



PRODUCT LINE GUIDE

**DOWTHERM, SYLTHERM,
DOWFROST, and DOWCAL
Heat Transfer Fluids**

*The Industry's Broadest Range of
Performance and Economic Options*



There's a DOWTHERM, SYLTHERM, DOWFROST or DOWCAL Fluid To Meet Your Needs

Dow is a leading science and technology company that provides innovative chemical, plastic and agricultural products and services to many essential consumer markets. With annual sales of \$19 billion, Dow serves customers in 162 countries and a wide range of markets that are vital to human progress, including food, transportation, health and medicine, personal and home care, and building and construction, among others. Committed to the principles of sustainable development, Dow and its 41,000 employees seek to balance economic, environmental and social responsibilities.

The family of DOWTHERM^{*}, SYLTHERM^{†1}, DOWFROST^{*}, and DOWCAL^{*} heat transfer fluids available from Dow consists of eighteen high performance products. The line includes three distinct fluid chemistries—synthetic organic, silicone, and

inhibited glycol—providing you with the industry's broadest range of performance and economic options. You'll find an overview description of our full line of fluids, plus a summary of performance characteristics and recommended applications on page 18 of this brochure.

Because Dow offers the most comprehensive range of fluid options, we are uniquely equipped to thoroughly and fairly assess your performance and economic requirements, and then recommend the best fluid to meet your needs.

We're equipped to supply you globally

As the world's premier supplier of heat transfer fluids, we're positioned to serve you globally. So whether your project is in Asia/Pacific, Europe, Latin America, North America, or anywhere else in the world, we can supply the fluid you need to make it a success.

*Trademark of The Dow Chemical Company

†Trademark of Dow Corning Corporation

¹Dow is a distributor of SYLTHERM products manufactured by Dow Corning Corporation.



Fluids for High Temperature Process Heating and Single Fluid Process Heating and Cooling

DOWTHERM Synthetic Organic Fluids Offer Excellent Stability

Each of our eight DOWTHERM synthetic organic fluids offers exceptional thermal stability. This stability can translate into more efficient heat transfer, longer fluid life, and optimum operating economics. For example, DOWTHERM A fluid has set the industry standard for over 60 years—precisely because of its excellent thermal stability in applications up to 400°C (750°F).

All DOWTHERM fluids feature vapor pressures lower than steam. Three DOWTHERM fluids—DOWTHERM RP, DOWTHERM MX, and DOWTHERM T—are designed to operate in non-pressurized or low-pressure heat transfer systems. DOWTHERM RP fluid in particular has been shown to be more thermally stable than partially hydrogenated terphenyl and dibenzyl toluene fluids.

DOWTHERM J fluid can be used in batch processing applications for single fluid process heating and cooling. And DOWTHERM Q fluid offers long-term advantages as an economical replacement for hot oils in applications with moderate temperature requirements above 260°C (500°F).

SYLTHERM Silicone Fluids Are Long-lasting, Odorless Options

SYLTHERM 800, SYLTHERM XLT[†], and SYLTHERM HF silicone fluids are low viscosity fluids that offer excellent heat transfer performance and can provide exceptionally long service life (often more than 10 years) without periodic reclaiming. In addition, SYLTHERM 800 fluid has the broadest operating range of any heat transfer fluid.

SYLTHERM fluids are essentially odorless, are low in acute oral toxicity, and, in the U.S., are not listed as reportable under SARA Title III, Section 313¹.

[†]Trademark of Dow Corning Corporation

¹You may need to comply with similar or additional legislation in other countries. Contact your Dow representative for information.

Low Temperature Fluids for Protection of Water-based Process Circuits and HVAC Systems, Plus Food Processing Applications

DOWTHERM, DOWFROST, and DOWCAL Inhibited Glycol-based Fluids Provide Freeze and Corrosion Protection

DOWTHERM, DOWFROST, and DOWCAL inhibited glycol-based fluids are widely used for freeze/burst and corrosion protection in closed-loop, water-based heating and air conditioning systems, as well as in water-based process cooling circuits. Solutions of these fluids offer fluid freeze protection to -50°C (-60°F) and system burst protection below -73°C (-100°F). DOWTHERM, DOWFROST, and DOWCAL fluids contain specially formulated corrosion inhibitor packages which provide protection for metals commonly used in heat transfer systems.

The food processing industry also takes advantage of the low temperature performance and corrosion protection properties of these glycol-based fluids. Applications include food product chilling and freezing, as well as coil defrosting and cold room dehumidifying.

Low temperature pumpability down to -50°C (-60°F) and high temperature operation up to 175°C (350°F) can make these fluids useful in single fluid process heating and cooling applications (batch processing).

You not only get more fluid options, you get more support

Dow is more than just a supplier of heat transfer fluids; we are also a leading source of heat transfer expertise. No other company can match Dow's more than 60 years' experience as a fluid supplier. In addition, our fluids are used every day in Dow processing plants all over the world. This combination of fluid knowledge and applications expertise has made Dow the industry's leading source of technical support. Call on our experienced staff of fluid specialists. They can consult with you on the design, operation, and maintenance of your heat transfer system to help you achieve optimum performance and economy.

The Dow representative in your area can also provide you with a free copy of the new Windows software version of the FLUIDFILE^{*} software program. The FLUIDFILE program makes evaluating and selecting the best Dow heat transfer fluids for specific applications faster, easier, and more precise.

