



Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction

Class Number 4470

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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 single-ply, polymer-modified bitumen sheet, built-up roof (BUR) and liquid applied roof assemblies.
- 1.1.2 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 surveillance program.

1.2 Scope

- 1.2.1 This standard applies to all single-ply, polymer-modified bitumen sheet, BUR and liquid applied roof assemblies intended to protect the building and its occupancy from the weather elements of nature.
- 1.2.2 The performance of a roof assembly depends on all components that make up the assembly, beginning with the deck and its securement to the structure to the uppermost layer exposed to the weather. It is therefore necessary to evaluate the entire roof assembly as a single entity.
- 1.2.3 This 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 evaluates single-ply, polymer-modified bitumen sheet, BUR and liquid applied roof assemblies for their performance in regard to fire from above and below the structural deck, simulated wind uplift, susceptibility to hailstorm damage, water leakage, foot traffic, corrosion of metal parts, susceptibility to heat damage, puncture resistance (optional) and solar reflectance (optional). An optional noncombustible core rating for roof insulation is also included.

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 and loss control specialists was also considered.
- 1.3.2 Meeting these requirements will qualify a single-ply, polymer-modified bitumen sheet, BUR or liquid applied roof assembly as certified. A certified roof assembly is not a significant fire hazard and can withstand wind uplift forces, hail stones, etc., when installed in accordance with all certification requirements. Products and assemblies which meet all the requirements identified in this standard may not be certified if other conditions which adversely affect performance exist or if the intent of this standard is not met. Certification requirements prohibit substitution of components in the roof assembly without prior authorization from the certification agency.
- 1.3.3 Products and assemblies having characteristics not anticipated by this standard which do not conform to these requirements shall be permitted to be certified if performance equal, or superior, to that required by this standard is demonstrated, or they meet the intent of this standard.

1.4 Basis for Certification

Certification is based upon satisfactory evaluation of the product when used in a roof assembly and the manufacturer in the following major areas:

- 1.4.1 Examination and tests on production samples to evaluate:
 - the suitability of the component product for use in a roof assembly;

- the performance of the component product as part of a roof assembly as specified by the manufacturer and required by the certification agency; and, as far as practical,
- the durability and reliability of the component product when used as part of a roof assembly.

1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be 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 component product as certified;
- the continued use of acceptable quality control 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 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:

AISI (American Iron and Steel Institute)

- North American Specification for the Design of Cold-Formed Steel Structural Members, 2012 Edition, AISI S100-200

ASTM International (American Society for Testing and Materials)

- Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Reflectometer, ASTM C1549

- Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter, ASTM D240
- Standard Test Method for Ash from Petroleum Products, ASTM D482
- Standard Test Method for Tensile Properties of Plastics, ASTM D638
- Standard Test Methods for Coated Fabrics, ASTM D751
- Standard Test Method for Apparent Density of Rigid Cellular Plastics, ASTM D1622
- Standard Test Method for Climbing Drum Peel for Adhesives, ASTM D1781
- Standard Test Method for Determining Ignition Temperature of Plastics, ASTM D1929
- Heat Of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method), ASTM D4809-00(2005)
- Standard Test Method for Gross Calorific Value of Coal and Coke, ASTM D5865-04
- Standard Test Method for the Gross Calorific and Ash Value Of Waste Materials, ASTM D5468-02
- Standard Test Method for Dynamic Puncture Resistance of Roofing Membrane Specimens, ASTM D5635
- Standard Test Method for Corrosion Resistance of Ferrous Metal Fastener Assemblies Used in Roofing and Waterproofing, ASTM D6294
- Standard Test Method for Determining Water Migration Resistance Through Roof Membranes, ASTM D7281
- Standard Test Method for Fire Tests of Roof Coverings, ASTM E108
- Gross Calorific Value Of Refuse-Derived Fuel By The Bomb Calorimeter, ASTM E711-87(2004)
- Standard Test Methods for Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA), ASTM E2058
- Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials, ASTM G154
- Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis, ASTM E1252
- Standard Practice for General Techniques of Gas Chromatography Infrared (GC/IR) Analysis. ASTM E1642

EN

- Test Procedure, EN 13823, Reaction To Fire Tests For Building Products - Building Products Excluding Floorings Exposed To The Thermal Attack By A Single Burning Item

