Designation: B201 – 80 (Reapproved 2014)

Endorsed by American
Electroplaters' Society
Endorsed by National
Association of Metal Finishers

Standard Practice for
Testing Chromate Coatings on Zinc and Cadmium Surfaces[1]

This standard is issued under the fixed designation B201; 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 U.S. Department of Defense.

1. Scope

1.1 This practice covers a procedure for evaluating the protective value of chemical and electrochemical conversion coatings produced by chromate treatments of zinc and cadmium surfaces.

1.2 The protective value of a chromate coating is usually determined by salt-spray test and by determining whether or not the coating possesses adequate abrasion resistance.

1.3 Other methods, such as exposure to a humidity environment, can be used, but are generally of too long a duration to be of practical value. "Steam Tests" using pressure cookers have also been used for testing chromate films on hot-dip galvanized surfaces.

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 *ASTM Standards:*[2]
B117 Practice for Operating Salt Spray (Fog) Apparatus

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *time to failure*—time to failure will depend on the type of coating tested. A list of some expected protective values obtainable in a given salt spray test is shown in Appendix X2.

3.1.1.1 *Discussion*—In most instances, failure is defined as the first appearance on significant surfaces of white corrosion products visible to the unaided eye at normal reading distance, except that the presence of white corrosion products at sharp edges (for example, on threaded fasteners) and at junctions between dissimilar metals should not be considered failure. In some instances, it may be desirable to regard the first appearance of red rust as failure.

3.1.2 *significant surfaces*—in general, significant surfaces are those surfaces that are visible and subject to corrosion or wear, or both, except that surfaces that are normally difficult to coat by electroplating or mechanical deposition may be exempt. The designation of significant surfaces may be indicated on the drawing.

4. Significance and Use

4.1 This practice is applicable to chromate coatings of the colorless (both one and two-dip), iridescent yellow or bronze, olive drab, black, colorless anodic, yellow or black anodic types, and of the dyed variety, when applied to surfaces of electrodeposited zinc, mechanically deposited zinc, hot-dipped zinc, rolled zinc, electrodeposited cadmium, mechanically deposited cadmium, and zinc die castings.

NOTE 1—Colorless coatings are also referred to as clear-bright or blue-bright coatings.

4.2 Because of variables inherent in the salt-spray test, which may differ from one test cabinet to another, interpretation of test results for compliance with expected performance should be specified by the purchaser.

---

[1] This practice is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.07 on Conversion Coatings.

Current edition approved Nov. 1, 2014. Published November 2014. Originally approved in 1945. Last previous edition approved in 2009 as B201 – 80 (2009)$^{\varepsilon 1}$. DOI: 10.1520/B0201-80R14.

[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.

4.3 Properties such as thickness, color, luster, and ability to provide good paint adhesion are not covered in this practice, nor are the chemical composition and the method of application of these finishes.

5. Conditioning

5.1 *Aging*—Before subjecting a chromate coating to test, it must be aged at room temperature in a clean environment for at least 24 h after the chromating treatment.

5.2 *Preparation of Specimen*—The test surface must be free of fingerprints and other extraneous stains and must not be cleaned except by gentle wiping with a clean, dry, soft cloth to remove loose particles. Oily or greasy surfaces should not be used for testing, and degreasing with organic solvents is not recommended.

6. Procedure

6.1 *Salt Spray Test*—Expose the clean specimen to a 5 % solution salt spray and conduct the test in accordance with the latest revision of Practice B117. Unless otherwise specified, only those surfaces that are positioned in the test chamber in accordance with Practice B117 are considered pertinent for evaluating failure.

6.2 *Abrasion Resistance Test*—To determine whether the coating is adherent, nonpowdery, and abrasion resistant, rub the chromated surface with a gritless, soft gum eraser (art-gum) for 2 to 3 s by hand (about ten strokes) using normal pressure (about 70 kPa (10 psi)) and a stroke approximately 50 mm long. The chromate coating should not be removed or worn through to the underlying metal as a result of this treatment.

6.3 *Test for Colorless (Clear) Coatings*—This test applies only to coatings that are free of secondary supplementary coatings, such as oil, water or solvent-based polymers, or wax.

6.3.1 Determine the presence of a colorless (clear) coating by placing a drop of lead acetate testing solution on the surface. Allow the drop to remain on the surface for 5 s. Remove the testing solution by blotting gently, taking care not to disturb any deposit that may have formed. A dark deposit or black stain is indicative of the absence of a coating.

6.3.2 Prepare the test solution by dissolving 50 g of lead acetate trihydrate ($Pb(C_2H_3O_2)_2 \cdot 3H_2O$) in 1 L of distilled or deionized water. The pH of the solution should be between 5.5 and 6.8. Any white precipitate formed during the initial preparation of the solution may be dissolved by small additions of acetic acid; provided that the pH is not reduced to a value below 5.5. Upon formation of a white precipitate thereafter, the solution should be discarded.

6.3.3 For comparative purposes, treat an untreated surface similarly. On an untreated surface, a black spot forms almost immediately.

APPENDIXES

(Nonmandatory Information)

X1. NATURE OF COATINGS

X1.1 The primary purpose of chromate finishes is to retard the formation of white corrosion products upon exposure to stagnant water, moist atmosphere, or stagnant environments containing organic vapors, such as may emanate from certain plastics, paints, and other organic materials. Chromate finishes will not prevent the growth of metallic filaments, commonly known as "whiskers."

X1.2 Coatings covered by this practice generally contain oxides of the basis metal and tri- and hexavalent chromium in varying proportions, except that colorless coatings contain little or no hexavalent chromium. They may be produced by either chemical or electrochemical processes from solutions containing hexavalent chromium compounds with one or more of certain anions which act as activators, film formers or both. There is evidence that over an extended period, chromate coatings undergo some chemical changes even under ordinary conditions. These changes increase with increase in temperature. At temperatures above approximately 65°C, these changes take place fairly rapidly, converting the soluble hexavalent chromium ion into an insoluble compound and thereby reducing its protective value under salt spray and humid conditions. Colorless or light iridescent coatings appear to be less sensitive to elevated temperatures than are heavy chromate coatings.

X1.3 The quality of the chromate film depends to a large extent on the chemical purity and the physical condition of the basis surface to which it is applied. In order to produce an acceptable coating, it is essential that the surface be properly cleaned and free of heavy metallic impurities such as lead, copper, and contamination (specific for zinc), such as brightener occlusions, and oxides, which interfere with the chromating reaction.

X1.4 The thickness of the coating to be chromated should be not less than 5.0 µm and the thickness requirement on the coating and chromated finish should apply after the chromate treatment. The color and luster produced by a given treatment will depend to some extent on the surface condition of the metal to which it is applied and may vary from part to part, or even on one single part.

X2. PROTECTION BY CHROMATE COATINGS

TABLE X2.1 Expected Protection

Type of Coating	Expected Minimum Hours to White Corrosion of Zinc
One-dip colorless (clear bright)	12
Two-dip colorless (clear bright)	24
Black dip	48
Anodic-colorless	48
Anodic-black	96
Iridescent yellow or bronze	96
Anodic-yellow	150
Olive-drab	150

X2.1 Table X2.1 illustrates the minimum degree of protection that can be expected from the various types of chromate coatings on electrodeposited zinc when subjected to a 5 % salt spray test.

X2.2 These values are shown for guidance purposes only and are not to be construed as endpoint requirements. All types of zinc and cadmium coatings can be chromated, and there may or may not be differences in the protection afforded by the chromate depending on the type of coating and the method of processing, so the actual protection required should be established to the satisfaction of the manufacturer and the purchaser.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/