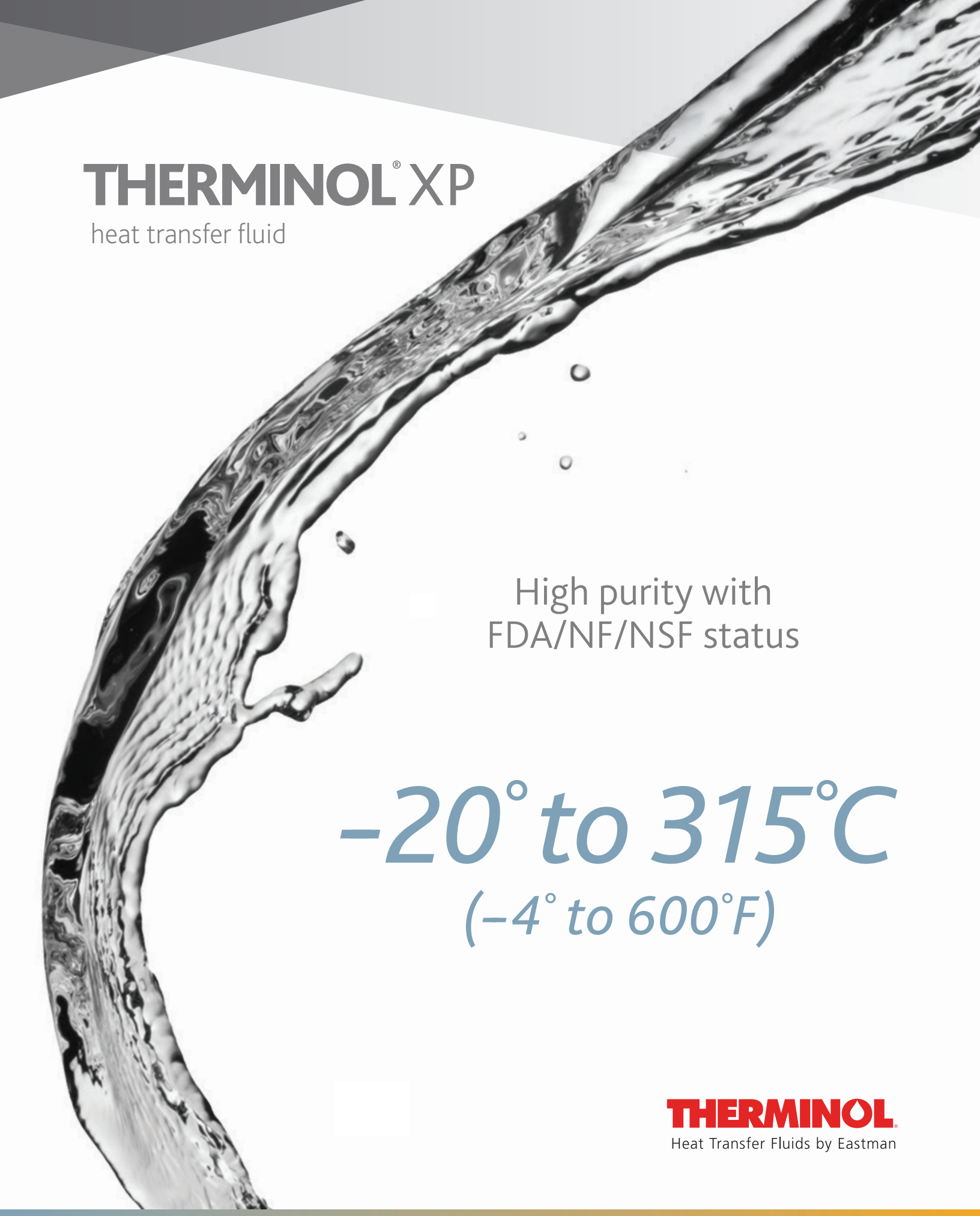
THERMINOL® XP

heat transfer fluid



High purity with
FDA/NF/NSF status

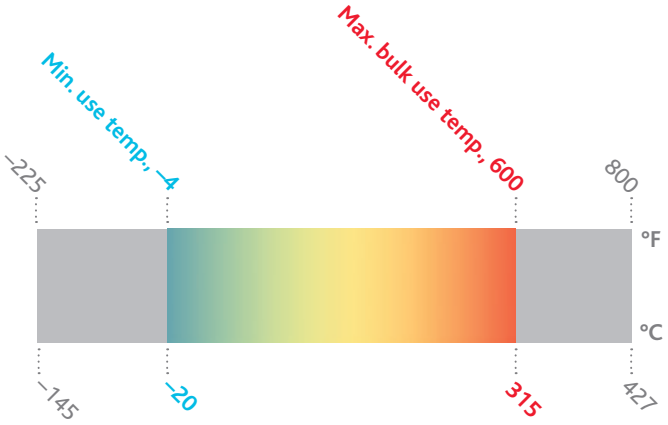
–20°C to 315°C

(–4°F to 600°F)

THERMINOL®
Heat Transfer Fluids by Eastman

THERMINOL® XP

heat transfer fluid



Eastman Therminol® XP heat transfer fluid is an extremely pure white mineral oil which provides low toxicity and reliable heat transfer at moderate temperatures. When operating temperatures prohibit the use of steam or steam is not readily available, Therminol XP can provide safe and efficient operation in heat transfer systems.

Therminol XP is available globally. Contact your local Eastman Therminol sales representative for more information.

Physical and chemical characteristics

Therminol XP has outstanding regulatory status for those seeking heat transfer fluids which have minimum environmental reporting requirements:

- Meets the purity specifications in U.S. Food and Drug Administration Regulation 21 CFR 172.878
- Meets the requirements of National Formulary (NF)
- Listed as a registered nonfood compound by NSF International (Category Code HT-1: Heat transfer fluids—Incidental contact)

NSF

Nonfood Compounds Program Listed (HT1) (127162)

Heat transfer fluids are intended only for indirect heating purposes. Under no circumstances should Therminol XP come into contact or in any way contaminate food, animal feed, food products, food packaging materials, food chemicals, pharmaceuticals, or any items which ultimately may be directly or indirectly ingested by humans. Any contact may contaminate these items to the extent that their destruction may be required. Carefully review the information contained in a properly prepared Safety Data Sheet prior to making a fluid decision.

