Designation: C1241 – 14

Standard Test Method for Volume Shrinkage of Latex Sealants During Cure[1]

This standard is issued under the fixed designation C1241; 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 a laboratory procedure for determining volume shrinkage, which occurs during cure, of a latex sealant.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided 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.*

NOTE 1—A related ISO standard is ISO 10563. The user should compare to determine how it differs from this test method.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C717 Terminology of Building Seals and Sealants

D1475 Test Method For Density of Liquid Coatings, Inks, and Related Products

2.2 *ISO Standards:*[3]

ISO 10563 Building Construction–Sealants–Determination of Change in Mass and Volume

3. Terminology

3.1 *Definitions*—Refer to Terminology C717 for definitions of the following terms used in this test method: cure, joint, latex sealant, sealant, shrinkage (volume), and tooling.

4. Summary of Test Method

4.1 The sealant is extruded onto polyethylene release film and weighed. After curing for 28 days, its volume shrinkage is calculated using the sealant's density, the percent weight lost during the 28-day cure, and the density of water. The density of the sealant is determined by the weight-per-gallon cup procedure described in Test Method D1475.

5. Significance and Use

5.1 Shrinkage of a sealant, after application in a building joint, is caused by loss of volatile components from the sealant. This loss results in a decrease in volume and, hence, a change in the sealant's shape. This change in shape, in some applications, should be taken into consideration for acceptable joint appearance and geometry.

5.2 The shrinkage value obtained by this test method helps predict the appearance and geometry of the cured sealant in a building joint and is helpful in determining the amount and type of tooling to be done during installation of the sealant.

5.3 Latex sealants cure primarily through water evaporation. They may also contain small amounts of other volatile components. However, in this test method all volatiles are treated as water. This assumption still provides a meaningful shrinkage value since the small quantities of other volatiles and their differences in density from that of water do not significantly affect the usefulness of the result obtained.

6. Apparatus

6.1 *Polyethylene Film*—Three sheets, each about 51 by 51 mm (2 by 2 in.) by 0.127 mm (5 mil) thick.

6.2 *Weight-per-Gallon Cup,* 80 to 90 mL capacity.

6.3 *Constant Temperature Bath or Room,* held at 23 ± 2.0°C (73 ± 3.6°F).

6.4 *Forceps.*

6.5 *Distilled Water.*

7. Procedure

7.1 Standard Conditions are as defined in Terminology C717.

7.2 Condition the sealant to be tested in a closed container at standard conditions for at least 24 h.

7.3 Condition approximately 2 L of distilled water at standard conditions for at least 24 h.

[1] This test method is under the jurisdiction of ASTM Committee C24 on Building Seals and Sealants and is the direct responsibility of Subcommittee C24.20 on General Test Methods.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

7.4 Determine the density (D_s) in grams per millilitre of fresh sealant by Test Method D1475. Record the average density (D_s) of three determinations.

NOTE 2—It is very important that the volume of the weight-per-gallon cup be accurately determined according to the calibration procedure described in Test Method D1475. Use distilled water from 7.3. Determine the distilled water density by measuring its temperature to the nearest 1°C at the time of cup calibration and use of Table 1.

7.5 Weigh each of the polyethylene sheets to the nearest 0.001 g.

7.6 Extrude a set of sealant specimens containing two beads approximately 3 mm (⅛ in.) in diameter and 38 mm (1½ in.) long onto a weighed polyethylene sheet.

7.7 Immediately weigh the sheet with sealant and determine the net weight of fresh sealant to the nearest 0.001 g.

NOTE 3—Handling the sheets with bare hands will leave fingerprints, hence, handling only with forceps is recommended.

7.8 Prepare and weigh two more sets of sealant specimens as in 7.6 and 7.7.

7.9 Cure the sealant specimens, while still attached to the polyethylene, for 28 days at standard conditions. Protect the specimens from picking up dust.

7.10 After the 28-day cure period, weigh each sheet with sealant and determine the net weight of each set of sealant specimens to the nearest 0.001 g.

8. Calculation

8.1 Calculate the percent weight loss (% *Wl*) from each set of specimens as follows:

$$\%\ Wl = \frac{W_f - W_c}{W_f} \times 100 \quad (1)$$

where:

W_f = net weight of fresh sealant, g (7.7), and
W_c = net weight of sealant after 28 days cured (7.10).

8.2 Calculate the average percent weight loss ($\%\ \overline{Wl}$) of the three sets of sealant specimens.

8.3 Calculate the percent volume shrinkage of the sealant as follows:

$$\%\ \text{volume shrinkage} = \frac{\bar{D}_s \times \%\ \overline{Wl}}{0.9976} \quad (2)$$

where:

$\bar{D}_s$ = average density of fresh sealant, g/mL (7.4),
$\%\ \overline{Wl}$ = average percent weight loss (8.2), and
0.9976 = density of water at 23°C, g/mL (Table 1).

TABLE 1 Absolute Density of Water, g/mL

°C	Density
15	0.999127
16	0.998971
17	0.998772
18	0.998623
19	0.998433
20	0.998231
21	0.998020
22	0.997798
23	0.997566
24	0.997324
25	0.997072
26	0.996811
27	0.996540
28	0.996260
29	0.995972
30	0.995684

9. Report

9.1 Report the following information for each sealant tested:
9.1.1 Identification of the sealant, and
9.1.2 Percent volume shrinkage as calculated in 8.3.

10. Precision and Bias[4]

10.1 *Precision*—The precision of this test method is based on the results of five laboratories testing three materials in triplicate.
10.1.1 *Repeatability*—In the future use of this test method, the difference between two test results obtained by the same operator on the same material will be expected to exceed 0.771 % only about 5 % of the time.
10.1.2 *Reproducibility*—In future use of this test method, the difference between two test results obtained by different operators in different laboratories on the same material will be expected to exceed 1.862 % only about 5 % of the time.

10.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for this test method for volume shrinkage, bias has not been determined.

11. Keywords

11.1 latex sealant; sealant; shrinkage (volume); tooling

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:C24-1044.