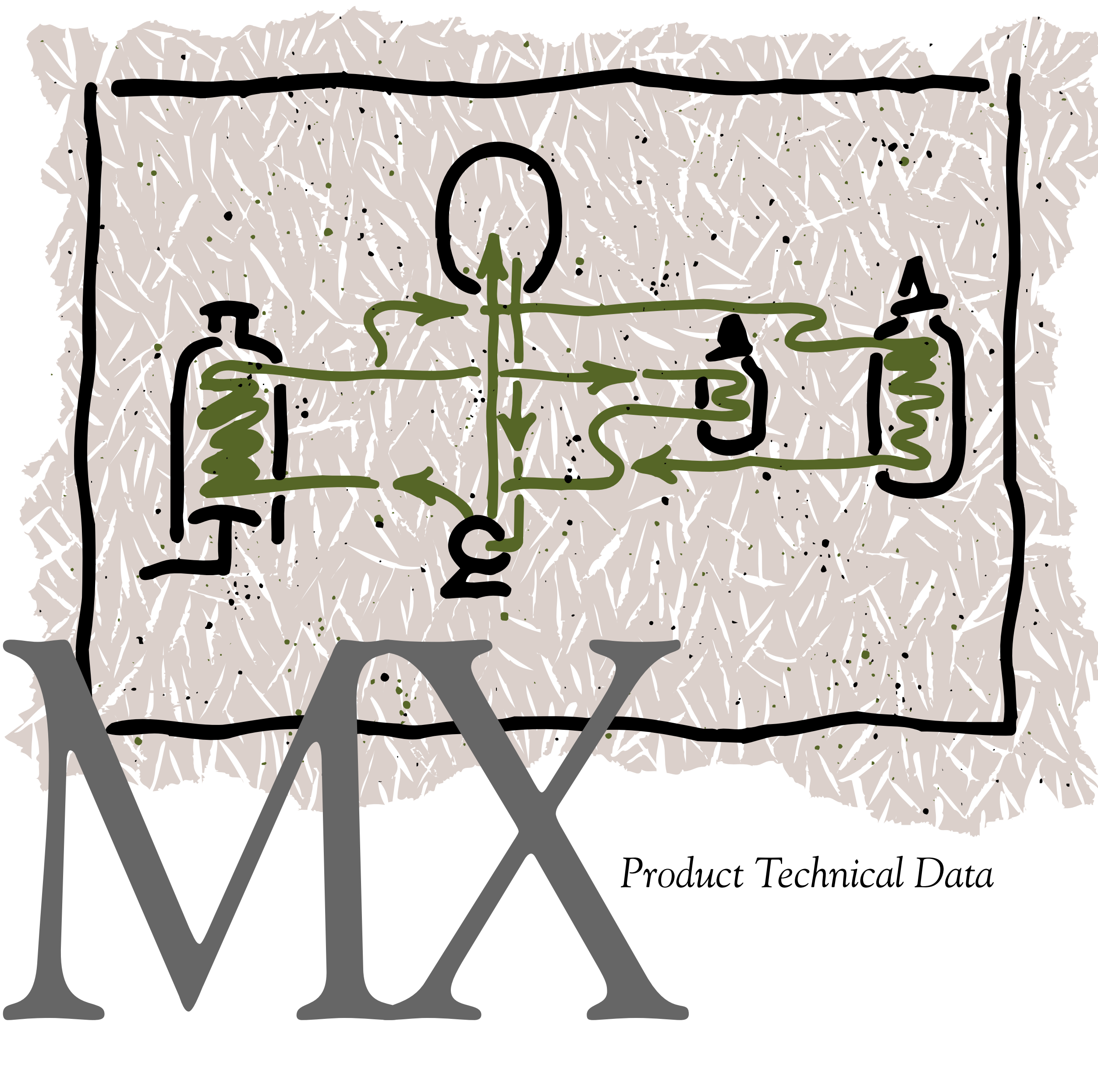
DOWTHERM MX
Heat Transfer Fluid



Product Technical Data

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For Information About Our Full Line of Fluids…

To learn more about the full line of heat transfer fluids manufactured or distributed by Dow — including DOWTHERM* synthetic organic, SYLTHERM† silicone and DOWTHERM, DOWFROST*, and DOWCAL* glycol-based fluids — request our product line guide. Call the number for your area listed on the back of this brochure.

Dowtherm MX Heat Transfer Fluid

DOWTHERM MX heat transfer fluid contains a mixture of alkylated aromatics and is designed for use as an alternative to hot oils in liquid phase heat transfer systems. Its normal application range is -10°F to 625°F (-23°C to 330°C). Unlike other moderately priced synthetic organic heat transfer fluids, DOWTHERM MX fluid can be used in non-pressurized systems up to temperatures of 620°F (327°C). DOWTHERM MX fluid exhibits better thermal stability than hot oils, particularly noticeable at the upper end of hot oils' use range at temperatures above 550°F (288°C). Furthermore, the low-temperature pumpability of DOWTHERM MX fluid is significantly better than that of a typical hot oil.

Throughout its operating range, the low viscosity of DOWTHERM MX fluid contributes to heat transfer efficiency. Its film coefficient at 600°F (315°C) is 20 percent higher than a typical hot oil. DOWTHERM MX fluid is also non-corrosive to common metals and alloys, assuring compatibility with most heat transfer systems.

