Designation: D 1875 – 03

Standard Test Method for Density of Adhesives in Fluid Form[1]

This standard is issued under the fixed designation D 1875; 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 covers the measurement of density (weight per gallon) of adhesives, and components thereof, when in liquid form.

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

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:*

D 907 Terminology of Adhesives[2]

E 1 Specification for ASTM Thermometers[3]

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[4]

3. Terminology

3.1 *Definitions*—Many terms in this test method are defined in Terminology D 907.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *density*—the mass (weight in vacuum) of a unit volume of the liquid at any given temperature expressed as the weight in pounds avoirdupois, of a U.S. gallon measure of the liquid at 25°C, unless otherwise specified.

4. Significance and Use

4.1 This test method is particularly applicable where the fluid has too high a viscosity or where a component is too volatile for a specific gravity balance determination.

5. Apparatus

5.1 *Weight-Per-Gallon Cup*—A weight-per-gallon cup[5] of plated brass or stainless steel with counterbalance is recommended. The capacity of this cup with cover is exactly 83.2 mL (2.81 fl oz) at 25°C (77°F).

NOTE 1—The use of cups that are factory calibrated eliminates the need for further calibration. These cups are calibrated with distilled water so that their proper net weight is obtained at 25°C. A temperature of 25°C is therefore recommended when using these cups. Volume expansion of both cup and the material to be measured causes erroneous results, if the matter of temperature is not standardized. However, where less accuracy is required, consideration of temperature differentials may be ignored.

5.2 *Thermometer*—ASTM Saybolt Viscosity Thermometer having a range from 19 to 27°C (66 to 80.5°F) and conforming to the requirements for Thermometer 17C as prescribed in Specification E 1.

5.3 *Constant-Temperature Bath*, capable of maintaining a temperature of 25 ± 0.1°C (77 ± 0.5°F).

5.4 *Laboratory Balance*, 200 g (0.44 lb) or greater capacity, accurate to ±0.1 g (0.0002 lb).

NOTE 2—A hanging pan, triple-beam balance, or overhead-beam type of balance with scales graduated to 0.1 g has been found to provide results, the mean of which was consistent with the over all precision and accuracy of this test method.

NOTE 3—Fingerprints and smudges on the cup changes the weight and is to be avoided. Handle only with tongs and with hands protected by clean, dry, absorbent material.

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[1] This test method is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.10 on Working Properties.

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[2] *Annual Book of ASTM Standards*, Vol 15.06.

[3] *Annual Book of ASTM Standards*, Vol 14.03.

[4] *Annual Book of ASTM Standards*, Vol 14.02.

[5] Weight-per-gallon cups may be obtained from the Paul N. Gardner Co., Pompano Beach, FL.

6. Sampling

6.1 Take representative samples of the lot to be evaluated from three or more separate containers, chosen at random. Do not take samples from containers that appear to be nonrepresentative. Place the samples in airtight containers, filled to prevent excessive air space above the adhesive, and stored at room temperature to reduce evaporation or drying to a minimum. Ensure that the adhesive in the container is thoroughly mixed if there is a tendency for the materials to separate.

7. Procedure

7.1 Test three portions of each sample.

7.2 Clean and dry the cup with nonresidual solvents.

7.3 Fill the cup with the adhesive at a temperature below 25°C. Force down the cap for the cup to the extent of its travel, leaving the overflow orifice open. Immediately remove any excess overflow of adhesive from the cup by a suitable volatile solvent. Avoid air bubbles occluded within the cup.

7.4 Bring the cup and contents to the specified temperature, 25°C. Use the constant-temperature bath or room if necessary. This may be expected to cause further slight flow of adhesive from the overflow orifice due to expansion of the adhesive with the rise of temperature.

7.5 Remove the excess overflow by carefully wiping with a suitable solvent on an absorbent material. Dry the outside of the cup, if necessary, by wiping with the absorbent material. Do not remove overflow that occurs subsequent to the first wiping after attainment of the desired temperature. Weigh the filled cup immediately to the nearest 0.1 g using the counterbalance for the cup.

8. Calculation

8.1 If the regular weight-per-gallon cup with capacity of 83.2 mL is used, the weight in grams of the contents, divided by 10, is the weight per gallon in pounds, or calculate the density in pounds per gallon as follows:

$$D = WK$$

where:

D = density, lb/gal,
W = weight of contents, g, (8.3455)/V = constant for cup at calibration temperature (Note 4), or
K = 0.1003065 for cup with 83.2-mL capacity at 25°C (K considered as = 0.1, unless greater accuracy is desired), and
V = volume of cup, mL.

NOTE 4—The numerator of K, 8.3455, is calculated from the volume-weight relationship as follows:

$$(2.5400^3 \times 231.00)/453.59 = 8.3455$$

where:

2.5400 = conversion factor for centimetres to inches
231.00 = conversion for cubic inches to gallons, and
453.59 = conversion factor for grams to pounds.

9. Report

9.1 Report the following information:

9.1.1 Complete identification of the adhesive tested, including type, source, manufacturer's code number, lot or batch number, condition, and date.

9.1.2 Number of containers received and number sampled.

9.1.3 Number of samples tested, and

9.1.4 Average density to the third decimal in pounds per gallon at the specified temperature (for example, D = X.XXX lb/gal at 25°C), and the maximum and minimum values.

10. Precision and Bias

10.1 The number of laboratories, materials, and determinations in this study DOES NOT meet the minimum requirements for determining precision prescribed in Practice E 691:

PRACTICE E 691	STUDY	MINIMUM
Laboratories	1	6
Materials	3	4
Determinations	10	2

10.1.1 Precision statement for test method: wt per vol Precision, characterized by repeatability, Sr, r, and reproducibility, SR, R has been determined for the materials to be:

Materials	Average	Sr	SR	r	R
A	10.83	0.01	0.01	0.03	0.03
B	10.81	0.02	0.02	0.04	0.04
C	10.81	0.01	0.01	0.02	0.02

10.1.2 This precision statement is provisional. Within five years, additional data will be obtained and processed which does meet the requirements of Practice E 691.

11. Keywords

11.1 density; weight-per-gallon