Designation: B 695 – 00

Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel[1]

This standard is issued under the fixed designation B 695; 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 the requirements for a coating of zinc mechanically deposited on iron and steel basis metals. The coating is provided in several thicknesses up to and including 107 µm. The seven thickest classes are usually referred to as "mechanically galvanized."

1.2 *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.*

NOTE 1—The performance of this coating complies with the requirements of Specification A 153 and MIL-C-81562.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound equivalents of SI units may be approximate.

2. Referenced Documents

2.1 *ASTM Standards:*

A 153 Specification for Zinc Coating (Hot–Dip) on Iron and Steel Hardware[2]

A 194/A194M Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service[3]

A 325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength[4]

A 490 Specification for Heat-Treated, Steel Structural Bolts, 150 ksi Minimum Tensile Strength[4]

A 563 Specification for Carbon and Alloy Steel Nuts[4]

B 117 Practice for Operating Salt Spray (Fog) Apparatus[5]

B 183 Practice for Preparation of Low-Carbon Steel for Electroplating[6]

B 242 Practice for Preparation of High-Carbon Steel for Electroplating[6]

B 322 Practice for Cleaning Metals Prior to Electroplating[6]

B 487 Test Method for Measurement of Metal and Oxide Coating Thicknesses by Microscopical Examination of a Cross Section[6]

B 499 Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals[6]

B 571 Test Methods for Adhesion of Metallic Coatings[6]

B 602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings[6]

F 1470 Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection[7]

2.2 *Military Standard:*

MIL-C-81562 Coating, Cadmium, Tin Cadmium and Zinc (Mechanically Deposited)[8]

2.3 *AISC Standard:*

Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts[9]

3. Classification

3.1 *Classes*—Zinc coatings are classified on the basis of thickness, as follows:

Class	Minimum Thickness, µm
110	107
80	81
70	69
65	66
55	53
50	50
40	40
25	25
12	12
8	8
5	5

3.2 *Types*—Zinc coatings are identified by types on the basis of supplementary treatment required, as follows:

[1] This specification is under the jurisdiction of ASTM Committee B-8 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.08.04 on Light Metals.

Current edition approved March 10, 2000. Published May 2000. Originally published as B 695 – 82. Last previous edition B 695 – 91 (1997).

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

[3] *Annual Book of ASTM Standards*, Vol 01.01.

[4] *Annual Book of ASTM Standards*, Vol 15.08.

[5] *Annual Book of ASTM Standards*, Vol 03.02.

[6] *Annual Book of ASTM Standards*, Vol 02.05.

[7] *Annual Book of ASTM Standards*, Vol 01.08.

[8] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[9] Available from American Institute of Steel Construction, Inc., 400 N. Michigan Ave., Chicago, IL 60611.

Type I—As coated, without supplementary treatment (Appendix X2.1).

Type II—With colored chromate conversion treatment (Appendix X2.2).

4. Ordering Information

4.1 To make the application of this standard complete, the purchaser should supply the following information to the seller in the purchase order or other governing document:

4.1.1 Class, including a maximum thickness, if appropriate, type, and for Type II, color and need for supplemental lubricant (3.1, 3.2, and 6.2.5),

4.1.2 Nature of substrate (for example, high-strength steel), need for stress relief (6.2.1), and cleaning precautions to be followed (6.2.2 and 6.2.3),

4.1.3 Significant surfaces (6.3),

4.1.4 Requirements for and methods of testing for one or more of the following, if required: need for and type of test specimens (8.1), thickness (6.3 and 8.3), adhesion (6.4 and 8.4), corrosion resistance (6.5 and 8.5), absence of hydrogen embrittlement, and the waiting period before testing and testing loads (6.6 and 8.6),

4.1.5 Inspection responsibility (Section 11) and sampling plan for each inspection criterion (Section 7), and

4.1.6 Requirements for certified report of test results (Section 10).

5. Workmanship

5.1 The coating shall be uniform in appearance and substantially free of blisters, pits, nodules, flaking, and other defects that can adversely affect the function of the coating. The coating shall cover all surfaces as stated in 6.3 including roots of threads, thread peaks, corners, recesses, and edges. The coating shall not be stained or discolored throughout to an extent that would adversely affect appearance as a functional requirement. However, superficial staining, that results from rinsing or drying, and variations in color or luster shall not be cause for rejection.

