



June 10, 2008

TO: PARTIES INTERESTED IN EVALUATION REPORTS ON METAL ROOF COVERINGS

SUBJECT: Acceptance Criteria for Metal Roof Coverings, Subject AC166-0508-R2 (WM/CA)

Dear Madam or Sir:

Enclosed is a copy of the subject acceptance criteria approved by the ICC-ES Evaluation Committee on May 29, 2008, with an effective date of June 1, 2008.

The acceptance criteria was revised to provide provisions for the evaluation of metal roof coverings applied over spaced sheathing or spaced supports. Proposed revisions related to use of the systems as diaphragms were held for further study.

Evaluation reports issued on or after the effective date noted above, and falling within the scope of this criteria, will be required to comply with the enclosed edition of the criteria. Evaluation reports issued prior to the effective date may be in compliance either with the enclosed acceptance criteria or with the previous edition. Evaluation reports based on a superseded version of an acceptance criteria must be brought into compliance with the most recent edition at the time the reports are reissued. Therefore, applicants should submit data verifying compliance at the time they apply for re-examination.

If you have any questions, please contact Woods McRoy, P.E., Senior Staff Engineer, at (800) 423-6587, extension 5686. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,

A handwritten signature in black ink that reads 'Kurt Stochlia'.

Kurt Stochlia, P.E.
Vice President

KS/raf

Enclosure

cc: Evaluation Committee



ACCEPTANCE CRITERIA FOR METAL ROOF COVERINGS

AC166

Approved May 2008

Effective June 1, 2008

Previously approved October 2007, February 2007, July 2006, October 2005,
November 2001, March 2000

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 purpose of issuing ICC-ES evaluation reports.

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ACCEPTANCE CRITERIA FOR METAL ROOF COVERINGS

1.0 INTRODUCTION

1.1 Purpose: The purpose of this criteria is to establish requirements for recognition of metal roof coverings in ICC Evaluation Service, Inc. (ICC-ES), evaluation reports under the 2006 *International Building Code*® (IBC), the 2006 *International Residential Code*® (IRC), and the 1997 *Uniform Building Code*™ (UBC).

The reason for development of this criteria is to clarify requirements for metal roof coverings set forth in the codes and to provide guidelines for qualifying components and installation procedures that are alternates to those specified in the codes.

1.2 Scope: This criteria applies to shingles or panels manufactured from metals complying with the applicable code and installed over solid or closely fitted decking, and shingles installed over spaced sheathing and panels installed over spaced supports.

1.3 Definitions:

1.3.1 Closely Fitted Decking: Roof sheathing, dimensional lumber, or filled-in spaced sheathing with joints spaced approximately $\frac{1}{8}$ inch (3 mm).

1.3.2 Metal Roof Panel: Interlocking metal sheet having a minimum installed weather exposure of 3 square feet (0.279 m²).

1.3.3 Metal Roof Shingle: Interlocking sections of metal sheet having an installed weather exposure of less than 3 square feet (0.279 m²).

1.3.4 Nonstructural Standing Seam Metal Roof Panel: A standing seam metal roof panel used mainly as roof covering and requiring the support of an independent roof deck or solid sheathing.

1.3.5 Standing Seam Metal Roof Panel: A metal roof panel with a generally flat profile except for the raised edge or "standing seam" designed to interlock with the adjoining panel on each side.

1.4 Codes and Referenced Standards:

1.4.1 2006 *International Building Code*® (IBC), International Code Council.

1.4.2 2006 *International Residential Code*® (IRC), International Code Council.

1.4.3 1997 *Uniform Building Code*™ (UBC).

1.4.4 FM-4470-92, Approval Standard for Class I Roof Coverings, Factory Mutual.

1.4.5 ASTM International:

1.4.5.1 ASTM A 463-02a, Specification for Steel Sheet, Aluminum-Coated, by the Hot Dip Process.

1.4.5.2 ASTM A 653-04a, Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-coated Galvannealed by the Hot-Dip process.

1.4.5.3 ASTM A 755-04, Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

1.4.5.4 ASTM A 792-03, Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

1.4.5.5 ASTM A 875-02a, Standard Specification for Steel Sheet Zinc-5 percent, Aluminum Alloy-coated by the Hot-dip process.

