



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

This standard is issued under the fixed designation D 2501; 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 either acceptable SI units or in other units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

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:

D 287 Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)<sup>3</sup>

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)<sup>3</sup>

D 1298 Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method<sup>3</sup>

D 2140 Test Method for Carbon-Type Composition of Insulating Oils of Petroleum Origin<sup>4</sup>

D 4052 Test Method for Density and Relative Density of Liquids by Digital Density Meter<sup>5</sup>

<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 D 02.04 on Hydrocarbon Analysis.

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

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 10.03.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 05.02.

### 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 D 445. 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 D 1298 or Test Method D 4052. Equivalent results can be obtained by determining API Gravity at 60°F (15.56°C) in accordance with Test Method D 287, and converting the result to density at 15°C by means of Table 3 of the Petroleum Measurement Tables (American Edition).<sup>6</sup>

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

<sup>6</sup> Published jointly by, and available from ASTM Headquarters and the Institute of Petroleum, 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.