Designation: B 840 – 99

Standard Specification for Electrodeposited Coatings of Zinc Cobalt Alloy Deposits[1]

This standard is issued under the fixed designation B 840; 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.

1. Scope

1.1 This specification covers the requirements for electrodeposited zinc cobalt alloy coatings on metals.

1.2 The following precautionary caveat pertains to the test method portion only, Section 8, of this specification: *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) Apparatus[2]
B 183 Practice for Preparation of Low-Carbon Steel for Electroplating[3]
B 242 Practice for Preparation of High-Carbon Steel for Electroplating[3]
B 320 Practice for Preparation of Iron Castings for Electroplating[3]
B 322 Practice for Cleaning Metals Prior to Electroplating[3]
B 374 Terminology Relating to Electroplating[3]
B 487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section[3]
B 499 Test Method for Measurement of Coating Thicknesses By the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals[3]
B 504 Test Method for Measurement of Thickness of Metallic Coatings by the Coulometric Method[3]
B 507 Practice for Design of Articles to Be Electroplated on Racks[3]
B 568 Test Method for Measurement of Coating Thickness by X-Ray Spectrometry[3]
B 571 Test Methods for Adhesion of Metallic Coatings[3]
B 602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings[3]
B 697 Guide for Selection of Sampling Plans for Inspection of Electrodeposited Metallic and Inorganic Coatings[3]
B 762 Method of Variables Sampling of Metallic and Inorganic Coatings[3]
B 849 Specification for Pretreatments of Iron or Steel for Reducing Risk of Hydrogen Embrittlement[3]
B 850 Specification for Post-Coating Treatments of Iron or Steel for Reducing Risk of Hydrogen Embrittlement[3]
D 3951 Practice for Commercial Packaging[4]

3. Terminology

3.1 *Definitions*—Many terms used in this specification are defined in Terminology B 374.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *significant surface, n*—that portion of a coated article's surface where the coating is required to meet all the requirements of the coating specification for that article. Significant surfaces are usually those that are essential to the serviceability or function of the article or can be a source of corrosion products or tarnish films that interfere with the function or desirable appearance of the article. Significant surfaces are those surfaces that are identified by the purchaser by, for example, indicating them on an engineering drawing of the product or marking a sample item of the product.

4. Classification

4.1 There is one coating class, and it is defined as Class 1—deposits having 99 mass % zinc, the balance being cobalt.

4.2 There are five coating types and they are defined as follows:

4.2.1 Type a—With colorless (blue bright) chromate conversion coatings.
4.2.2 Type b—With yellow chromate conversion coating.
4.2.3 Type c—With bronze chromate conversion coating.
4.2.4 Type d—With black chromate conversion coating.
4.2.5 Type e—Any of the above types plus organic topcoat.

NOTE 1—Whereas colored chromate conversion coatings are usually meant to include various shades of yellow to bronze when used with non-alloyed zinc, yellow and bronze chromate conversion coatings are considered distinctly different when applied to alloyed zinc coatings and are formulated specifically to produce the desired coating.

[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.

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

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

[4] *Annual Book of ASTM Standards*, Vol 15.09.

4.3 There are three grades according to thickness and are defined as follows:

Minimum Thickness, µm	New ASTM Grade	Old ASTM Grade
6	6	1
12	12	2
18	18	3

5. Ordering Information

5.1 In order to make the application of this specification complete, the purchaser needs to supply the following information to the seller in the purchase order and drawings.

5.1.1 Title, ASTM designation number, and date of issue of this specification.

5.1.2 Deposit by classification including class, type, and grade (see 4.1, 4.2, 4.3).

5.1.3 Composition and metallurgical condition of the substrate to be coated.

5.1.4 Location of significant surfaces (3.2.1).

5.1.5 Heat treatment for stress relief, whether it has been performed by purchaser or is required (6.7).

5.1.6 Heat treatment after electroplating, if required (6.8).

5.1.7 Whether or not location of rack marks is to be defined (6.3.1).

5.1.8 Any requirement for special test specimens (8.1.1).

5.1.9 Acceptance inspection procedure to be used (Section 7).

5.1.10 Any requirement for certification (Section 10).

5.1.11 Any other items needing agreement. For the purposes of this specification, prior agreement on the nature of the finish is required as items plated in bulk may differ in appearance from those that are rack plated.