The recommended maximum bulk and film temperatures for Therminol XP 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 XP 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.

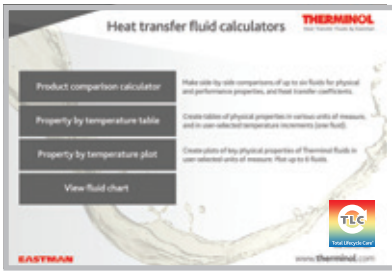
Therminol XP is noncorrosive to metals commonly used in the construction of heat transfer systems.

While Therminol XP 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 Therminol XP should check with their safety and risk management experts for specific instructions.

Typical properties[a]

Appearance	Colorless, odorless liquid
Composition	White mineral oil
Maximum bulk temperature	315°C (600°F)
Maximum film temperature	330°C (625°F)
Normal boiling point	358°C (676°F)
Pumpability, at 300 mm^2/s (cSt)	–1°C (30°F)
Pumpability, at 2000 mm^2/s (cSt)	–20°C (–4°F)
Flash point, COC (ASTM D-92)	199°C (390°F)
Autoignition temperature (ASTM E-659)	346°C (655°F)
Pour point (ISO 3016)	–29°C (–20°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)	72°C (162°F)
20 ft/s, 1-in. tube (6.096 m/s, 2.54-cm tube)	51°C (123°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)	30°C (85°F)
20 ft/s, 1-in. tube (6.096 m/s, 2.54-cm tube)	17°C (63°F)
Coefficient of thermal expansion at 200°C	0.000892/°C (0.000495/°F)
Heat of vaporization at maximum use temperature	214 kJ/kg (91.9 Btu/lb)
Average molecular weight	350
Pseudocritical temperature	542°C (1007°F)
Pseudocritical pressure	15.2 bar (220 psia)
Pseudocritical density	280 kg/m^3 (17.5 lb/ft^3)
Dielectric constant @ 23°C (ASTM D-924)	2.14

