



Standard Test Method for Vapor-Liquid Ratio of Spark-Ignition Engine Fuels¹

This standard is issued under the fixed designation D 2533; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This test method covers a procedure for measuring the volume of vapor formed at atmospheric pressure from a given volume of gasoline. The ratio of these volumes is expressed as the vapor-liquid (V/L) ratio of the gasoline at the temperature of the test.

1.2 Dry glycerol can be used as the containing liquid for nonoxygenated fuels.

1.3 Mercury can be used as the containing liquid with both oxygenated and nonoxygenated fuels. Because oxygenates in fuels may be partially soluble in glycerol, gasoline-oxygenate blends must be tested using mercury as the containing fluid.

NOTE 1—Test Method D 4815 can be used to determine the presence of oxygenates in fuels.²

1.4 The values stated in both inch-pound and SI units are to be regarded separately as the standard. The units given in parentheses are for information only.

1.5 *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. For specific hazard statements, see Section 7 and Note 11.*

2. Referenced Documents

2.1 ASTM Standards:

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products³

D 4815 Test Method for Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C₁ to C₄ Alcohols in Gasoline by Gas Chromatography³

D 5188 Test Method for Vapor-Liquid Ratio Temperature Determination of Fuels (Evacuated Chamber Method)³
E 1 Specification for ASTM Thermometers⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 $T_{(V/L=20)}$, n —the equilibrium temperature at which the partial pressure of a sample under test conditions is equal to 101.3 kPa (14.69 psia) and the vapor-liquid ratio is 20.

3.1.2 *vapor-liquid ratio of a fuel, n*—the ratio, at a specified temperature and pressure, of the volume of vapor in equilibrium with liquid to the volume of liquid sample charged, at 0°C (32°F).

NOTE 2—This ratio differs from the absolute vapor-liquid ratio because corrections are not made for (1) liquid sample expansion with increasing temperature, (2) decrease in liquid sample volume by vaporization, and (3) dissolved air in the liquid sample.

4. Summary of Test Method⁵

4.1 A measured volume of liquid fuel at 32 to 40°F (0 to 4°C) is introduced through a rubber septum into a glycerol or mercury filled buret. The charged buret is placed in a temperature-controlled water bath. The volume of vapor in equilibrium with liquid fuel is measured as the desired temperature or temperatures and the specified pressure, usually 760 mm Hg. The vapor-liquid ratio (V/L) is then calculated.

4.2 If it is desired to know the temperature corresponding to a given V/L, the vapor-liquid ratio is determined at several temperatures and the selected pressure. The results are plotted and the temperature read at the given V/L.

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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In 1967, this method was adopted as standard without revision.

² Test Method D 5188 is applicable to both gasoline and gasoline-oxygenate blends for measuring this property and does not require the use of mercury.

³ *Annual Book of ASTM Standards*, Vol 05.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.03.

⁵ Another procedure for measuring the vapor-liquid ratio of gasoline, which gives equivalent results, and employing the Sunbury Vapor-Liquid Ratio Apparatus, is described in Appendix VII, p. 783, *1964 Annual Book of ASTM Standards*, Part 17.

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

