



Designation: B634 – 14

Standard Specification for Electrodeposited Coatings of Rhodium for Engineering Use¹

This standard is issued under the fixed designation B634; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This specification covers requirements for electrodeposited coatings of rhodium used for engineering purposes.

1.2 Coatings of rhodium covered by this specification are usually employed for their corrosion resistance, stable electrical contact resistance, wear resistance, reflectivity, and heat resistance.

1.3 **Appendix X1** covers some typical applications for electrodeposited rhodium.

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

1.5 *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 The following documents form a part of this document to the extent referenced herein.

2.2 *ASTM Standards:*² <http://www.astm.org/catalog/standards/sist/4fe1c650-b70>

B183 Practice for Preparation of Low-Carbon Steel for Electroplating

B242 Guide for Preparation of High-Carbon Steel for Electroplating

B252 Guide for Preparation of Zinc Alloy Die Castings for Electroplating and Conversion Coatings

B254 Practice for Preparation of and Electroplating on Stainless Steel

B281 Practice for Preparation of Copper and Copper-Base Alloys for Electroplating and Conversion Coatings

- B322** Guide for Cleaning Metals Prior to Electroplating
 - B343** Practice for Preparation of Nickel for Electroplating with Nickel
 - B456** Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
 - B481** Practice for Preparation of Titanium and Titanium Alloys for Electroplating
 - B482** Practice for Preparation of Tungsten and Tungsten Alloys for Electroplating
 - B487** Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section
 - 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** 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
 - E8** Test Methods for Tension Testing of Metallic Materials
- 2.3 *Military Standards:*
- MIL-R-46085** Rhodium Plating, Electrodeposited³
 - QQ-N-290** Nickel Plating, Electrodeposited³

3. Classification

3.1 Electrodeposited coatings of rhodium on the basis of thickness are classified as follows:

Class	Minimum Thickness, μm
0.05	0.05
0.25	0.25
0.5	0.5
1	1
2.5	2.5
6.25	6.25

¹ This specification is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.04 on Precious Metal Coatings.

Current edition approved Sept. 1, 2014. Published September 2014. Originally approved in 1978. Last previous edition approved in 2009 as B634 – 88 (2009). DOI: 10.1520/B0634-14.

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, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

4. Ordering Information

4.1 To make application of this standard complete, the purchaser needs to supply the following information to the seller in the purchase order or other governing document:

- 4.1.1 Name, designation, and year of issue of this standard,
- 4.1.2 Class including a maximum thickness, if appropriate (3.1),
- 4.1.3 Nature of substrate, for example, high strength steel, need for stress relief, undercoats, embrittlement relief (5.1, 5.2, 5.3),
- 4.1.4 Significant surfaces (6.2),
- 4.1.5 Appearance (6.3),
- 4.1.6 Requirements and methods of testing for one or more of the following requirements: need for and type of test specimens (8.1); thickness (8.2); adhesion (8.3); absence of embrittlement (8.4); reflectivity (8.5); and undercoats (S1.4), and
- 4.1.7 Sampling plans (Section 7) and quality assurance (S1.2).

5. Process Requirements

5.1 *Preparatory Procedures*—The basis metal shall be subjected to such cleaning procedures as are necessary to ensure a surface satisfactory for subsequent electroplating. Materials used for cleaning shall have no damaging effects on the basis metal resulting in pits, intergranular attack, stress corrosion cracking, or hydrogen embrittlement.

NOTE 1—For basis metal preparations, the following appropriate ASTM standards are recommended: Practices B183, B242, B252, B254, B281, B322, B343, B481, and B482.

5.2 *Preplating Operations:*

5.2.1 Electroplating shall be applied after all basis metal heat treatments and mechanical operations such as forming, machining, and joining of the article have been completed.

5.2.2 *Stress Relief Treatment*—All steel parts having an ultimate tensile strength of 1050 MPa (approximately 35 HRC) and above and that have been machined, ground, cold formed, or cold straightened shall have heat treatment to $190 \pm 15^\circ\text{C}$ for a minimum of 5 h before cleaning and electroplating.

