



# Standard Viscosity-Temperature Charts for Liquid Petroleum Products<sup>1</sup>

This standard is issued under the fixed designation D 341; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 The kinematic viscosity-temperature charts (see Figs. 1 and 2) covered by this standard are a convenient means to ascertain the kinematic viscosity of a petroleum oil or liquid hydrocarbon at any temperature within a limited range, provided that the kinematic viscosities at two temperatures are known.

1.2 The charts are designed to permit petroleum oil kinematic viscosity-temperature data to plot as a straight line. The charts here presented provide a significant improvement in linearity over the charts previously available under Method D 341 – 43. This increases the reliability of extrapolation to higher temperatures.

## 2. Referenced Documents

### 2.1 ASTM Standards:

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity)<sup>2</sup>

<sup>1</sup> These charts are under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and are the direct responsibility of Subcommittee D02.07 on Flow Properties.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 05.01.

### 2.2 ASTM Adjuncts:

Adjunct D 341, Viscosity-Temperature Charts 1–7<sup>3</sup>

## 3. Technical Hazard

3.1 **Caution**—The charts should be used only in that range in which the hydrocarbon or petroleum fluids are homogeneous liquids. The suggested range is thus between the cloud point at low temperatures and the initial boiling point at higher temperatures. The charts provide improved linearity in both low kinematic viscosity and at temperatures up to 340°C (approximately 650°F) or higher. Some high-boiling point materials can show a small deviation from a straight line as low as 280°C (approximately 550°F), depending on the individual sample or accuracy of the data. Reliable data can be usefully plotted in the high temperature region even if it does exhibit some curvature. Extrapolations into such regions from lower temperatures will lack accuracy, however. Experimental data taken below the cloud point or temperature of crystal growth will generally not be of reliable repeatability for interpolation or extrapolation on the charts. It should also be emphasized that fluids other than hydrocarbons will usually not plot as a straight line on these charts.

<sup>3</sup> Available from ASTM International Headquarters. Order Adjunct No. ADJD0341CS.

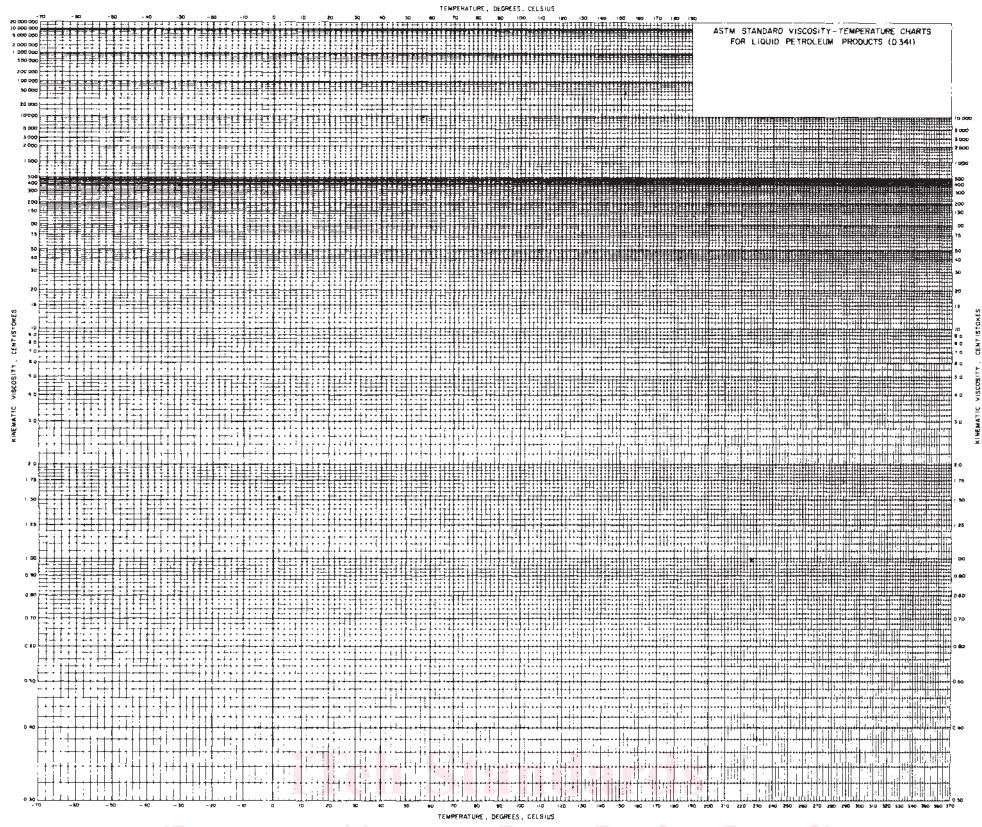


FIG. 1 Facsimile of Kinematic Viscosity-Temperature Chart I High Range (Temperature in degrees Celsius)

