Designation: ~~C719 – 93 (Reapproved 2010)~~ C719 – 13

Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)[1,2]

This standard is issued under the fixed designation C719; 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 is an accelerated laboratory procedure for evaluating the performance of a building sealant in a test configuration that is subjected to water immersion, cyclic movement, and temperature change.[3]

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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*:[4]

C33 Specification for Concrete Aggregates

C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

C150 Specification for Portland Cement

C717 Terminology of Building Seals and Sealants

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology C717.

4. Summary of Test Method

4.1 This test method consists of subjecting standard joint specimens to a series of treatments as follows: (*a*) immersion in water for seven days; (*b*) exposure in an oven for seven days while under compression; (*c*) automatic compression and extension cycling at room temperature at a specified rate and amount of joint movement; and (*d*) alternate compression and extension of the joint at high and low temperatures, respectively, under specified conditions described herein.

4.2 The effects of the test shall be evaluated by visual inspection for cohesive and adhesive failures, sealant deformation, and bubble formation within the sealant.

4.3 This test method is applicable to any joint movement. The most common test movements are ±12.5 and ±25 % as used in the examples.

5. Significance and Use

5.1 The failure of a building sealant in an active joint is usually manifested by cohesive failure in the sealant or adhesive failure between the sealant and the substrate, or both. The method described in this test method relates only to the performance of the

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[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.

Current edition approved ~~June 15, 2010~~June 15, 2013. Published ~~August 2010~~July 2013. Originally approved in 1972. Last previous edition approved in ~~2005~~2010 as C719 – 93~~(2005).~~(2010). DOI: ~~10.1520/C0719-93R10.~~10.1520/C0719-13.

[2] This test method is also known as the Hockman Cycle in recognition of Arthur Hockman who originated the method at the National Bureau of Standards.

[3] Supporting data are available from ASTM International Headquarters. Request RR:C24-1013.

[4] 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.

sealant when properly installed with recommended primers, and does not evaluate sealant failures caused by improper joint design, excessive joint movement, improper application practices, and other factors known to cause sealant failure in buildings and building areas.

6. Apparatus

6.1 *Compression-Extension Machine,*[5] designed to automatically compress the joint width of the test specimen from ~~½~~0.500 in. (12.7 mm) to the minimum dimension desired (Table 1, Column C) and extend the specimen from ~~½~~0.500 in. to the maximum extension desired (Table 1, Column E) at a constant rate of ⅛ in./h (3.2 mm/h). The machine shall be equipped with grips of sufficient strength to withstand, without bending, the resistance of high tensile strength sealants (see Figs. 1-3).

6.2 *Cold Box or Chamber,* maintained ~~at −15~~at −15 ± 3°F (−26.1 ± 1.7°C).

6.3 *Forced-Draft Oven,* controlled at 158 ± 3.6°F (70 ± 2°C).

6.4 *C-clamps,* or other device for maintaining the specimen under compression.

6.5 *Spacer Blocks.*

6.6 *Room or Chamber,* maintained at standard conditions of 73.4 ± 3.6°F (23 ± 2°C), 50 ± 5 % relative humidity.

7. Test Specimens

7.1 The standard substrate used in the test shall be portland cement mortar, float glass, and aluminum alloy.

NOTE 1—When requested, only one or two of the standard materials may be tested with the sample. Likewise other substrates such as brick, marble, wood, etc., may be specified by the purchaser in place of or in addition to the standard substrate for test with the sealant sample.

