THERMINOL® D12

Heat Transfer Fluids By SOLUTIA™
Applied Chemistry, Creative Solutions

D12

Combined Heating & Cooling Highly Stable Heat Transfer Fluid

-85°C to 260°C

+400°C
+350°C
+300°C
+250°C
+200°C
+150°C
+100°C
+50°C
+0°C
-50°C
-100°C

TM

Moisture Removal from Therminol® D12 Cooling Systems

For heat transfer fluids used in cooling systems, it is important to prevent the chiller heat exchanger surface from being coated by ice. This icing will reduce the efficiency of the chiller and can occasionally cause blockage in the system piping.

Various methods of moisture removal are presented in the following sections.

Free water removal

If moisture is present in the system after the Therminol D12 is charged to the system, the moisture is often above the saturation level. This free water can be removed by opening the system low-point drains periodically after brief system circulation. The water should be allowed to settle for at least one hour before the low-point drains are checked for moisture.

Once the system is in operation, low levels of free water can be removed by filtration of ice particles in 100 mesh strainers.

After the free water is removed, the moisture level is at the saturation level (see figure 2). Although the Therminol D12 moisture saturation level is low compared to other organic coolants, the soluble moisture may cause icing problems in the cooling system.

Saturated water removal

The saturated moisture drying of Therminol D12 in the system can be accomplished by different methods.

Water removal by molecular sieves

Water can be removed from Therminol D12 by circulating the fluid over molecular sieves. The molecular sieves are placed in a side stream for bypass flow control.

Free water will saturate the molecular sieves, which will require frequent molecular sieve replacement or regeneration.

The moisture can be removed down to 1 ppm concentration level by this method.

The Nitrogen purge method

By running the system expansion tank hot, the moisture can be removed by purging nitrogen through the expansion tank vapour space. The fluid can be circulated through the expansion tank from 70°C to 170°C. Nitrogen is purged through the vapour space in the expansion tank from 4 to 24 hours.

Lower tank operating temperatures and slower nitrogen flow rates will increase the time required for the water removal.

