



# THERMINOL<sup>®</sup> D-12

heat transfer fluid

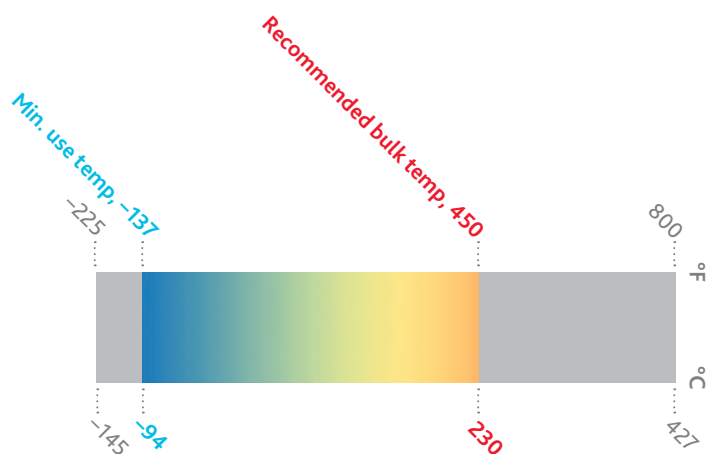
Low-temperature coolant/heat transfer fluid that is NSF HT1 certified and outperforms FDA specifications for use in food contact applications

***-94° to 230°C***  
***(-137° to 450°F)***

**THERMINOL.**  
Heat transfer fluids by Eastman

# THERMINOL® D-12

heat transfer fluid



Eastman Therminol® D-12 heat transfer fluid is a liquid phase heat transfer fluid specially developed for process cooling combined with moderate heating cycles using a single fluid in place of the traditional dual steam/brine or steam/glycol systems.

Therminol D-12 is available globally. Contact your local Eastman Therminol sales representative for more information.

## Physical and chemical characteristics

Therminol D-12 is especially suited to applications where a low order of acute toxicity and odor are desired. This product is registered to the NSF International Registration Guidelines for Nonfood Compounds. Therminol D-12 meets the technical



Nonfood Compounds  
Program Listed ( HT1 )  
( 130383 )

requirements of 21 CFR 178.3570 for incidental food contact set forth by the FDA. Therminol D-12 is based on halogen-free chemistry, and it is considered nonhazardous and practically harmless for environmental purposes. For complete information regarding the safety of Therminol D-12, consult the Safety Data Sheet.

Therminol D-12 has a temperature range of  $-94^{\circ}$  to  $190^{\circ}\text{C}$  ( $-137^{\circ}$  to  $374^{\circ}\text{F}$ ) without overpressure or up to  $230^{\circ}\text{C}$  ( $450^{\circ}\text{F}$ ) with appropriate level of system pressurization. In combined heating or cooling applications, Therminol D-12 can serve both needs, delivering excellent heat transfer rates even at  $-45^{\circ}\text{C}$  ( $-50^{\circ}\text{F}$ ). Therminol D-12 remains liquid and is easily pumped at temperatures as low as  $-94^{\circ}\text{C}$  ( $-137^{\circ}\text{F}$ ). Start-up problems often associated with batch processing systems are eliminated, and steam or electrical tracing is not required.

The recommended bulk and maximum film temperatures for Therminol D-12 are based on industry-standard thermal studies. Operation at or below these temperature maximums can provide long service life under most operating conditions.

Actual fluid life is dependent on the total system design and operation and can vary by heat transfer fluid chemistry. As fluid ages, the formation of low- and high-boiling compounds may result. Low-boiling compounds should be vented from the system as necessary to a safe location away from personnel and sources of ignition and in compliance with applicable regulations and laws. The high-boiling compounds can be very soluble in the fluid. Significant overheating or fluid contamination will accelerate decomposition and may result in increased high-boiler and solids concentrations. Excess solids can typically be filtered for removal.

Eastman recommends that systems using Therminol D-12 fluid be blanketed with an atmosphere of inert gas to protect against the effects of fluid oxidation on its performance and life expectancy. Pressure relief device(s) should be installed where required.

