



Freon™ 410A

Refrigerant (R-410A)

Transport Properties—Viscosity, Thermal Conductivity, and Heat Capacity for Liquid and Vapor

Technical Information

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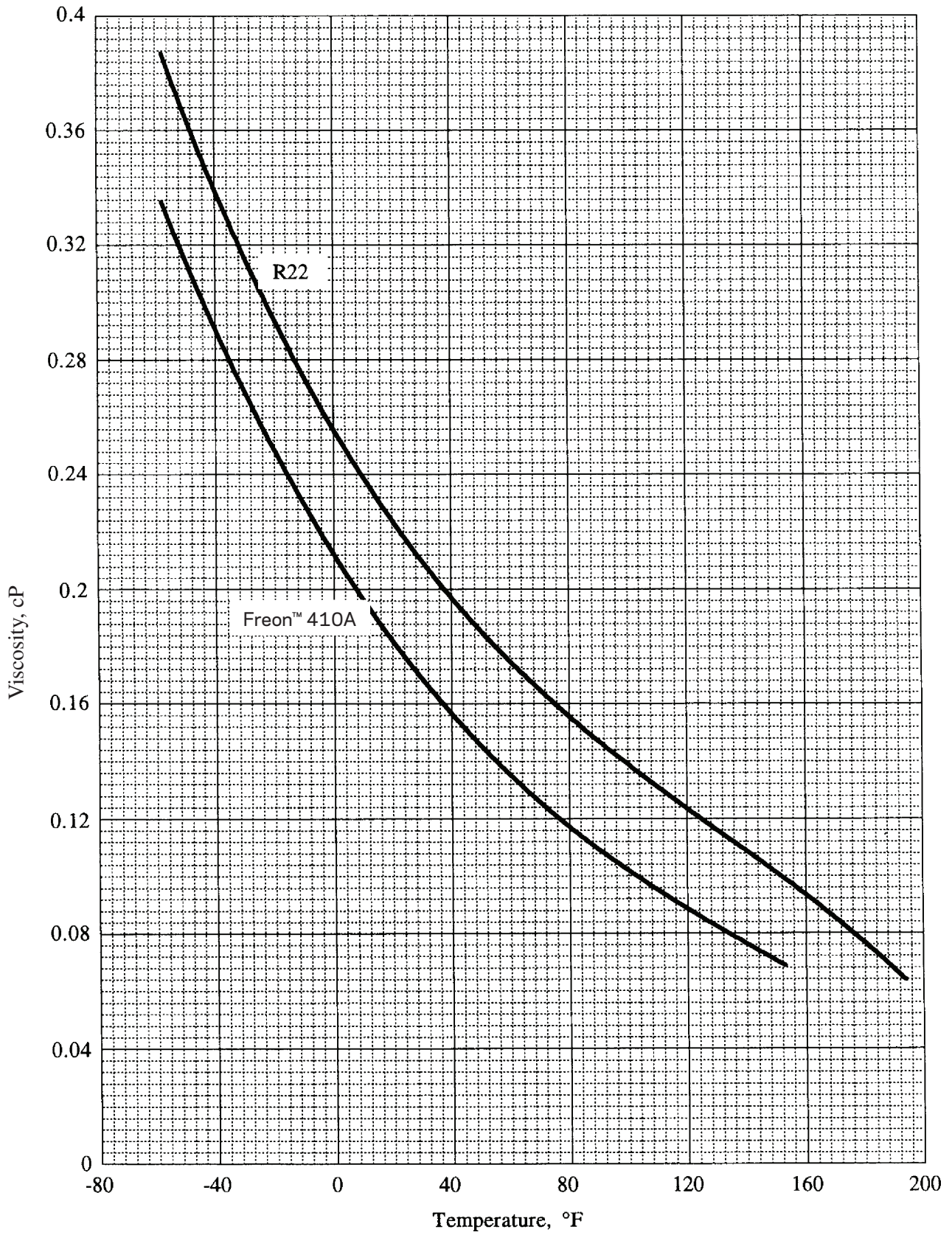
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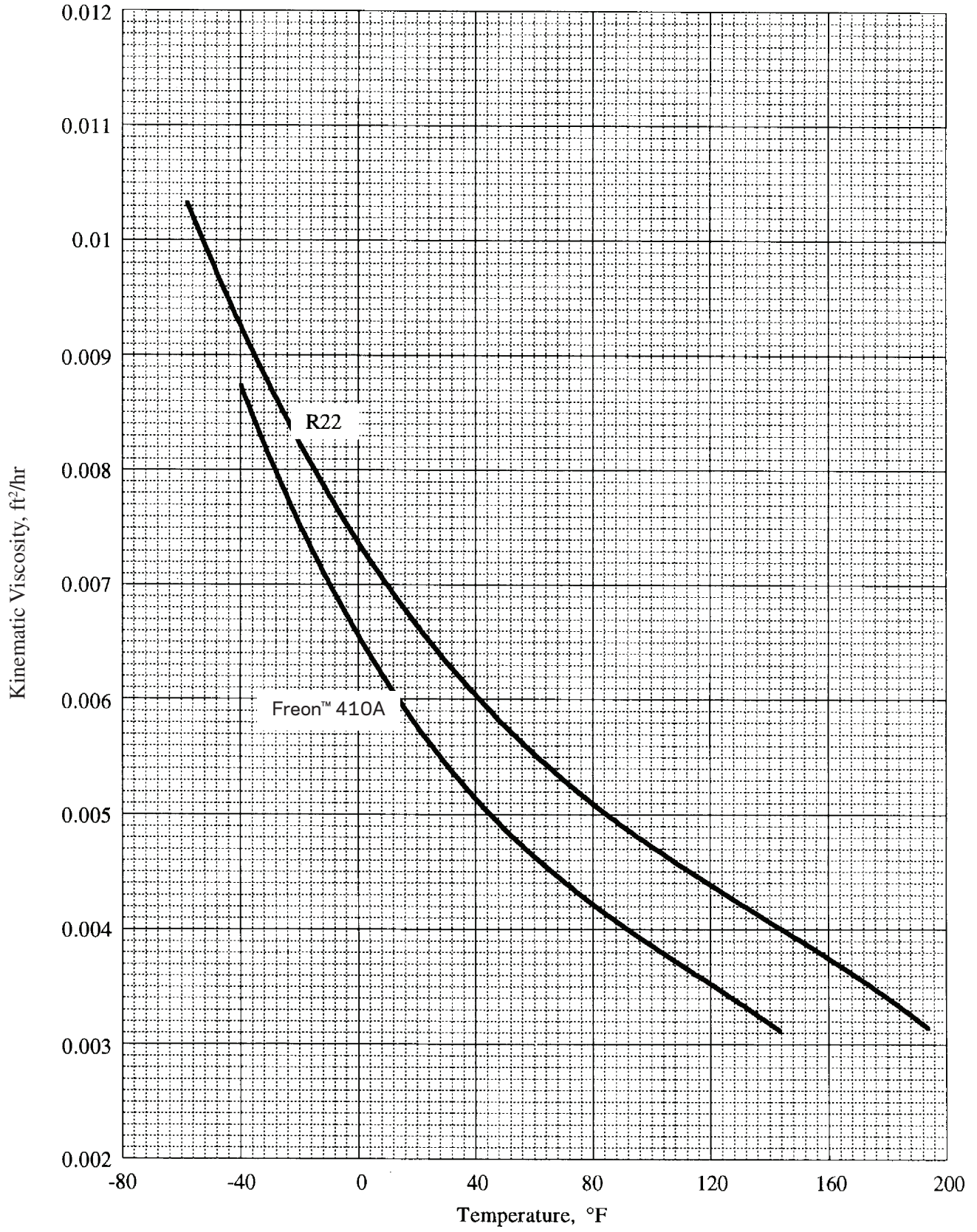


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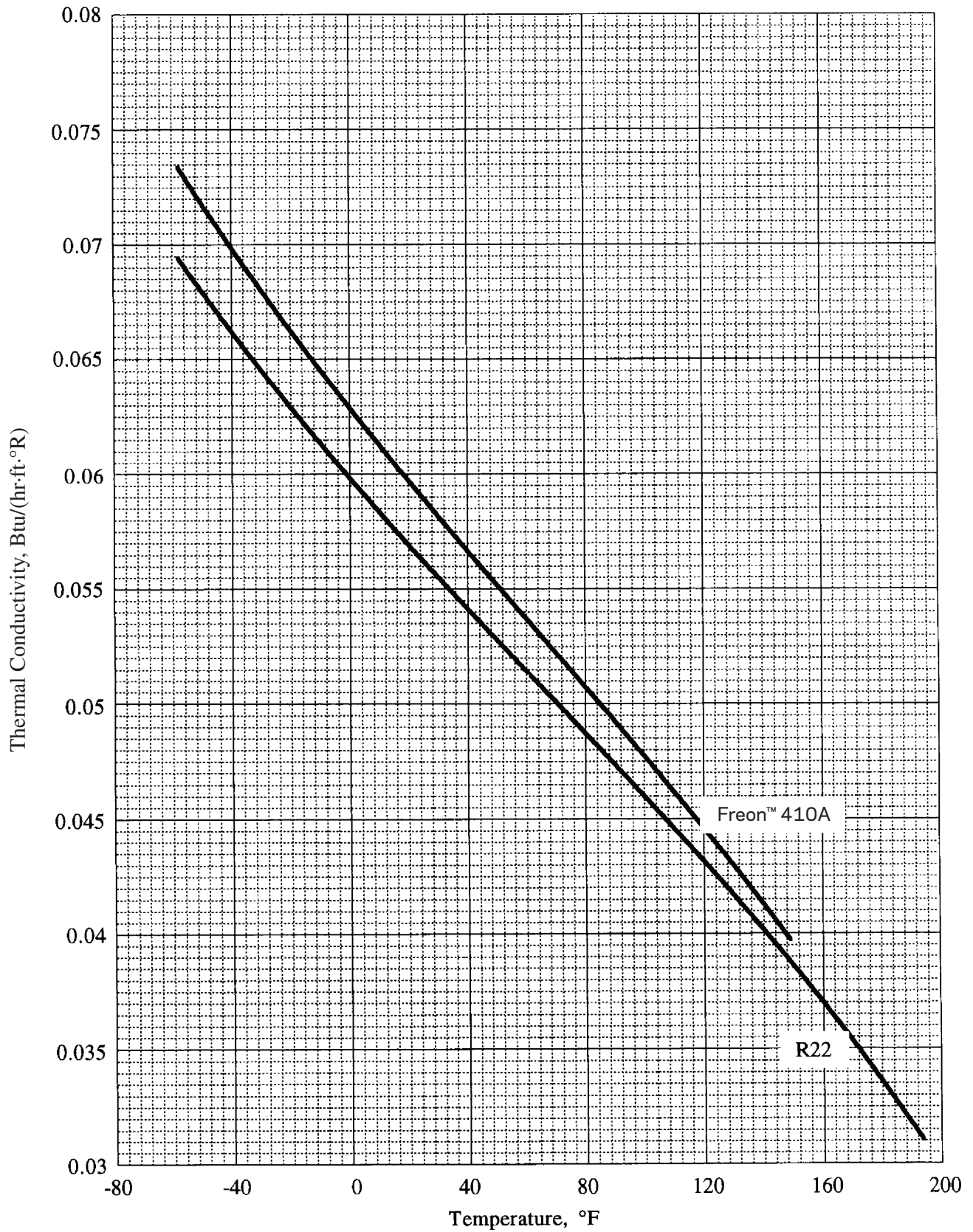
Saturated Liquid Viscosity



