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## Standard Specifications and Operating Instructions for Glass Capillary Kinematic Viscometers<sup>1</sup>

This standard is issued under the fixed designation D 446; 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.*

<sup>€1</sup> NOTE—Footnote 5 was added editorially in March 1999.

### 1. Scope

1.1 This standard gives specifications and 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 D 445. Other viscometers of the glass capillary type which are capable of measuring kinematic viscosity within the limits of precision given in Test Method D 445 may be used.

1.4 The values stated in SI units are to be regarded as the standard.

### 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)<sup>2</sup>

D 2162 Test Method for Basic Calibration of Master Viscometers and Viscosity Oil Standards<sup>2</sup>

#### 2.2 ISO Documents:<sup>3</sup>

ISO 3105 Glass Capillary Kinematic Viscometers—Specifications and Operating Instructions

ISO 3104 Petroleum Products—Transparent and Opaque Liquids—Determination of Kinematic Viscosity and Calculation of Dynamic Viscosity

<sup>1</sup> These specifications and operating instructions are under the jurisdiction of ASTM Committee D-2 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.

<sup>3</sup> Available from the American National Standards Institute, 11 West 42nd St., New York, NY 10036.

ISO Guide 25 General Requirements for the Calibration and Testing Laboratories

### 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  $\pm 10$  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. Nomenclature for Figures

4.1 The figures in the annexes contain letters to designate specific parts of each viscometer. These letters are also used in the text of the standard when reference to the viscometers is given. The more frequently used letters on the figures in the annexes are as follows:

|             |                      |
|-------------|----------------------|
| A           | lower reservoir      |
| B           | suspended level bulb |
| C and J     | timing bulbs         |
| D           | upper reservoir      |
| E, F, and I | timing marks         |