



Designation: D341 – 20

# Standard Practice for Viscosity-Temperature Equations and Charts for Liquid Petroleum or Hydrocarbon Products<sup>1</sup>

This standard is issued under the fixed designation D341; 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 U.S. Department of Defense.*

## 1. Scope\*

1.1 This practice covers kinematic viscosity-temperature equations and charts (see Figs. 1-3), which 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 have been derived from the equations shown in Section 5. The charts here presented provide a significant improvement in linearity over the charts previously available under Method D341 – 03. This increases the reliability of extrapolation to higher temperatures.

1.3 The values provided in SI units are to be regarded as standard.

1.3.1 *Exception*—The values given in parentheses are provided for information only.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

NOTE 1—Any ASTM standard that measures kinematic viscosity at multiple temperatures is applicable to D341. Some examples are given below.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and are the direct responsibility of Subcommittee D02.07 on Flow Properties.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)

D7279 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids by Automated Houillon Viscometer

### 2.2 ASTM Adjuncts:<sup>3</sup>

Viscosity-Temperature Charts 1–7

## 3. Method Limitations

3.1 **Warning**—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.

3.2 These charts are derived from the equations shown in Section 5 and are applicable over the following ranges:

Fig. 1	0.30 cSt to 20 000 000 cSt and –70 °C to 370 °C
Fig. 2	1.50 cSt to 200 000 cSt and –40 °C to 150 °C
Fig. 3	0.18 cSt to 7.0 cSt and –70 °C to 370 °C

## 4. Procedure for Use of the Charts

4.1 Plot two known kinematic viscosity-temperature points on the chart. Draw a sharply defined straight line through them.

<sup>3</sup> Available from ASTM International Headquarters. Order Adjunct No. ADJD0341CS. Original adjunct produced in 1965.

