



THERMINOL[®] VP-3

heat transfer fluid

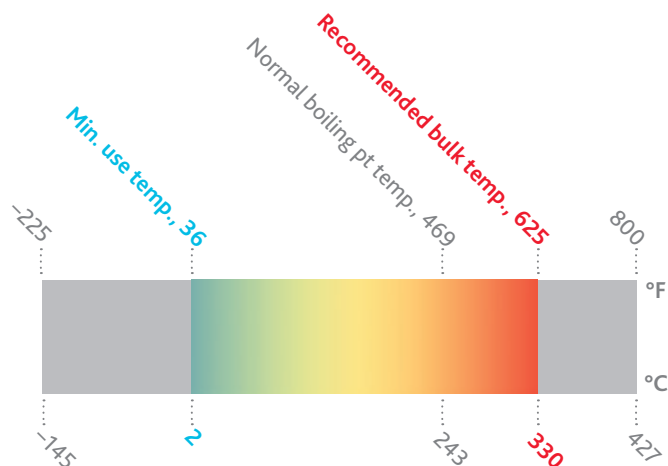
High-temperature
vapor/liquid phase fluid

2° to 330°C
(36° to 625°F)

THERMINOL.
Heat transfer fluids by Eastman

THERMINOL® VP-3

heat transfer fluid



Eastman Therminol® VP-3 liquid/vapor phase heat transfer fluid was specially developed to allow vapor phase heat transfer at lower temperatures than are practical with traditional diphenyl oxide/biphenyl constituted fluids.

Therminol VP-3 is available globally. Contact your local Eastman Therminol sales representative for more information.

For more information about vapor phase system design, operation, and safety, refer to the *Vapor phase design guide* or the Therminol VP-3 safety data sheet (SDS).

Physical and chemical characteristics

Therminol VP-3 is designed for use with excellent thermal stability at a maximum continuous operating temperature of 330°C (625°F) in the liquid or vapor phase.

Therminol VP-3 has a normal boiling point of 243°C (469°F), 14°C (26°F) below the normal boiling point of Therminol VP-1, allowing vapor phase at the lower temperature.

A crystallization point of 2.4°C (36°F) makes Therminol VP-3 easy to handle and may eliminate the need for costly heat tracing in moderate climates.

The recommended bulk and maximum film temperatures for Therminol VP-3 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.

The odor of Therminol VP-3 is milder than other vapor phase organic heat transfer fluids. Therminol VP-3 contains virtually no biphenyl.

Therminol VP-3 is a Class IIIB combustible fluid under the definitions of the National Fire Protection Association (NFPA). As with any other combustible material, proper system design and operation are important to safe operation. Vapor leaks could condense into a stable mist suspension that may be explosive in certain concentrations in air. Consequently, the use of protective devices may be required to minimize fire risk, and users of Therminol VP-3 should check with their safety and risk management experts for specific instructions.


Typical properties^a

Appearance	Above 2.4°C (36°F), clear, sediment-free liquid
Composition	Phenylcyclohexane + bicyclohexyl
Recommended bulk temperature	330°C (625°F)
Maximum film temperature	360°C (675°F)
Normal boiling point	243°C (469°F)
Crystallizing point	2.4°C (36°F)
Flash point, COC (ASTM D92)	104°C (219°F)
Autoignition temperature (ASTM E659)	360°C (680°F)
Autoignition temperature (DIN 51794)	351°C (664°F)
Coefficient of thermal expansion at 200°C	0.001204/°C (0.000669/°F)
Total acidity (ASTM D664)	<0.2 mg KOH/g
Average molecular weight	161
Pseudocritical temperature	406°C (764°F)
Pseudocritical pressure	38.5 bar (558.4 psia)
Pseudocritical density	352 kg/m ³ (22 lb/ft ³)
Chlorine content (DIN 51577)	<10 ppm
Copper corrosion (ASTM D130)	<<1a
Moisture content, maximum (ASTM E203)	150 ppm
Surface tension in air at 25°C	43.2 dynes/cm
Dielectric constant @ 23°C (ASTM D924)	2.48

^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 VP-3 fluid. Does not constitute an express warranty. See disclaimer on the back page of this bulletin.

