

MARLOTHERM® LH

heat transfer fluid

Wide-temperature-range fluid
for heating and cooling

-30° to 330°C
(-20° to 625°F)

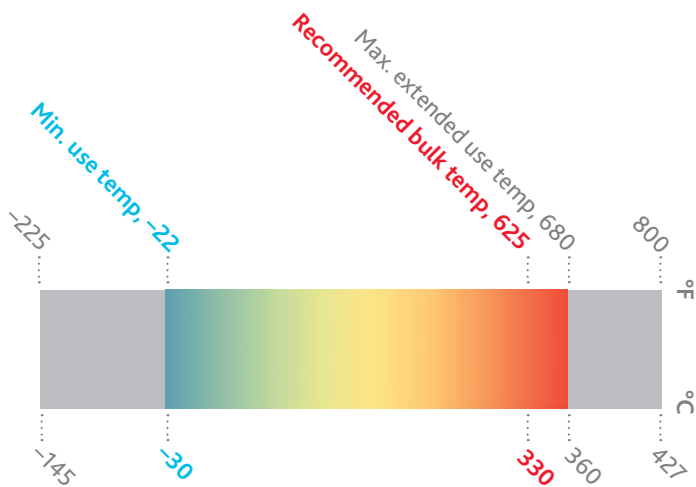
Max. extended use temp.: 360°C (680°F)

MARLOTHERM

Heat transfer fluids by Eastman

MARLOTHERM[®] LH

heat transfer fluid



Eastman Marlotherm[®] LH heat transfer fluid is a low-viscosity, synthetic organic heat transfer medium for use in both the liquid and vapor phase for closed, forced-circulation heat transfer systems.

Marlotherm LH is available globally. Contact your local Eastman sales representative for more information.

Physical and chemical characteristics

The recommended bulk (330°C [625°F]) and maximum film (380°C [715°F]) temperatures are based on industry-standard thermal studies. With this recommended bulk temperature, the stability of the fluid will enable several years of operation without fluid exchange in well-designed and maintained systems. The maximum extended use temperature would still be suitable for operating the fluid but with a significantly reduced lifetime. Marlotherm LH heat transfer fluid offers outstanding performance and thermal stability at 330°C (625°F), which results in reliable, consistent performance over a long period of time. While there are industry standards for measuring the thermal stability of heat transfer fluids, there is no established standard for deriving a recommended maximum temperature limit.*

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 Marlotherm LH 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. Marlotherm LH is noncorrosive to metals commonly used in the construction of heat transfer systems.

While Marlotherm LH has a relatively high flash point, it 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 Marlotherm LH should check with their safety and risk management experts for specific instructions. To ensure optimal fluid life in use, annual fluid sampling and analysis is recommended for all heat transfer fluid systems.

*DIN 4754 stipulates that the supplier shall indicate the permissible feed temperature "at which the heat transfer medium will remain for use for at least one year." However, an exchange of the fluid after only a year of operation isn't economical, and increased maintenance is expected once the fluid reaches the end of its service life. Therefore, the maximum operating temperature should be recommended at a level that usually allows the user to operate the fluid permanently for several years.

Typical properties^a


Appearance	Clear liquid
Composition	Benzyltoluene
Recommended bulk temperature	330°C (625°F)
Maximum extended use temperature	360°C (680°F)
Maximum film temperature	380°C (715°F)
Normal boiling point	278°C (532°F)
Pumpability, at 300 mm ² /s (cSt)	-67°C (-88°F) ^b
Pumpability, at 2000 mm ² /s (cSt)	<-70°C (<-94°F) ^b
Crystallizing point ^c	-30°C (-22°F)
Flash point, COC (ASTM D92)	132°C (270°F)
Autoignition temperature (ASTM E659)	473°C (883°F)
Autoignition temperature (DIN 51794)	510°C (950°F)
Pour point (ASTM D97)	-79°C (-110°F)
Minimum liquid temperatures for fully developed turbulent flow ($N_{Re} > 10,000$)	
10 ft/sec, 1-in. tube (3.048 m/s, 2.54-cm tube)	1°C (34°F)
20 ft/sec, 1-in. tube (6.096 m/s, 2.54-cm tube)	-17°C (1.4°F)
Minimum liquid temperatures for transitional region flow ($N_{Re} > 2000$)	
10 ft/sec, 1-in. tube (3.048 m/s, 2.54-cm tube)	-37°C (-35°F)
20 ft/sec, 1-in. tube (6.096 m/s, 2.54-cm tube)	-48°C (-54°F)
Heat of vaporization at 360°C	259 kJ/kg (111 Btu/lb)
Coefficient of thermal expansion @ 200°C	0.000981/°C (0.000545/°F)
Kinematic viscosity at 100°C (ASTM D445)	1.08 mm ² /s (cSt)
Kinematic viscosity at 40°C (ASTM D445)	2.78 mm ² /s (cSt)
Average molecular weight	182.3
Pseudocritical temperature	499°C (930°F)
Pseudocritical pressure	35.2 bar (510 psia)
Pseudocritical density	336.7 kg/m ³ (21.02 lb/ft ³)
Liquid density at 25°C (ASTM D4052)	992 kg/m ³ (8.28 lb/gal)
Copper corrosion (ASTM D130)	1a
Moisture content, maximum (ASTM E203)	300 ppm
Dielectric constant @ 23°C (ASTM D924)	2.7

