Designation: C1736 – 11

# Standard Practice for Non-Destructive Evaluation of Adhesion of Installed Weatherproofing Sealant Joints Using a Rolling Device[1]

This standard is issued under the fixed designation C1736; 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 The non-destructive procedure described in this practice induces a depression (strain) in the sealant, creating an elongation of the sealant and a stress on the adhesive bond at the sealant to joint substrate interface. The primary purpose of the practice is to reveal sealant adhesion anomalies not discernible by visual examination, at the time of the evaluation, which may affect air infiltration resistance, or water infiltration resistance, or both, of the sealed joint.

NOTE 1—The nondestructive procedure may require immediate repair of the sealant bead, if failure is identified. Appropriate materials and equipment should be available for this purpose.

1.2 This practice is useful for the evaluation of adhesion of weatherseals in joints that are backed with compressible materials such as backer rod. This practice is not as useful in joints with solid backing.

1.3 The proper use of this practice requires a working knowledge of the principles of sealants as applied in movement joint applications.

1.4 A sealant fails to perform as a weatherseal when it allows air, or water, or both, to infiltrate the joint. This practice does not evaluate the performance of an installed sealant as a weatherseal. This practice is intended to only evaluate the characteristics of the adhesive bond in a particular installation.

NOTE 2—In addition to identifying adhesion characteristics of the sealant joint, this practice may provide the user with an indication of other characteristics and anomalies including, but not limited to, changes in sealant depth, insufficiently sized or configured backer rods, cohesive failures, entrapped air voids, and solid contaminants. Anomalies of this nature may be interpreted and addressed by the evaluator.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 The committee with jurisdiction for this standard is not aware of any comparable standard published by other organizations.

1.7 *This standard does not purport to address all of the safety problems, 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:*[2]

C717 Terminology of Building Seals and Sealants

C1193 Guide for Use of Joint Sealants

C1472 Guide for Calculating Movement and Other Effects When Establishing Sealant Joint Width

## 3. Terminology

3.1 *Definitions*—Refer to Terminology C717 for definitions of the terms used in this standard.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *target depression, n*—The amount of depression needed to reveal sealant adhesion anomalies, determined either in field or in laboratory, during or prior to a sealant evaluation, when using a device with a rolling component.

## 4. Significance and Use

4.1 Many parameters contribute to the overall performance of a sealant application. Some of the most significant parameters are sealant joint geometry, joint movement, joint design, sealant movement capability, quality of workmanship, quality of adhesive bond, and quality of the sealant material.

4.2 If a sealant fails in adhesion, there is no straightforward procedure for determining the cause. The adhesive failure may be due to workmanship, the specific surface preparation used, the specific sealant used, poor joint design, poor bond chemistry, or other causes. Comprehensive information for the use of joint sealants is provided in Guide C1193.

4.3 This technique may not produce useful results when the sealant is in compression. Comprehensive information regarding the impact of temperature on sealant joint dimensions may be found in Guide C1472.

[1] This practice is under the jurisdiction of ASTM Committee C24 on Building Seals and Sealants and is the direct responsibility of Subcommittee C24.30 on Adhesion.

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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.

## 5. Testing Equipment

5.1 *Non-Permanent Marking Equipment*—The following may be used to perform location marking for repairs of failed sealant adhesion:

5.1.1 *Substrate Marking*—Removable non-residue tape, non-permanent self adhesive labels, or other adjacent substrate marking devices that will not permanently stain, permanently adhere to, or damage the substrate.

5.1.2 *Sealant Marking*—Staples or push pins to affix survey ribbon, or any other device or method that can be applied to the sealant to re-locate the area that has failed in adhesion for repair purposes, which will not pose a hazard to technicians or pedestrians.

5.2 *Evaluation Device*—Device with a rolling component that has a non-sharp convex edge profile, and a minimum width of 1.5 mm. Rolling component width may impact repeatability of the evaluation, and should be reported per 8.1.11.

