

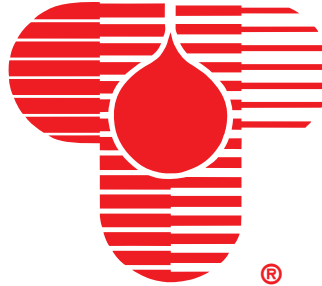
THERMINOL®

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Heat Transfer Fluids by **Solutia**

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CLEANING ORGANIC HEAT TRANSFER FLUID SYSTEMS

Introduction

Heat transfer fluids will give long and trouble-free service in properly designed and operated systems. However, less than ideal operating conditions can result in degradation of the heat transfer fluid, formation of solids, and even deposits on heat transfer surfaces. This bulletin will assist the operator in cleaning a heat transfer fluid system and restoring performance.

Consequences of Contamination

Well designed and operated heat transfer fluid systems are among the safest, most reliable, and most cost effective heating designs possible. However, allowing the heat transfer fluid to become heavily contaminated or severely degraded can result in:

- reduced heat transfer rates
- diminished fuel efficiency
- flow blockages in small diameter or low velocity areas
- extended start-up times at low temperatures
- fouling of heat transfer surfaces
- overheating and damage, or even complete failure, of heater tubes

Contaminants and Their Sources

Combinations of the following four mechanisms are generally responsible for causing fouling in heat transfer fluid systems.

Rust, Dirt, and Pipe Scale: Rust and dirt are the most common sources of solids in heat transfer fluid systems. Ordinarily these infiltrate the system during construction or maintenance.

Oxidation: By far the most common source of contamination is oxidation of the heat transfer fluid. Small amounts of oxidation are rarely a problem; however, excessive oxidation can create solids and high viscosity compounds which impair system effectiveness.

Thermal Degradation: The thermal degradation rate of any organic thermal liquid is a function of fluid chemistry, system operating temperature, and time. Products of degradation can include higher molecular weight compounds and even solids (coke). Carbon formation and build-up can occur when metal surfaces reach excessive temperatures.

Process Contamination: Though less common than oxidation or thermal degradation, process contamination can be a major problem in heat transfer fluid systems. Solids, sludges, decomposition products, and reaction products are possible.

Cleaning Techniques

The following information is presented as a general guide to the user. Many factors should be considered when developing a cleaning procedure for your heat transfer fluid system and this general procedure is not intended to cover all situations. Consult with your Therminol Fluids Specialist when developing a cleaning program for your specific situation.

If your system has problems with ...

Consider these cleaning techniques ...

Solids

Small diameter particles suspended in heat transfer fluid can be effectively removed via filtration. Solids adhered to surfaces or deposited in low velocity areas cannot be removed until they are presented to the filter.

Glass fiber string wound cartridges are commonly used and highly effective for this application. Proper filter sizing will consider the solids concentration and required flow rates. Filter housing construction must be adequate for expected temperatures and pressures.

For high concentrations of solids, bag filters or other high surface area designs can be employed.

Filters with 100 micron or less nominal particle removal ratings should be considered for initial system treatment. Continuous filtration through 10 micron rated filters will maintain system cleanliness (see Therminol Information Bulletin Number 3).

Sludges, high viscosity fluid, or residues

Therminol FF flushing fluid was specifically developed by Solutia for this application and is highly effective in removing sludges, fluid residues, degradation products, and other deposits prior to installation of new heat transfer fluid.

Drain the System

Bring the fluid temperature to 93°C (200°F) and shut down the heater. Continue operating the circulating pumps as long as possible to keep loose solids and sludge in suspension. Drain the system through all low point drains. CAUTION MUST BE TAKEN TO AVOID CONTACT WITH HOT FLUID AND PIPING. In areas where gravity draining is not sufficient or possible (e.g., heater coils), compressed nitrogen may be effective in blowing additional fluid from the system. It is important to remove as much of the degraded heat transfer fluid as possible to maximize the effectiveness of Therminol FF in cleaning interior system surfaces.

Fluid removed from the system must be stored, handled, and disposed of in accordance with applicable regulations. Consult the MSDS and your environmental, safety, and health professionals' guidance. In many cases, used heat transfer fluids can be returned to Solutia. Contact your Therminol Fluids Specialist for further information.

If not already present, install a fine mesh strainer in the system return line to the main circulating pumps.