^aThese data are based on samples tested in the laboratory and are not guaranteed for all samples. Contact us for complete sales specifications for Marlotherm LH fluid. Does not constitute an express warranty. See disclaimer on the back page of this bulletin. ^bOperation at temperatures below -30°C (-22°F) is not advised due to the potential formation and effects of crystals at lower temperatures. ^cTemperature at which initial crystals may form

Heat transfer fluid calculators

THERMINOL
Heat transfer fluids by Eastman

- Product comparison calculator** - Make side-by-side comparisons of up to six fluids for physical and performance properties, and heat transfer coefficients.
- Property by temperature table** - Create tables of physical properties in various units of measure, and in user-selected temperature increments (see fluid).
- Property by temperature plot** - Create plots of key physical properties of Therminol fluids in user-selected units of measure. Plot up to 6 fluids.
- View fluid chart**


Total Heat Transfer Coefficient

To create your own customized table

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

Therminol.com/resources

and download the Therminol heat transfer fluid calculator.

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

Liquid properties of Marlotherm® LH heat transfer fluid by temperature^a (SI UNITS)

Temperature		Liquid density	Liquid heat capacity	Liquid enthalpy ^b	Heat of vaporization	Liquid thermal conductivity	Liquid viscosity ^c		Vapor pressure ^d
°C	°F	kg/m ³	kJ/(kg-K)	kJ/kg	kJ/kg	W/(m-K)	cSt (mm ² /s)	cP (mPa-s)	kPa
-30	-22	1032	1.43	-17.8	501	0.137	27.0	27.9	—
-20	-4	1025	1.47	-3.28	495	0.136	17.0	17.4	—
-10	14	1018	1.51	11.6	489	0.135	11.4	11.6	—
0	32	1010	1.54	26.8	483	0.134	7.99	8.08	—
10	50	1003	1.58	42.4	477	0.133	5.85	5.87	—
20	68	996	1.61	58.3	470	0.132	4.44	4.42	—
30	86	988	1.64	74.6	464	0.130	3.47	3.43	—
40	104	981	1.68	91.2	458	0.129	2.78	2.73	—
50	122	973	1.71	108	452	0.128	2.28	2.22	0.01
60	140	966	1.75	125	446	0.127	1.90	1.84	0.02
70	158	958	1.78	143	440	0.126	1.62	1.55	0.04
80	176	951	1.82	161	435	0.125	1.40	1.33	0.07
90	194	943	1.85	179	429	0.124	1.22	1.15	0.13
100	212	936	1.88	198	423	0.122	1.08	1.01	0.22
110	230	928	1.92	217	417	0.121	0.96	0.89	0.37
120	248	920	1.95	236	411	0.120	0.87	0.80	0.60
130	266	913	1.99	256	405	0.119	0.79	0.72	0.96
140	284	905	2.02	276	399	0.118	0.72	0.65	1.48
150	302	897	2.05	297	394	0.117	0.66	0.59	2.24
160	320	889	2.09	317	388	0.116	0.61	0.55	3.31
170	338	881	2.12	338	382	0.114	0.57	0.50	4.80
180	356	873	2.15	360	376	0.113	0.53	0.47	6.83
190	374	864	2.19	381	370	0.112	0.50	0.43	9.55
200	392	856	2.22	403	364	0.111	0.47	0.40	13.1
210	410	848	2.25	426	359	0.110	0.45	0.38	17.8
220	428	839	2.29	448	353	0.109	0.42	0.36	23.8
230	446	831	2.32	471	347	0.107	0.40	0.33	31.4
240	464	822	2.35	495	340	0.106	0.38	0.32	41.0
250	482	813	2.38	518	334	0.105	0.37	0.30	52.8
260	500	804	2.42	543	328	0.104	0.35	0.28	67.3
270	518	795	2.45	567	322	0.103	0.34	0.27	85.0
280	536	786	2.48	592	315	0.102	0.33	0.26	106
290	554	776	2.52	617	309	0.100	0.31	0.24	132
300	572	767	2.55	642	302	0.099	0.30	0.23	162
310	590	757	2.59	668	295	0.098	0.29	0.22	198
320	608	747	2.62	694	288	0.097	0.29	0.21	239
330	626	736	2.65	720	281	0.096	0.28	0.20	288
340	644	726	2.69	747	274	0.095	0.27	0.20	344
350	662	715	2.72	774	267	0.093	0.26	0.19	408
360	680	703	2.76	801	259	0.092	0.26	0.18	481