1.4.5.6 ASTM E 72-02, Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

1.4.5.7 ASTM E 108-04, Test Methods for Fire Tests of Roof Coverings.

1.4.5.8 ASTM E 1592-01, Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

1.4.5.9 ASTM G 152-04, Practice for Operating Open-Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

1.4.5.10 ASTM G 155-04, Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials.

1.4.5.11 ASTM G 154-00a, Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

1.4.6 Underwriters Laboratories Inc.:

1.4.6.1 UL 1897-98, Uplift Tests for Roof Covering Systems—with Revisions through November 2002.

1.4.6.2 UL 790-04, Tests for Fire Resistance of Roof Covering Materials.

1.4.6.3 UL 580-94, Tests for Uplift Resistance of Roof Assemblies—with Revisions through February 1998.

1.4.7 ICC-ES Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43).

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information concerning materials, dimensions, coatings, manufacturing process and installation instructions shall be submitted.

2.1.2 Installation Instructions: Dimensioned scale drawings and details noting all thicknesses; size and location of fasteners; and installation details, including flashing and roof slope limitations, shall be submitted.

2.1.3 Packaging and Identification: Method of packaging and identifying components shall be specified. Identification shall include the ICC-ES evaluation report number and notice of any product installation limitations.

2.1.4 Field Preparation: Method of field cutting, trimming or forming, and treatment of cut edges, shall be submitted.

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

2.3 Test Reports: Test reports shall comply with AC85.

2.4 Product Sampling: Test specimens shall be sampled in accordance with the product sampling requirements of AC85. Section 3.1 of AC85 applies to tests conducted in accordance with Section 3.1.11 of this criteria. Section 3.2 of AC85 applies to all other tests.

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3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 IBC and IRC: For recognition under the IBC or IRC, the following data shall be submitted:

3.1.1 Materials: Reports of tests showing compliance with the material requirements of Sections 1507.4.3 or 1507.5.4 (IBC) or Sections R905.4.4 or R905.10.3 (IRC), as applicable. For steel products, minimum thickness requirements shall be based on the galvanized thickness. For materials other than those listed in Tables 1507.4.3 (1) and 1507.4.3(2) (IBC) or Tables R905.10.3(1) and R905.10.3(2) (IRC), the material shall be shown to be equivalent to those listed.

3.1.2 Weathering Tests: For recognition under the IBC, reports of weatherometer tests in accordance with Section 1504.6 (IBC) are required for products installed at slopes less than 2:12 (16.67%). Physical integrity shall be confirmed based on visual and physical examination of exposed test specimens.

3.1.3 Roof Slope: Minimum roof slopes shall be in accordance with Section 1507.4.2 (IBC) or Section R905.10.2 (IRC) for metal panels; or with Section 1507.5.2 (IBC) or Section R905.4.2 (IRC) for metal shingles.

3.1.4 Roof Decks: Roof decks shall comply with Section 1507.4.1 (IBC) or Section R905.10.1 (IRC) for metal panels; or with Section 1507.5.1 (IBC) or Section R905.4.1 (IRC) for metal shingles.

3.1.5 Underlayment: Underlayment shall comply with Section 1507.5.3 (IBC) or Section R905.4.3 (IRC) for metal panels not meeting the slope and seam requirements of IBC Section 1507.4.2, or metal shingles.

Exception: Underlayment is not required for metal panels or metal shingles supported by solid or closely fitted decking, provided reports of tests showing compliance with Section 4.5 of this criteria are submitted.

3.1.6 Attachment: Attachment of metal panels shall comply with Section 1507.4.4 (IBC) or Section R905.10.4 (IRC). Attachment of metal shingles shall comply with Section 1507.5.5 (IBC) or Section R905.4.5 (IRC). Recognition of attachment shall also be consistent with assemblies tested for wind resistance in accordance with Section 3.1.7 of this criteria.

