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# **Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrail**

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**AASHTO Designation: M 180-18 (2021)**

Technically Revised: 2018

Reviewed but Not Updated: 2021

**Technical Subcommittee: 4d, Safety Devices**



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## 1. SCOPE

- 1.1. This specification covers corrugated sheet steel prepared for use as beams in highway guardrails.
  - 1.2. The values stated in SI units are to be regarded as the standard.
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## 2. REFERENCED DOCUMENTS

### 2.1. *AASHTO Standards:*

- M 111M/M 111, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- M 232M/M 232, Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- T 65M/T 65, Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

### 2.2. *ASTM Standards:*

- A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength
- A563M, Standard Specification for Carbon and Alloy Steel Nuts (Metric)
- A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process
- A1046/A1046M, Standard Specification for Steel Sheet, Zinc-Aluminum-Magnesium Alloy-Coated by the Hot-Dip Process
- B6, Standard Specification for Zinc
- B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- E376, Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods
- F568M, Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners (withdrawn 2012; no replacement)

### 2.3. *ANSI Standards:*

- B1.13M, Metric Screw Threads D M Profile
- B18.2.4.1M, Hex Nuts, Style 1, Metric
- B18.2.4.6M, Hex Nuts, Heavy, Metric

2.4. *Federal Standard:*  
■ TT-P-641, Type II Zinc Dust Primer for Steel or Galvanized Metal Surfaces

2.5. *Military Standard:*  
■ DOD-P-21035, Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

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### 3. CLASSIFICATION

3.1. *Six types and two classes of guardrail are provided as follows:*

3.1.1. *Types:*

*Type I*—Zinc-coated, 550 g/m<sup>2</sup> (1.80 oz/ft<sup>2</sup>) total both sides coating weight (mass) minimum single-spot.

*Type II*—Zinc-coated, 1100 g/m<sup>2</sup> (3.60 oz/ft<sup>2</sup>) total both sides coating weight (mass) minimum single-spot.

*Type III*—Beams to be painted.

*Type IV*—Beams of corrosion-resistant steel.

*Type V*—Zinc-6 percent aluminum-3 percent magnesium alloy coated, 245 g/m<sup>2</sup> (0.80 oz/ft<sup>2</sup>) total both sides coating weight (mass) minimum single-spot.

*Type VI*—Zinc-6 percent aluminum-3 percent magnesium alloy coated, 305 g/m<sup>2</sup> (1.00 oz/ft<sup>2</sup>) total both sides coating weight (mass) minimum single-spot.

3.1.2. *Classes:*

*Class A*—Base metal nominal thickness—2.67 mm (0.105 in.).

*Class B*—Base metal nominal thickness—3.43 mm (0.135 in.).

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### 4. ORDERING INFORMATION

4.1. *Orders for guardrail under this specification shall include the following information, as required, to adequately describe the desired material:*

4.1.1. Quantity (linear meter or number of pieces),

4.1.2. Class of guardrail,

4.1.3. Type of guardrail,

4.1.4. Effective length of beam section 3.8 or 7.6 m (12.5 ft or 25.0 ft),

4.1.5. Shape (W-beam or thrie beam), and

4.1.6. Exceptions to this specification or special requirements, if any.

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### 5. BASIS OF ACCEPTANCE

5.1. All material shall be subject to inspection and sampling at the fabricating plant, warehouse, or after delivery to the site of construction.

5.2. *Acceptance by Sampling:*

5.2.1. The engineer may take one piece of guardrail, a backup plate, and end or buffer section from each 200 pieces in a lot, or from each lot if less than 200 pieces are included therein, for determination of compliance with specification requirements. If one piece fails to meet the requirements, two other pieces shall be tested. If either of these pieces fails to conform to the requirements of this specification, the lot of material represented by these samples shall be rejected. A lot shall be considered that quantity of material offered for inspection at one time that bears the same heat and coating identification.

5.3. *Acceptance by Brand Registration and Guarantee:*

5.3.1. By mutual agreement between the fabricator and engineer, acceptance may be based on a brand registration and guarantee filed with the engineer by the fabricator. For acceptance of a brand, the fabricator shall furnish a brand registration and guarantee meeting the approval of the engineer and showing the brand name or designation, the manner in which it will appear on the fabricated beams, the typical mechanical properties, chemical composition if specified, the class and type of guardrail, and other specified properties. The fabricator shall also guarantee that, as long as material is furnished under that brand and designation, it will conform fully to the requirements of the specification and shall be replaced without cost to the engineer when found not in conformity with any of the specified requirements. The brand registration and guarantee shall be sworn to for the fabricator by a person having legal authority to bind the company. Upon approval of a brand registration and guarantee, that brand will be accepted without further certification. If, in subsequent actual field use, there is evidence of misbranding as determined by random sampling and detection of inadequate tensile strength, yield strength, elongation, improper coating, deficient thickness, or improper fabrication, the material will be rejected and approval for further use withdrawn until subsequently reapproved. Samples for test of any material offered for use may be taken at any time deemed desirable by the engineer.

5.3.2. The manufacturer or fabricator shall make such tests and measurements as necessary to ensure that the material produced complies with all specification requirements. These tests and measurements shall be so identified by the identification symbols or code used on the beam that the manufacturer can produce specific reports showing these test results. Copies of reports of these tests shall be kept on file and shall be submitted to the engineer on request.

5.3.3. The brand shall be removed or obliterated by the manufacturer or fabricator on all material where control tests, as outlined herein, do not show conformance to this specification.

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## 6. MATERIALS

6.1. *Base Metal*—The beam, transition, end, and buffer sections shall consist of sheet produced from electric arc furnace or basic oxygen furnace steel and shall meet the mechanical properties specified in Section 8. The chemical composition of the base metal for Type IV beams shall be as approved by the engineer.

6.2. *Zinc*—The zinc used for the coating of Type I and II sections shall be as prescribed in ASTM B6, and shall be at least equal to the grade designated as “Prime Western.”

6.3. *Zinc-Aluminum-Magnesium Alloy*—The zinc-aluminum-magnesium alloy for Types V and VI shall contain 5–13 percent aluminum, 2–4 percent magnesium, and up to 1 percent total additional alloying elements (except iron), and the balance zinc as prescribed in ASTM A1046/A1046M Coating Bath Composition, Table 6 Type 1.

6.4. *Bolts and Nuts:*

6.4.1. Unless otherwise specified, bolts and nuts for Types I, II, and III beams shall conform to or exceed the requirements of ASTM A307 and shall be coated in accordance with Section 9.4.