



Designation: **E1514 – 98 (Reapproved 2011) E1514 – 98 (Reapproved 2017)^{ε1}**

Standard Specification for Structural Standing Seam Steel Roof Panel Systems¹

This standard is issued under the fixed designation E1514; 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.

^{ε1} NOTE—Editorial changes were made in 2.6, 4.1.3, 5.2.2, and throughout in October 2017.

1. Scope

1.1 This specification covers the design, construction, and weatherability of structural standing seam steel roof panel systems. It includes performance requirements for the following elements only: panels, concealed panel clips, panel/clip anchorage, and panel joint sealers.

NOTE 1—These systems are used on both low-slope and steep-slope roof applications. They also are used with or without an underlying deck or sheathing.

1.2 The objective of this specification is to provide for the overall performance of the structural standing seam steel roof panel system as defined in 3.2.6 during its service life in order to provide weather protection, carry the specified design loads, and allow proper access over the roof surface in order to provide for periodic maintenance of equipment by the owner.

1.3 In addition to structural, the specifier shall evaluate other characteristics beyond the scope of this specification that affect the final choice of roof construction. These include, but are not limited to, functional, legal, insurance, and economic considerations. See Appendix X1 for specifier's checklist.

1.4 The specification is not intended to exclude products or systems not covered by the referenced documents.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 The text of this specification contains notes and footnotes that provide explanatory information and are not requirements of this specification.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

A463/A463M Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

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

A792/A792M Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

A875/A875M Specification for Steel Sheet, Zinc-5 % Aluminum Alloy-Coated by the Hot-Dip Process

C711 Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants

C765 Test Method for Low-Temperature Flexibility of Preformed Tape Sealants

C879 Test Methods for Release Papers Used with Preformed Tape Sealants

D1667 Specification for Flexible Cellular Materials—Poly (Vinyl Chloride) Foam (Closed-Cell)

D3310 Test Method for Determining Corrosivity of Adhesive Materials

E631 Terminology of Building Constructions

¹ This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.57 on Performance of Metal Roof 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.

E1592 Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

E1646 Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference

E1680 Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems

G21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

2.2 *FM Approvals LLC-Standard:*³

Approval Standard for Class 1 Panel Roofs, Class Number 4471

2.3 *UL Standard:*⁴

UL 580 Standard for Safety, Tests for Uplift Resistance of Roof Assemblies

2.4 *AISI Document:*⁵

S100 North American Specification for the Design of Cold-Formed Steel Structure Members

2.5 *MBMA Document:*⁶

MBMA Low Rise Building Systems Manual, Latest Edition

2.6 *ASHRAE Document:*⁷

1997-ASHRAE Handbook of Fundamentals

3. Terminology

3.1 *Definitions:*

3.1.1 Refer to the latest edition of MBMA Low Rise Building Systems Manual and Terminology **E631** for definitions of terms used in this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *construction loads, n*—those loads encountered during the erection of the roof system only.

3.2.2 *fixing line, n*—a line or adjacent lines of fixed points.

3.2.3 *maintenance loads, n*—loads including, but not limited to, personnel, equipment, and materials required to maintain functionality of the building.

3.2.4 *oil canning, n*—a waviness that occurs in flat areas of metal.

3.2.5 *sealer, n*—any material that is used to seal cracks, joints, or laps.

3.2.6 *structural standing seam steel roof panel system, n*—a steel roof system designed to resist positive and negative loads applied normal to the panel surface without the benefit of a supporting deck or sheathing.

3.2.7 *thermal movement, n*—the reaction of the roof system in response to changes in the panel temperature.

4. Performance Requirements

4.1 *Design*—The roof system shall be designed for specified design loads and thermal effects.

4.1.1 Minimum design loads shall be determined by the governing code or the design professional.

4.1.2 The finished roof system shall be capable of sustaining a minimum 200-lb (0.9-kN) concentrated load on any 12-in. by 12-in. (300-mm by 300-mm) area of finished roof without causing seam separation, permanent panel buckling, or loss of weathertightness.

4.1.3 Thermal movement shall be provided for in accordance with Sections 7 and 8. Temperature differentials for many localities are found in documents referenced in 2.5, 2.6, and Footnote 13-8.⁸

4.1.4 The standing seam roof system clips do not always provide full lateral support to secondary structural members. The degree of lateral support provided to the secondary structural members by the panel system shall be determined by an appropriate test, or in the absence of such test, the panel must be assumed to provide no lateral support.

NOTE 2—The Base Test Method for Purlins Supporting a Standing Seam Roof System in the AISI S100 Cold-Formed Steel Design Manual is used to evaluate lateral support when the secondary structural is cold-formed Zee or Cee purlins.

4.2 *Protection of Incompatible Materials*—Components constructed of incompatible materials shall not be placed together without an effective separating material.

