Designation: A 767/A 767M – 00b

Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement[1]

This standard is issued under the fixed designation A 767/A 767M; 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 Department of Defense.

1. Scope

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

1.2 This specification is applicable for orders in either inch-pound units (as Specification A 767) or SI units (as Specification A 767M).

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

2. Referenced Documents

2.1 *ASTM Standards:*

A 90 Test Method for Weight (Mass) of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles[2]

A 615/A 615M Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement[3]

A 706/A 706M Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement[3]

A 780/A 780M Practice for Repair of Hot Dip Galvanized Coatings[2]

A 996/A 996M Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement[3]

B 6 Specification for Zinc (Slab Zinc)[4]

E 376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods[5]

2.2 *American Concrete Institute Specification:*[6]

ACI 301 Specifications for Structural Concrete

3. Ordering Information

3.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for material ordered to this specification. Such requirements shall include, but are not limited to the following:

3.1.1 Quantity of bars,

3.1.2 Size of bars,

3.1.3 Reinforcing bar specification (ASTM designation and year of issue) and grade,

3.1.4 Class of coating,

3.1.5 Galvanization before or after fabrication, and

NOTE 1—A typical ordering description is as follows: Deformed Grade 420 bars to ASTM A 615M-____; 1600 m, No. 19, 8 m long in secured lifts; zinc-coated (galvanized) to ASTM A 767M-____; including Class 1 coating, and galvanization after fabrication.

[Deformed Grade 60 bars to ASTM A 615-____; 4000 linear ft, No. 6, 20 ft, 0 in. long in secured lifts; zinc-coated (galvanized) to ASTM A 767-____, including Class 1 coating, and galvanization after fabrication.]

4. Galvanizing

4.1 *Handling*:

4.1.1 The galvanizer shall be permitted to subject the newly coated steel reinforcing bars to air or steam wiping to remove excess zinc from the bars. After the wiping, the coated steel reinforcing bars shall meet the minimum coating mass [weight].

NOTE 2—During the wiping process care should be taken to maintain a uniformly thick coating around the perimeter of the bar.

4.1.2 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.

4.2 *Mass [Weight] of Coating and Test*:

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

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[2] *Annual Book of ASTM Standards*, Vol 01.06.

[3] *Annual Book of ASTM Standards*, Vol 01.04.

[4] *Annual Book of ASTM Standards*, Vol 02.04.

[5] *Annual Book of ASTM Standards*, Vol 03.03.

[6] Available from American Concrete Institute, P.O. Box 9094, Farmington Hills, MI 48333–9094.

4.2.1 This specification includes two classes of coating mass [weight]. The mass [weight] of zinc coating based on actual area of the bar, shall conform to the requirements shown in Table 1.

NOTE 3—The nominal diameter of a deformed bar is equivalent to that of a plain round bar having the same mass per metre [weight per foot] as the deformed bar. Coating mass [weight] shown in Table 1 is based on an assumed area ratio of 1.2:1 (actual to nominal surface area of the steel reinforcing bar).

4.2.2 *Magnetic Thickness Measurements*—The mass [weight] of the coating shall be determined by magnetic thickness gage measuremens in accordance with Practice E 376. The thickness measurement is used to calculate the mass [weight] by multiplying it by the surface area of coated bar and by the zinc density. One or more of the following methods shall be permitted to be used to referee the results obtained by magnetic thickness measurments.

4.2.2.1 *Stripping Method*—The mass [weight] shall be determined by stripping the coating from the steel reinforcing bar section in accordance with Test Method A 90/A 90M.

NOTE 4—This is a destructive test appropriate for small samples of a minimum of 2000 mm^2[3 $in.^2$] of surface area. It does note include the mass [weight] of iron reacted with the zinc coating and may overestimate coating mass [weight] by up to 10%.

4.2.2.2 *Weighing Before and After Galvanizing*—The mass [weight] shall be determined by weighing steel reinforcing bars before and after galvanizing. The difference between the two measurements divided by the surfce area of the bars provides the mass [weight]. The original weighing shall occur after pickling and drying. The second weighing shall occur after cooling to ambient temperature.

4.2.2.3 *Microscopy*—The mass [weight] shall be determined by cross-sectional and optical measurement in accordance with Test Method B 487. A cross-section sample of the steel shall be polished and examined with an optical microscope to determine the coating thickness. The coating mass [weight] shall be determined by multiplying coating thickness by the surface area of the coated sample and by the density of zinc.