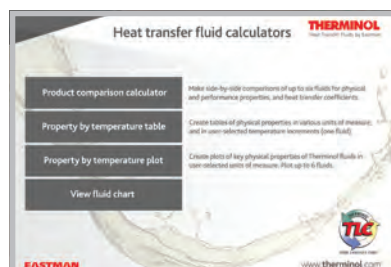
Therminol D-12 is generally noncorrosive to metals commonly used in the construction of heat transfer systems.

Therminol D-12 is not classified as a fire-resistant heat transfer fluid. Consequently, the use of protective devices may be required to minimize fire risk, and users of Therminol D-12 should check with their safety and risk management experts for specific instructions.

## Typical properties<sup>a</sup>

|                                                                                      |                                                  |
|--------------------------------------------------------------------------------------|--------------------------------------------------|
| Appearance                                                                           | Clear, water-white liquid                        |
| Composition                                                                          | Synthetic hydrocarbons                           |
| Recommended bulk temperature                                                         | 230°C (450°F)                                    |
| Maximum film temperature                                                             | 245°C (475°F)                                    |
| Normal boiling point                                                                 | 192°C (378°F)                                    |
| Pumpability, at 300 mm <sup>2</sup> /s (cSt)                                         | −82°C (−116°F)                                   |
| Pumpability, at 2000 mm <sup>2</sup> /s (cSt)                                        | −94°C (−137°F)                                   |
| Flash point, PMCC (ASTM D93)                                                         | 62°C (144°F)                                     |
| Autoignition temperature (DIN 51794)                                                 | 277°C (531°F)                                    |
| Autoignition temperature (ASTM E659)                                                 | 247°C (477°F)                                    |
| Minimum liquid temperatures for fully developed turbulent flow ( $N_{Re} > 10,000$ ) |                                                  |
| 10 ft/s, 1-in. tube (3.048 m/s, 2.54-cm tube)                                        | −37°C (−35°F)                                    |
| 20 ft/s, 1-in. tube (6.096 m/s, 2.54-cm tube)                                        | −51°C (−59°F)                                    |
| Minimum liquid temperatures for transitional region flow ( $N_{Re} > 2000$ )         |                                                  |
| 10 ft/s, 1-in. tube (3.048 m/s, 2.54-cm tube)                                        | −64°C (−82°F)                                    |
| 20 ft/s, 1-in. tube (6.096 m/s, 2.54-cm tube)                                        | −71°C (−96°F)                                    |
| Coefficient of thermal expansion at 100°C                                            | 0.00112/°C (0.00062/°F)                          |
| Heat of vaporization at maximum use temperature                                      | 198 kJ/kg (85.2 Btu/lb)                          |
| Total acidity (ASTM D664)                                                            | <0.2 mg KOH/g                                    |
| Average molecular weight                                                             | 162                                              |
| Pseudocritical temperature                                                           | 360°C (680°F)                                    |
| Pseudocritical pressure                                                              | 16.2 bar (235 psia)                              |
| Pseudocritical density                                                               | 229 kg/m <sup>3</sup> (14.1 lb/ft <sup>3</sup> ) |
| Chlorine content, ppm (DIN 51577)                                                    | <10 ppm                                          |
| Sulfur content, ppm (ASTM D7691)                                                     | <10 ppm                                          |
| Copper corrosion (ASTM D130)                                                         | <<1a                                             |
| Moisture content, maximum (ASTM E203)                                                | 80 ppm                                           |
| Dielectric constant @ 23°C (ASTM D924)                                               | 2.02                                             |

<sup>a</sup>These data are based on samples tested in the laboratory and are not guaranteed for all samples. Contact us for complete sales specifications for Therminol D-12 fluid. Does not constitute an express warranty. See disclaimer on the back page of this bulletin.



