



Standard Test Method for Measuring Viscosity at High Shear Rate by Tapered Bearing Simulator Viscometer at 100°C¹

This standard is issued under the fixed designation D6616; 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 laboratory determination of the viscosity of engine oils at 100°C and $1 \cdot 10^6 \text{ s}^{-1}$ using the Tapered Bearing Simulator (TBS) viscometer.²

NOTE 1—This test method is similar to Test Method D4683 which uses the same TBS viscometer to measure high shear viscosity at 150°C.

1.2 The Newtonian calibration oils used to establish this test method range from approximately 5 to 12 mPa·s (cP) at 100°C and either the manual or automated protocol was used by each participant in developing the precision statement. The viscosity range of the test method at this temperature is from 1 mPa·s (cP) to above 25 mPa·s (cP), depending on the model of TBS.

1.3 The non-Newtonian reference oil used to establish the shear rate of $1 \cdot 10^6 \text{ s}^{-1}$ for this test method has a viscosity of approximately 10 mPa·s at 100°C.

1.4 Application to petroleum products other than engine oil has not been determined in preparing the viscometric information for this test method.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. This test method uses the milliPascal second (mPa·s) as the unit of viscosity. This unit is equivalent to the centiPoise (cP), which is shown in parentheses.

1.6 *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 to determine the applicability of regulatory limitations prior to use.*

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

Current edition approved Nov. 1, 2012. Published November 2012. Originally approved in 2001. Last previous edition approved in 2007 as D6616–07. DOI: 10.1520/D6616-07R12.

² Available from Tannas Co., 4800 James Savage Rd., Midland, MI 48642. This viscometer and associated equipment as listed in the research report was used to develop the precision statement. To date, no other equipment has demonstrated, through ASTM International interlaboratory testing, the ability to meet the precision of this test. This is not an endorsement or certification by ASTM International.

2. Referenced Documents

2.1 ASTM Standards:³

D4683 Test Method for Measuring Viscosity of New and Used Engine Oils at High Shear Rate and High Temperature by Tapered Bearing Simulator Viscometer at 150 °C

D4741 Test Method for Measuring Viscosity at High Temperature and High Shear Rate by Tapered-Plug Viscometer

3. Terminology

3.1 Definitions:

3.1.1 *density, n* —mass per unit volume. In the SI, the unit of density is the kilogram per cubic metre. For practical use, the submultiple, gram per cubic centimetre, is more convenient. The density in gram per cubic centimetre is equal to 1/1000 the density in kg/m^3 .

3.1.2 *Newtonian oil or fluid, n* —an oil or fluid that at a given temperature exhibits a constant viscosity at all shear rates or shear stresses.

3.1.3 *non-Newtonian oil or fluid, n* —an oil or fluid that exhibits a viscosity that varies with changing shear stress or shear rate.

3.1.4 *shear rate, n* —the velocity gradient in fluid flow. The SI unit for shear rate is s^{-1} .

3.1.5 *shear stress, n* —the motivating force per unit area for fluid flow. The *area* is the area under shear. The SI unit for shear stress is the Pa.

3.1.6 *viscosity, n* —the ratio between the applied shear stress and the rate of shear. It is sometimes called the coefficient of dynamic viscosity. This coefficient is a measure of the resistance to flow of the liquid. In the SI, the unit of viscosity is the Pascal-second; often the milliPascal-second or its equivalent the centiPoise is found more convenient.

3.1.6.1 *apparent viscosity, n* —the viscosity of a non-Newtonian fluid at a given shear rate or shear stress determined by this test method.

³ 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.