Designation: B695 – 04(Reapproved 2009)

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

This standard is issued under the fixed designation B695; 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 A153/A153M 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 are given for informational purposes.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A194/A194M Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A490 Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

A563 Specification for Carbon and Alloy Steel Nuts

B117 Practice for Operating Salt Spray (Fog) Apparatus

B183 Practice for Preparation of Low-Carbon Steel for Electroplating

B242 Guide for Preparation of High-Carbon Steel for Electroplating

B322 Guide for Cleaning Metals Prior to Electroplating

B487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section

B499 Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals

B571 Practice for Qualitative Adhesion Testing of Metallic Coatings

B602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings

B697 Guide for Selection of Sampling Plans for Inspection of Electrodeposited Metallic and Inorganic Coatings

B762 Test Method of Variables Sampling of Metallic and Inorganic Coatings

F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

2.2 *Military Standard:*

MIL-C-81562 Coating, Cadmium, Tin Cadmium and Zinc (Mechanically Deposited)[3]

2.3 *AISC Standard:*

Specifications for Structural Joints Using ASTM A325 or A490 Bolts[4]

3. Classification

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

[1] This specification is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatingsand is the direct responsibility of Subcommittee B08.06 on Soft Metals.

Current edition approved Sept. 1, 2009. Published December 2009. Originally approved in 1982. Last previous edition approved in 2004 as B695– 04. DOI: 10.1520/B0695-04R09.

[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.

[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

[4] Available from American Institute of Steel Construction (AISC), One E. Wacker Dr., Suite 700, Chicago, IL 60601-2001, http://www.aisc.org.

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:

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 Supplying the following information by the purchaser to the seller in the purchase order or other governing document will make the application of this specification complete:

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 free of blisters, pits, nodules, flaking, and other defects that are capable of adversely affecting 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 capable of adversely affecting 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 B242. 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 B183. Useful guidelines are also given in Guide B322.

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:

(1) The zinc metal to be deposited, in powder form;

(2) Impact media, which includes glass, for example, 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;

(3) A "promoter" or "accelerator" which aids in the uniform deposition of the metal powder; and

(4) 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 is capable of ranging from yellow through bronze and olive-drab to brown and black and that are capable of being dyed to a desired color. Bright dips that do not contain salts that yield films containing hexavalent chromium ions are precluded as treatments for producing Type II coatings.

6.2.5.2 Waxes, lacquers, or other organic coatings are not prohibited from being 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