



Standard Test Method for Determination of Dynamic Viscosity and Derived Kinematic Viscosity of Liquids by Oscillating Piston Viscometer¹

This standard is issued under the fixed designation D7483; 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.

1. Scope*

1.1 This test method covers the measurement of dynamic viscosity and derivation of kinematic viscosity of liquids, such as new and in-service lubricating oils, by means of an oscillating piston viscometer.

1.2 This test method is applicable to Newtonian and non-Newtonian liquids; however the precision statement was developed using Newtonian liquids.

1.3 The range of dynamic viscosity covered by this test method is from 0.2 mPa·s to 20 000 mPa·s (which is approximately the kinematic viscosity range of 0.2 mm²/s to 22 000 mm²/s for new oils) in the temperature range between –40 to 190°C; however the precision has been determined only for new and used oils in the range of 34 to 1150 mPa·s at 40°C, 5.7 to 131 mPa·s at 100°C, and 46.5 to 436 mm²/s at 40°C.

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

1.5 *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.*

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](#)

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

Current edition approved June 15, 2013. Published July 2013. Originally approved in 2008. Last previous edition approved in 2013 as D7483 – 13. DOI: 10.1520/D7483-13A.

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.

[D4057 Practice for Manual Sampling of Petroleum and Petroleum Products](#)

[D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products](#)

[D5967 Test Method for Evaluation of Diesel Engine Oils in T-8 Diesel Engine](#)

[D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products and Lubricants](#)

[D6708 Practice for Statistical Assessment and Improvement of Expected Agreement Between Two Test Methods that Purport to Measure the Same Property of a Material](#)

[D6792 Practice for Quality System in Petroleum Products and Lubricants Testing Laboratories](#)

2.2 ISO Standards:³

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

2.3 NIST Standard:⁴

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

3. Terminology

3.1 Definitions:

3.1.1 *dynamic viscosity* (η), n —the ratio between the applied shear stress and rate of shear of a liquid.

3.1.1.1 *Discussion*—It is sometimes called the coefficient of dynamic viscosity or, simply, viscosity. Thus, dynamic viscosity is a measure of the resistance to flow or to deformation of a liquid under external shear forces.

3.1.1.2 *Discussion*—The term dynamic viscosity can also be used in a different context to denote a frequency-dependant quantity in which shear stress and shear rate have a sinusoidal time dependence.

3.1.2 *kinematic viscosity* (ν), n —the ratio of the dynamic viscosity (η) to the density (ρ) of a liquid.

3.1.2.1 *Discussion*—For gravity flow under a given hydrostatic head, the pressure head of a liquid is proportional to its

³ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.ch>.

⁴ Available from <http://physics.nist.gov/ccu/Uncertainty/index.html>.