^{*}Trademark of The Dow Chemical Company

The Optimum Heat Transfer Fluid For Your Application

Applications for DOWTHERM Synthetic Organic Fluids and SYLTHERM Silicone Fluids: -100°C (-150°F) to 400°C (750°F)

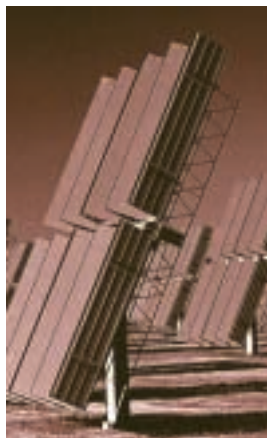
- Indirect heating of process liquids and polymers
- Single fluid process heating and cooling (particularly pharmaceutical batch processing)
- Pipeline tracing to maintain process temperatures
- Energy recovery
- Low pressure cogeneration systems
- Drying and heating of bulk materials
- Solar energy collection and storage
- Gas processing
- Ebullient cooling

Applications for DOWTHERM, DOWFROST, and DOWCAL Inhibited Glycol-based Fluids: -50°C (-60°F) to 175°C (350°F)

- HVAC system freeze/burst/corrosion protection
- Thermal energy storage (TES)
- Ground source heat pumps
- Hydronic heating systems
- Immersion freezing or chilling of solid, wrapped foods
- Batch processing
- Refrigeration coil defrosting
- Conveyor roller defrosting
- Process chilling
- Sidewalk snow melting systems
- Refrigeration warehouse floor heating
- Cooling liquid foods
- Fermentation cooling
- Cold room dehumidifying
- Heat recovery
- Solar heating
- Ice skating rinks



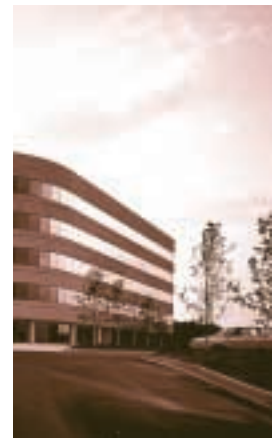
Process heating and cooling



Solar heating



Cooling liquid foods



HVAC system freeze/
burst/corrosion protection,
TES systems

Choose From Our Family of Eighteen Fluids

DOWTHERM Synthetic Organic Fluids

DOWTHERM A

With excellent thermal stability at 400°C (750°F), this fluid's maximum recommended film temperature is 427°C (800°F). Its recommended use temperature range in liquid phase operations is from 15°C (60°F) to 400°C (750°F) and in vapor phase from 257°C (495°F) to 400°C (750°F). With low viscosity to minimize start-up problems and a freezing point of 12°C (54°F), DOWTHERM A fluid can be used without steam tracing in installations protected from the weather.

DOWTHERM G

As the most stable, low pressure liquid-phase fluid, DOWTHERM G fluid offers low vapor pressure with high thermal stability and pumpability at moderately low temperatures. This efficient, medium-range heat transfer fluid has a recommended use temperature range of -7°C (20°F) to 360°C (680°F).

DOWTHERM J

DOWTHERM J heat transfer fluid can be used in liquid phase as low as -80°C (-110°F) and up to 315°C (600°F). In vapor phase, the range is from 181°C (358°F) to 315°C (600°F). This is the fluid of choice for the most demanding single fluid heating and cooling applications (batch processing). Thermal stability is excellent in both the liquid and vapor phases.

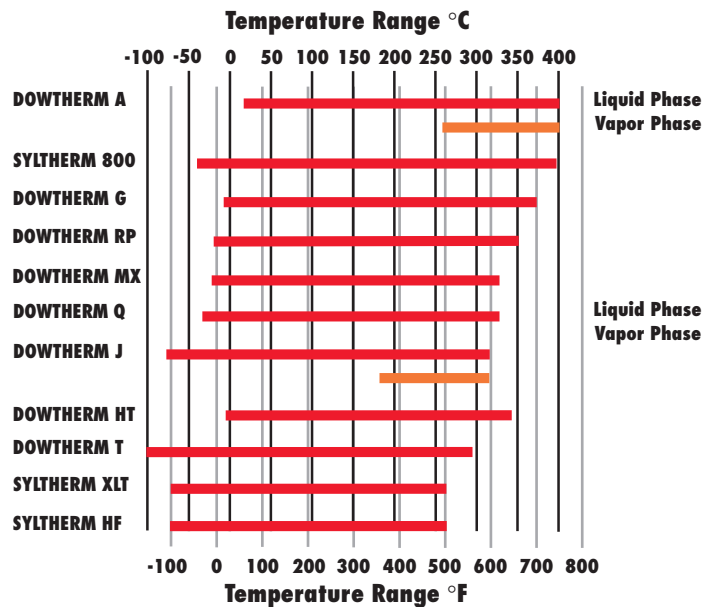
DOWTHERM HT

This modified terphenyl fluid has a high boiling point 345°C (650°F) which results in an unusually low vapor pressure. The recommended use temperature range is from 0°C (25°F) to 345°C (650°F). This fluid exhibits only faint odor characteristics. Plus, it is completely compatible with other fluids with modified terphenyl chemistry.

DOWTHERM MX

DOWTHERM MX heat transfer fluid is a mixture of alkylated aromatics designed for use as an alternative to hot oils in liquid phase heat transfer systems. The normal operating temperature range for DOWTHERM MX fluid is -23°C (-10°F) to 330°C (625°F).

DOWTHERM Synthetic Organic and SYLTHERM Silicone Heat Transfer Fluids



DOWTHERM RP

DOWTHERM RP heat transfer fluid is a liquid phase fluid used in pressureless or low-pressure systems. It can be used to a maximum bulk temperature of 350°C (660°F) and a maximum film temperature of 375°C (710°F). DOWTHERM RP fluid degrades primarily to low molecular weight products, reducing the need to remove high molecular weight material from the system. DOWTHERM RP fluid can also be used to top up other low pressure fluids in some cases.

DOWTHERM T

This mixture of C₁₄-C₃₀ alkyl benzenes is intended for liquid phase operation in non-pressurized systems. DOWTHERM T fluid has an optimum maximum use temperature of 288°C (550°F). It can be used to an extended bulk temperature of 316°C (600°F). It has good low temperature properties that allow for low temperature start-up, and good thermal stability at the maximum use temperature.

DOWTHERM Q

Introduced as an alternative to hot oils, DOWTHERM Q fluid has a recommended use temperature range of -35°C (-30°F) to 330°C (625°F). It combines high temperature stability with low temperature pumpability—a combination hot oils can't match. Because of its superior thermal stability, this fluid can offer substantial economic savings over the life of your heat transfer project.

SYLTHERM Silicone Fluids

SYLTHERM 800

SYLTHERM 800 fluid is a highly stable, long-lasting, silicone fluid with a recommended operating temperature range of -40°C (-40°F) to 400°C (750°F), the broadest range of any heat transfer fluid. Operating continuously at the upper end of this range, SYLTHERM 800 fluid exhibits low potential for fouling and can often remain in service for 10 years or more. The fluid is essentially odorless and is very low in acute oral toxicity. Silicone heat transfer fluids such as SYLTHERM 800 fluid are not listed as reportable in the U.S. under SARA Title III, Section 313¹.

