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Standard Test Method for APPARENT VISCOSITY OF ENGINE OILS AT LOW TEMPERATURE USING THE COLD-CRANKING SIMULATOR¹

This standard is issued under the fixed designation D 2602; 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 method was adopted as an ASTM-IP Standard.

1. Scope

1.1 This test method covers the laboratory determination of apparent viscosity of engine oils at 0°F (-17.8°C) and at high shear rates. The results are related to engine-cranking characteristics of engine oils (Notes 1, 2 and 3).

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems 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.*

NOTE 1—The CRC test oils used to establish this test method cover the range from 600 to 8400 cP (mPa·s) at 0°F (-17.8°C) and 2000 to 20 000 cP (mPa·s) at -20°F (-28.9°C). Precision data for this test method are based only on the data at 0°F.

NOTE 2—The detailed relations between the apparent viscosities determined by this test method and engine-cranking performance as determined by the Coordinating Research Council (CRC) L-49 test are shown in Appendixes I and II of Test Method D 2602. See also CRC Report No. 409 (available from Coordinating Research Council, Inc., 219 Perimeter Center Parkway, Atlanta, GA 30346). It is important to be aware that the CRC L-49 test is much less standardized and precise than this test method. Therefore, apparent viscosity values obtained by this test method may not predict accurately the engine-cranking viscosities in individual engines, even though the correlation with average engine results is satisfactory.

NOTE 3—Since this test method was developed solely for use in relation to engine cranking characteristics of engine oils, the apparent viscosity values obtained should not be used to predict other types of performance. For example, the method is not suitable

to predict flow rates to rocker arm bearings, or other engine locations at low temperatures.

NOTE 4—Originally many specifications using the cold cranking simulator were set at 0°F (-17.8°C). Around 1977 many of these specifications were changed to -18°C. At all places in this test method, the use of -18°C may be substituted for 0°F (-17.8°C). If -18°C is used, the calibration of the sensor and the calibration of the viscometric cell must be carried out at -18°C using standard oils with known viscosities at -18°C. Section 12 on Precision and Bias applies to measurements made at -18°C as well as 0°F (-17.8°C).

2. Terminology

2.1 Definitions:

2.1.2 *viscosity*—the ratio between the applied shear stress and rate of shear. 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. The centipoise is 1 mPa·s and is customarily used.

2.1.3 *Newtonian oil or fluid*—an oil or fluid that exhibits a constant viscosity at all shear rates.

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

2.1.5 *apparent viscosity*—the determined viscosity obtained by use of the method under description. Since many engine oils are non-New-

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