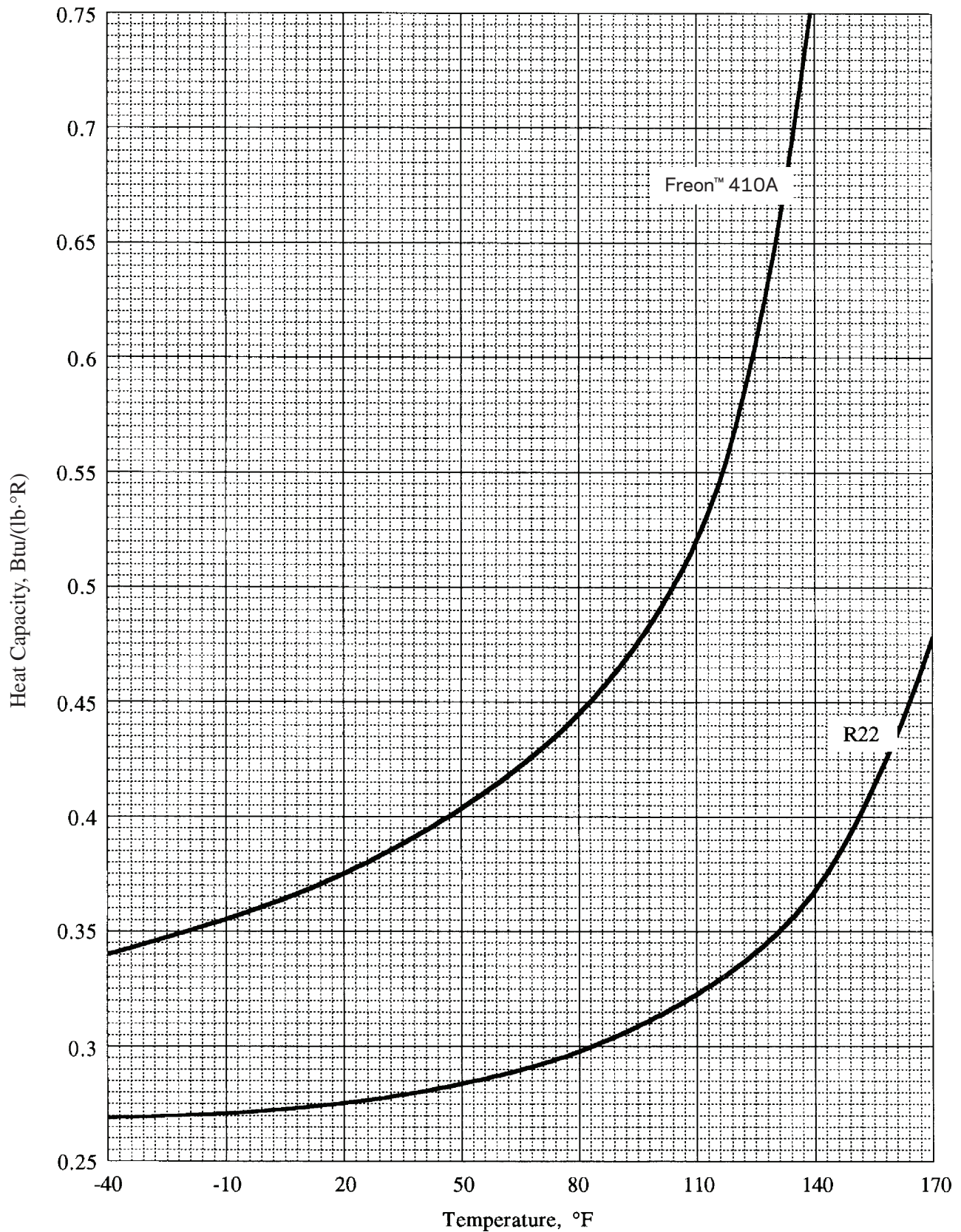
Saturated Liquid Kinematic Viscosity



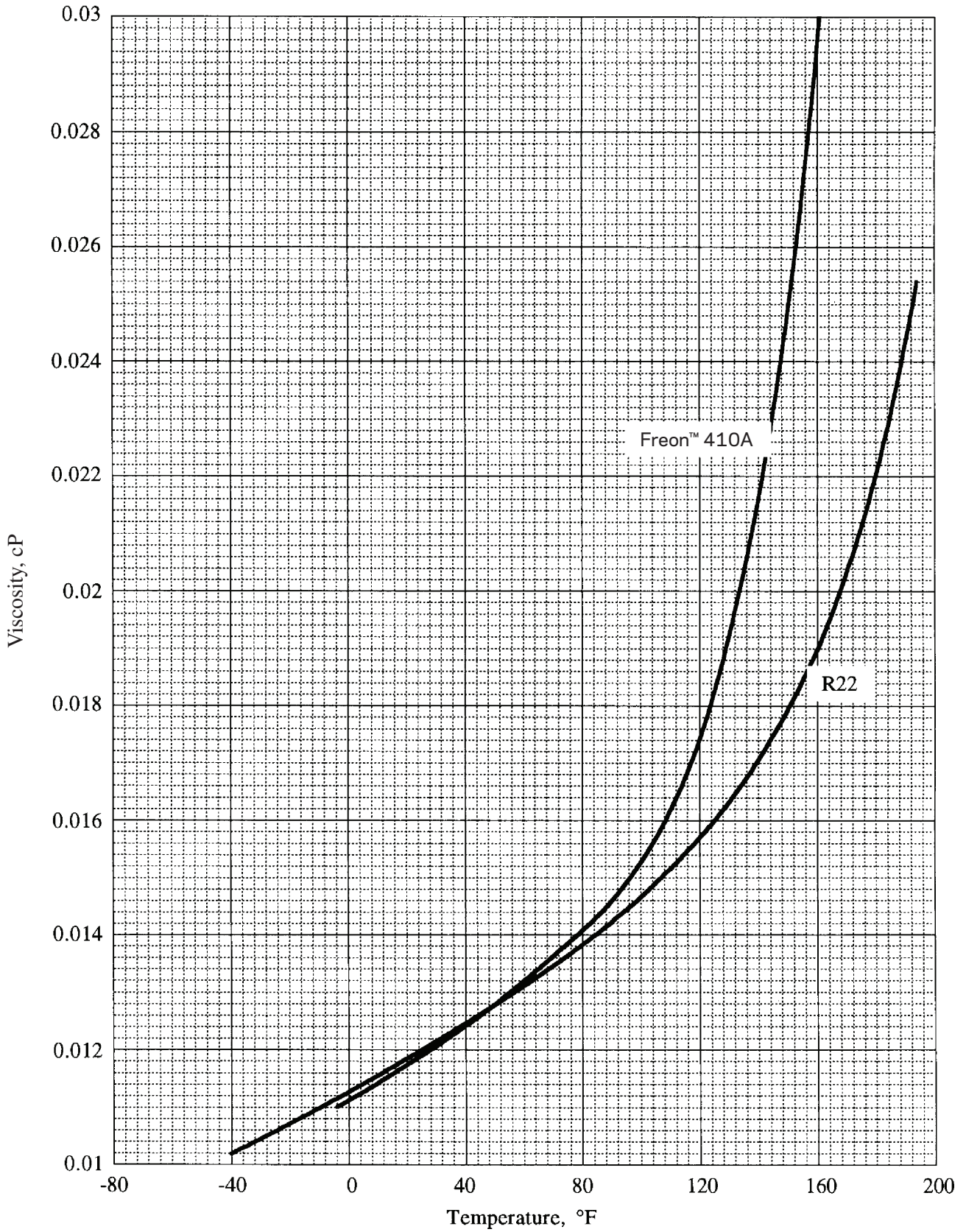
Saturated Liquid Thermal Conductivity



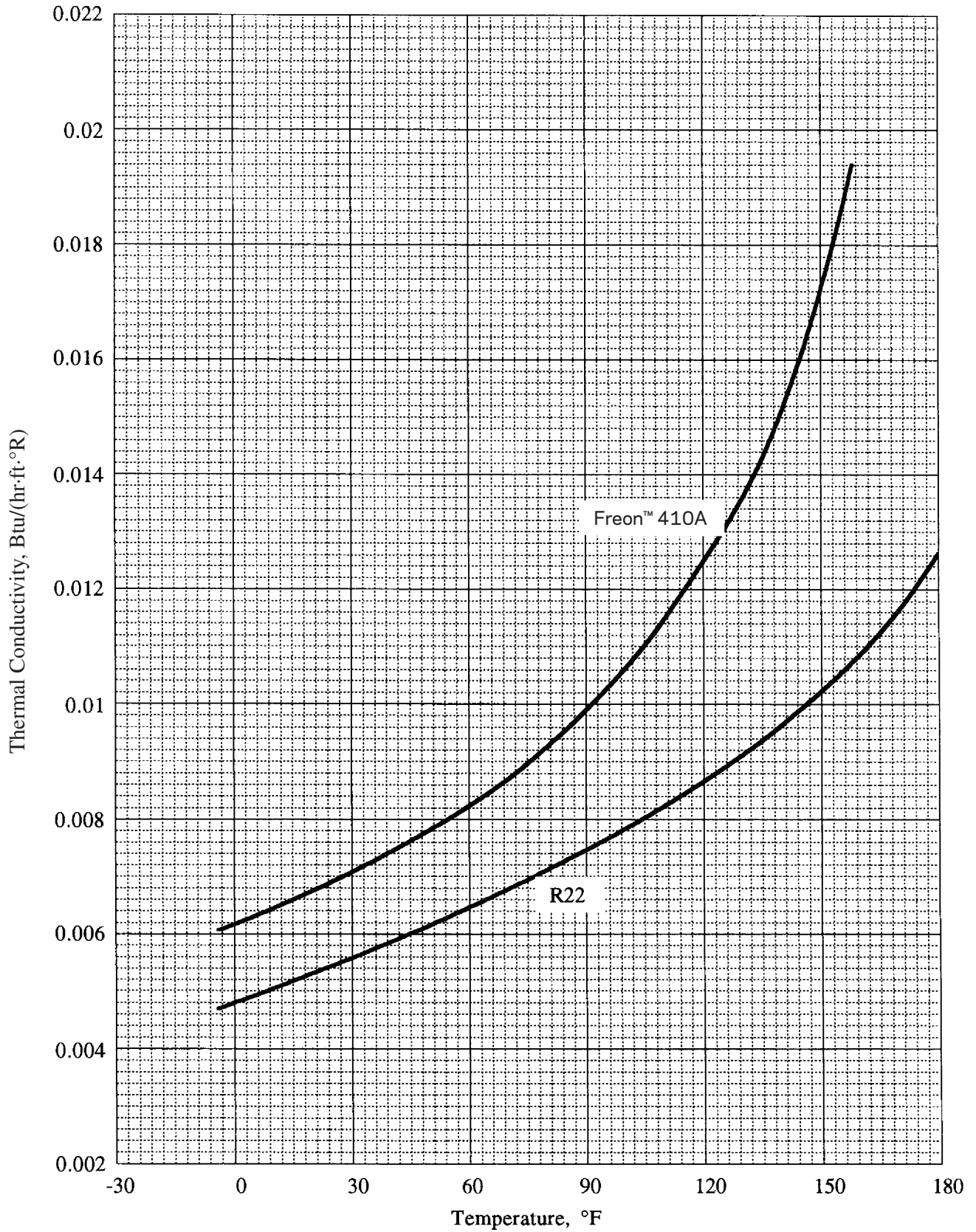
Saturated Liquid Heat Capacity



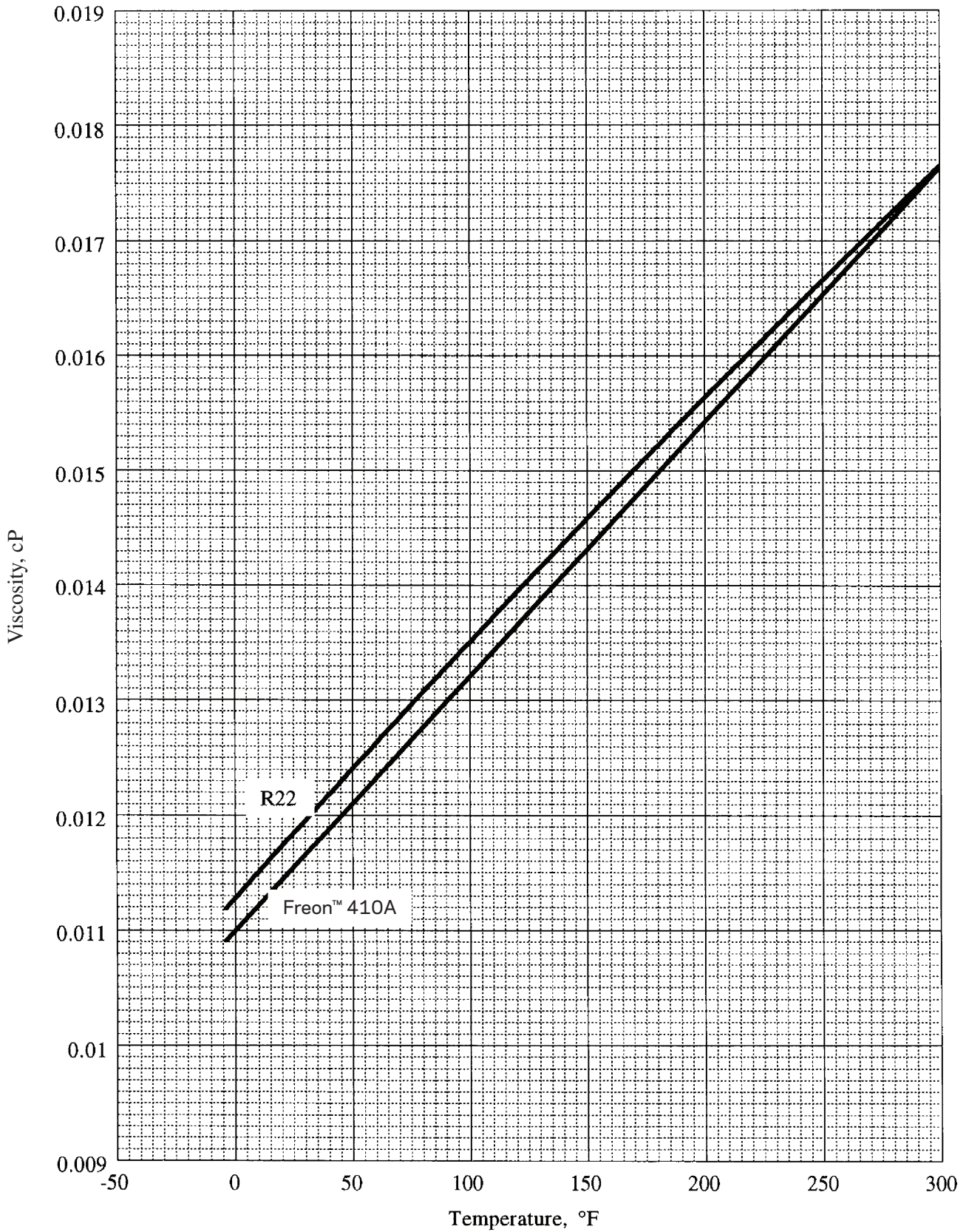
Saturated Vapor Viscosity



