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Standard Test Method for Naphthenes in Saturates Fractions by Refractivity Intercept¹

This standard is issued under the fixed designation D 2159; 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 determination of naphthenes or “equivalent naphthenes” in saturates fractions obtained by Test Methods D 2002 or Test Method D 2003 from naphthas or depentanized gasolines which have end points that do not exceed 221°C (430°F) as determined by Test Method D 86.

1.2 Polycyclic naphthenes, if present, will cause a high value for total naphthenes to be indicated. Although the basic data for this correlation compensate in part for the presence of dicyclic naphthenes, results may be high by as much as 1 volume % for each 1 volume % dicyclic naphthenes present. Thus the naphthene content indicated for stocks with end points greater than 163°C (325°F) should be considered “equivalent naphthenes.”

1.3 The preferred unit of measure is volume percent.

1.4 *This standard does not purport to address all of the safety problems, 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 86 Test Method for Distillation of Petroleum Products²
- D 941 Test Method for Density and Relative Density (Specific Gravity) of Liquids by Lipkin Bicapillary Pycnometer²
- D 1218 Test Method for Refractive Index and Refractive Dispersion of Hydrocarbon Liquids²
- D 2002 Test Methods for Isolation of Representative Saturates Fraction from Low-Olefinic Petroleum Naphthas²
- D 2003 Test Method for Isolation of Representative Saturates Fraction from High-Olefinic Petroleum Naphthas²

3. Summary of Test Method

3.1 The refractive index and density of the saturates fraction are determined. The refractivity intercept, calculated from these data, and the density are used with Fig. 1 to obtain the volume percent naphthenes or volume percent “equivalent naphthenes.”

4. Significance and Use

4.1 This test method provides information on the total volume percent of naphthenes in saturate petroleum fractions. This information is important in characterizing the quality of petroleum fractions as feeds to catalytic reforming processes and as gasoline blending components.

5. Test Methods

5.1 The apparatus and procedures described in the test methods listed in 5.1.1 and 5.1.2 are recommended; other equipment that will give comparative accuracy and precision is permitted.

5.1.1 *Density*—Test Method D 941 Pycnometers should be calibrated at 20°C.

NOTE 1—Methylcyclohexane or 2,2,4-trimethylpentane are recommended and certified samples may be obtained from the National Institute of Standards and Technology. Secondary reference samples of known refractive index and density may be established for future reference, after standardization of the tests has been accomplished with the primary standard.

5.1.2 *Refractive Index*—Test Method D 1218. The refractometer should be calibrated to give data accurate to six units in the fifth decimal of refractive index for the D line of sodium at 20°C (Note 1).

5.1.3 *Standardization of Equipment*—The refractive index and density tests must be standardized to give the correct refractive index and density values for a pure hydrocarbon primary reference standard.

6. Procedure

6.1 Determine the density and the refractive index, for the D line of sodium, at 20°C of the saturates fraction after standardizing these tests. It is preferable to complete the density and refractive index determinations within an 8-h period to reduce the possibility of a change in composition.

7. Calculation

7.1 Calculate the refractivity intercept as follows:

$$\text{Refractivity intercept} = n - (d/2)$$

where:

n = refractive index at 20°C, and

d = density at 20°C.

7.2 Enter Fig. 1³ (Note 2) with the refractivity intercept and density values and read the volume percent naphthenes for the saturates fraction at the point of intersection.

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.04 on Hydrocarbon Analysis.

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² Annual Book of ASTM Standards, Vol 05.01.

³ From the data shown in Table 1, a nomograph has been prepared for reading the percent naphthenes. This nomograph is available at a nominal cost from ASTM Headquarters, 1916 Race St., Philadelphia PA 19103. Request Adjunct No. 12-421590-00.