Designation: B633 – 13

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

This standard is issued under the fixed designation B633; 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 material and process requirements for electrodeposited zinc coatings applied to iron or steel articles to protect them from corrosion.

1.2 The coatings are provided in four standard thickness classes (4.1), in the as-plated condition or with one of five types of supplementary finishes (4.2).

1.3 High strength metals, unless otherwise specified, including high strength steels having a tensile strength greater than 1700 MPa (247 ksi, 46HRC) shall not be electroplated.

1.4 It does not cover continuous processes for electrodeposited zinc coated steel wire or sheets (see Specification A591/A591M for sheets.)

1.5 It may be used for fasteners but specific specifications have been developed for manufacturing fasteners in Committee F16 which may be more applicable (see Specifications F1941 and F1941M.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *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.*

1.8 *This standard has been revised to address RoHS requirements that seek to limit the exposure of workers and the public from exposure to toxic metals. Additional types V and VI have been added to permit non-chromate passivate treatments to be used in replacement of hexavalent chromium.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A591/A591M Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight [Mass] Applications (Withdrawn 2005)[3]

B117 Practice for Operating Salt Spray (Fog) Apparatus

B183 Practice for Preparation of Low-Carbon Steel for Electroplating

B201 Practice for Testing Chromate Coatings on Zinc and Cadmium Surfaces

B242 Guide for Preparation of High-Carbon Steel for Electroplating

B254 Practice for Preparation of and Electroplating on Stainless Steel

B320 Practice for Preparation of Iron Castings for Electroplating

B322 Guide for Cleaning Metals Prior to Electroplating

B374 Terminology Relating 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

B504 Test Method for Measurement of Thickness of Metallic Coatings by the Coulometric Method

B567 Test Method for Measurement of Coating Thickness by the Beta Backscatter Method

B568 Test Method for Measurement of Coating Thickness by X-Ray Spectrometry

B571 Practice for Qualitative Adhesion Testing of Metallic Coatings

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

Current edition approved May 15, 2013. Published June 2013. Originally approved in 1978. Last previous edition approved in 2011 as B633 – 11. DOI: 10.1520/B0633-13.

[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] The last approved version of this historical standard is referenced on www.astm.org.

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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
B849 Specification for Pre-Treatments of Iron or Steel for Reducing Risk of Hydrogen Embrittlement
B850 Guide for Post-Coating Treatments of Steel for Reducing the Risk of Hydrogen Embrittlement
D2092 Guide for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting (Withdrawn 2008)[3]
F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection
F1941 Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
F1941M Specification for Electrodeposited Coatings on Threaded Fasteners (Metric)

2.2 *Military Standard:*[4]
MIL-STD-1312 Fastener Tests, Methods (Test 12)

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions of the terms used in this specification are in accordance with Terminology B374.

3.1.2 *passivate*—for the purpose of this specification, a conversion coating on zinc shall not contain hexavalent chromium.

4. Classification

4.1 *Thickness*—The coating shall be provided in one of the four thickness classes defined in Table 1.

TABLE 1 Thickness Classes for Coatings

Classification Number and Conversion Coating Suffix	Service Condition	Thickness, min µm
Fe/Zn 25	SC 4 (very severe)	25
Fe/Zn 12	SC 3 (severe)	12
Fe/Zn 8	SC 2 (moderate)	8
Fe/Zn 5	SC 1 (mild)	5

4.2 *Finish*—The coating shall have one of the finish types defined in Table 2.

5. Ordering Information

5.1 When ordering the electroplating of articles, the purchaser shall state ASTM B633, the date of issue, service condition number, and the Type (see 4.1, 4.2, and 7.1).

5.2 If necessary, the purchaser shall include on his part drawings or purchase order the following:

5.2.1 Basis metal alloy designation and ultimate tensile strength of the steel,

TABLE 2 Finish Type and Corrosion Resistance Requirements

Type	Description	Minimum Salt Spray h
I	As-plated without supplementary treatments	
II	With colored chromate coatings	96
III	With colorless chromate conversion coatings	12
IV	With phosphate conversion coatings	
V	With colorless passivate	72
VI	With colored passivate	120

5.2.2 Thickness, if other than specified (4.1, 7.1),

5.2.3 Location of significant surface (7.1.1, 7.1.2),

5.2.4 Luster (7.3),

5.2.5 Exceptions to stress relief heat treatment prior to plating, (6.4),

5.2.6 Exception to Hydrogen Embrittlement Relief after plating, (6.5).

5.2.7 Corrosion resistance test, if specified (9.3, 10.3),

5.2.8 Hydrogen embrittlement test, if required (9.4, 10.4), including the tensile strength of the items,

5.2.9 Sample size for inspection, if other than specified, and

5.2.10 Supplementary requirements, if applicable (see Supplementary Requirement).

6. Materials and Manufacture

6.1 The coatings shall be non-alloyed zinc produced by electrodeposition.

6.2 Defects in the surface of the basis metal, such as scratches, porosity, pits, inclusions, cracks, roll marks, and die marks, may adversely affect the appearance and performance of coatings applied thereto despite the observance of the best electroplating practices. Accordingly, the electroplater's responsibility for defects in the coating resulting from such conditions shall be waived, except when he is the prime contractor supplying electroplated parts. In this event, the basis metal shall be subjected to such polishing or buffing operations as are necessary to yield deposits with the desired final luster and appearance. To minimize problems of this sort, the specifications covering the basis material on the item to be electroplated shall contain appropriate limitations to such basis metal conditions.

6.3 *Cleaning of Basis Metal*—Proper preparatory procedures and thorough cleaning of the basis metal are essential to ensure satisfactory adhesion and corrosion resistance performance of the coating. It is recommended that the following appropriate recommended practices and guides be used: B183, B242, B254, B320, and B322.

6.4 *Pretreatment of Iron or Steel for the Purpose of Reducing the Risk of Hydrogen Embrittlement*—All steel parts having an ultimate tensile strength greater than 1000 MPa (31 HRC) and that have been machined, ground, cold formed, or cold straightened, shall be heat treated for stress relief to reduce the risk of hydrogen embrittlement in the part before clean and electroplate processes. If these heat treatments are not required, the purchaser shall specify in the ordering information their

[4] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://dodssp.daps.dla.mil.

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