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A subsidiary corporation of the International Conference of Building Officials

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ACCEPTANCE CRITERIA FOR FOAMED CLAY ROOFING SYSTEMS (PROPRIETARY)

AC134

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PREFACE

Evaluation reports issued by the ICBO Evaluation Service, Inc. (ICBO ES), are based upon performance features of the *Uniform Building Code*[™], *ICBO Uniform Mechanical Code*[™] and related codes. Section 104.2.8 of the *Uniform Building Code* is the primary charging section upon which evaluation reports are issued. Section 104.2.8 reads as follows:

The provisions of this code are not intended to prevent the use of any material, alternate design 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 the building official 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 has been issued to provide all interested parties with guidelines on implementing performance features of the codes. The attached acceptance criteria was developed and adopted following public hearings conducted by the Evaluation Committee. If the criteria is an updated version from a previous edition, solid vertical lines (█) in the outer margin within the criteria indicate a technical change or addition from the previous edition. Deletion indicators (▸) are provided in the outer margins where a paragraph or item has been deleted if the deletion resulted from a technical change. This 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 that 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 in 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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1.0 INTRODUCTION

The purpose of this criteria is to establish requirements for recognition of foamed clay roofing systems in ICBO Evaluation Service, Inc. (ICBO ES), evaluation reports. The systems include panels, tiles, shingles or shakes installed in accordance with Tables 15-B-1, 15-B-2 and 15-D-1 of the 1997 *Uniform Building Code*™ (UBC), hereinafter identified as “UBC” or “the code.”

2.0 DEFINITIONS

2.1 Foamed Clay Products: Foamed clay products are composed of fly ash/inorganic fillers and proprietary resin and are compressed in a mold to form either a flexible foamed clay or a rigid foamed clay roofing product. The surface can be non-textured with a smooth surface, or textured to simulate appearances such as wood shakes, wood shingles, or granulated asphalt shingles.

2.2 Flexible Foamed Clay Roofing Products: Flexible foamed clay roofing is defined as a foamed clay product that can be folded 180 degrees without fracture.

2.3 Rigid Foamed Clay Roofing Products: Rigid foamed clay roofing products are defined as those products that pass the flexural strength test method outlined in Section 6.2.4.

3.0 REFERENCE DOCUMENTS

1. ASTM C 1185-95a, Test Methods for Sampling and Testing of Non Asbestos Fiber-cement Flat Sheet, Roofing and Siding Shingles and Clapboard.
2. ICBO ES Acceptance Criteria for Special Roofing Systems (AC07).
3. ICBO ES Acceptance Criteria for Roofing Systems with Asphalt Shingles Made with Glass Felt (AC127).
4. ICBO ES Acceptance Criteria for Test Reports and Product Sampling (AC85).
5. ICBO ES Acceptance Criteria for Quality Control Manuals (AC10).
6. UBC Standard 15-2, Test Standard for Determining the Fire Retardancy of Roof Assemblies.
7. 1997 UBC.
8. ASTM D 3462-96, Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
9. ASTM D 4932-89 (1995), Test Method for Fastener Rupture and Tear Resistance of Roofing and Waterproofing Sheets, Roll Roofing, and Shingles.
10. ASTM D 412-92, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension.
11. ASTM D 624-91, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
12. ASTM C 373-88 (1994), Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products.

4.0 BASIC INFORMATION AND REPORTS OF TESTS

The following information must be submitted:

4.1 Product Description: Complete information, as applicable, concerning formulation, density, protective coatings and manufacturing process.

4.2 Installation Instructions: Dimensioned scale drawings and installation details, noting installation limitations and

size and location of fasteners. Installation shall comply with Tables 15-B-1, 15-B-2 or 15-D-1 of the code.

4.3 Packaging and Identification: Methods of packaging and identification of components are required. Identification shall include the ICBO ES evaluation report number, name or logo of the quality control agency, and notice of any product installation limitations. A copy of the installation instructions that are packaged with the product shall be submitted.

4.4 Field Preparation: Methods of field cutting, trimming or forming, and treatment of cut edges, shall be described.

4.5 Testing Laboratories: Testing laboratories shall comply with the ICBO ES Acceptance Criteria for Laboratory Accreditation (AC89).