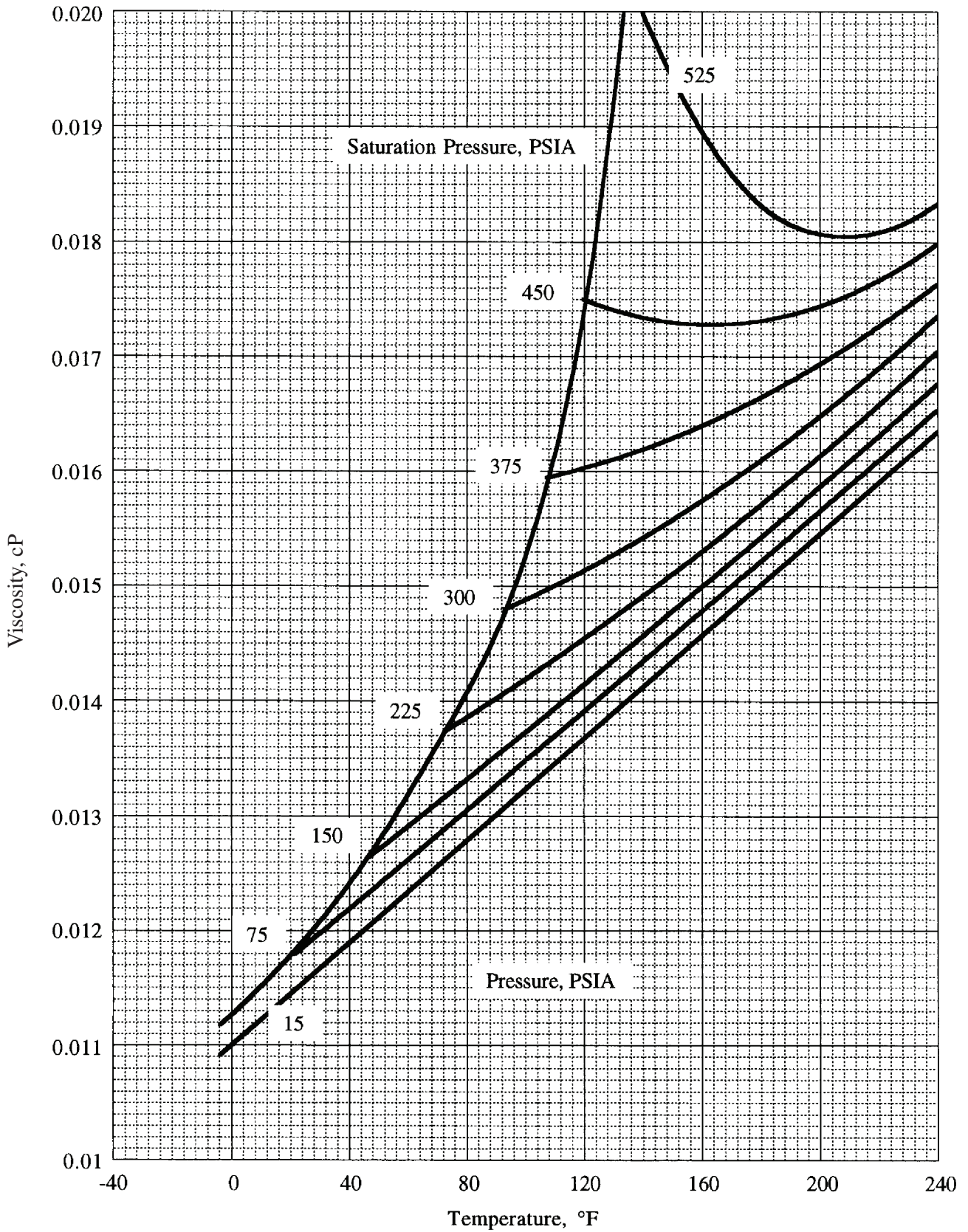
Saturated Vapor Thermal Conductivity



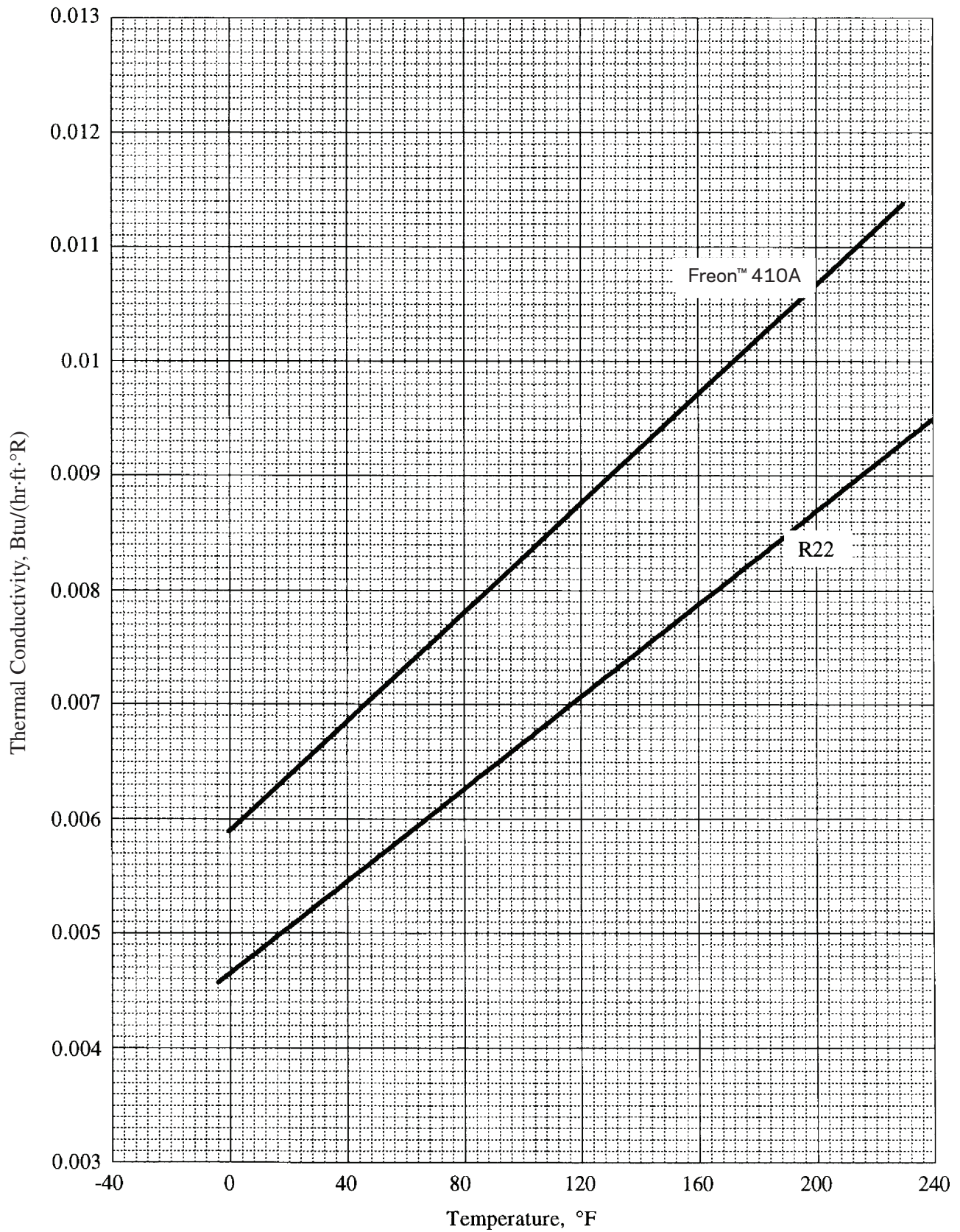
Gas Viscosity at Atmospheric Pressure



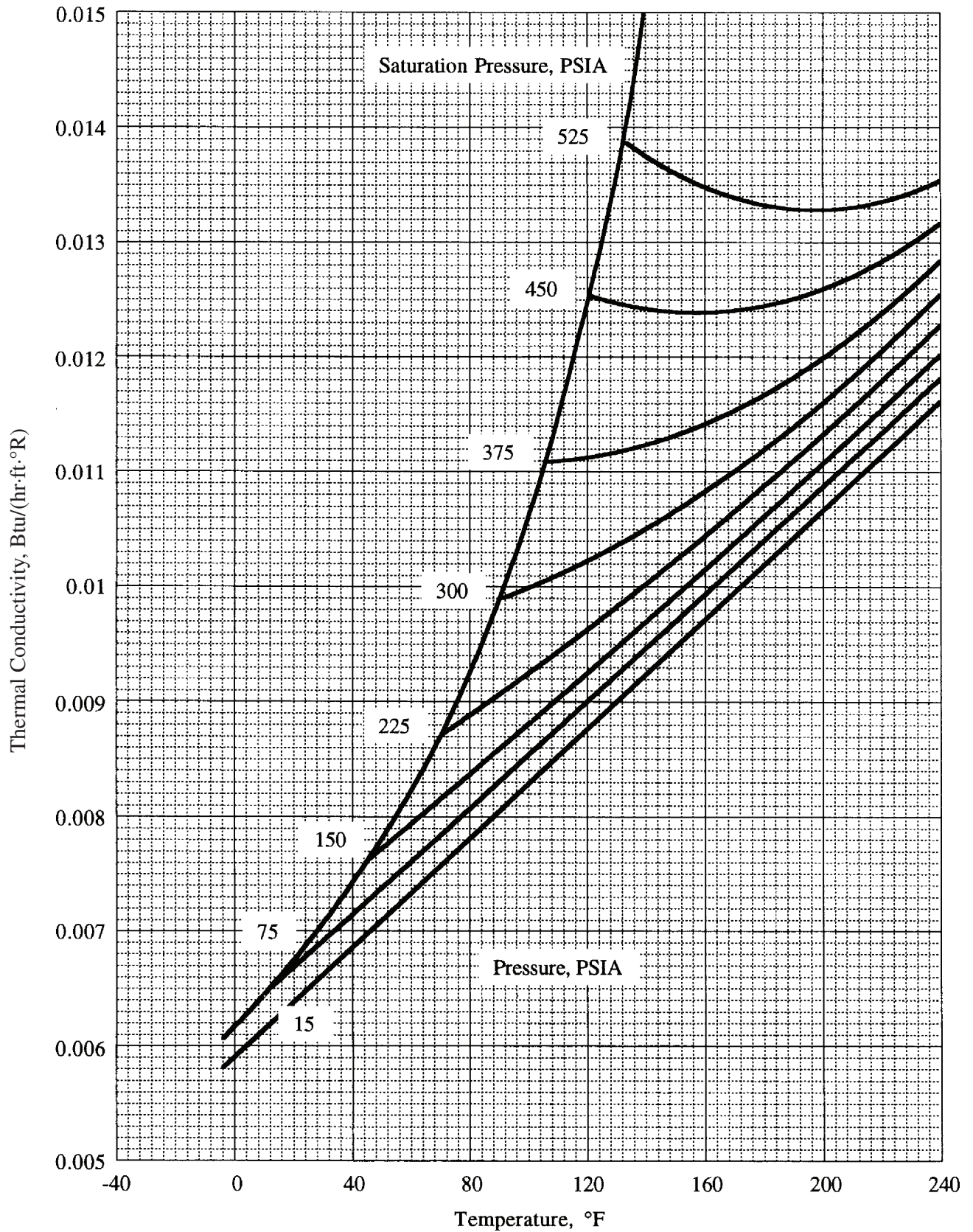
Vapor Viscosity



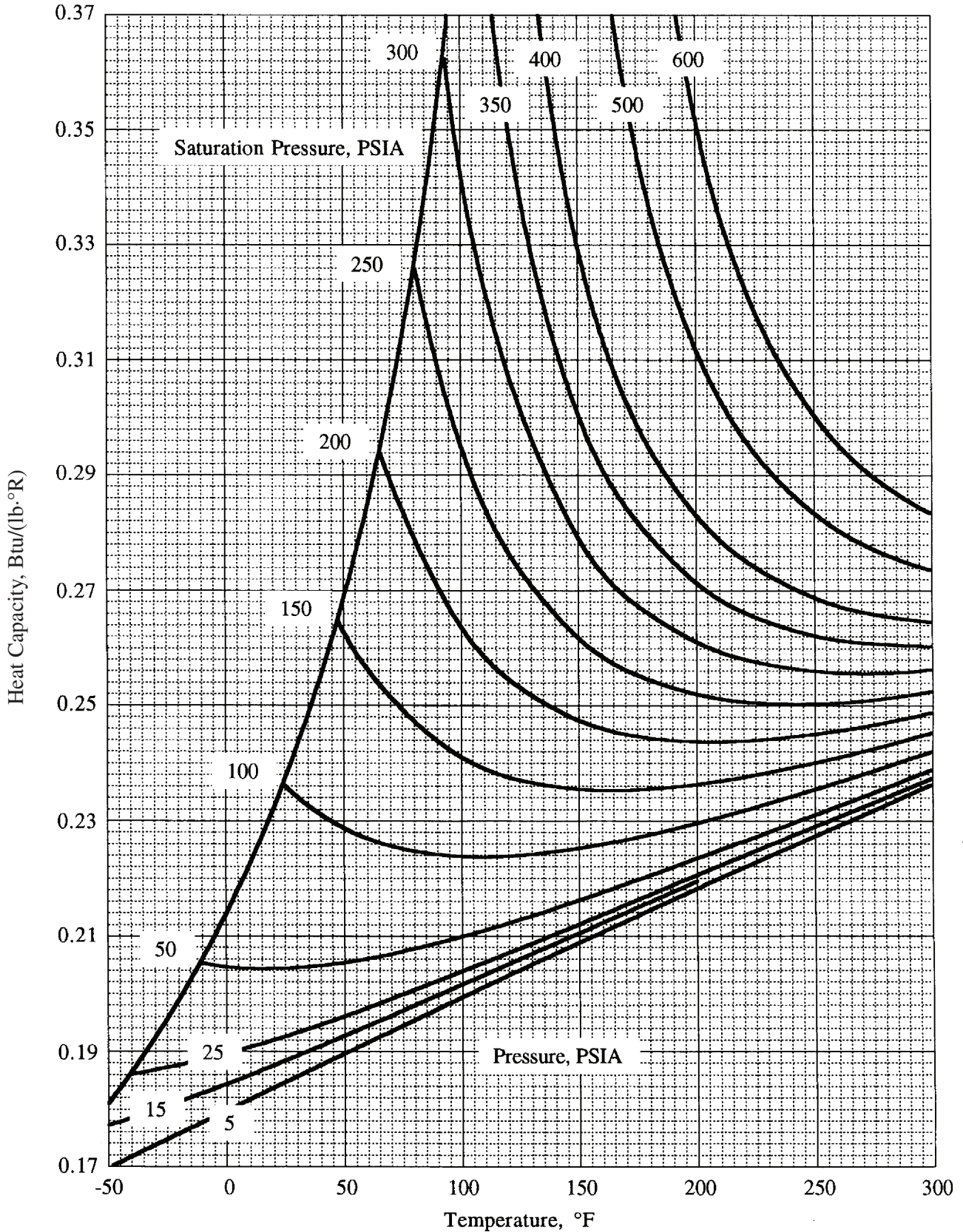
Gas Thermal Conductivity at Atmospheric Pressure



