



THERMINOL[®] D-12

heat transfer fluid

Low-odor, FDA-grade,
NSF-registered
cooling/heating fluid

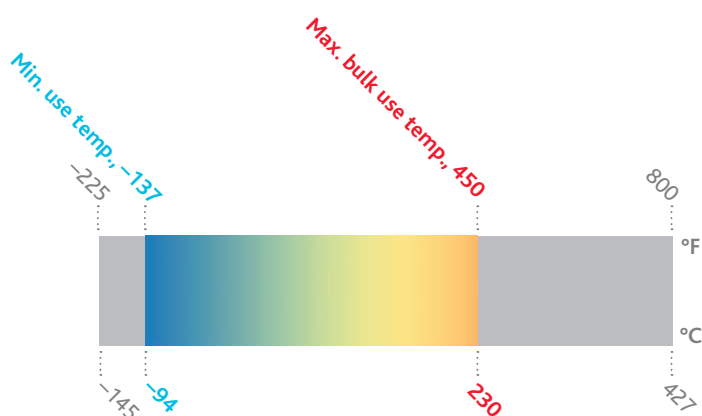
-94° to 230°C
(-137° to 450°F)

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 FDA-grade product is NSF registered with HT1 status, surpassing requirements for use where there is the possibility of incidental food contact. 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.



Nonfood Compounds
Program Listed (HT1)
(130383)

Therminol D-12 has a temperature range of -94° to 190°C (-137° to 374°F) without overpressure or up to 230°C (450°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°C (-50°F). Therminol D-12 remains liquid and is easily pumped at temperatures as low as -94°C (-137°F). Start-up problems often associated with batch-processing systems are eliminated, and steam or electrical tracing is not required.

The recommended maximum bulk and 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 utilizing Therminol D-12 fluid should 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.

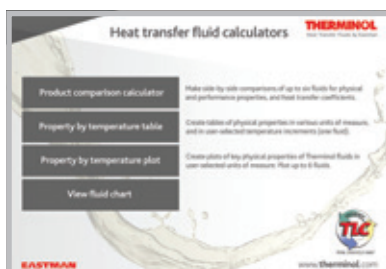
Therminol D-12 is not classified as a fire-resistant heat transfer fluid. Consequently, the use of protective devices may be required to minimize fire risk and users of Therminol D-12 should check with their safety and risk management experts for specific instructions.



Typical properties^a

Appearance	Clear, water-white liquid
Composition	Synthetic hydrocarbons
Maximum bulk temperature	230°C (450°F)
Maximum film temperature	245°C (475°F)
Normal boiling point	192°C (378°F)
Pumpability, at 300 mm ² /s (cSt)	−82°C (−116°F)
Pumpability, at 2000 mm ² /s (cSt)	−94°C (−137°F)
Flash point, PMCC (ASTM D-93)	62°C (144°F)
Autoignition temperature (DIN 51794)	277°C (531°F)
Autoignition temperature (ASTM E-659)	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 D-664)	<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 ³ (14.1 lb/ft ³)
Chlorine content, ppm (DIN 51577)	<10 ppm
Sulfur content, ppm (ASTM D-7691)	<10 ppm
Copper corrosion (ASTM D-130)	<<1a
Moisture content, maximum (ASTM E-203)	80 ppm
Dielectric constant @ 23°C (ASTM D-924)	2.02

^aThese 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

and download the Therminol heat transfer fluid calculator.

**For the technical service contact in your region,
visit the CONTACT US page on our website, www.therminol.com.**

Liquid properties of Therminol® D-12 heat transfer fluid by temperature^a (SI units)

Temperature		Liquid density	Liquid heat capacity	Heat of vaporization	Liquid enthalpy ^b	Liquid thermal conductivity	Liquid viscosity ^c		Vapor pressure ^d
°C	°F	kg/m ³	kJ/(kg·K)	kJ/kg	kJ/kg	W/(m·K)	cP (mPa·s)	cSt (mm ² /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

^aMaximum 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. ^bLiquid enthalpy basis is -17.8°C (0°F). ^c1 cSt = 1 mm²/s and 1 mPa·s = 1 cP. ^d100 kPa = 1 bar

Liquid properties of Therminol® D-12 heat transfer fluid by temperature^a (English units)

Temperature		Liquid density		Liquid heat capacity	Heat of vaporization	Liquid enthalpy ^b	Liquid thermal conductivity	Liquid viscosity ^c		Vapor pressure ^d
°F	°C	lb/gal	lb/ft³	Btu/(lb·°F)	Btu/lb	Btu/lb	Btu/(ft·h·°F)	lb/(ft·h)	cSt (mm²/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 alloys of construction. The need for the addition of costly and sometimes troublesome corrosion inhibitors and in-service monitoring of inhibitors concentration is therefore avoided.