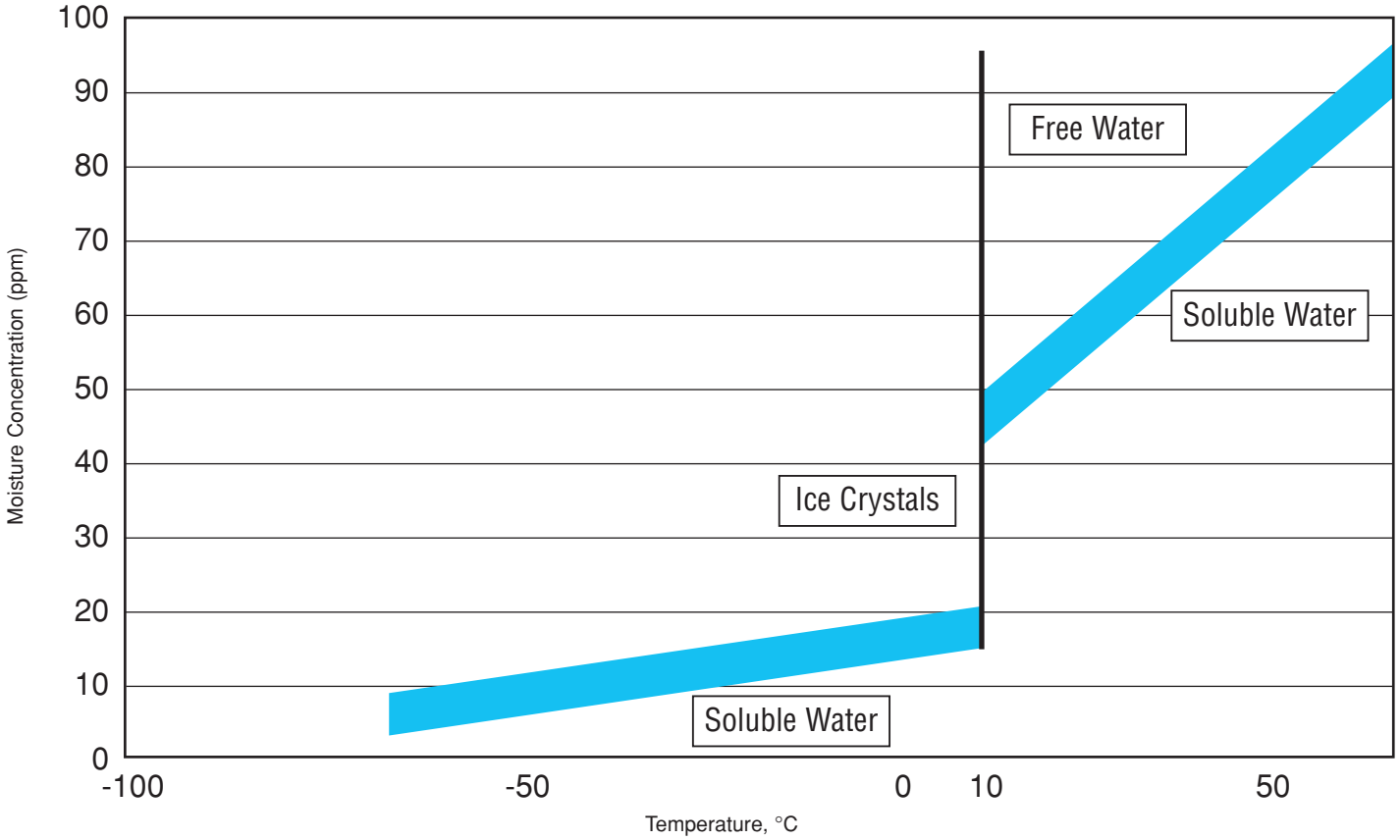
System Design

Standard pressure vessels, pipework, valves and instruments certified up to 2 bar and for low temperatures have to be selected in all cases for heating and cooling operation mode when the system is designed to work up to 200°C. When the system operates at higher temperatures, it should be equipped and certified for 4 bar pressure.

Equipment design should take into account the low flash point of this product.

Therminol® D12 Water Solubility

Fig. 2



Therminol D12 is a 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.

This fluid is of particular interest for applications in the pharmaceutical processes and for environmental test chambers. Therminol D12 has an operating temperature range of -85°C to 190°C without overpressure or up to 260°C with appropriate level of system pressurisation.

Therminol D12 is based on halogen-free chemistry, and it is considered non-hazardous and practically harmless for environmental purposes.

Thermal Stability

The thermal stability of a heat transfer fluid is one of the most important consideration in the selection of a fluid for operation under specific heat transfer conditions. Therminol D12 has made its reputation for its outstanding thermal stability.

Fluids such as Therminol D12 developed for use in single fluid combined heating and cooling systems, are generally selected with a good balance between low temperature pumpability and heat transfer properties and the ability to provide adequate heat input to the process, at temperatures up to 250°C.

Nevertheless proper design of fired or electrical heaters and of heat exchangers is an important aspect for the achievement of fluid performance and extended life, and bearing this in mind, the maximum bulk and film temperatures recommended for Therminol D12 are based on a combination of industrial experience and specific thermal studies with the aim of providing long fluid life and trouble free systems operation, without the risk of fouling or deposits.

Therminol D12 remains liquid and is easily pumped at temperatures down to minus 85°C. Start-up problems often associated with batch-processing systems are eliminated, and steam or electrical tracing is not required.

Typical Physical, Chemical and Thermal Properties of Therminol D12

Composition		Synthetic hydrocarbon
Appearance		Clear liquid
Max. bulk temperature		260°C
Max. film temperature		275°C
Kinematic viscosity @ 40°C	DIN 51562 - 1	1.23 mm^2/s (cSt)
Density @ 15°C	DIN 51757	764 kg/m^3
Flash point (Closed cup)	DIN EN 22719	59°C
Fire point	ISO 2592	71°C
Autoignition temperature	DIN 51794	277°C
Pour point	ISO 3016	<-85°C
Boiling point @ 1013 mbar		192°C
Coefficient of thermal expansion		0.00112/°C
Moisture content	DIN 51777 - 1	< 80 ppm
Total acidity	DIN 51558 - 1	<< 0.2 % mg KOH/g
Chlorine content	DIN 51577 - 3	<< 0.005 %
Copper corrosion	EN ISO 2160	<< 1a
Average molecular weight		180

Note: Values quoted are typical values obtained in the laboratory from production samples. Other samples might exhibit slightly different data. Specifications are subject to change. Write to Solutia for current sales specifications.