## To create your own customized table

with preferred properties, units of measure,  
and temperature intervals, visit

[www.therminol.com/resources](http://www.therminol.com/resources)

and download the Therminol heat transfer fluid calculator.

**For technical service, visit the contact page of our website,  
Therminol.com.**

# Liquid properties of Therminol® D-12 heat transfer fluid by temperature<sup>a</sup> (SI UNITS)

| Temperature |      | Liquid density    | Liquid heat capacity | Heat of vaporization | Liquid enthalpy <sup>b</sup> | Liquid thermal conductivity | Liquid viscosity <sup>c</sup> |                          | Vapor pressure <sup>d</sup> |
|-------------|------|-------------------|----------------------|----------------------|------------------------------|-----------------------------|-------------------------------|--------------------------|-----------------------------|
| °C          | °F   | kg/m <sup>3</sup> | kJ/(kg·K)            | kJ/kg                | kJ/kg                        | W/(m·K)                     | cP (mPa·s)                    | cSt (mm <sup>2</sup> /s) | kPa                         |
| -94         | -137 | 841               | 1.66                 | 400.6                | -137.4                       | 0.1255                      | 1750                          | 2080                     | —                           |
| -90         | -130 | 839               | 1.68                 | 397.5                | -130.7                       | 0.1250                      | 819                           | 977                      | —                           |
| -80         | -112 | 832               | 1.71                 | 389.9                | -113.8                       | 0.1238                      | 177                           | 213                      | —                           |
| -70         | -94  | 825               | 1.75                 | 382.4                | -96.5                        | 0.1225                      | 56.4                          | 68.3                     | —                           |
| -60         | -76  | 818               | 1.79                 | 375.0                | -78.8                        | 0.1213                      | 23.6                          | 28.9                     | —                           |
| -50         | -58  | 811               | 1.82                 | 367.7                | -60.8                        | 0.1200                      | 12.0                          | 14.8                     | —                           |
| -40         | -40  | 805               | 1.86                 | 360.6                | -42.3                        | 0.1186                      | 7.06                          | 8.77                     | —                           |
| -30         | -22  | 798               | 1.90                 | 353.6                | -23.5                        | 0.1173                      | 4.60                          | 5.76                     | —                           |
| -20         | -4   | 791               | 1.94                 | 346.7                | -4.3                         | 0.1159                      | 3.24                          | 4.09                     | 0.001                       |
| -10         | 14   | 784               | 1.98                 | 340.0                | 15.3                         | 0.1145                      | 2.41                          | 3.08                     | 0.004                       |
| 0           | 32   | 777               | 2.02                 | 333.4                | 35.2                         | 0.1130                      | 1.88                          | 2.43                     | 0.011                       |
| 10          | 50   | 770               | 2.05                 | 326.9                | 55.6                         | 0.1115                      | 1.52                          | 1.98                     | 0.027                       |
| 20          | 68   | 762               | 2.09                 | 320.5                | 76.3                         | 0.1100                      | 1.26                          | 1.65                     | 0.062                       |
| 30          | 86   | 755               | 2.13                 | 314.3                | 97.4                         | 0.1084                      | 1.07                          | 1.41                     | 0.131                       |
| 40          | 104  | 748               | 2.17                 | 308.1                | 118.9                        | 0.1068                      | 0.918                         | 1.23                     | 0.259                       |
| 50          | 122  | 741               | 2.21                 | 302.1                | 140.9                        | 0.1052                      | 0.800                         | 1.08                     | 0.484                       |
| 60          | 140  | 733               | 2.25                 | 296.1                | 163.2                        | 0.1035                      | 0.705                         | 0.961                    | 0.859                       |
| 70          | 158  | 726               | 2.29                 | 290.3                | 185.9                        | 0.1019                      | 0.626                         | 0.863                    | 1.46                        |
| 80          | 176  | 718               | 2.33                 | 284.5                | 209.0                        | 0.1001                      | 0.561                         | 0.781                    | 2.39                        |
| 90          | 194  | 710               | 2.37                 | 278.8                | 232.5                        | 0.0984                      | 0.504                         | 0.710                    | 3.77                        |
| 100         | 212  | 703               | 2.41                 | 273.1                | 256.4                        | 0.0966                      | 0.456                         | 0.649                    | 5.76                        |
| 110         | 230  | 695               | 2.45                 | 267.5                | 280.8                        | 0.0948                      | 0.414                         | 0.596                    | 8.57                        |
| 120         | 248  | 687               | 2.50                 | 262.0                | 305.5                        | 0.0929                      | 0.378                         | 0.550                    | 12.4                        |
| 130         | 266  | 678               | 2.54                 | 256.4                | 330.7                        | 0.0910                      | 0.345                         | 0.509                    | 17.6                        |
| 140         | 284  | 670               | 2.58                 | 250.9                | 356.3                        | 0.0891                      | 0.316                         | 0.472                    | 24.4                        |
| 150         | 302  | 661               | 2.62                 | 245.3                | 382.3                        | 0.0872                      | 0.290                         | 0.439                    | 33.2                        |
| 160         | 320  | 653               | 2.67                 | 239.7                | 408.8                        | 0.0852                      | 0.267                         | 0.409                    | 44.3                        |
| 170         | 338  | 644               | 2.71                 | 234.1                | 435.6                        | 0.0832                      | 0.246                         | 0.383                    | 58.3                        |
| 180         | 356  | 635               | 2.75                 | 228.4                | 463.0                        | 0.0812                      | 0.227                         | 0.358                    | 75.5                        |
| 190         | 374  | 625               | 2.80                 | 222.6                | 490.7                        | 0.0791                      | 0.210                         | 0.336                    | 96.5                        |
| 200         | 392  | 616               | 2.84                 | 216.7                | 518.9                        | 0.0770                      | 0.195                         | 0.316                    | 122                         |
| 210         | 410  | 606               | 2.89                 | 210.7                | 547.6                        | 0.0748                      | 0.180                         | 0.298                    | 152                         |
| 220         | 428  | 595               | 2.93                 | 204.5                | 576.7                        | 0.0727                      | 0.167                         | 0.281                    | 188                         |
| 230         | 446  | 584               | 2.98                 | 198.1                | 606.3                        | 0.0705                      | 0.156                         | 0.266                    | 229                         |
| 240         | 464  | 573               | 3.03                 | 191.4                | 636.3                        | 0.0682                      | 0.145                         | 0.252                    | 278                         |
| 250         | 482  | 562               | 3.08                 | 184.5                | 666.9                        | 0.0660                      | 0.135                         | 0.240                    | 333                         |