4.6 Test Reports: Test reports and product sampling shall comply with the ICBO ES Acceptance Criteria for Test Reports and Product Sampling (AC85). The test report shall be in sufficient detail to identify specimen properties that might affect performance as a roof covering. Except where otherwise specifically reported in the test method, each test applies to a set of at least five identical specimens. A qualified representative of the testing agency shall witness production methods, fabrications and installations of test specimens. The testing agency shall verify and report dimensions, weight, density, chemical formulation, treatment, moisture content and other relevant physical properties of the major components. The testing agency shall also verify and report the manner of installation, and provide a description of fasteners.

5.0 REQUIRED DATA

Reports of tests shall demonstrate that the products comply with all requirements of Section 6.1 for flexible roofing or Section 6.2 for rigid roofing.

5.1 Roofing Classification Tests: Roofing classification tests shall be conducted in accordance with UBC Standard 15-2 for new construction and for recognition of reroofing over existing roof covering materials. A minimum Class C classification is required.

5.2 Wind Uplift:

5.2.1 General: Recognition may be granted for use in areas subject to maximum basic wind speeds of 80 mph (129 km/h) on structures a maximum of 40 feet (12 192 mm) in height in Exposure B zones, provided the proponent can verify, in writing, that an investigation has determined that the product will perform satisfactorily when installed under these conditions. Recognition beyond these limits requires testing in accordance with Section 5.2.2.

5.2.2 Wind Uplift Tests: The test frame is composed of 2-by-4 wood studs spaced at 16 inches (406 mm) on center. The framing can be either in the long direction or in the short direction. The overall dimension of the frame shall be 4 feet (1219 mm) by 8 feet (2438 mm). The frame is covered with ¹⁵/₃₂-inch-thick (11.9 mm) plywood or ⁷/₁₆-inch-thick (11.1 mm) oriented strand board, which is fastened to the frame with 6d or 8d box nails at 6 inches (152 mm) on center. An air bladder, capable of expanding 5 inches (127 mm), is placed directly on the 4-foot-by-8-foot (1219 mm by 2438 mm) deck. The products are installed over the air bladder and fastened in accordance with manufacturer's instructions. The air bladder is connected to an air source with sufficient capacity to inflate the air bladder as well as override any leakage resulting from any fastener puncture of the air bladder. A manometer is connected to the air bladder to measure the resulting positive pressure. A minimum of five dial indicators or an equivalent measuring system are placed to monitor movement at five different locations on the test deck.

Each test assembly is loaded at a rate of 1 inch (25 mm) to 12 inches (305 mm) water column. The load is held for a minimum of one minute or until the dial indicator stabilizes. The load is removed and the rebound recorded after 2, 5, 7, 10 and 12 inches (51, 127, 178, 254, and 305 mm) water column. From 12 inches (305 mm) water column, the pressure is increased at a rate of 2 inches (51 mm) per minute until failure occurs.

Record deflection versus load for all loading. Two test assemblies are required.

Conditions of Acceptance: The lowest result is divided by a safety factor of 2 for a design pressure. The design pressure is then used to establish limits on wind speed, exposure, height and location in areas of discontinuities, in accordance with Chapter 16, Division III, of the code.

5.3 Reroofing:

5.3.1 General: Reroofing shall be in accordance with Appendix Chapter 15 of the code.

5.3.2 Roof Classification: Systems to be installed over existing roof coverings shall be shown to satisfy minimum Class C classification requirements in accordance with UBC Standard 15-2 by the installation and testing of the roof covering system over that existing roof covering.

6.0 TEST REQUIREMENTS

6.1 Flexible Roofing:

6.1.1 Dimensions and Weight: Prior to commencement of other tests, the product specimens shall be checked for shape, dimensional discrepancies, and consistency in weight. A minimum of 10 product specimens shall be individually weighed to the nearest 0.01 pound (0.0045 kg). Acceptance limits for the individual product weights shall be within ± 5 percent of the average of all 10 panels for nontextured products and within ± 10 percent for textured products.

