Technical Information **Bulletin** 2

In-use testing of Therminol and Marlotherm and other heat transfer fluids

Full fluid life—When Eastman Therminol® and Marlotherm® heat transfer fluids are used within recommended temperature limits, they should provide years of service.

Routine fluid testing—To help optimize long-lasting performance, a sample should be taken annually and in other special circumstances described in this publication. Routine sampling helps detect system malfunction, fluid contamination, and moisture and thermal degradation as well as other areas that impact system performance.

Complimentary sample analysis—Guidelines for requesting sample kits, submitting samples for testing, and interpretation of analytical results are outlined in this publication.

What is the fluid testing program?

Testing begins when a fluid sample from an operating heat transfer system is submitted for analysis. Specific analyses performed depend on the information provided to sales or technical service representatives. Most samples require only a routine analysis. At times, special analyses are performed to help determine the cause of system operational problems. Systems can be tested for total acid number, moisture, insoluble material, viscosity, flash point, and low- and high-boiling components.

Once analysis is complete, a report is provided with suggestions to help prolong fluid life or improve system performance. Years of practical experience with in-service organic heat transfer fluids provides the basis for comparing individual sample results with in-service use limits to indicate areas for potential corrective action. Maximum limits where corrective action should be taken to prevent further system problems are also provided.

Eastman launched Fluid Genius™, a new digital sample management platform. For more information go to FluidGenius.net or contact your Eastman account manager.

How often should system samples be analyzed?

A sample should be taken on new systems, on those that have recently been cleaned, those with major fluid maintenance, and those that have had a different fluid added. In addition, a sample should be taken at least annually on systems that continually operate at maximum temperature limits. When there is a problem, a fluid analysis may indicate the extent of the problem and the urgency necessary for corrective action.

How do I request a sample analysis kit?

- If you have **activated** your Fluid Genius account:
  - Log in at FluidGenius.net, navigate to the sample kit tab, and provide your name, fluid type, shipping address, and quantity of kits needed.
- If you **haven't activated** your Fluid Genius account, you can use one of the following methods:
  - Complete the contact form on Therminol.com or Eastman.com/Marlotherm and select sample analysis kit as the request type.
  - In North America, you can reach us at 1-800-433-6997.
  - Contact your local sales or technical specialist. Team members in all regions can be found on the "Meet the Team" page in the "Contact" section of Therminol.com.

How do I take a sample?

1. You should use the complimentary sample analysis kit shipped to you. The kit contains an aluminum sample bottle, a sample information label with GHS pictograms and signal words, an absorbant pad, a zipper pouch, and a detailed instruction booklet.

2. For analysis, the fluid sample needs to be 1 pint (0.5 liter). Withdraw fluid from a circulating line in accordance with instructions provided by the system manufacturer. Cool the sample to 140°F (60°C) or less before placing the fluid in the provided aluminum sample bottle. Complete the sample information label as indicated in the detailed instructions, and place the label on the bottle. Package the sample bottle as indicated in the instruction booklet for shipment to Eastman.

3. Observe safe procedures for handling high-temperature fluid during sampling. Ship the sample according to all current local, state, and federal laws and regulations. Fluids with flash points at or below 141°F (60.5°C) must comply with more stringent shipping requirements per local guidelines.

Where do I send the sample?

Send to the designated Eastman testing lab in your region. Eastman has testing labs in North America, South America, Europe, and Asia Pacific. Laboratory location addresses for shipping samples are included in the detailed instruction booklet in your sample analysis kit.

How soon can I get an answer?

Normally, within two weeks of sample receipt, fluid analysis and reporting will be completed with suggestions for corrective action. In an emergency, analysis can be completed within 48 hours.

What do the test results mean?

Our experience with in-use fluid analysis enables us to determine fluid property limits. If all test results fall in the normal range, the fluid is probably in good condition and reported system problems, presumably, are related to system design or operation. If one or more of the properties fall within the warning range, appropriate corrective action usually should be taken to minimize further change in the fluid or the system operation. Values at or beyond the action limits indicate the potential need for more immediate corrective actions or fluid replacement to ensure that acceptable system performance continues. An outline for interpreting test results follows. Although the test results suggest possible problems and corrective actions, customers must make their own determinations for their systems based on their particular circumstances.

Viscosity

Viscosity changes generally indicate contamination, thermal stress, or oxidation degradation. Viscosity is related to molecular weight of fluid components. Generally, lower-molecular-weight components decrease viscosity, and higher-molecular-weight components increase viscosity. Contamination from leaked process streams, incorrect material added to the heat transfer fluid system, and solvents from system cleaning, as well as thermal stressing and oxidation, may be the source of materials that increase or decrease viscosity.

Operational problems may result from either high- or low-viscosity conditions. If viscosity is very high, the circulating system may have difficulty in start-up, resulting in heater burnout. Heat transfer rates may also be reduced. If viscosity is low, low-boiling components will be more volatile and can result in pump cavitation and reduced flow.

To remove low-boiling components, heated fluid should be circulated through the expansion tank with inert gas purge of the vapor space. The vent discharge should be routed to a safe location for collection and disposal.