Heat transfer fluid calculators THERMINOL
The Thermolite & Therminol

- Product comparison calculator**
Make side-by-side comparisons of up to six fluids for physical and performance properties, and fluid handle coefficients.
- Property by temperature table**
Create tables of physical properties in various units of measure, and to user-selected temperature increments (per 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**

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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® VP-3 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
4	39.2	941	1.525	533.5	-0.7	0.1195	4.74	5.04	—
10	50	938	1.555	530.9	8.6	0.1187	3.91	4.17	0.001
20	68	933	1.604	526.4	24.4	0.1174	2.95	3.16	0.003
30	86	928	1.651	521.9	40.6	0.1162	2.31	2.49	0.007
40	104	923	1.698	517.3	57.4	0.1149	1.87	2.03	0.015
50	122	917	1.744	512.7	74.6	0.1136	1.56	1.70	0.030
60	140	911	1.789	508.1	92.3	0.1123	1.33	1.46	0.058
70	158	905	1.833	503.4	110.4	0.1110	1.15	1.28	0.108
80	176	899	1.876	498.7	128.9	0.1097	1.02	1.13	0.194
90	194	892	1.918	494.1	147.9	0.1084	0.908	1.02	0.338
100	212	885	1.960	489.4	167.3	0.1071	0.819	0.925	0.569
110	230	878	2.000	484.7	187.1	0.1058	0.744	0.848	0.933
120	248	871	2.040	480.0	207.3	0.1045	0.681	0.782	1.49
130	266	863	2.079	475.3	227.9	0.1031	0.627	0.726	2.32
140	284	855	2.118	470.7	248.9	0.1018	0.580	0.678	3.53
150	302	847	2.155	466.0	270.2	0.1005	0.538	0.635	5.27
160	320	839	2.192	461.3	292.0	0.0991	0.501	0.597	7.72
170	338	830	2.229	456.7	314.1	0.0978	0.467	0.563	11.1
180	356	821	2.265	452.0	336.5	0.0965	0.437	0.532	15.7
190	374	812	2.300	447.3	359.4	0.0951	0.408	0.503	21.9
200	392	803	2.336	442.6	382.6	0.0937	0.382	0.477	30.0
210	410	793	2.371	437.9	406.1	0.0924	0.358	0.452	40.7
220	428	783	2.407	433.2	430.0	0.0910	0.336	0.429	54.4
230	446	772	2.442	428.4	454.2	0.0896	0.315	0.408	71.9
240	464	761	2.479	423.5	478.8	0.0882	0.295	0.388	93.9
250	482	750	2.516	418.6	503.8	0.0868	0.277	0.369	121
260	500	738	2.555	413.5	529.1	0.0854	0.259	0.351	156
270	518	726	2.596	408.3	554.9	0.0840	0.243	0.335	197
280	536	714	2.641	402.9	581.1	0.0826	0.228	0.319	248
290	554	701	2.691	397.2	607.7	0.0812	0.213	0.304	309
300	572	687	2.747	391.2	634.9	0.0798	0.199	0.290	382
310	590	673	2.814	384.7	662.7	0.0784	0.186	0.277	469
320	608	658	2.895	377.6	691.2	0.0769	0.174	0.265	572
330	626	641	2.998	369.8	720.7	0.0755	0.163	0.253	693
340	644	624	3.137	360.8	751.3	0.0740	0.152	0.243	834
350	662	606	3.334	350.2	783.6	0.0726	0.141	0.234	997
360	680	586	3.634	337.1	818.3	0.0711	0.132	0.225	1180

^aRecommended bulk temperature 330°C (625°F). The normal boiling temperature is 243°C (469°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 VP-3 fluid. ^bEnthalpy basis is liquid at 4.4°C (40°F). ^c1 cSt = 1 mm²/s and 1 mPa·s = 1 cP ^d100 kPa = 1 bar