7.1.1 *Mortar Block*— Prepare cement mortar blocks, each 3 by 1 by 1 in. (75 by 25 by 25 mm) in size, using one part of high early strength portland cement conforming to Type III of Specification C150 to two parts by weight of clean uniformly graded, concrete fine aggregate (sand) conforming to Specification C33. Use sufficient water to produce a flow of ~~100 ± 5%~~ 100 ± 5 % when tested in accordance with the procedure for the determination of consistency of cement mortar described in Test Method C109/C109M. After curing one day in moist air and six days in saturated lime water at 73 ± 3°F (23 ± 2°C), prepare the surface of one face, 1 by 3 in. (25 by 75 mm), of each block by wet grinding either with a belt sander using No. 60 aluminum carbide sanding belt or using an iron lap with No. 60 silicon carbide (or aluminum oxide) grain until the aggregate is uniformly exposed. Return blocks to saturated lime water storage until needed.

7.1.1.1 Blocks may be prepared and shipped to other locations for use. The blocks may be shipped dry and shall be returned to lime water storage on arrival until needed.

7.1.1.2 Prior to use, wet grind the previously ground face to remove any laitance, rinse thoroughly under running tap water and dry the blocks overnight at 220 to 230°F (105 to 110°C). Clean the blocks of film or powder by vigorous brushing with a stiff-bristled fiber brush. Condition the blocks at standard conditions for not less than one day and not more than seven days.

[5] Series 520 Sealing Compound Tester, manufactured by Applied Test Systems Inc., 348 New Castle Rd., Butler, PA 16001, and a durability tester manufactured by Ambard, Inc., 269-11 81st Ave., New Hyde Park, NY 11040, have been found suitable for this purpose (Fig. 1(*a*)). For extension of the joint at cold temperature, the machine may be designed for extension only (Fig. 3).

The sole source of supply of the apparatus known to the committee at this time is Applied Test Systems Inc. and Ambard Inc. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee [1], which you may attend.

TABLE 1 Examples of Dimensions in Compression and Extension

Class	Dimension	
	C—Width of Joint in Compression, in. (mm)	E—Width of Joint in Extension, in. (mm)
~~12.5~~	~~7/16 (11.1)~~	~~9/16 (14.3)~~
~~25~~	~~⅜ (9.5)~~	~~⅝ (15.9)~~

TABLE 1 Examples of Dimensions in Compression and Extension

Class	Dimension	
	C—Width of Joint in Compression, in. (mm)	E—Width of Joint in Extension, in. (mm)
12.5	0.438 (11.1)	0.563 (14.3)
25	0.375 (9.5)	0.625 (15.9)
35	0.325 (8.3)	0.675 (17.1)
50	0.250 (6.4)	0.750 (19.1)
50/100	0.250 (6.4)	1.000 (25.4)

