Designation: C 1519 – 04

Standard Practice for Evaluating Durability of Building Construction Sealants by Laboratory Accelerated Weathering Procedures[1]

This standard is issued under the fixed designation C 1519; 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 practice covers the method for the determination of the durability of a sealant based on its ability to function in cyclic movement maintaining adhesion and cohesion after repeated exposure to laboratory accelerated weathering procedures.

1.2 This practice describes two laboratory accelerated weathering procedures for evaluating the durability of a sealant.

1.3 The RILEM TC139–DBS Durability Test Method is related to this practice.

1.4 *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:* [2]

C 717 Terminology of Building Seals and Sealants

C 719 Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

C 1442 Practice for Conducting Tests on Sealants Using Artificial Weathering Apparatus

G 113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials

G 141 Guide for Addressing Variability in Exposure Testing on Nonmetallic Materials

G 151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices That Use Laboratory Light Sources

G 154 Practice for Operating Fluorescent Light Apparatus For UV Exposure to Nonmetallic Materials

G 155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials

2.2 *RILEM Standard*

RILEM TC139–DBS Durability Test Method Determination of changes in adhesion, cohesion, and appearance of elastic weatherproofing sealants for high movement facade joints after exposure to artificial weathering[3]

3. Terminology

3.1 The definitions given in Terminology C 717 on terms relating to building seals and sealants and in Terminology G 113 on terms relating to natural and artificial weathering tests are applicable to this practice.

4. Significance and Use

4.1 This practice describes the procedure to evaluate and/or compare the durability of sealants when subjected to accelerated weathering and cyclic movement in a joint.

4.2 Sealant installation procedures, design considerations and movement during cure affect the aging processes and are fundamental to the success of any sealant. These factors are not addressed with this test procedure.

4.3 The amount, type and frequency of movement a sealant experiences during its lifetime strongly depends on the materials used in construction and on the orientation of the joint toward sunlight and many other factors that are not uniform or consistent.

4.4 Climatic exposures will differ with the orientation of the building and shading as well as with local and regional climatic conditions. Climates in a given location can vary from year to year because of differences in solar radiation, temperature, rainfall, and atmospheric conditions. Further, the quality and intensity of solar radiation on the earth's surface varies with geographic location, season, time of day, and cloud cover.

4.5 Variations in results may be expected when operating conditions are varied within the accepted limits of this practice. Therefore, all test results using this practice must be accompanied by a report of the specific operating conditions as required in Section 11. Refer to Practice G 151 for detailed information on the caveats applicable to use of results obtained according to this practice.

[1] This practice is under the jurisdiction of ASTM Committee C24 on Building Seals and Sealants and is the direct responsibility of Subcommittee C24.40 on Weathering.

Current edition approved May 1, 2004. Published July 2004. Originally approved in 2002. Last previous edition approved in 2002 as C 1519 - 02a.

[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] Published in *Materials and Structures* (2001), pp. 34, 579–588.

4.6 The results of laboratory exposure cannot be directly extrapolated to estimate an absolute rate of deterioration caused by natural weathering because the acceleration factor is material dependent and can be significantly different for each material and for different formulations of the same material. However, exposure of a similar material of known outdoor performance, a control, along with the test specimens allows comparison of the durability relative to that of the control under the test conditions. Evaluation in terms of relative durability also greatly improves the agreement in test results among different laboratories.

4.7 Results of this procedure will depend on the care that is taken to operate the equipment according to Practices G 154 and G 155. Significant factors include regulation of the line voltage, freedom from salt or other deposits from water, temperature control, humidity control, where applicable, condition and age of the burners and filters in xenon arc equipment, and age of lamps in fluorescent UV equipment.

NOTE 1—Additional information on sources of variability and on strategies for addressing variability in the design, execution and data analysis of laboratory accelerated exposure tests is found in Guide G 141.

5. Summary

5.1 For this procedure, specimens are prepared in which the sealant to be tested adheres to two parallel contact surfaces. This procedure uses the same type of specimens, in the same dimensions, and the same preparation and cure as described in Test Method C 719. While any substrates can be specified and used, this procedure was developed with anodized aluminum substrates. Following cure, the specimens are placed in an artificial weathering chamber for 4 weeks. On removal from the weathering chamber, they are placed in a cyclic movement machine and subjected to 6 cyclic movements of extension and compression at room temperature according to the method of C 719. Any degree of extension and compression can be used. After the movement cycles the sealant is blocked open at the recommended extension and examined for flaws. The cycle of weathering followed by movement testing and examination is repeated as often as specified. After each cycle, the number of cycles is recorded as well as the mode of failure, that is, cohesive or adhesive, amount of failure, the depth of any cracks or breaks and other pertinent observations, such as sealant deformation and bubble formation.

6. Apparatus

6.1 *Aluminum Supports*, for the preparation of test specimens (two supports for each specimen). Anodized aluminum is the standard substrate, but this method can be used with other substrates as well. Substrates should be compatible with the sealant, should not degrade under weathering, and should fit into the joint movement apparatus. If primer is recommended by the sealant manufacturer, it should be used in accordance with the manufacturer's recommendations.

6.2 *Spacers*, for the preparation of the specimens should be of a non-adherent material and of a shape to produce a sealant joint as depicted in Test Method C 719.

NOTE 2—If the spacers are made of a material to which the sealant adheres, their surfaces should be made non-adherent, for example, by a thin wax coating.

6.3 *Non-Adherent Substance*, for the preparation of test specimens, for example, polytetrafluoroethylene (PTFE) film or vellum paper, preferably on the advice of the sealant manufacturer.

6.4 *Ventilated Convection-Type Oven*, capable of being maintained at 50 ± 2°C.