4.2.3 *Number of Tests*—For determination of the coating mass [weight], three random samples shall be tested from each lot. For each magnetic thickness 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. For the microscopy method, five 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. For the stripping method and the weighing method, three samples per lot shall be measured.

TABLE 1 Mass [Weight] of Zinc Coating

Coating Class	Mass [Weight] of Zinc Coating, min, g/m^2[oz/ft^2] of Surface
Class I	
Bar Designation Size No. 10 [3]	915 [3.00]
Bar Designation Size No. 13 [4] and Larger	1070 [3.50]
Class II	
Bar Designation Size No. 10 [3] and Larger	6.10 [2.00]

NOTE 5—A lot shall be as follows: All bars of one size furnished to the same steel reinforcing bar specification that have been galvanized within a single production shift.

4.2.4 *Retests*—If the average zinc coating mass [weight] 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 mass [weight] of the six samples conforms to the requirements of Table 1, the lot shall be accepted.

4.3 *Chromating*—The galvanized coating shall be chromate treated. This is to preclude a reaction between the bars and fresh portland cement paste. Proprietary chromating solutions of equivalent strength are permitted in place of the generic chemical treatment specified.

4.3.1 If the chromate treatment is performed immediately after galvanizing, it may be accomplished by quenching the steel reinforcing bars in a solution containing at least 0.2 mass [wt] % of sodium dichromate in water (such as $2kg/m^3$[3 oz of each 10 gal] of quench water) or by quench chromating in a minimum of 0.2 % chromic acid solution. The solution shall be at least 32°C [90°F]. The galvanized reinforcing bars shall be immersed in the solution for at least 20 s.

4.3.2 If the galvanized reinforcing bars are at ambient temperature, the chromate treatment shall be the same as specified in 4.3.1 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.

5. General Requirements

5.1 The steel reinforcing bars shall conform to one of the following specifications: A 615M, A 706M, or A 996M [A 615, A 706, or A 996].

5.2 The zinc used for coating shall be any grade that conforms to Specification B 6.

6. Finish and Adherence of Coating

6.1 The zinc coating shall have no bare spots. The coating shall be free of blisters, flux spots or inclusions, dross, and acid or black spots. Bars that stick 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 6—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.

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

7. Fabrication

7.1 *Before Galvanizing*:

7.1.1 Steel reinforcing bars that are bent cold prior to galvanizing shall be fabricated to a bend diameter equal to or greater than those specified in Table 2.

7.1.2 Steel reinforcing bars shall be permitted to be cold bent to tighter diameters than specified in Table 2 (limited to the extent that the appropriate reinforcing bar specification allows) if stress relieved at a temperature from 480 to 560°C [900 to 1050°F] for 1 h per 25 mm [1 in.] of bar diameter.

7.2 *After Galvanizing*:

7.2.1 When galvanizing is performed before bending, some cracking and flaking of the galvanized coating in the area of the bend shall not be cause for rejection (Note 7).

7.2.2 Damage to the coating as a result of fabrication shall be repaired in accordance with Section 9.

NOTE 7—The tendency for cracking of the zinc coating increases with bar diameter and with severity and rate of bending.

8. Inspection

8.1 The inspector representing the purchaser shall have access at all times, while work on the contract of the purchaser is being performed, to those areas of the galvanizer's plant which concern the manufacture of the material ordered. The galvanizer shall afford the inspector all reasonable facilities to satisfy him that the coating is being furnished in accordance with this specification.

8.2 The material shall be inspected at the galvanizer's plant prior to shipment. However, if specified, the purchaser shall make the tests which govern the acceptance or rejection of the materials in his own laboratory or elsewhere.

8.3 Visual inspection of materials ready for shipment shall be made to determine conformity with the requirements of 6.1. For materials that fail inspection, it shall be permissible for the materials to be stripped and regalvanized, and resubmitted for inspection. They shall conform to the requirements of this specification.

