# THERMINOL INFORMATION BULLETIN NO. 2

THERMINOL® 2

Heat Transfer Fluids by **Solutia**

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## IN-USE TESTING OF THERMINOL® HEAT TRANSFER FLUIDS

When Therminol® heat transfer fluids are used within suggested temperature limits, they should provide years of service.

To help keep that long-lasting performance optimal, Solutia provides a heat transfer system fluid testing service. This service helps detect system malfunction, fluid contamination, and moisture and thermal degradation, as well as other areas that impact system performance.

Details of the testing service – how samples should be submitted for testing and guidelines for interpretation of analytical results – are outlined in this bulletin.

### 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 upon 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, and low and high boiling components.

Once analysis is complete, a phone discussion, which provides suggestions to help prolong fluid life or to improve system performance, takes place and is followed by a written report. General background experience for in-use fluid is the basis Solutia uses for comparing individual sample results with normal use limits, thus indicating areas for potential corrective action. Maximum limits where corrective action should be taken to prevent further system problems also are suggested.

### How Often Should System Samples be Analyzed?

A sample should be taken on new systems, on those that have recently been cleaned, and on 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. Analysis at least once every three years usually is adequate on systems that operate at least 50 °F below the maximum limit. When there is a problem, a fluid analysis at that time may indicate the extent of the problem and the urgency necessary for corrective action.

### How Do I Initiate an Analysis?

Sample analysis is initiated by calling either 800-433-6997, or 314-674-4687, or the Therminol fluid sales specialist for your area. Submission of a sample kit form, completed with your name, address and description of the system operation and problems, formally initiates the procedure.

### How Do I Take a Sample?

1. A free sample kit, obtained upon analysis request, should be used. The kit contains an aluminum sample bottle, instructions, a system description form, a pre-addressed mailing box and labels, and an order form for additional sample kits.

2. One pint (0.5 liter) of fluid is required for analysis. Withdraw fluid from a circulating line in accordance with instructions provided by the system manufacturer. Cool the sample to 200 °F or less, and place in a clean, metal container. Label with your company name, address, specific fluid name, system name (if there are multiple systems at your location), and sample date. Place the sealed container in the addressed box for shipment to Solutia.

3. Observe safe procedures for handling high-temperature fluid during sampling, and ship the sample according to all current local, state and federal laws and regulations.

## Where Do I Send the Sample?

Send by prepaid freight/postage to:
Chief Chemist
Solutia Inc.
Anniston Plant
300 Birmingham Highway
Anniston, AL 36201

## How Soon Can I Get an Answer?

Normally, within two weeks of sample receipt, a fluid analysis will be completed, results phoned in, and a written report sent out with suggestions for corrective action. In an emergency, analysis can be completed within 48 hours.

## What Do the Test Results Mean?

Our experience in 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, the customer must make his own determinations for his systems based upon his 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 startup, resulting in heater burnout. Heat transfer rates may 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 vapor space.

High viscosity generally requires that the fluid be removed, reclaimed and replaced. Correction sometimes, however, 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 mechanically corrected, 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 also may indicate severe fluid oxidation if the system is not protected with inert gas in expansion tank vapor space. Although not routinely reported, pH values can be useful in fluid and in 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.

A contamination or oxidation condition of this nature usually should be corrected by removing the material for reclamation or disposal.

**Moisture:** Moisture generally indicates that either there is a system leak on the process side or wet fluid has been added to the system. New systems, or a system cleaned using aqueous solutions, can contain residual water. Water also can 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, there is potential for steam to develop, which can cause fluid from the system 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.

**Acetone Insolubles:** The presence of acetone insolubles 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 string-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 chemically. 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 micron.

**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. It ultimately 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:** There are certain times when special testing is needed. These include 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.

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 | Potential 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 |
| Acetone Insoluble Increase | Contamination, dirt, corrosion, oxidation, thermal stress | Poor heat transfer, wear of pump seals, plugging narrow passages |
| Low Boiler and High Boiler Increase | Contamination, thermal stress | Pump cavitation, poor heat transfer, excess system pressure, deposits |
| Special and Appearance | As needed for quick determination of fluid condition or resolution of special problems | |

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