6.1.2 Weatherometer: Weatherometer tests shall conform to Section 4.1 of AC07. Tensile and elongation tests in accordance with ASTM D 412 shall be conducted before (control) and after weatherometer (weathered) exposure. Weathered specimen results shall be greater than or equal to 90 percent of control specimen results.

6.1.3 Penetration: Penetration tests shall conform to Section 4.2 of AC07.

6.1.4 Tear Strength: Tear strength shall be in accordance with Die T (Trouser Tear) Type Tear Curves of ASTM D 624. Minimum value for each specimen shall be 1,900 grams.

6.1.5 Density: Density tests shall conform to ASTM C 373. Results for water absorption, bulk density and apparent specific gravity shall be reported for quality control purposes.

6.1.6 Freezing and Thawing: Freezing and thawing tests shall conform to Section 4.7 of AC07, except the specimens are subjected to 100 cycles of freezing and thawing. Conditions of acceptance are that there shall be no breakage of, and no greater than $1\frac{1}{2}$ percent loss in dry weight in, any individual product.

6.1.7 Tensile Strength and Elongation: Tensile and elongation tests shall conform to ASTM D 412, Section 10, Test Method A. Results are reported and used as control results for the comparisons in Sections 6.1.8 and 6.1.9 of this criteria.

6.1.8 Heat-Rain: Heat-rain tests shall conform to Section 15 of ASTM C 1185, except the radiant heat shall be $160^{\circ}\text{F} \pm 10^{\circ}\text{F}$ ($71^{\circ}\text{C} \pm 5.6^{\circ}\text{C}$) instead of $140^{\circ}\text{F} \pm 9^{\circ}\text{F}$ ($60^{\circ}\text{C} \pm 5^{\circ}\text{C}$). Tensile and elongation tests shall be conducted after heat-rain exposure in accordance with Section 6.1.7 of this criteria.

ria. Exposed specimen results shall be greater than or equal to 75 percent of the control specimen results.

6.1.9 Warm Water: Warm water tests shall conform to Section 13 of ASTM C 1185. Tensile and elongation tests shall be conducted after warm-water exposure in accordance with Section 6.1.7 of this criteria. Exposed specimen results shall be greater than 80 percent of the control specimen results.

6.1.10 Fastener Damage: Rupture and tear resistance of roofing shingles shall conform to ASTM D 4932. Specimens shall be tested at $73 \pm 4^{\circ}\text{F}$ ($23 \pm 2^{\circ}\text{C}$) and $32 \pm 4^{\circ}\text{F}$ ($0^{\circ} \pm 2^{\circ}\text{C}$). Specimens shall be conditioned at each temperature for at least two hours before testing. Using galvanized roofing nails with a $1\frac{1}{2}$ -inch-long-by-0.1205-inch-diameter (38 mm by 3.6 mm) smooth shank and a $\frac{3}{8}$ -inch-diameter (9.5 mm) head, tear and rupture results in the direction the product is stressed for wind uplift (i.e., MD or XMD direction, whichever is less), shall be reported. A minimum of five specimens shall be tested, for tear and rupture in seated and unseated conditions, at each temperature. Results shall include seated and unseated fastener values, and are used to establish fastener pattern for wind uplift resistance.

6.1.11 Installed Weight: Installed weight shall be determined by calculation using the saturated weight determined in accordance with Section 6.1.5 of this criteria and the installed conditions, or shall be determined in accordance with Section 4.5.2 of AC07.

6.1.12 Pliability Test: Five specimens are cut from the product in each direction (MD and XMD) to a 1-inch-by-8-inch (25 mm by 203 mm) size. The specimens are conditioned at a $73^{\circ} \pm 5^{\circ}\text{F}$ ($23^{\circ} \pm 3^{\circ}\text{C}$) temperature and 50 ± 3 percent relative humidity for a minimum of 24 hours. The specimens are bent over a 1-inch-thick (25.4 mm) steel mandrel through a 180-degree angle within two seconds. No cracking or delamination shall occur.

6.1.13 Permeability Test: Three products are tested for permeability. Each product is sealed along edges with suitable metal or wood framing and putty, mastic or other compound, to provide a watertight seal. All nail holes must be sealed. The frame must provide sufficient stability to provide a minimum of 2 inches (51 mm) of water head above the highest point of the product. The specimen must be supported in a horizontal position by the frame alone. The 2-inch (51 mm) water head shall be maintained for a period of 24 hours. If necessary, water must be added during the test to maintain the water level.