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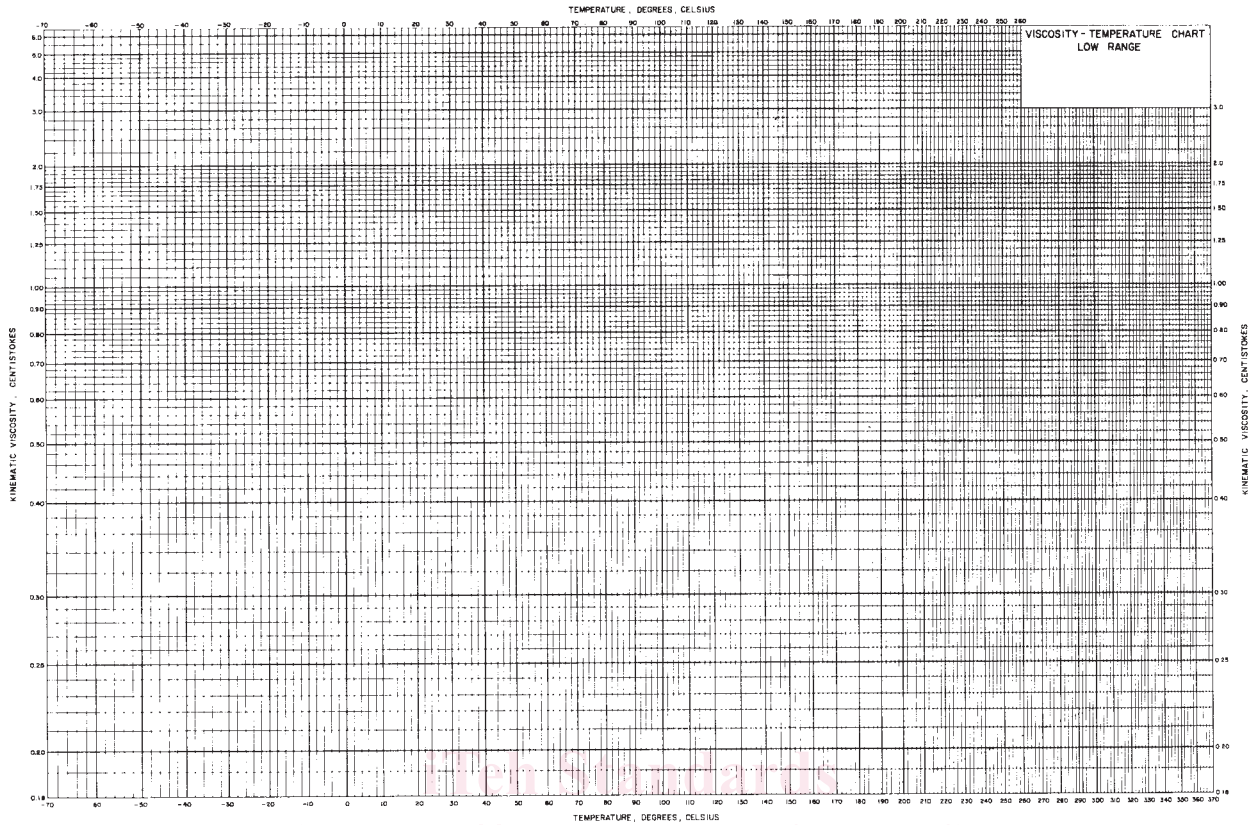


FIG. 2 Facsimile of Kinematic Viscosity-Temperature Chart II Low Range (Temperature in degrees Celsius)

#### 4. Description

4.1 The charts are designed to permit kinematic viscosity-temperature data for a petroleum oil or fraction, and hydrocarbons in general, to plot as a straight line over a wide range. Seven charts are available as follows:<sup>3</sup>

*Chart I—Kinematic Viscosity, High Range:*  
Kinematic Viscosity: 0.3 to 20 000 000 cSt  
Temperature: - 70 to + 370°C  
Size: 680 by 820 mm (26.75 by 32.25 in.)  
Pad of 50  
ADJD034101

*Chart II— Kinematic Viscosity, Low Range:*  
Kinematic Viscosity: 0.18 to 6.5 cSt  
Temperature: - 70 to + 370°C  
Size: 520 by 820 mm (20.5 by 32.25 in.)  
Pad of 50  
ADJD034102

*Chart III—Kinematic Viscosity, High Range:*  
Kinematic Viscosity: 0.3 to 20 000 000 cSt  
Temperature: - 70 to + 370°C  
Size: 217 by 280 mm (8.5 by 11.0 in.)  
Pad of 50  
ADJD034103

*Chart IV—Kinematic Viscosity, Low Range:*  
Kinematic Viscosity: 0.18 to 6.5 cSt  
Temperature: - 70 to + 370°C  
Size: 217 by 280 mm (8.5 to 11.0 in.)  
Pad of 50  
ADJD034104

*Chart V—Kinematic Viscosity, High Range:*  
Kinematic Viscosity: 0.3 to 20 000 000 cSt  
Temperature: - 100 to + 700°F  
Size: 680 by 820 mm (26.75 by 32.25 in.)  
Pad of 50  
ADJD034105

*Chart VI—Kinematic Viscosity, Low Range:*  
Kinematic Viscosity: 0.18 to 3.0 cSt

Temperature: - 100 to + 700°F  
Size: 520 by 820 mm (20.5 by 32.25 in.)  
Pad of 50

ADJD034106  
*Chart VII—Kinematic Viscosity, Middle Range:*  
Kinematic Viscosity: 3 to 200 000 cSt  
Temperature: - 40 to + 150°C  
Size: 217 by 280 mm (8.5 by 11.0 in.)  
Pad of 50  
ADJD034107

4.2 Charts I, II, V, and VI are preferred when convenience and accuracy of plotting are desired. Chart VII is the middle range section of Chart I at somewhat reduced scale. It is provided for convenience in connection with reports and data evaluation. Charts III and IV are the same as Charts I and II and are provided in greatly reduced scale for convenience in connection with reports or quick evaluation of data. These latter charts are not recommended for use where the most accurate interpolations or extrapolations are desired.

#### 5. Procedure

5.1 Plot two known kinematic viscosity-temperature points on the chart. Draw a sharply defined straight line through them. A point on this line, within the range defined in Section 3, shows the kinematic viscosity at the corresponding desired temperature and vice versa.<sup>4</sup>

<sup>4</sup> If the kinematic viscosities are not known, they should be determined in accordance with Test Method D 445.