Designation: D7803 – 19

Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating[1]

This standard is issued under the fixed designation D7803; 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 practice describes methods of preparing surfaces of hot-dip galvanized iron and steel for powder coating and the application of powder coating materials.

1.1.1 Powder coating is a dry finishing process which uses finely ground particles of pigment and resin, electrostatically charged, and sprayed onto a part to be coated. The parts are electrically grounded so that the charged particles projected at them adhere to the surface and are held there until melted and fused into a smooth coating in the curing oven.

1.1.2 Hot-dip galvanized iron or steel is produced by the immersion of fabricated or un-fabricated products in a bath of molten zinc, as specified in Specification A123/A123M or A153/A153M. This practice covers surface preparation and thermal pretreatment of iron and steel products and hardware which have not been painted or powder coated previously (Practice D6386). Galvanized surfaces may have been treated with protective coatings to prevent the occurrence of wet storage stain. This practice neither applies to sheet galvanized steel products nor to the coil coating or continuous roller coating processes.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *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.*

1.4 *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]

A123/A123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

B201 Practice for Testing Chromate Coatings on Zinc and Cadmium Surfaces

D4285 Test Method for Indicating Oil or Water in Compressed Air

D6386 Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

E376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy Current (Electromagnetic) Testing Methods

F21 Test Method for Hydrophobic Surface Films by the Atomizer Test

2.2 *Society for Protective Coatings Specifications:*[3]

Surface Preparation Specification No. 1 Solvent Cleaning

Surface Preparation Specification No. 2 Hand Tool Cleaning

Surface Preparation Specification No. 3 Power Tool Cleaning

Surface Preparation Specification No. WJ-1 Surface Preparation and Cleaning of Metals by Water-Jetting Prior to Recoating

Surface Preparation Specification No. WJ-2 Surface Preparation and Cleaning of Metals by Water-Jetting Prior to Recoating

[1] This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.46 on Industrial Protective Coatings.

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[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 Society for Protective Coatings (SSPC), 800 Trumbull Dr., Pittsburgh, PA 15205, http://www.sspc.org.

Surface Preparation Specification No. WJ-3 Surface Preparation and Cleaning of Metals by Water-Jetting Prior to Recoating
Surface Preparation Specification No. WJ-4 Surface Preparation and Cleaning of Metals by Water-Jetting Prior to Recoating
Surface Preparation Specification No. 15 Commercial Power Tool Cleaning
Surface Preparation Specification No. 16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

2.3 *NACE:*[4]

NACE 6G186 Surface Preparation of Soluble Salt Contaminated Steel Substrates Prior to Coating

3. Summary of Practice

3.1 This practice describes the procedures that can be used to prepare surfaces for powder coating application on new, partially weathered, and fully weathered zinc-coated surfaces on after-fabrication iron and steel products. These procedures improve the bond of the powder coating to the zinc surface providing for long life.

3.2 The proper preparation of galvanized surfaces prior to application of powder coating is dependent on cleaning, profiling, and thermal pretreatment.

4. Significance and Use

4.1 This practice describes the methods of preparation of hot-dip galvanized surfaces prior to the application of powder coating. The key to achieving proper adhesion between powder coatings and galvanized steel is surface preparation. The surface must be entirely free from visible metal oxides prior to powder coating. Any metal oxides that remain on the surface of the galvanized steel can potentially retain air or moisture. Upon heating during the curing stages of the powder application, the oxides may release water vapor or air, which can expand and penetrate the powder coating, causing blisters or voids.

4.2 The zinc coating is constantly in a state of change. From the time the steel part is removed from the galvanizing kettle, the exposed zinc coating interacts with the environment to form, first zinc oxides and zinc hydroxides, and then zinc carbonates.[5] The process of complete conversion of the outer layer of zinc carbonates can take up to two years of exposure to the environment, depending on the local weather and moisture conditions.

4.3 The zinc surface after full weathering is very resistant to atmospheric corrosion because the tight patina that is formed (zinc oxide, zinc hydroxide and zinc carbonate) is dense and tenacious. However, during the formative stages of patina development, the oxide/hydroxide layer is poorly adhered and must be removed in order for the powder coating to adhere properly to the galvanized coating. The second is pinholing/blistering of the coating which can severely limit its potential performance, especially in aggressive chloride environments. Entrapped gasses developed during the galvanizing process escape the surface through the coating as it cures at high temperatures. If these volatile materials are not removed through an outgassing process prior to the baking of the powder, then pinholing or blistering can occur. The presence of pinholes gives chlorides and other corrosive agents access to the zinc substrate consequently producing zinc corrosion products which may leach out through the coatings. While the presence of these corrosion products may not result in associated delamination of the coating, unsightly white staining of the coating can occur. Blisters are defects that are not adhered to the surface and may easily be broken into or off during handling, which creates performance and aesthetic issues. The proper preparation of the galvanized coating surface can increase the adhesion and coverage necessary to overcome these problems and results in a satisfactory service life of the powder coating and the galvanized coating together.

4.4 Variations in surface preparation produce end conditions that differ as far as surface roughness and zinc composition, hence they do not necessarily yield identical results when powder coatings are subsequently applied. The age of the zinc corrosion products on the galvanized coating will dictate the type of surface preparation to be selected.

5. Processes for Cleaning and Preparing Hot Dipped Galvanized Iron and Steel Surfaces for Powder Coating

5.1 *Newly Galvanized Metal*—The category of newly galvanized metal refers to zinc-coated metal that has no surface treatment after galvanizing, such as water quenching or chromate conversion coating, and has been galvanized within the previous 48 h. There also shall be no visible signs of zinc oxide or zinc hydroxide, which first appear as a fine white powder.

5.1.1 *Surface Smoothing*—Hot-dip galvanized surfaces, in general, are relatively smooth after galvanizing. There may be some thick/rough edges at the drip line due to excess liquid zinc run-off during the galvanization process, or high spots in the coating from included iron-zinc intermetallics (dross) or zinc oxide particles. These high spots and rough edges must be smoothed to avoid powder coat film gaps in the areas of the high spots. Zinc high spots shall be removed by cleaning with hand or power tools as described in SSPC Surface Preparation Specification 2 or 3 until they are level with the surrounding zinc area, taking care that the base coating is not removed by the cleaning methods. After smoothing, the surface shall be inspected for conformance to the required zinc thickness in accordance with Specification A123/A123M or A153/A153M utilizing a magnetic thickness instrument in accordance with Practice E376 and/or D7091. Any area falling below the required zinc thickness, before or after removal of any high spots, shall be repaired in accordance with Practice A780 using an appropriate method that is compatible with the curing temperature and time of the powder coating.

5.1.2 *Surface Cleaning*—Hot-dip galvanized surfaces must be clean and free of oil and grease before they are powder coated. Soluble salts shall be removed to the degree specified in the powder coating specification. Detection of soluble salts

[4] Available from NACE International (NACE), 15835 Park Ten Pl., Houston, TX 77084, http://www.nace.org.

[5] This interaction is described in "Duplex Systems," van Eijnsbergen, J. F. H., *Elsevier Science*, New York, NY 1994, and in *Zinc Handbook*, Porter, F., Marcel Dekker, Inc., New York, NY 1991.