FM Approvals

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Examination Standard for Class 1 Steep Slope Roof Covers

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Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product

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1 INTRODUCTION

1.1 PURPOSE

1.1.1 This standard states testing and certification requirements for Class 1 steep slope roof covers. Steep slope roof covers are manufactured in various forms of shingles or tiles.

1.1.2 Testing and certification criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up program.

1.2 SCOPE

1.2.1 This standard applies to any shingle or roof tile manufactured for use in steep slope roof systems. Testing includes wind resistance, interior and exterior fire resistance, and impact resistance.

1.2.2 Steep slope roofing is defined as a roof slope with an incline of > 2 units per 12 units (9.50).

1.3 BASIS FOR REQUIREMENTS

1.3.1 The requirements of this standard are based on experience, research and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions and/or loss control specialists was also considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of steep slope roofing systems for the purpose of obtaining certification. Steep slope roofing systems having characteristics not anticipated by this standard may be certified if performance equal, or superior, to that required by this standard is demonstrated.

1.4 BASIS FOR CERTIFICATION

Certification is based upon satisfactory evaluation of the product and the manufacturer in the following major areas:

1.4.1 Examination and tests on production samples shall be performed to evaluate

- the suitability of the product;
- the performance of the product as specified by the manufacturer and required for certification; and as far as practical,
- the durability and reliability of the product.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures is made to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 BASIS FOR CONTINUED CERTIFICATION

The basis for continual certification may include, but is not limited to, the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the certification report;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agencies product surveillance program.

1.6 EFFECTIVE DATE

The effective date of this certification standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is eighteen (18) months after the publication date of the standard for compliance with all requirements.

1.7 SYSTEM OF UNITS

Units of measurement used in this Standard are United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Conversion of U.S. customary units is in accordance

1.8 NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies.

ANSI/IEEE/ASTM SI 10, American National Standard for Metric Practice

ANSI FM 4473, American National Standard for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls

ANSI FM 4474, American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures

ASTM D 3161, Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method). Text in this standard has been extracted, with permission, from ASTM D 3161, copyright ASTM International, 100 Barr Harbor Drive, West Conshocken, PA 10428. A copy of the complete standard may be obtained from ASTM (**www.astm.org**).

ASTM E 108, Standard Test Methods for Fire Tests of Roof Coverings

ASTM G154, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

NFPA 276, Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-Deck Roofing Components

1.9 TERMS AND DEFINITIONS

For purposes of this standard, the following terms apply:

Composite Shingles – shingles manufactured from compounds other than asphalt with fabric reinforcements that are molded to shape.

Interlocking Shingles – individual asphalt reinforced organic or fiberglass mat shingles manufactured with interlocking tabs that allow subsequently, installed shingles to be held in place by interlocking or weaving a shingle with the adjacent shingle rather than nailing in place.

Self-Sealing Shingles – *shingles manufactured with asphalt and reinforced with an organic or fiberglass mat containing an adhesive strip or spot that adheres the shingle to the overlapping shingle*

Metal Roof Tiles *– formed metal shaped into individual shingles or shingle panels in a variety of profiles installed in overlapping rows to cover the fasteners that secure the rows below.*

Roof Tiles *– individual shingles manufactured from clay, stone/slate or concrete tiles installed in overlapping rows to cover the fasteners that secure the row below.*

2 GENERAL INFORMATION

2.1 PRODUCT INFORMATION

Steep slope roof covers are supplied in several forms including, self-sealing, interlocking and tab fastened. They may be fabricated as single or multiple units joined together. The steep slope roof covers are usually manufactured from asphalt, composite materials, metal, cement or clay. Other designs meeting the criteria of this standard may also be considered for certification. Steep slope roofing materials may be installed in either overlapping rows or courses with the fastened edge concealed from exposure to the weather.

2.2 CERTIFICATION APPLICATION REQUIREMENTS

The manufacturer shall provide the following preliminary information with any request for certification consideration:

- a complete list of all models, types, sizes, and options for the products or services being submitted for certification consideration;
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, brochures, sales literature, spec. sheets, installation and maintenance procedures, etc.
- the number and location of manufacturing facilities.

All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.