SYLTHERM XLT

SYLTHERM XLT fluid will operate as low as -100°C (-150°F) and up to 260°C (500°F). This wide operating temperature range makes this silicone fluid especially well-suited for single fluid process heating and cooling (batch processing) systems in the pharmaceutical and fine chemical industries. In addition, SYLTHERM XLT fluid has essentially no odor, is very low in acute oral toxicity, and is not listed as reportable in the U.S. under SARA Title III, Section 313¹.

SYLTHERM HF

SYLTHERM HF heat transfer fluid is a specially formulated silicone polymer designed for use as a low temperature, liquid phase heat transfer medium. With the same recommended use temperature range [-73°C (-100°F) to 260°C (500°F)] as SYLTHERM XLT fluid, SYLTHERM HF fluid also offers a closed-cup flash point above 63°C (145°F). In addition, SYLTHERM HF fluid has essentially no odor, is very low in acute oral toxicity, and is not listed as reportable in the U.S. under SARA Title III, Section 313¹.

¹You may need to comply with similar or additional legislation in other countries. Contact your Dow representative for information.

DOWTHERM, DOWFROST, and DOWCAL Inhibited Glycol-based Heat Transfer Fluids

DOWTHERM SR-1

This ethylene glycol-based fluid is suitable for use in closed-loop, water-based HVAC, process heating and cooling, and food industry applications operating from -50°C (-60°F) to 120°C (250°F). A specially formulated inhibitor package provides excellent corrosion protection for common metals. The inhibitor package is easily maintained, long-lasting, and replenishable. That means fluid replacement intervals are extended and long-term fluid costs are reduced. DOWTHERM SR-1 fluid has lasted more than 20 years in properly maintained heat transfer systems.

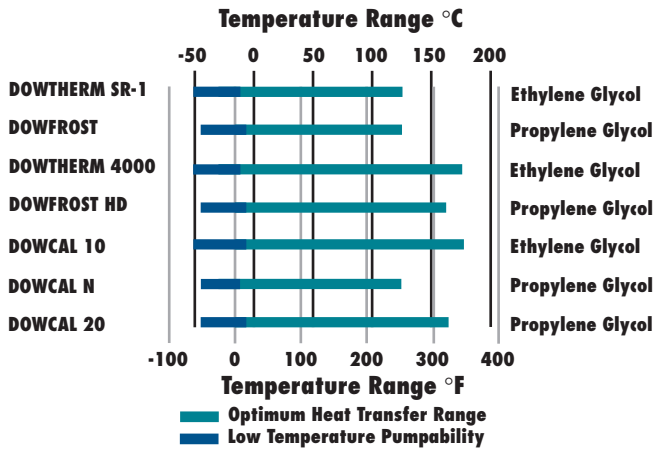
DOWFROST

DOWFROST fluid's recommended use temperature range is -45°C (-50°F) to 120°C (250°F). This propylene glycol-based fluid is used in solution with water in food processing applications. It is also used in freeze protection of building sprinkler systems where incidental contact with potable water is possible (e.g., when connected by a back-flow preventer to a city water supply), or where state regulations require the use of a propylene glycol-based fluid. A specially formulated industrial inhibitor package provides outstanding corrosion protection.

DOWTHERM 4000

This ethylene glycol-based fluid features the highest maximum use temperature of any glycol. Operating in water-based systems between -50°C (-60°F) and 175°C (350°F), this fluid is specially formulated with inhibitors to offer greater thermal stability and corrosion protection. The fluid is suitable for thermally demanding operations, as well as for applications where long fluid life and extended maintenance intervals are desired. The fluid's wide temperature range also makes it suitable for single fluid process heating and cooling.

DOWTHERM, DOWFROST, and DOWCAL
Inhibited Glycol-based Heat Transfer Fluids



At appropriate concentrations these fluids will provide burst protection to -73°C (-100°F).

DOWFROST HD

This propylene glycol-based fluid has a recommended use temperature range of -45°C (-50°F) to 160°C (325°F). It is suited for thermally demanding applications or where long fluid life and extended maintenance intervals are desired. Specially formulated inhibitors provide higher reserve alkalinity for improved long-term corrosion protection. Solutions of this fluid are used in closed-loop, water-based HVAC applications where customers prefer propylene glycol solutions or where state or provincial regulations require the use of propylene glycol solutions. Excellent copper corrosion protection makes DOWFROST HD fluid the preferred propylene glycol option for HVAC applications. The fluid may also be used for single fluid process heating and cooling.

DOWCAL 10

DOWCAL 10 fluid is an ethylene glycol-based fluid with a specially formulated inhibitor package to prevent corrosion. Available only in Europe, this fluid is used in water-based HVAC systems to provide freeze and corrosion protection. It can also be used for freeze point depression in other applications from -50°C (-60°F) to 175°C (350°F).

DOWCAL N

Like DOWFROST fluid, DOWCAL N fluid is a propylene glycol-based fluid that is low in acute oral toxicity and widely used to depress freeze points in food and beverage processing and in other applications between -45°C (-50°F) and 120°C (250°F). Available only in Europe, it features a specially formulated corrosion inhibitor package.

DOWCAL 20

Available in Europe, this fluid is capable of operating at higher temperatures than other propylene glycol-based fluids. It is low in acute oral toxicity and may be used in applications ranging from -45°C (-50°F) to 160°C (325°F). A specially formulated inhibitor package prevents corrosion of common materials of construction in HVAC, food and beverage processing, and other applications.



