



Designation: B 893 – 98

Specification for Hard-Coat Anodizing of Magnesium for Engineering Applications¹

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1. Scope

1.1 This specification covers requirements for electrolytically formed oxide coatings on magnesium and magnesium alloy parts where appearance, abrasion resistance, and protection against corrosion are important.

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.*

2. Referenced Documents

2.1 ASTM Standards:

- B 117 Practice for Operating Salt Spray (Fog) Apparatus²
- B 244 Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments³
- B 322 Practice for Cleaning Metals Prior to Electroplating⁴
- B 374 Terminology Relating to Electroplating⁴
- B 487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section
- B 537 Practice for Rating of Electroplated Panels Subjected to Atmospheric Exposure⁴
- B 602 Method of Attribute Sampling of Electrodeposited Metallic Coatings and Related Finishes⁴
- B 697 Guide for Selection of Sampling Plans for Inspection of Electro Deposited Metallic and Inorganic Coatings
- B 0762 Method of Variables Sampling of Metallic and Inorganic Coatings
- D 3951 Practice for Commercial Packaging⁵

2.2 ISO Standard:

ISO 2080 Electroplating and Related Processes - Vocabulary⁶

3. Terminology

3.1 *Definitions*—For definitions of terms relating to this specification see Terminology B 374.

3.1.1 *anodizing*—an electrolytic oxidation process in which the surface of a metal, when anodic, is converted to a coating having desirable protective or functional properties.

3.1.2 *hard coat*—in anodizing magnesium, an anodic oxide coating on magnesium with a higher apparent density and thickness, and a greater resistance to wear than the base metal.

4. Classification

4.1 *Coating Designation*—Thickness.

4.1.1 Minimum Thickness of 20 μm .

4.2 TYPE - Post Treatments.

4.2.1 TYPE A—no post treatment.

4.2.2 TYPE B—Purchaser Specified.

5. Ordering Information - (to be supplied by the purchaser to the producer.)

5.1 *Alloy Designation*—When ordering articles anodized in accordance with this specification, the purchaser shall state, the alloy designation number.

5.2 *Appearance*—Unless otherwise specified by the purchaser, an off-white color shall be acceptable for TYPE A coating. The purchaser shall specify the color and surface appearance required for TYPE B coatings. All coatings shall be uniform in color and free from stains. Alternatively, samples showing the required finish, or range of finishes, shall be supplied or approved by the purchaser. When required, the basis material may be subjected to such mechanical polishing as may be required to yield the desired final surface characteristics.

5.3 *Significant Surface*—The areas of the article covered by the coating, for which the coating is essential for service or appearance or both.

¹ This specification is under the jurisdiction of ASTM Committee B-08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.07 on Chemical Conversion Coatings.

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² *Annual Book of ASTM Standards*, Vol. 03.02.

³ *Annual Book of ASTM Standards*, Vol. 02.01.

⁴ *Annual Book of ASTM Standards*, Vol. 02.05.

⁵ *Annual Book of ASTM Standards*, Vol. 15.09.

⁶ Available from International Organization for Standardization, 1 Rue de Varembe, Case Postale 56, CH-1211 Geneva 20, Switzerland.

5.3.1 *Contact Marks*—Contact marks will occur. The Purchaser shall specify where contact marks are unacceptable.

5.4 *Tolerances*—Dimensional build-up is approximately one-half of anodic film thickness. The order document shall include any coating thickness tolerances and shall not exceed any applicable drawing dimensions.

5.5 The purchaser shall provide the number for this standard TYPE.

5.6 The purchaser shall state any special post treatments. (see 4.2 and 5.2)

5.7 *Test Methods*—The purchaser shall state the test method(s) by which the coated article will be evaluated (see Section 8).

5.8 *Sampling Plan*—(see Section 9)

5.9 Any requirement for certification (see Section 11)

5.10 Any requirement for packaging (see Section 12)

6. Materials and Process

6.1 Process

6.1.1 *Basis Metal*—This standard does not specify requirements for the surface condition of the basis metal before anodizing, but agreement should preferably be reached between the purchaser and the producer that the surface condition of the basis metal is satisfactory.