NOTE 2—The nature of the mechanical plating process is such that coatings characteristically will not be as smooth or as bright as some electroplated coatings.

6. Requirements

6.1 *Appearance*—The coating as deposited shall have a uniform silvery appearance, and a matte to medium-bright luster.

6.2 *Process*:

6.2.1 *Stress-Relief Treatment*—All steel parts that have an ultimate tensile strength of 1000 MPa and above and that contain tensile stresses caused by machining, grinding, straightening, or cold-forming operation shall be given a stress-relief heat treatment prior to cleaning and metal deposition. The temperature and time at temperature shall be 190 ± 15°C for a minimum of 3 h so that maximum stress relief is obtained without reducing the hardness below the specified minimum.

6.2.2 High-strength steels (which become embrittled when charged with hydrogen) and that have heavy oxide or scale shall be cleaned before application of the coating in accordance with Practice B 242. In general, nonelectrolytic alkaline, anodic-alkaline, and some inhibited acid cleaners are preferred to avoid the risk of producing hydrogen embrittlement from the cleaning procedure.

6.2.3 For low-carbon steels, see Practice B 183. Useful guidelines are also given in Practice B 322.

6.2.4 Mechanical deposition of zinc coatings shall consist, in general, of all of the steps listed below, and in the sequence as shown:

6.2.4.1 Preparation of the surface of the parts to be coated, by chemical (generally acidic) procedure to an extent that permits uniformly satisfactory results from subsequent steps.

6.2.4.2 Deposition of a thin metal coating, generally of copper, by immersion in appropriate chemical solutions, without the use of electric current. There are no thickness requirements for this coating.

6.2.4.3 Tumbling of the parts that have been treated according to 6.2.4.1 and 6.2.4.2 in a container with the following:

(i) the zinc metal to be deposited, in powder form;

(ii) impact media, which may be glass or other substances that are essentially inert to the chemicals of the deposition process. The function of this media is to aid in providing mechanical forces to drive the metal powder onto the substrate parts;

(iii) a "promoter" or "accelerator" which aids in the uniform deposition of the metal powder;

(iv) a liquid medium, generally water.

6.2.4.4 Separation of the parts from the solid and liquid media.

6.2.4.5 Rinsing.

6.2.4.6 Drying.

6.2.5 *Supplementary Treatments*:

6.2.5.1 *Colored Chromate Conversion Treatments (Type II)*—Colored chromate conversion treatment for Type II shall be done in a solution containing hexavalent chromium ions. This solution shall produce a bright or semi-bright continuous, smooth, protective film with a uniform color that may range from yellow through bronze and olive-drab to brown and black and that may be dyed to a desired color. Bright dips that do not contain salts that yield films containing hexavalent chromium ions are not permitted as treatments for producing Type II coatings.

6.2.5.2 Waxes, lacquers, or other organic coatings may be used to improve lubricity, and the need for them shall be supplied in the purchase order or other governing document (see 4.1.1). Supplemental lubrication treatments shall not be used to ensure conformance to the salt spray corrosion resistance requirements (see 8.5.4).

6.2.5.3 Lubrication of grade DH nuts processed in accordance with this specification and used with Specification A 325 high-strength bolts is a requirement of paragraph 6.5 of Specification A 325 and paragraph 4.8 of Specification A 563.

NOTE 3—Although not included in Specification A 194/A 194M, this provision should apply to mechanically galvanized A 194 2H nuts when supplied for use with Specification A 325 bolts.

NOTE 4—Specifications for structural joints using Specification A 325 or A 490 bolts references the use of lubricants on nuts to be used with Specification A 325 high-strength bolts and is found in the commentary on