Typical Properties of DOWTHERM Synthetic Organic and SYLTHERM Silicone Heat Transfer Fluids¹

English Units

		DOWTHERM A Diphenyl Oxide/ Biphenyl Blend	DOWTHERM G Mixture of Di- and Tri-Aryl Ethers	DOWTHERM J Alkylated Aromatic	DOWTHERM HT Partially Hydrogenated Terphenyl
Composition					
Temperature Use Range, °F	liquid vapor	60 to 750 495 ³ to 750	20 to 680	-110 to 600 358 ³ to 600	25 to 650
Vapor Pressure, psia	at max. use temp.	152.02	49.12	174.52	14.17
Thermal Conductivity, Btu/(hr · ft ²)(°F/ft)	at min. use temp.	0.081	0.074	0.086	0.072
	at max. use temp.	0.045	0.047	0.037	0.061
Specific Heat, Liquid, Btu/(lb · °F)	at min. use temp.	0.373	0.363	0.376	0.376
	at max. use temp.	0.644	0.565	0.721	0.656
Viscosity, cps	at min. use temp.	4.91	146	9.67	1815
	at max. use temp.	0.13	0.23	0.164	0.331
Density, Liquid, lb/ft ³	at min. use temp.	66.37	70.34	58.31	63.54
	at max. use temp.	42.57	51.68	35.46	48.36
Freezing Point, °F		53.6	<40	<-100	25
Flash Point, °F, Closed Cup		236	266	136	342
Autoignition Temperature, °F, ASTM E659-78		1139	1083	788	662

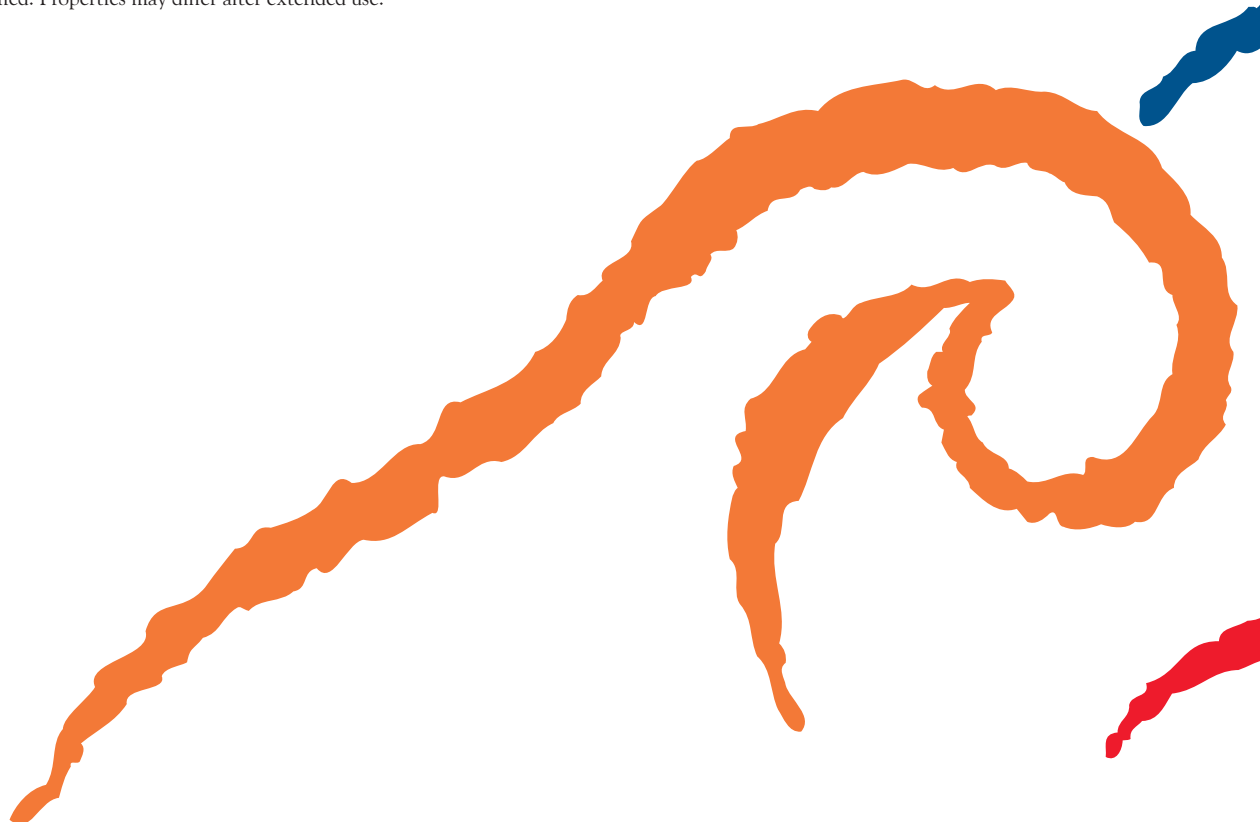
¹Properties shown are typical and should not be considered specifications.

²Properties for Aged fluid except flash point, viscosity.

³Boiling Point at atmospheric pressure.

^aProperties of fluid as supplied. Properties may differ after extended use.

^bASTM D2155



DOWTHERM Q Mixture of Diphenyl- ethane and Alkylated Aromatics	DOWTHERM RP Diaryl Alkyl	DOWTHERM MX Mixture of Alkylated Aromatics	DOWTHERM T C ₁₄ to C ₃₀ Alkyl Benzene Derivatives	SYLTHERM 800² Polydimethyl- siloxane	SYLTHERM XLT Polydimethyl- siloxane	SYLTHERM HF Polydimethyl- siloxane
-30 to 625	-4 to 660	-10 to 625	14 to 550	-40 to 750	-150 to 500	-100 to 500
48.08	13.63	15.1	2.6	197.32	75.46	39.76
0.084 0.048	0.0775 0.0513	0.0735 0.0523	0.081 0.043	0.085 0.037	0.078 0.0295	0.0752 0.0274
0.353 0.618	0.372 0.621	0.351 0.625	0.446 0.659	0.360 0.539	0.320 0.541	0.347 0.543
48.2 0.187	249 0.32	281.7 0.20	252 0.39	51.0 0.25	90.17 0.18	16.65 0.22
63.23 45.88	65.25 49.12	61.9 44.8	55.81 43.03	61.9 34.3	59.3 35.2	60.31 39.28
-30	<-4	-13	<14	<-40	-158	<-115
249	381	329	370	320 ^a	116	145
773	725	788	707 ^b	725 ^b	662 ^b	671 ^b



Typical Properties of DOWTHERM Synthetic Organic and SYLTHERM Silicone Heat Transfer Fluids¹