6.5 *Artificial Weathering Device*—Choice of type of apparatus and duration of exposure shall be by mutual agreement among the interested parties. Because of differences in test conditions, test results may differ with the type of apparatus used. Consult Practices G 154 and G 155 for differences in the spectral power distributions of the exposure sources and Practice C 1442 for the differences in test parameters in the two types of apparatus specified.

6.5.1 *Fluorescent UV/Condensation Apparatus*—Operate the device in accordance with Practice C 1442, Section 7.3.

6.5.2 *Xenon Arc Light Apparatus*—Operate the device in accordance with Practice C 1442, Section 7.2.

NOTE 3—The xenon arc ruggedness test was run at 70 % RH using an exposure cycle of 2 h light followed by 2 h light plus water spray for more thorough wetting. The test results compared well with those of outdoor exposures. Therefore, these conditions are considered an alternate to the default parameters.

7. Preparation of Test Specimens

7.1 Adhere the sealant to be tested to two parallel contact surfaces as described in Test Method C 719. The user is to specify the number of specimens.

7.2 Unless specified otherwise, use anodized aluminum substrates.

7.3 For each specimen, assemble two supports and two spacers as shown in Test Method C 719 and set up on the non-adherent substrate.

7.4 Follow the instructions of the sealant manufacturer, for instance, whether a primer is to be used.

7.5 Fill the hollow space formed by supports and spacers shall be with sealant previously conditioned for 24 h at 23 ± 2°C. The following precautions shall be taken:

(a) avoid the formation of air bubbles;

(b) discard the first 5 g of sealant out of the tube, cartridge or dispenser;

(c) press the sealant towards the contact surface of the supports; and

(d) trim the sealant surfaces so that they are flush with the face of the supports and spacers.

7.6 Backing materials and other joint formation aids should be removed as soon as possible, consistent with no deformation of the sealant, to assist in the curing process.

8. Conditioning

8.1 The specimens shall be conditioned or cured following the procedures of Test Method C 719, Section 8.

9. Test Procedure

9.1 After completion of the above curing process, place the test specimens in an artificial weathering device so that the sealant surface (top of the joint) faces the exposure source. The

face of the samples are positioned at the specified distance from the exposure source.

9.1.1 If the specimens do not completely fill the racks, fill the empty spaces with blank metal panels to maintain the test conditions within the chamber.

9.1.2 Specimens should be confined to an exposure area where the irradiance is at least 90 % of that measured at the center of the exposure area. Unless it is shown that irradiance uniformity meets the requirements of Practice G 151, section 5.1.3 for no repositioning, use one of the procedures described in section 5.1.4 to insure that all specimens receive radiant exposures that are as similar as possible. Irradiance uniformity can be determined in accordance with Practice G 151, Section A1.

9.1.3 Operate the artificial weathering device according to the specifications in 6.5 for 4 weeks.

NOTE 4—If the irradiance level of the xenon arc apparatus is set at 0.35 rather than 0.51 W/m^2.nm) at 340 nm, operate it for 5.8 weeks instead of 4 weeks. (See Annex A1.2.1 in C 1442 for determination of exposure time at other irradiance levels.

9.2 At the end of the 4 weeks in the artificial weathering machine, test the sealant to 6 movement cycles as described in Test Method C 719, section 9.4 and 9.5 (room temperature movement), at the prescribed movement amplitude.

9.2.1 Extend the specimen to the prescribed maximum extension and block open with appropriate spacers. Examine the sealants for any flaws. Flaws include any cracks, breaks, adhesive or cohesive loss. Measure and record the depth of any crack or flaw and any pertinent observations. Remove the blocks and allow the samples to recover to the dimensions of the sealant at initial cure.

9.3 Other measurements such as hardness, tensile strength, elongation and modulus can also be made, if specified.

9.4 The artificial weathering exposure, the movement test, the examination and measurements of any flaws represent one cycle of this durability procedure.

9.5 The cycle is to be repeated as often as is specified. Observations and measurements are to be made and recorded at the end of each cycle.

10. Periods of Exposure and Evaluation of Results

10.1 In most cases, periodic evaluation of materials is necessary to determine when significant changes occur.

10.2 The time of radiant exposure necessary to produce a defined change in a material property can be used to evaluate or rank the stability of materials. This method is more reliable than evaluating materials after an arbitrary exposure time or radiant exposure.

10.2.1 Exposure to an arbitrary time or radiant exposure may be used for the purpose of a specific test if agreed upon by the parties concerned or if required for conformance to a particular specification. When a single exposure period is used, select a time or radiant exposure that will produce the largest performance differences between the test materials.

10.2.2 In the development of a specification, the minimum exposure time shall be that necessary to produce a substantial change in the property of interest for the least stable material being evaluated. An exposure time that produces a significant change in one type of material cannot be assumed to be applicable to other types of materials.

11. Report

11.1 The report shall make reference to this practice and shall include the following information:

11.1.1 The name and type of sealant;

11.1.2 The batch of sealant from which the specimens were produced, if possible;

11.1.3 The type of support material if different than the standard of anodized aluminum;

11.1.4 The primer used, if applicable;

11.1.5 Weathering information to conform to the Report section of Practice G 151 plus the following:

11.1.5.1 Type, manufacturer and model of artificial weathering apparatus used,

11.1.5.2 Irradiance level and actual time (number of hours) in weathering apparatus.

11.1.6 The amplitude of extension/compression used for the movement cycles;

11.1.7 Whether or not flaws occurred, and, if the affirmative, the cycle at which they occurred, types of flaws (adhesion or cohesion or other types), and depth of any flaws; and

11.1.8 Any deviations from the specified procedures and conditions.

12. Keywords

12.1 artificial aging; artificial weathering; building sealants; durability; joint movement; sealants; weathering