3.1.7 Wind Resistance:

3.1.7.1 Metal shingles and metal panels to be installed on solid or closely fitted decking shall be tested in accordance with UL 1897. (Note: For nonstructural standing seam metal roof panel, refer to Section 3.1.7.3.) Connections to framing or to sheathing shall be based on minimum conditions (since test specimens establish a basis of acceptance). Allowable loading will be based on a minimum factor of safety of 2.0, applied to the peak load. Positive loads will be based on the adequacy of the structural framing and sheathing.

Metal shingles to be installed on spaced sheathing and metal panels to be installed on spaced supports shall be tested in accordance with UL 580, ASTM E 1592 or UL 1897. Connections to framing or to sheathing shall be based on minimum conditions (since test specimens establish a basis of acceptance). Allowable loading will be based on a minimum factor of safety of 2.0, applied to the

peak load. Testing shall be for both positive and negative loads.

Testing for gravity loads (Section 3.1.8) may be substituted for positive wind load testing. When using gravity load testing, the allowable positive wind load will be based on a minimum factor of safety of 2.0, applied to the average peak load.

3.1.7.2 The roof coverings shall be designed for wind loads in accordance with Chapter 16 of the IBC.

3.1.7.3 Nonstructural standing seam metal roof panels to be installed on solid wood sheathing shall be tested for wind resistance in accordance with Section 4.10. Allowable wind uplift resistance shall be based on a safety factor of 2 applied to the highest uplift pressure that is sustained for a minimum of one minute, meeting the conditions of acceptance in Section 4.10.4.

3.1.8 Gravity Loads: For shingles applied to spaced sheathing and panels applied to spaced supports, the maximum allowable gravity load on the shingles shall be determined by standard engineering methods in accordance with the applicable materials design standard or by testing in accordance with Section 4.1. The maximum allowable load, when based on testing, shall be the lesser of the average ultimate load determined in accordance with Section 4.1 divided by 2.5 or the least load causing a shingle or panel deflection of $l/60$.

As an alternative, the ICC-ES Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43) may be used to determine the maximum allowable gravity loads on the roof covering system.

3.1.9 Flashing: Flashing shall comply with Sections 1503.2 and 1503.3 (IBC) or Sections R903.2 and R903.3 (IRC) for metal panels; or with Sections 1503.2, 1503.3 and 1507.5.6 (IBC) or Sections R903.2, R903.3 and R905.4.6 (IRC) for metal shingles.

3.1.10 Impact Resistance: For recognition under the IBC, metal panels installed at roof slopes below 2:12 (16.67%) shall comply with the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470.

3.1.11 Fire Classification:

3.1.11.1 New Construction: Roofing assemblies shall be tested in accordance with either ASTM E 108 or UL 790.

EXCEPTIONS:

1. Ferrous and copper panels and shingles are Class A roof coverings in accordance with the exception to Section 1505.2 of the IBC and Section R902.1 of the IRC.

2. Under the IRC, metal panels and shingles are Class A roof coverings in accordance with Section R902.1 of the IRC.

3. Under the IBC, metal panels and shingles are Class B roof coverings in accordance with the exception to Section 1505.3 (IBC).

4. Under the IBC, nonclassified roofing in accordance with Section 1505.5 (IBC) and as permitted in Table 1505.1 (IBC).

3.1.11.2 Reroofing: Metal panels and shingles are permitted to be installed over existing roofs, provided the

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requirements of Section 1510 of the IBC or Section R907 of the IRC, as applicable, are met. The roof classification will be as noted in Section 3.1.11.1.

3.2 UBC: For recognition under the UBC, reports of the following shall be submitted:

3.2.1 Weatherometer tests in accordance with Section 4.1 of this criteria.

EXCEPTION: Not required when a steel roof covering utilizing a paint system in accordance with ASTM A 755, applied over steel with a corrosion-resistant coating in accordance with ASTM A 792, ASTM A 875, ASTM A 463, or ASTM A 653, is specified.

