Designation: D6383/D6383M – 99 (Reapproved 2021)

Standard Practice for Time-to-Failure (Creep-Rupture) of Adhesive Joints Fabricated from EPDM Roof Membrane Material[1]

This standard is issued under the fixed designation D6383/D6383M; 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 sample preparation temperatures, test parameters, and specimen exposure conditions that are applicable when Test Method D5405/D5405M is used for conducting time-to-failure (creep-rupture) tests of adhesive joints fabricated from ethylene-propylene-diene terpolymer (EPDM) roof membrane material.

1.2 This practice is applicable to joints fabricated in the laboratory from EPDM roof membrane materials and adhesives received from suppliers, and to joints prepared from EPDM seams sampled from field installations.

1.3 The joints are bonded using preformed tape or liquid-based adhesives, and EPDM roof membrane materials that are non-reinforced, fabric- or scrim-reinforced, and fabric backed. Primers are also used as recommended for the specific adhesive.

1.4 This practice contains notes that are explanatory and are not part of the mandatory requirements of this practice.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D907 Terminology of Adhesives

D1079 Terminology Relating to Roofing and Waterproofing

D5405/D5405M Test Method for Conducting Time-to-Failure (Creep-Rupture) Tests of Joints Fabricated from Nonbituminous Organic Roof Membrane Material

2.2 *SPRI Document:*[3]

SPRI Recommended Laboratory Test Methods for Liquid and Tape Adhesives Used to Splice Single-Ply Membranes

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminologies D907 and D1079.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *creep-rupture test*—a test that measures the time-to-failure of a specimen subjected to a constant load; progressive specimen deformation may also be measured.

3.2.2 *failure*—rupture of the bond resulting in complete separation of its adherents under the test conditions; or, alternatively, rupture of the membrane material away from the bonded section of the test specimen (that is, material rupture).

3.2.3 *time-to-failure*—the period of time beginning when a joint specimen is placed under load and ending when failure occurs.

4. Summary of Practice

4.1 Adhesive joints are prepared in the laboratory at ambient and low temperatures using tape or liquid adhesives and EPDM roof membrane material. Creep-rupture tests are then conducted in accordance with Test Method D5405/D5405M before and after subjecting these joints to artificial exposure in the laboratory. The loads are applied in either peel or shear configurations at ambient and elevated temperatures. Table 1 summarizes the preparation temperatures, test parameters, and

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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 Single Ply Roofing Institute (SPRI), 77 Rumford Ave., Suite 3B, Waltham, MA 02453.

TABLE 1 Summary of the Sample Preparation Temperature, Test Parameters, and Exposure Conditions Incorporated in the Practice

Sample Set Number	Sample Preparation Temperature		Test Parameters					
			Temperature		Loading	Load		Artificial Exposure Before Testing Conditions
	°C	°F	°C	°F	Peel	N	lbf	
1	23	73	23	73	Peel	9.8	2.2	None
2	23	73	70	158	Peel	9.8	2.2	None
3	–4	25	23	73	Peel	9.8	2.2	None
4	23	73	23	73	Peel	9.8	2.2	Heat: 90 °C [194 °F] for 90 days
5	23	73	23	73	Peel	9.8	2.2	Dry heat, wet heat, and freeze-thaw cycling according to SPRI procedure (see 9.1.2)
6	23	73	23	73	Shear	29.4	6.6	None
7	23	73	70	158	Shear	29.4	6.6	None

exposure conditions incorporated in this practice. Alternatively, adhesive joints are prepared from EPDM seams sampled from roofs in service, and then subjected directly to creep-rupture testing.

5. Significance and Use

5.1 An important factor affecting the performance of seams of EPDM membranes is their ability to remain bonded over the membrane's expected service life. Time-to-failure tests provide a means of characterizing the behavior of joints under constant load over time.