\*A Summary of Changes section appears at the end of this standard

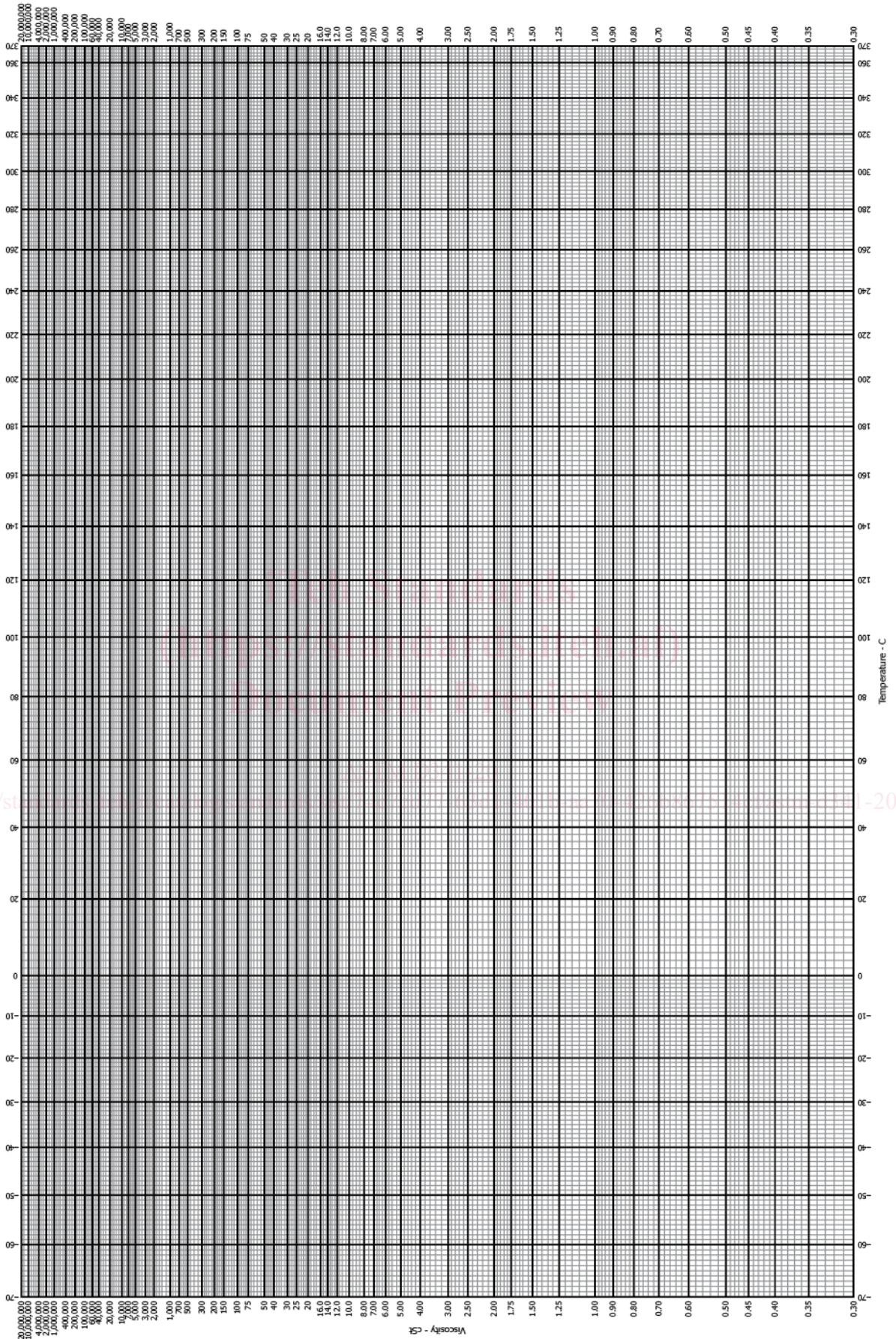


FIG. 1 Facsimile of Kinematic Viscosity-Temperature Chart I High Range (Temperature in degrees Celsius)



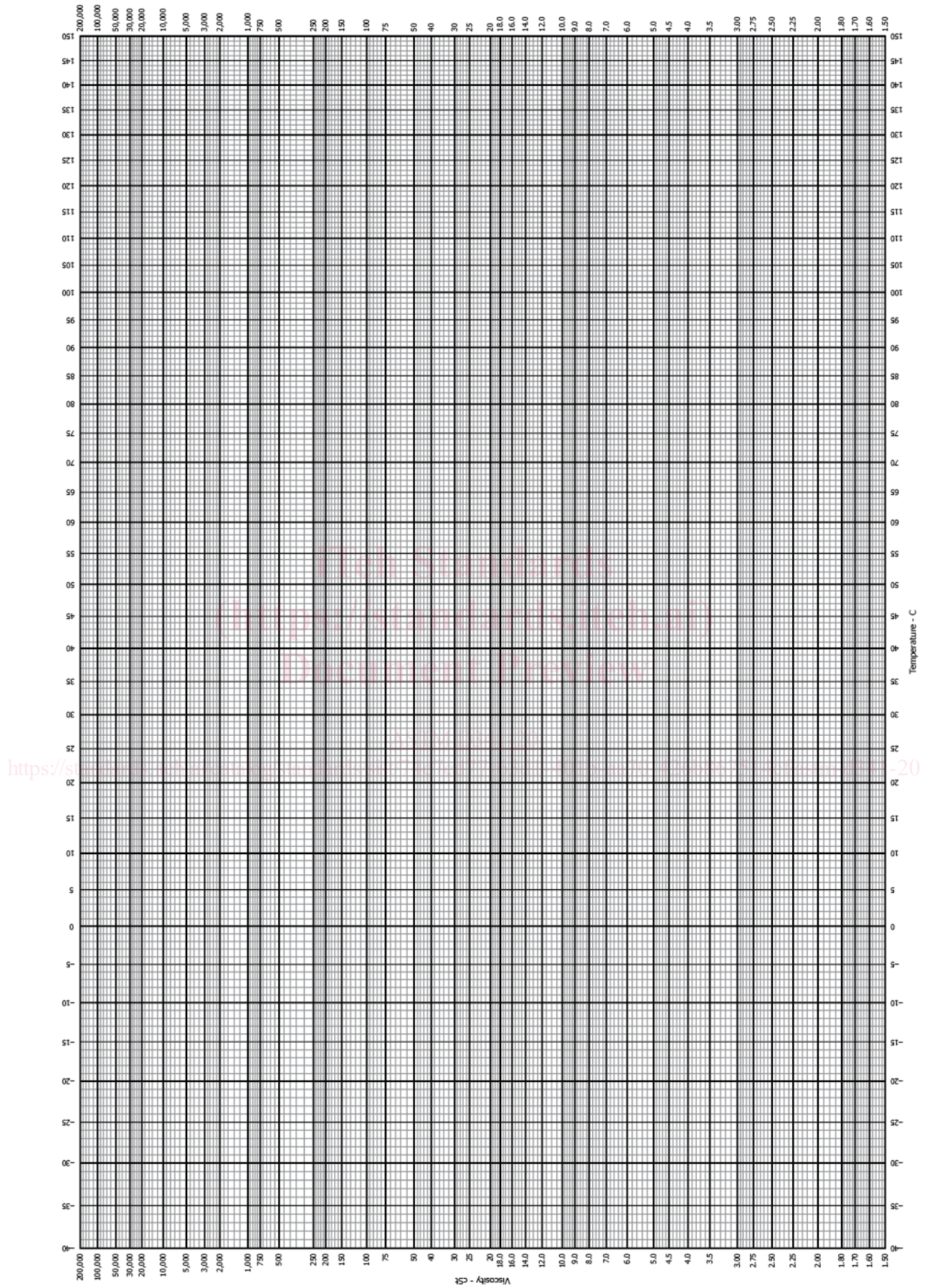


FIG. 2 Facsimile of Kinematic Viscosity-Temperature Chart I Medium Range (Temperature in degrees Celsius)

