Designation: B605 – 22

Standard Specification for Electrodeposited Coatings of Tin-Nickel Alloy[1]

This standard is issued under the fixed designation B605; 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 tin-nickel alloy coatings from aqueous solutions intended for the corrosion protection of fabricated articles of iron, steel, zinc-base alloys, copper, and copper alloys. The composition of the alloy remains constant at 65/35 tin-nickel in spite of wide fluctuations in both composition and operating conditions. The composition corresponds quite closely to an equiatomic ratio, and the process favors the co-deposition of tin and nickel atoms at identical rates.

1.2 This specification does not apply to sheet, strip, or wire in the fabricated form. It also may not be applicable to threaded articles having basic major diameters up to and including 19 mm because of the nonuniformity of thickness that can be expected on fine threads. However, a decision to use the coating on such components may be made by the purchaser.

1.3 *Units*—The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

B183 Practice for Preparation of Low-Carbon Steel for Electroplating
B242 Guide for Preparation of High-Carbon Steel for Electroplating
B246 Specification for Tinned Hard-Drawn and Medium-Hard-Drawn Copper Wire for Electrical Purposes
B252 Guide for Preparation of Zinc Alloy Die Castings for Electroplating and Conversion Coatings
B281 Practice for Preparation of Copper and Copper-Base Alloys for Electroplating and Conversion Coatings
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
B507 Practice for Design of Articles to Be Electroplated on Racks
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
B602 Guide for Attribute Sampling of Metallic and Inorganic Coatings
B634 Specification for Electrodeposited Coatings of Rhodium for Engineering Use
B697 Guide for Selection of Sampling Plans for Inspection of Electrodeposited Metallic and Inorganic Coatings
B762 Guide of Variables Sampling of Metallic and Inorganic Coatings
B765 Guide for Selection of Porosity and Gross Defect Tests for Electrodeposits and Related Metallic Coatings
B809 Test Method for Porosity in Metallic Coatings by Humid Sulfur Vapor ("Flowers-of-Sulfur")
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

[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 Nov. 15, 2022. Published December 2022. Originally approved in 1975. Last previous edition approved in 2015 as B605 – 95a (2015). DOI: 10.1520/B0605-22.

[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.

***A Summary of Changes section appears at the end of this standard**

D3951 Practice for Commercial Packaging

3. Terminology

3.1 *Definitions:*

3.1.1 Many terms used in this standard are defined in Terminology B374.

3.1.2 *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 those that are essential to the serviceability or function of the article, or which 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.

3.1.3 *undercoating, n*—a metallic coating layer between the basis metal or substrate and the topmost metallic coating. The thickness of an undercoating is usually greater than 0.8 µm. This is in contrast to strikes or flashes, whose thicknesses are generally lower.

4. Classifications

4.1 *Coating Grades*—Six grades of coatings, designated by service condition numbers, are covered by this specification. For each coating grade a coating thickness grade is specified (see Tables 1-3).

4.2 *Service Condition Number*—The service condition number indicates the severity of exposure for which the grade of coating is intended.

SC5—extended severe service
SC4—very severe service
SC3—severe service
SC2—moderate service
SC1—mild service
SC0—mild service (copper and copper alloys only)

NOTE 1—Typical service conditions for which the service condition numbers are appropriate are given in Appendix X1.

4.3 *Coating Thickness Notation*—The coating thickness is specified for each service condition in the following manner: Basis metal/Undercoating (thickness)/Sn-Ni (thickness). For example, Fe/Cu4/Sn-Ni25 would indicate a 25 µm tin-nickel coating over an iron or steel article with a 4 µm thick copper undercoating. All thickness notations are minimum thicknesses.

TABLE 1 Tin-Nickel Coatings on Steel

Service Condition Number		Thickness Notation	Minimum Thickness, µm
5	Fe/Cu[A] /Sn-Ni	as specified[B] (above 45)	as specified[B] (above 45)
4	Fe/Cu[A] /Sn-Ni	45	45
3	Fe/Cu[A] /Sn-Ni	25	25
2	Fe/Sn-Ni	15	15
1	Fe/Sn-Ni	8	8

[A] Copper undercoat shall be at least 4.0 µm.
[B] Thickness of Sn-Ni shall be stated in a Thickness Notation. A statement of Service Condition 5 is not sufficient.

TABLE 2 Tin-Nickel Coatings on Copper or Copper Alloys

Service Condition Number		Thickness Notation	Minimum Thickness, µm
5	Cu/Sn-Ni[A]	as specified[B] (above 45)	as specified[B] (above 45)
4	Cu/Sn-Ni[A]	45	45
3	Cu/Sn-Ni[A]	25	25
2	Cu/Sn-Ni[A]	15	15
0	Cu/Sn-Ni[A]	4	4

[A] An undercoating of copper 4.0 µm thick shall be applied on copper-zinc alloys to serve as a zinc diffusion barrier.
[B] Thickness of Sn-Ni shall be stated in a Thickness Notation. A statement of Service Condition 5 is not sufficient.

TABLE 3 Tin-Nickel Coatings on Zinc Alloys

Service Condition Number		Thickness Notation	Minimum Thickness, µm
4	Zn/Cu[A] /Sn-Ni	45	45
3	Zn/Cu[A] /Sn-Ni	25	25
2	Zn/Cu[A] /Sn-Ni	15	15
1	Zn/Cu[A] /Sn-Ni	8	8

[A] An undercoating of copper 4.0 µm thick shall be applied to prevent zinc from contaminating the Sn-Ni plating bath and to serve as a diffusion barrier.

5. Ordering Information

5.1 To make the application of this standard complete, the purchaser needs to supply the following information to the seller in the purchase order or other government documents.

5.1.1 The name, designation, and date of issue of this standard,

5.1.2 Location of significant surface(s) (see section 3.1.2),

5.1.3 The service number or coating thickness notation (see 4.2 and 4.3),

5.1.4 Undercoating, if required (see 6.2 and Tables 1-3),

5.1.5 Any requirement for submission of sample coated articles (see 7.2.1),

5.1.6 Whether or not location of rack marks is to be defined (see 7.2.1),

5.1.7 Any requirement for porosity testing and the criteria for acceptance (see 7.5.2),

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

5.1.9 Whether the part underwent cold forming or cold straightening subsequent to heat treatment (see Note 2),

5.1.10 Exception to heat treatment for stress relief prior to plating (see 7.6),

5.1.11 Baking requirements after electroplating, if required (see 7.7),

5.1.12 Any packaging requirement (see section 7.8),

5.1.13 Inspection procedure to be used (see Section 9),

5.1.14 Any requirement for certification (see Section 11), and

5.1.15 Any requirement for test specimens (see 8.1.1).

NOTE 2—Information in 5.1.8 and 5.1.9 is necessary for proper pretreatment (7.6) and post coating treatment (7.7) if applicable.