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Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment¹

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1. Scope

1.1 This specification is limited to vapor permeable flexible sheet materials which are intended to be mechanically attached and are generally installed behind the cladding system in exterior walls.

1.2 This specification is limited to the evaluation of materials and does not address installed performance. Although the fastening practices (type of fastener, fastening schedule, etc.) may affect the installed function of these materials, they are not included in this specification.

1.3 This specification does not address integration of the water-resistive barrier with other wall elements. The topic is addressed in more detail in Practice **E2112** and Guide **E2266**.

1.4 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 non-conformance with the standard.

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

- ~~D226~~**D226/D226M** Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
- D779** Test Method for Determining the Water Vapor Resistance of Sheet Materials in Contact with Liquid Water by the Dry Indicator Method
- D828** Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus
- D882** Test Method for Tensile Properties of Thin Plastic Sheeting
- ~~D4869~~**D4869/D4869M** Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing
- D5034** Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
- E96/E96M** Test Methods for Water Vapor Transmission of Materials
- E631** Terminology of Building Constructions
- E1677** Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls
- E2112** Practice for Installation of Exterior Windows, Doors and Skylights
- E2128** Guide for Evaluating Water Leakage of Building Walls
- E2136** Guide for Specifying and Evaluating Performance of Single Family Attached and Detached Dwellings—Durability
- E2266** Guide for Design and Construction of Low-Rise Frame Building Wall Systems to Resist Water Intrusion
- G154** Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

¹ This specification is under the jurisdiction of ASTM Committee **E06** on Performance of Buildings and is the direct responsibility of Subcommittee **E06.55** on Exterior Building Wall Systems/Performance of Building Enclosures.

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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.

2.2 *Other Standards:*

AATCC Test Method 127 Water Resistance: Hydrostatic Pressure Test³

CGSB CAN2-51.32.M77 Sheathing Membrane, Breather Type⁴

Federal Specification UU-B-790a Federal Specification Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)⁵

iTeh Standards
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[ASTM E2556/E2556M-10\(2016\)](#)

<https://standards.iteh.ai/catalog/standards/sist/6a5cc8eb-96c0-4e61-8332-436e9888f7e6/astm-e2556-e2556m-102016>

³ Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709-27709-2215, <http://www.aatcc.org>.

⁴ Available from Canadian General Standards Board (CGSB), 11 Laurier St., Phase III, Place du Portage, Gatineau, Quebec K1A 4G6, 0S5, Canada, <http://www.tpsgc-pwgsc.gc.ca/cgsb>, <http://www.tpsgc-pwgsc.gc.ca/ongc-cgsb>.

⁵ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>, 19111-5094, <http://quicksearch.dla.mil>.

TAPPI T-410 Test Method for Grammage of Paper and Paperboard (Weight Per Unit Area)⁶

UBC Standard 14-1 Kraft Waterproof Building Paper⁷

UBC Standard 32-1 Asphalt Saturated Rag Felt⁷

ICC-ES Acceptance Criteria AC38 for Water-Resistive Barriers⁸

3. Terminology

3.1 *Definitions*—For definitions of general terms related to building construction used in this specification, refer to Terminology E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *felt-based barrier, n*—asphalt-saturated organic felts that comply with Specification ~~D226~~D226/D226M and are intended for use as water-resistive barriers.

3.2.2 *paper-based barrier, n*—building papers composed predominantly of sulfate pulp fibers that comply with Federal Specification UU-B-790a and that are intended for use as water-resistive barriers.

3.2.3 *polymer-based barrier, n*—plastic sheet materials for use as water-resistive barriers. These materials are generally referred to as a housewrap or building wrap. These materials can be perforated with small holes or may be non-perforated, composed of films or non-woven materials.

3.2.4 *Type I WRB, n*—water-resistive barrier with base-level water resistance (see Table 1).

3.2.5 *Type II WRB, n*—water-resistive barrier with enhanced water resistance (see Table 1).

3.2.6 *Water-Resistive Barrier (WRB), n*—a material that is intended to resist liquid water that has penetrated the cladding system.

NOTE 1—Wall assemblies often include two lines of defense against rain water ingress. The cladding serves as the first line of defense and the water-resistive barrier as the second line of defense

NOTE 2—Water-resistive barriers are sometimes referred to as weather resistant barriers or sheathing membranes.

4. Classification

4.1 This specification covers vapor permeable flexible sheet materials that are classified as Type I and Type II, which are determined by the degree of water resistance. The water-resistive barrier material composition shall determine the specific test method used to measure physical and mechanical properties (see Table 1). Appendix XI provides explanatory information on the physical and mechanical property test methods.

5. Materials and Manufacture

5.1 Description of the material composition and structure shall be made available upon request.

5.1.1 Descriptions of the materials shall include roll weight and dimensions.

5.1.2 Descriptions of the material composition shall include linear density (basis weight). Basis weight shall be measured using TAPPI T-410.

6. Performance Requirements

6.1 All products seeking compliance with this specification shall conform to the minimum performance requirements listed in Table 1. Sampling and specimen size shall be in accordance with the referenced test methods. If not otherwise specified in the referenced test method, a minimum of five specimens shall be tested and all specimens shall meet the minimum performance requirements.