DOWTHERM MX fluid provides several long-term economic advantages–and some potential immediate cost savings–over hot oils. These include: reduced pump and exchanger size requirements, possible elimination of costly steam tracing, lower fluid makeup requirements, reduced system fouling and related maintenance expenses, expanded change out intervals.

In addition to performance and economic advantages of DOWTHERM MX fluid, Dow's supporting services are unequaled. They include technical backup in the design phase, during operation and after shutdown, as needed. Moreover, free analytical testing is provided to monitor fluid condition.

Fluid Selection Criteria

Thermal Stability

The thermal stability of a heat transfer fluid is dependent not only on its chemical structure, but also on the design and operating temperature profile of the system in which it is used. Maximum life for a fluid can be obtained by following sound engineering practices in the design of the heat transfer system. Three key areas of focus are: designing and operating the heater and/or energy recovery unit, preventing chemical contamination, and eliminating contact of the fluid with air.

Heater Design and Operation

Poor design and/or operation of the fired heater can cause overheating resulting in excessive thermal degradation of the fluid. Some problem areas to be avoided include:

1. Flame impingement.
2. Operating the heater above its rated capacity.
3. Modifying the fuel-to-air mixing procedure to change the flame height and pattern. This can yield higher flame and gas temperatures together with higher heat flux.
4. Low fluid velocity/high heat flux areas resulting in excessive heat transfer fluid film temperatures.

The manufacturer of the fired heater should be your primary contact for the proper equipment for your heat transfer system needs.

Chemical Contamination

A primary concern regarding chemical contaminants in a heat transfer fluid system is their relatively poor thermal stability at elevated temperatures. The thermal degradation of chemical contaminants may be very rapid which may lead to fouling of heat transfer surfaces and corrosion of system components. The severity and nature of the corrosion will depend upon the amount and type of contaminant introduced into the system.

Air Oxidation

Organic heat transfer fluids operated at elevated temperatures are susceptible to air oxidation. The degree of oxidation and the rate of reaction is dependent upon the temperature and the amount of air mixing. Undesirable by-products of this reaction may include carboxylic acids which would likely result in system operating problems.

Preventative measures should be taken to ensure that air is eliminated from the system prior to bringing the heat transfer fluid up to operating temperatures. A positive pressure inert gas blanket should be maintained at all times on the expansion tank during system operation.

Fluid Pumpability

The pumpability of the material is fairly good down to -10°F (-23°C) where its viscosity is 282 cps (282 mPa•s).

Corrosivity

DOWTHERM MX fluid is non-corrosive toward common materials and alloys used in the construction of equipment. Even at high operating temperatures, equipment in which DOWTHERM fluid is used will have an excellent service life. Most corrosion problems are caused by chemicals introduced into the system during cleaning or from process leaks. The nature and severity of the attack will depend on the amounts and types of contaminants involved.

When special materials of construction are used, extra precaution should be taken to avoid contaminating materials containing the following:

Construction Material	*Contaminant*
Austenitic Stainless Steel	*Chloride*
Nickel	*Sulfur*
Copper Alloys	*Ammonia*

Health and Safety

The Material Safety Data Sheet (MSDS) for DOWTHERM MX fluid gives information on potential health hazards, handling recommendations, first aid, and what to do in case of an accidental spill or leak. Because the sheets are regularly revised, be sure to request the most recent copy from your Dow sales representative or call your local Customer Information Center number listed on the back of this brochure.

CUSTOMER SERVICE FOR USERS OF DOWTHERM MX HEAT TRANSFER FLUID

Fluid Analysis

The Dow Chemical Company, and its subsidiaries, offer an analytical service for DOWTHERM MX heat transfer fluid. It is recommended that users send a one-pint (0.5 liter) representative sample at least annually to:

North America & Pacific
The Dow Chemical Company
Larkin Lab/Thermal Fluids
1691 North Swede Road
Midland, Michigan 48674
United States of America

Europe
Dow Benelux NV
Testing Laboratory for SYLTHERM and DOWTHERM Fluids
Oude Maasweg 4
3197 KJ Rotterdam – Botlek
The Netherlands

Latin America
Dow Quimica S.A.
Fluid Analysis Service
1671, Alexandre Dumas
Santo Amaro – Sao Paulo – Brazil 04717-903

This analysis gives a profile of fluid changes to help identify trouble from product contamination or thermal decomposition.

Fluid Sampling Procedures

When a sample is taken from a hot system it should be cooled to below 100°F (40°C) before it is put into the shipping container. Cooling the sample below 100°F (40°C) will prevent the possibility of thermal burns to personnel; also, the fluid is then below its flash point. In addition, any low boilers will not flash and be lost from the sample. Cooling can be done by either a batch or continuous process. The batch method consists of isolating the hot sample of fluid from the system in a properly designed sample collector and then cooling it to below 100°F (40°C). After it is cooled, it can be withdrawn from the sampling collector into a container for shipment.

The continuous method consists of controlling the fluid at a very low rate through a steel or stainless steel cooling coil so as to maintain it at 100°F (40°C) or lower as it comes out of the end of the cooler into the sample collector. Before a sample is taken, the sampler should be thoroughly flushed. This initial fluid should be returned to the system or disposed of in a safe manner in compliance with all laws and regulations.

It is important that samples sent for analysis be representative of the charge in the unit. Ordinarily, samples should be taken from the main circulating line of a liquid system. Occasionally, additional samples may have to be taken from other parts of the system where specific problems exist. A detailed method for analyzing the fluid to determine its quality is available upon request.

Used heat transfer fluid which has been stored in drums or tanks should be sampled in such a fashion as to ensure a representative sample.

