



ICBO Evaluation Service, Inc.

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ACCEPTANCE CRITERIA FOR CONCRETE TILE UNDERLAYMENT ON SPACED SHEATHING

January, 1989

PREFACE

Evaluation reports issued by the ICBO Evaluation Service, Inc. (ICBO ES), are based upon performance features of the Uniform Building Code, Uniform Mechanical Code, Uniform Plumbing Code and related codes. Section 105 of the Uniform Building Code is the primary charging section upon which evaluation reports are issued. Section 105 reads as follows:

The provisions of this code are not intended to prevent the use of any material or method of construction not specifically prescribed by this code, provided any alternate has been approved and its use authorized by the building official.

The building official may approve any such alternate, provided he finds that the proposed design is satisfactory and complies with 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 suitability, strength, effectiveness, fire resistance, durability, safety and sanitation.

The building official shall require that sufficient evidence or proof be submitted to substantiate any claims that may be made regarding its use. The details of any action granting approval of an alternate shall be recorded and entered in the files of the code enforcement agency.

The attached acceptance criteria for the general code sections noted have been issued to provide all interested parties with guidelines on implementing performance features of the codes. The attached acceptance criteria were developed and adopted following public hearings conducted by the Evaluation Committee. These criteria may be revised from time to time as the need dictates.

ICBO ES may consider alternate criteria, provided the proponent submits valid data demonstrating that the alternate criteria are at least equivalent to the attached criteria and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a material, type or method of construction, or equipment, meets the attached acceptance criteria, or it can be demonstrated that valid alternate criteria are equivalent and otherwise meet the applicable performance requirements of the codes, if the material, product, system or equipment is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use thereof, ICBO ES retains the right to refuse to issue or renew an evaluation report.

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ACCEPTANCE CRITERIA FOR CONCRETE TILE UNDERLAYMENT ON SPACED SHEATHING

1.0 Introduction: The purpose of these criteria is to establish requirements for ICBO Evaluation Service, Inc. (ICBO ES), recognition of underlayment used with spaced sheathing under concrete tiles as noted in Chapter 32 of the Uniform Building Code. Pliability, tensile strength, puncture-resistance, water-resistance and sag-resistance tests outlined in this specification involve comparative testing of samples prepared in the following manner:

- a. Product as manufactured.
- b. Product after conditioning by ultraviolet exposure.
- c. Product after conditioning by ultraviolet exposure and accelerated aging.

These tests apply to both board and roll-type materials. The two types are clarified under Section 2.0.

2.0 Underlayment: A board-type underlayment is one that does not immediately sag more than 5 1/2 inches when cantilevered 24 inches over a nominal 2-inch-wide wood member. Roll-type underlayment is underlayment not qualifying as board type.

3.0 Sampling: Material for testing must be selected by the testing laboratory from a representative production run. Three samples, 18 inches by 48 inches each, are to be cut from the middle of the rolls or boards. Tests are to be conducted on specimens cut from the samples in the following sequence:

Sample No. 1	Sample No. 2	Sample No. 3
Water-resistance Tensile strength Pliability Beach or Drop puncture test	Conditioned by U. V. exposure ↓ Long-term sag test ↓ Water-resistance Tensile strength Pliability Beach or Drop puncture test	Conditioned by U. V. exposure ↓ Accelerated aging ↓ Water-resistance Tensile strength Pliability Beach or Drop puncture test

The test specimens for all the tests are to be cut from the samples as shown in Figures Nos. 1, 2 or 3. Samples must be free of folds, wrinkles and other common defects. The test report must be in sufficient detail to permit positive identification of specimen tested. Sample description must include weight per square foot, nominal size and details of core, facing, and production methods. Conditioning procedures for product samples described in Section 1b and 1c are as detailed in Sections 4.0 and 5.0.

4.0 Conditioning by Ultraviolet Exposure: Exposure to ultraviolet sun lamps for 210 hours (10 hours per day for 21 days) in an enclosure as depicted in Figure No. 4. Two 18- or 21-inch by 48-inch samples are required for this. Ultraviolet exposure must be directed on the specimen surface that will be exposed to sunlight in normal application.

Lamps and the enclosure are to be adjusted so that the temperature on the sample is between 135°F. and 140°F.