^aRecommended bulk temperature 330°C (625°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 Marlotherm 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 Marlotherm LH 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
°F	°C	lb/gal	lb/ft ³	Btu/(lb·°F)	Btu/lb	Btu/lb	Btu/(ft·h·°F)	lb/(ft·h)	cSt (mm ² /s)	psia
-20	-29	8.61	64.4	0.344	215	-6.97	0.0793	63.8	25.6	—
0	-18	8.54	63.9	0.353	212	0.0	0.0785	38.4	15.5	—
20	-7	8.47	63.4	0.363	209	7.16	0.0778	24.7	10.1	—
40	4	8.41	62.9	0.372	206	14.5	0.0771	16.9	6.93	—
60	16	8.34	62.4	0.381	204	22.0	0.0764	12.1	5.00	—
80	27	8.27	61.9	0.390	201	29.7	0.0756	8.99	3.75	—
100	38	8.20	61.3	0.399	198	37.6	0.0749	6.92	2.91	—
120	49	8.13	60.8	0.409	195	45.7	0.0742	5.48	2.33	0.001
140	60	8.06	60.3	0.418	192	54.0	0.0734	4.45	1.90	0.003
160	71	7.99	59.8	0.427	189	62.4	0.0727	3.69	1.59	0.006
180	82	7.92	59.3	0.436	186	71.1	0.0720	3.11	1.35	0.011
200	93	7.85	58.7	0.445	184	79.9	0.0712	2.66	1.17	0.022
220	104	7.78	58.2	0.454	181	88.9	0.0705	2.31	1.02	0.040
240	116	7.71	57.7	0.463	178	98.0	0.0697	2.03	0.91	0.070
260	127	7.64	57.1	0.472	175	107	0.0690	1.80	0.81	0.12
280	138	7.56	56.6	0.481	172	117	0.0683	1.61	0.73	0.20
300	149	7.49	56.0	0.490	170	127	0.0675	1.45	0.67	0.31
320	160	7.42	55.5	0.499	167	136	0.0668	1.32	0.61	0.48
340	171	7.34	54.9	0.507	164	147	0.0660	1.21	0.57	0.73
360	182	7.27	54.4	0.516	161	157	0.0653	1.11	0.53	1.07
380	193	7.19	53.8	0.525	158	167	0.0646	1.02	0.49	1.54
400	204	7.11	53.2	0.534	156	178	0.0638	0.95	0.46	2.19
420	216	7.04	52.6	0.543	153	189	0.0631	0.88	0.43	3.04
440	227	6.96	52.0	0.552	150	200	0.0623	0.82	0.41	4.16
460	238	6.88	51.4	0.560	147	211	0.0616	0.77	0.39	5.61
480	249	6.79	50.8	0.569	144	222	0.0608	0.73	0.37	7.45
500	260	6.71	50.2	0.578	141	233	0.0601	0.68	0.35	9.76
520	271	6.63	49.6	0.587	138	245	0.0594	0.65	0.34	12.6
540	282	6.54	48.9	0.596	135	257	0.0586	0.61	0.32	16.2
560	293	6.45	48.3	0.604	132	269	0.0579	0.58	0.31	20.5
580	304	6.36	47.6	0.613	129	281	0.0571	0.55	0.30	25.7
600	316	6.27	46.9	0.622	125	293	0.0564	0.53	0.29	31.9
620	327	6.17	46.2	0.631	122	306	0.0556	0.50	0.28	39.3
640	338	6.08	45.4	0.641	119	319	0.0549	0.48	0.27	47.9
660	349	5.97	44.7	0.650	115	332	0.0541	0.46	0.26	58.0
680	360	5.87	43.9	0.660	111	345	0.0534	0.44	0.26	69.8

