
Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

AASHTO Designation: M 232M/M 232-19 (2023)¹

Technically Revised: 2019

Reviewed but Not Updated: 2023

Technical Subcommittee: 4f, Metals

ASTM Designation: A153/A153M-16a



American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This specification covers zinc coatings applied by the hot-dip process on iron and steel hardware. The hot-dip galvanizing process consists of parts being immersed in molten zinc for a time sufficient to allow a metallurgical reaction between iron from the steel surface and the molten zinc, resulting in the formation of Zn/Fe alloy layers bonding the coating to the steel surface.
- 1.2. This specification is intended to be applicable to hardware items that are centrifuged or otherwise handled to remove excess galvanizing bath metal (free zinc). Coating thickness grade requirements reflect this.
- 1.3. The values stated in SI units are to be regarded as the standard. The equivalent inch-pound units may only be approximate.
- 1.4. *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. *AASHTO Standard:*
 - < T 65M/T 65, Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
- 2.2. *ASTM Standards:*
 - < A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
 - < A780/A780M, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - < A902, Standard Terminology Relating to Metallic Coated Steel Products
 - < B6, Standard Specification for Zinc
 - < B487, Standard Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section
 - < B960, Specification for Prime Western Grade-Recycled (PWG-R) Zinc



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- < E376, Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods
- < F1470, Standard Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection
- < F1789, Standard Terminology for F16 Mechanical Fasteners

3. TERMINOLOGY

3.1. *Definitions:*

3.1.1. The following terms and definitions are specific to this specification. ASTM A902 contains other terms and definitions relating to metallic coated steel products. ASTM F1789 contains other terms and definitions relating to mechanical fasteners.

3.2. *Definitions of Terms Specific to This Standard:*

- 3.2.1. *average coating thickness, n*—the average of the specimen coating thickness values for the samples in an inspection lot.
- 3.2.2. *bare spots, n*—uncoated areas on the surface of the steel part that contain no measurable zinc coating.
- 3.2.3. *dross inclusions, n*—the iron/zinc intermetallics, oxides, and flux remnants present in a galvanized coating in a form other than the layer growth of the coating.
- 3.2.4. *individual measurement, n*—the reading from a magnetic thickness gauge of a single coating spot thickness, or the microscopic reading of a coating thickness as seen in an optical microscope at one spot.
- 3.2.5. *inspection lot, n*—the quantity of identical parts cleaned, fluxed, and galvanized together at one time in an appropriate container that is being submitted for acceptance as a group.
- 3.2.6. *malleable casting, n*—a steel article that has been subjected to a prolonged anneal to decarburize or graphitize the part to remove as much of the carbon as possible or to convert the carbon to graphite, which permits plastic deformation in compression without rupture.
- 3.2.7. *sample, n*—a collection of individual units of product from a single inspection lot selected in accordance with Section 6 and intended to represent that inspection lot for acceptance.
- 3.2.8. *specimen, n*—an individual test article upon which thickness measurements or mass [weight] determinations are performed.
- 3.2.9. *specimen coating thickness, n*—the average thickness from no fewer than five test measurements on a specimen, when each measurement location is selected to provide the widest dispersion (in all applicable directions) of locations within the specimen volume.
- 3.2.10. *threaded areas, n*—the sections of a steel part that have threads formed before hot-dip galvanizing.

4. MATERIALS AND MANUFACTURE

- 4.1. *Steel or Iron*—Ferrous articles to be hot-dip zinc coated shall conform to specifications designated by the purchaser.