5.3 *Post-Plating Procedures:*

5.3.1 *Embrittlement Relief*—Steel parts having an ultimate tensile strength of 1200 MPa (approximately 38 HRC) or greater shall be baked at $190 \pm 15^\circ\text{C}$ for a minimum of 8 h within 4 h after electroplating to provide hydrogen embrittlement relief. Steel parts having an ultimate tensile strength greater than 1300 MPa (approximately 40 HRC) shall be baked at $190 \pm 15^\circ\text{C}$ for a minimum of 23 h within 4 h after electroplating.

6. Coating Requirements

6.1 *Nature of Coating*—The coating shall be essentially pure rhodium produced by electrodeposition from aqueous electrolytes.

6.2 *Thickness*—The rhodium coating thickness on all significant surfaces shall conform to the requirements of the specified class as defined in Section 3.

6.3 *Significant Surfaces*—Significant surfaces are defined as those normally visible (directly or by reflection) or are essential to the serviceability or function of the article or which can be the source of corrosion products or tarnish films that interfere with the function or desirable appearance of the article. When necessary, the significant surfaces shall be indicated on the drawings of the parts, or by the provision of suitably marked samples.

NOTE 2—Variation in the coating thickness from point-to-point on a coated article is an inherent characteristic of electroplating processes. Therefore, the coating thickness will have to exceed the specified value at some points on the significant surfaces to ensure that the thickness equals or exceeds the specified value at all points. Therefore, the average coating thickness on an article will usually be greater than the specified value; how much greater is largely determined by the shape of the article (see Practice B507) and the characteristics of the electroplating process. Additionally, the average coating thickness on an article will vary from article to article within a production lot. If all of the articles in a production lot are to meet the thickness requirement, the average coating thickness of the production lot as a whole will be greater than the average necessary to ensure that a single article meets the requirements.

6.4 *Appearance:*

6.4.1 Electroplated coatings shall completely cover all surfaces as specified in the manufacturing document and shall have a uniform appearance to the extent that the nature of the basis metal and good commercial practices permit.

6.4.2 Defects in the surface of the basis metal such as scratches, pits, nonconducting inclusions, and roll and die marks, may adversely affect the appearance and performance of the applied coatings. Such defects that persist in the finish despite the observance of good metal finishing practices shall not be cause for rejection.

NOTE 3—Applied finishes generally perform better in service when the substrate over which they are applied is smooth and free from torn metal, inclusions, pores, and other defects. It is recommended that the specifications covering the unfinished product provide limits for those defects. A metal finisher often can remove defects through special treatments such as grinding, polishing, abrasive blasting, chemical treatments, and electropolishing. However, these are not normal in the treatment steps preceding the application of the finish. When they are desired, they are the subject of special agreement between the purchaser and the supplier.

6.5 *Adhesion*—The rhodium coatings shall be free of blisters and peeled areas when tested in accordance with 8.3.

7. Sampling

7.1 A random sample of the size required by Test Methods B602 or B762 shall be selected from the inspection lot (see 7.2). The articles in the lot shall be inspected for conformance to the requirements of this specification and the lot shall be classified as conforming or nonconforming to each requirement according to the criteria of the sampling plans in Test Method B602.

NOTE 4—Test Method B602 contains four sampling plans, three for use with nondestructive test methods. The fourth is to be used with destructive test methods. The three methods for nondestructive tests differ in the quality level they require of the product. Test Method B602 requires use of the plan with the intermediate quality level unless the purchaser specifies otherwise. It is recommended that the purchaser compare the plans with his needs and state which plan is to be used. If the plans in Test Method B602 do not serve the needs, additional ones are given in Guide B697 which provides a large number of plans and also gives guidance in the selection of a plan. When Guide B697 is specified, the buyer and seller