



Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement¹

This standard is issued under the fixed designation A767/A767M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification covers steel reinforcing bars with protective zinc coatings applied by immersing the properly prepared reinforcing bars into a molten bath of zinc.

NOTE 1—The galvanizer is identified throughout this specification as the manufacturer.

1.2 Guidelines for construction practices at the job-site are presented in [Appendix X1](#).

1.3 Guidelines for use of zinc-coated (galvanized) reinforcing bars with non-galvanized steel forms are presented in [Appendix X2](#).

1.4 The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables) shall not be considered as requirements of the specification.

1.5 This specification is applicable for orders in either inch-pound units (as Specification A767) or SI units (as Specification A767M).

1.6 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system may not be exact equivalents. Therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with this specification.

2. Referenced Documents

2.1 ASTM Standards:²

[A90/A90M Test Method for Weight \[Mass\] of Coating on](#)

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.05 on Steel Reinforcement.

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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.

[Iron and Steel Articles with Zinc or Zinc-Alloy Coatings A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement](#)
[A706/A706M Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement](#)
[A780/A780M Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings](#)
[A996/A996M Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement](#)
[B6 Specification for Zinc](#)
[B487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section](#)
[E376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current \(Electromagnetic\) Testing Methods](#)
[2.2 ACI Standard:³](#)
[ACI 301 Specifications for Structural Concrete](#)
[2.3 AWS Standard:⁴](#)
[AWS D1.4/D1.4M Structural Welding Code—Reinforcing Steel](#)

3. Terminology

3.1 Definition of Term Specific to This Specification:

3.1.1 *lot, n*—all bars of one size furnished to the same steel reinforcing bar specification that have been coated within a single production shift.

4. Ordering Information

4.1 Orders for zinc-coated (galvanized) bars for concrete reinforcement under this specification shall include the following information:

- 4.1.1 Specification for reinforcing bars to be coated (ASTM designation and year of issue) ([5.1](#)),
- 4.1.2 Quantity of bars,
- 4.1.3 Size and grade of bars,

³ Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.concrete.org>.

⁴ Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, <http://www.aws.org>.

*A Summary of Changes section appears at the end of this standard



- 4.1.4 Class of coating (Class 1 or Class 2) (6.5),
 4.1.5 Galvanizing before or after fabrication for Class 1 coating (7.3),
 4.1.6 ASTM designation A767 [A767M] and year of issue.
 4.2 The purchaser shall have the option to specify additional requirements, including but not limited to, the following:
 4.2.1 Requirements for inspection (8.1),
 4.2.2 Manufacturer certification (10.1), and
 4.2.3 Other special requirements, if any.

5. Materials

5.1 Steel reinforcing bars to be zinc-coated (galvanized) shall conform to one of the following Specifications: A615, A706, or A996 [A615M, A706M, or A996M], as specified by the purchaser.

5.2 The zinc used for coating shall be any grade that conforms to Specification B6.

6. Zinc Coating Process

6.1 Reinforcing bars shall be prepared for galvanizing using any surface cleaning process that allows the zinc to bond with the steel, such that the galvanized bar coating appearance and continuity requirements in Section 7 of this specification are satisfied.

6.2 The reinforcing bars shall be coated by immersing the reinforcing bars into a molten bath of zinc until the zinc reacts with the steel surface to form zinc-iron inter-metallic alloys.

6.3 After solidification of the zinc coating, the coated reinforcing bars shall meet the minimum coating thickness or equivalent weight [mass] requirements in Table 1.

NOTE 2—Excess liquid zinc can be removed from freshly coated bars either by allowing liquid zinc to drain off the surface by gravity, or by subjecting the bars to an air or wiping process, where in the case of the latter method, care should be taken to maintain a uniformly thick coating around the perimeter of the bar.

6.4 It shall be the responsibility of the galvanizer to maintain identity of the reinforcing bars throughout the galvanizing process and to the point of shipment.

