



Standard Test Method for Density or Relative Density of Pure Liquid Chemicals¹

This standard is issued under the fixed designation D 3505; 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.

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

1. Scope

1.1 This test method describes a simplified procedure for the measurement of density or relative density of pure liquid chemicals for which accurate temperature expansion functions are known. It is restricted to liquids having vapor pressures not exceeding 600 mm Hg (0.8 atm) at the equilibration temperature, and having viscosities not exceeding 15 cSt at 20°C (60°F).

1.2 Means are provided for reporting results in the following units:

Density g/cm³ at 20°C

Density g/ml at 20°C

Relative density 20°C/4°C

Relative density 60°F/60°F (15.56°C/15.56°C)

Commercial density, lb (in air)/U.S. gal at 60°F

Commercial density, lb (in air)/U.K. gal at 60°F.

NOTE 1—This test method is based on the old definition of 1 L = 1.000028 dm³ (1 mL = 1.000028 cm³). In 1964 the General Conference on Weights and Measures withdrew this definition of the litre and declared that the word “litre” was a special name for the cubic decimetre, thus making 1 mL = 1 cm³ exactly.

NOTE 2—An alternative method for determining relative density of pure liquid chemicals is Test Method D 4052.

1.3 The following applies to all specified limits in this test method: for purposes of determining conformance with this test method, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand digit used in expressing the specification limit, in accordance with the rounding-off method of Practice E 29.

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.* Specific hazard statements are given in 7.1.

2. Referenced Documents

2.1 ASTM Standards:

¹ This test method is under the jurisdiction of ASTM Committee D16 on Aromatic Hydrocarbons and Related Chemicals and is the direct responsibility of Subcommittee D16.04 on Instrumental Analysis.

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D 1193 Specification for Reagent Water²

D 1555 Test Method for Calculation of Volume and Weight of Industrial Aromatic Hydrocarbons³

D 3437 Practice for Sampling and Handling Liquid Cyclic Products³

D 4052 Test Method for Density and Relative Density of Liquids by Digital Density Meter⁴

E 1 Specification of ASTM Thermometers⁵

E 12 Terminology Relating to Density and Specific Gravity of Solids, Liquids, and Gases⁶

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁷

2.2 Other Document:

OSHA Regulations, 29 CFR, paragraphs 1910.1000 and 1910.1200⁸

3. Terminology

3.1 Definitions:

3.1.1 *density*—the mass of material per unit volume at a given temperature called the “reference temperature.” Weight corrected to a standard acceleration of gravity and corrected for the buoyant effect of air is used to measure mass. This method specifies the use of a beam balance to determine weight so that no correction for variation in acceleration of gravity is necessary. When a torsion or spring balance is used, such correction must be applied.

3.1.2 *relative density*—the ratio of the density of the material at reference temperature “ t ” to the density of pure water, in consistent units, at reference temperature t_2 . It is common practice to use reference temperature t_1 equal to t_2 .

3.1.2.1 Since the mass of water at 4°C is very close to 1 g/mL or 1 g/cm³, it is common practice to set the reference temperature t_2 for water at 4°C. When this is done and the density of the material is given in grams per millilitre, or grams per cubic centimetre, the value of density is very nearly

² Annual Book of ASTM Standards, Vol 11.01.

³ Annual Book of ASTM Standards, Vol 06.04.

⁴ Annual Book of ASTM Standards, Vol 05.02.

⁵ Annual Book of ASTM Standards, Vol 14.03.

⁶ Discontinued 1996; see 1995 Annual Book of ASTM Standards, Vol 15.05.

⁷ Annual Book of ASTM Standards, Vol 14.02.

⁸ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.