Flush the System

Fill the system with Therminol FF to a proper operating level*, including the expansion tank where solids tend to deposit. Filling from low points is suggested. Circulate the entire system at ambient conditions to thoroughly mix the Therminol FF with residual heat transfer fluid. Check the return line strainer periodically for plugging from solids which may have been dispersed from fouled areas of the system. For larger systems, less Therminol FF may be used by cleaning system subsections one at a time.

Gradually heat the circulating Therminol FF to about 110°C (225°F) and, using your standard operating procedures, vent any moisture that may have entered the system. When all the moisture has been vented, raise the circulating fluid to about 180°C (350°F) to maximize the solvent characteristics of the Therminol FF. Maintain full circulation of the entire system for 16 to 24 hours at 180°C.

* Typical volume expansion of Therminol FF from ambient to 180°C (350°F) is approx. 10% to 12%.

If your system has problems with ...

Sludges, high viscosity fluid, or residues (continued)

Consider these cleaning techniques ...

Cool the fluid to 93 °C (200 °F) and repeat the above draining procedure. CAUTION MUST BE TAKEN TO AVOID CONTACT WITH HOT FLUID AND PIPING. Remove as much of the Therminol FF and used fluid mixture as possible. Therminol FF removed from the system must be stored, handled, and disposed of in accordance with applicable regulations. Consult the MSDS and your environmental, safety, and health professionals' guidance. In many cases, used Therminol FF can be returned to Solutia. Contact your Therminol Fluids Specialist for further information.

Inspection After Cleaning

Once the system has been completely drained, visually inspect the system in the areas of low fluid velocity to check for solids which may have fallen out of suspension. Remove any solids discovered.

Heat Transfer System Start-up After Cleaning

Install new side stream filter cartridges and place the filter in operation. If the system does not have a sidestream filter to continuously remove solids during normal operation, installation of one should be considered prior to installation of new heat transfer fluid.

Refill the system with new heat transfer fluid and start-up following proper start-up procedures. Care should be taken to vent any moisture which may have entered the system during flushing, draining, or refilling. Small amounts of Therminol FF will not have an adverse effect on the operation or service life of the new fluid.

Compatibility of System Components and New Fluids With Therminol FF

Mechanical components in most high temperature heating systems which use organic heat transfer fluids are generally compatible with Therminol FF. This includes piping, flanges, gaskets, pumps, valves and valve packing, filters, and insulation.

Small amounts of Therminol FF remaining in the system will not have an adverse effect on the operation or the service life of the new heat transfer fluid.

Therminol FF is generally not recommended for use in vapor phase heat transfer fluid systems. Thorough removal of the residual Therminol FF will be required if use in a vapor phase system is desired.

CHEMICAL CLEANING OF HEAT TRANSFER FLUID SYSTEMS

Chemical cleaning can be an alternative to the Therminol FF procedure presented above. Chemical cleaning is generally more costly and requires significantly more time to return a system to operation and several steps are necessary to ensure effectiveness. System owners are typically responsible for waste disposal. Multiple flushings after cleaning will generate significantly more waste.

If chemical cleaning techniques are to be employed, consult your Therminol Fluid Specialist and a chemical cleaning supplier about detailed plans and procedures. A general outline of the process follows:

- Drain heat transfer fluid from system
- Solvent flush circulation
- Drain solvent flush
- Acidic solution circulation
- Flush with water
- Caustic and detergent solution circulation
- Flush with water
- Dry thoroughly

If your system has problems with ...

Consider these cleaning techniques ...

Process contamination

Removal of process contamination from heat transfer fluid systems must be treated on a case by case basis. Degradation products of the process contaminant as well as the possibility for reaction products with the heat transfer fluid must be considered. Consult your Therminol Fluids Specialist in the event of a process contamination.

Hard coke

When the system has been severely fouled by hard coke deposits, removing the highly inert carbon layer generally requires the use of mechanical cleaning techniques like sand or bead blasting, wire brushing, or high-pressure water jetting.

To maximize the effectiveness of mechanical cleaning techniques, the above procedure for cleaning with Therminol FF should be employed first. This will remove loose solids and sludges.

Severely overheating a heat transfer fluid can result in hard coking of heating surfaces. High temperature steam-air decoking of fired heaters has been reported to be effective when properly controlled.

For more information: call toll free 800-433-6997
visit our Web site – www.therminol.com

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