<sup>a</sup>Recommended bulk temperature 230°C (450°F). These data are based on samples tested in the laboratory and are not guaranteed for all samples. Contact us for complete sales specifications for Therminol D-12 fluid. <sup>b</sup>Liquid enthalpy basis is -17.8°C (0°F). <sup>c</sup>1 cSt = 1 mm<sup>2</sup>/s and 1 mPa·s = 1 cP. <sup>d</sup>100 kPa = 1 bar

# Liquid properties of Therminol® D-12 heat transfer fluid by temperature<sup>a</sup> (ENGLISH UNITS)

| Temperature |     | Liquid density |                    | Liquid heat capacity | Heat of vaporization | Liquid enthalpy <sup>b</sup> | Liquid thermal conductivity | Liquid viscosity <sup>c</sup> |                          | Vapor pressure <sup>d</sup> |
|-------------|-----|----------------|--------------------|----------------------|----------------------|------------------------------|-----------------------------|-------------------------------|--------------------------|-----------------------------|
| °F          | °C  | lb/gal         | lb/ft <sup>3</sup> | Btu/(lb·°F)          | Btu/lb               | Btu/lb                       | Btu/(ft·h·°F)               | lb/(ft·h)                     | cSt (mm <sup>2</sup> /s) | psia                        |
| -137        | -94 | 7.02           | 52.5               | 0.397                | 172.4                | -59.1                        | 0.0725                      | 4230                          | 2080                     | —                           |
| -120        | -84 | 6.97           | 52.1               | 0.405                | 169.2                | -52.2                        | 0.0719                      | 799                           | 396                      | —                           |
| -100        | -73 | 6.90           | 51.6               | 0.415                | 165.6                | -44.0                        | 0.0711                      | 193                           | 96.3                     | —                           |
| -80         | -62 | 6.84           | 51.2               | 0.425                | 162.0                | -35.6                        | 0.0703                      | 68.0                          | 34.3                     | —                           |
| -60         | -51 | 6.78           | 50.7               | 0.435                | 158.5                | -27.0                        | 0.0695                      | 31.1                          | 15.8                     | —                           |
| -40         | -40 | 6.71           | 50.2               | 0.445                | 155.1                | -18.2                        | 0.0686                      | 17.1                          | 8.77                     | —                           |
| -20         | -29 | 6.65           | 49.7               | 0.455                | 151.8                | -9.2                         | 0.0677                      | 10.7                          | 5.53                     | —                           |
| 0           | -18 | 6.59           | 49.3               | 0.465                | 148.5                | 0.0                          | 0.0668                      | 7.30                          | 3.82                     | 0.0002                      |
| 20          | -7  | 6.52           | 48.8               | 0.475                | 145.3                | 9.4                          | 0.0659                      | 5.35                          | 2.83                     | 0.0008                      |
| 40          | 4   | 6.46           | 48.3               | 0.486                | 142.2                | 19.0                         | 0.0649                      | 4.13                          | 2.21                     | 0.0024                      |
| 60          | 16  | 6.39           | 47.8               | 0.496                | 139.1                | 28.8                         | 0.0640                      | 3.30                          | 1.78                     | 0.0063                      |
| 80          | 27  | 6.32           | 47.3               | 0.506                | 136.1                | 38.9                         | 0.0630                      | 2.72                          | 1.49                     | 0.0149                      |
| 100         | 38  | 6.26           | 46.8               | 0.517                | 133.1                | 49.1                         | 0.0620                      | 2.29                          | 1.26                     | 0.0324                      |
| 120         | 49  | 6.19           | 46.3               | 0.527                | 130.2                | 59.5                         | 0.0609                      | 1.96                          | 1.10                     | 0.0656                      |