Table 1 — Physical Properties of DOWTHERM MX Fluid†

Composition: Mixture of akylated aromatic compounds

Color: Clear, yellow liquid

Property	English Units	SI Units
Reflux boiling point	623°F	328°C
Flash Point, CC[1]	329°F	165°C
Autoignition Temperature[2]	788°F	420°C
Pour Point	-13°F	-25°C
Average Molecular Weight	238	
Density at 75°F	59.9 lb/ft^3	959.5 kg/m^3
Density at 25°C	59.9 lb/ft^3	958.7 kg/m^3
Heat of Combustion	17479 Btu/lb	40629 kJ/kg
Estimated Critical Constants:		
T_c	995°F	535°C
P_c	18.69 atm	18.94 bar
V_c	0.0548 ft^3/lb	3.42 l/kg

† Not to be construed as specifications

1 Setaflash

2 ASTM E 659

Table 2 — Saturated Liquid Properties of DOWTHERM MX Fluid (English Units)[1]

Temp. °F	Specific Heat Btu/lb°F	Density lb/ft^3	Thermal Conductivity Btu/hrft^2(°F/ft)	Viscosity cP	Vapor Pressure psia
-10	0.351	61.9	0.0735	281.7	0.0
10	0.360	61.5	0.0728	119.5	0.0
30	0.368	61.0	0.0722	58.7	0.0
50	0.377	60.5	0.0715	32.3	0.0
70	0.386	60.0	0.0708	19.3	0.0
90	0.394	59.5	0.0702	12.4	0.0
110	0.403	59.0	0.0695	8.45	0.0
130	0.411	58.6	0.0688	6.02	0.0
150	0.420	58.1	0.0682	4.45	0.0
170	0.429	57.6	0.0675	3.40	0.0
190	0.437	57.1	0.0668	2.66	0.0
210	0.446	56.6	0.0662	2.13	0.0
230	0.455	56.0	0.0655	1.75	0.0
250	0.463	55.5	0.0648	1.45	0.0
270	0.472	55.0	0.0642	1.23	0.0
290	0.481	54.5	0.0635	1.05	0.0
310	0.489	54.0	0.0629	0.91	0.1
330	0.498	53.4	0.0622	0.79	0.1
350	0.506	52.9	0.0615	0.70	0.2
370	0.515	52.4	0.0609	0.62	0.3
390	0.524	51.8	0.0602	0.55	0.4
410	0.532	51.3	0.0595	0.50	0.6
430	0.541	50.7	0.0588	0.45	0.9
450	0.550	50.1	0.0582	0.41	1.3
470	0.558	49.6	0.0575	0.37	1.8
490	0.567	49.0	0.0568	0.34	2.5
510	0.575	48.4	0.0562	0.31	3.4
530	0.584	47.8	0.0555	0.29	4.6
550	0.593	47.2	0.0548	0.27	6.0
570	0.601	46.6	0.0542	0.25	7.8
590	0.610	46.0	0.0535	0.23	10.1
610	0.619	45.3	0.0528	0.22	12.8
630	0.627	44.7	0.0521	0.20	16.0
650	0.636	44.0	0.0514	0.19	19.9

[1] Not to be construed as specifications.

Table 3 — Saturated Liquid Properties of DOWTHERM MX Fluid (SI Units)[1]

Temp. °C	Specific Heat kJ/kg K	Density kg/m^3	Thermal Conductivity W/mK	Viscosity mPa•s	Vapor Pressure kPa
-20	1.480	989.8	0.127	213.9	0.0
-10	1.512	983.0	0.126	102.6	0.0
0	1.545	976.1	0.125	55.0	0.0
10	1.577	969.2	0.124	32.3	0.0
20	1.610	962.2	0.123	20.3	0.0
30	1.642	955.2	0.122	13.5	0.0
40	1.675	948.2	0.121	9.44	0.0
50	1.707	941.1	0.120	6.86	0.0
60	1.740	934.0	0.119	5.15	0.0
70	1.772	926.9	0.118	3.98	0.0
80	1.805	919.7	0.117	3.15	0.0
90	1.837	912.5	0.115	2.54	0.0
100	1.870	905.2	0.114	2.09	0.0
110	1.902	897.8	0.113	1.75	0.0
120	1.935	890.4	0.112	1.48	0.1
130	1.967	883.0	0.111	1.27	0.1
140	2.000	875.5	0.110	1.10	0.2
150	2.032	868.0	0.109	0.96	0.3
160	2.065	860.4	0.108	0.85	0.6
170	2.097	852.7	0.107	0.75	0.9
180	2.130	844.9	0.106	0.67	1.4
190	2.162	837.1	0.105	0.60	2.0
200	2.195	829.2	0.104	0.55	3.0
210	2.227	821.3	0.103	0.50	4.3
220	2.260	813.2	0.102	0.45	6.1
230	2.292	805.1	0.101	0.42	8.4
240	2.325	796.9	0.100	0.38	11.5
250	2.357	788.6	0.099	0.35	15.4
260	2.390	780.2	0.098	0.33	20.4
270	2.422	771.6	0.097	0.30	26.7
280	2.455	763.0	0.096	0.28	34.4
290	2.487	754.2	0.095	0.26	43.9
300	2.520	745.3	0.094	0.25	55.5
310	2.552	736.3	0.093	0.23	69.4
320	2.585	727.1	0.092	0.22	85.9
330	2.617	717.8	0.090	0.20	105.5
340	2.650	708.2	0.089	0.19	128.4

[1] Not to be construed as specifications.