EOTA, European Organisation for Technical Approvals

- System of Mechanically Fastened Flexible Roof Waterproofing Sheets - EAD 030351-00-0402

FM APPROVALS

- FM 4451, Examination Standard for Profiled Steel Panels for use as Decking in Class 1 Insulated Roof Construction
- 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.
- FM 4880, Examination Standard for Class 1 Fire Ratings of Insulated Wall or Roof/Ceiling Panels, Interior Finish Materials or Coatings and Exterior Wall Systems.
- FM 4882, Examination Standard for Roof Maintenance Coatings

-ISO (International Organization for Standardization)

- Reaction to Fire Tests for Building Products - Determination of the Heat of Combustion, ISO 1716:2002
- Reaction to Fire Tests for Building Products - Non-Combustibility Test, ISO 1182

NFPA (National Fire Protection Association)

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

1.9 Terms and Definitions

For purposes of this standard, the following terms apply:

Adhesive – A product used to adhere two 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.

Air Retarder - A layer or layers of material or a laminate used to reduce the flow of air from the building interior into a roof assembly. An air retarder is sealed to the underside of the roof cover at all penetrations and around the entire perimeter of the roof.

Bitumen - A class of amorphous black or dark colored (solid, semi-solid, or viscous) substances, natural or manufactured, composed principally of high molecular weight hydrocarbons, soluble in carbon disulfide, and found in petroleum asphalts, coal tars and pitches, wood tars and asphalts.

Board Stock Insulation - A panel with or without facers and a core of, or is comprised of, one of the following materials: APA-rated oriented strand board (OSB), asphalt/glass, glass-based, gypsum; mineral wool, perlite, polyisocyanurate/polyurethane foam, expanded polystyrene foam (EPS), extruded polystyrene foam (XPS), wood fiber or other suitable material. The material, the number of board stock layers, and the position of the product within an assembly will determine whether it is further classified as an insulation, cover board or thermal barrier.

Built-Up Roof (BUR) - A continuous semi-flexible roof cover consisting of multiple plies of saturated felts, coated felts, fabrics, or mats assembled in place with alternate layers of bitumen or cold adhesive.

Cementitious Panel Roof Deck - A factory fabricated roof deck consisting of a cementitious binder with or without reinforcing. The reinforcing, if present, may be organic or inorganic.

Cover Board - A board stock product used over insulation. It is applied as the top layer of some multilayer insulation assemblies.

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

Crease - During wind uplift testing, when a component is stressed to the point that it bends at a sharp, defined angle, without breaking. In the case of an insulation board, often a crack will form on the opposite face.

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

Delamination - Separation of the plies in a roof cover or system in any laminated roofing material or component, e.g., laminated layers of rigid insulation or the felt plies in a BUR roof or separation of any cover from the substrate to which it is adhered.

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

Fully Adhered - Describes roof components that have been bonded to the substrate using a compatible adhesive throughout the entire surface of the roof.

Gypsum Roof Deck - Roof decks which consist of a slurry of gypsum cement placed over steel reinforcing mesh and permanent form boards.

Heat Weld - A method of melting and fusing together the overlapping edges of separate sheets or sections of polymer modified bitumen or thermoplastic roof covers by the application of heat and pressure.

Insulation - Any of a variety of materials designed to reduce the flow of heat, either from, or into, a building.

Lightweight Insulating Concrete Insulation - A type of insulation comprised of portland cement, lightweight aggregate or preformed foam or hybrid combination of these. It may be applied with or without the use of EPS board encapsulated within the lightweight insulating concrete.

Liquid Applied Roof Cover - Arrive on the roof in a liquid state and are spray, brush or roller applied using proprietary procedures and could include a reinforcing fabric.

Maintenance Coating - A liquid applied product with or without reinforcements that is applied over a functioning roof system. Maintenance coatings do not increase the fire, wind, or hail resistance performance of the existing roof. Maintenance coatings are evaluated for combustibility from above the roof deck only. These products are evaluated per FM 4482 - *Examination Standard for Roof Maintenance Coatings*

Mechanically Fastened - Describes components that have been attached to the substrate, deck or structure at defined intervals using fasteners with or without stress distributors.

