

ACCEPTANCE CRITERIA FOR ROOF UNDERLAYMENT FOR USE IN SEVERE CLIMATE AREAS

AC48

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(Corrected July 2009)

**Previously approved January 2000, January 1998, July 1997,
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PREFACE

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard Codes. Section 104.11 of the *International Building Code*® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

This acceptance criteria has been issued to provide all interested parties with guidelines for demonstrating compliance with performance features of the applicable code(s) referenced in the acceptance criteria. The criteria was developed and adopted following public hearings conducted by the ICC-ES Evaluation Committee, and is effective on the date shown above. All reports issued or reissued on or after the effective date must comply with this criteria, while reports issued prior to this date may be in compliance with this criteria or with the previous edition. If the criteria is an updated version from the previous edition, a solid vertical line (|) in the margin within the criteria indicates a technical change, addition, or deletion from the previous edition. A deletion indicator (→) is provided in the margin where a paragraph has been deleted if the deletion involved a technical change. This criteria may be further revised as the need dictates.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria set forth in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise demonstrate compliance with the performance features of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

Acceptance criteria are developed for use solely by ICC-ES for purposes of issuing ICC-ES evaluation reports.

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1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish the basis of recognition in ICC-ES evaluation reports of severe climate roof underlayment installed over solid sheathing on areas of the roof subjected to wind-driven snow or ice buildup as specified in Tables 15-B-1, 15-B-2, 15-D-1 and 15-D-2 of the 1997 *Uniform Building Code*[™] (UBC) and, in areas where the average daily temperature in January is 25°F (−4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, as specified in Chapter 15 of the 2006 *International Building Code*[®] (IBC) and Chapter 9 of the 2006 *International Residential Code*[®] (IRC).

1.2 Referenced Documents:

1.2.1 2006 *International Building Code*[®] (IBC), International Code Council.

1.2.2 2006 *International Building Code*[®] (IBC), International Code Council.

1.2.3 1997 *Uniform Building Code*[™] (UBC).

1.2.4 ASTM C 794-80, Test Method for Adhesion-in-peel of Elastomeric Joint Sealants, ASTM International.

1.2.5 ASTM D 412-98a, Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension, ASTM International.

1.2.6 ASTM D 828-97, Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus, ASTM International.

1.2.7 ASTM D 1682-64 (1975), Test Method for Breaking Load and Elongation of Textile Fabrics, ASTM International.

1.2.8 ASTM D 1970, Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials, ASTM International. (See Table 1 for editions.)

1.2.9 ASTM E 96-00, Test Method for Water Vapor Transmission of Materials, ASTM International.

2.0 BASIC INFORMATION

2.1 Manufacturing Description: General information on the material and manufacturing process.

2.2 Product Description: Details regarding thickness, size, configuration, fastener locations, lapping of edges and ends, and any special precautions required for installation.

2.3 Product Identification and Installation Description: Installation instructions, method of packaging and field identification. Identification provisions shall include the evaluation report number and the name or logo of the inspection agency.

2.4 Jobsite Product Preparation: Method of field-cutting, trimming or forming; and treatment of cut edges and cut ends.

2.5 Testing Laboratories, Reports of Tests and Specimen Selection:

2.5.1 Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the Rules of Procedure for Evaluation Reports.

2.5.2 Test reports shall comply with AC85.

2.5.3 Sampling of the underlayments for tests under this criteria shall comply with Section 3.1 of AC85.

3.0 REQUIRED TEST DATA

3.1 UBC: For recognition under the UBC, the following data shall be submitted:

3.1.1 Underlayments Used in Conjunction with UBC Table 15-B-1: Reports of tests complying with Section 3.2 or ASTM D 1970. For products tested under ASTM D 1970, a maximum water absorption limit of 3 percent is permitted, provided tests in accordance with Sections 4.9 and 4.10 of this acceptance criteria are submitted.

3.1.2 Underlayments Used in Conjunction with UBC Tables 15-B-2, 15-D-1 and 15-D-2:

3.1.2.1 Tensile strength tests in accordance with Section 4.1 on control, accelerated-aged and ultraviolet-exposed specimens.

3.1.2.2 Water-vapor transmission tests in accordance with Section 4.2 on control specimens.

3.1.2.3 Pliability tests in accordance with Section 4.3 on control specimens.

3.1.2.4 Water-ponding tests in accordance with Section 4.4 on control and accelerated-aged specimens.

3.1.2.5 Peel-adhesion tests in accordance with Section 4.5 on control, seven-day water-immersed, accelerated-aged and ultraviolet-exposed specimens.