Figure 1 — Calculated Latent Heat of Vaporization of DOWTHERM MX Fluid (English Units)

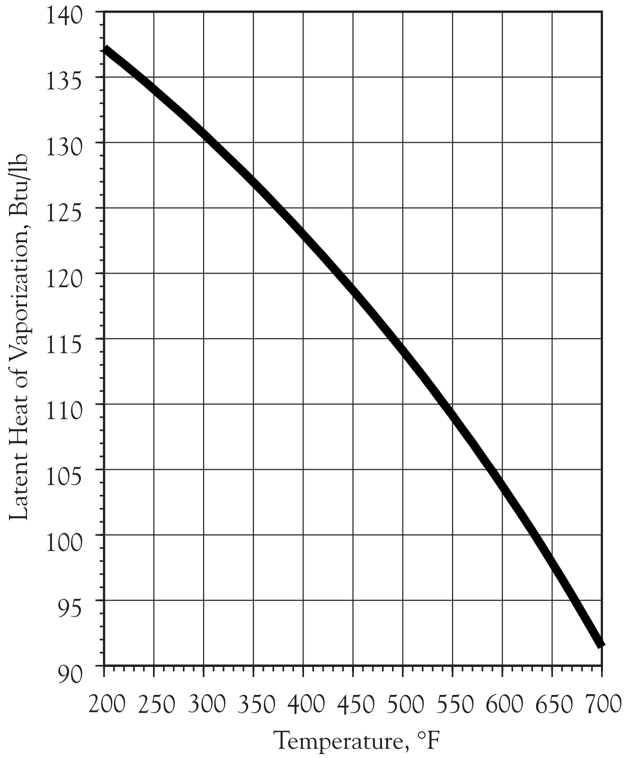


Figure 2 — Calculated Latent Heat of Vaporization of DOWTHERM MX Fluid (SI Units)