## 6. Summary of Practice

6.1 This practice induces a depression (strain) in the cured sealant, creating an elongation of the sealant and a stress on the adhesive bond at the sealant to joint substrate interface. Pressure is applied to the surface of the sealant near the center of the joint by the evaluation device. The sealant is depressed by the evaluation device, and an elongation of the sealant occurs; the amount of elongation should be based on joint design, or joint width, or both, and should produce the elongation within the limits of the joint design. The evaluation device uses a rolling component to continuously press into the sealant along a length of sealant joint (Fig. 1).

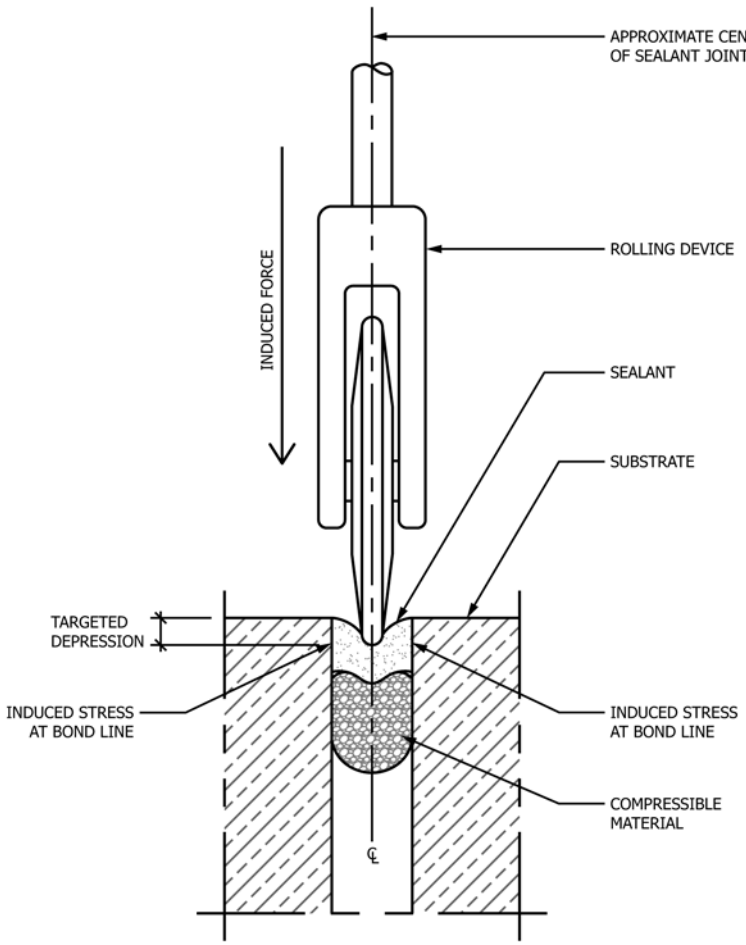
## 7. Procedures

7.1 The procedure makes use of rolling devices able to impart force against the surface of the cured sealant, creating a depression. Sealant should be cured for at least the minimum time recommended by the manufacturer. The procedures include depression inducement that is manually or guide wheel-maintained, and force control that is automatically maintained by the device used.

7.2 The required force producing a strain in the sealant and a stress on the bond line is determined per procedure below.

NOTE 3—If an applied force depresses the sealant more than its movement capability, the sealant may be damaged adhesively or cohesively. Therefore, care is needed to avoid over-straining the sealant.

7.3 *Depression Inducement Procedure*—This procedure makes use of a hand-held device such as a window screen




NOTE 1—As shown, this practice uses a device with a rolling component to apply force and induce a depression in the sealant, stressing the adhesion of the sealant on the bond line.

**FIG. 1 Evaluation Device with Rolling Component**

insertion roller, a backer rod insertion device, or any other such device that includes a rolling component with a convex edge profile. The rolling component shall have no sharp edges, and be at least 3 mm narrower than the joint sealant to be evaluated. The rolling device must pass along the approximate centerline of the sealant, attempting to control the depression by manually varying the force on the roller. By imposing a consistent depression in the sealant, adhesion loss as well as other characteristics and anomalies described in 1.4 can be identified.