High viscosity generally requires that the fluid be removed and replaced. Sometimes, however, correction can be obtained through dilution with new fluid. The cause of viscosity changes should be determined no matter what action is taken. Equipment malfunction or use of fluid beyond recommended temperature limits can result in thermal or oxidative degradation. The system can be corrected mechanically, or a fluid with a higher thermal stability can be used.

Total acid number

High acid numbers generally indicate possible contamination from material added to the system inadvertently or leaked from the process side. High acid numbers may also indicate severe fluid oxidation if the system is not protected with inert gas in the expansion tank vapor space. Although not routinely reported, pH values can be useful in fluid and system condition assessment.

If the acid condition becomes excessive, the system can corrode and fail. Corrosive products form sludge and deposits that decrease heat transfer rates.

Contamination or oxidation of this nature usually should be corrected by removing the material for disposal and replacement with new fluid.

Moisture

Moisture generally indicates either a system leak on the process side or wet fluid has been added to the system. New systems or systems cleaned using aqueous solutions can contain residual water. Water can also infiltrate through the open vents of expansion or storage tanks. Corrosion, high system pressures, pump cavitation, and vapor lock are possible problems caused by moisture. If hot fluid contacts a water pocket, steam could cause the system fluid to erupt and its components to fail.

Corrective actions include careful and gradual start-up of a potentially wet system with circulation through all parts until the boiling point of water has been exceeded. Heated fluid is circulated through the expansion tank where vapor space is slowly purged with inert gas to sweep moisture from the system. If a large amount of water contamination is present, it may be necessary to remove the fluid for external drying. Leaks from the process side should be corrected, and new heat transfer fluid should be stored to minimize water entry.

Note: When stored outside, new, sealed drums should be turned on their sides and adequately covered to prevent moisture contamination from the rain

Insolubles and nonevaporable content

The presence of insoluble solids and nonevaporable components generally indicates contamination from dirt, corrosion products, severe oxidation, or severe thermal stressing.

This condition may cause fouling of heat transfer surfaces, plugging of small-diameter lines, or narrow heat transfer passages as well as wear and plugging of mechanical seals and valves.

If these problems occur, side-stream filtration using glass fiber-wound filters usually can eliminate the source of dirt, corrosion, oxidation, or thermal stress. If solids contamination is extremely high, fluid may need to be removed for external filtration and the system may need to be cleaned. Therminol or Marlotherm flushing fluids have proven effective in removing fouling deposits from most synthetic and mineral oil systems. Modest solids content may require successively smaller-rated filter sizes to get the situation under control. A suggested filter rating generally is 10 to 25 microns

Low- and high-boiling components

Low- and high-boiling materials are measured by gas chromatographic analysis and generally indicate contamination, oxidation, or thermal stressing of fluid.

This condition can cause pump cavitation, a poor circulation rate, and decreased heat transfer rates. Ultimately, it can result in the fouling of heat transfer surfaces and the formation of solid materials.

To correct, remove the source of contamination, correct the abnormal thermal stress, and purge low boilers from the system. Very high levels of low and high boilers may require removal of fluid for reclamation or disposal.

Special tests

At certain times, special testing is needed. This testing includes solids and component analysis to help identify a source of contamination, a cause of degradation, or an operational problem. Compatibility of one fluid with other fluids, components, or materials of construction helps to assure trouble-free performance.

Can I test the fluid in my lab?

Test procedures are based on standard ASTM methods. Many labs have the capability to do these tests. Details for running specific tests are available and may be requested. However, interpretation of test results to provide guidance on potential actions to improve your HTF system require detailed knowledge on heat transfer fluid chemistries and their degradation. This knowledge may not be available in other labs.

Specific analytical testing may not be needed to determine the general condition of in-use fluid. A simple visual inspection can show if more detailed analysis is needed. Fluid from a well-maintained heat transfer system will usually be dark in color with viscosity similar to new fluid. Presence of moisture will result in cloudiness or separate fluid layers. High solids will usually appear as sediment at the bottom of a container.

Summary of in-use Therminol fluid test result interpretation

Test	Possible cause	Possible effects
Viscosity changes	Contamination, thermal degradation, fluid oxidation	Poor heat transfer rate, deposits, high vapor pressure, pump cavitation
Total acid number changes	Severe oxidation, contamination with acid or base	System corrosion, deposits
Moisture increase	System leaks, residual in new or cleaned unit, unprotected vent or storage	Corrosion, excess system pressure, pump cavitation
Solvent insoluble solids increase	Contamination, dirt, corrosion, oxidation, thermal stress	Poor heat transfer, wear of pump seals, plugging narrow passages
Low- and high-boiler increase	Contamination, thermal stress	Pump cavitation, poor heat transfer, excess system pressure, deposits
Flash point	Contamination, high amount of low boiler	Potential increased fire hazard, possible non-compliance with regulatory requirements
Special and appearance testing can be completed as needed for quick determination of fluid condition or resolution of special problems.		

For more information, visit **Therminol**.com or **Marlotherm**.com.

EASTMAN

The results of **insight**™

Eastman Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other locations, +(1) 423-229-2000

www.eastman.com/locations

TF-38B 7/21