SI Units

		DOWTHERM A Diphenyl Oxide/ Biphenyl Blend	DOWTHERM G Mixture of Di- and Tri-Aryl Ethers	DOWTHERM J Alkylated Aromatic	DOWTHERM HT Partially Hydrogenated Terphenyl
Composition					
Temperature Use Range, °C	liquid vapor	15 to 400 257 to 400	-7 to 360	-80 to 315 181 to 315	0 to 345
Vapor Pressure, Bar Abs	at max. use temp.	10.6	3.4	11.9	1.01
Thermal Conductivity, W/(m)(K)	at min. use temp. at max. use temp.	0.139 0.078	0.128 0.082	0.15 0.066	0.1251 0.1051
Specific Heat, Liquid, kJ/(kg)(K)	at min. use temp. at max. use temp.	1.556 2.702	1.518 2.362	1.571 3.012	1.423 2.751
Viscosity, mPa(s)	at min. use temp. at max. use temp.	5.0 0.13	152 0.23	9.98 0.16	953 0.33
Density, Liquid, kg/m ³	at min. use temp. at max. use temp.	1062.3 679.5	1125.6 826.9	933.6 568.2	1013.9 772.6
Freezing Point, °C		12	<-40	<-81	-3
Flash Point, °C, Closed Cup		113	130	57	172
Autoignition Temperature, °C, ASTM E659-78		615	583	420	350

¹Properties shown are typical and should not be considered specifications.

²Properties for Aged fluid except flash point, viscosity.

^aProperties of fluid as supplied. Properties may differ after extended use.

^bASTM D2155

DOWTHERM Q Mixture of Diphenyl- ethane and Alkylated Aromatics	DOWTHERM RP Diaryl Alkyl	DOWTHERM MX Mixture of Aldylated Aromatics	DOWTHERM T C ₁₄ to C ₃₀ Alkyl Benzene Derivatives	SYLTHERM 800² Polydimethyl- siloxane	SYLTHERM XLT Polydimethyl- siloxane	SYLTHERM HF Polydimethyl- siloxane
-35 to 330	-20 to 350	-23 to 330	-10 to 288	-40 to 400	-100 to 260	-73 to 260
3.4	0.96	1.05	0.2	13.7	5.2	2.7
0.128 0.077	0.134 0.089	0.1272 0.090	0.141 0.075	0.146 0.064	0.045 0.051	0.13 0.048
1.478 2.586	1.561 2.602	1.47 2.617	1.87 2.761	1.506 2.257	1.343 2.264	1.453 2.273
46.6 0.19	221.1 0.31	274 0.20	252 0.39	51.0 0.25	78.63 0.18	16.46 0.22
1011.4 733.7	1043.2 785.0	991.9 717.8	893.0 688.6	990.6 547.0	947.2 563.2	964.7 628.4
<-34	<-20	-25	<-10	<-40	<-111	<-82
120	Not determined	165	188	160 ^a	47	63
411	385	420	375 ^b	385 ^b	350 ^b	355 ^b



How To Select The Right Heat Transfer Fluid

First Choose Between High Temperature and Low Temperature Fluids

The decision to choose a synthetic organic fluid, a silicone fluid, or an inhibited glycol-based fluid is largely based on application temperature requirements. If your heat transfer application has a maximum use temperature requirement above 175°C (350°F), you should investigate “high temperature” synthetic organic and silicone fluids.

However, if your maximum use temperature will be lower than 175°C (350°F), or if you need freeze protection for a water-based system, consider using a “low temperature” inhibited glycol-based fluid.

Synthetic organic and silicone fluids are engineered to be thermally stable at temperatures up to 400°C (750°F). While operating at these elevated temperatures, these fluids exhibit vapor pressures much lower than steam, making them much more practical and less expensive to use. Some high temperature fluids, such as DOWTHERM J and SYLTHERM fluids, have broad operating temperature ranges. These fluids offer high temperature stability, as well as low temperature pumpability and excellent heat transfer characteristics.

Inhibited glycol-based fluids are actually solutions of water and inhibited glycols. The concentration of glycol in the fluid directly affects its performance properties and is specified by the user to meet specific application (typically minimum temperature) requirements.

What to Consider When Selecting a High Temperature Synthetic Organic or Silicone Fluid

Maximum Recommended Use Temperature/Thermal Stability

For efficient performance and longer fluid life, choose a fluid with a maximum recommended use temperature above your system’s anticipated bulk fluid temperature. A synthetic organic or silicone fluid’s maximum recommended operating temperature is an indication of the high temperature thermal stability properties of that fluid. Selection of a DOWTHERM or SYLTHERM fluid with a maximum recommended use temperature above your highest anticipated operating temperature will provide optimum heat transfer efficiency, fluid life, and operating economy. All DOWTHERM and SYLTHERM fluids exhibit excellent thermal stability within their recommended operating temperature ranges. Silicone fluids, in particular, exhibit low potential for fouling at elevated temperatures and, depending on service conditions, can last 10 years or longer when operating continuously at their recommended maximum operating temperatures.

Low Temperature Pumpability

If your system will be operated while exposed to cold winter weather, you’ll need a fluid offering low viscosity and, therefore, low temperature pumpability. Low temperature pumpability is especially critical if your system is subject to shutdown—whether planned or unplanned. If the heat transfer fluid in the system is not pumpable, system start-up can be difficult if not impossible. SYLTHERM silicone fluids offer excellent low temperature pumpability characteristics, experiencing little viscosity change down to the lower end of their recommended operating ranges. Some DOWTHERM synthetic organic fluids have very low crystal points so the fluid remains pumpable in extreme cold and the potential for prolonged costly system shutdown is minimized.

Flammability and Fire Hazards

Heat transfer systems occasionally experience vapor leaks to the atmosphere. Experience has shown that leaking vapors have usually cooled below the heat transfer fluid’s fire point.

Vapor Pressure

Certain applications require the high operating range of a synthetic organic or silicone fluid—but combined with low vapor pressure. While all DOWTHERM and SYLTHERM fluids have vapor pressures lower than steam, DOWTHERM G, DOWTHERM HT, and DOWTHERM RP fluids are especially effective in systems with specific low vapor pressure requirements. Another reason for selecting a fluid that offers low vapor pressure is the potentially lower initial investment in expansion tanks and other specialized equipment.

Project Economics and Fluid Recoverability

It is wise to look beyond initial cost when choosing your heat transfer fluid. Some fluids...such as hot oils...are less expensive at the outset—but those savings diminish significantly in the face of high yearly operating costs.

In evaluating potential long-term fluid cost, you'll want to consider two factors: 1) What effect will degradation and normal operational leakage have on annual fluid makeup requirements? 2) How often will a complete fluid change-out be necessary?

