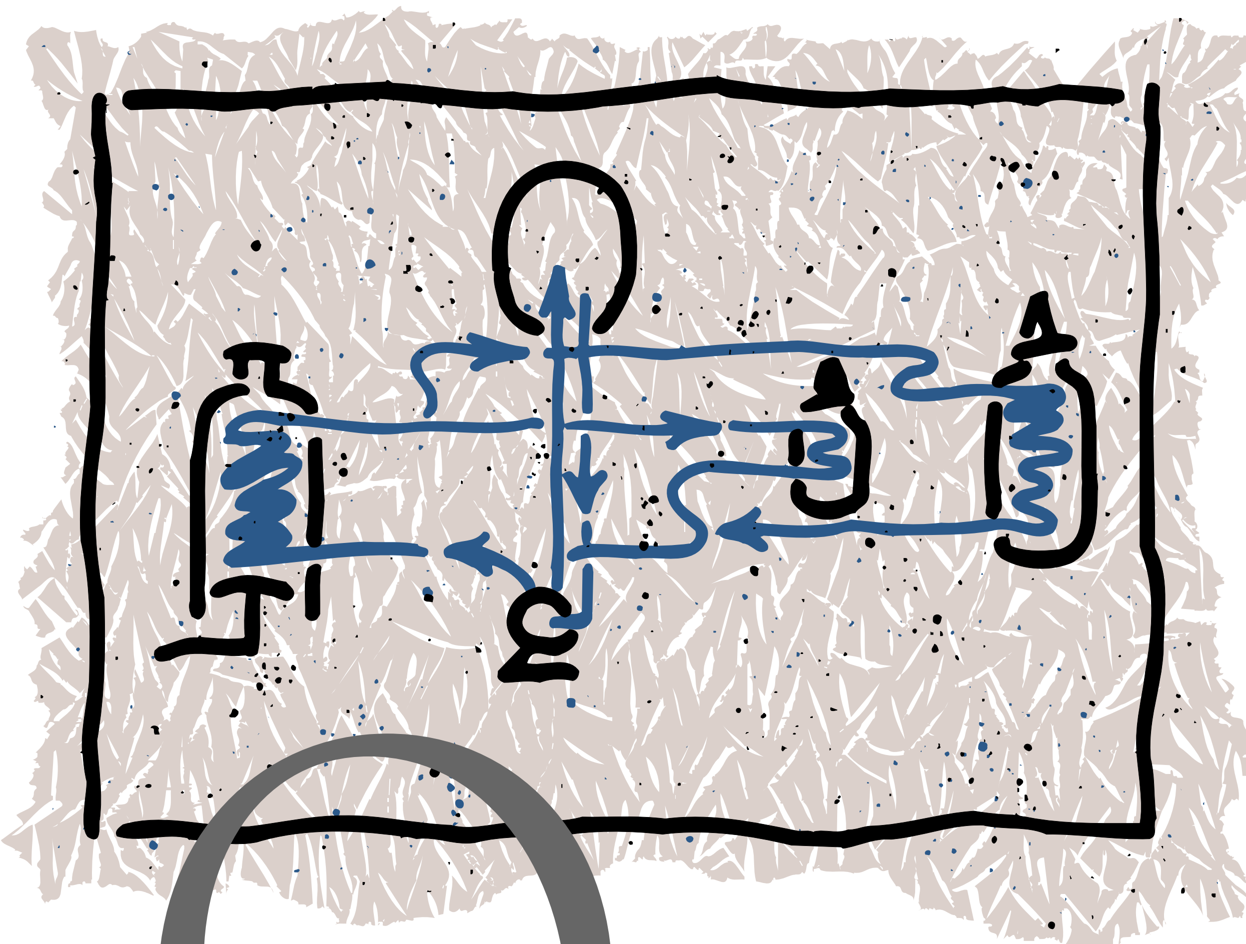
# DOWTHERM Q
# Heat Transfer Fluid



*Product Technical Data*

# CONTENTS

## High-Temperature Thermal Stability and Low-Temperature Pumpability Make DOWTHERM Q Superior to Hot Oils

DOWTHERM* Q heat transfer fluid contains a mixture of diphenylethane and alkylated aromatics and is designed for use as an alternative to hot oils in liquid phase heat transfer systems. Its normal application range is -30°F to 625°F (-35°C to 330°C). DOWTHERM Q fluid exhibits better thermal stability than hot oils, particularly noticeable at the upper end of hot oils' use range [at temperatures above 500°F (260°C)]. Furthermore, the low-temperature pumpability of DOWTHERM Q fluid is significantly better than that of a typical hot oil.

Throughout its operating range, the low viscosity of DOWTHERM Q fluid contributes to heat transfer efficiency. Its film coefficient at 600°F (315°C) is 42 percent higher than a typical hot oil. DOWTHERM Q fluid is also noncorrosive to common metals and alloys, assuring compatibility with most heat transfer systems.

DOWTHERM Q 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 changeout intervals, and a fluid credit program.

In addition to DOWTHERM Q fluid's performance and economic advantages, 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.

When it is time to change out your DOWTHERM Q heat transfer fluid, Dow's fluid credit program allows you to return the old fluid for credit toward the purchase of your new fluid charge.

### *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.

*Trademark of The Dow Chemical Company

†Trademark of Dow Corning Corporation

## Fluid Selection Criteria

### *Stability*

DOWTHERM Q fluid offers good thermal stability at temperatures up to 625°F (330°C). The maximum recommended film temperature is 675°F (360°C). Between 550°F and 600°F (290°C and 315°C), its stability is 15 to 30 times greater than that of a typical hot oil.

### *Freeze Point*

DOWTHERM Q fluid has a minimum pumpability temperature of -30°F (-35°C). Therefore, it can be used without steam tracing in most installations. Compare this lower use temperature to hot oil minimums as high as +32°F (0°C).

### *Viscosity*

The viscosity of DOWTHERM Q fluid at 600°F is 0.18 cps (at 315°C it is 0.2 mPa·s), accounting for a film coefficient that is 42 percent higher than that of a typical hot oil. DOWTHERM Q fluid's low viscosity is responsible for its low temperature start-up and pumpability performance. Viscosity at -30°F is only 29 cps (at -30°C it is only 24 mPa·s).

## 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. When heaters are operated at high temperatures, they are designed for minimum liquid velocities of 6 feet per second (2 m/s); a range of 6–12 feet per second (2–4 m/s) should cover most cases. The actual velocity selected will depend on an economic balance between the cost of circulation and heat transfer surface. Operating limitations are usually placed on heat flux by the equipment manufacturer. This heat flux is determined for a maximum film temperature by the operating conditions of the particular unit. 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—This can cause high heat flux areas resulting in excessive heat transfer fluid film temperatures.

The manufacturer of the fired heater should be the primary contact in supplying you with 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.

Preventive 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.

Units can be designed to operate at higher temperatures than those presently recommended in cases where the greater replacement costs of DOWTHERM Q fluid—resulting from its increased decomposition rate—can be economically justified. In such units, adequate provision must be made for good circulation, lower heat fluxes, and frequent or continuous purification.

## Corrosivity

DOWTHERM Q heat transfer fluid is noncorrosive toward common metals and alloys. Even at the high temperatures involved, equipment usually exhibits excellent service life.

Steel is used predominantly, although low alloy steels, stainless steels, Monel alloy, etc., are also used in miscellaneous pieces of equipment and instruments.

Most corrosion problems are caused by chemicals introduced into the system during cleaning or from process leaks. The severity and nature of the attack will depend upon the amounts and type of contamination 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* |

## Flammability

DOWTHERM Q heat transfer fluid is a combustible material, but has a relatively high flash point of 249°F (120°C) (SETA method), a fire point of 255°F (124°C) (C.O.C.), and an autoignition temperature of 773°F (412°C) (ASTM Method E659-78). The high autoignition temperature of DOWTHERM Q fluid provides a safety margin nearly 150°F (85°C) above the fluid's recommended upper use temperature. This is more than double the 70°F (40°C) safety margin provided by a typical hot oil. Autoignition safety margin is an important consideration because planned and unplanned temperature excursions must be accommodated.

Vapor leaks to the atmosphere are also sometimes encountered. Such leaks, however small, should not be tolerated because of the cost of replacing lost medium. Experience has shown that leaking vapors have usually cooled well below the fire point and fire has rarely resulted.

Leaks from pipelines into insulation are likewise potentially hazardous as they can lead to fires in the insulation. It has been found, for example, that leakage of organic materials into some types of insulation at elevated temperatures may result in spontaneous ignition due to auto-oxidation.

Vapors of DOWTHERM Q fluid do not pose a serious flammability hazard at room temperature, because the saturation concentration is so far below the lower flammability limit. Flammable mists are, however, possible under extremely unusual circumstances where the time of exposure to an ignition source, the temperature of the source and the atmosphere, the volume of mixture, the fuel-air ratio, and the mist particle size all fall within a somewhat narrow range.

If used and maintained properly, installations employing DOWTHERM Q fluid should present no unusual flammability hazards.

## Health and Safety Considerations

A Material Safety Data Sheet (MSDS) for DOWTHERM Q heat transfer fluid is available by calling the number listed on the back of this brochure. The MSDS contains complete health and safety information regarding the use of this product. Read and understand the MSDS before handling or otherwise using this product.

Provisions must be made to prevent significant discharge into public waters.

## Customer Service for Users of DOWTHERM Q Heat Transfer Fluid

### Fluid Analysis

The Dow Chemical Company offers an analytical service for DOWTHERM Q 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.

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.

### Fluid Return Program for DOWTHERM Fluids (Available in North America only)

In the unlikely event that you need to change out DOWTHERM Q fluid, Dow offers a fluid return program. If analysis of a particular fluid sample reveals significant thermal degradation of the medium, the customer will be advised to return the fluid in his system to Dow. If the fluid is contaminated with organic materials of low thermal stability, it may not be acceptable for Dow processing and will not qualify for the return program. In this case, Dow will advise the customer that the fluid cannot be processed and therefore should not be returned to Dow. No material should be sent to Dow until the fluid analysis has been completed and the customer informed of the results.

If the analysis shows fluid change-out is necessary, the customer should order sufficient new material to recharge the system before sending the old fluid to Dow. Under the fluid return program, Dow will credit the customer for all usable material recovered.

The Dow fluid return program permits customers to minimize their heat transfer fluid investment, handling downtime and inventory, while assuring that replacement fluid is of the highest quality.

Before returning material for credit, contact Dow at the number for your area listed on the back of this brochure for details.

For further information, please contact your nearest Dow representative or call the number for your area listed on the back of this brochure. Ask for DOWTHERM Q Fluid.

***Table 1 — Physical Properties of DOWTHERM Q Fluid*** [†]

Composition: Mixture of Diphenylethane and Alkylated Aromatics

| Property | English Units | SI Units |
|---|---|---|
| Temperature Range | -30 to 625°F | -35 to 330°C |
| Atmospheric Reflux Boiling Point | 513°F | 267°C |
| Flash Point[1] | 249°F | 120°C |
| Fire Point[2] | 255°F | 124°C |
| Autoignition Temperature[3] | 773°F | 412°C |
| Flammability Limits of Vapor in Air | | |
| Upper Flammability Limit, 5.5 Vol. % in Air | 375°F | 190°C |
| Lower Flammability Limit, 0.55 Vol. % in Air | 275°F | 135°C |
| Calculated Critical Points | | |
| Critical Temperature | 912°F | 489°C |
| Critical Pressure | 23.7 atm | 24 bar |
| Critical Volume | 0.0522 $ft^3$/lb | 3.258 l/kg |
| Molecular Weight (average) | 190 | |

[†]Not to be construed as specifications

[1]Closed Cup

[2]C.O.C.

