



Designation: D2501 – 91 (Reapproved 2005)

## Standard Test Method for Calculation of Viscosity-Gravity Constant (VGC) of Petroleum Oils<sup>1</sup>

This standard is issued under the fixed designation D2501; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers the calculation of the viscosity-gravity constant (VGC) of petroleum oils<sup>2</sup> having viscosities in excess of 4 cSt. =  $4 \times 10^{-6} \text{ m}^{-2}/\text{s}$  at 40°C (104°F).

1.2 **Annex A1** describes a method for calculating the VGC from Saybolt (SUS) viscosity and relative density.

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

1.4 *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:*<sup>3</sup>

**D287** Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)

**D445** Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

**D1298** Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

**D2140** Practice for Calculating Carbon-Type Composition of Insulating Oils of Petroleum Origin

**D4052** Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.04 on Hydrocarbon Analysis.

Current edition approved Nov. 1, 2005. Published November 2005. Originally approved in 1966. Last previous edition approved in 2000 as D2501 – 91 (2000). DOI: 10.1520/D2501-91R05.

<sup>2</sup> Coats, H. B., and Hill, J. B., *Industrial and Engineering Chemistry*, Vol 20, 1928, p. 641.

<sup>3</sup> 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. Summary of Test Method

3.1 The kinematic viscosity at 40°C (104°F) and the density at 15°C of the oil are determined. If the oil is extremely viscous, or if it is otherwise inconvenient to determine the viscosity at 40°C, the kinematic viscosity at 100°C (212°F) can be used. The viscosity-gravity constant is calculated from the measured physical properties using the appropriate equation.

### 4. Significance and Use

4.1 The viscosity-gravity constant (VGC) is a useful function for the approximate characterization of the viscous fractions of petroleum.<sup>2</sup> It is relatively insensitive to molecular weight and is related to a fluids composition as expressed in terms of certain structural elements. Values of VGC near 0.800 indicate samples of paraffinic character, while values close to 1.00 indicate a preponderance of aromatic structures. Like other indicators of hydrocarbon composition, the VGC should not be indiscriminately applied to residual oils, asphaltic materials, or samples containing appreciable quantities of nonhydrocarbons.

### 5. Measurement of Physical Properties

5.1 Preferably, determine the kinematic viscosity at 40°C as described in Test Method D445. However, if the sample is extremely viscous or if it is otherwise inconvenient to measure the viscosity at 40°C, the viscosity at 100°C may be determined.

5.2 Determine the density at 15°C in accordance with Test Method D1298 or Test Method D4052. Equivalent results can be obtained by determining API Gravity at 60°F (15.56°C) in accordance with Test Method D287, and converting the result to density at 15°C by means of Table 3 of the Petroleum Measurement Tables (American Edition).<sup>4</sup>

NOTE 1—If it is necessary to convert a result obtained using the digital

<sup>4</sup> Published jointly by, and available from, ASTM Headquarters and Energy Institute, 61 New Cavendish St., London W1M 8AP. Companion volumes—the British Edition and the Metric Edition—are also available. These tables supersede all other similar tables previously published by either of these societies and the National Bureau of Standards Circular C-410 and the supplement to Circular C-410.