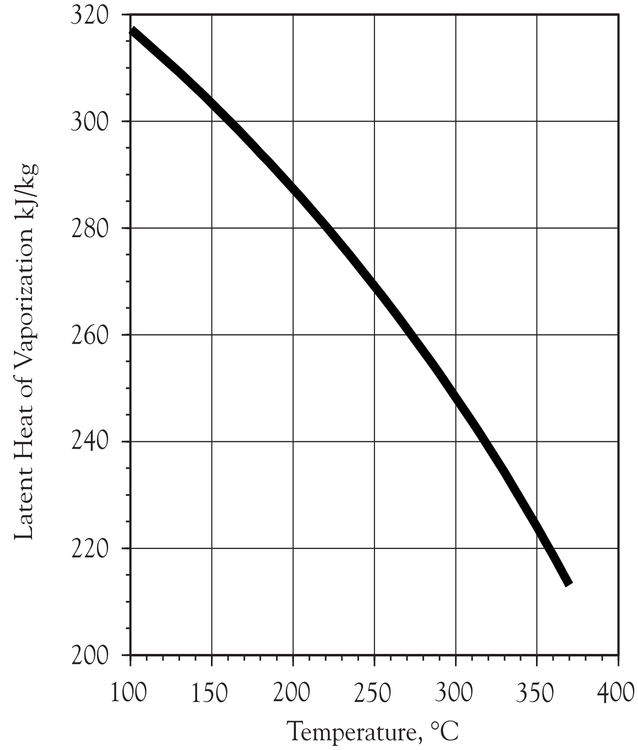


Figure 3 — Expanded Volume of DOWTHERM MX Fluid Basis—1 gallon at 77°F

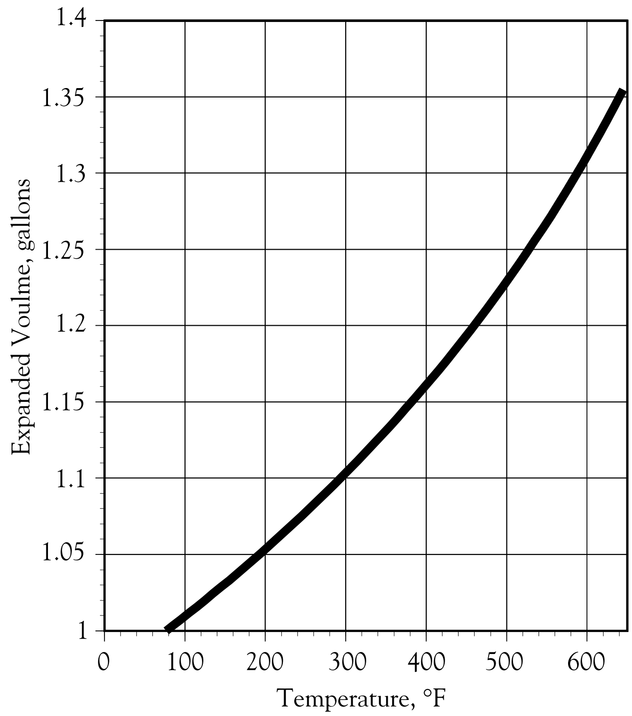


Figure 4 — Expanded Volume of DOWTHERM MX Fluid Basis—1m³ at 25°C

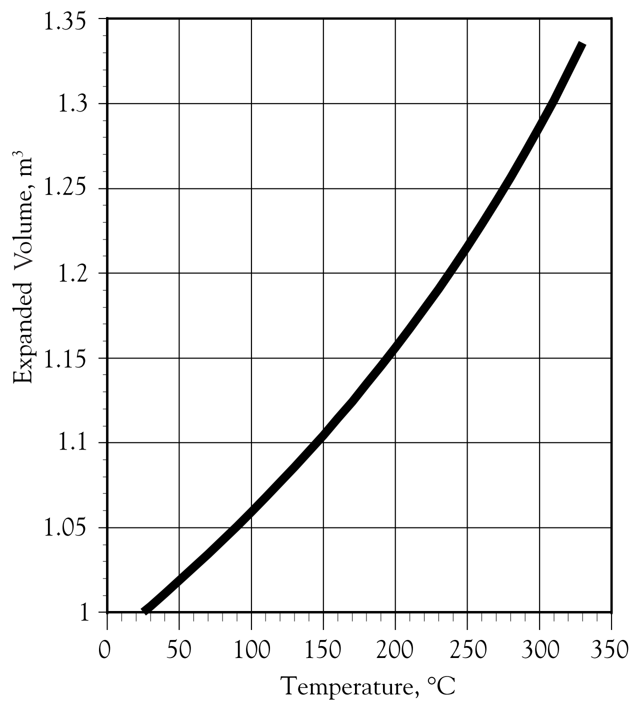
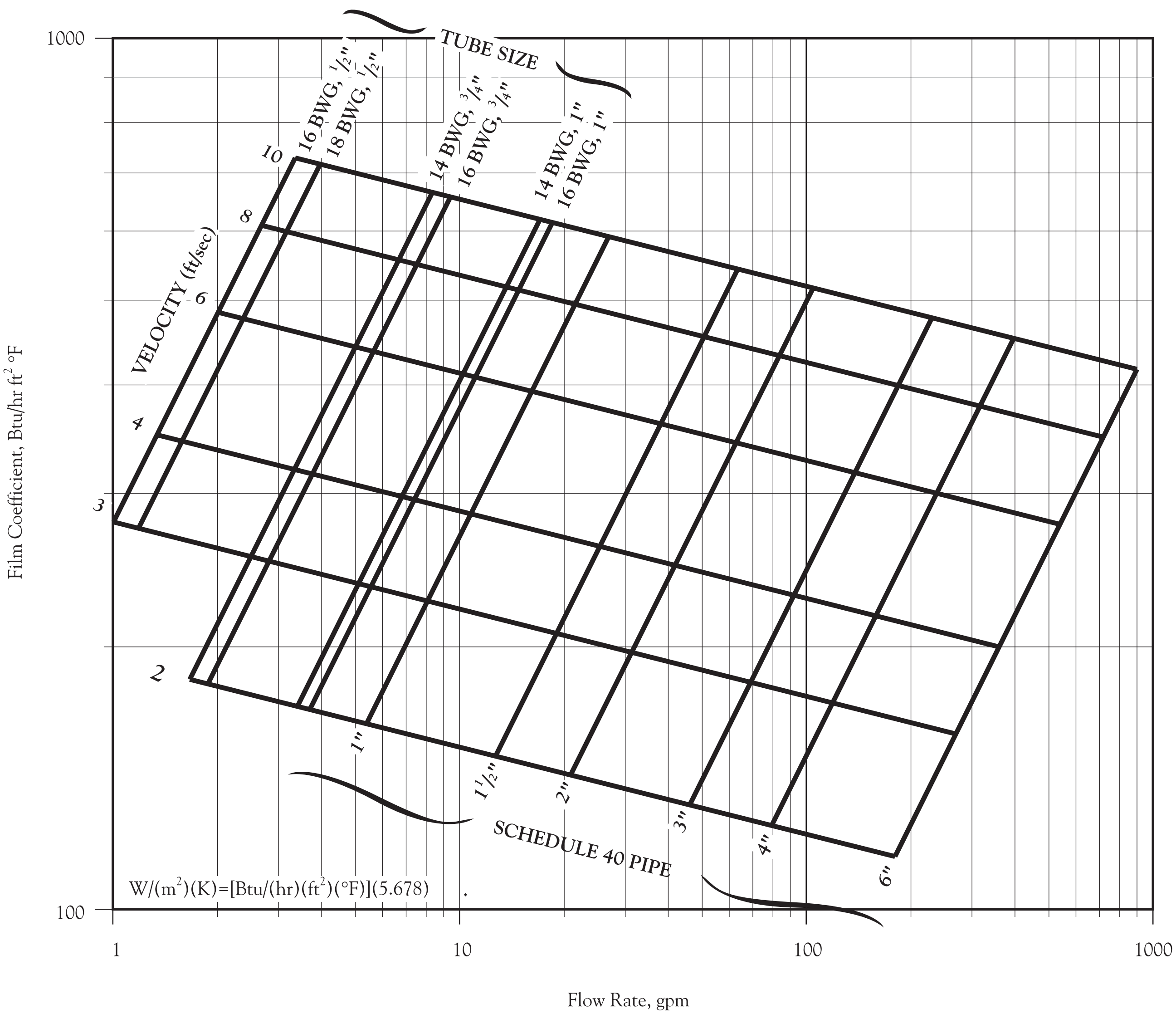
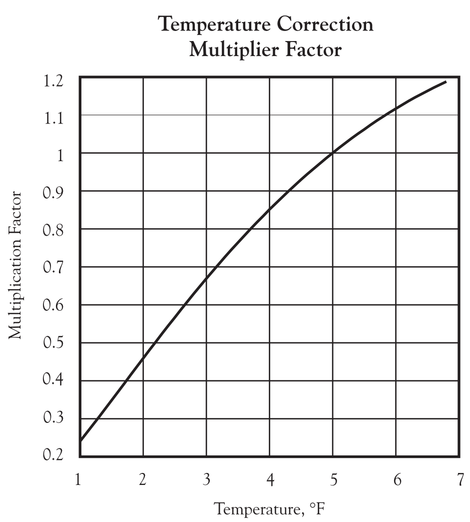