| 140         | 60  | 6.12           | 45.8               | 0.538                | 127.4                | 70.2                         | 0.0599                      | 1.71                          | 0.961                    | 0.125                       |
| 160         | 71  | 6.05           | 45.3               | 0.549                | 124.6                | 81.1                         | 0.0588                      | 1.50                          | 0.853                    | 0.224                       |
| 180         | 82  | 5.98           | 44.7               | 0.559                | 121.8                | 92.1                         | 0.0577                      | 1.32                          | 0.764                    | 0.384                       |
| 200         | 93  | 5.91           | 44.2               | 0.570                | 119.1                | 103.4                        | 0.0565                      | 1.18                          | 0.689                    | 0.632                       |
| 220         | 104 | 5.83           | 43.6               | 0.581                | 116.4                | 115.0                        | 0.0554                      | 1.06                          | 0.625                    | 1.00                        |
| 240         | 116 | 5.76           | 43.1               | 0.592                | 113.8                | 126.7                        | 0.0542                      | 0.951                         | 0.570                    | 1.53                        |
| 260         | 127 | 5.68           | 42.5               | 0.603                | 111.1                | 138.6                        | 0.0530                      | 0.860                         | 0.522                    | 2.28                        |
| 280         | 138 | 5.61           | 41.9               | 0.614                | 108.5                | 150.8                        | 0.0518                      | 0.780                         | 0.480                    | 3.29                        |
| 300         | 149 | 5.53           | 41.4               | 0.626                | 105.8                | 163.2                        | 0.0505                      | 0.709                         | 0.443                    | 4.65                        |
| 320         | 160 | 5.45           | 40.7               | 0.637                | 103.1                | 175.9                        | 0.0493                      | 0.646                         | 0.409                    | 6.43                        |
| 340         | 171 | 5.36           | 40.1               | 0.649                | 100.4                | 188.7                        | 0.0480                      | 0.591                         | 0.380                    | 8.70                        |
| 360         | 182 | 5.28           | 39.5               | 0.660                | 97.7                 | 201.8                        | 0.0467                      | 0.541                         | 0.353                    | 11.6                        |
| 380         | 193 | 5.19           | 38.8               | 0.672                | 94.9                 | 215.1                        | 0.0453                      | 0.496                         | 0.329                    | 15.1                        |
| 400         | 204 | 5.10           | 38.2               | 0.684                | 92.1                 | 228.7                        | 0.0440                      | 0.455                         | 0.308                    | 19.5                        |
| 420         | 216 | 5.01           | 37.4               | 0.696                | 89.2                 | 242.5                        | 0.0426                      | 0.419                         | 0.289                    | 24.8                        |
| 440         | 227 | 4.91           | 36.7               | 0.709                | 86.1                 | 256.6                        | 0.0412                      | 0.386                         | 0.271                    | 31.1                        |
| 460         | 238 | 4.80           | 35.9               | 0.722                | 83.0                 | 270.9                        | 0.0397                      | 0.356                         | 0.255                    | 38.6                        |
| 480         | 249 | 4.70           | 35.1               | 0.735                | 79.7                 | 285.4                        | 0.0383                      | 0.328                         | 0.241                    | 47.4                        |

