THERMINOL® D-12

heat transfer fluid

ANDREA GALLO DI LUIGI S.r.l.

Azienda fondata nel 1892

www.andreagallo.it

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

-94°C to 230°C

(-137°F to 450°F)

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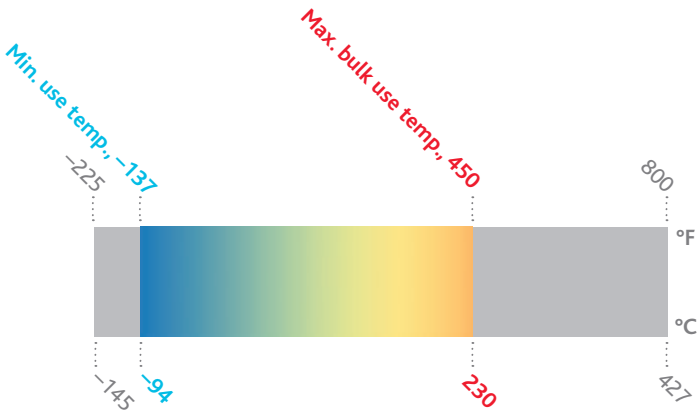
heat transfer fluid



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.

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.

NSF

Nonfood Compounds Program Listed (HT1) (130383)

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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.

The producer 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

[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 D-12 fluid. Does not constitute an express warranty. See disclaimer on the back page of this bulletin.

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/m³	kJ/(kg·K)	kJ/kg	kJ/kg	W/(m·K)	cP (mPa·s)	cSt (mm²/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

[a]Maximum 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. [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® 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.

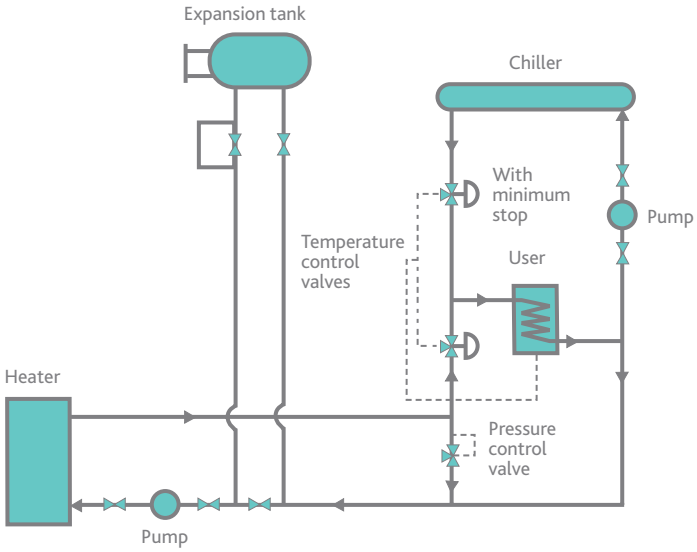
Typical design—heating and cooling of single user with one fluid

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.



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Specifica di Vendita

CODICE:	630650
PRODOTTO:	**OLIO DIATERMICO** THERMINOL D 12
DESCRIZIONE:	fluido diatermico

Riferimento SPC	
EDIZIONE:	3
VERSIONE:	1
DATA EMISSIONE:	27/07/2011

CARATTERISTICA	MINIMO	MASSIMO	METODO DI ANALISI
Aspetto: liquido limpido biancastro			GM-5
Densità a 15 °C (g/cm3)	0,756	0,768	ASTM D1287
Umidità (ppm)		80	ASTM D1744
Viscosità a 40 °C (cSt)	1,1	1,3	ASTM D445

Le presenti specifiche di vendita sono la traduzione di quelle del Produttore