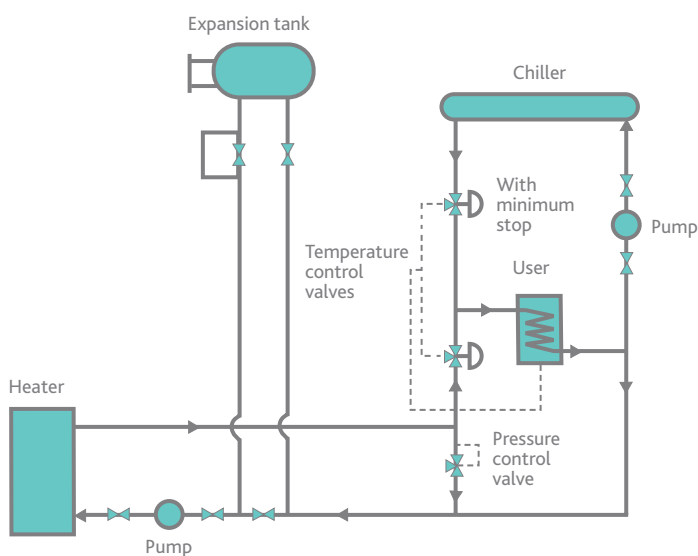
Typical design—heating and cooling of single user with one fluid

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

Our TLC Total Lifecycle Care program is designed to support Therminol heat transfer fluid customers throughout their systems' lifecycle. This comprehensive program includes system design support, start-up assistance, training, sample analysis, flush and refill fluids, and more. In North America, call our hotline at 1-800-433-6997 or contact your local sales or technical representative found in the "Contact us" section of our website.



In-service heat transfer fluid sample analysis

To help users get maximum fluid life, Eastman offers testing of in-service heat transfer fluids to detect contamination, moisture, thermal degradation, and other conditions that may impact system performance. Customers can access their specific test information via the myTherminol site portal. Sample analysis includes all-inclusive sample kits that are easy to use.

myTHERMINOL

Results of the test are presented in a detailed report that provides suggestions for corrective action. Test results are stored in a database for future reference. Customers can access their specific test information via my.therminol.com.

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.

Operational training

Eastman customers can take advantage of our heat transfer system operation and product training programs. These programs are customized to suit the varied needs of front-line technicians, operations supervisors, and maintenance technicians to design engineers.

Safety awareness training

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 or to find the sales or technical contact nearest you, visit the "Contact us" page on our website:
www.therminol.com.

North America
Solutia Inc.
A subsidiary of Eastman Chemical Company
575 Maryville Centre Drive
St. Louis, MO 63141 U.S.A.
Telephone:
Customer Service, 800-426-2463
Technical Service, 800-433-6997
Fax: Customer Service, (1) 314-674-7433

Latin America
Solutia Brasil Ltda.
A subsidiary of Eastman Chemical Company
Rua Alexandre Dumas, 1711—Birmann 12—
7º Andar 04717-004
São Paulo, SP, Brazil
Telephone:
Brazil, 0800 55 9989
Other Locations, +55 11 3579 1800
Fax: +55 11 3579 1833

Europe/Middle East/Africa
Solutia Europe SPRL/BVBA
A subsidiary of Eastman Chemical Company
Corporate Village—Aramis Building
Leonardo Da Vincilaan 1
1935 Zaventem, Belgium
Telephone: +32 2 746 5000
Fax: +32 2 746 5700

Asia Pacific
Eastman (Shanghai) Chemical
Commercial Company Ltd.
Building 3, Yaxin Science & Technology Park
Lane 399 Shengxia Road
Pudong New District
201210, Shanghai, P.R. China
Telephone: +86 21 6120 8700
Fax: +86 21 5027 9229



Eastman Chemical Company
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

Although the information and recommendations set forth herein are presented in good faith, Eastman Chemical Company and its subsidiaries make no representations or warranties as to the completeness or accuracy thereof. You must make your own determination of its suitability and completeness for your own use, for the protection of the environment, and for the health and safety of your employees and purchasers of your products. Nothing contained herein is to be construed as a recommendation to use any product, process, equipment, or formulation in conflict with any patent, and we make no representations or warranties, express or implied, that the use thereof will not infringe any patent. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS AND NOTHING HEREIN WAIVES ANY OF THE SELLER'S CONDITIONS OF SALE.

Safety Data Sheets providing safety precautions that should be observed when handling and storing our products are available online or by request. You should obtain and review available material safety information before handling our products. If any materials mentioned are not our products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

© 2016 Eastman Chemical Company. Eastman brands referenced herein are trademarks of Eastman Chemical Company or one of its subsidiaries. The ® used on Eastman brands denotes registered trademark status in the U.S.; marks may also be registered internationally. Non-Eastman brands referenced herein are trademarks of their respective owners.