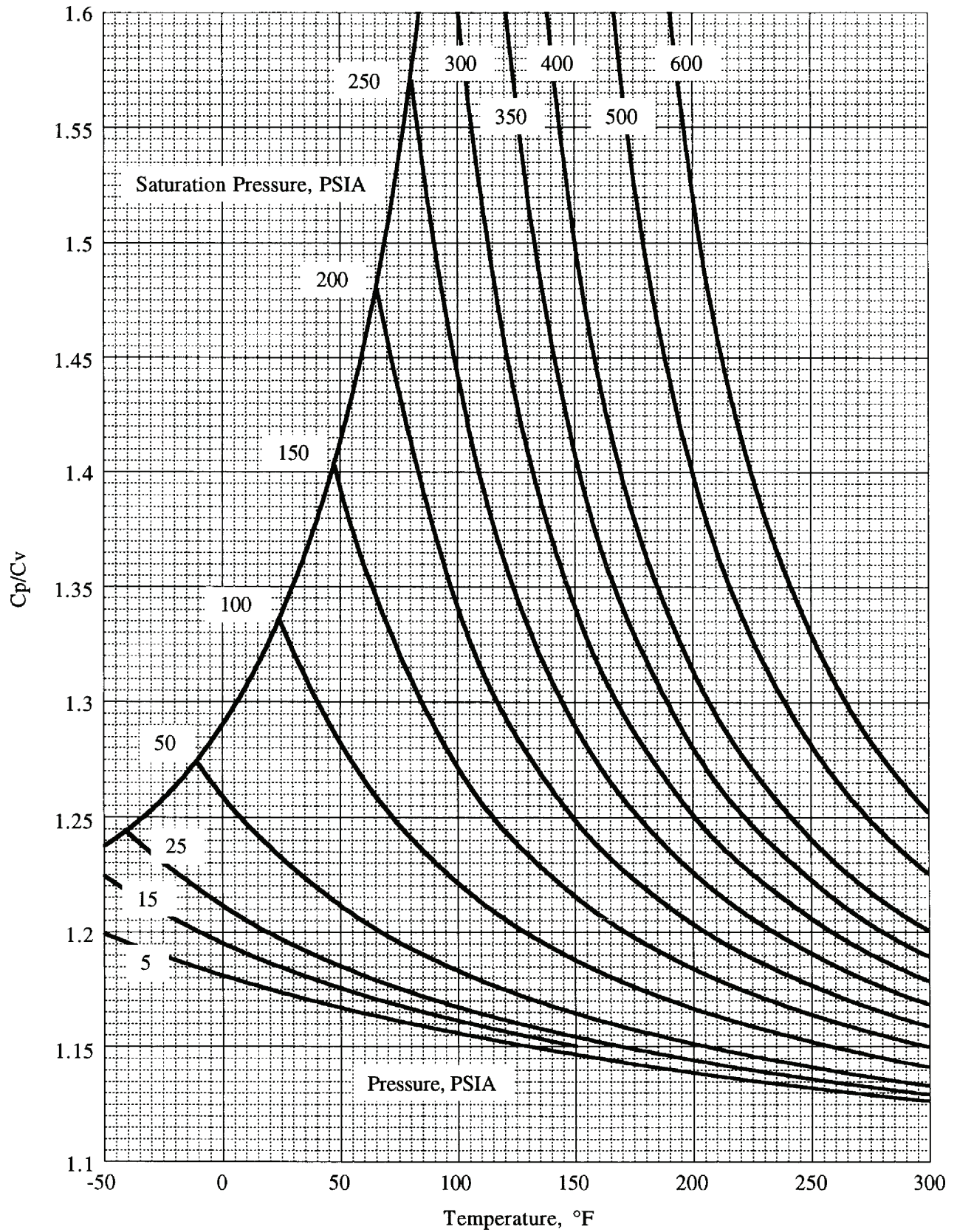
Vapor Thermal Conductivity



Vapor Heat Capacity



Vapor Heat Capacity Ratio



Equations for Property Estimation

English Units

Curves have been fitted to the measured data to obtain the following equations for estimation of Freon™ 410A properties within the ranges specified.