NOTE 3—The laboratory accelerated-ultraviolet (UV)/condensation exposure procedure specified in A1.2 is not intended to represent a specific service exposure. It is a method of comparing the stability of materials under consistent laboratory exposure conditions.

7. Other Requirements

7.1 The material shall not adhere to itself to an extent that will cause tearing or other damage on unrolling.

8. Sampling

8.1 The product to be tested for conformance to this specification shall be taken directly from a randomly selected roll which is representative of commercial product.

⁶ Available from Technical Association of the Pulp and Paper Industry (TAPPI), 15 Technology Parkway South, Norcross, Suite 115, Peachtree Corners, GA 30092, <http://www.tappi.org>.

⁷ Uniform Building Code (UBC) information is available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001-2070, <http://www.iccsafe.org>.

⁸ Available from the ICC Evaluation Service (ICC-ES), 5360 Workman Mill Road, Whittier, CA 90601, 3060 Saturn Street, Suite 100, Brea, CA 92821, <http://www.icc-es.org>.

TABLE 1 Requirements for Water Resistant Barriers

Test Requirement	Specimen Type	Test Method	Minimum Performance Requirements	
			Type I	Type II
Dry tensile strength or dry breaking force (choose 1)	(1) as manufactured (2) aged in accordance with A1.2	Test Method D828 for paper and felt materials, or Dry tensile force (choose 1)	3500 N/m [20 lb/in.] minimum (machine and cross direction)	3500 N/m [20 lb/in.] minimum (machine and cross direction)
Test Method D5034 (Grab Method)	Test Method D5034 (Grab Method)		178 N (40 lbf) minimum (machine direction) 178 N [40 lbf] minimum (machine direction) 156 N (35 lbf) minimum (cross direction) 156 N [35 lbf] minimum (cross direction)	
Water resistance test (choose 1)	(1) as manufactured (2) aged in accordance with A1.2	Test Method D779, or Water resistance test (choose 1)	10 min minimum (1) as manufactured and (2) aged in accordance with A1.2	60 min minimum Test Method D779, or Water Resistance Ponding Test (A1.1), or 10 min No water shall the membr
AATCC Test Method 127 except that the specimens shall be held at a hydrostatic head of 55 cm (21.6 in.)	not applicable			No leakage is permitted to the underside of any specimen in 5 h
AATCC Test Method 127 except that the specimens shall be held at a hydrostatic head of 55 cm [21.6 in.]	not applicable	No leakage is permitted to the underside of any specimen in 5 h		
Water vapor transmission test	as received	Test Method E96/E96M (Desiccant Method)		290 ng/(Pa · s · m ²) (5 perms) minimum
Water vapor transmission test	as received	Test Method E96/E96M (Desiccant Method)		290 ng/(Pa · s · m ²) (5 perms) minimum
Pliability test	as received	see A1.3		The material shall not crack when bent over a 1.6 mm (1/16 in.) diameter mandrel at a temperature of 0 °C (32 °F)
Pliability test	as received	see A1.3		The material shall not crack when bent over a 1.6 mm [1/16 in.] diameter mandrel at a temperature of 0 °C [32 °F]

8.2 The specimens shall be cut from the interior of the sample roll so that no specimen edge is nearer than 75 mm (3 in.) [3 in.] to the original sample edge.

8.3 Unless otherwise stated, all specimens to be tested shall be conditioned for a minimum period of 40 h at 23 ± 2°C (73.4 ± 4°F) [23 ± 2 °C [73.4 ± 4 °F]] and 50 ± 5 % relative humidity (RH).

9. Marking and Labeling

9.1 The finished product shall be marked or labeled with product identification.

9.2 Installation instructions shall be provided and shall include as a minimum the maximum weather exposure time allowed before cladding shall be installed, type of mechanical fastener and minimum fastener spacing to attach the WRB to the underlying structure, and lapping and taping requirements. This information shall be recorded and reported in any applicable test report or product rating.

10. Keywords

10.1 building felt; building paper; building wrap; housewrap; sheathing membrane; water-resistant barrier; weather-resistant barrier

ANNEX

(Mandatory Information)

A1. TEST METHODS AND PRACTICES

A1.1 Water Resistance Ponding Test

A1.1.1 *Scope*—This is a test method intended for evaluating the water resistance of a Type I water-resistive barrier.

A1.1.2 *Significance and Use*—This method is for use with water-resistive barriers.

A1.1.3 *Procedure*:

A1.1.3.1 Five specimens will be chosen at random from the material supplied.

A1.1.3.2 A ring shall be constructed with a sample of the membrane fastened between two 200-mm (~~8-in.~~)[8-in.] diameter aluminum rings using a rubber-type gasket. The membrane shall be placed between the rings and cupped to permit a depth of 25 mm (~~1-in.~~)[1 in.] of water to be exposed to ~~16 000 mm²~~16 000 mm² (~~25 in.~~ [25 in.²]) of its surface.

A1.1.3.3 Distilled water shall be poured into the cylinder to a depth of 25 mm (~~1-in.~~)[1 in.].

