Designation: C 1135 – 00 (Reapproved 2005)

Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants[1]

This standard is issued under the fixed designation C 1135; 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 quantitatively measuring the tensile adhesion properties of structural sealants, hereinafter referred to as the "sealant".

1.2 The values stated in SI (metric) units are to be regarded as the standard. The inch-pound 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—Two ISO standards are known that develop similar information to C 1135; ISO 8339 and ISO 8340.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 717 Terminology of Building Seals and Sealants

2.2 *ISO Standards:*[3]

ISO 8339 Determination of Tensile Properties

ISO 8340 Determination of Tensile Properties at Maintained Extension

3. Terminology

3.1 *Definitions*—Refer to Terminology C 717 for definitions of the following terms used in this test method: cohesive failure, primer, sealant, spacer, structural sealant, and substrate.

4. Significance and Use

4.1 Frequently, glass or other glazing or panel materials are structurally adhered with a sealant to a metal framing system. The sealants used for these applications are designed to provide a structural link between the glazing or panel and the framing system.

4.2 Although this test method is conducted at one prescribed environmental condition, other environmental conditions and duration cycles can be employed.

5. Apparatus and Materials

5.1 *Tensile Testing Machine*, capable of producing a tensile load on the specimen at the rate of 50.8 ± 5.1 mm (2.0 ± 0.20 in.) per minute.

5.1.1 *Fixed Member*—A fixed or essentially stationary member carrying one grip.

5.1.2 *Movable Member*—A movable member carrying a second grip.

5.1.3 *Grips*—The grips should be suitable to firmly grasp the test fixture that holds the test specimen and should be designed to eliminate eccentric specimen loading. Specimen loading should be perpendicular to the substrate/sealant interfaces. For alignment purposes, each grip shall have a swivel or universal joint at the end nearest to the specimen.

5.1.4 *Grip Fixture*—A fixture capable of being held by the grips and furnishing a tensile force to the sealant specimen.

5.2 *Spatulas*, for use in applying sealant.

5.3 *Caulking Gun*, for extruding sealant from cartridges when applicable.

5.4 *Substrate Panels*—Two substrates of the same finish are required for each test specimen.

NOTE 2—This test method is based on identical substrates of 6.3 × 25.4 × 76.2 mm (0.25 × 1.0 × 3.0 in.) clear float glass. Other substrates may be tested; however, consideration needs to be given to maintaining adequate rigidity of the substrates during testing.

5.5 *Spacer*—One piece spacer made from polytetrafluoroethylene (PTFE) or a suitable rigid material shall be used to which the test sealant will not bond.

5.6 *Substrate Cleaning Materials*.

5.7 *Primer* (if needed).

6. Test Specimen

6.1 *Assembly*:

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

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

6.1.1 Prior to assembly, wipe the substrates with a clean, dry, lint-free cloth, then thoroughly clean with a solution appropriate for the substrate material. Prior to evaporation of the cleaning solution, wipe the substrates dry with a clean, lint-free cloth.

NOTE 3—The precision and bias statement is based on glass substrates with a recommended cleaning solution of a 50 to 50 ratio isopropanol and water.

6.1.2 Apply recommended primer, if required. Then, construct the test specimen assemblies by forming a sealant cavity 12.7 by 12.7 by 50.8 mm (0.50 by 0.50 by 2.0 in.) between two substrate panels (see Fig. 1) with the aid of appropriate spacers.

6.2 *Preparation of Test Assemblies*:

6.2.1 Prepare a set of five test specimen assemblies for each sealant and substrate combination being tested (see Fig. 1).

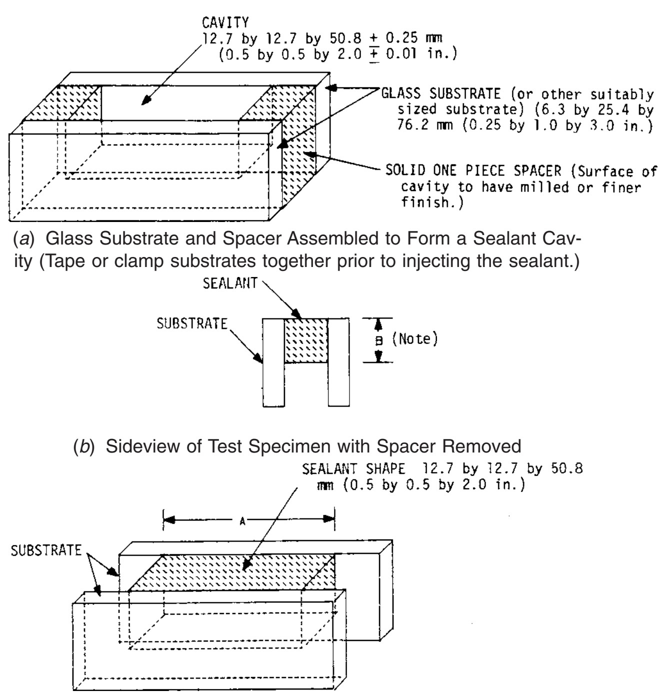
NOTE 4—Five test specimen assemblies should be prepared for each additional environmental condition being evaluated.

6.2.2 Fill each set of five assemblies with the sealant being tested. Immediately tool the sealant surface to ensure complete filling and wetting of the substrate surfaces. Take special care to strike off the sealant flush with the substrate.

6.3 *Labeling*—Each of the five specimens of each set should be individually identified.

7. Conditioning

7.1 Cure the specimens for 21 days at 23°C (3.6°F) and 50 ± 6 % relative humidity (standard conditions). Any deviations from the curing conditions must be listed in the report.