## Single-fluid combined cycle heating and cooling systems

Cycling temperatures through a wide temperature range in batch reaction processes (for example, in small industrial or pilot-scale production units) requires a heat transfer fluid with unique characteristics.

In the past, the solution to these problems in combined heating and cooling systems operating over a wide temperature range has been to rely on twin-loop systems with two independent fluids—usually, high-pressure steam for the heating and brine for the cooling loop.

Therminol D-12 offers design and production engineers an unrivaled choice, meeting their demands for efficiency and providing significant overall cost benefits when batch processing fine chemicals and pharmaceutical multipurpose plants.

Therminol D-12 has a number of practical advantages when used as a single fluid in dual-purpose heat transfer systems.

- **Closed-loop systems with wide temperature range**

Therminol D-12 can be used in combined closed-loop systems, providing full heating and cooling capabilities with a single fluid. This is a major advantage when compared with the twin-fluid/twin-loop concept, such as steam/brine or steam/water-glycol.

- **Reliable low-temperature pumpability**

Thermal degradation under operating conditions will not significantly alter the viscosity and pour point of the used fluid. The minimum use temperature of Therminol D-12 ensures that low-temperature pumpability should always remain satisfactory in a well-designed and maintained system.

- **Corrosion inhibitors not needed**

Therminol D-12 heat transfer fluid is noncorrosive to carbon steel and common construction alloys. The need for the addition of costly and sometimes troublesome corrosion inhibitors and in-service monitoring of inhibitors concentration is therefore avoided.

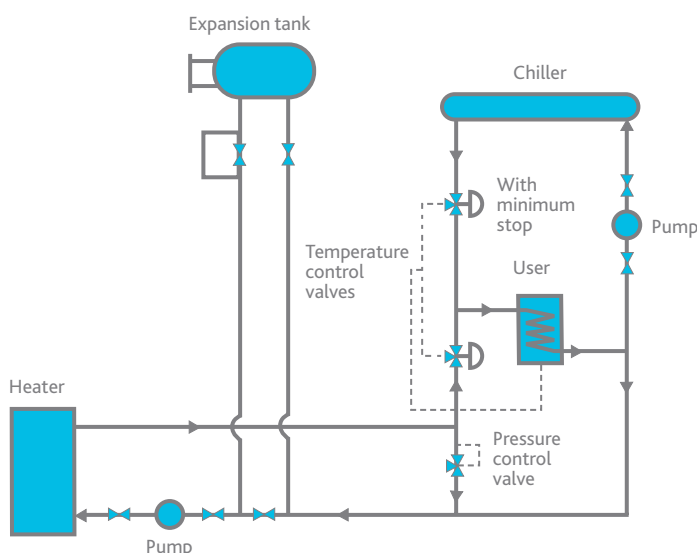
## Typical design—heating and cooling of single user with one fluid

The following figure shows a dual system for heating and cooling, using two separate circulating systems for a common user.