³ Available from FM Approvals LLC, 1151 Boston-Providence Turnpike, P.O. Box 9102, Approvals, 1151 Boston-Providence Turnpike, Norwood, MA 02062, <http://www.fmglobal.com>, <http://www.fmapprovals.com>.

⁴ Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

⁵ Available from American Iron and Steel Institute (AISI), 1140 Connecticut Ave., NW, Suite 705-800, Washington, DC 20036-20001, <http://www.steel.org>.

⁶ Available from Metal Building Manufacturers Association (MBMA), Inc., 1300 Summer Avenue, Cleveland, OH 44115-2851, <http://www.mbma.com>.

⁷ Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, <http://www.ashrae.org>.

⁸ 1981 *B Climatology of US No. 81*, National Climatic Data Center.

4.3 *Oil Canning*—Oil canning is an inherent characteristic of products covered by this specification, particularly those with broad, flat areas. It is the result of several factors that include, but are not limited to, induced stresses in the base material, fabrication methods, and installation and thermal forces. While oil canning is an aesthetic issue, structural integrity is not normally affected. Oil canning is not grounds for panel rejection, unless it does not meet prior standards established by the specifier.

5. Structural Integrity

5.1 Panel System Design:

5.1.1 Structural panels shall be designed in accordance with AISI Specification for the Design of Cold-Formed Steel Structural Members—and in accordance with sound engineering methods and practices.

5.1.2 Deflection and serviceability shall be accounted for.⁹ The deflection shall be limited so as to allow the roof to perform as designed. The substrate deflection shall not cause strains to the panels that affect the serviceability of the system.

5.2 Panel System Testing:

5.2.1 *Static (Positive or Negative Load Capacity)*—When the panel system does not comply with the requirements for using the design procedures of the AISI Specification, testing shall be performed to determine the roof's load capacity.

5.2.2 *Uplift Index*—When required by the specifier, the roof system shall be tested in accordance with the requirements of 5.3 of FM Approvals Approval Standard 4471, or Underwriters Laboratories UL 580, or Test Method E1592 or other applicable tests (see Appendix X2).

6. Panel Material

6.1 Panel material shall be a hot dip metallic coated product in accordance with one of the commonly used materials listed in 6.1.1 – 6.1.4.

6.1.1 Aluminum coated sheet steel produced to the requirements of Specification A463/A463M. Coating designation T265.

6.1.2 Aluminum-zinc alloy coated sheet steel produced to the requirements of Specification A792/A792M. Coating designation AZ-55. When an organic finish coating is used (as described in 6.2), coating designation of AZ-50 shall be permitted.

6.1.3 Zinc coated sheet steel produced to the requirements of Specification A653/A653M. Coating designation G90.

6.1.4 Zinc-5 % aluminum alloy metallic-coated sheet steel produced to the requirements of Specification A875/A875M. Coating designation GF90.

6.2 In addition to the foregoing material specifications, the specifier has the option to require organic finish coatings.

6.3 This specification does not preclude the use of other coating standards governing the same materials, as long as equivalency is established. The designer shall determine the suitability of material for the application.¹⁰

6.4 Steel grade and base metal thickness shall be as required to resist specified design loads.

7. Panel Clips

7.1 Connections of panels to structural members shall be made with concealed panel clips compatible with the panel design.

7.2 Provisions for the thermal movement between the panel and the structure to which it is attached shall be accomplished by the use of concealed panel clips allowing such movement, except as provided in 7.3.

7.3 When the building geometry and the rotational flexibility of the supporting member permit, it is permissible to resolve thermal movement through controlled rotation of the intermediate structural members rather than movement within the clip.

7.4 Where insulation is applied between the panels and supporting structure, the panel clips shall be designed to be compatible with the thickness and compressibility of the insulation. If thermal spacers are required for thermal performance, the clips must be compatible with the thermal spacer to reduce secondary stresses due to walking.

8. Panel and Clip Anchorage

8.1 A fixing line is required to anchor roof panels in order to maintain end alignment and to resist in-plane gravity and thermal force components.

8.2 Fasteners that penetrate the roof surface are permitted only at panel endlaps, penetrations, fixing lines, rib reinforcements, and at roof termination lines. Details at these locations shall allow for the expected thermal movement.

8.3 Nails shall not be used where subject to withdrawal loads.

9. Weather Tightness

9.1 Panel-to-panel sidelap connections and endlaps shall be weathertight.

9.2 Panels of maximum practical lengths shall be used to minimize endlaps.

⁹ Fisher, James M., and West, Michael A. "Serviceability Design Considerations for Low Rise Buildings," AISC Design Guide No. 3.

¹⁰ Equivalency shall be evaluated on the basis of minimum coating (thickness) of same material, according to the appropriate ASTM Specification.