6.5 *Class of Coating Thickness and Equivalent Weight [Mass]:*

6.5.1 This specification includes two classes of zinc coating thickness and corresponding equivalent weight [mass]. The equivalent weight [mass] of zinc coating on the bar shall conform to the requirements in Table 1.

6.6 *Coating Thickness Tests:*

6.6.1 Coating thickness tests shall be performed in accordance with one of the following test methods:

6.6.1.1 *Magnetic Thickness Gauge Measurements*—The thickness of the coating shall be determined by magnetic thickness gauge measurements in accordance with Practice E376. Use Table 1 to determine the equivalent weight [mass] of the coating. One or more of the following methods shall be permitted to be used to referee the results obtained by magnetic thickness gauge measurements.

6.6.1.2 *Stripping Method*—The weight [mass] shall be determined by stripping the coating from the steel reinforcing bar section in accordance with Test Method A90/A90M. This test method shall not be used for deformed reinforcing bars.

6.6.1.3 *Weighing Before and After Galvanizing*—The weight [mass] shall be determined by weighing steel reinforcing bars before and after galvanizing. The difference between the two measurements divided by the surface area of the bars provides the weight [mass]/unit area. The original weighing shall occur after pickling and drying. The second weighing shall occur after cooling to ambient temperature. This test method shall not be used for deformed reinforcing bars.

NOTE 3—Due to variations in the surface areas of deformed bars as a function of deformation pattern and bar size, the methods in 6.6.1.2 and 6.6.1.3 to measure coating thickness are not appropriate for deformed bars. These are destructive tests appropriate for small samples of a minimum of 3 in.² [2000 mm²] of surface area. These tests do not include the weight [mass] of iron reacted with the zinc coating and may overestimate coating weight [mass] by up to 10 %.

6.6.1.4 *Microscopy*—The equivalent weight [mass] shall be determined by cross-sectional and optical measurement in accordance with Test Method B487. A cross-section sample of the steel shall be polished and examined with an optical microscope to determine the coating thickness. Measurements of thickness shall not be taken on points located on longitudinal ribs or transverse deformations. Use Table 1 to determine the equivalent weight [mass] of the coating.

6.6.2 *Number of Tests*—The following number of coated steel samples and measurements shall be made to determine coating thickness:

6.6.2.1 For determination of the coating weight [mass] using magnetic thickness gauge measurements, three random samples shall be tested from each lot. For each magnetic thickness gauge measurement sample, five or more measurements shall be made at various points throughout the sample so as to represent the entire surface of the sample. A total of at least fifteen measurements shall be averaged to obtain the coating thickness.

TABLE 1 Zinc Coating Thickness and Equivalent Weight [Mass]

NOTE 1—The key value in this table is micrometres (µm) and is based on a zinc density of 7140 kg/m³. The other values are based on conventions using the following formulae: mils = µm × 0.03937; oz/ft² = µm × 0.0232; g/m² = µm × 7.14; and mg/cm² = µm × 0.714.

| Classification | Zinc Thickness | | Weight [Mass]/Unit Area | |
|---------------------------------------|----------------|-----|-------------------------|--------------------|
| | mils | µm | oz/ft ² | mg/cm ² |
| Class 1 | | | | |
| Bar Designation No. 3 [10] | 5.1 | 129 | 3.0 | 92 |
| Bar Designation No. 4 [13] and Larger | 5.9 | 150 | 3.5 | 107 |
| Class 2 | | | | |
| Bar Designation No. 3 [10] and Larger | 3.4 | 86 | 2.0 | 62 |



6.6.2.2 For determination of the coating thickness or equivalent weight [mass] using the stripping method and the weighing method, three random coated steel samples shall be tested from each lot.

6.6.2.3 For determination of the coating thickness or equivalent weight [mass] using the microscopy method, five random coated steel samples shall be tested per lot. Each sample shall be measured on four sides and the total of twenty measurements shall be averaged to obtain the coating thickness.