In choosing a high temperature fluid from our line, you'll also want to take into account the differences in the degradation and fouling potential of synthetic organic and silicone fluids.

Long-term economics of synthetic organic fluids—While synthetic organic fluids are highly stable within their recommended operating ranges, some degradation can be expected

over time. A fluid's tendency to degrade under your system's operating conditions has a direct impact on the fluid's long-term cost (due to fluid makeup and replacement expense over time). To maximize fluid life, select a synthetic organic fluid offering sufficient thermal stability to both accommodate your maximum planned operating temperature and allow for unplanned excursions above that level...even if the initial cost of the fluid is higher than that of a less stable fluid (see "Maximum Recommended Use Temperature/Thermal Stability").

Long-term economics of silicone fluids—In terms of initial purchase cost, silicone fluids are typically more expensive than synthetic organic fluids. However, in many cases, the use of silicone fluids can result in lower long-term expenses because they do not degrade in the same manner as other fluids or require top-off refills. Although silicone polymers exhibit some thermally induced changes over time, a balanced, steady-state equilibrium composition is eventually attained. Depending on service conditions, this can reduce or eliminate the need for makeup fluid and extend fluid life to ten years or longer.

Fluid analysis can also reduce long-term expense—Regardless of which type of high temperature fluid you choose, for maximum long-term economy, it is wise to participate in a regular fluid testing program such as Dow's fluid analysis service. Dow provides free annual fluid analysis to its customers to help them periodically assess fluid condition and help ensure that system problems are avoided.



How to Choose the Right Inhibited Glycol-based Heat Transfer Fluid

Ethylene vs. Propylene Glycol

Early in your fluid selection process, local regulations or a specific application may require that you decide between the use of an ethylene or a propylene glycol-based fluid.

In most heat transfer applications, ethylene glycol-based fluids are your best choice because of their superior heat transfer efficiency. This efficiency is largely due to the lower viscosity of ethylene glycol solutions. Another benefit of this viscosity advantage is the somewhat lower minimum operating temperatures ethylene glycols offer.

Propylene glycols are most commonly used in applications in which low acute oral toxicity is required, or for freeze protection where incidental contact with drinking water is possible. In some areas, use of propylene glycols is required by local regulation.

Both ethylene and propylene glycol-based fluids are used in food processing applications. The ingredients in DOWFROST and DOWCAL N inhibited propylene glycol-based fluids are generally recognized as safe by the U.S. FDA¹. Since these products also have the appropriate approvals, they can be used in immersion freezing of wrapped foods and other food applications where ethylene glycol is not permitted. (See “Food Product Chilling/Freezing” on page 15.)

Glycol Concentration

Glycol-based fluids are solutions of glycol and water. The amount of glycol in a particular solution directly affects the fluid’s performance. Therefore, the anticipated or desired glycol concentration should be considered when designing a system.

¹You may need to comply with similar or additional legislation in other countries. Contact your Dow representative for information.

Concentrations of DOWTHERM, DOWFROST, and DOWCAL Fluids Required to Provide Freeze Protection and Burst Protection at Various Temperatures

Temp., °C (°F)	Volume Percent Glycol Concentration Required			
	For Freeze Protection		For Burst Protection	
	DOWTHERM, DOWCAL 10 Fluids	DOWFROST, DOWCAL 20 & N Fluids	DOWTHERM, DOWCAL 10 Fluids	DOWFROST, DOWCAL 20 & N Fluids
-7 (20)	16%	18%	11%	12%
-12 (10)	25	29	17	20
-18 (0)	33	36	22	24
-23 (-10)	39	42	26	28
-29 (-20)	44	46	30	30
-34 (-30)	48	50	30	33
-40 (-40)	52	54	30	35
-46 (-50)	56	57	30	35
-51 (-60)	60	60	30	35

Note: These figures are examples only and may not be appropriate to your situation. Generally, for an extended margin of protection, you should select a temperature in this table that is at least 3°C (5°F) lower than the expected lowest ambient temperature. Inhibitor levels should be adjusted for solutions of less than 30% glycol. Contact Dow for information on specific cases or further assistance.

Freeze and Burst Protection

Closed-loop, water-based heat transfer systems are vulnerable to sudden freezes and extended cold weather. Solutions of glycol-based fluids provide two different kinds of cold weather protection:

Burst Protection: If your system does not operate during the winter and cold weather start-up will not be required, you will want to specify a glycol concentration sufficient to prevent bursting but not necessarily high enough to maintain the fluid in a pumpable state. Solutions of all seven Dow inhibited glycol-based fluids can provide burst protection to below -73°C (-100°F).

Freeze Protection: If your system must remain operational in cold weather, or if cold weather start-ups may be required, freeze protection will be needed. As indicated by their minimum recommended operating temperatures, the freeze protection capabilities of DOWTHERM, DOWFROST, and DOWCAL fluids vary slightly. Choose a solution concentration that will prevent the formation of ice crystals at 3°C (5°F) below the lowest anticipated system temperature.



Corrosion Protection

It is important to specify an *inhibited* glycol-based fluid because, without inhibitors, glycol fluids can be more corrosive than water. All seven DOWTHERM, DOWFROST and DOWCAL inhibited glycol-based fluids contain specially formulated industrial inhibitor packages designed to prevent corrosion.

Corrosion is a major contributor to maintenance and operating expense in water-based HVAC, food, and process systems. Effective corrosion prevention can improve system efficiency, extend equipment life, and improve overall operating economy.

Food Product Chilling/Freezing or Coil Defrosting/Dehumidifying

The low acute oral toxicity of DOWFROST, DOWCAL N, and DOWCAL 20 propylene glycol-based fluids and the moderate acute oral toxicity of DOWTHERM SR-1 and DOWCAL 10 ethylene glycol-based fluids make them highly useful fluids in many food industry applications. Selection of the proper glycol-based fluid in food processing applications depends largely on government regulatory requirements.

DOWFROST fluid is the fluid of choice for immersion freezing of wrapped meat or poultry products in food processing plants operated under U.S. federal inspection. The ingredients in DOWFROST fluid are listed as chemically acceptable by the U.S. Department of Agriculture (U.S.D.A.)¹. A supporting letter from Dow is available upon request. The ingredients in DOWFROST and DOWCAL N fluids are generally recognized as safe by the U.S. Food and Drug Administration (FDA)¹. DOWFROST and DOWCAL N fluids are also used in chilling or freezing applications where incidental fluid contact with food or beverage products is possible.