Figure 5 — Liquid Film Coefficient of DOWTHERM MX Fluid Inside Pipes and Tubes (Turbulent Flow Only) (English Units)





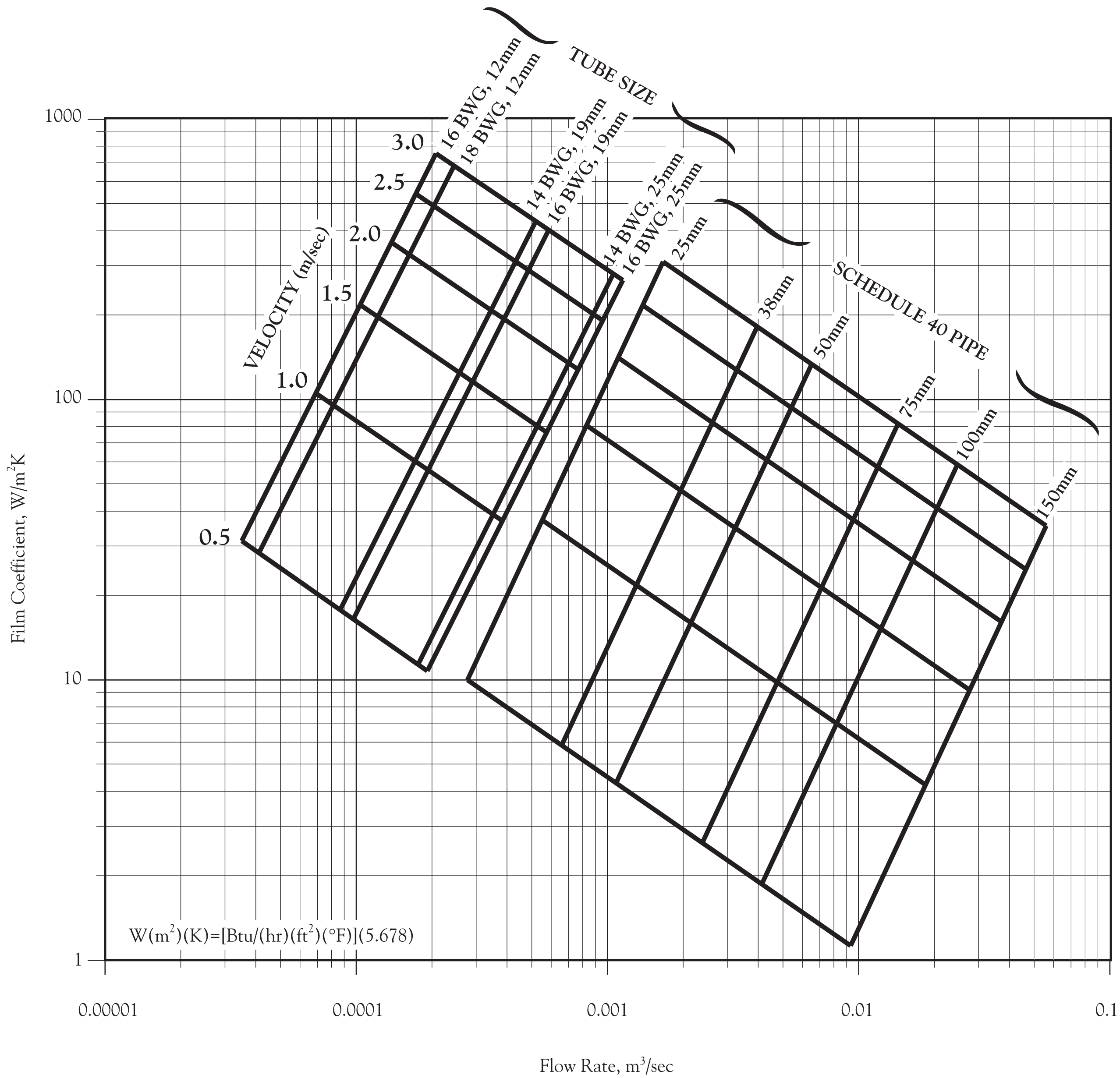
Sieder and Tate equation
Process Heat Transfer,
D.Q. Kern (1950) p. 103

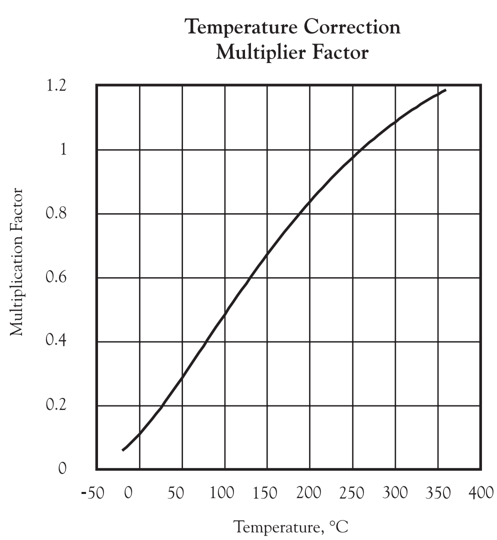
$$Nu = 0.027\, Re^{0.8} Pr^{1/3} \left(\frac{\mu}{\mu_w}\right)^{0.14}$$

Chart based on $\left(\frac{\mu}{\mu_w}\right)^{0.14} = 1$

Note: The values in this graph are based on the viscosity of fluid as supplied.