5.0 Accelerated Aging Process: One 18- or 21-inch by 48-inch specimen, subjected to the ultraviolet exposure described in Section 4.0 is used in this test. Twenty-five cycles are required. Samples must be in the air-dry period during periods of inactivity, which should be mentioned in the test log. Test must be conducted in a room where the temperature is maintained at 75 ± 5°F. The accelerated aging process must comply with the following cycling procedure:

- a. Samples are oven dried at 120°F. for three hours with all surfaces exposed.
- b. Samples are immersed in a pan with room temperature water for three hours. Samples must be sufficiently separated with a rack to allow water exposure on all surfaces.
- c. After removal from water, the samples are to be blotted dry before air drying for 18 hours at room temperature with surfaces exposed.

6.0 Test Methods and Performance Requirements: After the conditioning under Sections 4.0 and 5.0, all samples must be stored at 75 ± 5°F. and a relative humidity of 50 ± 5 percent.

a. 1. **Water-resistance Test:** See ASTM D 779. Five 2 1/2-inch by 2 1/2-inch specimens are to be cut from each of three samples described in Section 3.0. The specimens shall have corners folded to form a boat shape exposing one surface to the water. They are then floated in water at room temperature and dry indicator powder sprinkled on them as described in ASTM D 779. The time for change of color of the powder is to be observed as set forth in the standard. Condition of acceptance is 24 hours or more with no color change as defined in the standard.

2. **Alternate Method:** Five 4-inch by 5-inch specimens are selected from each of three samples described in Section 3.0. Each specimen is sealed along the edges with a suitable metal frame or round pipe and putty, mastic or other compound to provide a watertight seal. The test specimen is prepared so that a minimum 2-inch water head or water column can be

applied to the surface. The bottom of the specimen can be supported horizontally by a suitable metal frame, wire or other method so that it does not sag. The 2-inch head of water, measured from the bottom of the test specimen, shall be maintained for a period of 24 hours. If necessary, water shall be added during the test to maintain this level. Condition of the specimen should be reported at least once each hour for the first eight hours and the termination of the 24 hour period. Water is to be maintained at a test temperature of 75 ± 5°F.

Condition of Acceptance:

Bottom of specimens can be damp after 24 hours but no drip is permissible.

b. 1. **Dry Tensile Strength:** See ASTM D 828. Five 1-inch by 9-inch specimens from each conditioned set are to be cut in the machine direction and five in the cross direction. Tensile strength tests complying with ASTM D 828 are then conducted.

Conditions of Acceptance:

Machine Direction—70 lbs./in. minimum

Cross Direction—30 lbs./in. minimum

2. **Alternate Method:** See ASTM D 1682. Five 4-inch by 6-inch specimens are selected from each of three samples described in Section 3.0. Breaking strength is to be in accordance with ASTM D 1682 with the sample size being 4 inches by 6 inches with jaw size of 1-inch square. The jaws are to be spaced at a gauge length of 3 inches.

Conditions of Acceptance:

Machine Direction—110 lbs.

Cross Direction—110 lbs.

c. **Pliability Test:** This test is applicable only to the roll-type underlayment. Five specimens from each conditioned set are to be cut in the machine direction to a 1-inch by 8-inch size.

Specimens are then maintained at 0°F. for 24 hours and bent over a 1/8-inch steel mandrel through a 90-degree angle within two seconds. No cracking or delamination shall occur.

After results are noted, all samples are conditioned at 0°F. for 90 hours. They are then bent over the 1/8-inch steel mandrel through a 90-degree and 180-degree angle within two seconds. No cracking or delamination shall occur.

d. 1. **Beach Puncture Test:** See ASTM D 781. Three 10-inch by 10-inch specimens from each conditioned set are necessary. Puncture tests are then conducted in accordance with ASTM Method D 781 with the sample oriented in the weaker of the two directions, i.e., machine or cross. Acceptance level is 30 inch-pound.

2. **Alternate Drop Puncture Test:** One 12-inch by 25-inch specimen is selected from each conditioned set and attached along the shorter dimension to a frame consisting of nominal wood members spaced at 24 inches. The spacing simulates roof framing at 24 inches on center. The test specimen shall have a maximum sag of 1 inch measured from the top of the framing member. A puncture point is dropped from a height of 30 inches at five different locations within the 24-inch span.