Minor delamination - In wind uplift testing, an area approximately 1% of the test sample. For a 12 x 24 ft (3.7 x 7.3 m) test an area of 3 ft² (0.28 m²); for a 5 x 9 ft (1.5 x 2.7 m) test an area of 0.5 ft² (0.05 m²), whereby two adhered components which are intended to be in contact are not in contact.

Multi-Ply Roof Cover - A system consisting of zero or one base ply layer, zero to many plies and zero or one cap ply layer adhered to each other with an adhesive and together form a thick multi-layer weatherproof roof covering. For assemblies with base sheets (mechanically attached), the base sheet is not included when defining the number of plies of the roof cover. Multi-ply covers contain a minimum of two plies.

Noncombustible - The property of a material to not ignite or burn. Not capable of igniting and burning under the conditions described in Section 4.9.

Partially Adhered - Components that have been bonded to the substrate using a compatible adhesive applied in spots or ribbons across the surface of the roof.

Plastic Roof Deck - These decks may be thermoplastic or thermoset with or without reinforcement.

Polymer modified Bitumen Roof Cover - Factory produced sheets which generally consist of an asphaltic and rubber or plastic blend reinforced with glass and/or polyester mats.

Presecurement - The use of insulation with certain mechanically fastened single ply roof covers requires preliminary attachment of the insulation to the deck.

Recover - New roof components are installed over the existing roof cover. For the purposes of this standard only one existing roof is allowed.

Re-Roof - Stripping off the existing roof system of all covers, insulations, fasteners, etc., down to bare roof deck. For steel deck re-roof, in some cases, up to 15 lbs/sq ft (0.72 kg/sq m) of asphalt can remain on the deck.

Roof Assembly - A system of interacting roof components (including the roof deck) designed to weatherproof and, normally, to insulate a building's top surface.

Roof Cover - The layer of a roof assembly designed to protect the building components from the weather.

Roof System - A system of interacting roof components (not including the roof deck) designed to weatherproof and, normally, to insulate a building's top surface.

Service Wind Load – The uplift load resulting from a windstorm that a roof assembly must resist. The service load is equal to one half of the rated load in psf (kPa).

Single Ply Roof Cover - Factory produced sheets typically consisting of EPDM, PVC, TPO, CSPE or several variations of these. Modified bitumen covers applied in a single layer (no base or ply sheets) are considered single ply roof covers.

Solar Reflectance – The fraction of incident solar radiation upon a surface that is reflected from the surface.

Spray Foam Insulation - The field applied spray foam insulation systems consist of multiple components delivered to the job site where they are mixed and sprayed in place prior to applying the roof cover.

Steel Roof Deck – Corrugated metal used as a structural component to support a roof system.

Stress Distributor (Plate/Batten Bar) - A metal or plastic disk or bar which is used in conjunction with a fastener to secure roof components and designed to distribute a concentrated load over a larger surface area.

Structural Concrete Roof Deck - Are generally monolithic, cast in place decks or precast concrete plank. These decks have a minimum compressive strength of 2500 psi (17.2 mPa) and a density of approximately 150 lb/ft³ (2400 kg/m³). Roof assemblies on structural concrete are considered noncombustible on the deck underside.

Structure - Is the building framework to which the roof deck, or in some instances the roof cover, is fastened.

Surfacing - Is the top layer or layers of a roof assembly, specified or designed to protect the underlying roofing from direct exposure to the weather.

Thermoplastic - Polymers which soften when heated and harden when cooled. This process is repetitive provided the material is not heated above the point at which decomposition occurs.

Thermoset - A material that solidifies or “sets” irreversibly when heated. This property is usually associated with cross linking of the molecules induced by heat, chemical reaction or radiation.

Treated Wood Roof Deck - Fire-retardant treated lumber or plywood. These decks are factory treated to reduce fire spread on the underside of the deck.

Thermal Barrier - A board stock insulation placed on the roof deck to slow the temperature rise to the roof system during an interior building fire and to delay involvement of the roof system in the fire.

Vapor Retarder - A layer or layers of material or a laminate used to reduce the flow of water vapor into a roof assembly. A vapor retarder is not sealed to the underside of the roof cover.

Weld - A type of securement whereby metal or plastic products are joined together through heat or solvent fusion.

Wind Uplift - The force generated by wind on a roof system or components in a roof system resulting from wind-induced pressure.