2.3 REQUIREMENTS FOR SAMPLES FOR EXAMINATION

2.3.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing based on the following:

- Sample requirements to be determined by the certification agency.
- Production of steep slope roofing samples must be witnessed by a representative of the certification agency prior to submission for testing.

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of the certification agency.

2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the roof covers.

3 GENERAL REQUIREMENTS

3.1 REVIEW OF DOCUMENTATION

3.1.1 During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The certification examination results may further define the limits of the final certification.

3.2 MARKINGS

3.2.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- Name and address of the manufacturer or marking traceable to the manufacturer;
- Date of manufacture or code traceable to date of manufacture or lot identification;
- Product name, size, etc., as appropriate.

When hazard warnings are needed, the markings should be universally recognizable.

3.2.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.

3.2.3 The certification agency's mark of conformity shall be displayed visibly and permanently on the product and/or packaging as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.

3.2.4 All markings shall be legible, durable.

3.3 MANUFACTURER'S INSTALLATION AND OPERATION INSTRUCTIONS

3.3.1 The manufacturer shall

- prepare instructions for the installation, maintenance, and operation of the product;
- provide facilities for repair of the product and supply replacement parts, if applicable; and
- provide services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance.

3.4 CALIBRATION

3.4.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.

3.4.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of thus equipment.

4 PERFORMANCE REQUIREMENTS

4.1 SIMULATED WIND RESISTANCE TESTING

4.1.1 Simulated Wind Resistance Testing shall be conducted in accordance with ASTM D3161, Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan Induced Method).

4.1.2 Conditions of Acceptance for ASTM D3161 Testing

A minimum of two test panels shall possess adequate physical properties to resist a minimum wind speed of 110 mph (177 km/h) Class F. Any one or more full tab products shall not lift from the deck beyond perpendicular, tear loose or disengage.

OPTIONAL Following the completion of the 110 mph (177 km/h) Class F testing, the velocity may be increased to achieve a higher rating as follows. The velocity will be increased in 10 mph (16 km/h) increments, each for a duration of 10 minutes, until the 150 mph (241 km/h) test has been completed, or the test panel fails as indicated above.

4.1.3 For substrates used in new construction, testing for wind resistance of the substrate shall also be performed in accordance with ANSI/FM Approvals 4474, Evaluating the simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential pressures. The tests shall include the 12 x 24 ft (3.7 x 7.3 m) simulated wind uplift pressure test. The minimum resistance required for certification is Class 1-60 psf (2.9 kPa). Ratings are available in increments of 15 psf (0.7kPa).. The rating assigned to the assembly shall be the maximum simulated uplift resistance pressure which the assembly meets the below acceptance criteria for one (1) minute without failure.

4.1.4 Conditions of Acceptance for ANSI/FM Approvals 4474 12 x 24 ft (3.7 x 7.3 m) Simulated Wind Uplift Pressure Test

All substrates shall:

a) maintain their structural integrity during the entire classification period;

b) not fracture, split, crack or allow for fastener withdrawal.

4.2 FIRE SPREAD FROM ABOVE THE ROOF DECK

4.2.1 Testing for fire spread from above the roof deck shall be in accordance with ASTM E108, Standard Test Methods for Fire Tests of Roof Coverings. The tests shall include spread of flame, intermittent flame, and burning brand as applicable.

4.2.2 Conditions of Acceptance for Fire Spread Above the Roof Deck

A rating of Class A, B or C is obtained according to this test procedure. The Class A test shall include two Spread of Flame, Two Intermittent Spread of Flame and four Burning Brand test samples. Class B and Class C tests include two samples for each test.

During the Spread of Flame tests, there shall be no burning particles blown off the test assembly that continue to glow after reaching the floor.

During the intermittent flame exposure or burning brand test, there shall be no flaming on the underside of the deck.

Intermittent and burning brand are only conducted on combustible deck assemblies.

4.3 FIRE SPREAD FROM BELOW THE ROOF DECK

4.3.1 Testing for fire spread from below the roof deck shall be conducted in accordance with NFPA 276 Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-Deck Roofing Components.

4.3.2 Conditions of Acceptance for Fire Spread from Below the Roof Deck

4.3.2.1 The roof assembly, when subjected to the NFPA 276 test, shall not exhibit fuel contribution rates in excess of the values shown in the following table.