6.7 *Retests*—If the average zinc coating thickness or equivalent weight [mass] fails to meet the requirements of Table 1, six additional random samples from the lot shall be permitted to be tested. If the average zinc coating thickness or equivalent weight [mass] of the six samples conforms to the requirements of Table 1, the lot shall be accepted.

6.8 *Chromating*—The zinc coating shall be chromate treated unless waived by the purchaser.

NOTE 4—The purpose of chromate treatment is to preclude a reaction between the bars and fresh portland cement paste.

6.8.1 If the chromate treatment is performed immediately after zinc or zinc-alloy coating, it shall be accomplished either by quenching the coated steel reinforcing bars in a solution containing at least 0.2 weight [mass] % of pure sodium dichromate in water (such as 3 oz of each 10 gal [2 kg/m³] of quench water) or by quench chromating in a minimum of 0.2 % chromic acid solution. The solution shall be at least 90°F [32°C]. The galvanized zinc or zinc-alloy coated reinforcing bars shall be immersed in the solution for at least 20 s.

6.8.2 Proprietary chromating solutions of equivalent strength shall be permitted in place of the generic chemical treatment specified in 6.8.1.

6.8.3 If the zinc or zinc-alloy coated reinforcing bars are at ambient temperature, the chromate treatment shall be the same as specified in 6.8.1 except that 0.5 to 1.0 % concentration of sulfuric acid shall be added as an activator of the chromate solution. In this case, there is no temperature requirement for the activated chromate solution.

7. Finish and Adherence of Coating

7.1 The zinc-coated bars shall have no uncoated areas. The coating shall be free of blisters, flux spots or inclusions, dross, and acid spots. Bars that adhere together after galvanizing shall be rejected. In addition, the presence of tears or sharp spikes which make the bar hazardous to handle shall be cause for rejection. A matte gray finish appearance shall not be itself a cause for rejection.

NOTE 5—Specific concentrations of elements such as silicon, carbon, and phosphorus in steel tend to accelerate the growth of the zinc-iron alloy layer so that the galvanized coating may have a matte finish with little or no free zinc outer layer. The mass, shape, and amount of cold working of the bar being galvanized may also affect this condition.

7.2 The coating shall be adherent so it cannot be removed by any reasonable process of handling.

7.3 Class 1 Coatings—Fabrication:

7.3.1 Fabrication Before Galvanizing:

7.3.1.1 Minimum finished bend diameters for reinforcing bars that are fabricated before galvanizing shall be equal to or greater than those specified in Table 2.

7.3.1.2 When reinforcing bars are fabricated to smaller finished bend diameters than those specified in Table 2, the bars shall be stress relieved at a temperature from 900 to 1050°F [480 to 560°C] for 1 h per in. [25 mm] of bar diameter.

7.3.2 Fabrication After Galvanizing:

7.3.2.1 When fabrication is performed after galvanizing, some cracking and flaking of the galvanized coating in the bend areas shall not be cause for rejection (Note 6).

7.3.2.2 Damaged coating due to fabrication shall be repaired and cut ends shall be coated in accordance with Section 9.

NOTE 6—The tendency for cracking of the zinc coating increases with bar diameter and with severity and rate of bending.

7.4 *Class 2 Coatings*—The zinc coating shall not peel or flake off in any bend test meeting the requirements of Specifications A615, A706, or A996 [A615M, A706M, or A996M].

8. Inspection

8.1 Inspection of the zinc-coated (galvanized) bars shall be agreed upon between the purchaser and the manufacturer as part of the purchase order or contract.

9. Permissible Amount of Damaged Coating and Repair of Damaged Coating

9.1 The maximum amount of repaired damaged coating shall not exceed 1 % of the total surface area in each 1-ft [0.3-m] length of the bar. This limit on repaired damaged coating shall not include sheared or cut ends that are repaired with a zinc-rich formulation in accordance with Practice A780/A780M (see 9.3).