Properties of Therminol® D12 vs Temperatures

Temperature °C	Density kg/m³	Thermal Conductivity W/m.K	Heat Capacity kJ/kg.K	Viscosity		Vapour pressure (absolute) kPa*
				Dynamic mPa.s	Kinematic mm²/s**	
-85	835	0.124	1.635	295.878	354.345	-
-70	824	0.122	1.714	58.916	71.500	-
-60	818	0.121	1.759	23.922	29.245	-
-50	811	0.119	1.805	12.075	14.889	-
-40	804	0.118	1.850	7.059	8.780	-
-30	797	0.117	1.895	4.595	5.765	-
-20	790	0.116	1.941	3.234	4.094	-
-10	783	0.114	1.989	2.409	3.077	-
0	776	0.113	2.025	1.929	2.486	-
10	769	0.111	2.065	1.561	2.030	-
20	762	0.110	2.108	1.293	1.697	-
30	756	0.108	2.154	1.086	1.437	-
40	748	0.107	2.197	0.927	1.239	0.3
50	740	0.105	2.235	0.804	1.087	0.5
60	733	0.104	2.280	0.704	0.960	0.9
70	726	0.102	2.326	0.623	0.858	1.4
80	717	0.100	2.361	0.556	0.775	2.3
90	710	0.098	2.406	0.498	0.702	3.9
100	702	0.096	2.445	0.451	0.642	6.0
110	695	0.095	2.485	0.410	0.590	8.7
120	687	0.093	2.528	0.374	0.545	12.4
130	679	0.091	2.571	0.346	0.509	17.6
140	670	0.089	2.607	0.317	0.473	24.4
150	662	0.087	2.645	0.289	0.437	33.2
160	653	0.085	2.690	0.268	0.410	44.3
170	644	0.083	2.725	0.246	0.382	58.2
180	635	0.081	2.773	0.231	0.364	75.4
190	625	0.079	2.806	0.216	0.345	95.7
200	615	0.076	2.857	0.201	0.327	122.3
210	607	0.074	2.883	0.189	0.311	146.6
220	596	0.072	2.928	0.175	0.293	186.7
230	585	0.070	2.971	0.162	0.277	228.7
240	574	0.067	3.009	0.154	0.268	276.8
250	562	0.065	3.045	0.146	0.259	320.2
260	550	0.063	3.100	0.138	0.250	396.2

* 1 bar = 100 kPa - ** 1 mm²/s = 1 cSt

Note : Values quoted are typical values obtained in the laboratory from production samples. Other samples might exhibit slightly different data Specifications are subject to change. Write to Solutia for current sales specification.

Physical Property Formulae

Density (kg/m³) = -0.696982 * T(°C) - 0.000131384 * T²(°C) - 0.00000209079 * T³(°C) + 776.257

Heat Capacity (kJ/kg.K) = 2.01422 + 0.00386884 * T(°C) + 2.05029 * 10^{-6} * T²(°C) - 1.12621 * 10^{-8} * T³(°C) + 3.86282 * 10^{-11} * T⁴(°C)

Thermal Conductivity (W/m.K) = 0.112994 - 0.00014781 * T(°C) - 1.61429 * 10^{-7} * T²(°C)

Kinematic Viscosity (mm²/s) = $e^{\left(\frac{530.944}{T(°C)+146.4} - 2.68168\right)}$

Vapour Pressure (mbar) = $e^{\left(\frac{-3562.69}{T(°C)+194} + 13.8526\right)}$

«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.

Until recently, 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 D12 offers design and production engineers an unrivalled choice meeting their demands for efficiency and providing significant overall cost benefits when batch processing fine chemicals and pharmaceutical multi-purpose plants.

Therminol D12 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 D12 can be used in combined closed loop systems, to provide full heating and cooling capacity with the single fluid. This is a major advantage when compared with the «twin-fluid/twin-loop» concept, such as with steam/brine or steam/water-glycol, where flushing is required between cycles.

Reliable low temperature pumpability

Thermal degradation under operating conditions will not significantly alter the viscosity and pour point of the used fluid. The selection of minus 85°C for Therminol D12 minimum use temperature ensures that low temperature pumpability should always remain satisfactory in a well designed and maintained system.

Corrosion inhibitors not needed

Therminol D12 heat transfer fluid is non corrosive 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 level is therefore avoided.