Time Interval	***Maximum Fuel Contribution Rate***	
Min	***Btu/ft²/min***	***(kW/m²)***
3	410	(77.6)
5	390	(73.8)
10	360	(68.1)
Avg. (30 min)	285	(54.0)

There shall be no dropping of flaming particles into the furnace or uncontrolled flaming on the exterior surface of the sample during the NFPA 276 test.

4.4 HAIL DAMAGE RESISTANCE

4.4.1 Testing in accordance with ANSI FM 4473, American National Standard for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls shall be used to grant ratings of Class 2, 3, or 4 as described in ANSI FM 4473. A modified version of ANSI FM 4473, as described below shall be used to grant a Very Severe Hail (VSH) rating.

In order to qualify as certified, steep slope roofing materials must possess adequate physical properties to demonstrate impact resistance performance as it relates to hailstorms when evaluated in accordance with ANSI FM 4473 American National Standard for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls. Minimum acceptable performance is Class 2 nominal 1½ in. (38.1 mm) diameter ice ball. Classifications also include Class 3 nominal 1-3/4 in. (44.5 mm), and Class 4 nominal 2.0 in. (50.8 mm). Certification is contingent upon two successful test specimens meeting the acceptable criteria to qualify for the given classification. Testing for a VSH rating is conducted per ANSI FM 4473 with the following changes: Testing is performed with Class 4 nominal 2.0 in. (50.8 mm) diameter ice balls. The test samples are weathered prior to testing. Certification is contingent upon three successful test specimens meeting the acceptable criteria.

The Impact Resistance Test Apparatus consists of a launcher device capable of propelling frozen ice balls at speeds necessary to develop the intended kinetic energy and a speed meter capable of measuring ice balls speeds within 1 mph (1.6 km/h).

Class	***Nominal Ice Ball Diameter (in. [mm])***	***Kinetic Energy (ft-lb [J]) Target***	***Kinetic Energy (ft-lb [J]) + 10%***
2	1-1/2 (38.1)	7.77 (10)	8.55 (12)
3	1-3/4 (44.5)	14.95 (20)	16.5 (22)
4	2.0 (50.8)	26.81 (36)	29.5 (40)
VSH	2.0 (50.8)	53 (72)	58 (79)

A minimum of two test panels for Class 2, Class 3 or Class 4 shall be tested. A minimum of three test panels for VSH shall be tested. The first VSH test panel is tested with no conditioning, the second after 1000 hours Ultra Violet (UV) conditioning and the third following 1000 hours UV and 1000 hours Heat Conditioning. UV conditioning shall be conducted in accordance with ASTM G154 Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

For heat aging, non-asphaltic shingles are conditioned at 240 ± 5°F (116 ± 3°C) and asphaltic shingles are conditioned at 160 ± 5°F (71 ± 3°C).

4.4.2 Conditions of Acceptance for Hail Damage Resistance

Test panels with shingles shall have no visual evidence of punctures, splits, fractures, disengagement of lap elements or exposure of composition materials after direct impact from the freezer ice ball.

4.5 ADDITIONAL TESTS

Additional tests may be required, at the discretion of the certification agency, depending on design features and results of any foregoing tests.

4.6 RE-TESTING

A re-test following a failure shall be acceptable only at the discretion of the certification agency and with a technical justification of the conditions or reasons for failure.

5 OPERATIONS REQUIREMENTS

5.1 DEMONSTRATED QUALITY CONTROL PROGRAM

5.1.1 A quality assurance program is required to assure that subsequent steep slope roofing materials produced by the manufacturer shall present the same quality and reliability as the specific sample(s) examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests and may be documented in the certification report.
- Continued conformance to this standard is verified by certifier's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1.2 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines;
- incoming quality assurance, including testing;
- in-process quality assurance, including testing;
- final inspection and tests;
- equipment calibration;
- drawing and change control;
- packaging and shipping; and
- handling and disposition of non-conforming materials.

5.1.3 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records be maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

5.1.5 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the certification report, may be required to be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

5.2 SURVEILLANCE AUDIT

5.2.1 An audit of the manufacturing facility may be part of the certification agencies surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to ensure a uniform product consistent with that which was tested and certified.

5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency

5.3 MANUFACTURER'S RESPONSIBILITIES

5.3.1 The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

6 BIBLIOGRAPHY

ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories.