Designation: E936 – 98 (Reapproved 2004)

An American National Standard

Standard Practice for Roof System Assemblies Employing Steel Deck, Preformed Roof Insulation, and Bituminous Built-Up Roofing[1]

This standard is issued under the fixed designation E936; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the performance requirements for the design, components, construction, and service expectations of new roof system assemblies. For this purpose, the roof system always includes steel deck, preformed roof insulation, and bituminous built-up roofing, and their attachment. It may also include fire-resistive components, integral acoustical treatment, vapor retarder, adhesive or mechanical fastener attachment, and aggregates.

1.2 The objective is to provide realistic criteria for the overall performance of the roof assembly and its components because, by necessity and custom, a roof assembly contains a variety of components and is subject to varied environmental conditions.

1.3 To assist in the successful implementation of the installation and service requirements of the roof system assembly, criteria are established to provide for compatibility of the various components.

1.4 Nothing in this practice is intended to exclude products or systems not covered by the documents referenced in Section 2.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A446/A446M Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality (Withdrawn 1994)[3]

A529/A529M Specification for High-Strength Carbon-Manganese Steel of Structural Quality

A570/A570M Specification for Structural Steel, Sheet and Strip, Carbon, Hot-Rolled (Withdrawn 2000)[3]

A606 Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance

A607 Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled (Withdrawn 1998)[3]

A611 Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled (Withdrawn 2000)[3]

A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

B117 Practice for Operating Salt Spray (Fog) Apparatus

C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C208 Specification for Cellulosic Fiber Insulating Board

C209 Test Methods for Cellulosic Fiber Insulating Board

C236 Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box (Withdrawn 2001)[3]

C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

C550 Test Method for Measuring Trueness and Squareness

[1] This practice is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofingand is the direct responsibility of Subcommittee D08.20 on Roofing Membrane Systems.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

of Rigid Block and Board Thermal Insulation
C552 Specification for Cellular Glass Thermal Insulation
C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
C726 Specification for Mineral Wool Roof Insulation Board
C728 Specification for Perlite Thermal Insulation Board
C755 Practice for Selection of Water Vapor Retarders for Thermal Insulation
C1013 Specification for Faced Rigid Cellular Polyisocyanurate Roof Insulation (Withdrawn 1997)[3]
C1126 Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
C1289 Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
D41 Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D146 Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
D226 Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
D227 Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
D244 Test Methods and Practices for Emulsified Asphalts
D249 Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules (Withdrawn 2002)[3]
D312 Specification for Asphalt Used in Roofing
D371 Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules; Wide Selvage (Withdrawn 2002)[3]
D450 Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
D1079 Terminology Relating to Roofing and Waterproofing
D1227 Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
D1310 Test Method for Flash Point and Fire Point of Liquids by Tag Open-Cup Apparatus
D1863 Specification for Mineral Aggregate Used on Built-Up Roofs
D2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
D2626 Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing
D2822 Specification for Asphalt Roof Cement, Asbestos-Containing
D2823 Specification for Asphalt Roof Coatings, Asbestos-Containing
D2824 Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered, Asbestos Fibered, and Fibered without Asbestos
D2829 Practice for Sampling and Analysis of Existing Built-Up Roof Systems
D3617 Practice for Sampling and Analysis of Built-Up Roof Systems During Application
D3909 Specification for Asphalt Roll Roofing (Glass Felt) Surfaced With Mineral Granules
D4077 Specification for Cumene (Isopropylbenzene)
D4479 Specification for Asphalt Roof Coatings—Asbestos-Free
D4586 Specification for Asphalt Roof Cement, Asbestos-Free
D4601 Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
D4897 Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
D4990 Specification for Coal Tar Glass Felt Used in Roofing and Waterproofing
E84 Test Method for Surface Burning Characteristics of Building Materials
E96/E96M Test Methods for Water Vapor Transmission of Materials
E108 Test Methods for Fire Tests of Roof Coverings
E119 Test Methods for Fire Tests of Building Construction and Materials
E196 Practice for Gravity Load Testing of Floors and Low Slope Roofs
E241 Guide for Limiting Water-Induced Damage to Buildings
E541 Specification for Agencies Engaged in System Analysis and Compliance Assurance for Manufactured Building
E631 Terminology of Building Constructions
E651/E651M Practice for Evaluating Capabilities of Agencies Involved in System Analysis and Compliance Assurance for Manufactured Building
E699 Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
E907 Test Method for Field Testing Uplift Resistance of Adhered Membrane Roofing Systems

2.2 *Factory Mutual Research Corporation (FM) Documents:*[4]
FM Approval Guide
Approval Standard 4450
Class I Steel Deck Roofs
Approval Standard 4451 for Steel Deck Nominal 1½ in. Deep As Component of Class I Insulated Steel Roof Deck Construction
Approval Standard 4470 Class I Roof Covers
FM 1-28 Loss Prevention Data Insulated Steel Deck
FM-1-48 Loss Prevention Data SH Repair Procedures for Built-Up Roof Coverings Over Steel Decks
FM-1-49 Loss Prevention Data SH Perimeter Flashing
FM-1-52 Loss Prevention Data Wind Uplift