3.2.2 Penetration tests in accordance with Section 4.3 of this criteria.

3.2.3 Wind uplift data in accordance with Section 4.4 of this criteria.

3.2.4 Wind-driven rain tests in accordance with Section 4.5 of this criteria.

EXCEPTION: Not required when an underlayment of at least two layers of Type 15 or one layer of Type 30 felt and a solid substrate are specified.

3.2.5 Uplift-bend tests in accordance with Section 4.6 of this criteria are required for roof slopes exceeding 60 degrees from the horizontal and when tile or panel butts are not mechanically fastened or interlocked with the preceding course.

3.2.6 Materials data in accordance with Section 4.7 of this criteria.

3.2.7 Roof classification tests in accordance with Section 4.8 of this criteria.

EXCEPTIONS:

1. Roof construction recognized as nonrated.
2. Noncombustible roof coverings as specified under Section 1504.2 of the UBC.

3.2.8 Special installation requirements in accordance with Section 4.9 of this criteria.

4.0 TEST METHODS

4.1 Gravity Loads: Testing for gravity loads shall be in accordance with the bag method of ASTM E 72, Section 11, for three test specimens. Testing need only be performed in one direction on the assembly, consistent with the direction of the gravity loads on the in-place roof covering. The test specimen shall be of sufficient size to test connections or overlaps between shingles as applicable, or a minimum of 4 feet by 8 feet (1219 by 2438 mm), whichever is larger.

4.2 Weatherometer Test: When testing is required by Section 3.2.1, weather-exposed coatings applied over corrosion-resistant metal roof coverings complying with Section 1507.8 of the UBC shall be tested in accordance with this section.

4.2.1 Sample: Ten representative samples of the product shall be used, of which five shall be held as controls.

4.2.2 Apparatus: Tests shall be conducted in accordance with ASTM G 152-04, Cycle 1, Table X1.1,

ASTM G 154-00a, Cycle 5, Table X2.1, or ASTM G 155-04, Cycle 1, 5, or 9, Table X3.1.

4.2.3 Procedure: The test shall be run for a period of 2,000 hours. Specimen condition, examined under 5x magnification, may be reported at the end of 500, 1,000, and 1,500 hours of exposure, and is required after 2,000 hours.

4.2.4 Conditions of Acceptance: Surface changes do not result in cracking, checking, crazing, erosion, or chalking.

4.3 Penetration Tests: Determines adequacy under intermittent foot traffic.

4.3.1 Sample: Five representative samples shall be used.

4.3.2 Apparatus: A 3-inch-diameter (76 mm) steel plate with rounded corners. A device capable of imposing a 200-pound (890 N) load, and a measuring device capable of determining surface penetration to the nearest hundredth of an inch (0.025 mm).

4.3.3 Procedure: The test specimens shall consist of the roof covering and representative compressible insulation if used in the roof covering assemblies to be recognized. Specimens shall be continuously supported by a rigid backing such as concrete. The 200-pound (890 N) load is imposed on the plate which is centered on the specimen. The surface penetration shall be determined to the nearest hundredth of an inch (0.025 mm). The superimposed load is reduced to zero and reloaded a minimum of four additional times, with penetration and residual readings taken each time without removing the plate. The specimen shall be inspected after the test and the condition at the steel plate interface noted.

4.3.4 Condition of Acceptance: There shall be no tearing or cracking of the protective coating, causing exposure of the plastic, glass fibers, foam or other compressible materials; or excessive permanent deformation under the applied load, resulting in unsatisfactory performance of the roof covering.

4.4 Wind Uplift: Recognition may be granted for use in areas subject to a maximum basic wind speed of 80 mph (129 km/h) on structures a maximum of 40 feet (12 192 mm) in height in Exposure B areas, provided the proponent can verify, in writing, that he has investigated and determined that his product will perform satisfactorily when installed under these conditions. Recognition for use in areas beyond these limits shall be justified by tests conducted in accordance with Section 3.1.7 of this criteria.

