**Designation: D2493/D2493M – 16**

# Standard Practice for
# Viscosity-Temperature Chart for Asphalt Binders[1]

## 1. Scope

1.1 The viscosity-temperature chart covered by this standard is a convenient means of plotting data for estimating the viscosity of asphalt binders at any temperature within a limited range. Conversely, the chart may be used to ascertain the temperature at which a desired viscosity is attained.

1.2 The chart is suitable for asphalt binders and for asphalts recovered from laboratory aging tests or extracted from pavements.

1.3 The chart is based on a viscosity-temperature relationship that can be plotted using any appropriate set of units. For convenience, charts based on both conventional and SI units are provided.

1.4 The range of the chart is sufficient for roofing asphalts.

1.5 The range of the chart is sufficient for asphalt binders whose viscosity exceeds 0.01 Pa.S (10 centipoise).

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D341 Practice for Viscosity-Temperature Charts for Liquid Petroleum Products

D2170 Test Method for Kinematic Viscosity of Asphalts (Bitumens)

D2171 Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer

D4402 Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer

D4957 Test Method for Apparent Viscosity of Asphalt Emulsion Residues and Non-Newtonian Bitumens by Vacuum Capillary Viscometer

D7175 Test Method for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer

## 3. Significance and Use

3.1 The viscosity-temperature chart is a convenient means of plotting the viscosity data for estimating the viscosity of asphalt binders, recovered asphalts, and roofing asphalts at any temperature within a limited range. It is also a convenient means to estimate the temperature at which a desired viscosity is attained. Charts may be constructed manually or using computer graphing software.

3.2 Kinematic viscosity-temperature charts are described in Practice D341.

## 4. Description

4.1 Fig. 1 shows an example viscosity-temperature chart. For Fig. 1, the chart coordinates are logarithm of the logarithm of the viscosity in centipoise as the ordinate, and logarithm of the absolute temperature in degrees Rankine (degrees F + 459.7) as the abscissa. However, the viscosity in poise and the temperature in degrees Fahrenheit are shown in the chart for convenience.

4.2 Fig. 2 shows an example viscosity-temperature chart. For Fig. 2, the chart coordinates are logarithm of the logarithm of the viscosity in mPa·S as the ordinate, and logarithm of the absolute temperature in degrees Kelvin (degrees C + 273.2) as the abscissa. However, viscosity in Pa·S and the temperature in degrees Celsius are shown in the chart for convenience.

4.3 The temperature range of the charts may be extended or abbreviated as necessary.

## 5. Procedure

5.1 If the viscosities are not known they should be determined in accordance with Test Methods D2170, D2171, D4402, D4957, or D7175. Viscosities determined at temperatures other than the temperatures specified in each of these test methods may be used.
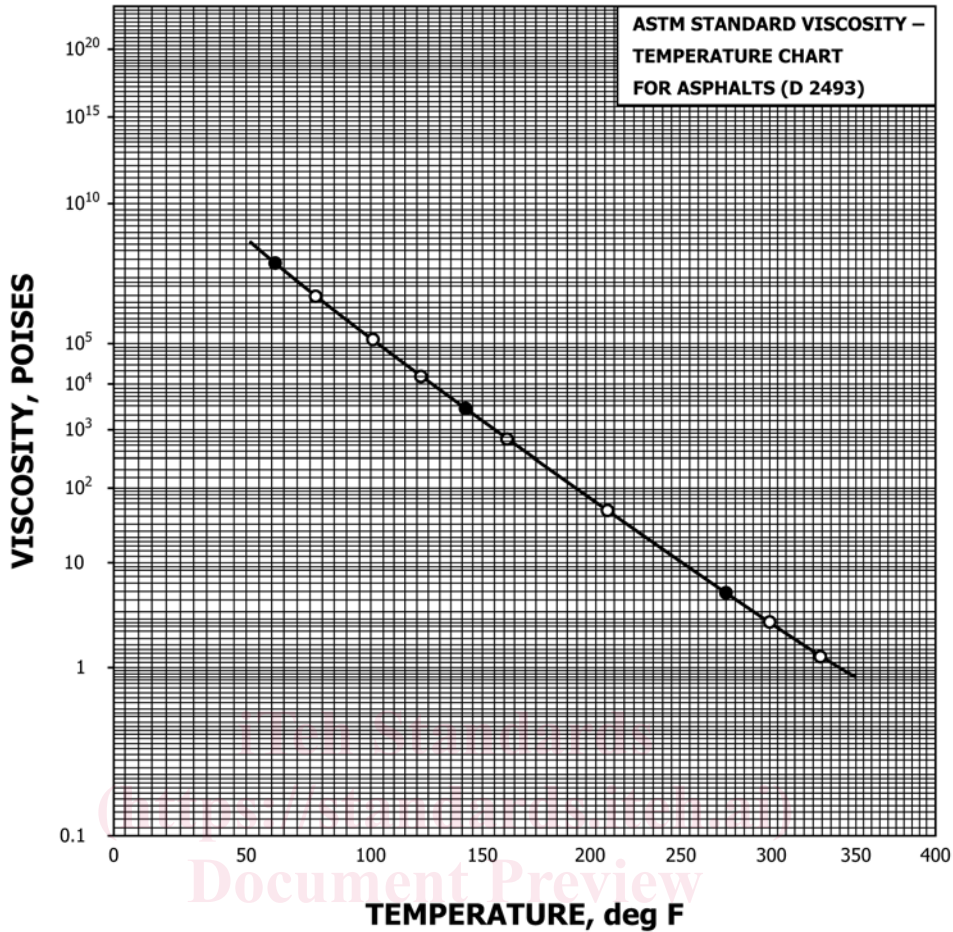
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## VISCOSITY – TEMPERATURE CHART



**FIG. 1 Viscosity-Temperature Chart for Asphalt Binders on Which a Typical Experimental Curve Has Been Plotted**

5.2 For temperatures above 60 °C [140 °F], plot two viscosity-temperature points and carefully draw a straight line through the points. Plot at least three viscosity-temperature points if the included temperature range is below 60 °C [140 °F]. Carefully draw a straight line or curve through the points. A point on this line, within the temperature range of the points plotted, shows the viscosity at the corresponding desired temperature.

NOTE 1—These charts are appropriate for use at higher temperatures, where asphalts are primarily viscous. At lower temperatures most asphalt binders become viscoelastic. When this occurs, viscosity alone is insufficient to describe an asphalt binder's flow properties. Caution should be used when applying this standard below that temperature.

NOTE 2—Some asphalt binders have viscosity-temperature relationships too complex to be represented by only three points, as shown in Fig. 1. In this case, determine the viscosity at sufficient temperatures to produce a curve adequate for the purpose intended.

NOTE 3—Viscosities determined by extrapolation of data may be unreliable.

5.3 The viscosity values represented by the data points may have been obtained at different shear rates. This chart does not reflect the shear rate at which the viscosities were determined.

## 6. Keywords

6.1 asphalt; rheology; viscosity; viscosity-temperature chart