Designation: C 1442 – 03

Standard Practice for Conducting Tests on Sealants Using Artificial Weathering Apparatus[1]

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1. Scope

1.1 This practice covers three types of laboratory weathering exposure procedures for evaluating the effect of actinic radiation, heat, and moisture on sealants.

1.2 The exposure sources used in the three types of artificial weathering devices are the filtered xenon arc, fluorescent ultraviolet lamps, and open flame carbon arc based on Practices G 155, G 154, and G 152, respectively.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.4 The ISO standard related to this Practice is ISO 11431. Significant differences exist between the procedures. The ISO specimens are exposed through glass and are elongated prior to examination for loss of adhesion or cohesion, or both, following exposure.

1.5 *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

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

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

G 152 Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

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

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

2.2 *ISO Standard:*

ISO 11431 Building Construction—Sealants: Determination of Adhesion/Cohesion Properties After Exposure to Heat and Artificial Light Through Glass and to Moisture[3]

3. Terminology

3.1 *Definitions*—Definitions of the following terms are found in Terminology C 717: *compound, cure, sealant, substrate.* Definitions of the following terms are found in Terminology G 113: *actinic radiation, control material, file specimen, fluorescent ultraviolet lamps, irradiance, radiant exposure, sample, solar radiation-ultraviolet, solar radiation-visible, spectral power distribution, xenon arc*.

4. Summary of Practice

4.1 The test sealant may be applied to a variety of types of substrates or tested as a free film. The configuration depends on the properties to be evaluated following exposure. At least four replicates of each sealant being tested are required. After curing, one replicate of each sealant being tested is retained as an unexposed file specimen and three replicates are exposed to actinic radiation, heat, and moisture. At the end of the exposure period, the test sealant is examined for property change in comparison with the unexposed file specimen and the performance is compared with that of an exposed control material, if used.

4.2 It is recommended that a similar material of known performance under use conditions (a control) be exposed simultaneously with the test specimen for evaluation of the performance of the test materials relative to that of the control under the same laboratory exposure conditions. It is preferable to use two control materials, one with relatively poor durability and the other with good durability.

5. Significance and Use

5.1 This practice determines the effects of actinic radiation, elevated temperature, and moisture on sealants and their constituents under controlled laboratory artificial weather test conditions.

[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.

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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.

5.2 When conducting exposures in devices which use laboratory light sources, it is important to consider how well the artificial test conditions will reproduce property changes and failure modes caused by end-use environments on the sealant being tested. Refer to Practice G 151 for full cautionary guidance regarding laboratory weathering.

5.3 Because of differences in the spectral power distributions of the exposure sources (xenon arc, fluorescent UV lamps, and open flame carbon arc), as well as other conditions used in the three types of laboratory weathering tests, these three procedures may not result in the same performance ranking or types of failure modes of sealants and different exposure durations may be required for detection of failure in the materials tested. Comparisons should not be made of the relative stability of sealants exposed in different types of apparatus.

6. Test Specimen

6.1 The size and configuration of the specimens are determined by the specifications of the test method used to evaluate the effect of exposure on the specimens. Where practical, it is recommended that specimens be sized to fit the sample holders supplied with the apparatus.

6.2 Some common specimen configurations may include slab, tensile bar, H-block aymar samples, patties, sheets, drawdowns, preformed joint sealants, prevulcanized elastomeric joint materials, beads, channels, and so forth.

6.3 Specimens configured for movement during exposure to artificial weathering conditions also may be used.

7. Apparatus

7.1 *Test Chamber*—Choice of apparatus and exposure conditions selected shall be by mutual agreement among the interested parties. The procedures shall be as described in 7.2, 7.3, and 7.4, which are based on test procedures in ASTM and ISO standards and on parameters used in round robin tests on sealants.

7.1.1 Committee G03 is developing information to be published in Appendices of Practices G 151, G 152, G 154, and G 155 for guidance on uniformity of conditions in the test chambers and the allowed operational fluctuations of the set points.

7.2 *Procedure for Exposure in Xenon Arc Light Apparatus*—Unless otherwise specified, use the following operating conditions and see Practices G 151 and G 155 for requirements that are not given below:

7.2.1 The xenon arc shall be used with daylight type filters to simulate direct exposure to solar radiation and conform with the spectral power distribution in Practice G 155.

7.2.2 The irradiance shall be set at a level not less than 0.35 nor greater than 0,51 W/(m^2 · nm) at 340 nm. For equivalent broadband irradiance levels at 300–400 nm and 300–800 nm, consult the manufacturer of the apparatus.

7.2.2.1 The irradiance level of 0.51 W/(m^2 · nm) at 340 nm is preferred for reasons given in Appendix X1.1. However, to accommodate users who are required to operate the machine at 0.35 W/(m^2 · nm) at 340 nm for other tests carried out simultaneously, the lower irradiance level is an option. The test duration is specified in terms of radiant exposure and the time is adjusted according to the formula in Annex A1.2 to obtain the same radiant exposure at different irradiance levels. See Appendix X2 for discussion on effect of variation in irradiance level.

7.2.3 The default exposure cycle shall be 102 minutes light only followed by a wet period of 18 minutes light with wetting either by water spray on the front surface or immersion in water. The water spray temperature is typically 21 ± 5°C, but may be lower if ambient water temperature is low and a holding tank is not used to store purified water. For immersion water temperature specifications, consult the manufacturer of the test apparatus.

7.2.4 The exposure cycle of 2 h light only followed by 2 h light plus wetting either by water spray on the front surface or immersion in water can be used by agreement between concerned parties.

NOTE 1—The cycle specified in 7.2.4, which provides more through wetting than the cycle in 7.2.3, was evaluated in ruggedness tests on sealants.

7.2.5 The uninsulated black panel temperature (BPT) shall be set at 70°C during the dry period of exposure to the radiation. For the equivalent insulated black panel temperature (black standard temperature, BST), consult the manufacturer of the apparatus.

7.2.6 In equipment that provides for adjustment of the chamber air temperature, the latter shall be set at 48°C.

7.2.7 In xenon arc apparatus that allows for control of relative humidity, it shall be set at 50 % during the dry period of exposure to light.

7.3 *Procedure for Exposure in Fluorescent UV Apparatus*—Unless otherwise specified, use the following operating conditions and see Practices G 151 and G 154 for requirements that are not given below:

7.3.1 Use fluorescent UVA-340 lamps that comply with the spectral power distribution specifications in Practice G 154.

7.3.2 In apparatus with irradiance control, irradiance shall be set at 0.77 W/(m^2 · nm) at 340 nm.

NOTE 2—The irradiance setting is an attempt to provide irradiance similar to that measured in the fluorescent UV apparatus without irradiance control, when operated at a temperature of 60°C. There can be differences in test results when using different irradiance levels. Refer to Appendix X2 for information regarding the effect of irradiance.

7.3.3 For specimens that are less than 20 mm thick, including support dimensions, the exposure cycle shall be 8 h UV at an uninsulated black panel temperature set at 60°C followed by 4 h wetting by condensation at an uninsulated black panel temperature set at 50°C.

7.3.4 For specimens that are more than 20 mm thick, including support dimensions, the exposure cycle shall be 5 h UV only at an uninsulated black panel temperature set at 60°C followed by 1 h UV plus wetting by water spray on the front surface. The water temperature shall be less than 40°C.

NOTE 3—Wetting by condensation is not applicable to specimens having a thickness greater than 20 mm because of inadequate heat transfer.

7.4 *Procedure for Exposure in Open Flame Carbon Arc Apparatus*—Unless otherwise specified, use the following