Both DOWFROST and DOWTHERM SR-1 fluids are listed as chemically acceptable by the U.S.D.A.¹ for defrosting refrigeration coils in establishments operating under the U.S. federal meat and poultry products inspection program. The compounds must be used in a manner that prevents direct or indirect contamination of edible products.

¹You may need to comply with similar or additional legislation in other countries. Contact your Dow representative for information.

Product Descriptions for DOWTHERM, DOWFROST, and DOWCAL Inhibited Glycol-based Heat Transfer Fluids

	DOWTHERM SR-1	DOWTHERM 4000	DOWCAL 10	DOWFROST	DOWFROST HD	DOWCAL 20	DOWCAL N
	Inhibited	Inhibited	Inhibited	Inhibited	Inhibited	Inhibited	Inhibited
	Ethylene Glycol	Ethylene Glycol	Ethylene Glycol	Propylene Glycol	Propylene Glycol	Propylene Glycol	Propylene Glycol
Composition, % by weight							
Glycols	95.4	92.4	93.5	95.5	94.0	93.5	95.5
Inhibitors & Water	4.6	7.6	6.5	4.5	6.0	6.5	4.5
Color	Fluorescent Pink	Fluorescent Orange	Pale Yellow ¹	Colorless	Fluorescent Yellow	Pale Yellow ¹	Pale Yellow ¹
Specific Gravity at 15/15°C (60/60°F)	1.1250–1.1350	1.130–1.144	1.125–1.135	1.050–1.060	1.053–1.063	1.050–1.060	1.050–1.060
pH of Solution Containing 50% Glycol	9.0–9.6	8.5–9.0	7.6–8.2	9.0–10.0	9.5–10.5	7.2–8.2	9.0–10.0
Reserve Alkalinity, Minimum	11.0 ml	25.0 ml	10.0 ml	10.0 ml	15.0 ml	8.0 ml	10.0 ml

¹Color available on request

Typical Properties[†] of Aqueous Solutions of DOWTHERM, DOWFROST, and DOWCAL Inhibited Glycol-based Heat Transfer Fluids (glycol concentrations 50% by volume)

		DOWTHERM SR-1	DOWTHERM 4000	DOWCAL 10	DOWFROST	DOWFROST HD	DOWCAL 20	DOWCAL N
Max. Operating Temp., °C (°F)		121 (250)	175 (350)	175 (350)	121 (250)	160 (320)	160 (325)	120 (250)
Freezing Point, °C (°F)		-37 (-34)	-37 (-34)	-37 (-34)	-34 (-28)	-34 (-28)	-34 (-28)	-34 (-28)
Physical Property	Temp. °C (°F)							
Thermal Conductivity	5 (40)	0.3682 (0.212)	0.3682 (0.212)	0.369 (0.212)	0.3528 (0.204)	0.3528 (0.204)	0.354 (0.204)	0.354 (0.204)
	80 (180)	0.4114 (0.238)	0.4114 (0.238)	0.413 (0.238)	0.3815 (0.221)	0.3815 (0.221)	0.383 (0.221)	0.383 (0.221)
	120 (250)	0.4168 (0.241)	0.4168 (0.241)	0.418 (0.241)	0.3792 (0.219)	0.3792 (0.219)	0.380 (0.219)	0.381 (0.219)
	175 (350)	NA	0.4043 (0.233)	0.406 (0.233)	NA	0.3645 ^{††} (0.210 ^{††})	0.366 (0.210 ^{††})	NA
Specific Heat	5 (40)	3.225 (0.770)	3.190 (0.762)	3.218 (0.762)	3.474 (0.830)	3.323 (0.794)	3.465 (0.794)	3.484 (0.830)
	80 (180)	3.515 (0.842)	3.486 (0.835)	3.510 (0.835)	3.763 (0.902)	3.662 (0.878)	3.757 (0.878)	3.771 (0.902)
	120 (250)	3.670 (0.878)	3.644 (0.872)	3.665 (0.872)	3.918 (0.937)	3.843 (0.920)	3.913 (0.920)	3.925 (0.937)
	175 (350)	NA	3.862 (0.925)	3.880 (0.925)	NA	4.024 ^{††} (0.965 ^{††})	4.068 (0.965 ^{††})	NA
Viscosity	5 (40)	6.63 (6.8)	6.63 (6.8)	6.54 (6.8)	13.77 (14.0)	13.77 (14.0)	13.6 (14.0)	13.6 (14.0)
	80 (180)	0.98 (0.94)	0.98 (0.94)	0.97 (0.94)	1.12 (1.1)	1.12 (1.1)	1.12 (1.1)	1.12 (1.1)
	120 (250)	0.53 (0.52)	0.53 (0.52)	0.52 (0.52)	0.60 (0.59)	0.60 (0.59)	0.60 (0.59)	0.60 (0.59)
	175 (350)	NA	0.28 (0.27)	0.28 (0.27)	NA	0.40 ^{††} (0.40 ^{††})	0.40 (0.40 ^{††})	NA
Density	5 (40)	1080 (67.47)	1092 (68.32)	1081 (68.32)	1051 (65.67)	1067 (66.68)	1052 (66.68)	1051 (65.67)
	80 (180)	1039 (64.80)	1047 (65.30)	1040 (65.30)	1002 (62.45)	1019 (63.50)	1002 (63.50)	1002 (62.45)
	120 (250)	1006 (62.78)	1015 (63.36)	1007 (63.36)	964 (60.11)	982 (61.27)	964 (61.27)	964 (60.11)
	175 (350)	NA	964 (60.10)	950 (60.10)	NA	939 ^{††} (58.42 ^{††})	918 (58.42 ^{††})	NA

[†] Properties shown are typical and should not be considered specifications.

^{††} At 160°C (325°F)



Glycol-based Fluid Maintenance

Fluid maintenance should be a major consideration in your choice of a glycol-based heat transfer fluid. A properly maintained inhibited glycol-based fluid should provide years of effective service. (DOWTHERM SR-1 fluid has lasted over 20 years in some applications.)