Conditions of Acceptance: At the end of 24 hours, there shall be no indication that water has dripped from the underside of the product. The underside may be damp as long as dripping does not occur.

6.2 Rigid Roofing:

6.2.1 Dimensions and Weight Test: Prior to commencement of other tests, the product shall be checked for shape; squareness of lugs, if any; dimensional discrepancies; and consistency in weight. Noninterlocking panels are permitted a $\frac{1}{2}$ -inch (12.7 mm) width and length tolerance before being considered off-size. A minimum of 10 products shall be individually weighed to the nearest 0.01 pound (0.0045 kg). For nontextured products, the individual product weights shall be within ± 5 percent of the average of all 10 panels; and for textured products shall be within ± 10 percent.

6.2.2 Weatherometer: Weatherometer (2,000 hours) tests shall conform to Section 4.1 of AC07, except the tensile and elongation tests are omitted.

6.2.3 Penetration: Penetration tests shall conform to Section 4.2 of AC07.

6.2.4 Flexural Strength: Flexural strength tests shall conform to Section 3.5.2 of AC07. The result must comply with Table 1 of AC07.

6.2.5 Flexural Strength (Modulus of Rupture): Flexural strength (modulus of rupture) tests shall conform to Section 5 of ASTM C 1185. The minimum saturated modulus of rupture shall be 798 psi (5498 kPa).

6.2.6 Freezing and Thawing: Freezing and thawing tests shall conform to Section 4.7 of AC07, except the specimens are subjected to 100 cycles of freezing and thawing. Conditions of acceptance are that there shall be no breakage of, and no greater than 1¹/₂ percent loss in dry weight in, any individual product.

6.2.7 Wet/Dry Cycling: Wet/dry cycling tests with fasteners on a restricted frame shall conform to Section 3.5.10 of AC07. Flexural strength tests (modulus of rupture) in accordance with Section 6.2.5 of this criteria shall be conducted on specimens after aging procedures. The mean flexural strength (modulus of rupture), after exposure, shall be at least 90 percent of values obtained on the control samples.

6.2.8 Water Absorption: Water absorption tests shall conform to Section 9 of ASTM C 1185. Results are reported for quality control purposes.

6.2.9 Heat-Rain: Heat-rain tests shall conform to Section 15 of ASTM C 1185, except the radiant heat shall be 160°F (71°C) ± 10°F (±5.6°C) instead of 140°F (60°C) ± 9°F (±5°C). Tensile (and elongation) tests in accordance with ASTM D 412 shall be conducted on specimens after heat-rain exposure in accordance with Section 6.1.7 of this criteria. Exposed specimen results shall be greater than or equal to 75 percent of values obtained on control specimens.

6.2.10 Warm Water: Warm-water tests shall conform to Section 13 of ASTM C 1185. Flexural strength (modulus of rupture) tests in accordance with Section 6.2.5 of this criteria shall be conducted after warm-water exposure.

Conditions of Acceptance: There shall be no apparent cracks, structural alteration or delamination; and exposed specimen flexural strength (modulus of rupture) results shall be greater than or equal to 80 percent of values obtained on control specimens.

6.2.11 Uplift Bend Test: For roof slopes exceeding 60 degrees from the horizontal, tests shall conform to Section 4.4 of AC07.

6.2.12 Installed Weight: Installed weight shall be calculated using the saturated weight determined in Section 6.2.8 of this criteria and the installed conditions, or shall be determined in accordance with Section 4.5.2 of AC07.

6.2.13 Permeability: Tests shall conform to Section 6.1.13 of this criteria.

7.0 QUALITY CONTROL

The products shall be produced under a quality control program administered by an inspection agency accredited by ICBO Evaluation Service, Inc., or recognized by the National Evaluation Service, Inc. A quality control manual, developed in consultation with a recognized quality control agency responsible for follow-up inspection, shall be submitted. Quality control manual requirements are noted in the ICBO ES Acceptance Criteria for Quality Control Manuals (AC10).