Exception: Minimum two layers of cemented products attached to substrate with mechanical fasteners.

3.1.2.6 Cycling and elongation tests in accordance with Section 4.6 on control specimens.

3.1.2.7 Accelerated aging in accordance with Section 4.7.

3.1.2.8 Ultraviolet exposure tests in accordance with Section 4.8.

3.2 IBC and IRC: For recognition under the IBC and IRC, reports of tests complying with Section 3.1.2 of this acceptance criteria or with ASTM D 1970 shall be submitted. For products tested under ASTM D 1970, a maximum water absorption limit of 3 percent is permitted, provided tests in accordance with Sections 4.9 and 4.10 of this acceptance criteria are submitted. **Underlayments qualified under ASTM D 1970 shall be limited to use with mechanically fastened roof coverings only.**

4.0 TEST METHODS

These test procedures are applicable only to underlayments evaluated under Section 3.1.2.

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4.1 Tensile Strength Tests: Tests are to be conducted on a minimum of five machine-direction specimens and five cross-direction specimens in accordance with ASTM D 828 for paper-type products, ASTM D 1682 for fabric-type products, ASTM D 412 for rubberized-type products and Section 7.3 of ASTM D 1970 for products that do not fall into any one of the three preceding product categories. Samples are 1 inch wide by 10 inches long (25.4 mm by 254 mm) for ASTM D 828, and 4 inches wide by 6 inches long (102 mm by 152 mm) for ASTM D 1682. Sample size for rubber-type products shall comply with ASTM D 412, Method A, Die C. Sample size for products tested in accordance with ASTM D 1970 shall comply with Section 7.3.1 of ASTM D 1970.

Conditions of Acceptance¹

SPECIFICATION	REQUIREMENTS ²
ASTM D 828 or ASTM D 412	Minimum 20 pounds per inch width
ASTM D 1682	Minimum 75 pounds per specimen
ASTM D 1970	Minimum 25 pounds per inch width

For **S1**: 1 inch = 25.4 mm, 1 pound = 4.45 N.

¹Control, accelerated-aged and ultraviolet specimens shall satisfy minimum requirements.

²Both machine and cross-direction specimens.

4.2 Water-vapor Transmission Test:

4.2.1 General: Tests are to be conducted in accordance with ASTM E 96, Procedure A.

4.2.2 Conditions of Acceptance: None. Results are to determine whether the product is a vapor barrier under the UBC.

4.3 Pliability:

4.3.1 General: Five 1-inch-wide-by-8-inch-long (25.4 mm by 203 mm) specimens are maintained at $14 \pm 3.6^\circ\text{F}$ ($-10 \pm 2^\circ\text{C}$) for 24 hours and immediately bent over a $1/8$ -inch (3.2 mm) steel mandrel through a 90-degree angle.

4.3.2 Conditions of Acceptance: Specimens show no cracking or delamination.

4.4 Water-ponding Test:

4.4.1 General: Three control specimens and three aged specimens are prepared. A 2-inch-diameter (51 mm) cylindrical tube with a 24-inch (610 mm) height of distilled water is sealed onto the specimen surface for a period of 48 hours. The drop in the water column from the original 24-inch (610 mm) height is to be reported in hundredths of an inch. The presence of any moisture on specimens shall be reported.

4.4.2 Conditions of Acceptance: Maximum percolation of 1.0 percent of column height [0.24 inch (6.1 mm)]. Compensation for evaporation is permitted by comparison with identical apparatus mounted on a nonabsorbent surface.

4.5 Peel-adhesion Test:

4.5.1 General: Six test specimens are prepared in accordance with ASTM C 794 for each substrate desired. The specimens are conditioned at $73 \pm 4^\circ\text{F}$ ($22.8 \pm 2.2^\circ\text{C}$) and 50 ± 5 percent relative humidity for seven days. Peel strength tests are then conducted after a seven-day curing period (control), after a seven-day water immersion, after

210 hours of ultraviolet exposure and after a 25-day accelerated aging cycle.

4.5.2 Condition of Acceptance: Peel strength of conditioned specimens shall exceed 75 percent that of the control specimens.

4.6 Cycling and Elongation Test:

4.6.1 General: Three specimens are prepared with $1/2$ -inch-thick (12.7 mm), 3-inch-by-6-inch (76 mm by 152 mm) A-C plywood. Each specimen includes two plywood pieces aligned so that the 6-inch (152 mm) edges are separated by $1/8$ inch (3.2 mm). The underlayment is attached to the plywood pieces across the joint and conditioned at $73 \pm 4^\circ\text{F}$ ($22.8 \pm 2.2^\circ\text{C}$) for seven days. After conditioning, specimens are placed in a cold box, which is maintained at -20°F (-28.9°C) for seven days. Specimens are then cycled between a $1/8$ -inch (3.2 mm) and $1/4$ -inch (6.4 mm) plywood edge separation for 100 cycles while maintaining the temperature at -20°F (-28.9°C). The rate of movement shall be $1/8$ inch (3.2 mm) per hour.

