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Standard Test Method for Temperature Corresponding to Vapor-Liquid Ratio of 20 for Gasoline and Gasoline-Oxygenate Blends (Bomb Method)¹

This standard is issued under the fixed designation D 5189; 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 (see Note 1) covers a procedure to determine the temperature at which the vapor formed from a gasoline or a gasoline-oxygenate blend, saturated with air at 0 to 1°C (32 to 34°F), produces a calculated partial pressure equal to 101.3 kPa (1 atm). This test method is performed with a metal fuel chamber, originally filled with the chilled liquid fuel, connected to a vapor chamber 20.0 times the volume of the liquid chamber. This temperature is considered to be comparable to the temperature at which the vapor-liquid ratio of the fuel (see Note 2) is equal to 20 as determined by Test Method D 2533. This test method is not applicable to samples having a vapor pressure above 180 kPa (26 psi) as determined by Test Method D 323 or by Test Method D 4953.

NOTE 1—This test method is also known as the “Bomb V/L Test Method.”

NOTE 2—Test Method D 2533 is applicable to gasoline-oxygenate blends only when mercury is used as the confining medium. Subcommittee D02.08 is currently evaluating the suitability of D 2533 using glycerol as the confining medium for certain gasoline-oxygenate blends.

1.2 The actual vapor-liquid ratio under these conditions is not exactly 20.0 since no corrections are made for the expansion of the liquid sample with increasing temperature, the decrease in liquid sample volume because of partial vaporization, the dissolved air in the liquid sample, and the effect of the air originally present in the vapor chamber.

1.3 In this test method the partial pressure of the fuel is observed as a gage pressure in the presence of air. In Test Method D 2533 the vapor pressure of the fuel is measured as an absolute pressure. Strict correspondence between the temperature at which the vapor-liquid ratio is 20, as determined by these two test methods, is hence only valid for ideal mixtures. For practical purposes results by these two test methods can be expected to be comparable.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.5 *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.* Specific precautionary statements are given in Section 7, Hazards, and Notes 9, 10, and 14.

2. Referenced Documents

2.1 ASTM Standards:

- D 323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)²
- D 2533 Test Method for Vapor-Liquid Ratio of Spark-Ignition Engine Fuels³
- D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products⁴
- D 4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)⁴

3. Terminology

3.1 Description of Terms Specific to This Standard:

3.1.1 $T_{(V/L=20)}$, n —the equilibrium temperature at which the partial pressure of a fuel, under the test conditions, is equal to 101.3 kPa (1 atm). At these conditions the volume of the vapor is equal to 20 times the volume of the liquid sample charged at 0 to 1°C (32 to 34°F).

3.1.2 *uncorrected vapor pressure*, n —the observed experimental pressure at that particular temperature.

3.1.3 *vapor-liquid (V/L) ratio*, n —the value calculated by Eq. 1 or 2 in Section 11 of this test method.

4. Summary of Test Method

4.1 The liquid chamber of the V/L apparatus, having a volume of approximately 25 mL, is filled with the chilled fuel at 0 to 1°C (32 to 34°F) and connected to the vapor chamber, having a volume 20 times the volume of the liquid chamber. The apparatus is immersed in a constant temperature bath set in the approximate temperature range of interest. A portion of the liquid will vaporize and a positive pressure will be observed. The assembly is shaken periodically until a constant pressure is observed on the pressure readout device attached to the apparatus. After recording this pressure and the corresponding temperature, the apparatus is moved to another constant temperature bath set at a temperature 5 to 15°C (9 to 27°F) higher than the previous bath. The apparatus is shaken periodically until a constant pressure is observed. This pressure and the corresponding temperature are again recorded.

4.2 Using the equation shown in 11.1, the corresponding V/L ratios for these temperatures are calculated. The temperature corresponding to a V/L of 20 is then determined by interpolation. This temperature is also known as $T_{(V/L=20)}$.

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 D02.08 on Volatility.

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² Annual Book of ASTM Standards, Vol 05.01.

³ Annual Book of ASTM Standards, Vol 05.02.

⁴ Annual Book of ASTM Standards, Vol 05.03.