



Standard Test Method for Basic Calibration of Master Viscometers and Viscosity Oil Standards¹

This standard is issued under the fixed designation D 2162; 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 ([€]) 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} NOTE—Equation 8 was corrected editorially in November 2001.

1. Scope

1.1 This test method covers the calibration of master viscometers and viscosity oil standards, both of which may be used to calibrate routine viscometers as described in Test Method D 445 and Specifications D 446 over the temperature range from 15 to 100°C.

1.2 The calibration constants in mm²/s² are to be regarded as the standard. The kinematic viscosities in mm²/s are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific precautionary statements see Section 7.*

2. Referenced Documents

2.1 ASTM Standards:

- D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)²
- D 446 Specifications and Operating Instructions for Glass Capillary Kinematic Viscometers²
- D 1193 Specification for Reagent Water³
- D 1250 Guide for Petroleum Measurement Tables²
- D 1480 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Bingham Pycnometer²
- D 1590 Test Methods for Surface Tension of Water and Waste Water³
- E 1 Specification for ASTM Thermometers⁴

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.07 on Flow Properties.

Current edition approved June 10, 1999. Published August 1999. Originally published as D 2162 – 63 T. Last previous edition D 2162 – 93 (1998).

² Annual Book of ASTM Standards, Vol 05.01.

³ Annual Book of ASTM Standards, Vol 11.01.

⁴ Annual Book of ASTM Standards, Vol 14.03.

2.2 ISO Standard:⁵

ISO 3666 Viscosity of Water

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *basic calibration, n*—calibration based on the primary standard, water.

3.1.1.1 *Discussion*—Pure water has a kinematic viscosity of 1.0034 mm²/s (cSt) at 20°C. See ISO 3666.

3.1.2 *master viscometer, n*—glass capillary viscometer with a liquid driving head of at least 400 mm.

3.1.2.1 *Discussion*—It is specially designed to minimize errors due to surface tension, kinetic energy, and capillary end effects.

3.1.3 *viscosity oil standard, n*—stable Newtonian liquid, the kinematic viscosity of which has been related to the kinematic viscosity of water through the step-up procedure described in this test method.

4. Summary of Test Method

4.1 Two or more master viscometers, having calibration constants in the 0.001 to 0.003-mm²/s² (cSt/s) range, are calibrated with water at 20°C. The kinematic viscosities of two or more oil standards are measured at 40°C in these two master viscometers. Corrections are made for buoyancy and, where necessary, for temperature and surface tension.

4.2 A third master viscometer, with a calibration constant of 0.003 to 0.009 mm²/s² (cSt/s), is then calibrated at 40°C with the two standard oils and its calibration factor calculated at standard conditions for water at 20°C. In like manner additional viscosity oil standards and additional master viscometers are calibrated at 40°C using the average results from at least two master viscometers or two oil standards. Steps between successive calibration constants or viscosities increase by a factor of three or less until the desired viscosity range is covered.

⁵ Available from American National Standards Institute, 11 W. 42nd St., 13th floor, New York, NY 10036.

