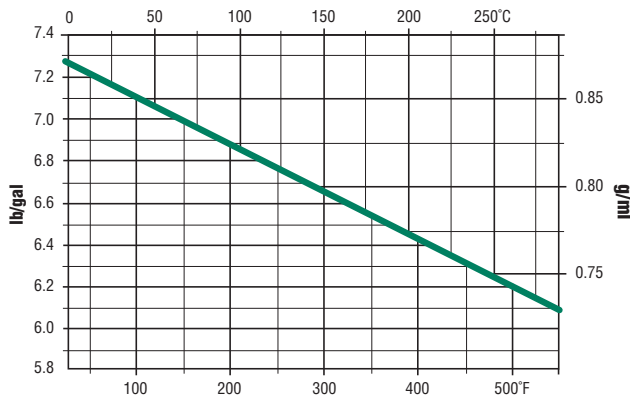
VISCOSITY



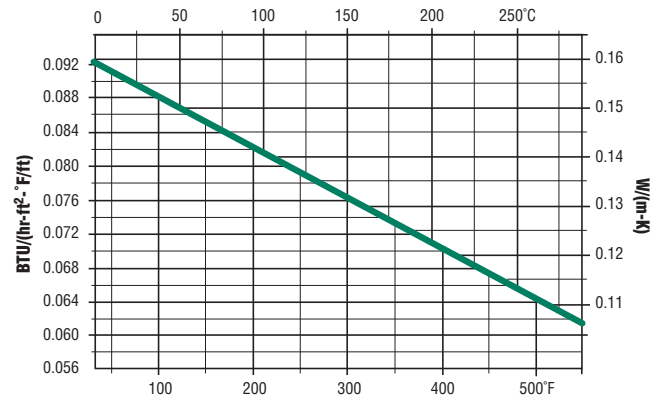
SPECIFIC HEAT



DENSITY



THERMAL CONDUCTIVITY



Inerting the System

Immediately after pre-cleaning the system and before adding fluid, consider purging with inert gas. Purging will help eliminate air and water vapor, and will limit further corrosion. By pressurizing the inert gas, you can leak-test the system using the simple soap-bubble detection method. And because you've eliminated the air, fluid oxidation at start-up is also minimal.

Charging the System

When charging the system, we suggest you fill from the bottom (a point near pump suction) using a small positive displacement pump — not the system pump. Charging from the system's low point can help reduce trapped air in the system, which will substantially reduce the entrainment of gas bubbles and resultant pump cavitation.

Fluid Disposal

Because Paratherm heat transfer fluids are produced from natural US feedstocks, they are exceptionally safe to use and easy to dispose. Used or contaminated Paratherm fluids can be safely combined with spent lubricating oils and recycled locally (EPA, citation 57FR21524). Paratherm strongly encourages recycling of used heat transfer fluid to conserve natural resources

and to minimize the problem of liquid waste in landfills. Please check local, state and federal regulations first, of course. *Liquids contaminated with chlorinated solvents or other regulated materials may require special handling, and may not be accepted by recyclers.*

Fluid Analysis

Overheating, oxidation and contamination of your heat transfer fluid will significantly reduce its ability to perform. Product quality and production levels can suffer, and in severe cases considerable damage to your thermal oil system can result. Periodic analysis of your fluid can allow detection of problems in the early stages, where corrective action costs far less.

Quality Control

Paratherm thoroughly tests each batch of heat transfer fluid to ensure absolute conformance to tight product specifications. Each shipment is traceable to its master batch, with all test results archived at Paratherm.

Technical Assistance

Our technical expertise is available to you in the conceptual stage, during planning and design, and through system construction, start-up and operation. We want to work closely with you in

the recommendation of proven thermal fluid systems, components, supplies and procedures. We also advise on system cleaning and repair, should these become necessary. And if your application calls for fluids that we are unable to provide, Paratherm will assist you with the names and phone numbers of competitors' engineers that can help.

Additional Information

Paratherm has available technical data sheets covering a variety of thermal fluid and system topics including fire prevention, system performance tracking, recommended components, draining, flushing and charging and fluid analysis, among others. We'd be pleased to forward these to you upon request.



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Note: The information and recommendations in this literature are made in good faith and are believed to be correct as of the below date. You, the user or specifier, should independently determine the suitability and fitness of Paratherm heat transfer fluids for use in your specific application. We warrant that the fluids conform to the specifications in Paratherm literature. Because our assistance is furnished without charge, and because we have no control over the fluid's end use or the conditions under which it will be used, we make no other warranties—expressed or implied, including the warranties of merchantability or fitness for a particular use or purpose (recommendations in this bulletin are not intended nor should be construed as approval to infringe on any existing patent). The user's exclusive remedy, and Paratherm's sole liability is limited to refund of the purchase price or replacement of any product proven to be otherwise than as warranted. Paratherm Corporation will not be liable for incidental or consequential damages of any kind.