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Standard Specifications and Operating Instructions for Glass Capillary Kinematic Viscometers¹

This standard is issued under the fixed designation D446; 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 (ϵ) 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 These specifications cover operating instructions for glass capillary kinematic viscometers of all the types described in detail in [Annex A1](#), [Annex A2](#), and [Annex A3](#) as follows:

Modified Ostwald viscometers, [Annex A1](#)
Suspended-level viscometers, [Annex A2](#)
Reverse-flow viscometers, [Annex A3](#)

1.2 The calibration of the viscometers is described in Section 6.

1.3 This standard covers some widely used viscometers suitable for use in accordance with Test Method [D445](#). Other viscometers of the glass capillary type which are capable of measuring kinematic viscosity within the limits of precision given in Test Method [D445](#) may be used.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards*:²

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

[D2162](#) Practice for Basic Calibration of Master Viscometers and Viscosity Oil Standards

2.2 *ISO Documents*:³

[ISO 3104](#) Petroleum Products—Transparent and Opaque Liquids—Determination of Kinematic Viscosity and Calculation of Dynamic Viscosity

¹ These specifications and operating instructions are 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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² 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.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[ISO 3105](#) Glass Capillary Kinematic Viscometers—Specifications and Operating Instructions

[ISO 5725](#) Basic Methods for the Determination of Repeatability and Reproducibility of a Standard Measurement Method

[ISO 17025](#) General Requirements for the Competence of Testing and Calibration Laboratories

[ISO Guide 25](#) General Requirements for the Calibration and Testing Laboratories

2.3 *NIST Standards*:⁴

[NIST 1297](#) Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results

3. Materials and Manufacture

3.1 Fully annealed, low-expansion borosilicate glass shall be used for the construction of all viscometers. The size number, serial number, and manufacturer's designation shall be permanently marked on each viscometer. All timing marks shall be etched and filled with an opaque color, or otherwise made a permanent part of the viscometer. See detailed description of each type of viscometer in [Annex A1](#), [Annex A2](#), and [Annex A3](#).

3.2 With the exception of the FitzSimons and Atlantic viscometers, all viscometers are designed to fit through a 51-mm hole in the lid of a constant-temperature bath having a liquid depth of at least 280 mm; and it is assumed that the surface of the liquid will be not more than 45 mm from the top of the bath lid. For certain constant-temperature baths, especially at low or high temperatures, it may be necessary to construct the viscometers with the uppermost tubes longer than shown to ensure adequate immersion in the constant-temperature bath. Viscometers so modified can be used to measure kinematic viscosity within the precision of the test method. The lengths of tubes and bulbs on the figures should be held within $\pm 10\%$ or ± 10 mm, whichever is less, such that the calibration constant of the viscometer does not vary by more than $\pm 15\%$ from the nominal value.

⁴ Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, <http://www.nist.gov>.

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