The temperature controller output is connected in a split-range manner to the cold heat transfer fluid control valve. As the output increases from 0% to 55%, the cold-fluid valve closes (with a minimum stop to prevent deadheading the cooling zone pump).

As the output increases from 45% to 100%, the hot-fluid valve opens. The pressure control valve maintains a minimum flow through the heater in all conditions.

Even with the slight overlap in the cold- and hot-fluid valve ranges, this design operates with a minimum of interchange between the two circulating systems.





# TLC Total Lifecycle Care® program

Eastman's TLC Total Lifecycle Care® program is designed to support Therminol customers throughout their systems' life cycle. This comprehensive program includes system design support, start-up assistance, training, sample analysis, flush and refill fluids, and our fluid trade-in program. In North America, call our hotline at 1-800-433-6997 or contact your local sales or technical representative.

## In-service heat transfer fluid sample analysis

When Therminol heat transfer fluids are used within suggested temperature limits, they may provide years of trouble-free service. To help users get maximum life, Eastman offers testing of in-service heat transfer fluids to detect contamination, moisture, thermal degradation, and other conditions that may impact system performance. This comprehensive analysis includes acid number, kinematic viscosity, insoluble solids, low boilers, high boilers, and moisture content. Additional special analyses are available on request. Sample analysis includes sample collection kits that are easy to use. Most systems should be sampled annually. Users should also sample anytime a fluid-related problem is suspected.

## FLUIDGENIUS

Customers can also access their specific test information via our new, advanced heat transfer fluid management tool, Fluid Genius™. Fluidgenius.net is an all-in-one digital platform that gives you the ultimate edge. From sampling kits to expert guidance, our comprehensive service keeps you on track. Our team of experts will reach out shortly to get you up and running on our system so that you can stay up and running on yours.

To conduct your sample analysis, you will be provided with an all-inclusive, easy-to-use sample kit. Kit design may vary depending on fluid and shipping and lab requirements within the region. To learn more and request access to Fluid Genius, visit [fluidgenius.net](http://fluidgenius.net)

## Technical service hotline

Experienced technical service specialists can help answer your questions regarding heat transfer fluid selection, system start-ups, system design, and operational issues.

## System design support

Eastman regularly assists some of the world's largest engineering, chemical, and equipment manufacturing companies on the design and operation of heat transfer systems. Our liquid phase and vapor phase design guide information and system design data have been field tested in numerous installations. Eastman also conducts engineering seminars for customers, engineering firms, and equipment manufacturers to cover a wide range of heat transfer fluid system design and operation issues. Customers can request a technical service visit to audit heat transfer systems for fluid loss and leak prevention opportunities.

## Operational training

Eastman believes that by sharing our experience with customers, we can help improve system design, promote safety, and reduce overall cost. Customers can take advantage of Eastman's heat transfer system operation and product training programs. These programs are customized to suit the varied needs of frontline technicians, operations supervisors, maintenance technicians, and design engineers. Customers can also receive training assistance for dealing with important topics like fluid safety and handling.

## Safety awareness training

At Eastman, we're "All in for Safety." We provide our customers safety awareness training that focuses on the design, start-up, operation, and maintenance of heat transfer fluid systems.

## Start-up assistance

Eastman provides start-up assistance by reviewing procedures and offering suggestions to reduce typical problems. Customers can also receive help by calling their local Eastman technical specialist or through on-site assistance.

For more information, visit [Therminol.com](http://Therminol.com).



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