^aRecommended bulk temperature 330°C (625°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 Marlotherm fluid. ^bLiquid enthalpy basis is -17.8°C (0°F). ^c1 cSt = 1 mm²/s and 1 mPa·s = 1 cP.

Vapor properties of Marlotherm LH heat transfer fluid by temperature^a (SI UNITS)

Temperature		Vapor density	Vapor heat capacity	Vapor enthalpy ^b	Vapor thermal conductivity	Vapor viscosity ^c	
°C	°F	kg/m ³	kJ/(kg·K)	kJ/kg	W/(m·K)	cP (mPa·s)	cSt (mm ² /s)
0	32	0.00001	0.924	509	0.0117	0.0055	—
10	50	0.00002	0.963	519	0.0120	0.0057	—
20	68	0.00005	1.00	529	0.0123	0.0059	—
30	86	0.00012	1.04	539	0.0126	0.0061	—
40	104	0.00028	1.08	550	0.0130	0.0063	—
50	122	0.00060	1.12	560	0.0133	0.0065	—
60	140	0.00122	1.15	572	0.0137	0.0067	5494
70	158	0.00234	1.19	584	0.0140	0.0069	2949
80	176	0.00429	1.23	596	0.0144	0.0071	1655
90	194	0.00756	1.26	608	0.0148	0.0073	967
100	212	0.0128	1.30	621	0.0152	0.0075	585
110	230	0.0211	1.34	634	0.0157	0.0077	366
120	248	0.0336	1.37	648	0.0161	0.0079	236
130	266	0.0521	1.41	661	0.0165	0.0081	156
140	284	0.0787	1.44	676	0.0170	0.0083	106
150	302	0.116	1.47	690	0.0175	0.0085	73.6
160	320	0.168	1.51	705	0.0179	0.0088	52.1
170	338	0.238	1.54	720	0.0184	0.0090	37.7
180	356	0.331	1.57	736	0.0189	0.0092	27.7
190	374	0.454	1.60	752	0.0195	0.0094	20.7
200	392	0.612	1.64	768	0.0200	0.0096	15.7
210	410	0.813	1.67	784	0.0205	0.0098	12.0
220	428	1.07	1.70	801	0.0211	0.0100	9.38
230	446	1.38	1.73	818	0.0217	0.0102	7.39
240	464	1.77	1.76	835	0.0222	0.0104	5.88
250	482	2.25	1.79	853	0.0228	0.0106	4.73
260	500	2.82	1.81	871	0.0234	0.0108	3.85
270	518	3.51	1.84	889	0.0240	0.0110	3.15
280	536	4.33	1.87	907	0.0247	0.0113	2.60
290	554	5.30	1.90	925	0.0253	0.0115	2.16
300	572	6.43	1.92	944	0.0259	0.0117	1.81
310	590	7.76	1.95	963	0.0266	0.0119	1.53
320	608	9.31	1.97	982	0.0273	0.0121	1.30
330	626	11.1	2.00	1001	0.0280	0.0123	1.11
340	644	13.2	2.02	1021	0.0287	0.0125	0.949
350	662	15.5	2.04	1040	0.0294	0.0127	0.817
360	680	18.3	2.07	1060	0.0301	0.0129	0.706
370	698	21.4	2.09	1080	0.0308	0.0131	0.613

^aRecommended bulk temperature of 330°C (625°F). Vapor properties are given for saturated vapor. These data are based on samples analyzed in the laboratory and are not guaranteed for all lots. Contact us for complete sales specifications. ^bEnthalpy basis is liquid at -17.8°C (0°F). ^c1cSt = 1 mm²/s and 1 mPa·s = 1 cP.