The puncture point shall be affixed to any shaft and have a right angle triangular pyramid shape 1 inch in height with rounded leading edges of 0.062 ± .002 inch radius. The point shall be honed to a 0.062 inch radius and the base edges left sharp. The weight of the puncture point and shaft shall be 1.00 lb ± 0.01 lb.

Condition of Acceptance:

There shall be no puncture of the test specimen.

e. **Long-term Sag Test:** This is conducted only on samples conditioned under Section 4.0. The fixture used for the ultraviolet exposure test can be used except that the ultraviolet lamps are replaced by regular 100 watt lamps. A 12-inch by 48-inch sample is cut from the middle of the 18- or 21-inch by 48-inch specimen.

Test Procedure:

a. Temperature shall be maintained at 100°F.

b. Specimen is placed over three 2-inch nominal width rafters spaced at 24 inches on center with ends nailed to the outermost rafters.

c. A 1-pound sand bag is placed at the center of each span.

d. Initial sag at centerline span is to be recorded.

e. After 48 hours, sag at the same location is again recorded.

Condition of acceptance is that the final sag shall not exceed the initial sag by more than 5 percent.

7.0 Summary: See attached Table No. 1.

8.0 Quality Control: For recognition by the ICBO ES, the underlayment must be manufactured under a recognized quality control program with inspections by a recognized independent agency. A quality control manual, jointly developed by the applicant and the quality control agency in compliance with the requirements noted in the ICBO ES "Acceptance Criteria for Quality Control Manuals" must be submitted.

TABLE NO. 1¹

ITEM	TEST	ACCEPTANCE LEVELS
a. 1.	Water-resistance	24 hours minimum
a. 2.	Alternate method	24 hours minimum
b. 1.	Dry tensile strength	Machine Direction—70 lbs./in. Cross Direction—30 lbs./in.
b. 2.	Alternate method	Machine Direction—110 lbs./in. Cross Direction—110 lbs./in.
c.	Pliability	No cracking or delamination
d. 1.	Beach puncture	30 inch-pound
d. 2.	Alternate method	No puncture from 30-inch drop
e.	Long-term sag	Final sag shall not exceed initial sag by 5%.

¹Acceptance levels shown are for product as manufactured, product after ultraviolet exposure and product after accelerated aging.

A1, A2, A3, A4, A5—Tensile Strength M.D. 1" × 9"
B1, B2, B3, B4, B5—Tensile Strength C.D. 1" × 9"
C1, C2, C3, C4, C5—Water-Resistance 2 1/2" × 2 1/2"

D1, D2, D3, D4, D5—Pliability 1" × 8"
E1, E2, E3—Beach Puncture 10" × 10"