4.5 Wind-driven Rain Test:

4.5.1 General: The test frame shall be approximately 10 feet by 10 feet (3048 mm by 3048 mm) and hinged at the lower end to permit roof pitch variations. It shall be rigidly supported during the test. The test specimen shall be sized to fill the area within the test frame as completely as possible. Components shall be conditioned to have an initial moisture content representative of field conditions.

Components shall be trimmed as necessary to fit within the test frame and to provide pitched, vertical and horizontal joints, if this is the practice. Components shall be laid in accordance with installation instructions that shall be a part of the laboratory report. Batten lifts removed while cutting peripheral tile shall be simulated with suitable packing.

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Gaps along the frame and unused nail holes shall be sealed with a suitable compound. The frame shall not be erected against the side of a higher building or other solid surface where normal airflow over the specimen can be affected.

The airflow over the test frame shall be directed and smoothed by suitably shaped baffles. The airstream velocity measured on a vertical plane midway between the upper and lower edge of the test specimen on a 24-inch (610 mm) grid shall be within the required axial velocity. The test report shall include the wind velocity profile developed on the 24-inch (610 mm) grid basis. The axial velocity over the test section shall be monitored with a calibrated vane-type velocimeter mounted approximately 6 feet (1829 mm) downstream of the wind source at the midheight of the panel.

The velocimeter readings shall be taken with a stopwatch using a minimum 1-minute duration. The wind velocity is maintained between 35 and 40 miles per hour (56 and 64 km/h), and water is introduced into the wind stream.

4.5.2 Apparatus:

4.5.2.1 Wind Source: Airflow over the test rig shall be calibrated as previously indicated.

4.5.2.2 Water Supply: A sprinkle-pipe system, mounted on a movable frame capable of simulating a uniform 6-inch-per-hour (152 mm/hr) rainfall as monitored with flow gages calibrated in cubic feet per second, is an example of an acceptable system.

Uniform distribution of simulated rainfall requires calibration of water flow gages, monitoring the water supply to ensure sufficient distribution over the test specimen surface at each specified pitch, proper orientation and air-speed. The simulated rain striking the test specimen shall be uniformly distributed within a 20 percent variation over the test deck.

Distribution and calibration of water flow may also be determined by the following method: A shallow tray is attached to the test rig in place of the test specimen. The tray bottom is covered with a layer of thick absorbent paper (high-wet-strength, extra-thick, white filter paper) that has been weighed and lined to form 12-inch (305 mm) squares. At the required wind velocity, water is fed into the airstream at a suitable rate, indicated by the flow-rate meters, for a time sufficient to wet but not saturate the paper. The air and water flows are then stopped, and the paper is removed and cut into squares. Each square is weighed. Using the initial average dry weight and sample weight after exposure, the amount of water striking the test area, and the distribution, can be determined. The test is repeated with different flow meter settings at the same air velocity, to determine if distribution is affected by water flow. A chart shall then be prepared, for review and future reference, that describes the simulated-rain distribution for each flow meter setting, pitch and orientation. When the simulated-rain distribution is determined, calibration may be made by collecting water falling into a sealed box gasketed and clamped to the underside of the test rig when the test specimen frame is left open. The volume of water collected in the box over a suitable time interval serves as a check for the required flow. This method allows water to be collected over a longer period or allows water to be measured continuously as it is drained from the test rig box.

4.5.3 Procedure: The underside of the test specimen shall be photographed immediately prior to starting tests.

The airflow shall be between 35 and 40 miles per hour (56 and 64 km/h), with velocity and pressure differentials across the test surface measured and recorded. The pressure distribution across the surface shall be measured at not less than 10 points.

The water supply rate shall be adjusted for a simulated rainfall of 6 inches (152 mm) per hour.

The roof slope should be the flattest proposed for installation.

For tile and panel roofing materials, a slope of 3:12 is used. The test shall commence at the specified airspeed with three cycles of simulated rainfall of 15 minutes each, with the wind generator stopped for 5 minutes after each cycle to allow observation and recording of the specimen condition. The condition of joints (as viewed from the underside) shall be reported after each rainfall insofar as water infiltration is concerned. Damage, if any, to specimens and fasteners shall also be reported. Upon completion of the test, components shall be dismantled and condition of lapped areas and undersurfaces noted and photographed.