Saturated Liquid Viscosity in cP (-60 to 150 °F)

$$\mu = 0.212 - 1.65E-3 T + 7.07E-6 T^2 - 1.57E-8 T^3$$

Saturated Liquid Kinematic Viscosity in ft²/hr (-60 to 150 °F)

$$\nu = 6.56E-3 - 4.38E-5 T + 2.38E-7 T^2 - 6.96E-10 T^3$$

Saturated Liquid Heat Capacity in Btu/(lb·°R) (-40 to 120 °F)

$$C_p = 0.363 + 5.353E-4 T + 4.969E-7 T^2 + 7.029E-8 T^3$$

Saturated Vapor Viscosity in cP (0 to 150 °F)

$$\mu = 1.100E-2 + 5.48E-6 T + 1.44E-6 T^2 - 2.11E-8 T^3 + 1.02E-10 T^4$$

Gas Viscosity at Atmospheric Pressure in cP (0 to 300 °F)

$$\mu = 1.099E-2 + 2.21E-5 T$$

Saturated Liquid Thermal Conductivity in Btu/(hr·ft·°R) (-60 to 150 °F)

$$k = 6.28E-2 - 1.63E-4 T + 2.41E-7 T^2 - 1.27E-9 T^3$$

Saturated Vapor Thermal Conductivity in Btu/(hr·ft·°R) (0 to 150 °F)

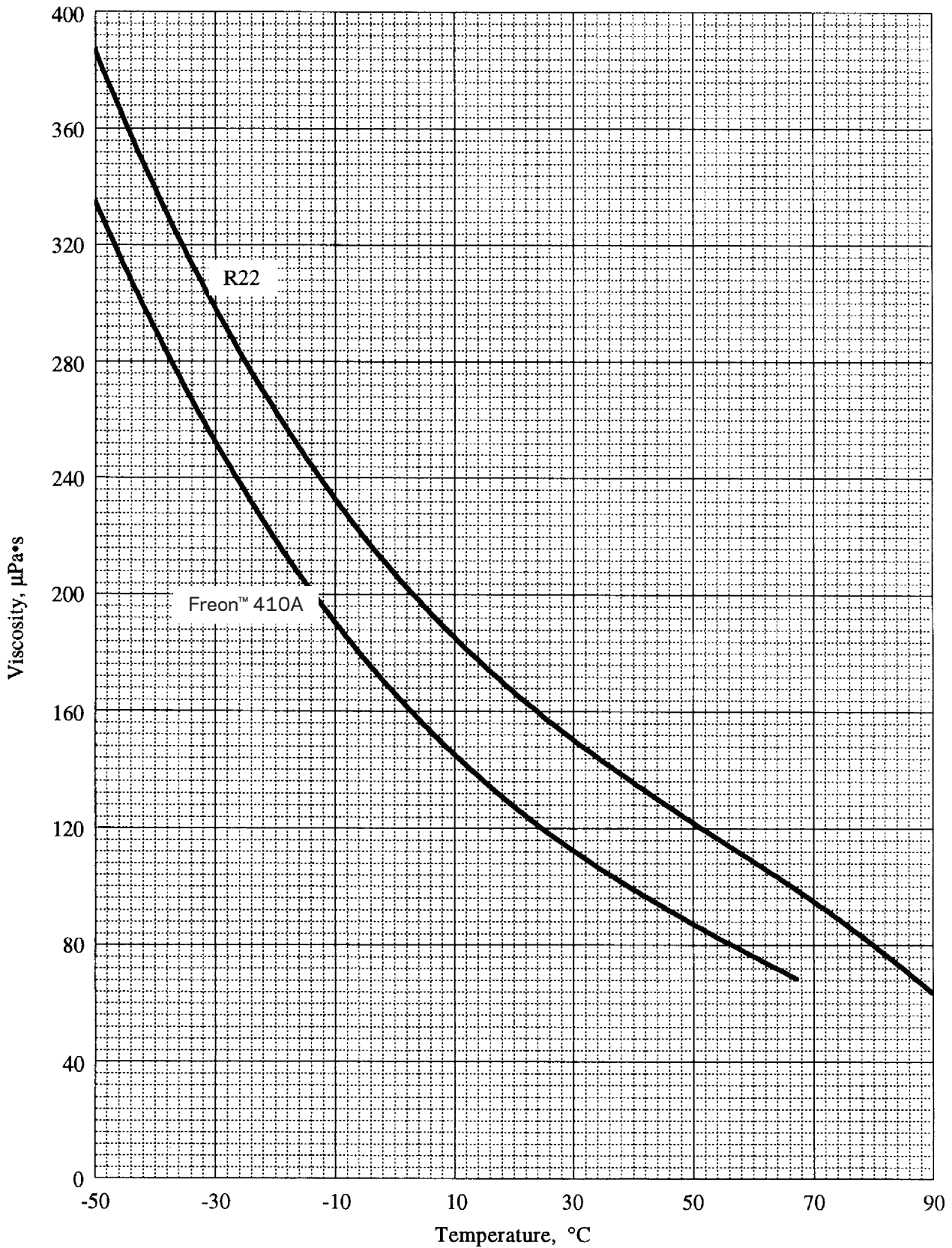
$$k = 6.24E-3 + 5.38E-5 T - 6.46E-7 T^2 + 5.23E-9 T^3$$

Gas Thermal Conductivity at Atmospheric Pressure in Btu/(hr·ft·°R) (0 to 300 °F)