(*a*) Glass Substrate and Spacer Assembled to Form a Sealant Cavity (Tape or clamp substrates together prior to injecting the sealant.)

(*b*) Sideview of Test Specimen with Spacer Removed

(*c*) End view of Test Specimen with Spacer Removed

NOTE 1—Dimension B in Fig. 1(*c*) is known as the sealant edge bite or sealant contact depth.

FIG. 1 Sealant Test Specimen

7.2 Remove all spacer sections from the specimens. If desired, spacers may be removed prior to the end of the 21 day cure. If removed early, note this in the report.

8. Procedure

8.1 *Testing*:

8.1.1 Pull all specimens on the tensile test machine at standard conditions at a rate of 50.8 mm (2.0 in.) per minute. If an analog chart recording device is being used, the chart speed should be a minimum of 127 mm (5.0 in.) per minute (508 mm (20.0 in.) per minute is preferred) to allow for a more accurate reading of force at specific elongations.

8.1.2 Measure and record to the nearest 0.8 mm (0.03125 in.) the actual minimum length (Dimension A) and minimum width (Dimension B), in millimetres (inches) as shown in Fig. 1.

8.1.3 Record the tensile load, *C*, (see Note 5), newtons (lbs) at 10, 25, 50, and 100 %, and at maximum elongation (see Note 6). Measure and record percent cohesive failure.

NOTE 5—If the substrate breaks, disregard the value at which it breaks. Other values obtained prior to breakage are acceptable.

NOTE 6—Calculate the maximum elongation from the recording chart value at the point of maximum load.

8.2 *Observations*—Observe the specimens and record any obvious air bubbles trapped in the sealant during the preparation of test specimens.

9. Calculation

9.1 Calculate actual sealant minimum contact area, *D*, in square millimetres (square inches) as follows:

$$D = A \times B \quad (1)$$

where:

A = sealant length, Dimension A (see Fig. 1) and
B = sealant bite, Dimension B (see Fig. 1).

9.2 Calculate tensile stress as follows:

$$T = \frac{C}{D} \quad (2)$$

where:

T = tensile strength, MPa (psi), and
C = tensile load, N (lb).

NOTE 7—$\frac{C}{D} = \frac{N}{mm^2}$ = MPa, and $\frac{C}{D} = \frac{lb}{in.^3}$ = psi.

10. Report

10.1 *Report Form*—The test results and observations are to be reported on the form shown in Fig. 2.

10.2 Report the following information:

10.2.1 Any primer used and any deviations from the test method such as, if the spacers were removed prior to the 21-day cure period, if the curing conditions deviated from those listed, and any other deviation from the test method,

10.2.2 The actual sealant minimum contact area, in square millimetres (square inches) as calculated in 9.1,

10.2.3 Tensile stress in megapascals (pounds per square inch) at 10, 25, 50, and 100 % and at maximum elongation, as calculated in 9.2. (Use actual contact area from 10.2.2.),

10.2.4 The percent elongation at maximum tensile load,

Test Report for Test Method C 1135
for Tensile Adhesion Properties of Structural Sealants

Submitted by ____________________ Page _____ of _____
Test Date _____/_____/_____

Sealant ____________________ Substrate ____________________

Test Speed __________ Chart Speed __________ Test Temperature/% RH __________ Cleaning Solution __________

Cure Cycle and Conditions ____________________

Aging Cycle and Conditions ____________________

	Specimen	Comments	Tensile Load (*C*)/Stress (*C*/*D*) (N (lbs)/MPa (psi))[A] at the following elongations: 10%	25%	50%	100%	Ultimate Tensile Load/ Stress N (lbs) /MPa(psi)[A]	Ultimate Elongation, %	Cohesive Failure, %	Length, *A* mm (in.)	Edge Bite, *B* mm (in.)	Actual Area, *D* mm^2 ($in.^2$)
1												
2												
3												
4												
5												
	Average											

Comments and Observations ____________________

[A] psi × 0.006894 = MPa.

FIG. 2 Report Form

FIG. 2 Report Form

10.2.5 The mode of failure in percent cohesive failure, and

10.2.6 Any observation from 8.2.

11. Precision and Bias [4]

11.1 *Precision*—The precision for this test method is summarized in Table 1.

11.2 *Bias*—Bias depends on strict conformance to this test method when both preparing and measuring test specimens. There was no bias reported in the test results when both acid and neutral curing structural silicone sealants were evaluated after both room temperature conditioning and after conditioning seven days immersed in water prior to testing at room temperature.

[4] Supporting data are available from ASTM Headquarters. Request RR:C24-1028.

TABLE 1 Summary of Precision Data

NOTE 1— The intervals in Column 1 were determined based on the testing of five replicates of two materials at two conditions (representing a total of four materials) tested by either (1) four or (2) three laboratories.

	$I(r)^A$ Repeatability	$I(R)^B$ Reproducibility
Stress, psi		
At 10 % elongation (1)	6	13
At 25 % elongation (1)	6	12
At 50 % elongation (1)	7	11
At 100 % elongation (1)	11	13
Ultimate stress/tensile (2), psi	38	51
Ultimate elongation (2), %	76	126
Mode of failure (2):		
Cohesive failure, %	42	55

[A] In future use of this test method, the difference between two test results obtained in the same laboratory on the same material will be expected to exceed the intervals *I* (*r*) above only 5 % of the time.

[B] In future use of this test method, the difference between two test results obtained in different laboratories on the same material, will be expected to exceed the intervals *I* (*R*) above only 5 % of the time.