4.5.4 Conditions of Acceptance: There can be no leaks. The test report shall indicate the extent of tile or panel fluttering during the test periods and whether it was due to oversized nail holes or loosening fasteners.

4.6 Uplift-bend Test:

4.6.1 General: The test specimen is a roof, four courses high and four tiles (minimum) or panels wide. Spaced or solid sheathing over typical roof framing, using minimum-size components, shall be used to typify field conditions. Fastener loads cannot exceed approved allowable values. Where allowable values are not available, load shall be based on a minimum factor of safety of 4, unless allowed otherwise. The test roof shall be erected and secured in a vertical position for testing, with the required loads applied horizontally. The horizontal load is applied at the center of the butt edge of an inner tile or panel in the second course from the bottom of the test specimen. The loads required to lift the tile butt a distance of $\frac{1}{8}$ inch (3.2 mm) and 2 inches (51 mm) are to be recorded. The latter is considered to be ultimate load. If failure occurs before the 2-inch (51 mm) movement, the method of failure shall be recorded. The same procedure is repeated for the butt edge of an inner tile or panel in the top course of the test structure, recording the same loads. The test is continued with a load equal to three times the tile weight applied horizontally outward and vertically downward at the center of the butt edge of an inner tile in the second course from the bottom of the test deck.

4.6.2 Condition of Acceptance: The load required to lift the tile butt $\frac{1}{8}$ inch (3.2 mm) shall be a minimum of twice the weight. When subjected to a load equivalent to three times the tile weight, the tile shall not crack, break or fall off the specimen deck.

4.7 Materials: The metal shall be corrosion-resistant as defined in Section 1502 of the UBC. Test reports demonstrating compliance with standards satisfying this definition are required.

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4.8 Roof Classification Test: When required by Section 3.2.7, fire-retardant roof tests conducted in accordance with UBC Standard 15-2 and this criteria are necessary for metal shingles and metal tiles. Testing is also necessary for all reroofing over existing roof covering materials if such recognition is requested.

Roof underlayments necessary for obtaining the classification in the tests shall be manufactured under a listing program of an accredited agency or be recognized in a current ICC-ES evaluation report.

4.8.1 Calibration: The calibration procedure shall be in accordance with UBC Standard 15-2, except that a calibrated vane-type velocimeter shall be used with a calibrated stopwatch to obtain an average wind velocity. Direct reading velocimeters are not acceptable because of wind speed fluctuations.

4.8.2 In addition to the information on items in Sections 2.3 and 2.4 of this criteria, the test report shall also include a description of the flame front, based on observation by laboratory personnel. This includes extent of the flame front at the upper deck edge and separate comment on licks of flame beyond. Distribution of flame across the deck shall also be reported. Additionally, an isometric view of the test decks, with cross-sections noting side laps, head laps, felt installation, and thicknesses, and showing details of joint treatment, etc., shall be included.

4.9 Special Installation Requirements: For use in areas subject to wind-driven snow, ice build-up, wind-driven dust or sand or other areas as designated by the proponent or building official, installation instructions must specify both of the following:

1. Solid sheathing with two layers of Type 15 felt or one layer of Type 30 felt for the field of the roof.

2. Solid sheathing with two layers of Type 15 felt applied shingle-fashion, solid-cemented together with approved cementing material between the plies, extending from the eave up to the roof to a point 36 inches (914 mm) inside the exterior wall line of the building.

4.10 Wind Uplift Resistance of Nonstructural Standing Seam Metal Roof Panels: Nonstructural standing seam metal roof panels to be installed on solid wood sheathing shall be tested in accordance with UL 580, modified to add the following considerations:

4.10.1 Sample: One roof assembly or test specimen shall be constructed and tested for each fastening condition.

4.10.2 Apparatus: Sheathing shall be a minimum of $15/32$ -inch-thick plywood. Supporting members shall be provided, such as joists, braces and perimeter framing, that is representative of the construction for which classification is desired. Test roof assemblies shall be installed such that the measured pressure differential shall occur between the top of the sheathing and the top of the metal roof panel.