Liquid properties of Therminol® VP-3 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/ft ³	Btu/(lb·°F)	Btu/lb	Btu/lb	Btu/(ft·h·°F)	lb/(ft·h)	cSt (mm ² /s)	psia
40	4	7.85	58.8	0.365	229.4	0.0	0.0690	11.3	4.96	—
60	16	7.81	58.4	0.378	227.3	7.4	0.0682	8.04	3.55	—
80	27	7.76	58.1	0.391	225.2	15.1	0.0674	6.04	2.68	0.001
100	38	7.71	57.7	0.403	223.0	23.1	0.0666	4.74	2.12	0.002
120	49	7.66	57.3	0.416	220.8	31.3	0.0658	3.85	1.73	0.004
140	60	7.60	56.9	0.428	218.6	39.7	0.0649	3.22	1.46	0.008
160	71	7.55	56.5	0.439	216.3	48.4	0.0641	2.75	1.26	0.017
180	82	7.49	56.0	0.451	214.1	57.3	0.0633	2.40	1.10	0.032
200	93	7.43	55.5	0.462	211.9	66.4	0.0624	2.12	0.985	0.059
220	104	7.36	55.1	0.473	209.6	75.7	0.0616	1.90	0.889	0.103
240	116	7.29	54.6	0.483	207.4	85.3	0.0607	1.71	0.810	0.176
260	127	7.22	54.0	0.494	205.2	95.1	0.0599	1.56	0.744	0.291
280	138	7.15	53.5	0.504	202.9	105.0	0.0590	1.43	0.688	0.468
300	149	7.08	52.9	0.514	200.7	115.2	0.0582	1.31	0.640	0.732
320	160	7.00	52.4	0.524	198.5	125.6	0.0573	1.21	0.597	1.12
340	171	6.92	51.8	0.534	196.2	136.2	0.0565	1.12	0.559	1.68
360	182	6.84	51.1	0.543	194.0	147.0	0.0556	1.04	0.525	2.46
380	193	6.75	50.5	0.553	191.8	157.9	0.0547	0.967	0.494	3.53
400	204	6.66	49.8	0.562	189.5	169.1	0.0538	0.899	0.465	4.99
420	216	6.57	49.1	0.571	187.3	180.4	0.0530	0.836	0.439	6.94
440	227	6.47	48.4	0.581	185.0	191.9	0.0521	0.779	0.415	9.51
460	238	6.37	47.7	0.590	182.7	203.6	0.0512	0.725	0.392	12.8
480	249	6.27	46.9	0.600	180.3	215.5	0.0503	0.675	0.371	17.1
500	260	6.16	46.1	0.611	177.9	227.6	0.0494	0.628	0.351	22.6
520	271	6.05	45.3	0.622	175.4	240.0	0.0485	0.584	0.333	29.4
540	282	5.93	44.4	0.634	172.8	252.5	0.0476	0.543	0.315	37.8
560	293	5.81	43.5	0.647	170.0	265.3	0.0467	0.504	0.299	48.2
580	304	5.68	42.5	0.663	167.1	278.4	0.0458	0.468	0.284	60.8
600	316	5.54	41.5	0.683	163.9	291.9	0.0448	0.434	0.270	76.1
620	327	5.40	40.4	0.708	160.3	305.8	0.0439	0.402	0.257	94.4
640	338	5.24	39.2	0.741	156.1	320.2	0.0430	0.373	0.245	116
660	349	5.07	38.0	0.791	151.2	335.5	0.0420	0.345	0.235	142
680	360	4.89	36.6	0.869	145.0	352.1	0.0411	0.319	0.225	172

Vapor properties of Therminol® VP-3 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)	mPa·s	cSt
4	40	0.00005	1.08	533.3	0.0084	0.0067	—
10	50	0.00009	1.11	539.4	0.0089	0.0069	—
20	68	0.00020	1.15	550.7	0.0097	0.0071	—
30	86	0.00044	1.20	562.5	0.0105	0.0074	—
40	104	0.00091	1.24	574.7	0.0114	0.0076	—
50	122	0.00179	1.28	587.3	0.0122	0.0079	—
60	140	0.00337	1.32	600.3	0.0130	0.0081	—
70	158	0.00610	1.37	613.8	0.0139	0.0084	1370
80	176	0.0107	1.41	627.7	0.0148	0.0086	809
90	194	0.0180	1.45	642.0	0.0156	0.0089	493
100	212	0.0296	1.49	656.7	0.0165	0.0091	309
110	230	0.0472	1.53	671.8	0.0174	0.0094	199
120	248	0.0734	1.57	687.3	0.0183	0.0096	131
130	266	0.111	1.61	703.2	0.0192	0.0099	88.7
140	284	0.166	1.65	719.5	0.0201	0.0101	61.2
150	302	0.242	1.69	736.2	0.0211	0.0104	43.0
160	320	0.346	1.73	753.3	0.0220	0.0106	30.8
170	338	0.487	1.77	770.7	0.0230	0.0109	22.4
180	356	0.674	1.81	788.5	0.0239	0.0111	16.5
190	374	0.920	1.84	806.7	0.0249	0.0114	12.4
200	392	1.24	1.88	825.2	0.0258	0.0116	9.41
210	410	1.65	1.91	844.0	0.0268	0.0119	7.23
220	428	2.16	1.95	863.2	0.0278	0.0121	5.62
230	446	2.81	1.98	882.6	0.0288	0.0124	4.41
240	464	3.61	2.02	902.4	0.0298	0.0126	3.50
250	482	4.60	2.06	922.4	0.0308	0.0129	2.80
260	500	5.81	2.09	942.7	0.0319	0.0131	2.26
270	518	7.28	2.13	963.2	0.0329	0.0134	1.84
280	536	9.05	2.16	984.0	0.0340	0.0136	1.50
290	554	11.2	2.20	1005	0.0350	0.0139	1.24
300	572	13.7	2.23	1026	0.0361	0.0141	1.03
310	590	16.7	2.26	1047	0.0371	0.0143	0.857
320	608	20.3	2.30	1069	0.0382	0.0146	0.718
330	626	24.5	2.33	1090	0.0393	0.0148	0.604
340	644	29.5	2.36	1112	0.0404	0.0150	0.510
350	662	35.4	2.40	1134	0.0415	0.0153	0.432
360	680	42.3	2.43	1155	0.0426	0.0155	0.367