9.2 All damaged coating due to fabrication and handling, to the point of shipment to the job-site, shall be repaired with a zinc-rich formulation in accordance with Practice A780/A780M.

9.3 When coated bars are sheared, saw-cut, or cut by other means during the fabrication process, the cut ends shall be coated with a zinc-rich formulation in accordance with Practice A780/A780M.

10. Certification

10.1 When specified in the purchase order or contract, the manufacturer shall furnish, at the time of shipment, a certification that the material was manufactured and tested in

TABLE 2 Minimum Finished Bend Diameters

| Bar Designation No. | Grade 40 [280] | Grade 50 [350] | Grades 60, 75, 80 [420, 520, 550] |
|----------------------|-----------------|----------------|-----------------------------------|
| 3, 4, 5 [10, 13, 16] | 6d ^A | 6d | 6d |
| 6 [19] | 6d | 6d | 6d |
| 7, 8 [22, 25] | 6d | 8d | 8d |
| 9, 10 [29, 32] | ... | ... | 8d |
| 11 [36] | ... | ... | 8d |
| 14, 18 [43, 57] | ... | ... | 10d |

^Ad = nominal diameter of the bar.



accordance with this specification. A report of the tests results shall be included with the certification.

10.2 A material test report, certificate of inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document shall meet the requirements of the invoked ASTM standard(s) and conform to any existing EDI agreement be-

tween the purchaser and the manufacturer. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

NOTE 7—The industry definition as invoked here is: EDI is the computer-to-computer exchange of business information in a standard format such as ANSI ASC X12.

11. Keywords

11.1 corrosion resistance; galvanizing; steel reinforcing bars; zinc-coated

APPENDIXES

(Nonmandatory Information)

X1. GUIDELINES FOR CONSTRUCTION PRACTICES AT THE JOB-SITE

X1.1 ASTM Specification A767/A767M is a product specification. Requirements for zinc-coated (galvanized) steel reinforcing bars from the point of shipment to the job-site and subsequent construction practices at the job-site are not delineated in this product specification.

X1.2 The American Concrete Institute publishes a reference specification "Specifications for Structural Concrete ACI 301." An architect-engineer may cite ACI 301 in the project specifications for any construction project involving structural concrete. ACI 301 includes provisions for zinc-coated (galvanized) reinforcing bars.

X1.3 The project specifications should prescribe requirements for the zinc-coated (galvanized) reinforcing bars from the point of shipment to the job-site and subsequent construction practices at the job-site. If ACI 301 is not cited in the project specifications, the following guidelines are intended to serve as a resource for preparing requirements in project specifications:

X1.3.1 Coating damage incurred during shipment, storage, handling, and placing of zinc-coated (galvanized) reinforcing bars should be repaired with a zinc-rich formulation in accordance with Practice **A780/A780M**. Prior to repairing damaged coating, rust should be removed from the damaged areas by suitable means.

X1.3.2 When handling zinc-coated (galvanized) reinforcing bars, care should be exercised to avoid damaging the coating.

X1.3.3 Zinc-coated (galvanized) reinforcing bars should be off-loaded as close as possible to their points of placement or under the crane so that the bars can be hoisted to the area of placement to minimize rehandling.

X1.3.4 Zinc-coated (galvanized) reinforcing bars should be stored off the ground on protective cribbing, and timbers should be placed between bundles when stacking of the bundles is necessary. Space the cribbing sufficiently close to prevent sags in the bundles.

X1.3.5 Zinc-coated (galvanized) reinforcing bars and uncoated steel reinforcing bars should be stored separately.

X1.3.6 If the extent of damaged coating exceeds 2 % of the surface area of the zinc-coated (galvanized) reinforcing bar in any 1-ft [0.3-m] length, the coated bar should be rejected.