4.7 Accelerated Aging:

4.7.1 General: Six specimens, 12 inches by 12 inches (305 mm by 305 mm) in size, are aged by the cyclic process described herein. Twenty-five cycles are required, with each cycle consisting of the following:

1. Oven drying at 120°F (48.9°C) for three hours with all surfaces exposed.
2. Immersion in water maintained at room temperature for three hours, with all surfaces exposed.
3. Removal from water and blotting dry before air-drying for 18 hours at room temperature with all surfaces exposed. Samples shall be in the air-dry period over weekends and holidays, which should be confirmed in the test log. The room temperature shall be maintained at $73 \pm 5^\circ\text{F}$ ($22.8 \pm 2.8^\circ\text{C}$).

4.7.2 Conditions of Acceptance: No visible damage to the specimens, such as cracking or chipping. Additionally, tests in accordance with Sections 3.1.2.1, 3.1.2.4 and 3.1.2.5 shall be conducted. Results shall show no deterioration due to accelerated aging (except for peel-adhesion tests, where results shall be as specified in Section 4.5).

4.8 Ultraviolet Exposure:

4.8.1 General: Exposure to ultraviolet sunlamps for 210 hours (10 hours per day for 21 days) in an enclosure in accordance with Figure 1. Two 18-inch-by-48-inch (457 mm by 1219 mm) samples are required for this. Ultraviolet exposure shall be directed on the specimen surface that will be exposed to sunlight in normal application. Lamps and enclosure are to be adjusted so that the temperature on the sample is between 135°F and 140°F (57.2°C and 60°C). Sunlamp bulbs shall be General Electric Type H275 RUV (275 W) or equivalent bulbs providing UV characteristics of $5.0 \text{ W/m}^2/\text{nm}$ irradiance at a wavelength of 315 to 400 nm at one meter.

4.8.2 Conditions of Acceptance: No visible surface or structural changes such as peeling, chipping,

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cracking, flaking or pitting when observed under minimum five-power magnification. Additionally, ultraviolet-exposed specimens shall be subjected to tensile-strength and peel-adhesion tests with conditions of acceptance as noted in Sections 4.1 and 4.5, respectively.

4.9 Temperature-cycling Tests:

4.9.1 General: This test applies to products tested under ASTM D 1970 having a water absorption value greater than 0.1 percent and less than 3 percent. A minimum of five representative samples shall be subjected to 25 consecutive cycles of this test, each cycle consisting of one hour of water exposure at room temperature followed by six hours at minus 40°F (-40°C), 2 hours at 70°F (21.1°C), 14 hours at 180°F (82°C), and 1 hour at 70°F (21.1°C); between cycles, such as on weekends and holidays, the samples may be maintained at 70°F (21.1°C). A plus 5°F (2.8°C) tolerance is allowed on these temperatures. The underlayment shall be applied to a rigid wood frame simulating the field installation procedure recommended by the manufacturer. Horizontal and vertical joints shall be included in the specimens. Spray nozzles for the water exposure shall be located approximately 7 feet (2134 mm) above the test decks, and shall deliver 6 inches (152 mm) of water per hour at a temperature of 40°F to 60°F (4.4°C to 15.6°C). The test decks shall be installed at the lowest slope recommended for field installation. At the conclusion of the 25 cycles, the specimens shall be examined under 5 x magnifications.

4.9.2 Conditions of Acceptance: The product is considered to have passed this test if no crazing, cracking or other deleterious surface or joint changes are noted at the end of the test. Additionally, there shall be no sign of failure or distress at fastener locations and underlayment joints.

4.10 Water Percolation Test:

4.10.1 General: This test applies to products tested under ASTM D 1970 having a water absorption value greater than 0.1 percent and less than 3 percent. Percolation tests involve mounting a 1-inch-diameter (25.4 mm) (or larger) tube on the surface of at least three underlayment specimens. The tube is centered over the surface, and sealed. The tube is then filled with distilled water to a height of 48 inches (1219 mm). The water column is maintained at 75°F ± 5°F (23.8°C ± 2.8°C) at 50 percent ± 5 percent relative humidity for a period of 48 hours. The drop in water level is to be reported in hundredths of an inch.

