

Designation: C 1241 – 00 (Reapproved 2005)

# Standard Test Method for Volume Shrinkage of Latex Sealants During Cure<sup>1</sup>

This standard is issued under the fixed designation C 1241; 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  $(\epsilon)$  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: <sup>2</sup>

C 717 Terminology of Building Seals and Sealants

D 1475 Test Method for Density of Paint, Varnish, Lacquer, and Related Products

2.2 ISO Standards:<sup>3</sup>

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

#### 3. Terminology

3.1 *Definitions*—Refer to Terminology C 717 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

 $^{\rm 1}$  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 Sealant Standards.

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 D 1475.

# 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  $\pm$  2.0°C (73  $\pm$  3.6°F).
  - 6.4 Forceps.
  - 6.5 Distilled Water.

#### 7. Procedure

- 7.1 Standard conditions of temperature and relative humidity for the test shall be 23  $\pm$  2°C (73  $\pm$  3.6°F) and 50  $\pm$  5 %, respectively.
- 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.
- 7.4 Determine the density ( $D_s$ ) in grams per millilitre of fresh sealant by Test Method D 1475. Record the average density ( $D_s$ ) of three determinations.

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<sup>&</sup>lt;sup>2</sup> 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.

<sup>&</sup>lt;sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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 D 1475. Use distilled water from 7.3. Determine the distilled water density by measuring its temperature to the nearest  $1^{\circ}$ 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 (1/8 in.) in diameter and 38 mm (11/2 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 (% WI) from each set of specimens as follows:

TABLE 1 Absolute Density of Water, g/mL

°C Density  15 10 0.999127 0.998971 17 0.998772 18 0.998623 19 0.998433 20 0.998231 21 0.998202 0.998231 22 0.997798 23 0.997566 24 0.997566 24 0.99702 25 0.99702 26 0.996811 27 0.996540 28 0.996260 29 0.995972		
16 17 18 0.998772 18 0.998623 19 0.998433 20 0.998231 M C 1 2 4 21 22 0.998020 0.997798 23 0.997566 24 0.997324 25 0.997072 26 0.996811 27 0.996540 0.996260	°C	Density
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18	16	0.998971
19	17	0.998772
20	18	0.998623
21	19	0.998433
/Ca <sub>22</sub> log/standards/astm/U2a 0.997798 /4/5-4la3- 23 0.997566 24 0.997324 25 0.997072 26 0.996811 27 0.996540 28 0.996260	20	0.998231 TM C124
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24     0.997324       25     0.997072       26     0.996811       27     0.996540       28     0.996260	/ca <sub>22</sub> log/standa	rds/astm/UZa 0.997798 / 4 / 3-4 Ia3-
25 0.997072 26 0.996811 27 0.996540 28 0.996260	23	0.997566
26 0.996811 27 0.996540 28 0.996260	24	0.997324
27 0.996540 28 0.996260	25	0.997072
28 0.996260	26	0.996811
	27	0.996540
29 0.995972	28	0.996260
	29	0.995972
30 0.995684	30	0.995684

$$\% Wl = \frac{W_f - W_c}{W_f} \times 100$$
 (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 (%  $\overline{Wt}$ ) of the three sets of sealant specimens.
- 8.3 Calculate the percent volume shrinkage of the sealant as follows:

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

where:

 $\overline{D}_s$  = 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).

# 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

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<sup>&</sup>lt;sup>4</sup> Supporting data have been filed at ASTM Headquarters. Request RR: C24-