[3]ASTM E659-78

*Table 2—Saturated Vapor Properties of DOWTHERM Q (English Units)*
*Values are estimated by an Equation of State*

| Temp. °F | $\Delta H_{lv}$ Btu/lb | $Z_{vapor}$ | Cp/Cv |
|---|---|---|---|
| 300 | 134.6 | 0.996 | 1.0266 |
| 320 | 132.9 | 0.995 | 1.0264 |
| 340 | 131.1 | 0.993 | 1.0262 |
| 360 | 129.3 | 0.990 | 1.0261 |
| 380 | 127.5 | 0.987 | 1.0262 |
| 400 | 125.6 | 0.984 | 1.0263 |
| 420 | 123.7 | 0.979 | 1.0265 |
| 440 | 121.7 | 0.974 | 1.0269 |
| 460 | 119.7 | 0.969 | 1.0273 |
| 480 | 117.6 | 0.962 | 1.0280 |
| 500 | 115.4 | 0.954 | 1.0288 |
| 520 | 113.2 | 0.946 | 1.0298 |
| 540 | 110.9 | 0.936 | 1.0310 |
| 560 | 108.5 | 0.925 | 1.0324 |
| 580 | 106.1 | 0.913 | 1.0342 |
| 600 | 103.5 | 0.899 | 1.0363 |
| 620 | 100.8 | 0.885 | 1.0389 |
| 640 | 98.0 | 0.868 | 1.0419 |
| 660 | 95.1 | 0.851 | 1.0457 |
| 680 | 92.0 | 0.831 | 1.0503 |

*Table 3—Saturated Vapor Properties of DOWTHERM Q (SI Units)*
*Values are estimated by an Equation of State*

| Temp. °C | $\Delta H_{lv}$ kJ/kg | $Z_{vapor}$ | Cp/Cv |
|---|---|---|---|
| 100 | 329.5 | 0.999 | 1.0283 |
| 110 | 326.2 | 0.999 | 1.0278 |
| 120 | 322.9 | 0.998 | 1.0274 |
| 130 | 319.5 | 0.998 | 1.0271 |
| 140 | 316.0 | 0.997 | 1.0268 |
| 150 | 312.5 | 0.996 | 1.0265 |
| 160 | 308.9 | 0.995 | 1.0264 |
| 170 | 305.2 | 0.993 | 1.0262 |
| 180 | 301.5 | 0.991 | 1.0261 |
| 190 | 297.6 | 0.988 | 1.0261 |
| 200 | 293.7 | 0.985 | 1.0262 |
| 210 | 289.7 | 0.982 | 1.0264 |
| 220 | 285.7 | 0.978 | 1.0266 |
| 230 | 281.5 | 0.973 | 1.0270 |
| 240 | 277.2 | 0.967 | 1.0275 |
| 250 | 272.8 | 0.961 | 1.0280 |
| 260 | 268.3 | 0.954 | 1.0288 |
| 270 | 263.6 | 0.947 | 1.0297 |
| 280 | 258.9 | 0.938 | 1.0307 |
| 290 | 253.9 | 0.928 | 1.0320 |
| 300 | 248.9 | 0.918 | 1.0334 |
| 310 | 243.6 | 0.906 | 1.0352 |
| 320 | 238.1 | 0.894 | 1.0373 |
| 330 | 232.5 | 0.880 | 1.0397 |
| 340 | 226.6 | 0.865 | 1.0426 |
| 350 | 220.4 | 0.849 | 1.0461 |
| 360 | 214.0 | 0.831 | 1.0503 |

## *Table 4—Saturated Liquid Properties of DOWTHERM Q Fluid (English Units)*

| Temp. °F | Specific Heat Btu/lb°F | Density lb/ft$^3$ | Therm. Cond. Btu/hr ft$^2$(°F/ft) | Viscosity cP | Vapor Pressure psia |
|---|---|---|---|---|---|
| -30 | 0.353 | 62.84 | 0.0741 | 29.0 | |
| -20 | 0.358 | 62.57 | 0.0737 | 23.1 | |
| -10 | 0.362 | 62.31 | 0.0734 | 18.4 | |
| 0 | 0.366 | 62.05 | 0.0730 | 14.7 | |
| 10 | 0.370 | 61.79 | 0.0727 | 11.8 | |
| 20 | 0.375 | 61.53 | 0.0723 | 9.60 | |
| 30 | 0.379 | 61.26 | 0.0720 | 7.86 | |
| 40 | 0.383 | 61.00 | 0.0716 | 6.50 | |
| 50 | 0.387 | 60.74 | 0.0712 | 5.42 | |
| 60 | 0.392 | 60.48 | 0.0708 | 4.57 | |
| 70 | 0.396 | 60.21 | 0.0704 | 3.88 | |
| 80 | 0.400 | 59.95 | 0.0701 | 3.32 | |
| 90 | 0.404 | 59.69 | 0.0697 | 2.87 | |
| 100 | 0.409 | 59.43 | 0.0693 | 2.50 | |
| 110 | 0.413 | 59.17 | 0.0689 | 2.19 | |
| 120 | 0.417 | 58.90 | 0.0684 | 1.94 | |
| 130 | 0.421 | 58.64 | 0.0680 | 1.72 | |
| 140 | 0.425 | 58.38 | 0.0676 | 1.54 | |
| 150 | 0.429 | 58.12 | 0.0672 | 1.38 | 0.01 |
| 160 | 0.434 | 57.86 | 0.0668 | 1.25 | 0.01 |
| 170 | 0.438 | 57.59 | 0.0663 | 1.14 | 0.01 |
| 180 | 0.442 | 57.33 | 0.0659 | 1.04 | 0.02 |
| 190 | 0.446 | 57.07 | 0.0654 | 0.95 | 0.02 |
| 200 | 0.450 | 56.81 | 0.0650 | 0.88 | 0.03 |
| 210 | 0.454 | 56.54 | 0.0645 | 0.81 | 0.04 |
| 220 | 0.458 | 56.28 | 0.0641 | 0.75 | 0.06 |
| 230 | 0.462 | 56.02 | 0.0636 | 0.70 | 0.08 |
| 240 | 0.467 | 55.76 | 0.0632 | 0.65 | 0.10 |
| 250 | 0.471 | 55.50 | 0.0627 | 0.61 | 0.14 |
| 260 | 0.475 | 55.23 | 0.0623 | 0.57 | 0.18 |
| 270 | 0.479 | 54.97 | 0.0618 | 0.54 | 0.22 |
| 280 | 0.483 | 54.71 | 0.0613 | 0.51 | 0.28 |
| 290 | 0.487 | 54.45 | 0.0609 | 0.48 | 0.36 |
| 300 | 0.491 | 54.18 | 0.0604 | 0.46 | 0.45 |
| 310 | 0.495 | 53.92 | 0.0599 | 0.44 | 0.55 |
| 320 | 0.499 | 53.66 | 0.0594 | 0.41 | 0.68 |
| 330 | 0.503 | 53.40 | 0.0589 | 0.40 | 0.83 |
| 340 | 0.507 | 53.14 | 0.0585 | 0.38 | 1.01 |
| 350 | 0.511 | 52.87 | 0.0580 | 0.36 | 1.22 |
| 360 | 0.515 | 52.61 | 0.0575 | 0.35 | 1.46 |
| 370 | 0.519 | 52.35 | 0.0570 | 0.33 | 1.74 |
| 380 | 0.523 | 52.09 | 0.0565 | 0.32 | 2.07 |
| 390 | 0.527 | 51.82 | 0.0560 | 0.31 | 2.45 |
| 400 | 0.531 | 51.56 | 0.0555 | 0.30 | 2.88 |
| 410 | 0.535 | 51.30 | 0.0550 | 0.29 | 3.37 |
| 420 | 0.539 | 51.04 | 0.0545 | 0.28 | 3.93 |
| 430 | 0.543 | 50.78 | 0.0540 | 0.27 | 4.57 |
| 440 | 0.547 | 50.51 | 0.0535 | 0.26 | 5.28 |
| 450 | 0.551 | 50.25 | 0.0530 | 0.25 | 6.09 |
| 460 | 0.555 | 49.99 | 0.0525 | 0.25 | 6.99 |
| 470 | 0.558 | 49.73 | 0.0520 | 0.24 | 7.99 |
| 480 | 0.562 | 49.46 | 0.0515 | 0.23 | 9.11 |
| 490 | 0.566 | 49.20 | 0.0510 | 0.23 | 10.36 |
| 500 | 0.570 | 48.94 | 0.0505 | 0.22 | 11.73 |
| 510 | 0.574 | 48.68 | 0.0500 | 0.22 | 13.24 |
| 520 | 0.578 | 48.42 | 0.0495 | 0.21 | 14.91 |
| 530 | 0.582 | 48.15 | 0.0490 | 0.21 | 16.74 |
| 540 | 0.586 | 47.89 | 0.0485 | 0.20 | 18.75 |
| 550 | 0.589 | 47.63 | 0.0480 | 0.20 | 20.93 |
| 560 | 0.593 | 47.37 | 0.0475 | 0.19 | 23.32 |
| 570 | 0.597 | 47.10 | 0.0470 | 0.19 | 25.91 |
| 580 | 0.601 | 46.84 | 0.0465 | 0.18 | 28.72 |
| 590 | 0.605 | 46.58 | 0.0460 | 0.18 | 31.76 |
| 600 | 0.609 | 46.32 | 0.0455 | 0.18 | 35.05 |
| 610 | 0.612 | 46.06 | 0.0450 | 0.17 | 38.59 |
| 620 | 0.616 | 45.79 | 0.0445 | 0.17 | 42.41 |
| 630 | 0.620 | 45.53 | 0.0440 | 0.17 | 46.51 |
| 640 | 0.624 | 45.27 | 0.0435 | 0.16 | 50.90 |
| 650 | 0.627 | 45.01 | 0.0430 | 0.16 | 55.61 |
| 660 | 0.631 | 44.74 | 0.0425 | 0.16 | 60.64 |
| 670 | 0.635 | 44.48 | 0.0420 | 0.16 | 66.01 |
| 680 | 0.639 | 44.22 | 0.0416 | 0.15 | 71.72 |

## *Table 5 — Saturated Liquid Properties of* DOWTHERM *Q Fluid (SI Units)*

| *Temp.* °C | *Specific Heat* kJ/kg K | *Density* kg/m$^3$ | *Therm. Cond.* W/m K | *Viscosity* mPa⋆s | *Vapor Pressure* bar |
|---|---|---|---|---|---|
| -35 | 1.478 | 1011.4 | 0.1280 | 46.6 | |
| -30 | 1.492 | 1003.2 | 0.1277 | 24.2 | |
| -20 | 1.525 | 995.6 | 0.1266 | 16.1 | |
| -10 | 1.557 | 988.0 | 0.1255 | 10.9 | |
| 0 | 1.589 | 980.5 | 0.1244 | 7.56 | |
| 10 | 1.621 | 972.9 | 0.1232 | 5.42 | |
| 20 | 1.653 | 965.4 | 0.1220 | 4.00 | |
| 30 | 1.685 | 957.8 | 0.1208 | 3.04 | |
| 40 | 1.716 | 950.2 | 0.1195 | 2.37 | |
| 50 | 1.748 | 942.7 | 0.1183 | 1.89 | |
| 60 | 1.779 | 935.1 | 0.1170 | 1.54 | |
| 70 | 1.811 | 927.6 | 0.1156 | 1.28 | |
| 80 | 1.842 | 920.0 | 0.1143 | 1.07 | |
| 90 | 1.873 | 912.4 | 0.1129 | 0.92 | |
| 100 | 1.904 | 904.9 | 0.1115 | 0.80 | |
| 110 | 1.935 | 897.3 | 0.1101 | 0.70 | |
| 120 | 1.966 | 889.8 | 0.1087 | 0.62 | 0.01 |
| 130 | 1.997 | 882.2 | 0.1072 | 0.55 | 0.01 |
| 140 | 2.027 | 874.6 | 0.1058 | 0.50 | 0.02 |
| 150 | 2.058 | 867.1 | 0.1043 | 0.45 | 0.03 |
| 160 | 2.088 | 859.5 | 0.1028 | 0.41 | 0.05 |
| 170 | 2.118 | 852.0 | 0.1013 | 0.38 | 0.07 |
| 180 | 2.148 | 844.4 | 0.0998 | 0.35 | 0.09 |
| 190 | 2.178 | 836.8 | 0.0982 | 0.33 | 0.13 |
| 200 | 2.208 | 829.3 | 0.0967 | 0.31 | 0.17 |
| 210 | 2.238 | 821.7 | 0.0952 | 0.29 | 0.23 |
| 220 | 2.268 | 814.2 | 0.0936 | 0.27 | 0.31 |
| 230 | 2.297 | 806.6 | 0.0921 | 0.26 | 0.40 |
| 240 | 2.327 | 799.0 | 0.0905 | 0.24 | 0.51 |
| 250 | 2.356 | 791.5 | 0.0889 | 0.23 | 0.64 |
| 260 | 2.386 | 783.9 | 0.0874 | 0.22 | 0.81 |
| 270 | 2.415 | 776.4 | 0.0858 | 0.21 | 1.00 |
| 280 | 2.444 | 768.8 | 0.0843 | 0.20 | 1.24 |
| 290 | 2.473 | 761.2 | 0.0827 | 0.19 | 1.51 |
| 300 | 2.502 | 753.7 | 0.0811 | 0.19 | 1.82 |
| 310 | 2.530 | 746.1 | 0.0796 | 0.18 | 2.19 |
| 320 | 2.559 | 738.6 | 0.0780 | 0.17 | 2.61 |
| 330 | 2.587 | 731.0 | 0.0765 | 0.17 | 3.09 |
| 340 | 2.616 | 723.4 | 0.0749 | 0.16 | 3.64 |
| 350 | 2.644 | 715.9 | 0.0734 | 0.16 | 4.25 |
| 360 | 2.672 | 708.3 | 0.0719 | 0.15 | 4.95 |