Figure 6 — Liquid Film Coefficient of DOWTHERM MX Fluid Inside Pipes and Tubes (Turbulent Flow Only) (SI Units)





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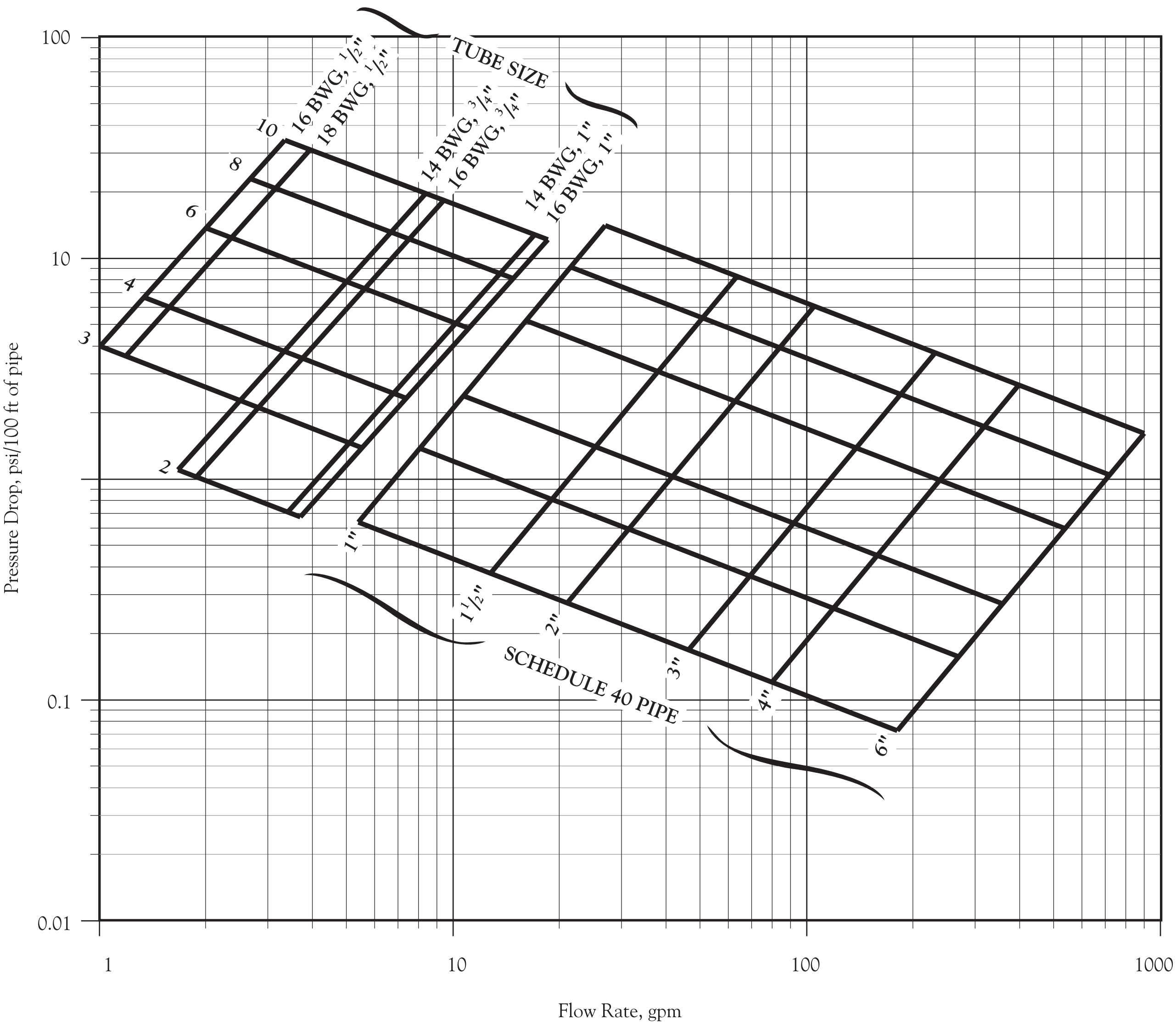
Note: The values in this graph are based on the viscosity of fluid as supplied.

Figure 7 — Pressure Drop vs. Flow Rate for DOWTHERM MX Fluid in Schedule 40 Nominal Pipe and BWG Tube (English Units)