7.4 *Force Control Procedure*—This procedure makes use of a hand-held pneumatic device that includes a rolling component with a convex edge profile. The rolling component shall have no sharp edges, and be at least 3 mm narrower than the joint to be evaluated. The rolling device must pass along the approximate centerline of the sealant. By imposing a consistent force to the sealant, adhesion loss as well as other characteristics and anomalies described in 1.4 can be identified.

7.4.1 *Repeatability*—The device must be able to provide empirical repeatable data wherein sealant deflections resulting from the consistent force delivered by the device to the sealant does not deviate outside of a range of ±1 mm regardless of the sealant configuration, as measured with a dial indicator on the opposite side of the bead.

7.4.2 *Pressure Maintenance*—The device must be able to maintain continuous consistent force, returning to equilibrium from rapid thrusts of the device in or out of the joint in 0.5 s or less.

7.4.3 *Force Adjustment*—The force in the device and on the rolling component must be adjustable in order to produce a controlled strain in the sealant and stress on the bond line sufficient to reveal adhesion anomalies, but less than an amount that could harm the weatherseal.

7.4.3.1 *Calibration of Force*—The amount of force applied to the sealant to create an effective bond line stress will vary, depending on a given sealant's designed properties in combination with a specific sealant configuration. It is important, when calibrating the device in-laboratory or in-field, to establish a sealant force target(s) for a given evaluation that produces an appropriate bond line stress.

7.5 These procedures can be used for continuous evaluation of 100 % of the sealant or for any areas where conditions inconsistent with the practices of Guide C1193 are suspected.

## 8. Reporting Guide

8.1 A comprehensive report will include the following items:

8.1.1 Physical address and age of the building, general description of building, and number of floors in the building.

8.1.2 Evaluating agency, name(s) of technicians, specifying authority, and relevant observers present during evaluation.

8.1.3 General description of the evaluation.

8.1.4 Date, time, temperature, and general weather conditions during evaluation. This information should be logged daily, and may be keyed to specific grid locations on the building when the information has particular relevance; for example, when joint size changes are significant due to thermal movement (see 4.3).

8.1.5 Area(s) evaluated according to grid locations on the building, and total length of sealant evaluated by this practice compared to total amount of sealant installed ("X" % of total sealant installation).

8.1.6 Target depression used during evaluation when using 7.3 (depression inducement), or calibration criteria and force used during evaluation when using 7.4 (force control).

8.1.7 Details of evaluated area(s): Substrate type(s), type of sealant, general condition of sealant, age of sealant (dates of sealant installation) if information is available, width range of the sealed joint(s), and movement capability of sealant as defined by the manufacturer.

8.1.8 Supporting photos, or sketches, or both, that graphically illustrate the evaluation.

8.1.9 Sealant adhesive failures should be reported; additional irregularities that could compromise the long- term performance of the sealant, listed in Note 2, may also be reported.

8.1.10 Sealant adhesion failure reported as a fraction of total sealant installation tested provides statistical relevance to the evaluation. Sealant adhesion failure rate ($R$) is calculated by dividing the total length of adhesively failed sealant ($F$) by the total length of sealant tested ($T$), or $F \div T = R$.

8.1.10.1 *Example*—100 cm of adhesively failed sealant divided by 10 000 cm of total sealant tested = 0.01 (Rate of adhesive sealant failure). [(100 cm) ÷ (10 000 cm) = (0.01)]

8.1.11 Type of evaluation device used, width of rolling component used, and procedure chosen, that is, depression inducement () or force control ().

8.2 If a comprehensive report is not required, the evaluator may use those parts of the reporting guide that are most applicable to the needs of the project.

## 9. Repair

9.1 Contact the sealant manufacturer (if known) for specific recommendations for the repair of the sealant found to be deficient or damaged during the evaluation.

## 10. Keywords

10.1 continuous sealant evaluation; cured; joint; nondestructive evaluation; rolling device; sealant failure in adhesion