*Figure 1 — Thermal Conductivity of DOWTHERM Q Fluid (English Units)*

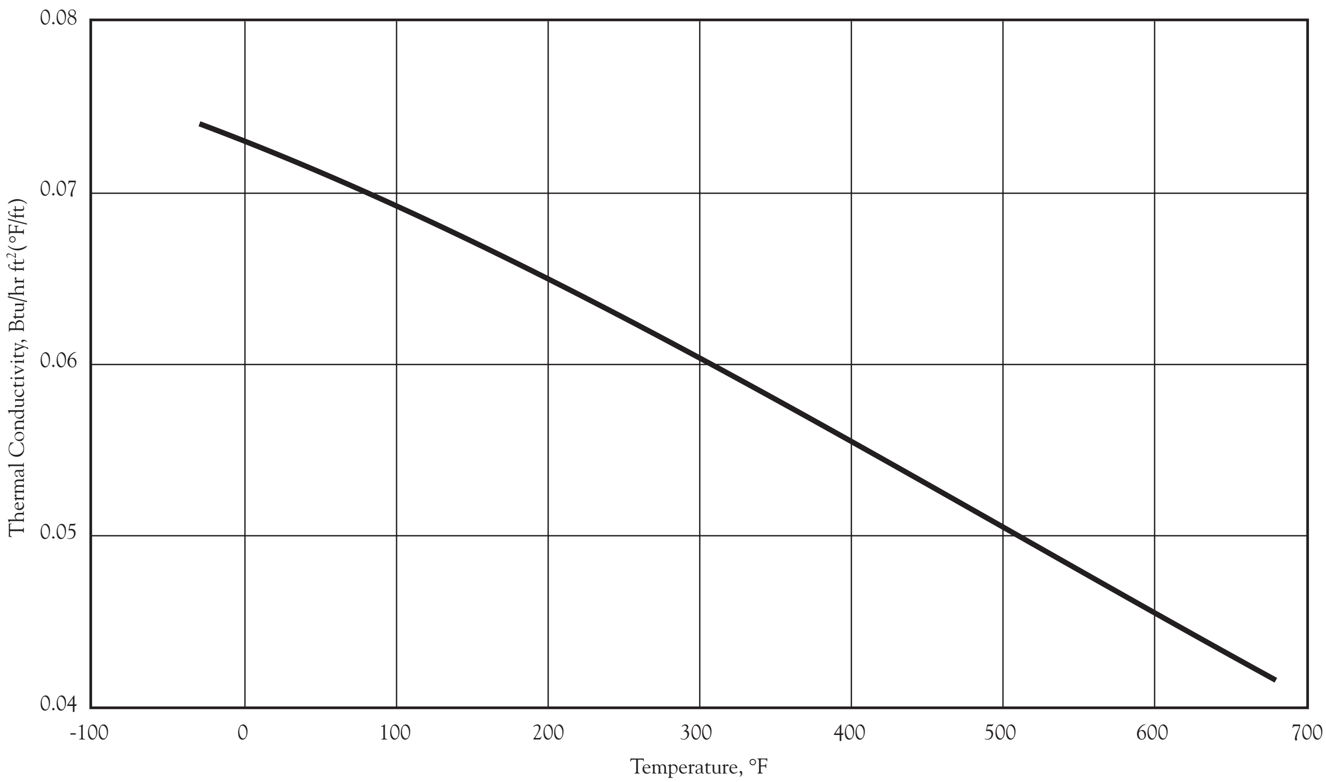



*Figure 2 — Thermal Conductivity of DOWTHERM Q Fluid (SI Units)*

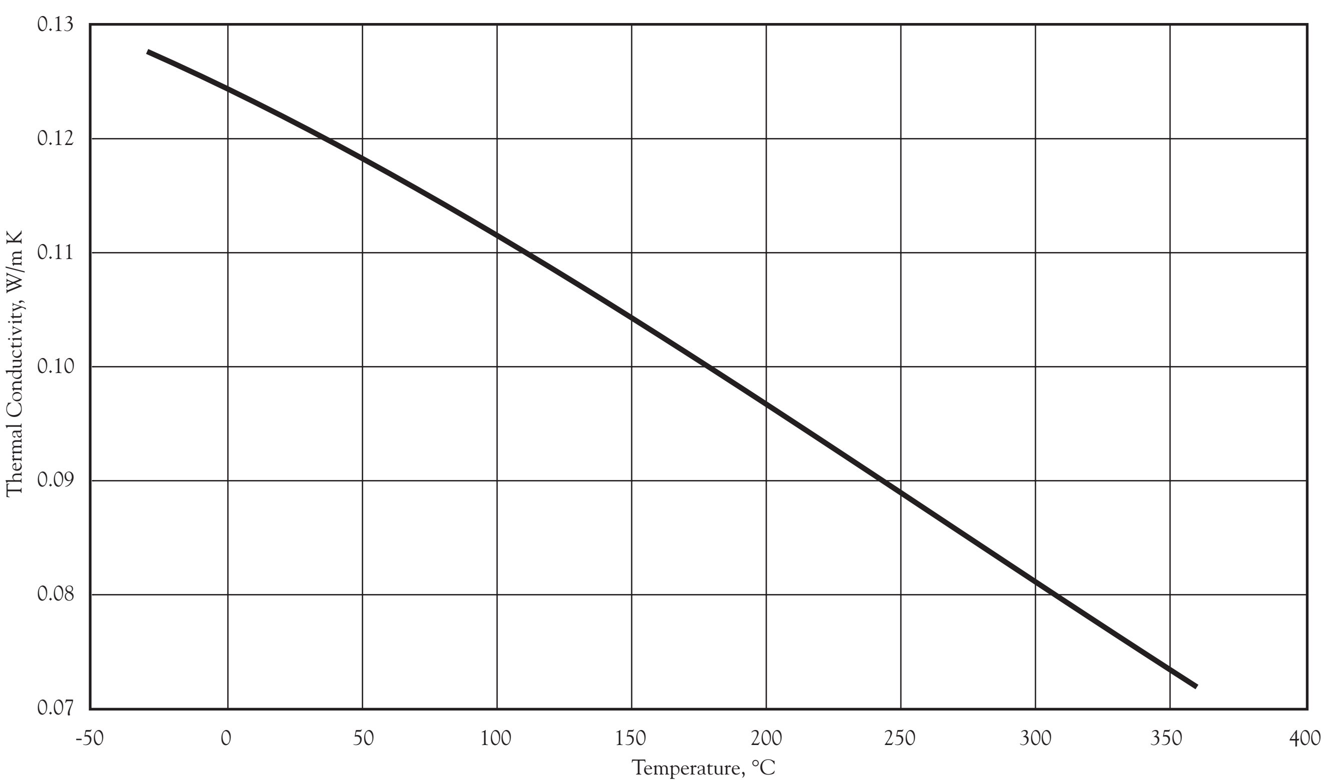


*Figure 3—Vapor Pressure of DOWTHERM Q Fluid (English Units)*

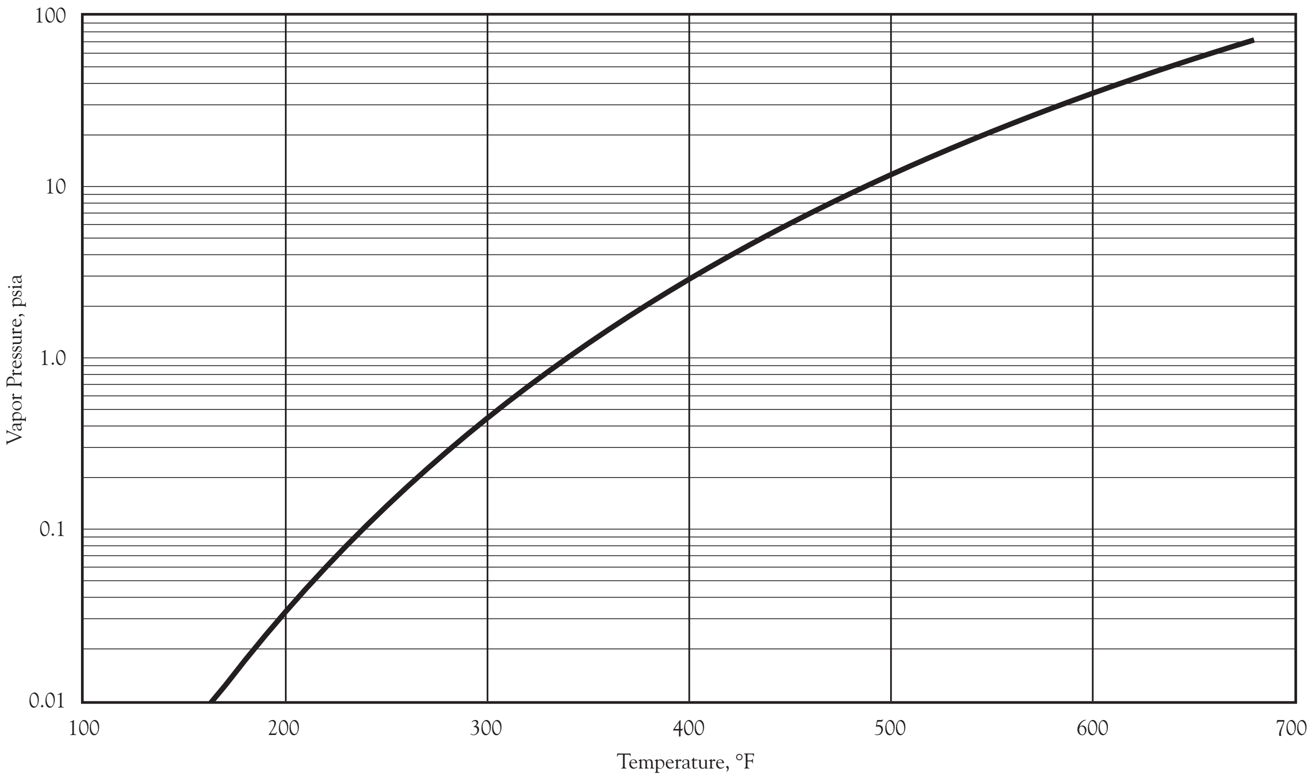



*Figure 4—Vapor Pressure of DOWTHERM Q Fluid (SI Units)*

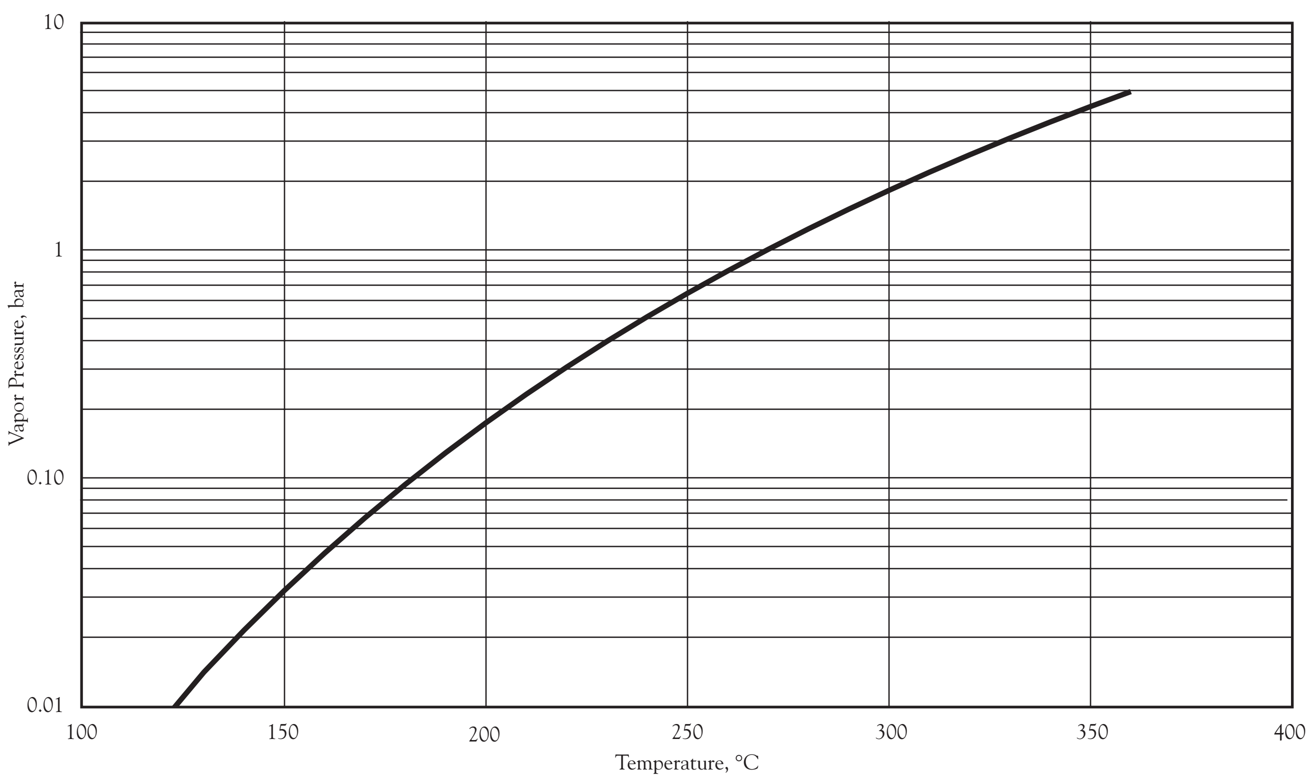


*Figure 5—Specific Heat of DOWTHERM Q Fluid (English Units)*

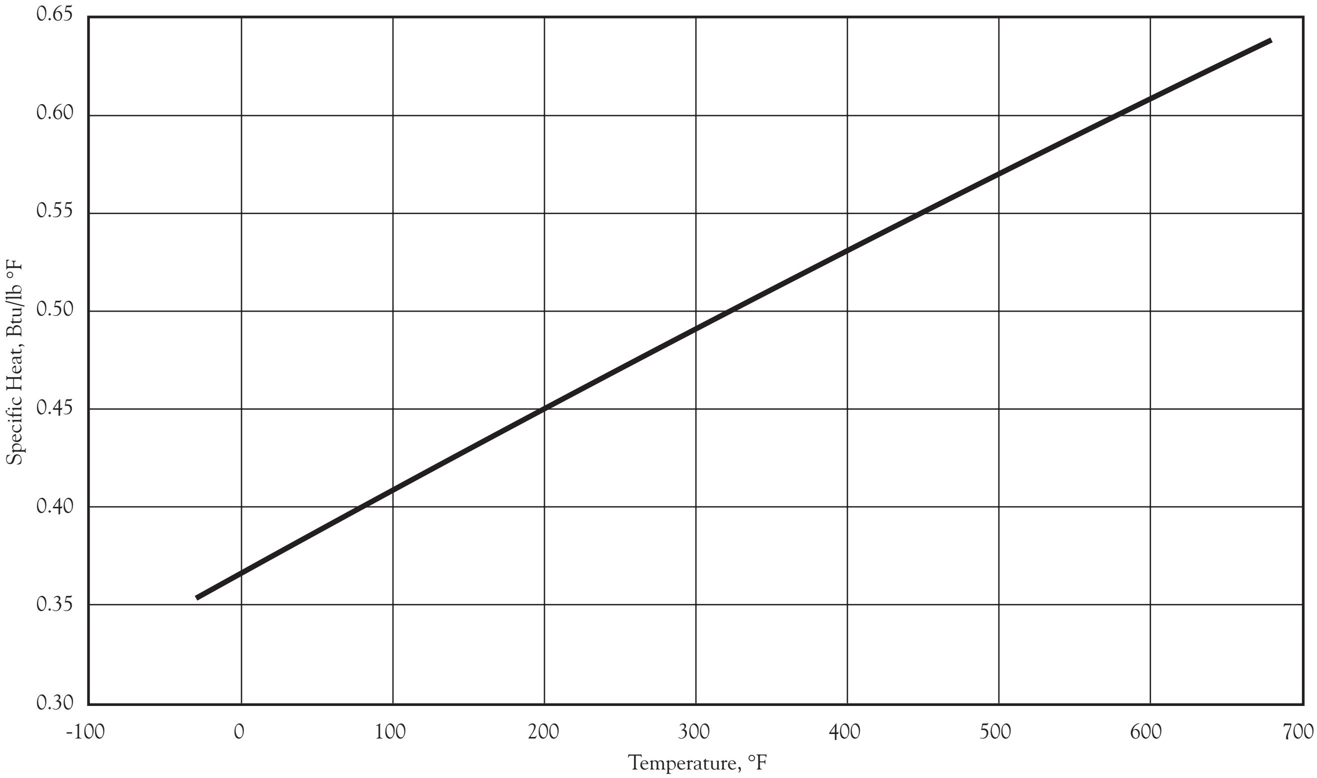



*Figure 6—Specific Heat of DOWTHERM Q Fluid (SI Units)*

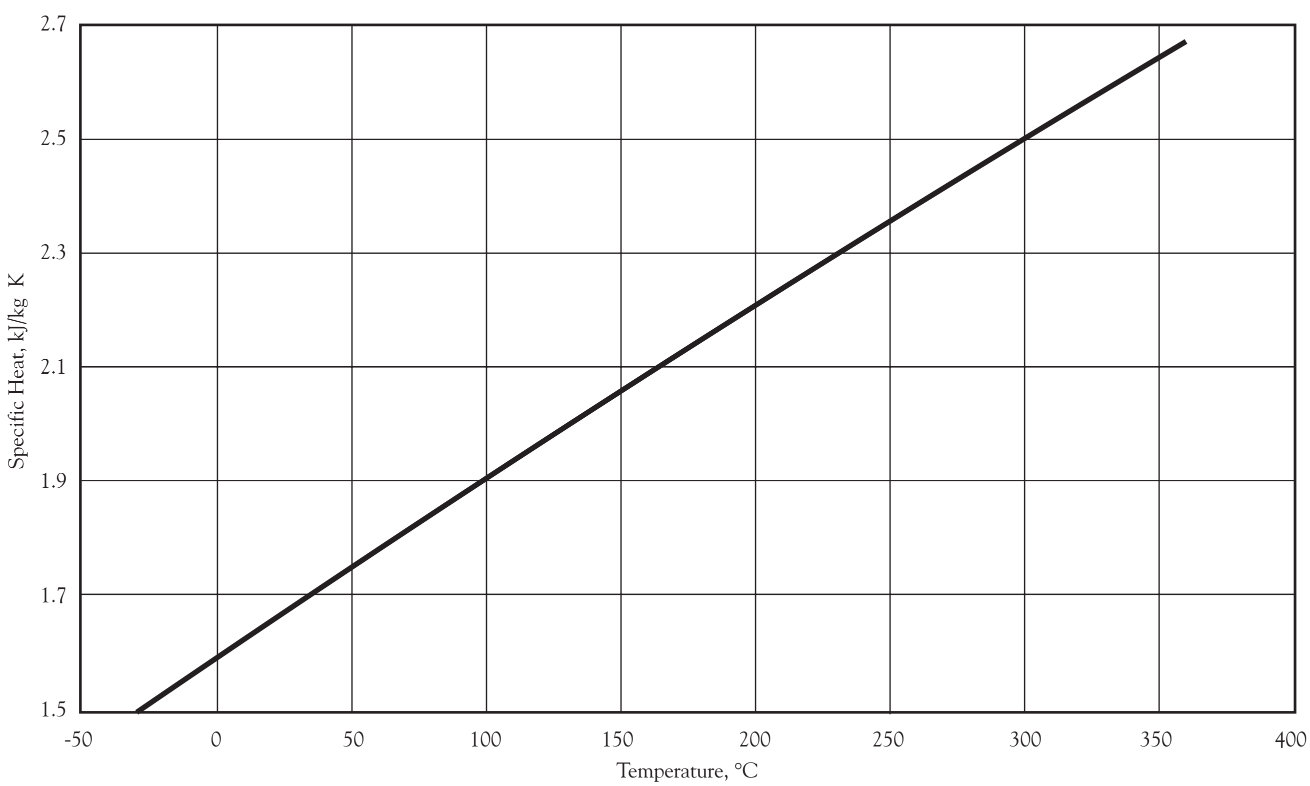


*Figure 7 — Liquid Density of DOWTHERM Q Fluid (English Units)*

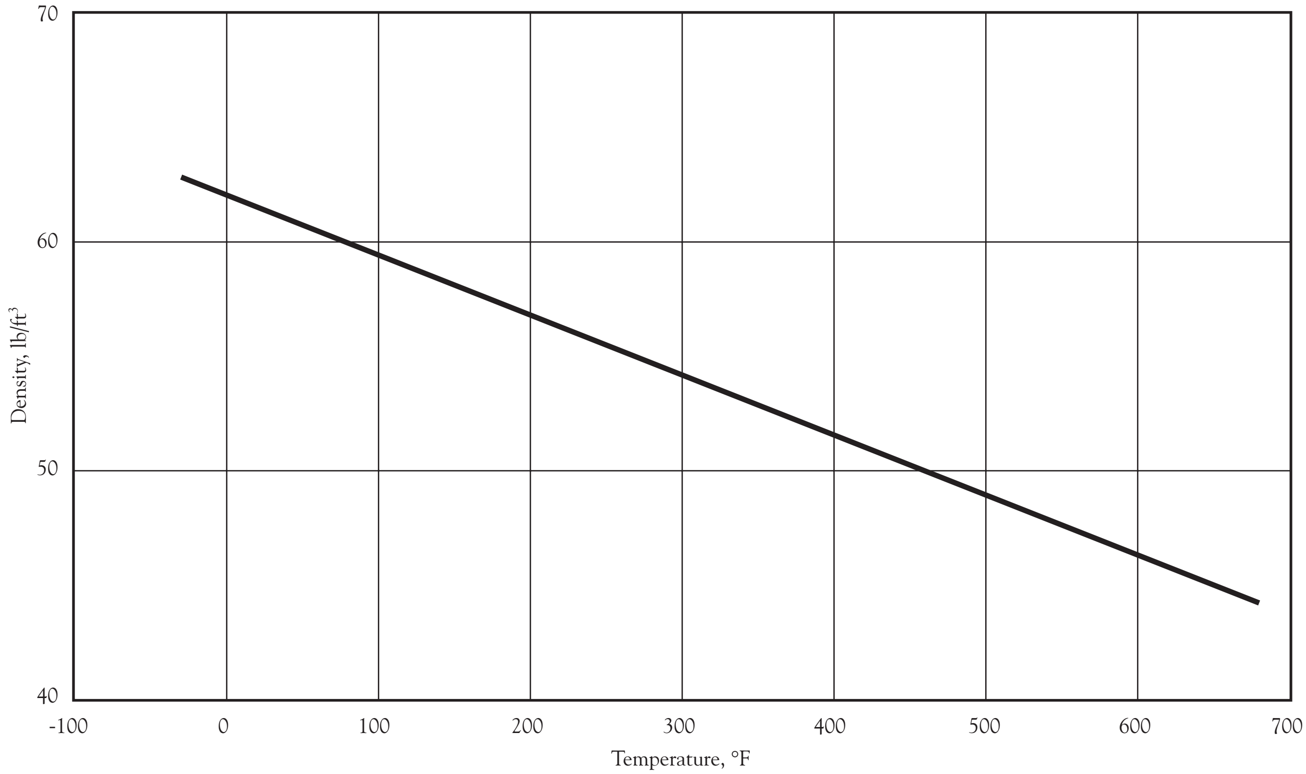



*Figure 8 — Liquid Density of DOWTHERM Q Fluid (SI Units)*

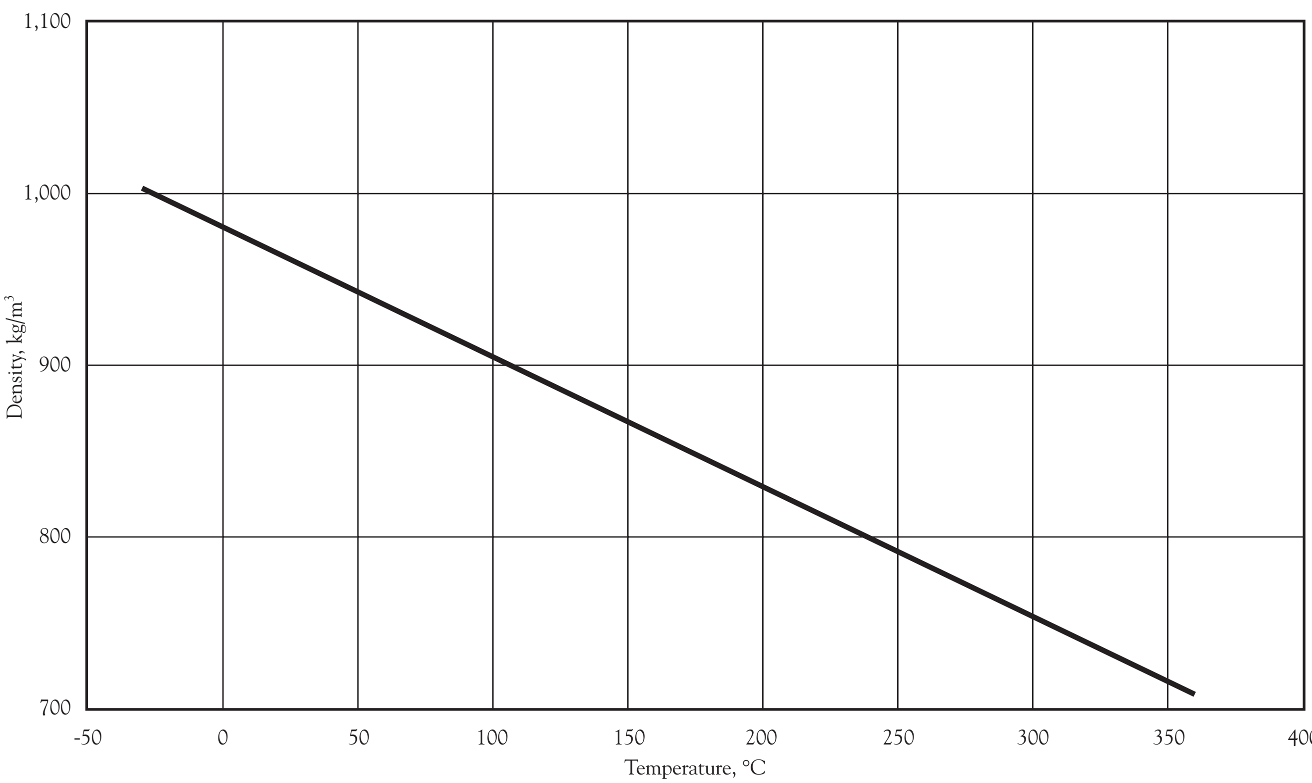


*Figure 9—Liquid Viscosity of DOWTHERM Q Fluid (English Units)*

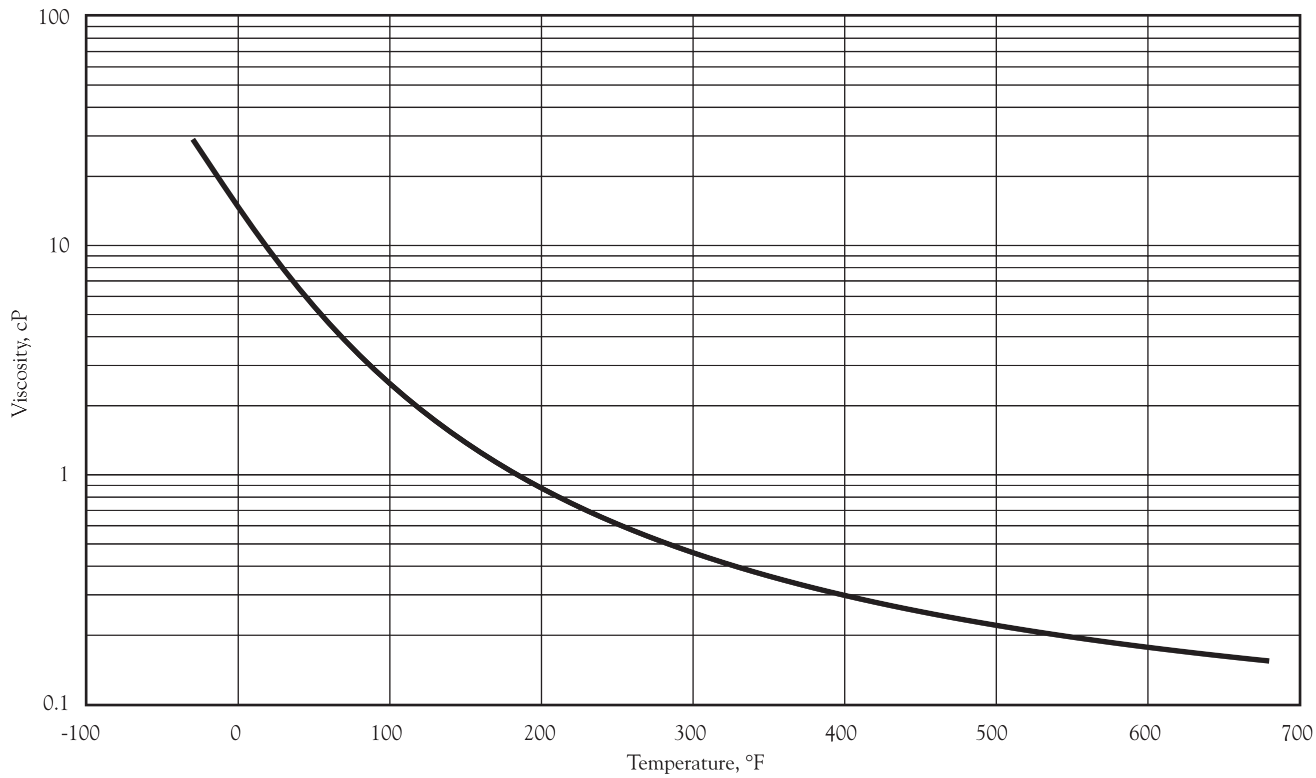



*Figure 10—Liquid Viscosity of DOWTHERM Q Fluid (SI Units)*

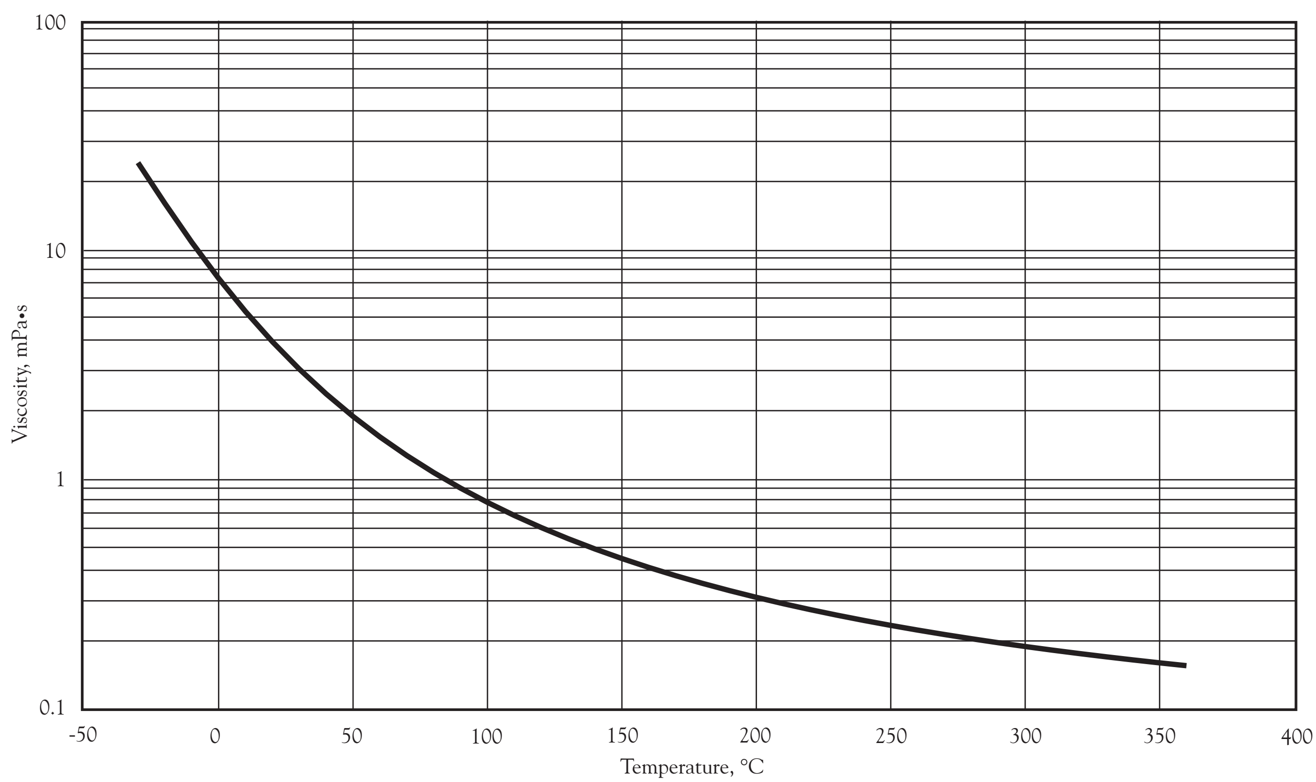


*Figure 11 — Calculated Heat of Vaporization of* ***Dowtherm*** *Q Fluid (English Units)*