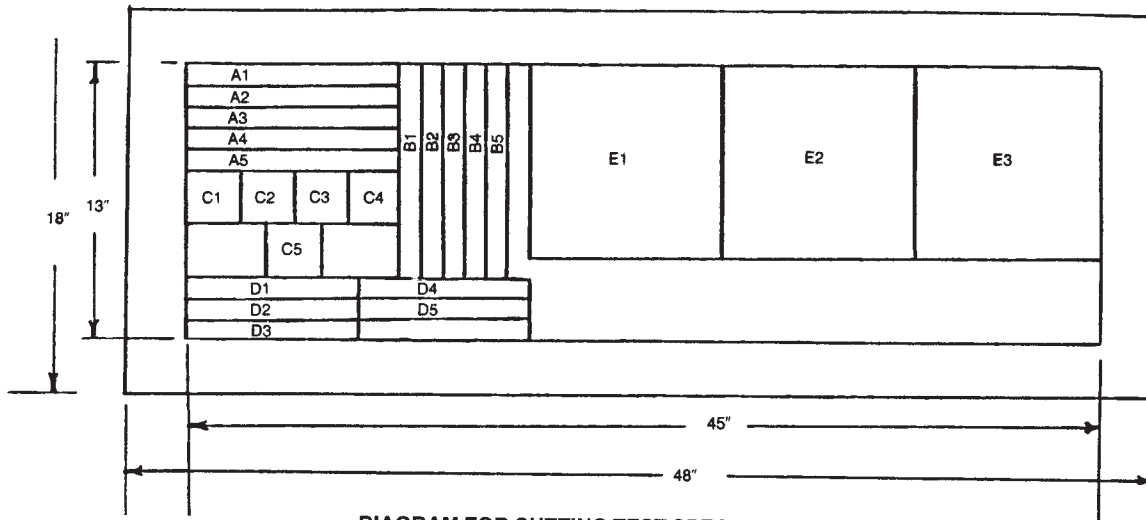


DIAGRAM FOR CUTTING TEST SPECIMENS
FROM THE TEST SAMPLES
FIGURE NO. 1

A1, A2, A3, A4, A5—GRAB TENSILE (MD) 4" × 6"
B1, B2, B3, B4, B5—GRAB TENSILE (CD) 4" × 6"
C1, C2, C3, C4, C5—WATER PERMEABILITY 4" × 6"

D1, D2, D3, D4, D5—PLIABILITY—1" × 8"
E —DROP PUNCTURE—12" × 25"

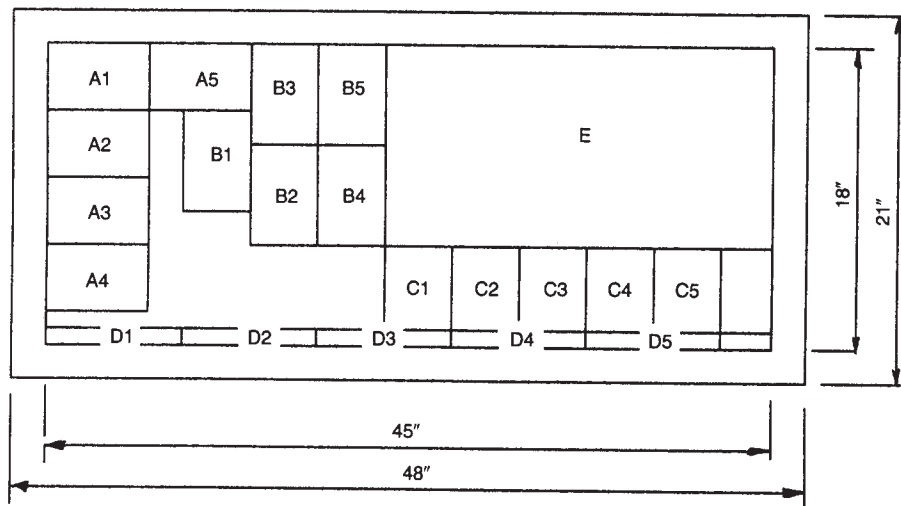


DIAGRAM FOR CUTTING TEST SPECIMENS
FOR GRAB TENSILE METHOD
FIGURE NO. 2

A1, A2, A3, A4, A5—TENSILE STRENGTH (MD) 1" × 9"
 B1, B2, B3, B4, B5—TENSILE STRENGTH (CD) 1" × 9"
 C1, C2, C3, C4, C5—WATER PERMEABILITY 4" × 5"

D1, D2, D3, D4, D5—PLIABILITY TEST—1" × 8"
 E —DROP PUNCTURE—12" × 25"