Typical Design - Heating and Cooling of Single User with one Fluid

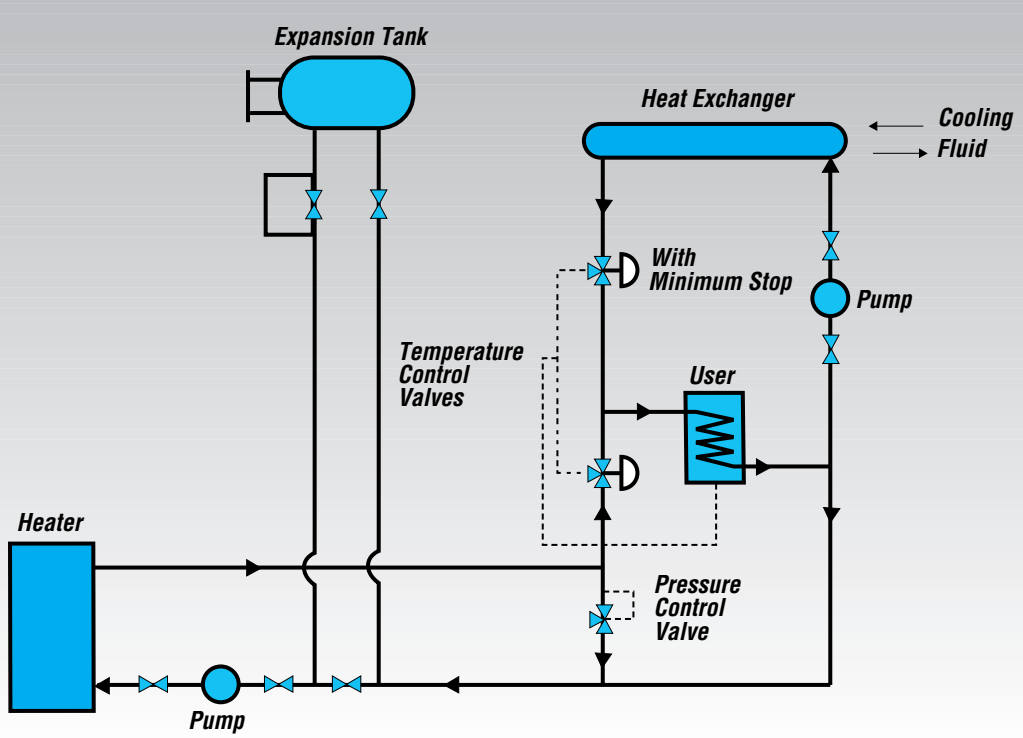
The figure 1 shows a dual system for heating and cooling, using two separate circulating systems for a common user.

The temperature controller output is connected in a split range manner to the cold heat transfer fluid control valve. As the output increases from 0-55%, the cold fluid valve closes (with a minimum stop to prevent deadheading the cooling zone pump).

As the output increases from 45-100%, 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.

Fig. 1



The Therminol® Range

Therminol D12 is one of the Solutia synthetic heat transfer fluids covering an operating range from -85°C to +400°C, suitable for most process heating or waste heat recovery applications, and capable of operation at or near atmospheric pressure within their recommended operating temperature range.

As a user's process temperature demands change there is always a Therminol fluid capable of meeting the new requirements. In addition Therminol fluids are often interchangeable allowing conversion by a simple top-up procedure where this is preferred.

Solutia also has a standard DP-DPO eutectic, Therminol VP-1.

Quality Management

All our manufacturing units have obtained ISO 9002 quality control certification. This registration means that plant procedures, quality control systems, material sampling, product storage, handling, packaging, shipping, product literature and characteristic data, record keeping and other company procedures are in line with the quality requirements of the ISO 9002 standards and its other national equivalents.

This is your quality assurance.

Health, Safety and Environmental Information

Please contact the Solutia Europe/Africa HQ for the Material safety data sheet, or if any other information concerning health, safety and environmental issues is required during filling or operation of your heat transfer system with this product.

Asia
Solutia Singapore Pte. Ltd.
101 Thomson Road - #19-00 United Square Singapore 307591
Tel.: (+65) 355 7231 - Fax: (+65) 254 3138

Latin America
Solutia Brasil Ltda.
Rua Gomes de Carvalho 1306 - 60 andar - conj. 61 e 62
CEP : 04547-005 • Vila Olímpia - Sao Paulo, SP, Brasil
Phone: (+55) 11-5087 3000 - Fax: (+55) 11-5087 3030

North America
Solutia Inc.
10300 Olive Boulevard - PO Box 66760
St Louis, MO 63166-6760 - USA
Tel.: (+1) 314 674 10 00

People's Republic of China
Solutia Chemical Co. Ltd., Suzhou
9th floor, Kings Tower
16 Shi Shan Road - Suzhou New District - Suzhou, PRC 215011
Phone: (+86) 512 8258167 - Fax: (+86) 512 8250417

SOLUTIA™
Applied Chemistry, Creative Solutions™

Europe
Solutia Europe S.A./N.V.
Rue Laid Burniat 3 - Parc Scientifique - Fleming
B-1348 Louvain-la-Neuve (Sud) - Belgium
Tel.: (+32) 10 48 15 47 - Fax: (+32) 10 48 14 86
http://www.solutia.com

Please contact us for more information :

GROUP PROVOC T.B.S 10-19 (12/98) E