6. Coating Requirements

6.1 *Substrate*—The metal to be plated shall be free of flaws and defects that will be detrimental to the zinc alloy coating. It shall be subjected to such cleaning, pickling, and electroplating procedures as are necessary to yield deposits with the desired quality.

NOTE 2—Proper preparatory procedures and thorough cleaning are essential to ensure satisfactory adhesion and corrosion resistance performance of the coating. Materials used for cleaning should not damage the basis metal, for example, by causing defects such as pits, intergranular attack, or stress corrosion cracking. It is recommended that the following ASTM practices for cleaning, where appropriate, be used: Practices B 183, B 242, B 320 and B 322.

6.1.1 The electroplating shall be applied after all basis metal heat treatments have been completed.

6.2 *Nature of Coating*:

6.2.1 The coating shall consist of a zinc cobalt alloy that is approximately 99 mass % zinc and the balance cobalt.

6.2.2 The coating shall be produced from an aqueous electroplating system, either alkaline or acid, and may be specified at the discretion of the purchaser.

6.2.3 The coating shall have such supplementary conversion coatings as defined in 4.2 and specified in the purchase order.

6.3 *Appearance*:

6.3.1 The coating on all readily visible surfaces shall have an acceptable and characteristic appearance as agreed upon by the purchaser and seller. The coating shall be uniform insofar as the basis metal will permit. When the article is to be plated on a rack, contact marks may be unavoidable. Location of such mark(s) shall be indicated on the article or its drawing.

6.3.2 Defects and variations in appearance that arise from surface conditions of the substrate (scratches, pores, roll marks, inclusions, and the like) and that persist in the coating despite the observance of good metal finishing practices, shall not be cause for rejection. The coating shall be adherent, free from blisters, pits, or discontinuities, and shall be free of cracks in the as plated state. Flaking shall be cause for rejection in either the as plated state or after subsequent operations.

NOTE 3—These coatings are commonly used in automotive applications where subsequent forming, bending, and crimping operations are commonly performed. These operations will necessarily detract from the performance of the coatings. While some cracking of coatings will be unavoidable, flaking of the coatings after these subsequent operations shall be cause for rejection.

NOTE 4—Coatings generally perform better in service when the substrate over which they are applied is smooth and free of torn metal, inclusions, pores, and other defects. The specifications covering the unfinished product should provide limits for these defects. A metal finisher can often remove defects through special treatments, such as grinding, polishing, abrasive blasting, chemical etches, and electropolishing. However, these are not normal in the treatment steps preceding the application of the coating. When they are desired, they are the subject of special agreement between the purchaser and the seller.

6.4 *Thickness*—The thickness of the coating everywhere on the significant surfaces as defined in 3.2.1 and shall conform to the requirements of the specified grade as defined in 4.3.

NOTE 5—The thickness of electrodeposited coatings varies from point to point on the surfaces of a product (see Practice B 507). The thickness is less in interior corners and in holes. Such surfaces are often exempt from thickness requirements. If the full thickness is required in those locations, the electroplater will have to use special techniques that will probably raise the cost of the process.

NOTE 6—The coating requirement of this specification is a minimum. Variation in the thickness from point to point on an article and from article to article in a production lot is inherent in electroplating. Therefore, if all of the articles in a production lot are to meet the thickness requirement, the average coating thickness for the production lot as a whole will be greater than the specified minimum.

6.5 *Adhesion*—The coating shall withstand normal handling and storage conditions without chipping, flaking, or other coating damage and shall conform to the minimum requirements set forth in Section 8.

6.6 *Corrosion Resistance*—The corrosion resistance of the coating may be evaluated using the method in Appendix X1.

6.7 *Pretreatment of Iron and Steel for Reducing the Risk of Hydrogen Embrittlement*:

6.7.1 Parts that are made of steels with ultimate tensile strengths of 1000 MPa (hardness of 31 HRC or greater), that have been machined, ground, cold formed, or cold straightened subsequent to heat treatment shall require stress relief heat treatment when specified by the purchaser, the tensile strength to be supplied by the purchaser. Specification B 849 may be consulted for a list of pretreatments that are widely used.

6.8 *Post-Coating Treatments of Iron and Steel for Reducing the Risk of Hydrogen Embrittlement*:

6.8.1 Parts that are made of steels with ultimate tensile strengths of 1000 MPa (hardness of 31 HRC or greater), as well as surface hardened parts, may require post-coating