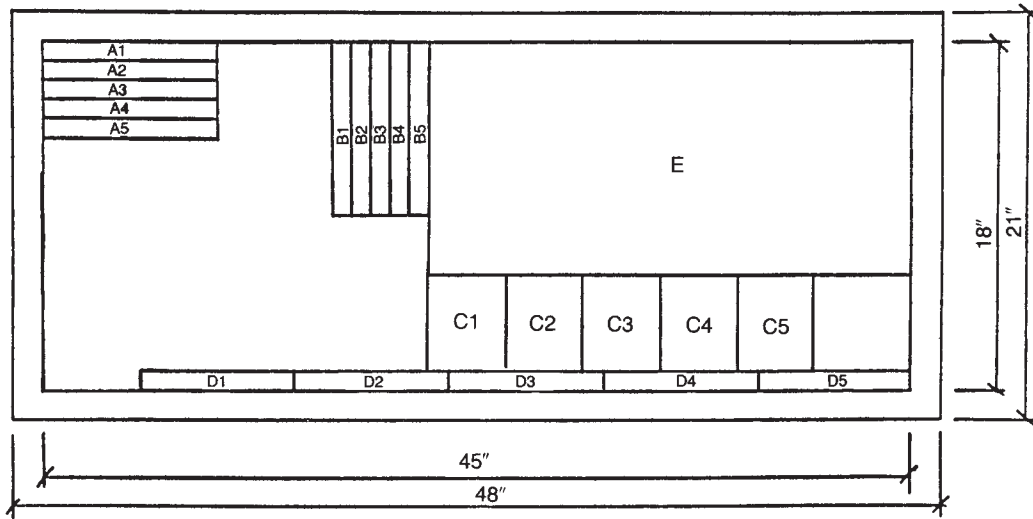
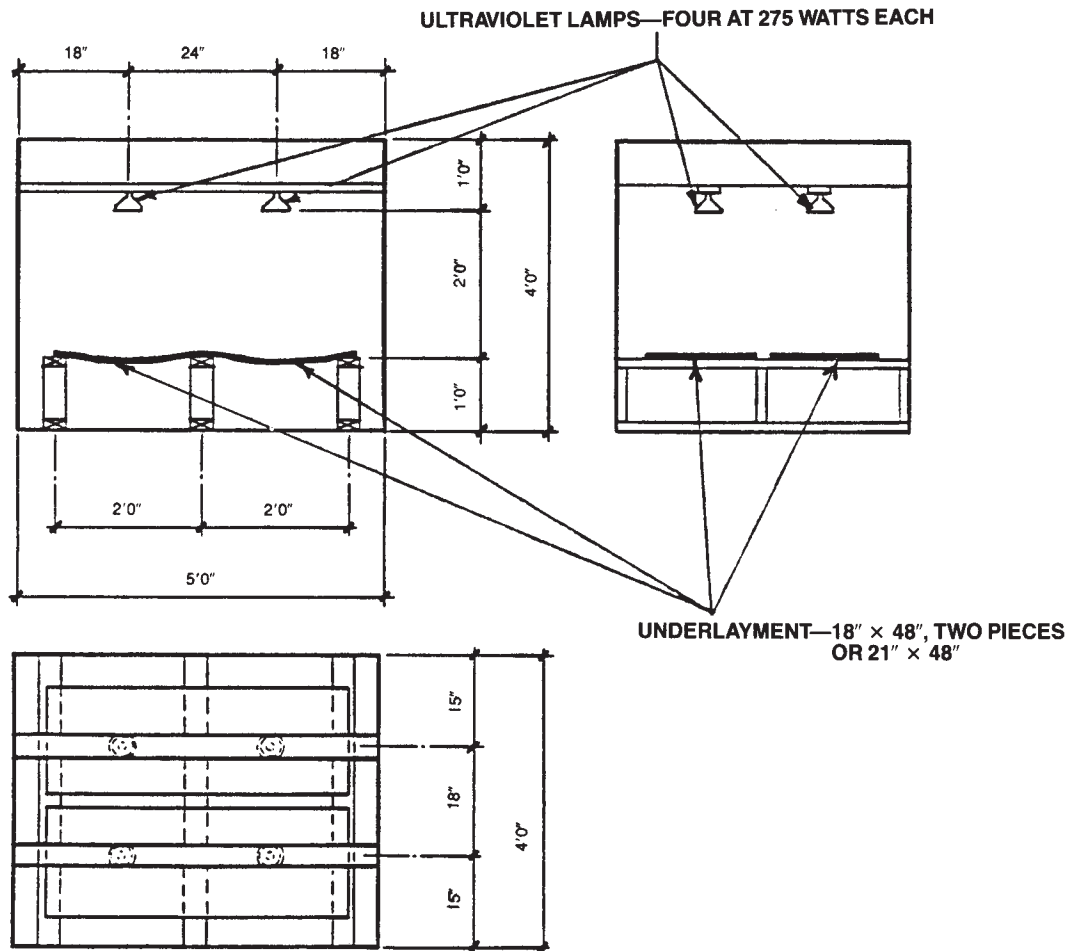


DIAGRAM FOR CUTTING TEST SPECIMENS FROM
 TEST SAMPLES FOR STRIP TENSILE METHOD
 FIGURE NO. 3



FIXTURE FOR ULTRAVIOLET EXPOSURE
 FIGURE NO. 4