Designation: ~~D2502 – 04 (Reapproved 2009)~~ D2502 – 14

Standard Test Method for Estimation of Mean Relative Molecular Mass of Petroleum Oils from Viscosity Measurements[1]

This standard is issued under the fixed designation D2502; 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~~ Scope*

1.1 This test method covers the estimation of the mean relative molecular mass of petroleum oils from kinematic viscosity measurements at ~~100~~100 °F and ~~210°F (37.78~~210 °F (37.78 °C and ~~98.89°C).~~98.89 °C).[2] It is applicable to samples with mean relative molecular masses in the range from 250 to 700 and is intended for use with average petroleum fractions. It should not be applied indiscriminately to oils that represent extremes of composition or possess an exceptionally narrow mean relative molecular mass range.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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:*[3]

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

D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)

2.2 *ASTM Adjuncts:*

Mean Relative Molecular Mass of Petroleum Oils from Viscosity Measurements[4]

3. Summary of Test Method

3.1 The kinematic viscosity of the oil is determined at ~~100 and 210°F (37.78 and 98.89°C).~~100 °F and 210 °F (37.78 °C and 98.89 °C). A function "*H*" of the ~~100°F~~100 °F viscosity is established by reference to a tabulation of *H* function versus ~~100°F~~100 °F viscosity. The *H* value and the ~~210°F~~210 °F viscosity are then used to estimate the mean relative molecular mass from a correlation chart.

4. Significance and Use

4.1 This test method provides a means of calculating the mean relative molecular mass of petroleum oils from another physical measurement.

4.2 Mean relative molecular mass is a fundamental physical constant that can be used in conjunction with other physical properties to characterize hydrocarbon mixtures.

5. Procedure

5.1 Determine the kinematic viscosity of the oil at ~~100~~100 °F and ~~210°F (37.78~~210 °F (37.78 °C and ~~98.89°C)~~98.89 °C) as described in Test Method D445 or Test Method D7042.

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[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum ~~Products~~ Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.04.0K on Correlative Methods.

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[2] Hirschler, A. E., *Journal of the Institute of Petroleum*, JIPEA, Vol 32, 1946, p. 133.

[3] 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.

[4] Available from ASTM International Headquarters. Order Adjunct No. ADJD2502.

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

5.2 Look in Table 1 for ~~100°F (37.78°C)~~100 °F (37.78 °C) viscosity and read the value of *H* that corresponds to the measured viscosity. Linear interpolation between adjacent columns may be required.

5.3 Read the viscosity–mean relative molecular mass chart for *H* and ~~210°F (98.89°C)~~210 °F (98.89 °C) viscosity. A simplified version of this chart is shown in Fig. 1 for illustration purposes only (Note 1). Interpolate where necessary between adjacent lines of ~~210°F~~210 °F viscosity. After locating the point corresponding to the value of *H* (ordinate) and the ~~210°F~~210 °F viscosity (superimposed lines), read the mean relative molecular mass along the abscissa.

Example:
Measured viscosity, cSt:
~~100°F (37.78°C) = 179~~
100 °F (37.78 °C) = 179
~~210°F (98.89°C) = 9.72~~
210 °F (98.89 °C) = 9.72

Look in Table 1 for 179 and read the corresponding value $H = 461$.
Using $H = 461$ and ~~210°F~~210 °F viscosity = 9.72 in conjunction with chart gives mean relative molecular mass = 360 (see Fig. 1).

NOTE 1—A ~~22 by 28-in. (559 by 711-mm) chart~~chart 22 in. by 28 in. (559 mm by 711 mm) is available as an adjunct to this test method was used in cooperative testing of the method. If other charts are used, the precision statements given in the Precision section will not apply.

5.4 Report the mean relative molecular mass to the nearest whole number.

6. Precision and Bias

6.1 The precision of this test method as obtained by statistical examination of interlaboratory test results is as follows:

6.1.1 *Repeatability*—The difference between successive test results obtained by the same operator with the same apparatus under constant operating conditions on identical test material, would in the long run, in the normal and correct operation of the test method, exceed the value 3 only in one case in twenty.

6.1.2 *Reproducibility*—The difference between two single and independent results, obtained by different operators, working in different laboratories on identical test material, would in the long run, in the normal and correct operation of the test method, exceed the value 25 only in one case in twenty.

6.2 *Bias*—Since there is no accepted reference material suitable for determining bias for this test method, no statement of bias can be made.

6.3 The precision for this test method was not obtained in accordance with RR:D02-1007, "Manual on Determining Precision Data for ASTM Methods on Petroleum Products and Lubricants."

7. Keywords

7.1 kinematic viscosity; mean relative molecular mass; petroleum oils