^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 Therminol VP-3 fluid. ^bEnthalpy basis is liquid at 4.4°C (40°F). ^c1 cSt=1 mm²/s and 1 mPa·s = 1 cP

Vapor properties of Therminol[®] VP-3 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	Btu/(ft·h·°F)	lb/(ft·h)	mPa·s
40	4	0.000003	0.261	229.4	0.0049	0.0163	0.00674
60	16	0.00001	0.270	234.7	0.0054	0.0170	0.00702
80	27	0.00002	0.282	240.3	0.0059	0.0176	0.00729
100	38	0.00005	0.294	246.0	0.0065	0.0183	0.00757
120	49	0.00010	0.306	252.0	0.0070	0.0190	0.00785
140	60	0.00021	0.315	258.3	0.0075	0.0197	0.00813
160	71	0.00041	0.327	264.7	0.0081	0.0203	0.00841
180	82	0.00075	0.339	271.4	0.0086	0.0210	0.00869
200	93	0.00133	0.349	278.3	0.0092	0.0217	0.00897
220	104	0.00228	0.361	285.4	0.0098	0.0224	0.00925
240	116	0.00377	0.373	292.7	0.0104	0.0230	0.00953
260	127	0.00607	0.382	300.2	0.0109	0.0237	0.00981
280	138	0.00949	0.392	308.0	0.0115	0.0244	0.0101
300	149	0.0145	0.404	315.9	0.0121	0.0251	0.0104
320	160	0.0216	0.413	324.1	0.0127	0.0258	0.0106
340	171	0.0315	0.423	332.4	0.0133	0.0264	0.0109
360	182	0.0451	0.435	341.0	0.0139	0.0271	0.0112
380	193	0.0635	0.445	349.7	0.0146	0.0278	0.0115
400	204	0.0879	0.454	358.6	0.0152	0.0284	0.0118
420	216	0.120	0.464	367.7	0.0158	0.0291	0.0120
440	227	0.161	0.473	376.9	0.0165	0.0298	0.0123
460	238	0.213	0.483	386.3	0.0171	0.0304	0.0126
480	249	0.280	0.492	395.9	0.0178	0.0311	0.0129
500	260	0.363	0.500	405.5	0.0184	0.0318	0.0131
520	271	0.466	0.509	415.4	0.0191	0.0324	0.0134
540	282	0.592	0.519	425.3	0.0198	0.0331	0.0137
560	293	0.747	0.528	435.4	0.0204	0.0337	0.0139
580	304	0.935	0.535	445.5	0.0211	0.0343	0.0142
600	316	1.16	0.545	455.7	0.0218	0.0350	0.0145
620	327	1.44	0.554	466.0	0.0225	0.0356	0.0147
640	338	1.77	0.564	476.4	0.0232	0.0363	0.0150
660	349	2.16	0.571	486.7	0.0239	0.0369	0.0152
680	360	2.64	0.581	497.1	0.0247	0.0375	0.0155



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.

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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 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.

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 toward the purchase of new Therminol heat transfer fluid.

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

For more information, visit Therminol.com.

EASTMAN
The results of insight[™]

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www.eastman.com/locations

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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.

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