



Designation: E 1637 – 98

## Standard Specification for Structural Standing Seam Aluminum Roof Panel Systems<sup>1</sup>

This standard is issued under the fixed designation E 1637; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers the design, construction, and weatherability of structural standing seam aluminum 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 aluminum 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 the equipment by the building owner.

1.3 In addition to structural characteristics, 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 the specifier's checklist.

1.4 This 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 the standard. The values given in parentheses are for information only.

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

### 2. Referenced Documents

#### 2.1 ASTM Standards:

B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate<sup>2</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee E-6 on Performance of Buildings and is the direct responsibility of Subcommittee E06.57 on Performance of Metal Roof Systems.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 02.02.

C 711 Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants<sup>3</sup>

C 765 Test Method for Low-Temperature Flexibility of Preformed Tape Sealants<sup>3</sup>

C 879 Test Method for Release Papers Used with Preformed Tape Sealants<sup>3</sup>

D 1667 Specification for Flexible Cellular Materials—Vinyl Chloride Polymers and Copolymers (Closed-Cell Form)<sup>4</sup>

D 3310 Test Method for Determining Corrosivity of Adhesive Metals<sup>5</sup>

E 631 Terminology of Building Constructions<sup>6</sup>

E 1592 Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference<sup>6</sup>

E 1646 Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference<sup>6</sup>

E 1680 Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems<sup>6</sup>

G 21 Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi<sup>7</sup>

2.2 *Factory Mutual Research Corporation Standard:* Approval Standard Class 1 Panel Roofs Class No. 4471<sup>8</sup>

2.3 *Underwriters Laboratories Standard:* UL 580, Standard for Safety, Tests for Uplift Resistance of Roof Assemblies<sup>9</sup>

2.4 *Aluminum Association Document:* Aluminum Design Manual, Latest Edition<sup>10</sup>

2.5 *AISI Document:*

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 15.06.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 04.11.

<sup>7</sup> *Annual Book of ASTM Standards*, Vols 08.03 and 14.02.

<sup>8</sup> Available from Factory Mutual Research Corp., P.O. Box 688, Norwood, MA 02062.

<sup>9</sup> Available from Underwriters' Laboratories, 333 Pfingsten Rd., Northbrook, IL 60062.

<sup>10</sup> Available from Aluminum Assn., 818 Connecticut Ave., NW, Washington, DC 20006.

Cold-Formed Steel Design Manual, Latest Edition<sup>11</sup>

2.6 *MBMA Document:*

MBMA Low Rise Building Systems Manual, Latest Edition<sup>12</sup>

2.7 *ASHRAE Document:*

1997 ASHRAE Handbook, Fundamentals<sup>13</sup>

2.8 *National Climatic Center Document:*

1981 B Climatology of U.S. #81<sup>14</sup>

### 3. Terminology

3.1 *Definitions:*

3.1.1 Refer to the latest edition of the MBMA Low Rise Building Systems Manual and Terminology E 631 for definitions of terms used in this specification.

3.2 *Descriptions 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 aluminum roof panel system, n*—an aluminum 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 environmental 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 extremes for many localities are found in documents referenced in 2.6-2.8.

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 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.

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 the Specifications for Aluminum Structures and in accordance with sound engineering methods and practices.

5.1.2 Deflection and serviceability shall be accounted for.<sup>15</sup> 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 Specifications for Aluminum Structures, 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 Factory Mutual Research Corporation Approval Standard 4471, or Underwriters Laboratories U.L. 580 or Test Method E 1592 or other applicable tests (see Appendix X2).

### 6. Panel Material

6.1 The panel material shall be in accordance with the Specifications for Aluminum Structures and Specification B 209.

6.2 Aluminum alloy, temper, and 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 support members permit, it is permissible to resolve

<sup>11</sup> Available from American Iron and Steel Institute, 1101 17th Street, NW, Suite 1300, Washington, DC 20036-4700.

<sup>12</sup> Available from Metal Building Manufacturers Assn., Inc., 1300 Summer Avenue, Cleveland, OH 44115-2851.

<sup>13</sup> Available from American Society of Heating, Refrigerating and Air Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, GA 30329.

<sup>14</sup> Available from National Climatic Center, Asheville, NC.

<sup>15</sup> Fisher, J. M. and West, M. A., "Serviceability Design Considerations for Low-Rise Buildings," AISI Design Guide, No. 3.