A1.1.3.4 The ring shall be raised by 250 mm (~~9.8 in.~~)[9.8 in.] above a sheet of plain kraft paper placed underneath the membrane to aid in monitoring any passage of water.

A1.1.3.5 The membrane shall be maintained at constant conditions of temperature ($23 \pm 2^\circ\text{C}$ (~~73.4 \pm 4 $^\circ\text{F}$~~)) 2°C [73.4 \pm 4 $^\circ\text{F}$] and RH ($50 \pm 5\%$) and be inspected at frequent intervals over a period of 2 h for water passage through the barrier material.

A1.1.4 *Report*:

A1.1.4.1 The report shall include the following:

- (1) The material and the side tested.
- (2) The material sampling procedure used.
- (3) Pass/fail test results for each specimen tested.
- (4) Any modification to the method.

A1.1.5 *Precision and Bias*—No information is presented about either the precision or bias of this test method for evaluating water resistance since the test result is nonquantitative.

A1.2 Accelerated Aging (UV Exposure and Cyclic Drying/Wetting)

A1.2.1 *Scope*—This practice is used to condition samples of water-resistive barriers to evaluate degradation of performance due to accelerated aging (UV exposure and dry/wet cycling).

A1.2.2 *Significance and Use*—This practice is not intended to represent a service exposure. It is a method of comparing the stability of materials under consistent laboratory exposure conditions.

A1.2.3 *Procedure*:

A1.2.3.1 Three samples shall be conditioned at $23 \pm 2^\circ\text{C}$ (~~73 \pm 4 $^\circ\text{F}$~~) 2°C [73 \pm 4 $^\circ\text{F}$] and $50 \pm 5\%$ RH for a minimum of 40 h. One sample shall be used for preparing unexposed specimens as a control. Two samples shall be exposed to UV radiation, followed by exposure to drying and wetting cycles in accordance with A1.2.3.2 of this specification.

A1.2.3.2 Two samples shall be exposed to fluorescent UVA-340 lamps in a fluorescent UV condensation apparatus operated in

accordance with Practice **G154**, Cycle 1. The samples shall be exposed for a duration of 2 weeks (336 h). UV radiation exposure shall be directed on the sample surfaces that will be exposed to sunlight in normal applications.

A1.2.3.3 Three specimens shall be cut from each of the samples that have been exposed to UV radiation and subjected to further accelerated aging consisting of 25 cycles of drying and soaking as follows:

- (1) Oven drying at 49°C (120°F) 49°C [120°F] for 3 h, with all surfaces exposed.
- (2) Immersion in room-temperature ($23 \pm 2^{\circ}\text{C}$ ($73 \pm 4^{\circ}\text{F}$)) 2°C [$73 \pm 4^{\circ}\text{F}$] water for 3 h, with all surfaces submerged.
- (3) After removal from the water, specimens shall be blotted dry, then air-dried for 18 h at a $23.8 \pm 2.8^{\circ}\text{C}$ ($75 \pm 5^{\circ}\text{F}$) 2.8°C [$75 \pm 5^{\circ}\text{F}$] room temperature, with all surfaces exposed.

A1.3 Pliability

A1.3.1 *Scope*—This is the test method intended for evaluating the pliability of a water-resistive barrier

A1.3.2 *Significance and Use*—This method is for use with water-resistive barriers

A1.3.3 *Procedure*:

A1.3.3.1 Five specimens will be chosen at random from the material supplied.

A1.3.3.2 Each specimen is bent $180 \pm 5^{\circ}$ over a 1.6 mm ($\frac{1}{16}$ in.) mandrel in 2 ± 1 s.

A1.3.3.3 The specimen and mandrel shall be maintained at constant conditions of temperature ($0 \pm 2^{\circ}\text{C}$ ($32 \pm 4^{\circ}\text{F}$)) 2°C [$32 \pm 4^{\circ}\text{F}$] during the test procedure.

A1.3.4 *Report*:

A1.3.4.1 The report shall include the following:

- (1) The material tested.
- (2) The material sampling procedure used.
- (3) Observations of any visual cracking.
- (4) Any modification to the method.

A1.3.5 *Precision and Bias*—No information is presented about either the precision or bias of this test method for evaluating pliability since the test result is non-quantitative.

APPENDICES

(Nonmandatory Information)

X1. EXPLANATORY INFORMATION ON MECHANICAL AND PHYSICAL TEST METHODS

INTRODUCTION

X1.1 There are a number of attributes of WRBs that should be considered in their selection. These include water resistance, water vapor permeance, air resistance, durability⁹ compatibility with other materials, cost, installation challenges, and more. There are three different base materials that make up Type I and II water-resistive barriers. These base materials are felt, paper, and polymeric materials. Within North America, each base material has been historically evaluated using test methods that each respective base material industry recognized as most applicable or appropriate for material characterization. These test methods, while providing distinction with a given base material, are not always transferable between base material types. Because the goal of a single set of test methods that can be used to accurately evaluate the comparable critical performance properties of all WRBs is not attainable at this time, this specification is envisioned as a first step towards that goal. **Appendix X1** describes additional information about

⁹ For more information see Guide **E2136**.