



Member of the FM Global Group

Examination Standard for Steep Slope Building Integrated Photovoltaic 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 steep slope building integrated photovoltaic roof covers that are installed as the roof covering.
- 1.1.2 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

- 1.2.1 This standard applies to all building integrated steep slope photovoltaic roof covers that are installed as the roof covering.
- 1.2.2 Steep slope roofing is defined as a roof slope with an incline of > 2 units per 12 units (9.50).
- 1.2.3 This standard evaluates steep slope building integrated photovoltaic roof covers for their performance in regard to fire from above and below the structural deck, simulated wind uplift, susceptibility from hail damage, electrical safety and electrical performance. The standard is intended to evaluate only those hazards investigated and is not intended to determine suitability for the end use of a product.
- 1.2.4 This standard only addresses the photovoltaic roof covers and does not address any other electrical component utilized to supply the generated electrical power to the facility.
- 1.2.5 This standard does not evaluate flexible or rigid photovoltaic modules installed on low slopes roofs.

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 photovoltaic roof covers for the purpose of obtaining certification. Products having characteristics not anticipated by this standard may be certified if performance is 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, when used as part of a certified roof assembly, 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 for use in a roof assembly;
 - the performance of the product as part of a roof assembly as specified by the manufacturer and required for certification;
 - the durability and reliability of the product.

- 1.4.2 Steep slope photovoltaic roof covers shall be fabricated, tested and certified in accordance with recognized, international standards per current edition of either IEC/EN 61730-2 or ANSI/UL 1703 for electrical safety and IEC/EN 61215-1, IEC/EN 61215-1-1, IEC/EN 61215-1-2, IEC/EN 61215-1-3, IEC/EN 61215-1-4 and IEC/EN 61215-2 for electrical performance.
- 1.4.3 An examination of the manufacturing facilities and audit of quality control procedures may be conducted 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 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 by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this examination 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 with ANSI/IEEE/ASTM SI 10.

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.

American Iron and Steel Institute (AISI)

- AISI S100, *North American Specification for the Design of Cold-Formed Steel Structural Members*

American National Standard Institute (ANSI)

- ANSI/FM 4473, *Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls*

- ANSI/FM 4474, *Evaluating the Simulated Wind Uplift resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures*
- ANSI/UL 1703, *Flat Plate Photovoltaic Modules and Panels*

American Society for Testing and Materials (ASTM International)

- ASTM E108, *Standard Test Method for Fire Tests of Roof Coverings*
- ASTM D3161, *Standard Test Method for Wind-Resistance of Steep Slope Roofing Products*
- ASTM G154, *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*

International Electrotechnical Commission (IEC)

- IEC/EN 61215-1, IEC/EN 61215-1-1, IEC/EN 61215-1-2, IEC/EN 61215-1-3, IEC/EN 61215-1-4 and IEC/EN 61215-2, *Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval*
- IEC/EN 61730-2, *Photovoltaic (PV) module safety qualifications – Part 2: Requirements for Testing*

FM Approvals LLC (FM)

- FM 4451, *Examination Standard for Profiled Steel Panels for Use as Decking in Class 1 Insulated Roof Construction.*

National Fire Protection Association (NFPA)

- NFPA 276, *Standard Method of Fire Test 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:

Adhesive – Adhesive is used in construction to adhere components together. Depending on the use, the adhesive could be in either a liquid form, semi liquid form, reactive liquid form or a solid form as in a tape or as in hot asphalt which is solid until heated.

Building Integrated Photovoltaics – Device that converts solar energy into electricity that are also used to replace conventional building materials such as roofing shingles.

Crack – During testing, when a component is stressed to the point that it separates from itself while continuing to maintain the applied uplift pressure without catastrophic failure of the test assembly.

Crease - During testing, when a component is stressed to the point that it bends at a sharp, defined angle, without breaking. Often a crack will form on the opposite face of the component.

Deck - The structural component of the roof assembly to which the roof system is secured.

Fasteners - A mechanical securement device used alone or in combination with a stress distributor to secure various components of a roof assembly.

Mechanically Fastened - Mechanically fastened describes components of the roof assembly that have been attached to the substrate at defined intervals using fasteners with, or without, stress distributors.