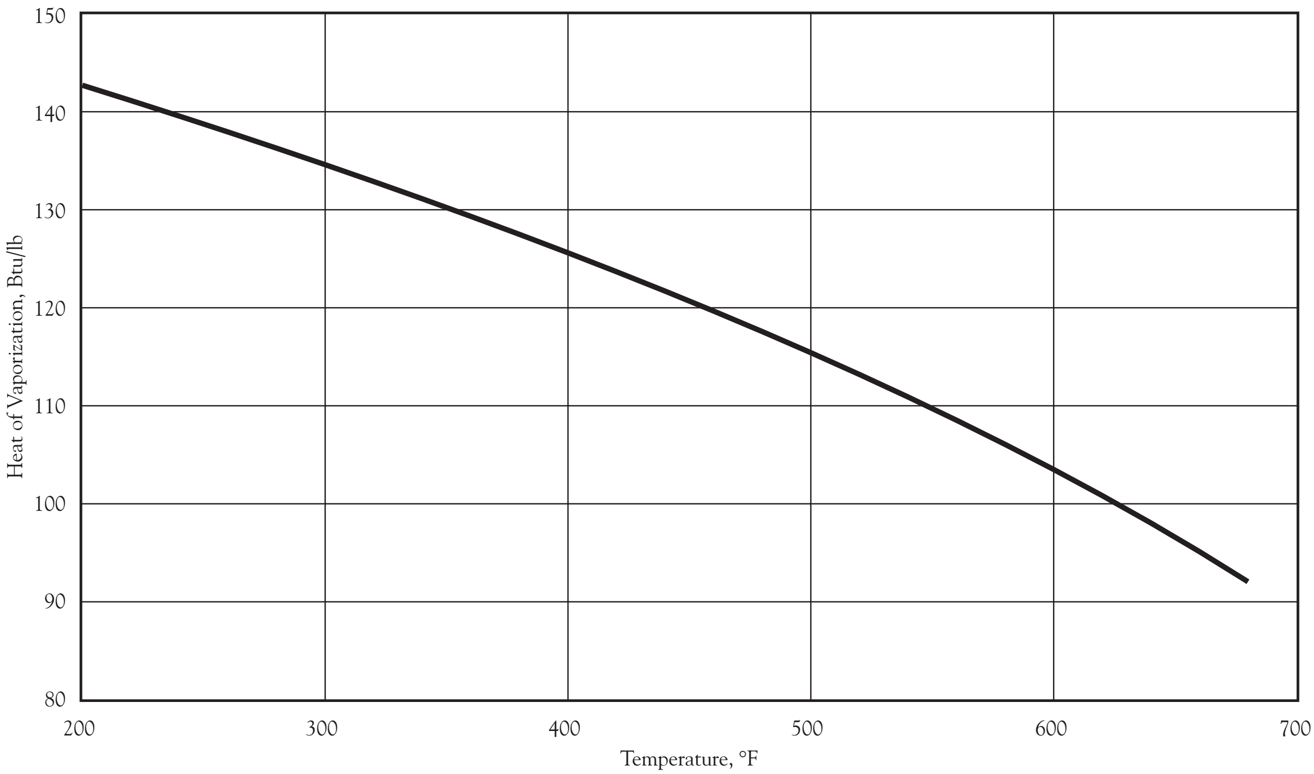



*Figure 12 — Calculated Heat of Vaporization of* ***Dowtherm*** *Q Fluid (SI Units)*

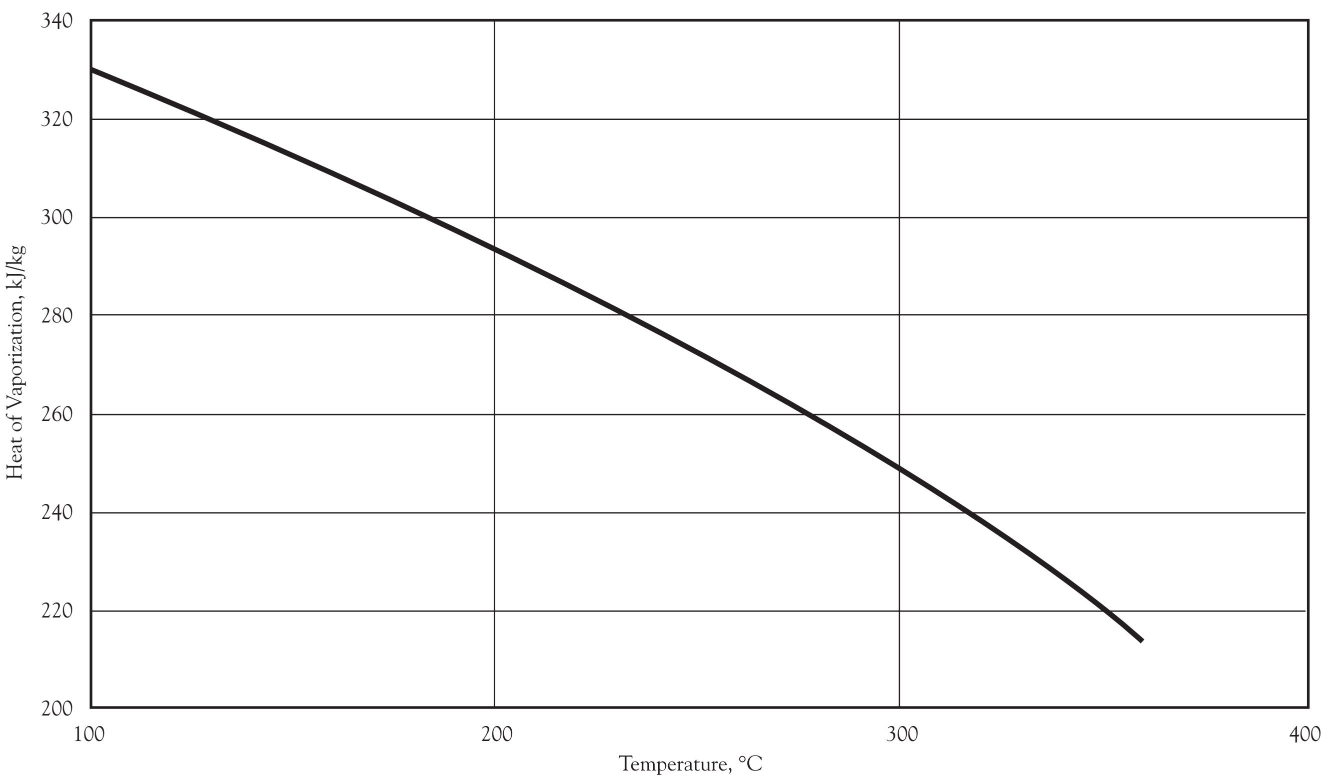
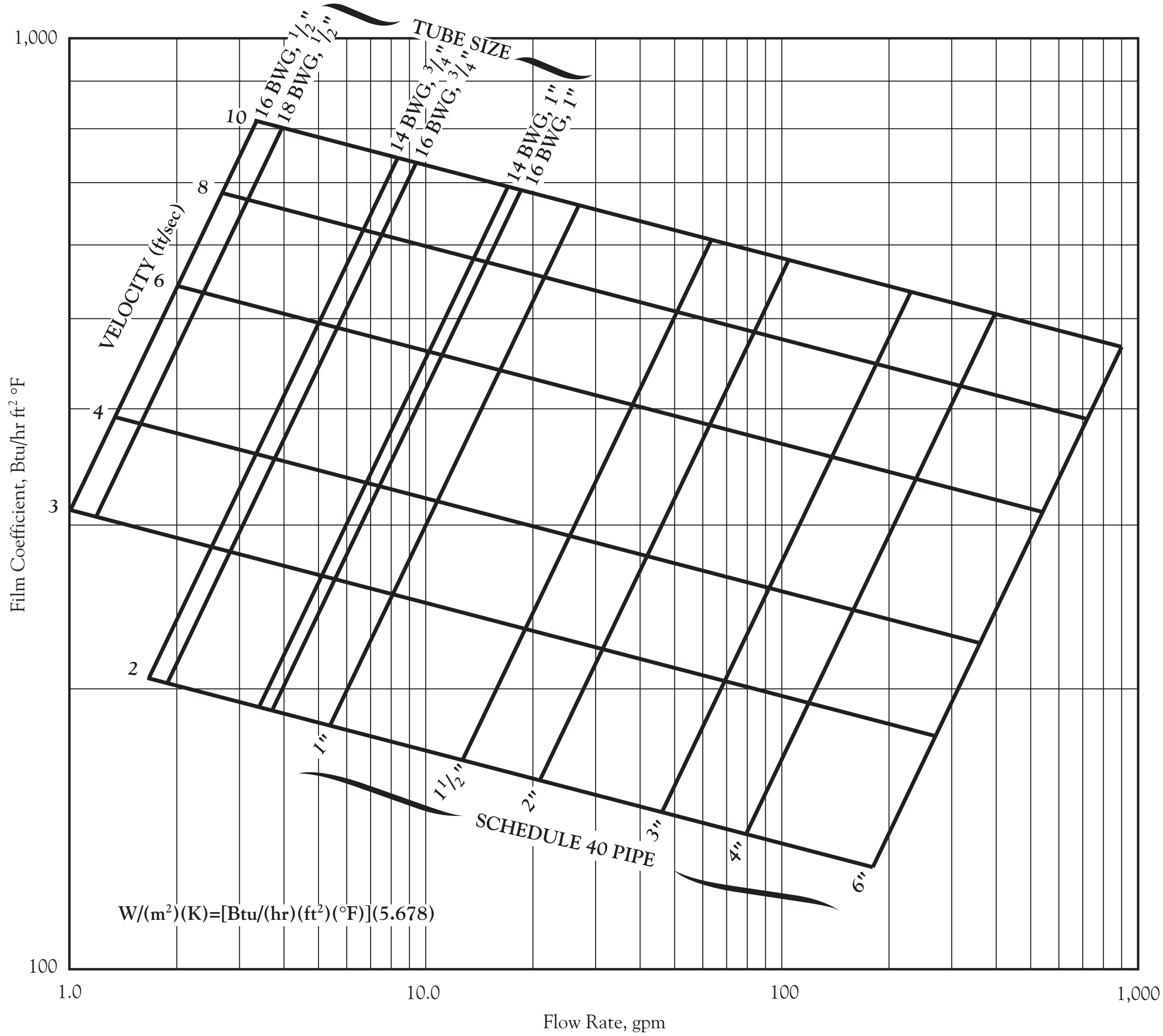
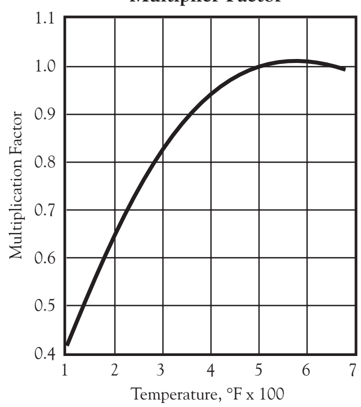


***Figure 13—Liquid Film Coefficient for DOWTHERM Q Fluid Inside Pipes and Tubes (Turbulent Flow Only) (English Units)***




**Temperature Correction Multiplier Factor†**




†Note: Below 100°F, an error in the temperature correction factor above 5% may be incurred. This is dependent on the diameter and velocity effect on the Reynolds number and friction factor.

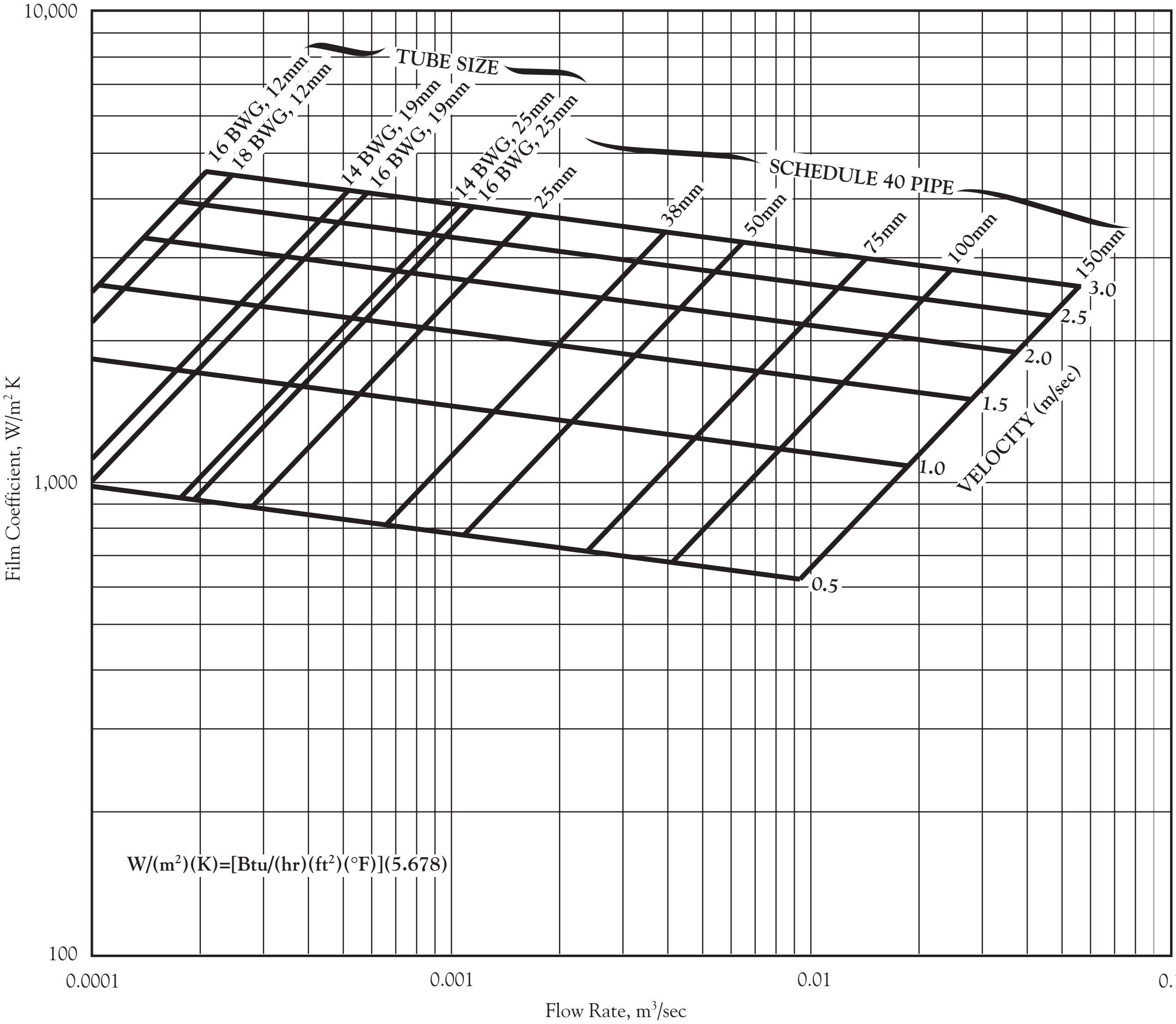
Sieder and Tate equation
Process Heat Transfer,
D.Q. Kern (1950) p. 103

