



Standard Test Method for Low-Temperature Viscosity of Lubricants Measured by Brookfield Viscometer¹

This standard is issued under the fixed designation D 2983; 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 Department of Defense.

1. Scope*

1.1 This test method covers the use of the Brookfield viscometer and a low-temperature bath for the determination of the low-shear-rate viscosity of lubricants. The test may operate in the viscosity range of 500 to 1 000 000 mPa·s (cP). The bath-controlled temperature is selected within the range of +5° to –40°C.

1.2 The test method uses the SI unit, milliPascal-second (mPa·s), as the unit of viscosity. (1 cP = 1 mPa·s).

1.3 *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

D 341 Standard Viscosity-Temperature Charts for Liquid Petroleum Products

2.2 *European Procedure:*

CEC L18-A-80³

2.3 *ASTM Adjuncts:*

ADJD6300 D2PP, Version 4.43, Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products⁴

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *apparent viscosity*—the dynamic viscosity determined by this test method. Apparent viscosity may vary with the

spindle speed (shear rate) of the Brookfield viscometer if the lubricant is non-Newtonian at low temperatures. See Appendix X1 for a brief explanation.

3.1.2 *reference viscosity*^{5,6}—the viscosity of a Newtonian standard reference fluid specified at each of several user-specified temperatures. Reference viscosities of typical standard reference fluids are listed in Appendix X2.

4. Summary of Test Method

4.1 A lubricant fluid sample is preheated, allowed to stabilize at room temperature, and then poured into a glass cell with a special spindle. The glass cell is then placed into a pre-cooled cold cabinet set at a predetermined test temperature between +5 to –40°C for 16 h. Then a viscometer is utilized that rotates the specified spindle within the sample at the speed giving a maximum torque reading on the viscometer. The resulting torque reading is used to calculate the viscosity of the oil.

5. Significance and Use

5.1 The low-temperature, low-shear-rate viscosity of gear oils, automatic transmission fluids, torque and tractor fluids, and industrial and automotive hydraulic oils, Annex A4, are of considerable importance to the proper operation of many mechanical devices. Measurement of the viscometric properties of these oils and fluids are often used to specify their acceptability. This test method is used in a number of specifications.

5.2 This test method describes how to measure apparent viscosity directly without the errors associated with either interpolation or extrapolation of experimental data.

NOTE 1—Viscosity values obtained by either interpolation or extrapolation are subject to errors caused by gelation or non-Newtonian response to rotor speed, or both. Only in the case of known Newtonian oils is interpolation acceptable for the purpose of calibrating the rotor and glass cell. If such viscosity versus temperature plots are required, they can be made by the procedure outlined in Annex A1.

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.

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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 CEC, Mandou Plaza-25th Floor, B-1210 Brussels, Belgium.

⁴ Available from ASTM International Headquarters. Order Adjunct No. ADJD6300.

⁵ The sole source of supply of the Standard Newtonian Brookfield viscosity reference fluids known to the committee at this time is Cannon Instrument Co., Post Office Box 16, State College, PA 16801.

⁶ 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,⁴ which you may attend.

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