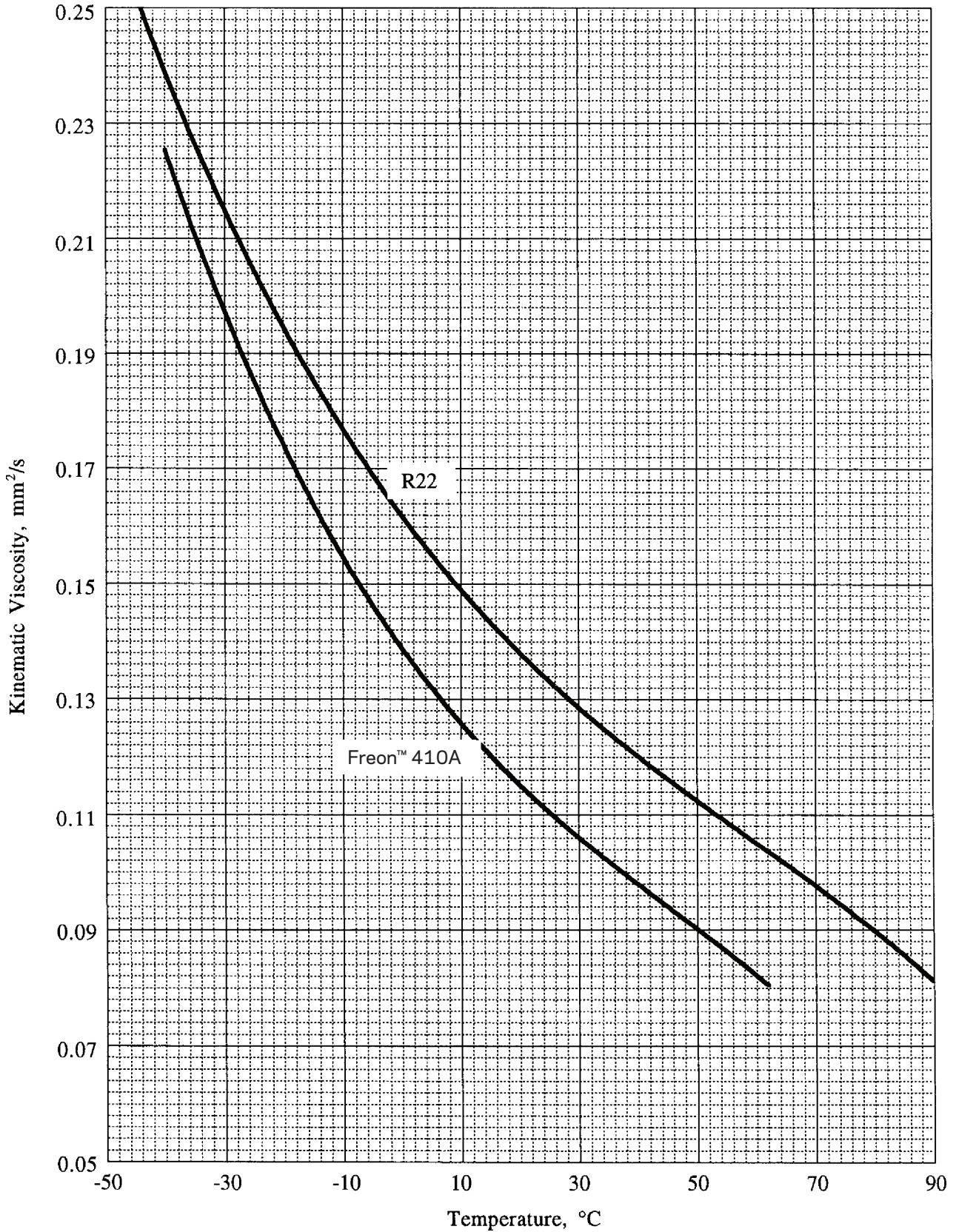
$$k = 5.89E-3 + 2.38E-5 T$$

Where T = Temperature, °F

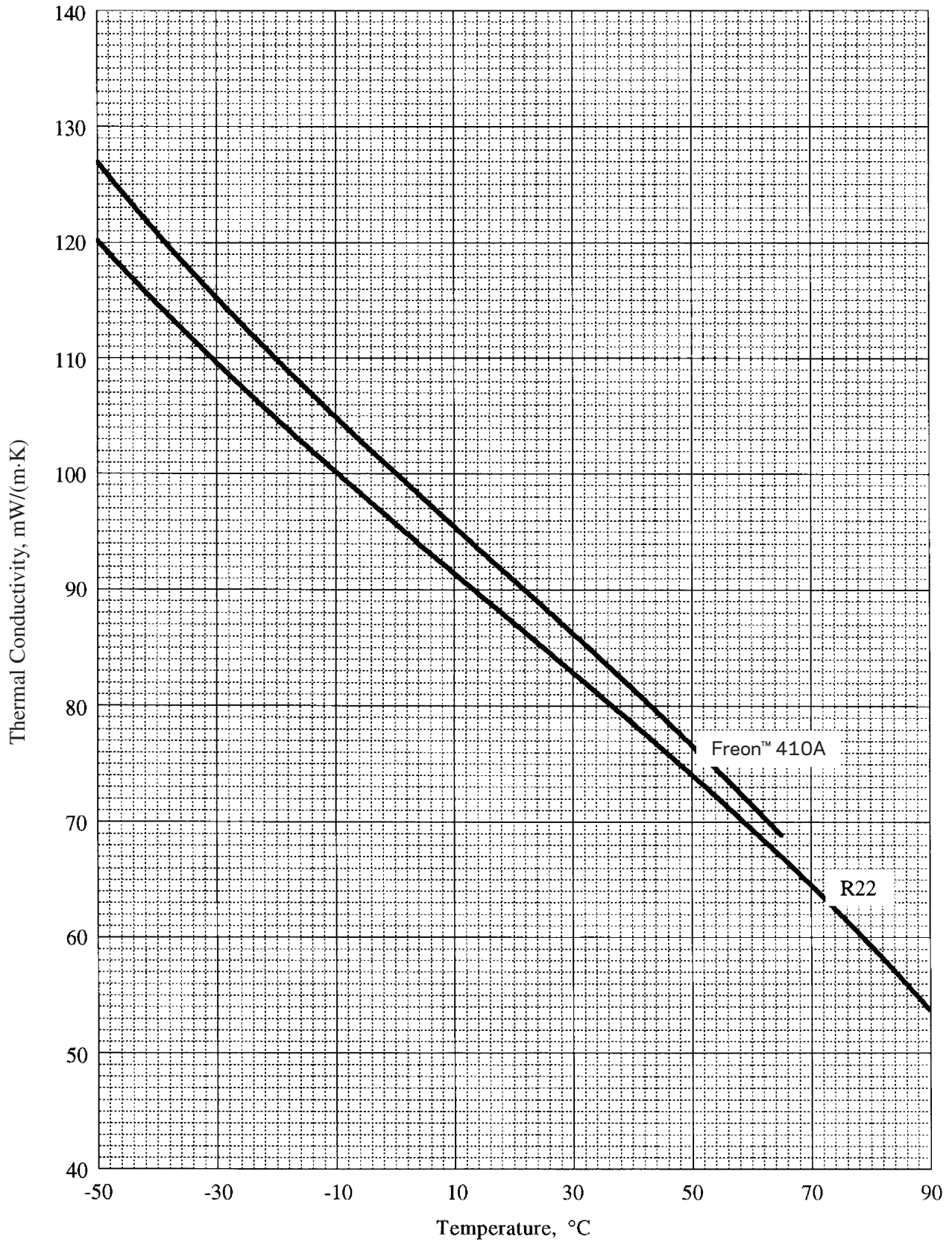
Saturated Liquid Viscosity



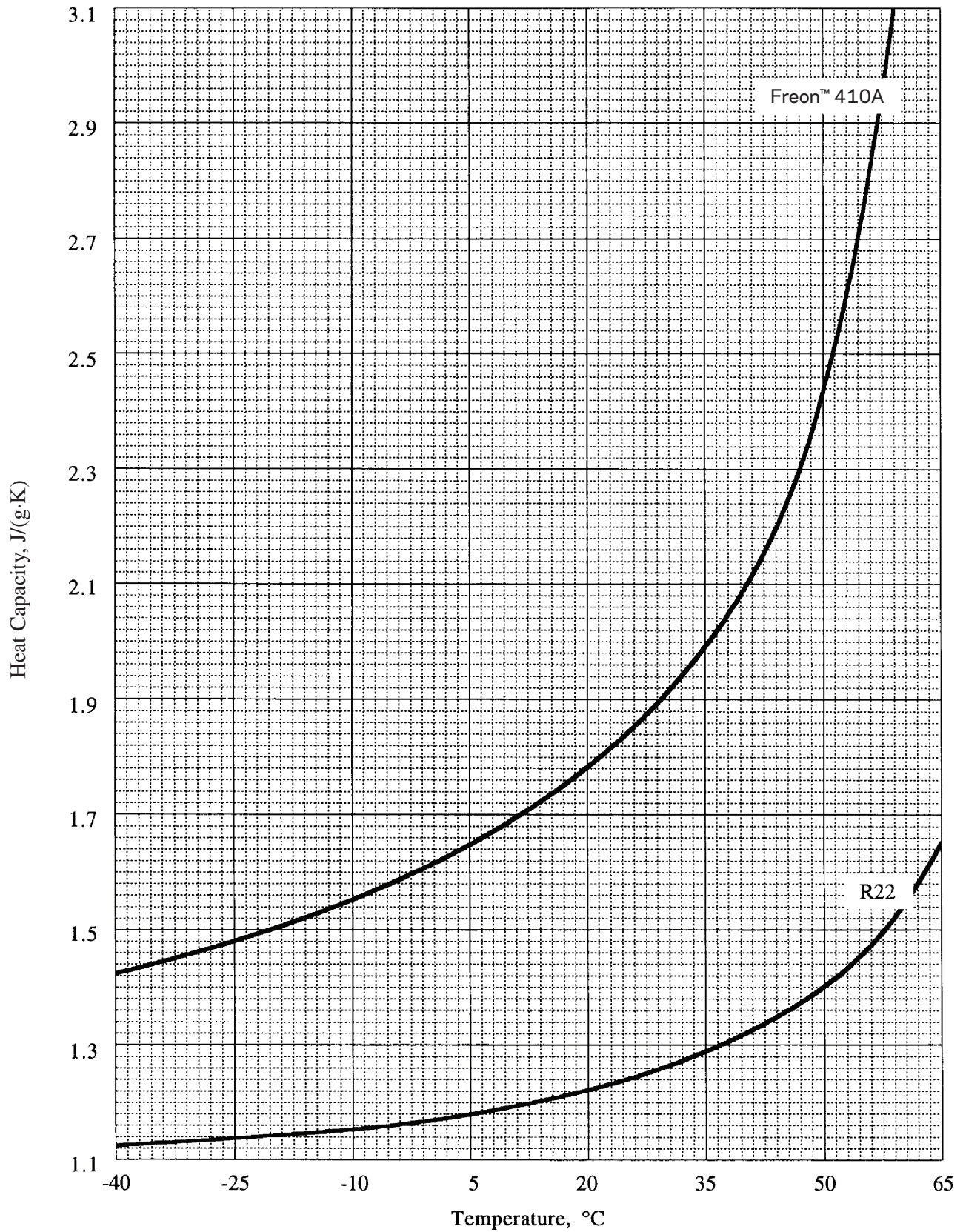
Saturated Liquid Kinematic Viscosity



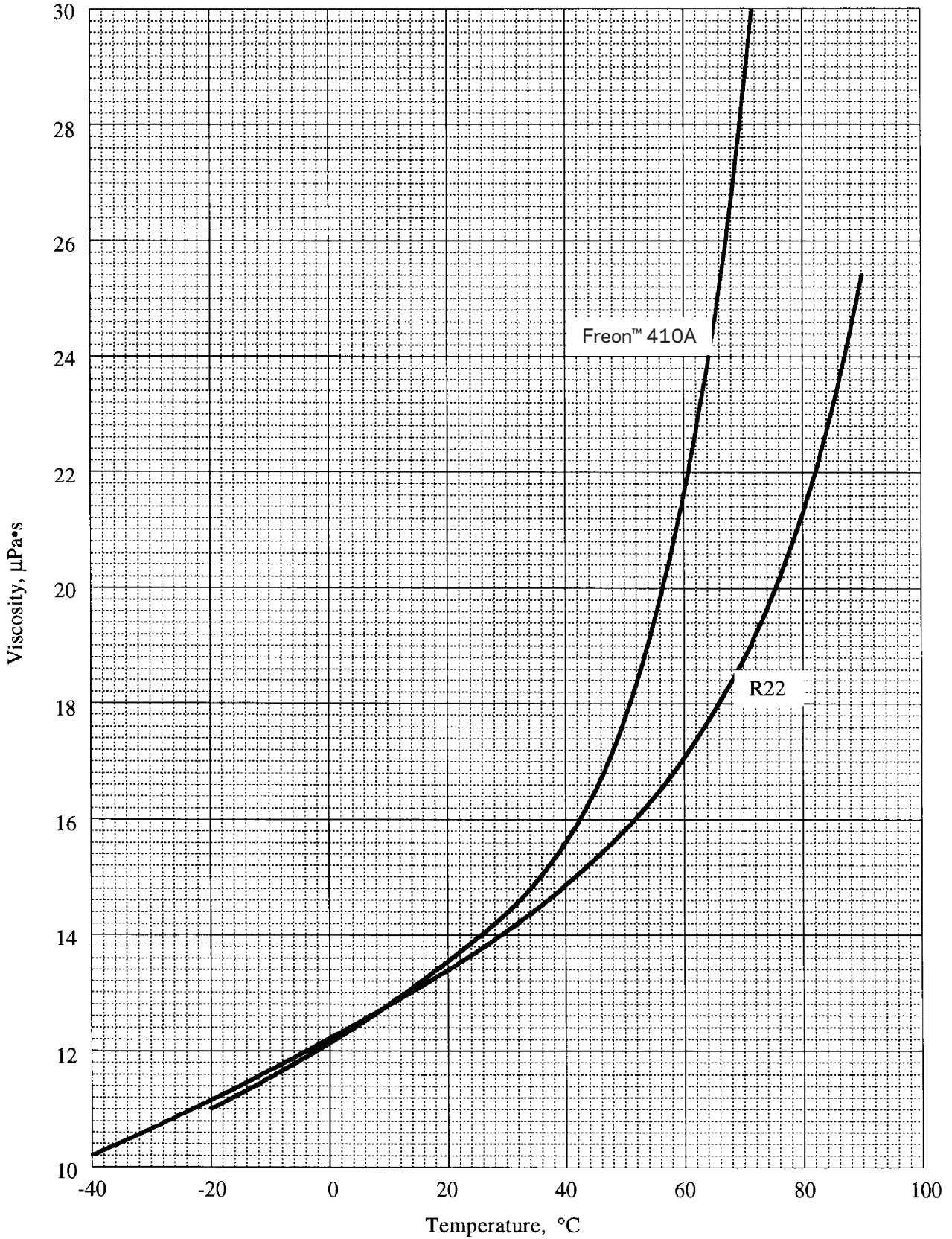
Saturated Liquid Thermal Conductivity



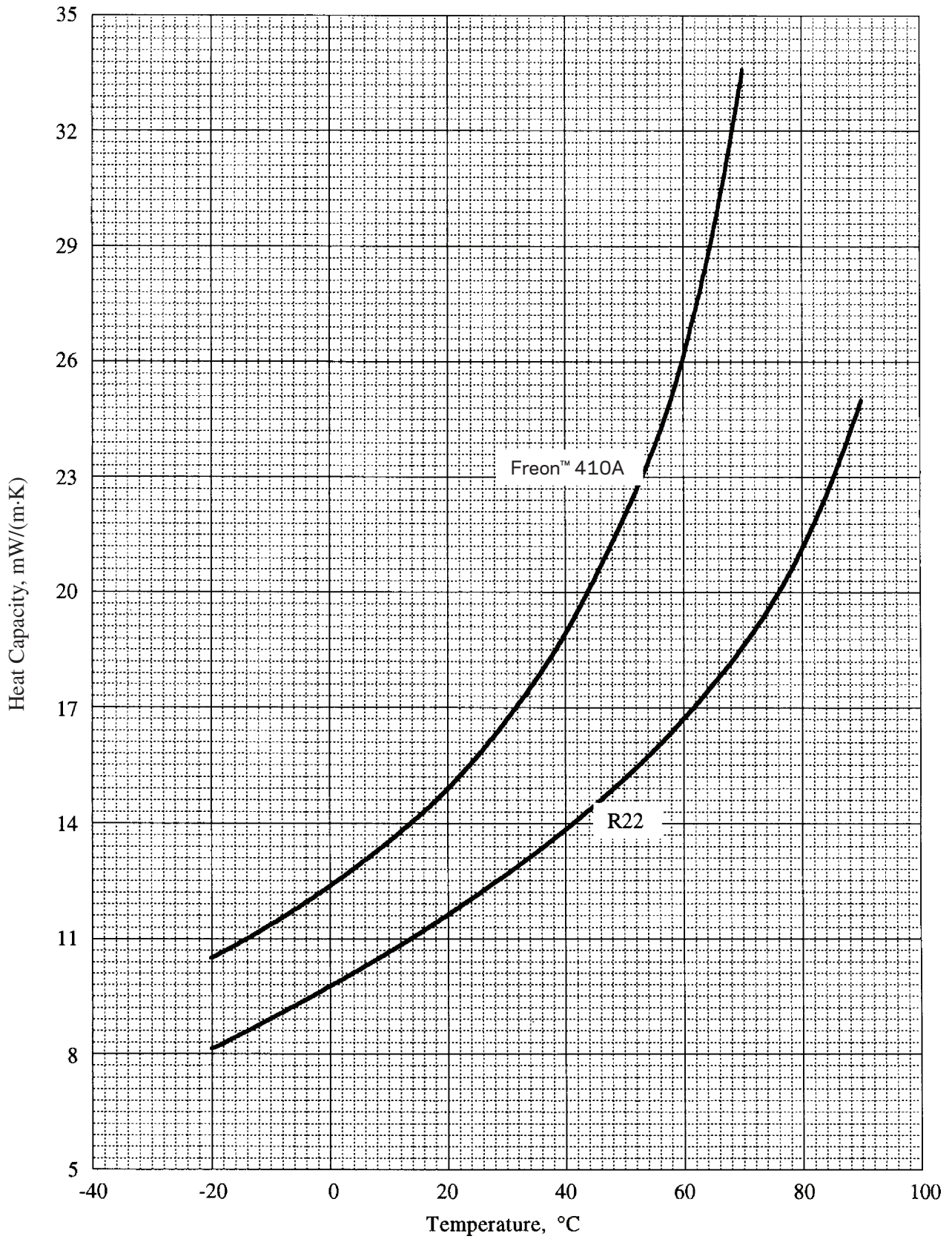
Saturated Liquid Heat Capacity



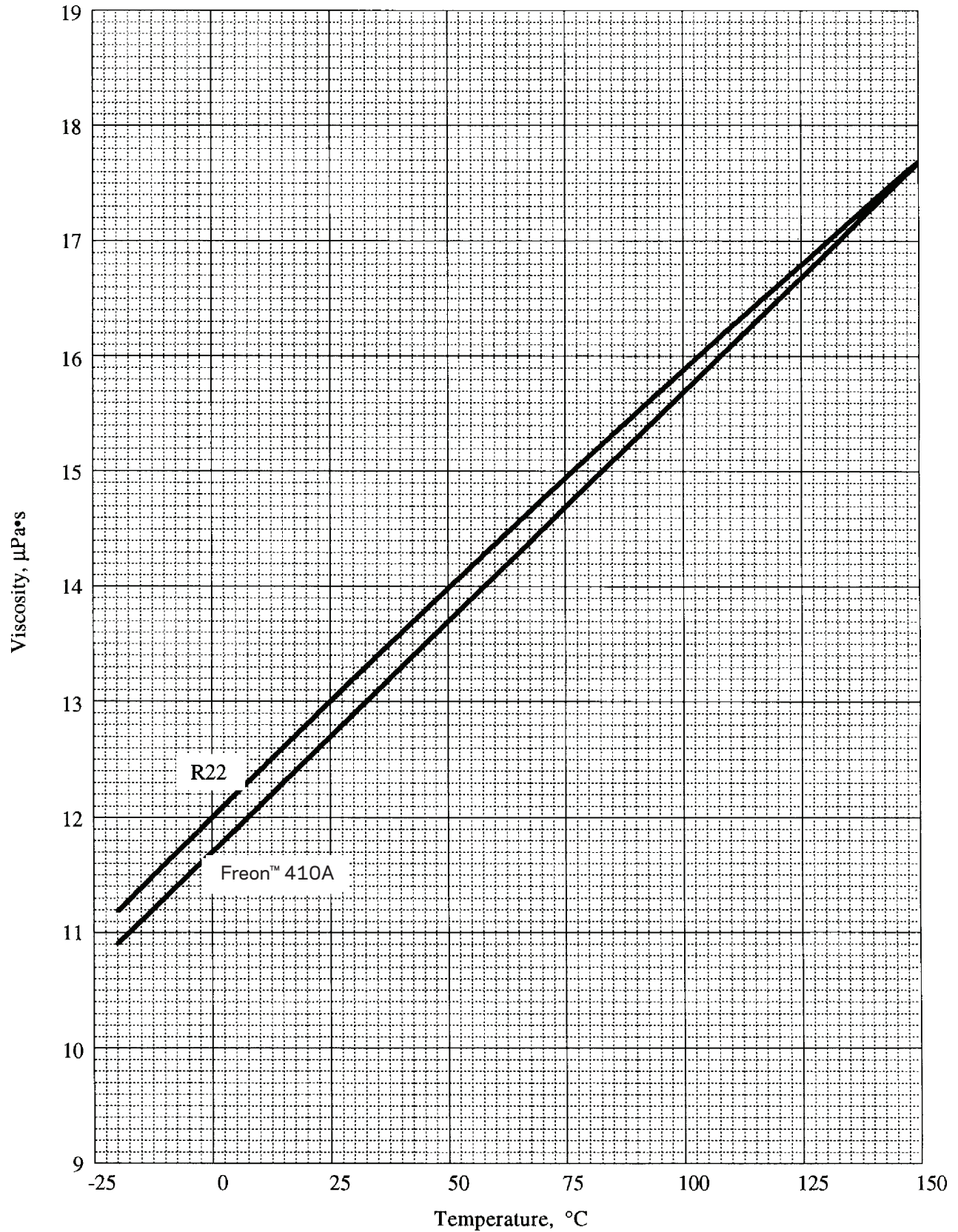
Saturated Vapor Viscosity



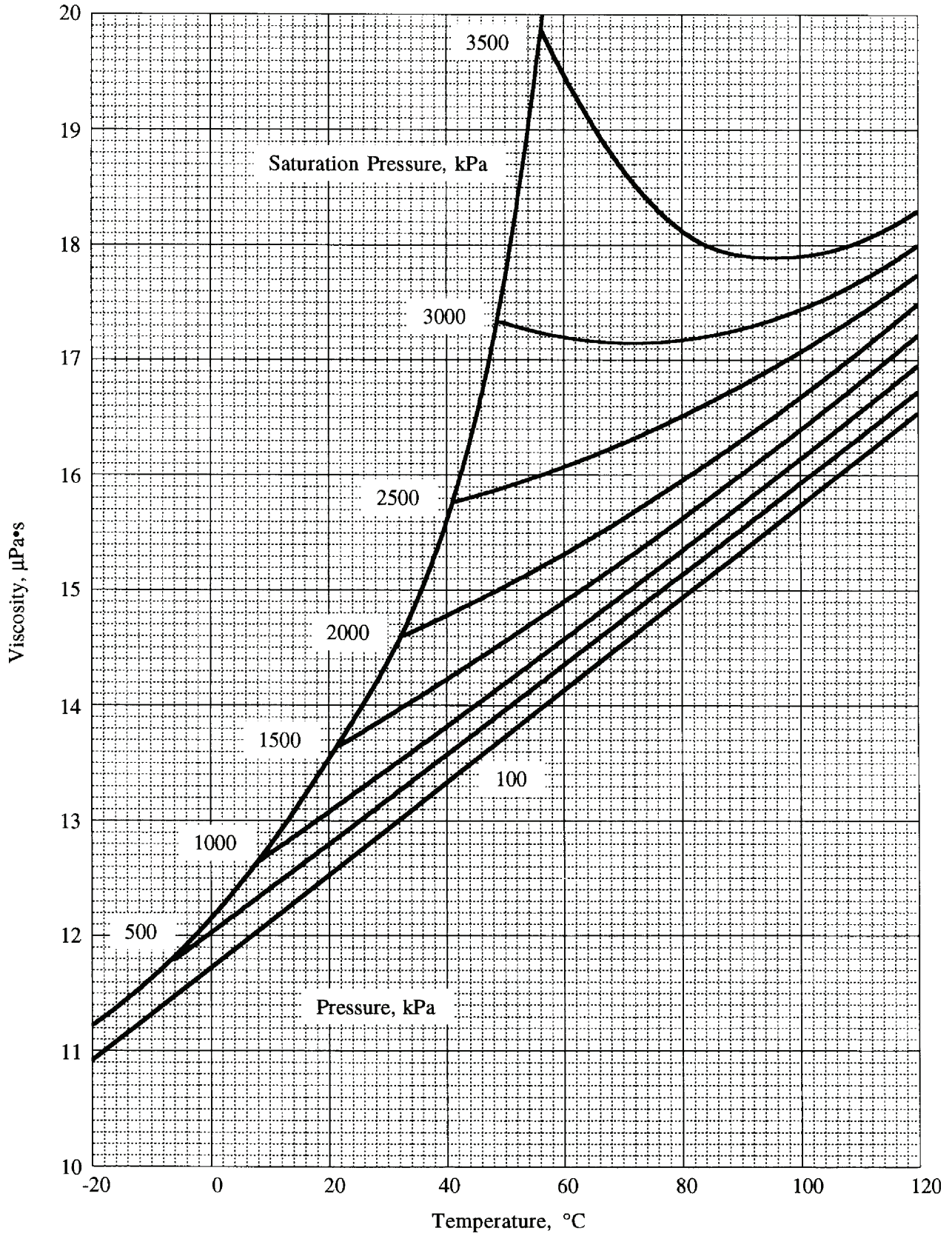
Saturated Vapor Thermal Conductivity



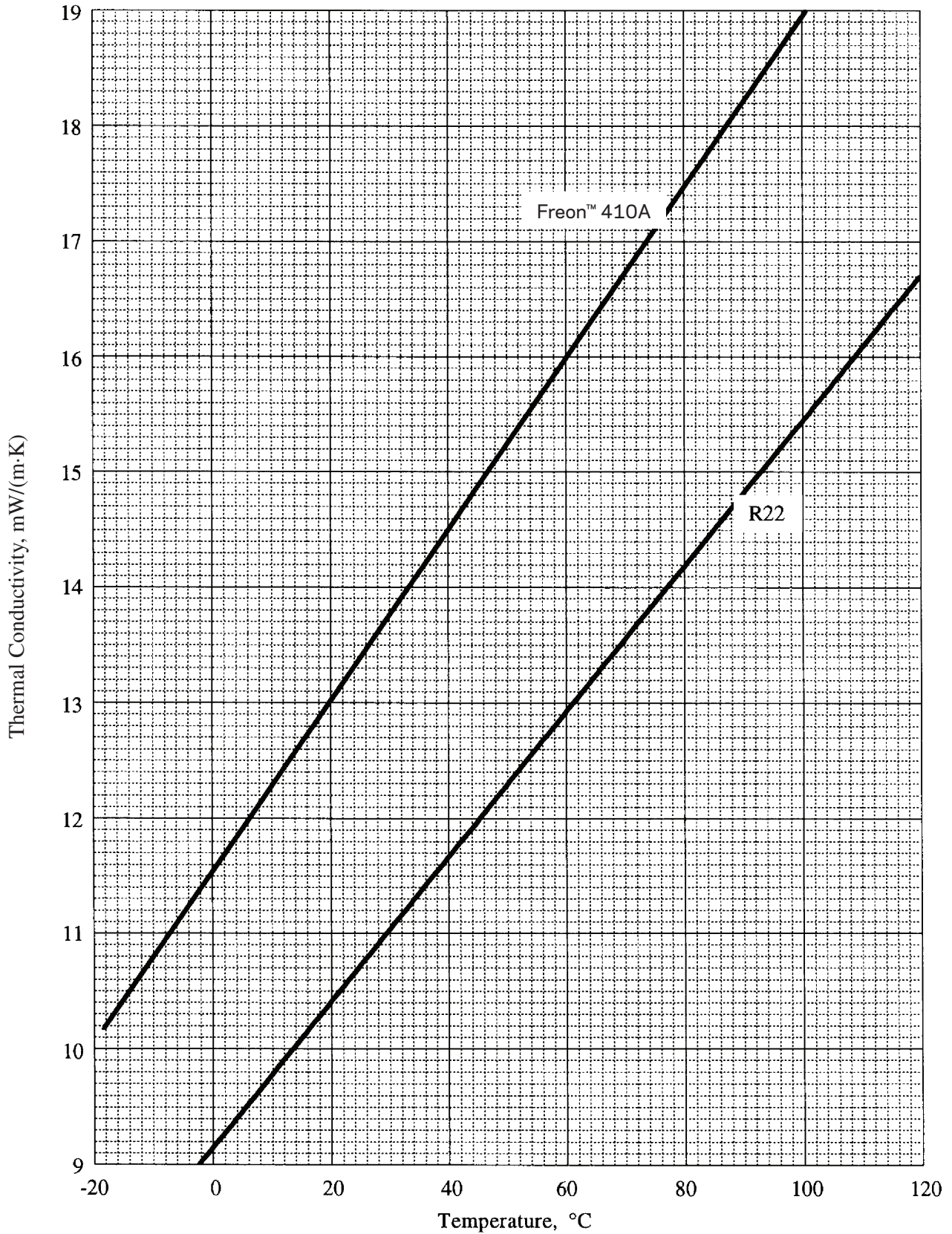
Gas Viscosity at Atmospheric Pressure



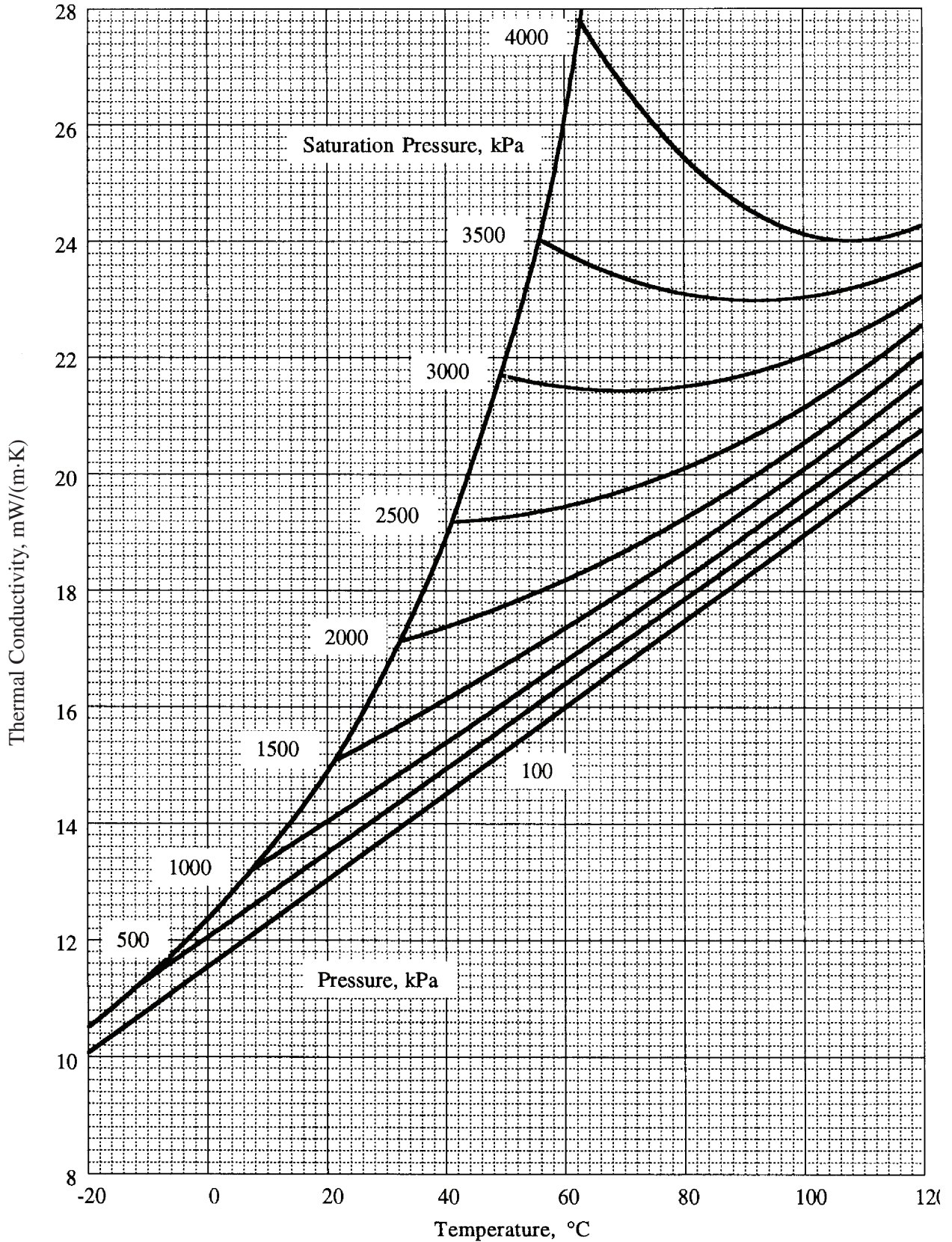
Vapor Viscosity



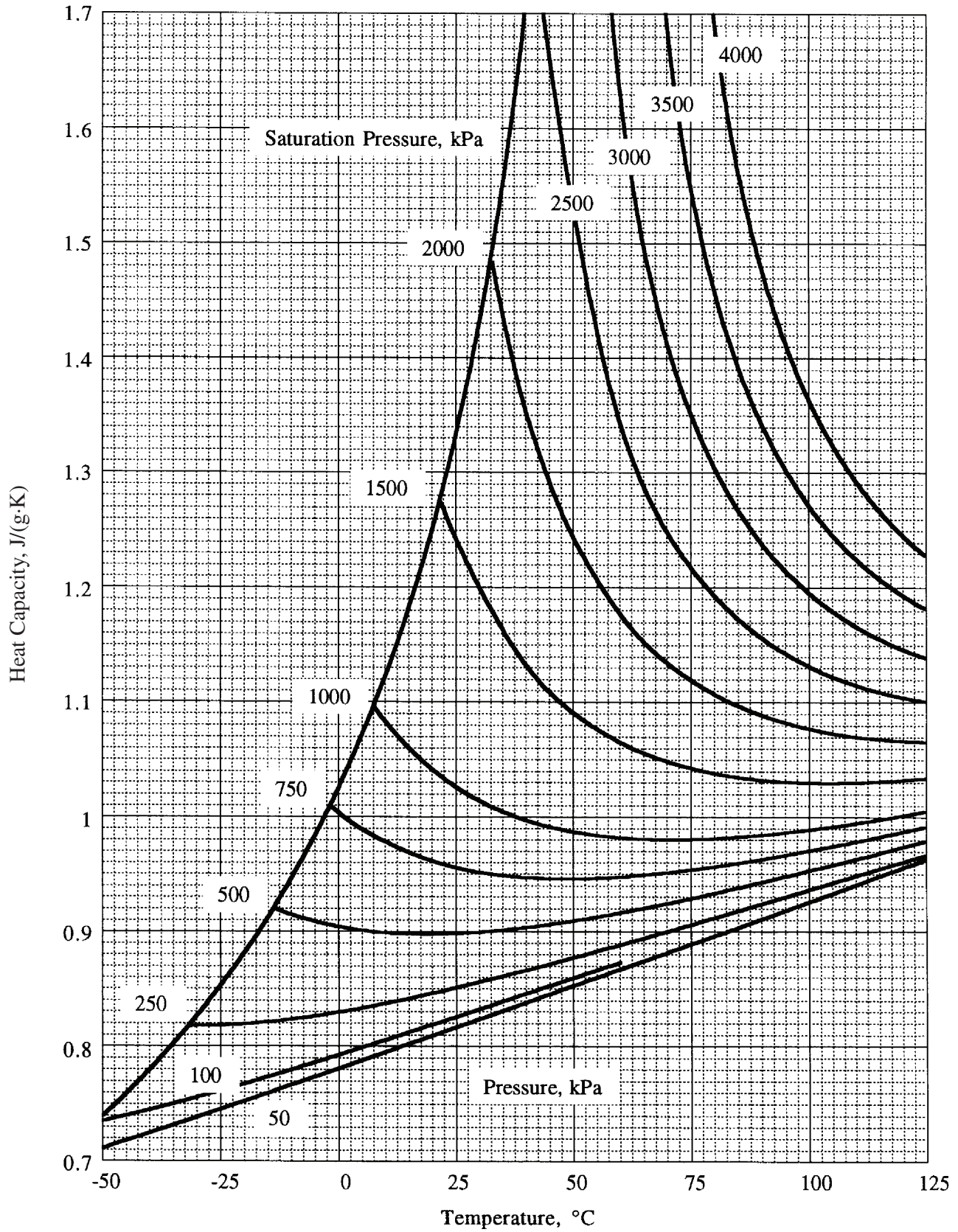
Gas Thermal Viscosity Conductivity at Atmospheric Pressure