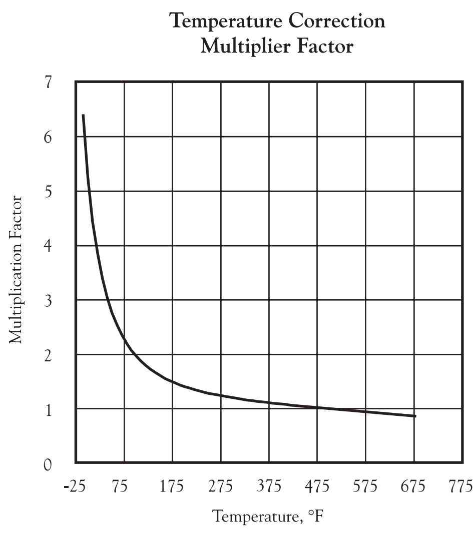
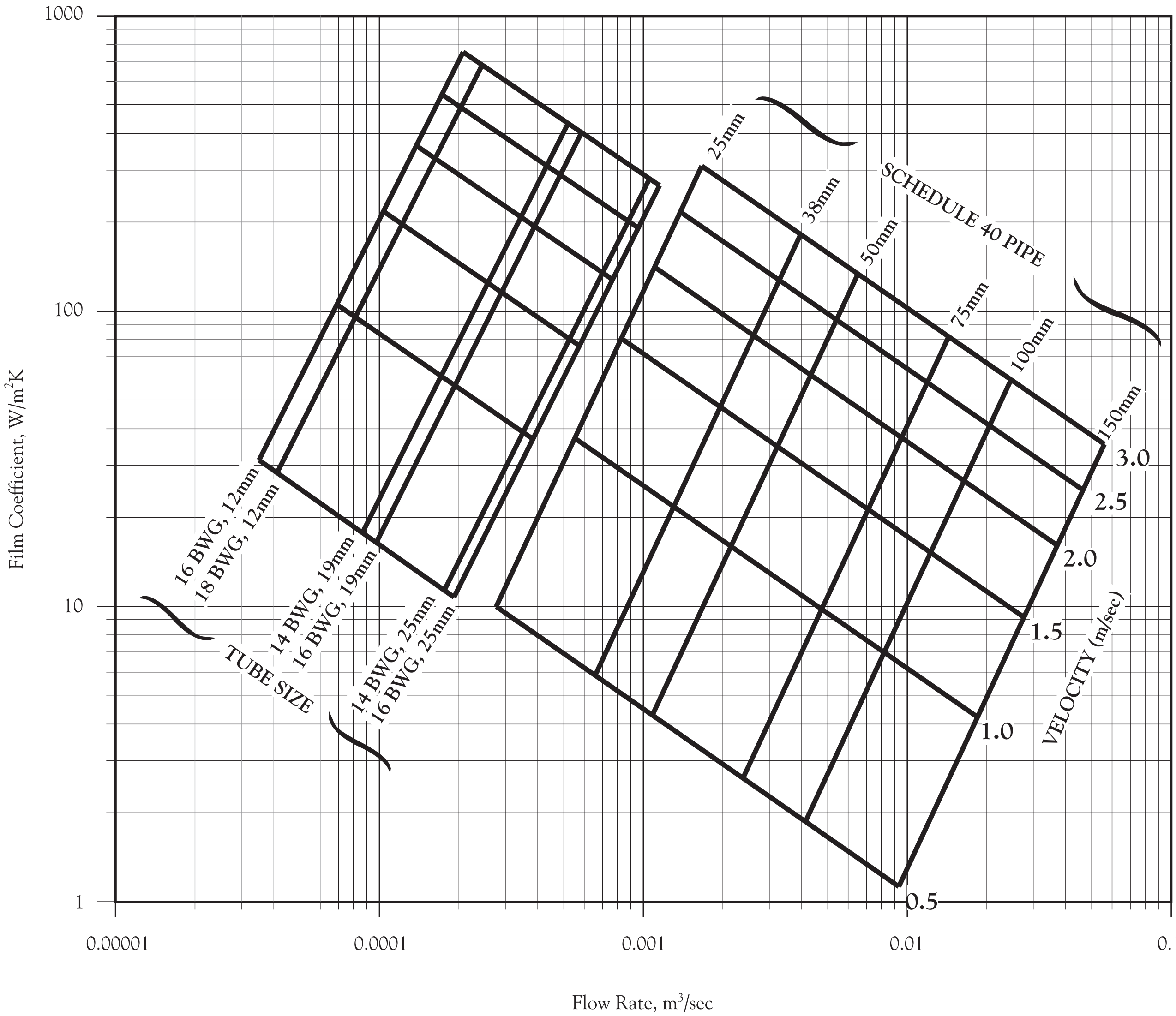
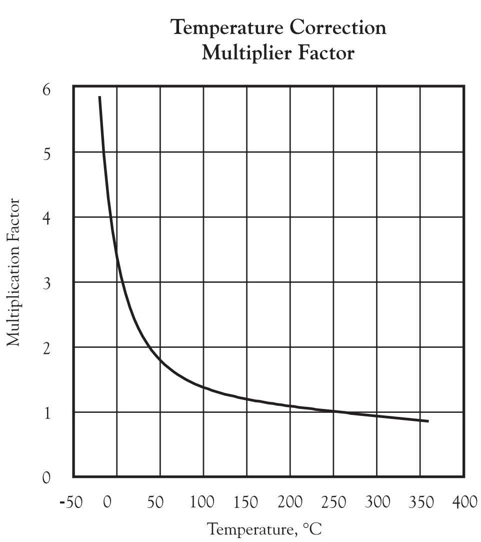


Figure 8 — Pressure Drop vs. Flow Rate for DOWTHERM MX Fluid in Schedule 40 Nominal Pipe and BWG Tube (SI Units)





DOWTHERM* MX Heat Transfer Fluid

Product Technical Data

For further information, call...

In The United States And Canada: 1-800-447-4369 • FAX: 1-517-832-1465

In Europe: +31 20691 6268 • FAX: +31 20691 6418

In The Pacific: +886-2-25478732 • FAX: +886-2-27174115

In Other Global Areas: 1-517-832-1560 • FAX: 1-517-832-1465

http://www.dow.com/heattrans

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