Over the sheathing and under the metal roof panels, underlayment shall be omitted, and a loose-fitting, pleated, 4-mil plastic film shall be provided to assist in obtaining uniform pressure on the metal roof panels. The standing seam panels shall be secured through the plastic film into the plywood sheathing with anchor clips, in accordance with the manufacturer's installation instructions.

4.10.3 Procedure: The test assembly shall be subjected to positive and negative pressures at the values and time duration given for the Class 30, 60, and 90 classifications. Subsequent to the completion of Phase 5 of the Class 90 test sequence, the test specimen may be subjected to supplemental static uplift pressures at the option of the manufacturer. If additional testing is desired:

- The negative pressure in the vacuum chamber shall be maintained at 56.5 psf (2.71 kPa).

- The static uplift pressure shall be supplied from below. The initial positive static uplift pressure shall be 63.5 psf (3.04 kPa). Subsequent pressure intervals shall increase in increments of 15 psf (0.72 kPa), with each pressure level held for one minute, until failure or until the desired uplift pressure is attained. The allowable uplift pressure shall be based on the safety factor as noted in Section 3.1.7.4.

4.10.4 Conditions of Acceptance: There shall be no buckling of metal panels that results in permanent loss of stiffness as determined by separate load tests comparing buckled and unbuckled panels. There shall be no separation of components or permanent distortion on any of the metal panels. There shall be no sidejoint disengagement. There shall be no failure of one or more fasteners of any type.

5.0 QUALITY CONTROL

5.1 Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted.

5.2 Unless required by Section 5.4, third-party follow-up inspections are not required under this acceptance criteria.

5.3 The documentation shall contain sufficient detail to verify that each type of metal complies with that specified in the evaluation report. Mill certificates shall verify that all metal, mechanical, chemical and corrosion resistance properties comply with standards specified in the evaluation report. When required by Section 2217 of the UBC, verification of steel ductility shall be included. As an alternative, metal tiles shall be drawn from each production shift and be tested to demonstrate compliance with the standard specified in the evaluation report. Quality control tests, and conditions of acceptance for coatings applied to metal, shall be specified in the documentation. Additionally, the dimensions shall be checked periodically to ensure that when installed in a specific manner, a uniform and tight installation is achieved. Complete records of all mill certificates, independent laboratory tests and in-house tests shall be retained on file for a minimum of two years.

5.4 Roofing assemblies listed as Class A, B or C as determined by test shall be produced 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. Quality control documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted. The quality control program shall ensure the ongoing compliance of the roof coverings with the requirements of ASTM E 108 or UL 790, as applicable.

EXCEPTIONS TO INSPECTIONS BY AN ACCREDITED AGENCY:

1. Under the IBC and the IRC, ferrous and copper panels and shingles that are Class A roof coverings in

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accordance with the exception to Section 1505.2 of the IBC and Section R902.1 of the IRC.

2. Under the IRC, metal panels and shingles that are Class A roof coverings in accordance with Section R902.1 of the IRC.

3. Under the IBC, metal panels and shingles that are Class B roof coverings in accordance with the exception to Section 1505.3 of the IBC.

4. Under the IBC, nonclassified roofing that is in accordance with Section 1505.5 of the IBC and as permitted in Table 1505.1 of the IBC.

5. Under the UBC, roof construction recognized as nonrated.

6. Under the UBC, roof constructions complying with the exception for a noncombustible roof covering under Section 1504.2 of the UBC.

6.0 EVALUATION REPORT RECOGNITION

Reports on shingles applied to spaced sheathing with allowable gravity loads of less than 48 psf (2.3 kPa), shall include a condition of use stating that the shingles must not be used in applications subject to the 300-pound (1.3 kN) concentrated load specified in IBC Sections 1607.4 and 1607.11 and IBC Table 1607.1 Item 30. ■