TABLE 2 Minimum Finished Bend Diameters

Bar No.	Grade 300 [40]	Grade 350 [50]	Grade 420 [60]	Grade 520 [75]
10,13,16 [3,4,5]	6*d*[A]	6*d*	6*d*	. . .
19 [6]	6*d*	6*d*	6*d*	6*d*
22,25 [7,8]	6*d*	8*d*	8*d*	8*d*
29,32 [9,10]	. . .	. . .	8*d*	8*d*
36 [11]	. . .	. . .	8*d*	8*d*
43,57 [14,18]	. . .	. . .	10*d*	10*d*

[A] *d* = nominal diameter of the bar.

9. Repair of Damaged Coating

9.1 All coating damage due to fabrication or handling (tothe point of shipment) shall be repaired with a zinc-rich formulation in accordance with Practice A 780/A780M.

9.2 Sheared ends shall be coated with a zinc-rich formulation.

10. Certification

10.1 Upon request of the purchaser in the contract or order, the galvanizer's certification that the material was manufactured and tested in accordance with this specification, together with the report of the tests results, shall be furnished at the time of shipment.

10.2 When Specification A 615/A615M steel is supplied, a silicon analysis shall be provided.

11. Keywords

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

APPENDIXES

(Nonmandatory Information)

X1. Guidelines for Job-Site Practices

X1.1 Specification A 767/A 767M is a product standard. Requirements for zinc-coated (galvanized) steel reinforcing bars from the point of shipment to the job-site and subsequent practices at the job-site are not delineated in this product standard.

X1.2 The American Concrete Institute promulgates "Specifications for Structural Concrete ACI 301." Specifications ACI 301 is intended to be used in its entirety in the project specifications. An architect-engineer may cite Standard Specifications ACI 301 in the project specifications for any cast-in-place concrete construction project. Standard Specifications ACI 301 include provisions for zinc-coated (galvanized) steel reinforcing bars.

X1.3 The project specifications should prescribe requirements for the zinc-coated (galvanized) steel reinforcing bars from the point of shipment to the job-site and subsequent practices at the job-site. In the absence of these requirements in the project specifications, the following guidelines for job-site practices are recommended:

X1.3.1 When handling coated steel reinforcing bars, care should be exercised to avoid bundle-to-bundle or bar-to-bar abrasion.

X1.3.2 Equipment for handling coated steel reinforcing bars should have protected contact areas.

X1.3.3 Coated steel 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 Coated steel reinforcing bars should be stored off the ground on protective cribbing, and timbers placed between bundles when stacking is necessary. Space the supports sufficiently close to prevent sags in the bundles.

X1.3.5 Coated and uncoated steel reinforcing bars should be stored separately.

X1.3.6 When the extent of coating damage exceeds 2 % of the surface area of the coated steel reinforcing bar in any 0.3–metre [one-foot] length, the coated bar should be rejected.

X1.3.7 When the extent of the damage does not exceed 2 % of the surface area in any 0.3–metre [one-foot] length, all damaged coating discernible to a person with normal or corrected vision should be repaired with a zinc-rich formulation complying with Specification A 767/A 767M.

X1.3.8 Placed coated steel reinforcing bars should be inspected for coating damage prior to placing concrete. Where damage exists, it should be repaired with a zinc-rich formulation complying with Specification A 767/A 767M.

X1.3.9 Repair material should be applied in strict accordance with the written instructions furnished by the repair material manufacturer. Prior to application of the repair material, rust should be removed from the damaged areas by suitable means. The repair material should be allowed to cure before placing concrete over the coated steel reinforcing bars.

X1.3.10 When placing coated steel reinforcing bars, all wire bar supports, spacers, and tying wire should be coated with zinc or with dielectric material.

X1.3.11 After placing, walking on coated steel reinforcing bars should be avoided. The placement of mobile equipment should be planned to avoid damage to the coated bars.

X1.3.12 When immersion-type vibrators are used to consolidate concrete around coated steel reinforcing bars, the vibrators should be equipped with nonmetallic heads.

X2. Guidelines for Use of Galvanized Reinforcing Bars with Non-Galvanized Steel Formwork

X2.1 Galvanized steel reinforcing bars contain a zinc-coated surface that is of a different electrochemical potential than uncoated steel or stainless steel. When formwork for casting concrete is made of uncoated steel or stainless steel, the use of galvanized steel reinforcing bars necessitates an electrical isolation of the galvanized steel reinforcing bars from the formwork. Should electrical conact 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 push 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 arrangement. In more severe cases, the concrete can adhere to the metal formwork.