

Approval Standard

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
April 2010



Approval 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

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Foreword

The FM Approvals certification mark 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 Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

- a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

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1 INTRODUCTION

1.1 Purpose

This standard states Approval requirements for single-ply, polymer-modified bitumen sheet, built-up roof (BUR) and liquid applied roof assemblies.

1.2 Scope

- 1.2.1 This standard applies to all single-ply, polymer-modified bitumen sheet, built-up roof (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, built-up roof (BUR) and liquid applied roof assemblies for their performance in regard to fire from above and below the structural deck, simulated wind uplift, corrosion of metal parts, susceptibility from hail storm damage, foot traffic, puncture resistance and water leakage.

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, built-up roof (BUR) or liquid applied roof assembly as FM Approved. An FM Approved roof assembly is not a significant fire hazard and can withstand wind uplift forces, hail stones, etc., when installed in accordance with all Approval requirements. Approval requirements prohibit substitution of components in the roof assembly without prior authorization from FM Approvals.
- 1.3.3 Products which do not conform to these requirements shall be permitted to be FM Approved if they meet the intent of this standard. Conversely, those that do conform may not be FM Approved if other conditions prevail.

1.4 Basis for Approval

Approval is based upon (1) satisfactory evaluation of the product when used in a roof assembly and (2) 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 FM Approvals; 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 to evaluate the manufacturer's ability to consistently produce the component product which is examined and tested, and the marking procedures used to identify the product. These examinations may be repeated as part of FM Approvals' product follow-up program.

1.5 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the component product as FM Approved;
- the continued use of acceptable quality control procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval Report;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Facilities and Procedures Audits (F&PA's) conducted as part of FM Approvals' product follow-up program.

1.6 Effective Date

1.6.1 The effective date of an Approval Standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or else forfeit Approval. The effective date shall apply to the entire Approval Standard, or, where so indicated, only to specific paragraphs of the standard.

1.6.2 The effective date for this standard is December 31, 2011 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. Appendix A lists the selected units and conversions to SI units for measures appearing in this standard. Conversion of U.S. customary units is in accordance with *Standard for Use of the International System of Units (SI): The Modern Metric System*, BSR/IEEE/ASTM SI 10.

1.8 Applicable Documents

The following standards, test methods, and practices are referenced in this standard:

- *Fire Tests of Roof Coverings*, ASTM E108, ASTM International

- *Standard Test Method for Determining Water Migration Resistance Through Roof Membranes*, ASTM D7281, ASTM International
- *Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures*, American National Standard, ANSI/FM Approvals 4474
- *Standard Test Method for Corrosion Resistance of Ferrous Metal Fastener Assemblies Used in Roofing and Waterproofing*, ASTM D6294, ASTM International
- *Guideline for European Technical Approval of Systems of Mechanically Fastened Flexible Roof Waterproofing Membranes*, ETAG 006, Amended April 2007, EOTA, European Organisation for Technical Approvals
- *Metallic and other non-organic coatings- sulfur dioxide test with general condensation of moisture*, EN ISO 6988:1995
- *Sulfur dioxide corrosion testing in a saturated atmosphere*, DIN 50018
- *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials*, ASTM G154, ASTM International
- *Standard Test Method for Ash from Petroleum Products*, ASTM D482, ASTM International
- *Standard Test Methods for Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA)*, ASTM E2058, ASTM International
- *Reaction to Fire Tests for Building Products - Determination of the Heat of Combustion*, ISO 1716:2002
- *Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens*, ASTM D5602, ASTM International
- *Standard Test Method for Dynamic Puncture Resistance of Roofing Membrane Specimens*, ASTM D5635, ASTM International
- *Reaction to Fire Tests for Building Products - Non-Combustibility Test*, ISO 1182
- *Standard Test Method for Tensile Properties of Plastics*, ASTM D638, ASTM International
- *Standard Test Method for Climbing Drum Peel for Adhesives*, ASTM D1781, ASTM International
- *Standard Test Methods for Coated Fabrics*, ASTM D751, ASTM International
- *Standard Test Method for Determining Ignition Temperature of Plastics*, ASTM D1929, ASTM International
- *Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter*, ASTM D240, ASTM International
- *Standard Test Method for Autoignition Temperature of Liquid Chemicals*, ASTM E659, ASTM International
- *North American Specification for the Design of Cold-Formed Steel Structural Members*, 2007 Edition, AISI S100-200