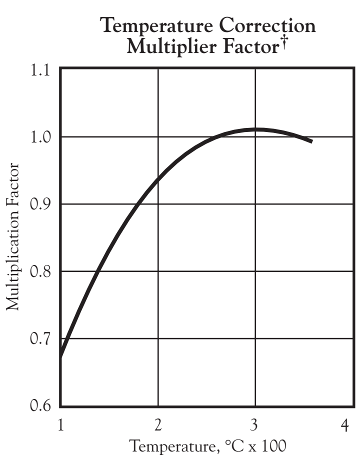
$$Nu = 0.027\, Re^{0.8} Pr^{1/3} \left(\frac{\mu}{\mu_w}\right)^{0.14}$$

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 14—Liquid Film Coefficient for DOWTHERM Q Fluid Inside Pipes and Tubes (Turbulent Flow Only) (SI Units)*




†Note: Below 40°C, an error in the temperature correction factor above 5% may be incurred. This is dependent on the diameter and velocity effect on the Reynolds number and friction factor.

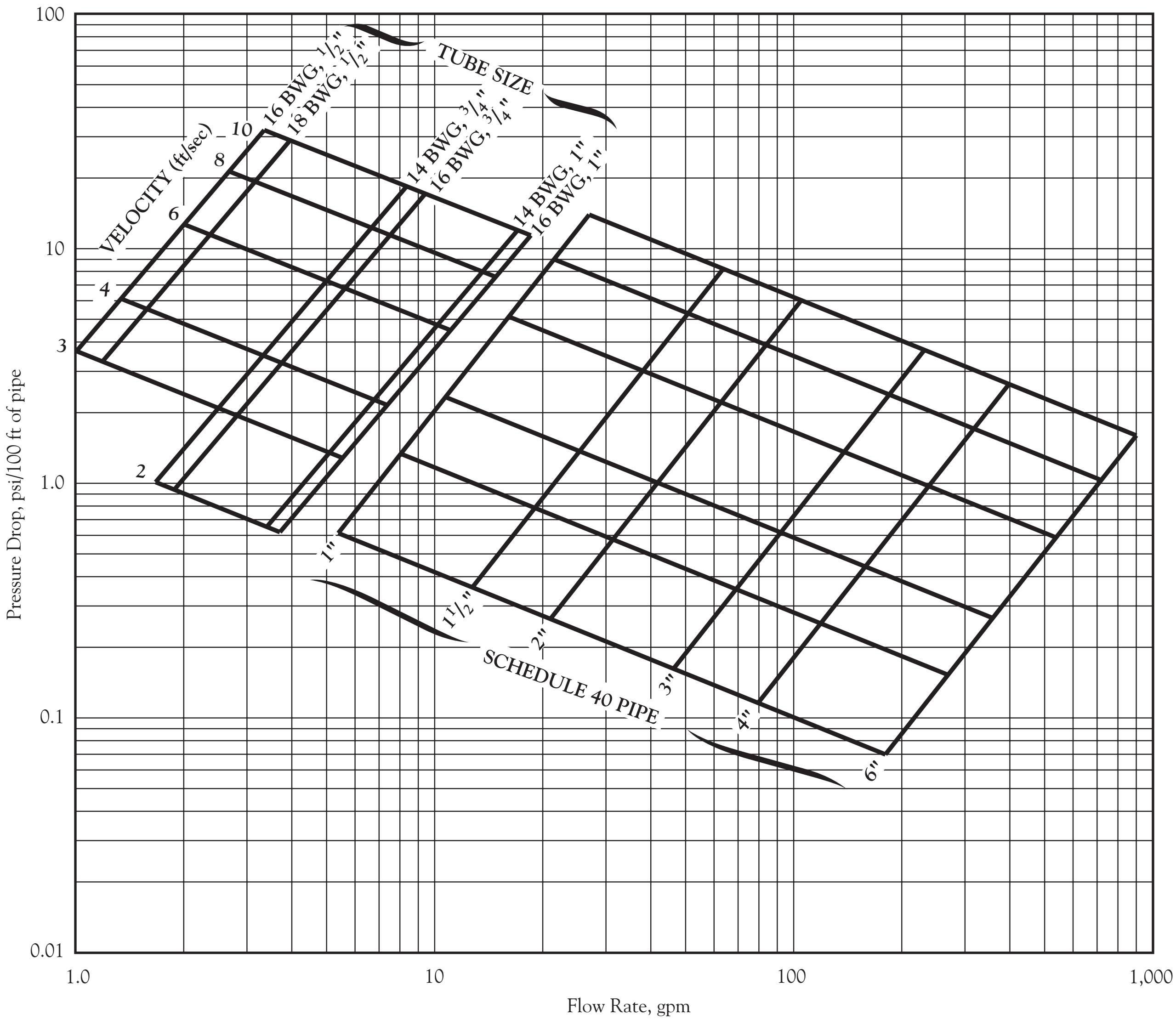
Sieder and Tate equation
Process Heat Transfer,
D.Q. Kern (1950) p. 103

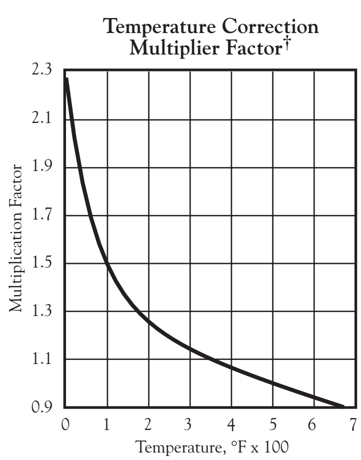
$$Nu = 0.027\, Re^{0.8} Pr^{1/3} \left(\frac{\mu}{\mu_w}\right)^{0.14}$$

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.

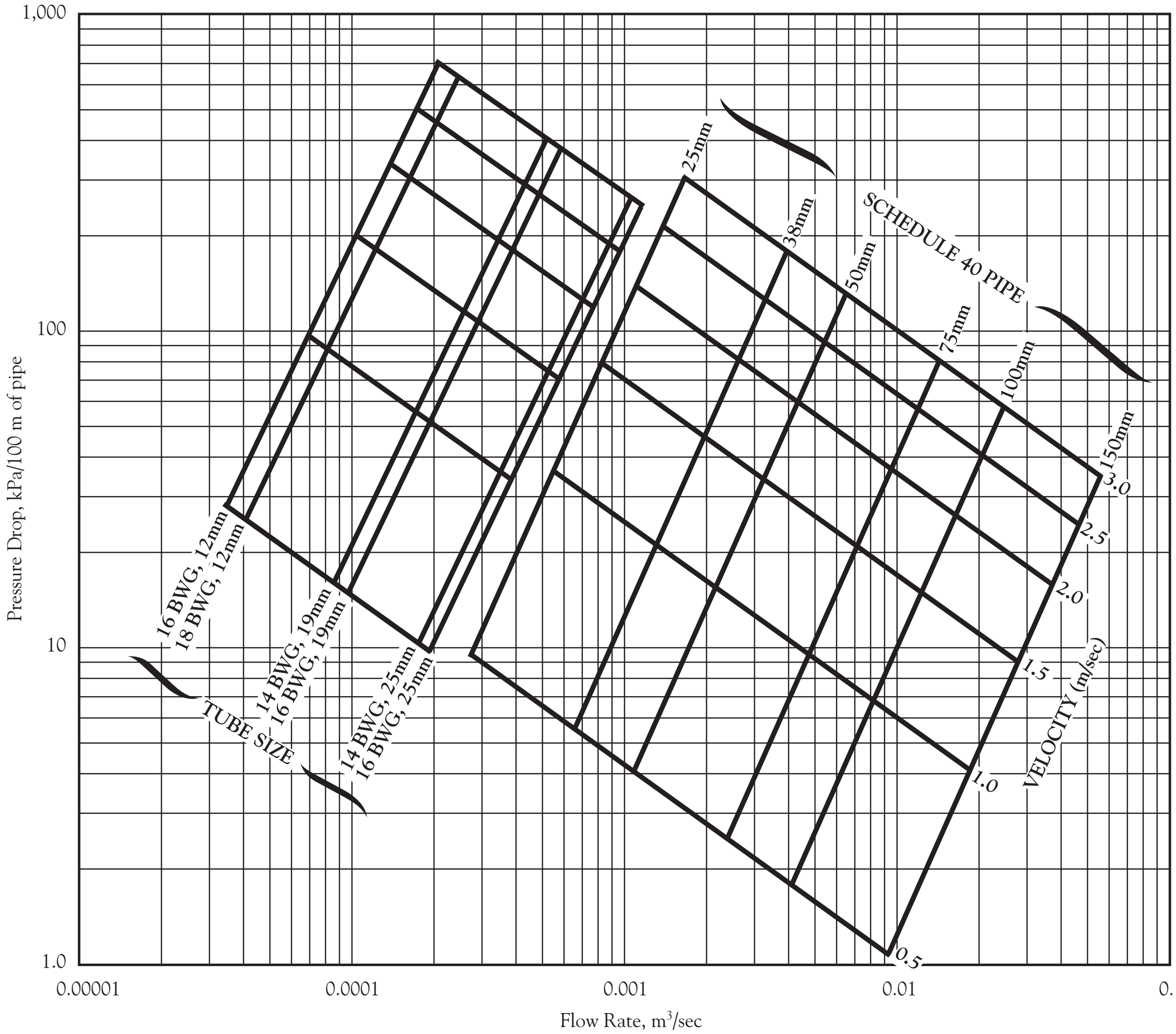
*Figure 15—Pressure Drop vs. Flow Rate of DOWTHERM Q Fluid in Schedule 40 Nominal Pipe and BWG Tube (English Units)*

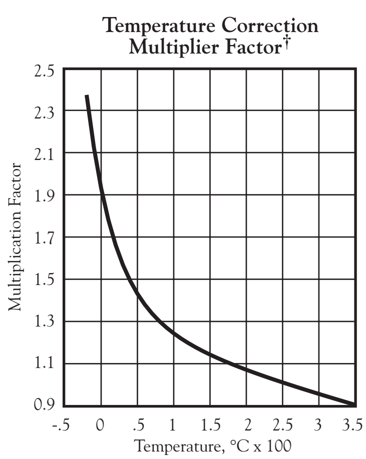



†Note: Below 100°F, an error in the temperature correction factor above 5% may be incurred. This is dependent on the diameter and velocity effect on the Reynolds number and friction factor.