NOTE 1—Table 1 is based on the results of an industry government consortium study on creep-rupture resistance (time-to-failure) of EPDM adhesive joints.[4,5] Referral to Footnotes 4 and 5 provides typical time-to-failure data, developed under the conditions in Table 1, for EPDM joints fabricated in the laboratory with non-reinforced EPDM roof membrane material, butyl-based tapes, and liquid adhesives. It is noted that the peel load specified in this practice is 9.8 N [2.2 lbf]. The peel load under which the tests described in Footnotes 4 and 5 were conducted was 9.3 N [2.1 lbf]. A load of 9.8 N [2.2 lbf] corresponds to 1 kgf [2.2 lbf], and dead weights of 1-kg [2.2-lbm] mass are available through laboratory equipment supply houses. Similarly, a load of 29.4 N [6.6 lbf] corresponds to a dead weight of 3-kg [6.6-lbm] mass.

5.2 Time-to-failure tests complement other mechanical tests such as strength for characterizing joints of EPDM roof membranes, and can be incorporated in specifications for adhesives for joining EPDM roof membrane material.

5.3 This practice, which is specific to EPDM joints, complements Test Method D5405/D5405M that provides general requirements for the preparation and creep-rupture testing of joints fabricated from any nonbituminous organic roof membrane material.

5.4 Laboratory experience in conducting time-to-failure tests of joints EPDM roof membranes has shown that specimens are less creep-resistant under peel loading than under shear loading. Consequently, the majority of the tests stipulated in this practice are performed under peel loading.

5.5 This practice does not develop time-to-failure data on all environmental conditions to which EPDM adhesive seams can be subjected in service.

6. Test Specimen

6.1 *Laboratory Specimens*—Prepare peel specimens and shear specimens as described in Section 8 of Test Method D5405/D5405M. Table 1 lists the seven sample sets for which specimens are prepared.

6.1.1 *Peel Specimen Dimensions*—The dimensions of the peel specimens shall be 125 by 25 mm [5 by 1 in.] ± 2 %. The bond length shall be 75 mm [3 in.] ± 2 %. The bond is located at one end of the specimen.

6.1.2 *Shear Specimen Dimensions*—The dimensions of the shear specimens shall be 150 by 25 mm [6 by 1 in.] ± 2 %. The bond length shall be 25 mm [1 in.] ± 2 %. The bond is located at the center of the specimen.

6.1.3 *EPDM Surface Preparation*—Prior to bond formation, prepare the surface of the sheet material in accordance with the EPDM supplier's instructions. Where primers are incorporated in the bonding procedure, apply primers in accordance with the EPDM supplier's instructions.

6.1.4 *Temperature*—Prepare sample sets at 23 ± 2 °C [73 ± 4 °F] and at –4 ± 2 °C [25 ± 4 °F]; report the preparation temperature. Use a temperature-controlled chamber or similar means, if necessary, to achieve the specified temperature regulation. Samples prepared at –4 °C [25 °F] shall be kept at that temperature until the individual specimens are readied for testing (for example, placement in the test chamber, and other steps conducted before testing). The temperature at which specimens are readied shall be 23 ± 2 °C [73 ± 4 °F]. The time between readying for testing and conducting the time-to-failure tests shall not exceed 24 h.

6.1.5 *Humidity*—Prepare specimens at ambient humidity; report the relative humidity during preparation. Condensation shall not be visible when preparing the specimens at the colder temperature.

[4] Rossiter, W. J., Jr., Vangel, M. G., Embree, E., Kraft, K. M., and Seiler, J. F., Jr., "Performance of Tape-Bonded Seams of EPDM Membranes: Comparison of the Peel Creep-Rupture Response of Tape-Bonded and Liquid-Adhesive-Bonded Seams," *Building Science Series 175*, National Institute of Standards and Technology, May 1996.

[5] Rossiter, W. J., Jr., Vangel, M. G., and Kraft, K. M., "Performance of Tape-Bonded Seams of EPDM Membranes: Comparison of the Creep-Rupture Performance of Tape-Bonded and Liquid-Adhesive-Bonded Samples as Affected by Test Temperature, Exposure Prior to Testing, Cold Temperature Preparation, and Shear Loading," *Building Science Series 177*, National Institute of Standards and Technology, July 1998.