Designation: D5293 – 10

Standard Test Method for Apparent Viscosity of Engine Oils and Base Stocks Between –5 and –35°C Using Cold-Cranking Simulator[1]

This standard is issued under the fixed designation D5293; 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 apparent viscosity of engine oils and base stocks by cold cranking simulator (CCS) at temperatures between –5 and –35°C at shear stresses of approximately 50 000 to 100 000 Pa and shear rates of approximately 10^5 to 10^4 s^{-1} for viscosities of approximately 900 to 25 000 mPa·s. The range of an instrument is dependent on the instrument model and software version installed. Apparent Cranking Viscosity results by this method are related to engine-cranking characteristics of engine oils.

1.2 A special procedure is provided for measurement of highly viscoelastic oils in manual instruments. See Appendix X2.

1.3 Procedures are provided for both manual and automated determination of the apparent viscosity of engine oils using the cold-cranking simulator.

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.* Specific warning statements are given in Section 8.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2162 Practice for Basic Calibration of Master Viscometers and Viscosity Oil Standards

D2602 Test Method for Apparent Viscosity of Engine Oils at Low Temperature Using the Cold-Cranking Simulator[3]

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

2.2 *ISO Standard:*

ISO 17025 General Requirements for the Competence of Testing and Calibration Laboratories[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *Newtonian oil or fluid*, *n*—one that exhibits a constant viscosity at all shear rates.

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

3.1.3 *viscosity,* η, *n*—the property of a fluid that determines its internal resistance to flow under stress, expressed by:

$$\eta = \frac{\tau}{\gamma} \tag{1}$$

where:

τ = the stress per unit area, and

γ = the rate of shear.

3.1.3.1 *Discussion*—It is sometimes called the coefficient of dynamic viscosity. This coefficient is thus a measure of the resistance to flow of the liquid. In the SI, the unit of viscosity is the pascal-second; for practical use, a submultiple (millipascal-second) is more convenient and is customarily used. The millipascal second is 1 cP (centipoise).

3.2 *Definitions of Terms Specific to This Standard:*

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

3.2.1.1 *Discussion*—Since many engine oils are non-Newtonian at low temperature, apparent viscosity can vary with shear rate.

3.2.2 *calibration oils*, *n*—oils with known viscosity and viscosity/temperature functionality that are used to define the

[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] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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

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