2.3 *Underwriters' Laboratories, Inc. (UL) Documents:*[5]
Roofing Materials and Systems Directory
Publication No. 1256—Outline of the Proposed Investigation for Roof Deck Construction
U.L. 580 Standard for Safety, Tests for Wind Uplift Resistance of Roof Assemblies
Fire Resistance Directory

[4] Available from Factory Mutual Research Corporation, P.O. Box 688, Norwood, MA 02062.
[5] Available from Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

2.4 *National Roofing Contractors Association (NRCA) Document:*[6]
NRCA Energy Manual
Bulletin 2-91
Equiviscous Temperature (EVT)
NRCA/ARMA Manual of Roof Maintenance and Repair
ARMA/NRCA Quality Control Guidelines for the Application of Built-Up Roofing
Roofing and Waterproofing Manual, 1989
In Service R-Values (ISR) for Polyisocyanurate and Polyurethane Roof Insulation Boards

2.5 *Steel Deck Institute (SDI) Document:*[7]
Steel Deck Institute Design Manual

2.6 *American Iron and Steel Institute (AISI) Standards:*[8]
Specification for the Design of Cold Formed Steel Structural Members, August 19, 1986 Edition

2.7 *American Institute of Architects (AIA):*[9]
Roof System Design Manual

2.8 *Canadian Roofing Contractors Association (CRCA):*[10]
Roofing Manual

2.9 *American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):*[11]
Roofing Insulation Recommendations

2.10 *Sheet Metal and Air Conditioning Contractors National Association Standard:*[12]
Architectural Sheet Metal Manual, SMACMA

2.11 *The Aluminum Association Incorporated Standard:*[13]
Specification for Aluminum Sheet Metal Work in Building Construction

2.12 *Copper Development Association, Inc. Documents:*[14]
Architectural Applications 405/7R
Base and Cap Flashings 402/9
Sheet Copper Fundamentals 406/9
Building Expansion Joints 408/70

2.13 *American Welding Society (AWS) Standard:*[15]
AWS D1.3-81, Specification for Welding Sheet Steel in Structures

2.14 *National Institute of Standards and Technology Publications:*[16]
Building Science Series No. 9—Thermal Shock Resistance for Built-up Membranes
Building Science Series No. 55—Preliminary Performance Criteria for Bituminous Membrane Roofing
Building Science Series No. 92—Viscosities of Roofing Asphalts at Application Temperatures
Technical Note 473—Laboratory Field Comparisons of Built-up Roofing Membranes

2.15 *Midwest Roofing Contractors Association Document:*[17]
Ten Years of Roofing Research

3. Terminology

3.1 *Definitions*—Refer to Terminology D1079 and Terminology E631.

4. Performance Concepts

4.1 *Design*—The roof system should be designed in accordance with this practice to resist the effects of the usual or normal weather and loading conditions which can cause excessive deflection, destroy adhesive bond, fracture the insulation, and result in premature failure of the roof system. Such weather and loading conditions may include, but are not confined to water, wind, hail, snow, ice, and uniform and concentrated loading, and thermal expansion and contraction of building units. The roof system should be sloped to provide drainage under design loading conditions and the design should sustain the anticipated live load if drainage is obstructed (see 16.4).

4.2 *Construction*—During construction, the partially completed and the completed roof assembly should (*1*) be protected against construction traffic and equipment to be used in the construction of the roof assembly and subsequent traffic and use by other trades and (*2*) provide weather protection consistent with the construction schedule requirements as determined by the existing weather conditions.

4.3 *Service*—The roof system assembly when in service should:

4.3.1 Be protected against anticipated building maintenance procedures.

4.3.2 Provide weather protection.

4.3.3 Provide thermal insulation.

4.3.4 Provide a vapor retarder, if required.

4.3.5 Provide fire safety and uplift resistance as required by the building owner, applicable building codes, or insurance underwriters.

4.3.6 Carry anticipated design dead loads and live loads.

4.3.7 Receive proper and periodic maintenance over its service life.

4.4 The components used in the roof system assembly should be compatible with each other.

[6] Available from National Roofing Contractors Assoc., 10255 West Higgins Road, Suite 600, Rosemont, IL 60018-5607.
[7] Available from Steel Deck Institute (SDI), PO Box 25, Fox River Grove, IL 60021-0025.
[8] Available from American Iron and Steel Institute (AISI), 1101 17th St., NW, Suite 1300, Washington, DC 20036.
[9] Available from American Institute of Architects, 1735 New York Ave., NW, Washington, DC 20006.
[10] Available from Canadian Roofing Contractors Assn., 155 Queen St., Suite 1300, Ottawa, Ontario Canada K1P 6L1.
[11] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329.
[12] Available from Sheet Metal and Air Conditioning Contractors' National Assn., 4201 Lafayette Center Drive, Chantilly, VA 22021.
[13] Available from The Aluminum Association, 818 Connecticut Ave. NW, Washington, DC 20006.
[14] Available from Copper Development Assn., Inc.,260 Madison Ave., 16th Fl., New York, NY 10016.
[15] Available from The American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126.
[16] Available from National Institute of Standards and Technology, 100 Bureau Dr., Stop 3460, Gaithersburg, MD 20899–3460.
[17] Available from Midwest Roofing Contractors Assn., 4840 West 15th St., Suite 1000, Lawrence, KS 66049-3876.