Designation: D5133 – 05

# Standard Test Method for Low Temperature, Low Shear Rate, Viscosity/Temperature Dependence of Lubricating Oils Using a Temperature-Scanning Technique[1]

This standard is issued under the fixed designation D5133; 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 the apparent viscosity of engine oil at low temperatures.

1.2 A shear rate of approximately 0.2 $s^{-1}$ is produced at shear stresses below 100 Pa. Apparent viscosity is measured continuously as the sample is cooled at a rate of 1°C/h over the range −5 to −40°C, or to the temperature at which the viscosity exceeds 40 000 mPa·s (cP).

1.3 The measurements resulting from this test method are viscosity, the maximum rate of viscosity increase (Gelation Index), and the temperature at which the Gelation Index occurs.

1.4 Applicability to petroleum products other than engine oils has not been determined in preparing this test method.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D341 Practice for Viscosity-Temperature Charts for Liquid Petroleum Products

D3829 Test Method for Predicting the Borderline Pumping Temperature of Engine Oil

D4684 Test Method for Determination of Yield Stress and Apparent Viscosity of Engine Oils at Low Temperature

## 3. Terminology

3.1 *Definitions:*

3.1.1 *apparent viscosity*, *n*—the viscosity obtained by use of this test method.

3.1.1.1 *Discussion*—See 3.1.6 for definition of viscosity and units.

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

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

3.1.4 *shear rate*, *n*—velocity gradient perpendicular to the direction of flow.

3.1.4.1 *Discussion*—The SI unit for shear rate is the reciprocal second (1/s; also $s^{-1}$).

3.1.5 *shear stress*, *n*—force per unit area in the direction of flow.

3.1.5.1 *Discussion*—The SI unit for shear stress is the Pascal (Pa).

3.1.6 *viscosity*, *n*—that property of a fluid which resists flow.

3.1.6.1 *Discussion*—Viscosity is defined as the ratio of the applied shear stress (force causing flow) and the shear rate (resultant velocity of flow per unit distance from a stationary surface wet by the fluid). Mathematically expressed:

$$\text{viscosity} = \text{shear stress/shear rate or, symbolically, } \eta = \tau/G \quad (1)$$

in which the symbols in the second portion of Eq 1 are defined by the terms in the first portion of the equation. The SI unit for viscosity used herein is milliPascal seconds (mPa·s).

3.2 *Definitions of Terms Specific to This Test Method*:[3]

[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 April 1, 2005. Published April 2005. Originally approved in 1990. Last previous edition approved in 2001 as D5133–01. DOI: 10.1520/D5133-05.

[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] The sole source of supply of the equipment and materials known to the committee at this time is Tannas Co., 4800 James Savage Rd., Midland, MI 48642. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

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

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.