Branded inhibited glycol-based fluids (such as DOWTHERM, DOWFROST, and DOWCAL fluids) have a maintenance advantage over unbranded products. These Dow fluids can be periodically analyzed for inhibitor concentration, freeze point, and any significant changes in fluid quality. Unbranded glycol-based fluids, on the other hand, often can't be analyzed because their precise content is unknown. That means you are forced to guess about fluid condition and may replace fluid unnecessarily just to be sure system protection is maintained.

Dow provides annual fluid analysis to customers with systems containing 950 liters (250 gallons) of DOWTHERM, DOWFROST, or DOWCAL glycol-based fluid. Self-testing instruments are also available for use by operators of smaller systems.

Heat Transfer

Assistance From Dow

Dow fluid specialists can help you design, operate, and maintain your heat transfer system for optimum performance and economy. For assistance and answers to your questions, just contact the Dow representative in your area.

Here are just a few of the services we offer:

- System Design Consultation
- Piping Specs and Equipment Information
- Operational Troubleshooting
- Industrial Hygiene Service
- System Leak Detection
- Fluid Consumption Reports
- Fluid Analysis
- Health & Safety Presentations

Free Software Program Helps You Evaluate and Select the Right Fluid

To streamline and improve the accuracy of your fluid selection process, order your free FLUIDFILE software program from Dow. Complete facts about the entire family of DOWTHERM, DOWFROST, and SYLTHERM heat transfer fluids are available on this user-friendly engineering tool for Windows. A FLUIDFILE software program is also available in Europe for DOWCAL fluids.

To receive this fluid selection software, contact the Dow representative in your area.

Request Additional Dow Product and Applications Literature

For more information about heat transfer fluids and fluid applications, just call the number for your area listed on the back of this brochure and request the appropriate brochure listed below.

Synthetic Organic Fluids

DOWTHERM A (Product Brochure)

DOWTHERM G (Product Brochure)

DOWTHERM HT (Product Brochure)

DOWTHERM RP (Product Brochure)

DOWTHERM MX (Product Brochure)

DOWTHERM Q (Product Brochure)

DOWTHERM J (Product Brochure)

DOWTHERM T (Product Brochure)

Guide to Suppliers of Heat Transfer Equipment/Piping Specs
Health and Environmental Safety Brochure
for Synthetic Organic Fluids

Silicone Fluids

SYLTHERM 800 (Product Brochure)

SYLTHERM XLT (Product Brochure)

SYLTHERM HF (Product Brochure)

Inhibited Glycol-based Fluids

Engineering Guide for DOWTHERM Ethylene
Glycol-based Heat Transfer Fluids

Engineering Guide for DOWFROST Propylene
Glycol-based Heat Transfer Fluids

DOWCAL 10 (Product Brochure)

DOWCAL N (Product Brochure)

DOWCAL 20 (Product Brochure)

Applications Literature

Food Processing Applications Brochure

HVAC Applications Brochure

HVAC Fluid Specifications

Thermal Energy Storage Brochure

The Full Family of Heat Transfer Fluids

Performance & Recommended Applications[†]

Fluid Type	Fluid	Temp. Range, °C ^{††}	(°F ^{††})	High Temperature Thermal Stability	Low Temperature Pumpability	Low Vapor Pressure	Vapor Phase Operation Possible	Low Viscosity	Freeze/Corrosion Protection in Water-based Systems	Long-term Economy	Hot/Cold Cycle Operation for Batch Processing	Acute Oral Toxicity ^{†††}
Synthetic Organic Fluids	DOWTHERM A	15 to 400	(60 to 750)	▲			▲	▲		▲		■
	DOWTHERM G	-7 to 370	(20 to 680)	▲	■	▲		▲		▲		■
	DOWTHERM HT	0 to 345	(25 to 650)	▲	■	▲		▲		▲		■
	DOWTHERM Q	-35 to 330	(-30 to 625)	▲	●	▲		▲		▲	●	■
	DOWTHERM RP	-4 to 350	(-20 to 660)	▲	■	▲		▲		▲		
	DOWTHERM MX	-23 to 330	(-10 to 625)	▲	●	▲		▲		▲	●	■
	DOWTHERM T	-10 to 288	(14 to 550)	■	●	▲		●		●		
Silicone Fluids	DOWTHERM J	-80 to 315	(-110 to 600)	▲	▲		▲	▲		▲	▲	■
	SYLTHERM 800	-40 to 400	(-40 to 750)	▲	●			▲		▲	●	▲
	SYLTHERM XLT	-100 to 260	(-150 to 500)	▲	▲	■		▲		▲	▲	▲
Glycol-based Fluids	SYLTHERM HF	-73 to 260	(-100 to 500)	▲	▲	■		▲		▲	▲	
	DOWTHERM 4000	-50 to 175	(-60 to 350)	▲	▲			▲	▲	▲	●	■
	DOWFROST HD	-45 to 160	(-50 to 325)	▲	●			●	▲	▲	■	▲
	DOWTHERM SR-1	-50 to 121	(-60 to 250)	▲	▲			▲	▲	▲	●	■
	DOWFROST	-45 to 121	(-50 to 250)	▲	●			●	▲	▲	■	▲
	DOWCAL 10	-50 to 175	(-60 to 350)	▲	▲			▲	▲	▲	●	■
	DOWCAL N	-45 to 120	(-50 to 250)	▲	●			●	▲	▲	■	▲
DOWCAL 20	-45 to 160	(-50 to 325)	▲	●			●	▲	▲	■	▲	

[†] Performance within fluid operating range.

▲ Outstanding ● Excellent ■ Good

^{††} Liquid phase temperature range. Vapor phase operating range for DOWTHERM A fluid is 257°C (495°F) to 400°C (750°F). For DOWTHERM J fluid, 181°C (358°F) to 315°C (600°F).

^{†††} When used in industrial applications.



PRODUCT LINE GUIDE

**DOWTHERM, SYLTHERM,
DOWFROST, and DOWCAL
Heat Transfer Fluids**



For further information, call...

In The United States And Canada: 1-800-447-4369; Fax: 1-989-832-1465

In Europe: +32 3 450 2240; Fax: +32 3 450 2815

In The Pacific: +886-2-25478732; Fax: +886-2-27174115

In Other Global Areas: 1-989-832-1560; Fax: 1-989-832-1465

www.dowtherm.com

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