6.1.2 *Surface Preparation*—Preparatory procedures and cleaning of the basis material may be necessary, see Practice B 322.

6.1.3 *Hard-Coating*—Following the preparatory operations, the articles are introduced into the solution for a period of time at the current density and temperature required to produce the hard-coated surface.

NOTE 1—Hard-Coating solutions and operating conditions are commercially available. The appropriate operating instructions should be followed.

NOTE 2—Intricately shaped articles may not receive the same thickness of coating in recessed areas due to lower current densities. Auxiliary cathodes, may be used to improve anodize thickness in these areas.

6.2 Post Treatments:

6.2.1 *Final Rinsing*—Rinsing subsequent to anodizing is necessary to remove all traces of the electrolyte that may affect the appearance and performance of the part. Deionized or distilled water may be used to avoid water spots.

6.2.2 *Post Treatment*—Surface sealers or topcoats may be specified to reduce friction, add color, or further increase performance.

7. Requirements

7.1 Acceptance:

7.1.1 *Visual Defects*—The significant surfaces of the article to be hardcoated shall be free of clearly visible defects such as pits, roughness, striations, or discoloration when examined with normal or corrected to 20/20 eyesight at a distance of approximately 0.5 meter.

NOTE 3—Defects in the surface of the basis material such as scratches, porosity, inclusions, etc., may adversely affect the appearance and performance of the article.

7.1.2 Thickness

7.1.2.1 *Coating Thickness for SC20*—The anodic film thickness shall be a minimum of 20 μm and not exceed 30 μm on the significant surface.

7.1.2.2 *Test*—Hard-coating thickness shall be evaluated by one or more of the following test methods in Section 8.

7.2 *Qualification Tests*—The process shall be evaluated monthly or more frequently if required by the purchaser using the following test methods on panels that are of the same alloy of the parts coated with TYPE A hard coat.

7.2.1 *Corrosion Test*—Use method described in 8.1

7.2.2 *Abrasion Resistance Test*—Use the Taber Abraser test method in Annex A1 of this specification.

8. Test Methods

8.1 *Corrosion Test*—Panel(s) shall be subjected to a 5 percent salt spray (fog) test in accordance with Practice B 117 for 336 h. The panel(s) shall be prepared and evaluated in accordance with Practice B 537. A Protective Rating of 6 or less is considered a failure.

8.2 *Abrasion Resistance Test*—Test panels in accordance with Annex A1. The acceptance criteria shall be as follows.

8.2.1 *Abrasive Wheel No. CS-10*—A wear index of more than 7 mg/1000 cycles or less than 10 000 wear cycles shall be considered a failure.

8.2.2 *Abrasive Wheel No. CS-17*—A wear index of more than 20 mg/1000 cycles or less than 5 000 wear cycles shall be considered a failure.

8.3 Thickness Tests:

8.3.1 Eddy-Current Method (Test Method B 244)

8.3.2 Microscopical Cross Section Method (Test Method B 487).

9. Sampling

9.1 The purchaser and producer are urged to employ statistical process control in the coating process. Properly performed, statistical process control will assure coated products of satisfactory quality and will reduce the amount of acceptance inspection. The sampling plan used for the inspection of the quality coated article shall be agreed upon between the purchaser and producer.

9.1.1 When a collection of coated articles (inspection lot, see 8.2) is examined for compliance with the requirements placed on the articles, a relatively small number of the articles (sample) is selected at random and is inspected. The inspection lot is then classified as complying with the requirements based on the results of the inspection of the sample. The size of the sample and the criteria for compliance are determined by the application of statistics. The procedure is known as sampling inspection. Test Method B 602, Guide B 697, and Method B 762 contain sampling plans that are designed for sampling inspection of coatings.

9.1.2 Test Method B 602 contains four sampling plans, three for use with tests that are non-destructive and one when they are destructive. Method B 602 provides a default plan if one is not specified.

9.1.3 Guide B 697 provides a large number of plans and also gives guidance in the selection of a plan. Guide B 697 provides a default plan if one is not specified.