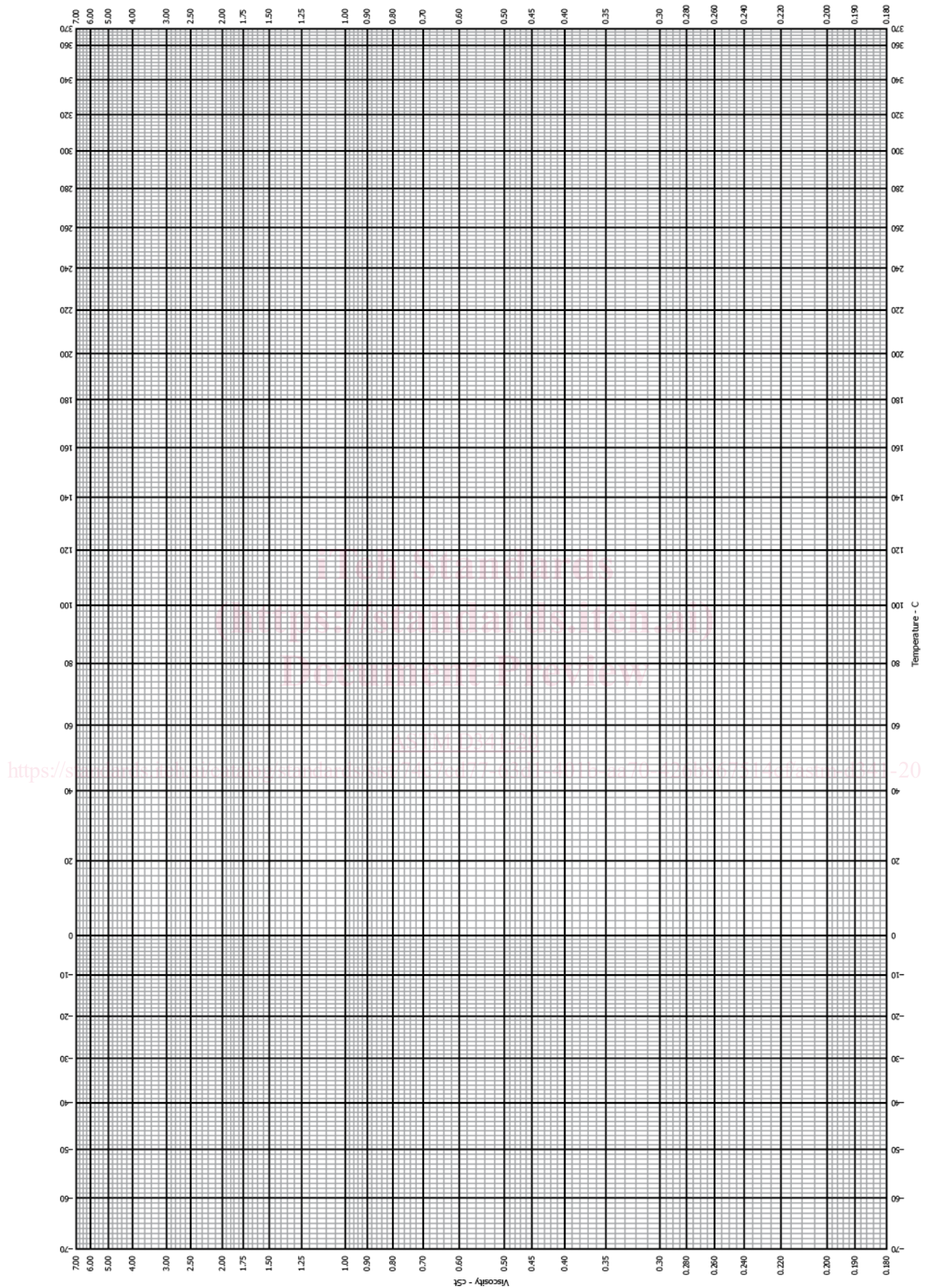


FIG. 3 Facsimile of Kinematic Viscosity-Temperature Chart I Low Range (Temperature in degrees Celsius)