Vapor properties of Marlotherm LH heat transfer fluid by temperature^a (ENGLISH UNITS)

Temperature		Vapor density	Vapor heat capacity	Vapor enthalpy ^b	Vapor thermal conductivity	Vapor viscosity ^c	
°F	°C	lb/ft ³	Btu/(lb·°F)	Btu/lb	W/(m·K)	lb/(ft·h)	cP (mPa·s)
40	4	0.000001	0.225	221	0.0068	0.0135	0.0056
60	16	0.000002	0.235	226	0.0070	0.0140	0.0058
80	27	0.00001	0.245	230	0.0072	0.0146	0.0060
100	38	0.00001	0.256	235	0.0074	0.0151	0.0062
120	49	0.00003	0.266	241	0.0077	0.0156	0.0065
140	60	0.00008	0.276	246	0.0079	0.0162	0.0067
160	71	0.0002	0.285	252	0.0081	0.0167	0.0069
180	82	0.0003	0.295	257	0.0084	0.0173	0.0071
200	93	0.0006	0.305	263	0.0086	0.0178	0.0074
220	104	0.0010	0.314	270	0.0089	0.0184	0.0076
240	116	0.0017	0.324	276	0.0092	0.0189	0.0078
260	127	0.0028	0.333	283	0.0095	0.0195	0.0081
280	138	0.0045	0.342	289	0.0098	0.0201	0.0083
300	149	0.0070	0.351	296	0.0101	0.0206	0.0085
320	160	0.0105	0.360	303	0.0104	0.0212	0.0088
340	171	0.0154	0.369	311	0.0107	0.0217	0.0090
360	182	0.0222	0.378	318	0.0110	0.0223	0.0092
380	193	0.0314	0.386	326	0.0114	0.0229	0.0095
400	204	0.0434	0.394	333	0.0117	0.0234	0.0097
420	216	0.0591	0.403	341	0.0120	0.0240	0.0099
440	227	0.0793	0.411	349	0.0124	0.0245	0.0101
460	238	0.105	0.419	358	0.0128	0.0251	0.0104
480	249	0.137	0.426	366	0.0132	0.0257	0.0106
500	260	0.176	0.434	375	0.0135	0.0262	0.0108
520	271	0.224	0.441	383	0.0139	0.0268	0.0111
540	282	0.283	0.448	392	0.0143	0.0273	0.0113
560	293	0.353	0.455	401	0.0147	0.0279	0.0115
580	304	0.437	0.462	410	0.0152	0.0285	0.0118
600	316	0.537	0.469	419	0.0156	0.0290	0.0120
620	327	0.654	0.476	428	0.0160	0.0296	0.0122
640	338	0.792	0.482	437	0.0165	0.0301	0.0124
660	349	0.953	0.488	447	0.0169	0.0307	0.0127
680	360	1.140	0.494	456	0.0174	0.0312	0.0129

^aRecommended bulk temperature of 330°C (625°F). Vapor properties are given for saturated vapor. These data are based on samples analyzed in the laboratory and are not guaranteed for all lots. Contact us for complete sales specifications. ^bEnthalpy basis is liquid at -17.8°C (0°F). ^c1cSt = 1 mm²/s and 1 mPa·s = 1 cP.



TLC Total Lifecycle Care[®] program

Eastman's TLC Total Lifecycle Care[®] program is designed to support Marlotherm 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-service heat transfer fluid sample analysis—When Marlotherm 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.

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 answer your questions regarding heat transfer fluid selection, system start-ups, system design, and operational issues. For questions in North America, call 800-433-6997. For questions in other regions, contact your local technical support representative.

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.

Flushing fluid and fluid refill—Liquid phase heat transfer systems can be cleaned with special cleaning fluids. After the system is flushed, the appropriate liquid phase Marlotherm heat transfer fluid can be added. For cleaning options, contact your local Eastman heat transfer fluid specialist.

Eastman's fluid sustainability support*—As part of our commitment to sustainability and the environment, Eastman offers a trade-in program for used Marlotherm and competitive heat transfer fluids. Depending on the fluid and its condition, it may be turned in for potential credit toward the purchase of new Marlotherm heat transfer fluid.

*Marlotherm reclamation service is only offered at our Germany location.

For more information, visit Marlotherm.com.

EASTMAN

The results of insight[™]

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