4.10.2 Conditions of Acceptance: There shall be no accumulation of moisture on the underside of the specimen. A maximum water percolation equivalent to a 0.5-inch (12.7 mm) column height is permitted.

5.0 QUALITY CONTROL

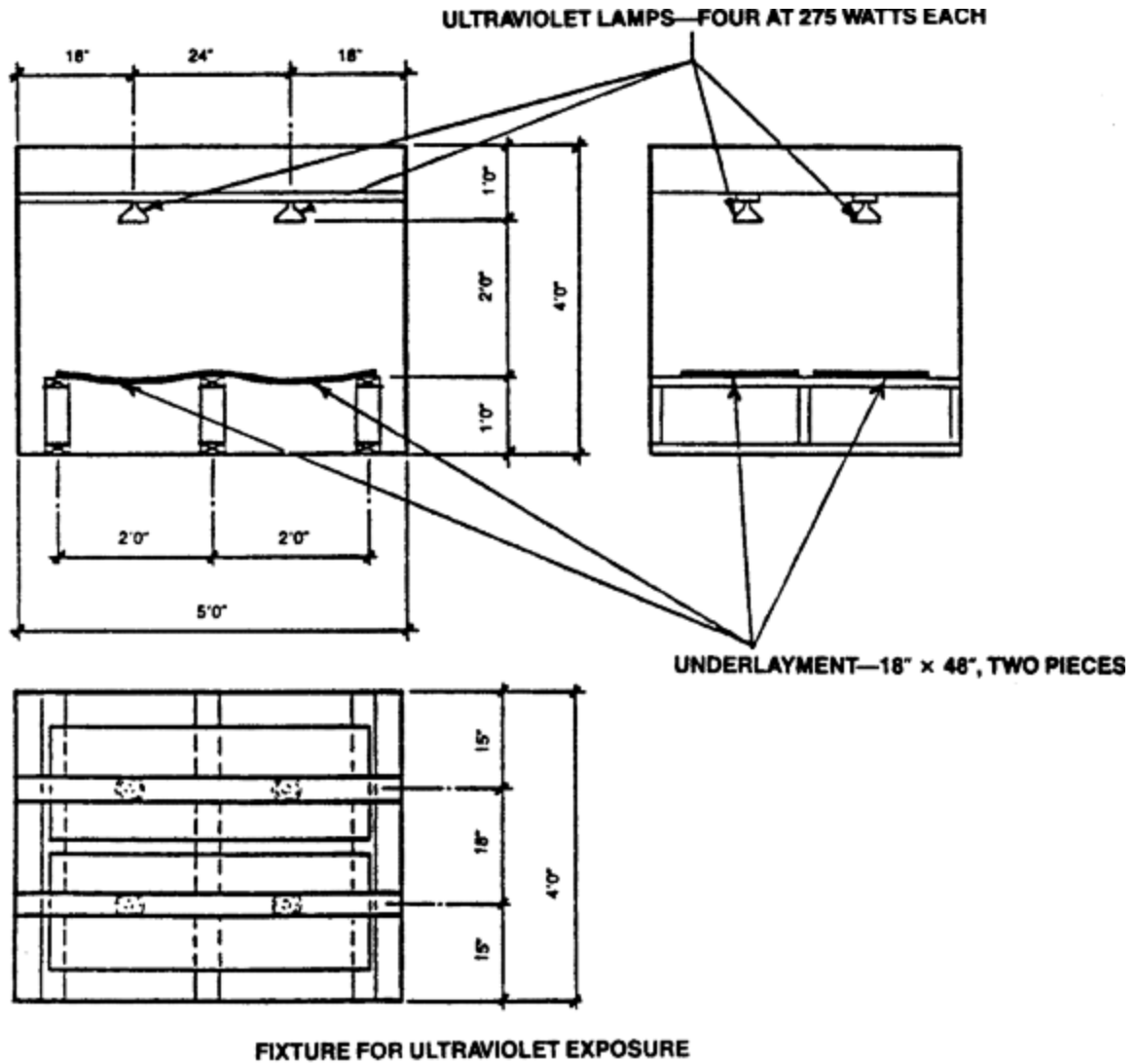
5.1 The products shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by the International Accreditation Service (IAS) or otherwise acceptable to ICC-ES.

5.2 A quality control manual complying with the ICC-ES Acceptance Criteria for Quality Control Manuals (AC10) shall be submitted.

TABLE 1—REFERENCED STANDARDS

STANDARD	DATE OF STANDARD		
	IBC	IRC	UBC
ASTM D 1970	2001	2001	1990

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For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 1