[a]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 XP 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
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® XP 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/m³	kJ/(kg·K)	kJ/kg	kJ/kg	W/(m·K)	cP (mPa·s)	cSt (mm²/s)	kPa
–20	–4	904	1.62	443.9	–3.6	0.1180	1840	2030	—
–10	14	897	1.67	437.5	12.8	0.1174	601	670	—
0	32	891	1.72	431.1	29.7	0.1168	238	267	—
10	50	885	1.77	424.6	47.2	0.1161	110	124	—
20	68	878	1.82	418.1	65.1	0.1155	57.3	65.2	—
30	86	872	1.86	411.5	83.5	0.1148	32.9	37.8	—
40	104	866	1.91	404.9	102.3	0.1141	20.5	23.7	—
50	122	859	1.96	398.3	121.7	0.1133	13.6	15.9	—
60	140	853	2.00	391.6	141.5	0.1125	9.56	11.2	—
70	158	847	2.05	384.9	161.8	0.1118	7.01	8.28	—
80	176	840	2.10	378.2	182.5	0.1109	5.33	6.34	—
90	194	834	2.14	371.5	203.7	0.1101	4.18	5.01	0.01
100	212	827	2.18	364.7	225.3	0.1093	3.36	4.06	0.02
110	230	821	2.23	357.9	247.4	0.1084	2.76	3.37	0.03
120	248	814	2.27	351.1	269.9	0.1075	2.31	2.84	0.05
130	266	808	2.31	344.2	292.8	0.1065	1.97	2.44	0.09
140	284	801	2.36	337.4	316.2	0.1056	1.70	2.12	0.15
150	302	795	2.40	330.5	340.0	0.1046	1.48	1.86	0.24
160	320	788	2.44	323.6	364.1	0.1036	1.30	1.65	0.36
170	338	782	2.48	316.7	388.7	0.1025	1.15	1.48	0.55
180	356	775	2.52	309.8	413.7	0.1015	1.03	1.33	0.82
190	374	768	2.56	302.8	439.1	0.1004	0.929	1.21	1.19
200	392	761	2.60	295.8	464.9	0.0993	0.841	1.10	1.71
210	410	755	2.63	288.8	491.0	0.0982	0.764	1.01	2.41
220	428	748	2.67	281.8	517.6	0.0970	0.698	0.933	3.35
230	446	741	2.71	274.8	544.5	0.0959	0.640	0.863	4.58
240	464	734	2.75	267.7	571.8	0.0947	0.588	0.801	6.20
250	482	727	2.78	260.6	599.4	0.0934	0.542	0.746	8.27
260	500	720	2.82	253.5	627.4	0.0922	0.502	0.697	10.9
270	518	712	2.85	246.3	655.7	0.0909	0.465	0.653	14.2
280	536	705	2.89	239.2	684.4	0.0896	0.432	0.613	18.4
290	554	698	2.92	231.9	713.5	0.0883	0.402	0.576	23.6
300	572	690	2.95	224.7	742.8	0.0869	0.375	0.543	29.9
310	590	682	2.99	217.4	772.5	0.0856	0.350	0.513	37.5
320	608	675	3.02	210.1	802.5	0.0842	0.327	0.485	46.8
330	626	667	3.05	202.7	832.9	0.0828	0.306	0.459	57.9

[a]Maximum recommended bulk temperature 315°C (600°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 XP fluid. [b]Liquid enthalpy basis is –17.8°C (0°F). [c]1 cSt = 1 mm²/s and 1 mPa•s = 1 cP. [d]100 kPa = 1 bar.