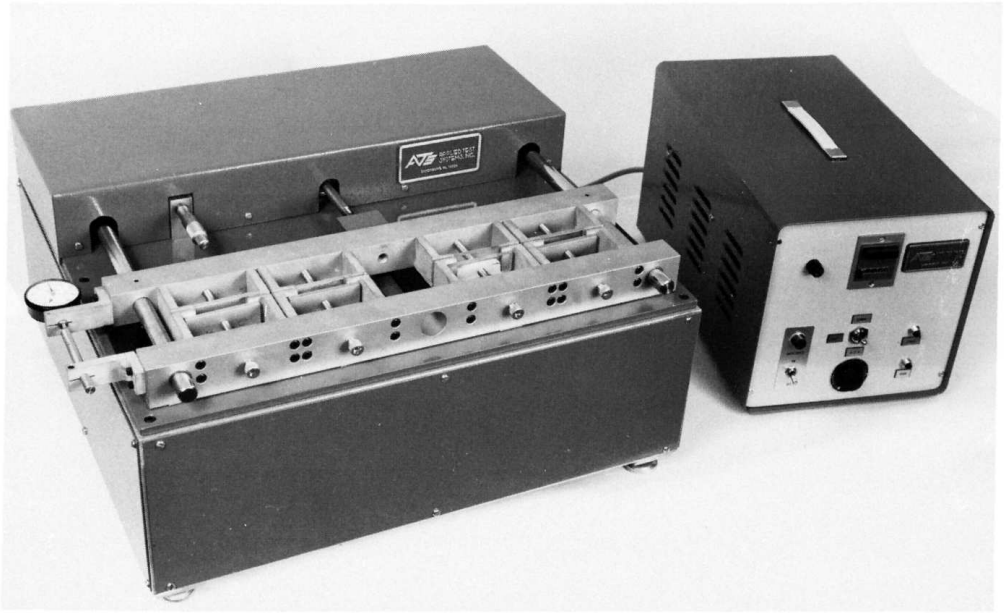

FIG. 1 Compression-Extension Machine

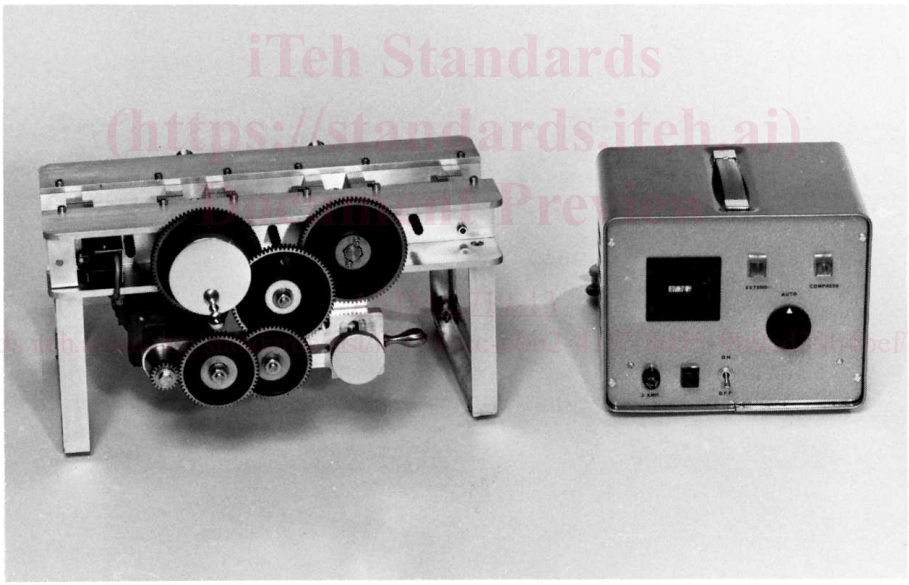

FIG. 2 Compression-Extension Machine with Control Unit

7.1.2 *Float Glass*— Glass plates shall be 3 by 1 by ¼ in. (76.2 by 25.4 by 6.4 mm) clear float glass. Prior to use, the glass shall be cleaned by wiping the surface with methyl ethyl ketone or similar solvent. Then dip the surface in a detergent solution. This should be a 0.04 % solution of an alcohol ethoxy sulfate.[6] An alternative would be a 0.1 % solution of a clear hand dishwashing detergent.[7] These solutions should be made up in distilled or deionized water. Rinse the surface (without touching it) in distilled or deionized water and allow it to air dry. The float glass requires reinforcement to survive the rigors of the subsequent testing procedures. This must be done prior to the compression-extension cycling performed in 9.4. Reinforcement is provided by adhering 3 by 1 by ¼ in. (76.2 by 25.4 by 6.4 mm) aluminum plates to the two outside surfaces of the formed test specimen. Any adhesive may be used. Commercially available two part epoxies have been found suitable. Although the time of reinforcement is not critical, application of the aluminum plates to the glass before preparing the test specimens has been found convenient.

[6] Neodol 25-35, a registered trademark of Shell Oil Co., One Shell Plaza, Houston, TX 77002, has been found suitable for this purpose.

[7] Dawn, a registered trademark of Proctor & Gamble Co., P.O. Box 599, Cincinnati, OH 54201, or Palmolive Green, a registered trademark of Colgate Palmolive Co., 300-T Park Ave., New York, NY 10022 have been found suitable for this purpose.