X1.3.7 If the extent of damaged coating does not exceed 2 % of the surface area in any 1-ft [0.3-m] length, all damaged coating discernible to a person with normal or corrected vision should be repaired with a zinc-rich formulation in accordance with Practice **A780/A780M**. The 2 % limit on maximum allowed damaged coating should include previously repaired areas damaged before shipment as required by Specification A767/A767M.

X1.3.8 No uncoated steel reinforcement, or any other embedded metal dissimilar to zinc, should be permitted in the same structural concrete member with or in close proximity to galvanized reinforcing bars, except as part of a cathodic-protection system. Galvanized bars should not be electrically coupled to uncoated bars.

X1.3.9 Zinc-coated (galvanized) reinforcing bars should be supported on wire bar supports that are zinc-coated (galvanized), on wire bar supports coated with epoxy or another polymer, or on supports made of plastic. When precast concrete bar supports with embedded tie wires or dowels are used with coated bars, the wires or dowels should be coated with zinc or polymer. Reinforcing bars used as support bars should be zinc-coated (galvanized).

X1.3.10 Embedded steel items used with zinc-coated (galvanized) reinforcing bars should be zinc-coated (galvanized) or coated with non-metallic materials.

X1.3.11 Zinc-coated (galvanized) reinforcing bars should be fastened (tied) with tie wire coated with zinc or polymer.

X1.3.12 If zinc-coated (galvanized) reinforcing bars are cut in the field, the bar ends should be coated with a zinc-rich formulation in accordance with Practice **A780/A780M**.

X1.3.13 After installing mechanical splices on zinc-coated (galvanized) reinforcing bars, damaged coating and areas of removed coating should be repaired with a zinc-rich formulation in accordance with Practice **A780/A780M**. Exposed parts of mechanical splices should be coated with the same zinc-rich formulation that is used for the repair of damaged coating



X1.3.14 Welding of zinc-coated (galvanized) reinforcing bars should conform to the requirements in AWS D1.4/D1.4M. After completing welds on zinc-coated (galvanized) reinforcing bars, damaged coating should be repaired with a zinc-rich formulation in accordance with Practice **A780/A780M**. Welds should be coated with the same zinc-rich formulation that is used for the repair of damaged coating.

X1.3.15 After field bending or straightening zinc-coated (galvanized) reinforcing bars, damaged coating should be

repaired with a zinc-rich formulation in accordance with Practice **A780/A780M**.

X1.3.16 After placement of zinc-coated (galvanized) reinforcing bars, the coated bars should be inspected for damaged coating prior to placing concrete. Where damaged coating exists, it should be repaired with a zinc-rich formulation in accordance with Practice **A780/A780M**.

X2. GUIDELINES FOR USE OF ZINC-COATED (GALVANIZED) STEEL REINFORCING BARS WITH NON-GALVANIZED STEEL FORMS

X2.1 Zinc-coated (galvanized) steel reinforcing bars contain a zinc-coated surface that is of a different electrochemical potential than uncoated steel or stainless steel. When forms for casting concrete are made of uncoated steel or stainless steel, the use of zinc-coated (galvanized) steel reinforcing bars necessitates an electrical isolation of the zinc-coated (galvanized) steel reinforcing bars from the forms. Should electrical

contact between the two occur, the result will be a shadowing of a ghost appearance of the reinforcing bar on the finished concrete surface. Zinc ions will tend to migrate to the surface of the concrete and appear in a darker color, or shadow, on the concrete surface, in the shape of the reinforcing bar configuration. In more severe cases, the concrete can adhere to the metal forms.

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A767/A767M – 09 (2015)) that may impact the use of this standard. (Approved Sept. 1, 2015.)

(1) Revised Sections 1, 2, 4 (formerly 3), 5, 6 (formerly 4), 7 (formerly 6), 8, 10.1, 10.2 (formerly 10.3), and Appendixes X1 and X2; added new Section 3; and re-positioned the units throughout the specification.

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