Liquid properties of Therminol® XP 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
–4	–20	7.54	56.4	0.387	191.0	–1.6	0.0682	4443	2032	—
0	–18	7.53	56.3	0.389	190.4	0.0	0.0681	3400	1560	—
20	–7	7.47	55.9	0.403	187.3	7.9	0.0678	1050	484	—
40	4	7.41	55.4	0.416	184.2	16.1	0.0673	402	187	—
60	16	7.35	55.0	0.429	181.1	24.5	0.0669	183	85.7	—
80	27	7.29	54.6	0.442	178.0	33.2	0.0665	94.9	44.9	—
100	38	7.24	54.1	0.454	174.8	42.2	0.0660	54.8	26.1	—
120	49	7.18	53.7	0.467	171.7	51.4	0.0656	34.4	16.5	—
140	60	7.12	53.2	0.479	168.5	60.9	0.0651	23.1	11.2	—
160	71	7.06	52.8	0.491	165.3	70.6	0.0646	16.4	8.02	—
180	82	7.00	52.4	0.503	162.1	80.5	0.0640	12.2	6.01	—
200	93	6.94	51.9	0.515	158.8	90.7	0.0635	9.38	4.66	0.0018
220	104	6.88	51.5	0.527	155.6	101.1	0.0629	7.43	3.73	0.0034
240	116	6.82	51.0	0.538	152.3	111.8	0.0624	6.04	3.06	0.0063
260	127	6.76	50.6	0.550	149.1	122.7	0.0618	5.02	2.56	0.0112
280	138	6.70	50.1	0.561	145.8	133.8	0.0612	4.23	2.18	0.0194
300	149	6.64	49.7	0.572	142.5	145.1	0.0605	3.63	1.89	0.0325
320	160	6.58	49.2	0.583	139.2	156.7	0.0599	3.15	1.65	0.0528
340	171	6.52	48.7	0.594	135.9	168.4	0.0592	2.76	1.46	0.0837
360	182	6.45	48.3	0.604	132.6	180.4	0.0585	2.44	1.30	0.129
380	193	6.39	47.8	0.614	129.3	192.6	0.0578	2.17	1.17	0.195
400	204	6.33	47.3	0.625	125.9	205.0	0.0571	1.95	1.06	0.289
420	216	6.27	46.9	0.635	122.6	217.6	0.0564	1.76	0.967	0.420
440	227	6.20	46.4	0.645	119.2	230.4	0.0556	1.59	0.886	0.600
460	238	6.14	45.9	0.654	115.8	243.4	0.0549	1.45	0.815	0.841
480	249	6.07	45.4	0.664	112.5	256.5	0.0541	1.32	0.752	1.16
500	260	6.01	44.9	0.673	109.1	269.9	0.0533	1.21	0.697	1.58
520	271	5.94	44.4	0.683	105.6	283.5	0.0525	1.12	0.648	2.13
540	282	5.87	43.9	0.692	102.2	297.2	0.0516	1.03	0.604	2.82
560	293	5.80	43.4	0.701	98.7	311.1	0.0508	0.950	0.565	3.70
580	304	5.73	42.9	0.709	95.3	325.2	0.0499	0.879	0.529	4.80
600	316	5.66	42.3	0.718	91.8	339.5	0.0490	0.815	0.497	6.16
620	327	5.58	41.8	0.726	88.3	354.0	0.0481	0.757	0.468	7.83

TLC Total Lifecycle Care®

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.

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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. 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, and maintenance technicians to 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.

Flush fluid and fluid refill

Liquid phase heat transfer systems can be cleaned with Therminol® FF flushing fluid. After the system is flushed, the appropriate liquid phase Therminol heat transfer fluid can be added.

Fluid trade-in program*

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

**Available in North America. Contact your local sales representative for more information.*

For more information, visit our website, **Therminol.com.**

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EASTMAN

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