- *Test Procedure, 12 x 24 ft Wind Uplift Tests for Single Ply and Multi Ply Roof Coverings using Positive Static Pressure, FM Approvals, LLC*
- *Test Procedure, 12 x 24 ft Wind Uplift Tests for Single Ply and Multi Ply Roof Coverings using Reduced Pressure, FM Approvals, LLC*
- *Test Procedure, 12 x 24 ft Wind Uplift Tests for Single Ply and Multi Ply Roof Coverings using a Combination of Positive and Reduced Static Pressure, FM Approvals, LLC*
- *Test Procedure, 5 x 9 ft Wind Uplift Tests for Single Ply and Multi Ply Roof Coverings using Positive Static Pressure, FM Approvals, LLC*
- *Test Procedure, 5 x 9 ft Wind Uplift Tests for Single Ply and Multi Ply Roof Coverings using Reduced Pressure, FM Approvals, LLC*
- *Test Procedure, 2 x 2 ft Wind Uplift Test for Fully Adhered Roof Coverings, FM Approvals, LLC*
- *Test Procedure, FM Approvals Construction Materials Calorimeter, FM Approvals, LLC*
- *Test Procedure, Corrosion Resistance Testing For Stress Plates, Batten Bars, and Fasteners Used to Secure Membranes and Insulations in Roof Construction, FM Approvals, LLC*
- *Test Procedure, Corrosion Resistance Testing For Stress Plates, Batten Bars, and Fasteners Used to Secure Membranes and Insulations in Roof Construction assessed to ETAG 006 in support of CE Marking to CPD, FM Approvals, LLC*
- *Test Procedure, Test Method for Determining the Susceptibility to Hail Damage of Roof Coverings, FM Approvals, LLC*
- *Test Procedure, Test Method for Ultraviolet (UV) Weathering of Roof, FM Approvals, LLC*
- *Test Procedure, 6 x 6 Delamination Tests for Roofing Adhesives and Substrates Using Tensile Loading, FM Approvals, LLC*
- *Test Procedure, Membrane Delamination Tests for Roofing Membranes and Substrates Using Tensile Loading, FM Approvals, LLC*
- *Test Procedure, Membrane Peel Tests for Roof Membrane Seam or Cover Tape/Cover Strip Combination using Tensile Loading, FM Approvals, LLC*
- *Test Procedure, Pull Out Tests for Fastener/Roof Deck Combinations and Pull Through Tests for Fastener/Stress Plate or Batten Bar Combinations using Tensile Loading, FM Approvals, LLC*
- *Test Procedure, Pull Through Tests for Roofing Membranes and Substrates Using Tensile Loading, FM Approvals, LLC*
- *Test Procedure, Test Method for Determining the Foot Traffic Resistance of Roof Coverings, FM Approvals, LLC*
- *Test Method for Determining the Susceptibility to Heat Damage of Roof Insulation, FM Approvals, LLC*
- *Test Procedure, ASTM E2058, Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA), FM Approvals, LLC*

- *Test Procedure, ISO 1716, Reaction-to-Fire Tests for Building Products - Determination of the Heat of Combustion*, FM Approvals, LLC
- *Test Procedure, ASTM Oxygen Bomb Testing: ASTM D240-02 Heat Of Combustion Of Liquid Hydrocarbon Fuels By Bomb Calorimeter, ASTM D4809-00(2005) Heat Of Combustion Of Liquid Hydrocarbon Fuels By Bomb Calorimeter (Precision Method), ASTM D5468-02 Gross Calorific And Ash Value Of Waste Materials, ASTM D5865-04 Gross Calorific Value Of Coal And Coke, ASTM E711-87(2004) Gross Calorific Value Of Refuse-Derived Fuel By The Bomb Calorimeter*, FM Approvals, LLC
- *Test Procedure, ASTM D1929-96 (Reapproved 2001)^{E1}, Standard Test Method For Determining Ignition Temperature Of Plastics*, FM Approvals, LLC
- *Test Procedure, ISO 1182, Reaction To Fire Test For Building Products - Non-Combustibility Test*, FM Approvals, LLC
- *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*, FM Approvals, LLC
- *Test Procedure, Standard Test Method for Surface Burning Characteristics of Building Materials*, FM Approvals, LLC
- *Test Procedure, Reaction to Fire Tests - Ignitability of Building Products Subjected to Direct Impingement of Flame - Part 2: Single-Flame Source Test*, FM Approvals, LLC

1.9 Definitions

For purposes of this standard, the following terms apply:

Adhesive – Adhesive is used in roof construction to adhere roof coverings to roof coverings as in lap construction. It is also used to bond roof coverings to the substrate below or to adhere insulation to the substrate. Depending on the use, the adhesive could be in either a liquid form, semi 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.

Batten Bar - A batten bar is a metal bar or plastic strip which is used in conjunction with fasteners to secure roof covers in place.

Bitumen - A class of amorphous black or dark colored (solid, semi-solid, or viscous) cementitious 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 board stock insulation has 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 classified as an insulation, cover board or thermal barrier.

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