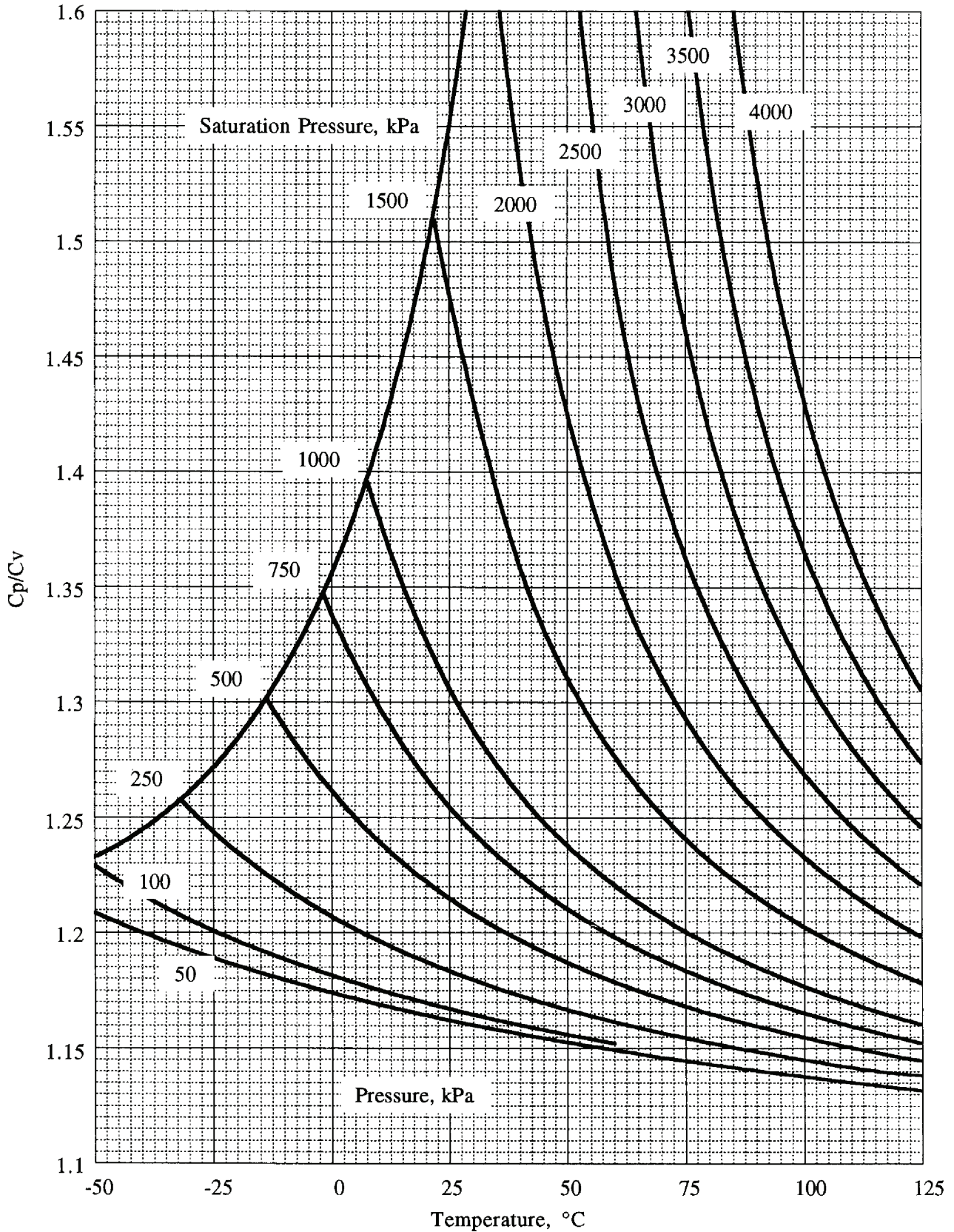
Vapor Thermal Conductivity



Vapor Heat Capacity



Vapor Heat Capacity Ratio



Equations for Property Estimation

Metric Units

Curves have been fitted to the measured data to obtain the following equations for estimation of Freon™ 410A properties within the ranges specified.

Saturated Liquid Viscosity in $\mu\text{Pa}\cdot\text{s}$ (-50 to 70 °C)

$$\mu = 166 - 2.25 T + 1.81E-2 T^2 - 9.20E-5 T^3$$

Saturated Liquid Kinematic Viscosity in mm^2/s (-50 to 70 °C)

$$\nu = 0.139 - 1.43E-3 T + 1.43E-5 T^2 - 1.04E-7 T^3$$

Liquid Heat Capacity in $\text{J}/(\text{g}\cdot\text{K})$ (-40 to 50 °C)

$$C_p = 1.603 + 5.727E-3 T + 9.903E-5 T^2 + 1.855E-6 T^3$$

Saturated Vapor Viscosity in $\mu\text{Pa}\cdot\text{s}$ (-20 to 70 °C)

$$\mu = 12.10 + 8.33E-2 T + 1.47E-4 T^2 - 4.67E-5 T^3 + 1.08E-6 T^4$$

Gas Viscosity at Atmospheric Pressure in $\mu\text{Pa}\cdot\text{s}$ (-30 to 120 °C)

$$\mu = 11.70 + 3.98E-2 T$$

Saturated Liquid Thermal Conductivity in $\text{mW}/(\text{m}\cdot\text{K})$ (-50 to 70 °C)

$$k = 100.1 - 0.471 T + 6.86E-4 T^2 - 1.29E-5 T^3$$

Saturated Vapor Thermal Conductivity in $\text{mW}/(\text{m}\cdot\text{K})$ (-20 to 70 °C)

$$k = 6.24E-3 + 5.38E-5 T - 6.46E-7 T^2 + 5.23E-9 T^3$$

Vapor Thermal Conductivity at Atmospheric Pressure in $\text{mW}/(\text{m}\cdot\text{K})$ (-30 to 120 °C)

$$k = 11.54 + 7.41E-2 T$$

Where T = Temperature, °C

For more information on Freon™ refrigerants, visit freon.com.

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Replaces: H-65144-1
C-11745 (8/19)