***Figure 16—Pressure Drop vs. Flow Rate of DOWTHERM Q Fluid in Schedule 40 Nominal Pipe and BWG Tube (SI Units)***

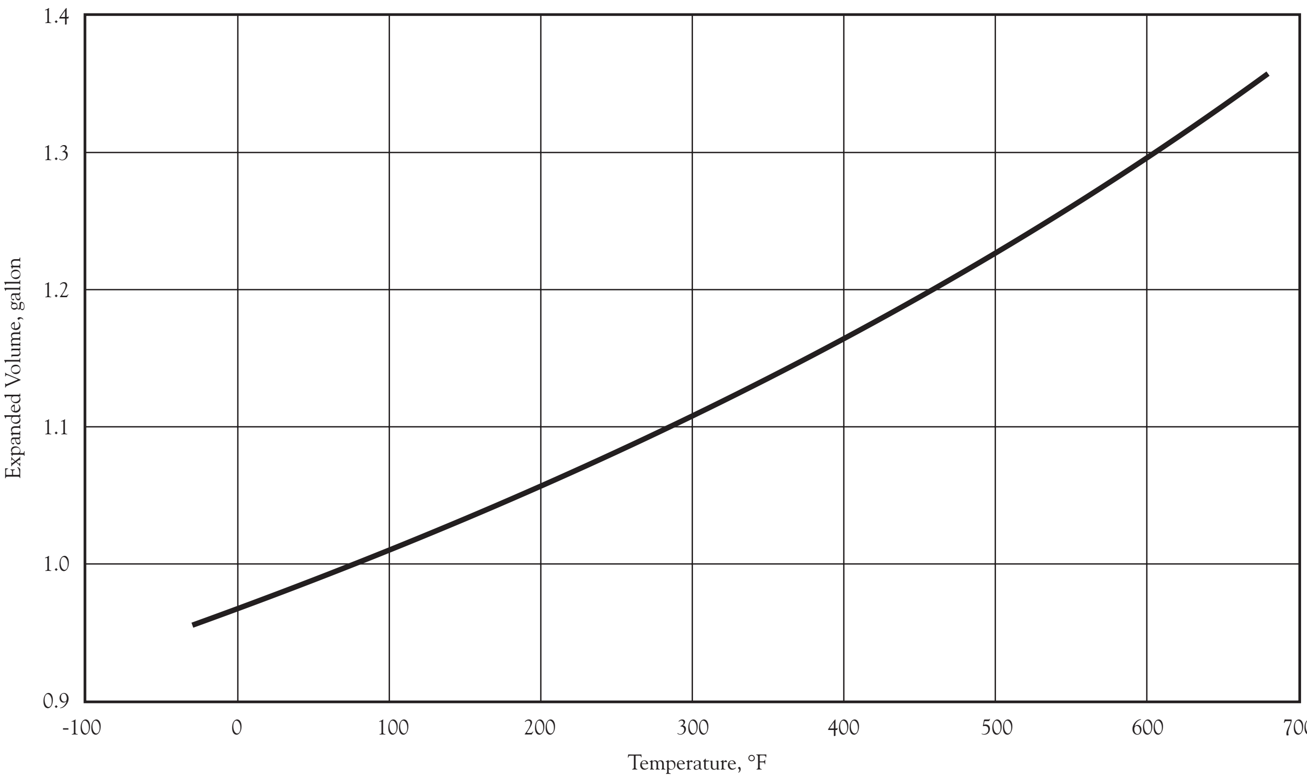



†Note: Below 40°C, an error in the temperature correction factor above 5% may be incurred. This is dependent on the diameter and velocity effect on the Reynolds number and friction factor.

## *Figure 17—Thermal Expansion of DOWTHERM Q Fluid (English Units)*

***Basis: 1 gallon at 77°F***




## *Figure 18—Thermal Expansion of DOWTHERM Q Fluid (SI Units)*

***Basis: 1 m³ at 25°C***

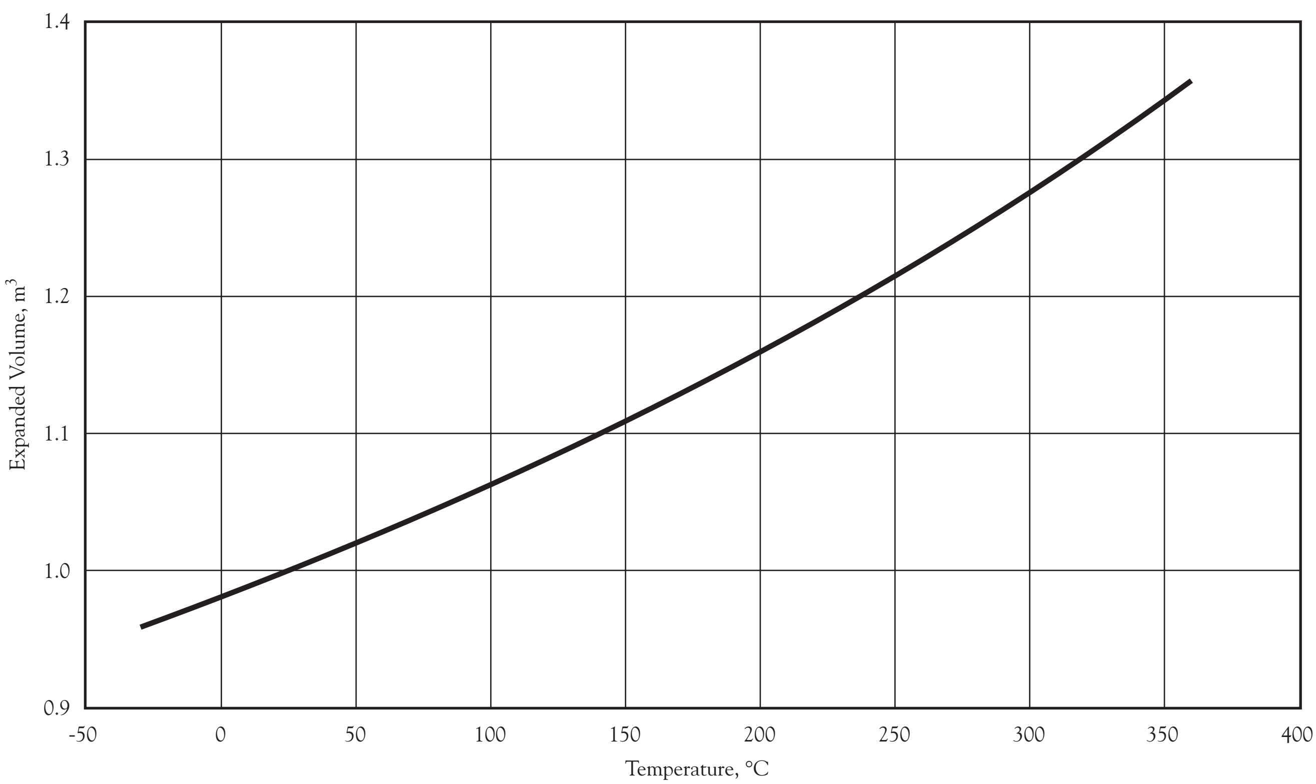


*Figure 19— Typical Liquid Phase Heating Scheme Using DOWTHERM Fluids*

**Instrument Legend**

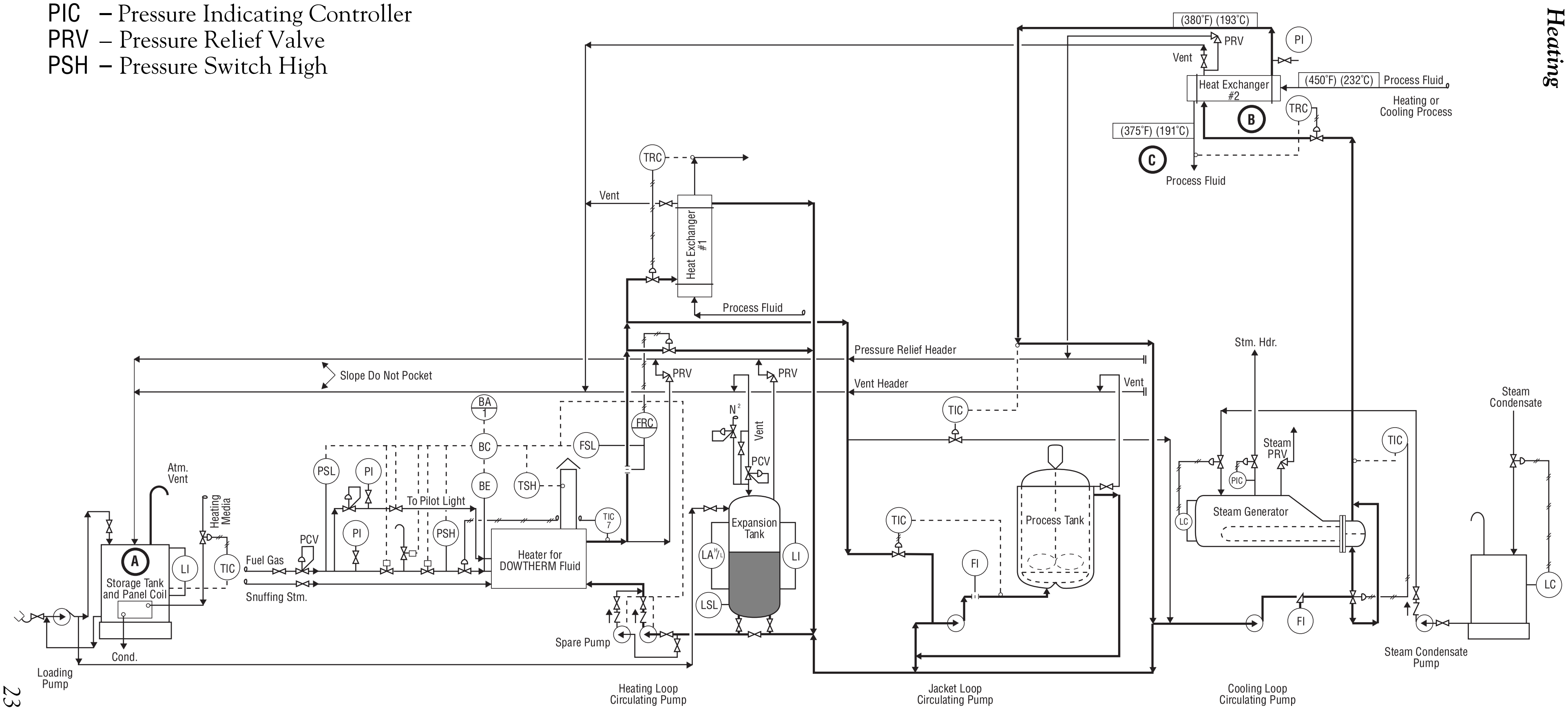
BA – Burner Alarm
BC – Burner Control
BE – Burner Element (Fire-Eye)
FI – Flow Indicator (Orifice)
FRC – Flow Recording Controller
FSL – Flow Switch Low
LA H/L – Level Alarm–High/Low
LI – Level Indicator
LC – Level Controller
LSL – Level Switch Low
PCV – Pressure Control Valve
PI – Pressure Indicator
PIC – Pressure Indicating Controller
PRV – Pressure Relief Valve
PSH – Pressure Switch High
PSL – Pressure Switch Low
TIC – Temperature Indicating Controller
TRC – Temperature Recorder Controller
TSH – Temperature Switch High

——— Principal Circuits with DOWTHERM Fluid
– – – Electrical Lines
–//–//– Instrument Air Lines

(A) – External heating required if fluid pumpability is limiting in cold weather.

(B) – Heat exchanger #2 is cooled with DOWTHERM Q Fluid to avoid any possibility of contaminating the process fluid with water in the event of a tube leak.

(C) – Process fluid freezes at 100°F (81°C).



# DOWTHERM* Q Heat Transfer Fluid

*Product Technical Data*

***For further information, call...***

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

**In The Pacific: +886 2 715 3388 • FAX: +886 2 717 4115**

**In Other Global Areas: 1-517-832-1556 • FAX: 1-517-832-1465**

**http://www.dow.com/heattrans**



Published June 1997

**NOTE:** SYLTHERM heat transfer fluids are manufactured by Dow Corning Corporation and distributed by The Dow Chemical Company under an exclusive agreement.

Printed in U.S.A.



NA/LA/Pacific: Form No. 176-01407-697 AMS
Europe: CH 153-041-E-697