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Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This guide covers surface cleaning and eight methods of treating new zinc-coated by the continuous process (galvanized) surfaces produced by either the hot-dip method or by electroplating. This guide covers surfaces that have not been treated previously at the mill to provide temporary protection against staining by moisture other than by easily removed protective oils (see **Appendix X1**). For preparing surfaces of new or weathered items of zinc-coated steel produced by batch processing, refer to Practice **D 6386**.

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

2. Referenced Documents

- 2.1 **ASTM Standards:**²
- A 780** Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - D 6386** Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
 - D 6492** Practice for Detection of Hexavalent Chromium On Zinc and Zinc/Aluminum Alloy Coated Steel
- 2.2 **SSPC—The Society for Protective Coatings Standards:**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. 7** Brush-Off Blast Cleaning
- Paint Specification No. 27** Basic Zinc Chromate-Vinyl Butyral Wash Primer

3. Summary of Guide

3.1 This guide describes surface cleaning and treatment methods that provide galvanized surfaces suitable for painting, specifically so that an applied coating system can develop the adhesion necessary for satisfactory service life.

3.2 Eight methods of treatment (**Note 1** and **Note 2**) are covered as follows:

- 3.2.1 **Method A**—Zinc Phosphate Treatment.
- 3.2.2 **Method B**—Chromate Treatment.
- 3.2.3 **Method C**—Aqueous Chromic-Organic Treatment.
- 3.2.4 **Method D**—Acid-Curing Resinous Treatment.
- 3.2.5 **Method E**—Annealing Heat Treatments.
- 3.2.6 **Method F**—Amorphous Complex-Oxide Treatment.
- 3.2.7 **Method G**—Abrasive Blast Cleaning.
- 3.2.8 **Method H**—Fluro-Titanic/Zirconic Polymer Treatment.

NOTE 1—Materials employed in these methods of treatment are available from a number of sources as proprietary compounds or methods. Selection may be made from available sources.

NOTE 2—The use of solvents containing volatile organic compounds to prepare or treat the surface of metal components contributes to air pollution in the same manner as the use of solvent containing paints and coatings. The user of this guide must determine the applicability of appropriate regulations governing the volatile organic compound content of the materials used in a shop application (Miscellaneous Metal Parts), field painting (Architectural), or specific process industry.

3.3 Variations in surface preparation produce end conditions that differ and hence do not necessarily yield identical results when paints are subsequently applied. Service conditions will dictate the type of surface preparation to be selected, although the quality produced by any individual method may vary with different zinc coatings.

¹ This guide 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), 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656, http://www.sspc.org.

3.4 Galvanized surfaces are treated by using various methods and apparatus; satisfactory application may be made at the following locations:

	Mill	Plant	Field
Method A	Y	Y	Y
Method B	Y	Y	...
Method C	Y	Y	...
Method D	Y	Y	Y
Method E	Y
Method F	Y	Y	...
Method G	Y	Y	Y
Method H	Y	Y	...

3.5 This guide does not describe the cleaning necessary to provide a zinc-coated (galvanized) surface suitable for the application of the treatments. Many cleaning methods are applicable and the preferred method should be agreed upon between the purchaser and the supplier.

NOTE 3—Most producers of zinc-coated (galvanized) steel sheets and coils have adopted the practice of applying an inhibitor to the zinc surface to give temporary protection against staining by moisture during shipping or storage. Some of these inhibitors interfere with proper reaction of most of the treatments described in these methods, and an unsatisfactory surface for painting results. It is strongly recommended that the purchaser consult the supplier of the chemical treatment to be used as to the suitability of the zinc surfaces for treatment by any of these methods.

3.6 *Surface Cleaning*—Galvanized surfaces must be clean and free of oil and grease before they are treated. Adhesion problems have been experienced with newly galvanized articles that have been water quenched or treated with chromate conversion coatings. These two post-galvanizing processes, water quenching and chromate conversion coating, are not recommended for galvanized articles that are to be treated before painting. The presence of chromate conversion coatings on the surface of the galvanized steel can be detected using Practice D 6492.

3.6.1 *Aqueous Alkaline Cleaning*—An alkaline solution, pH in the range of 11 to 12 definitely not greater than 13, can be used to remove traces of oil, grease, or dirt. An alkaline cleaner is unsuitable for removal of heavy build-up of zinc oxide or wet storage stain. See the American Galvanizers Publication, *Wet Storage Stain*,⁴ for description of these conditions. The alkaline solution is nominally 2 to 5 % sodium compounds, with small additions of emulsifying, chelating, or sequestering agents, or combinations thereof. This solution can be applied through immersion in a tank filled with the solution, by spraying, or by brushing with a soft bristle brush, usually nylon and not steel or copper. When dipping or spraying, the solution works best in the temperature range from 60 to 85°C. After cleaning, rinse thoroughly in hot water or water under pressure. Allow to dry completely before proceeding. Whenever galvanized steel is rinsed, heated drying to accelerate the complete removal of water from the surface is desirable.

3.6.2 *Solvent Cleaning*—Typical cleaning solvents, such as mineral spirits or high-flash naphtha, can be used to remove oil and grease. The procedure to be used is as specified in SSPC *Surface Preparation Specification 1*. Proper rags or brushes

should be used to wipe the galvanized parts. **Warning**—These rags or brushes should be cleaned or recycled often, since oil can accumulate on their surfaces and be transferred back to the galvanized part. Small parts may be dipped or cleaned in ultrasonic baths of solvents. After cleaning, rinse thoroughly in hot water or water under pressure. Allow to dry completely before proceeding.

3.6.3 *Hand or Power Tool Cleaning*—Hand or power tool cleaning may be used to clean light deposits of zinc reaction by-products, such as wet storage stain, as specified in SSPC *Surface Preparation Specification 2 or 3*.

4. Significance and Use

4.1 This guide describes procedures that can be used to prepare new zinc-coated surfaces for painting and improve the bond of paint to the zinc surface.

5. Processes

5.1 *Method A, Zinc Phosphate Treatment*—This conversion-coating method consists of reacting the zinc surface in a zinc acid phosphate solution containing oxidizing agents and other salts for accelerating the coating action. The zinc surface is converted to a crystalline phosphate coating of the proper texture to inhibit corrosion and increase the adherence and durability of the paint film. Such treatments are recommended for product finishes and may be carried out by immersion, spray, or brush application.

5.2 *Method B, Chromate Treatment*—This treatment consists of a dip or spray with a dilute solution of a mixture of chromium trioxide and other acids, with the proper accelerator, for a period from 5 to 30 s at room temperature to 55°C (130°F) to provide a thin amorphous chromate coating that increases corrosion resistance and paint adhesion.

5.3 *Method C, Aqueous Chromic-Organic Treatments*—Certain water-soluble resins, when properly formulated with chromium compounds, may be applied to zinc surfaces by roller coat or other suitable means, such as dip and squeegee rolls. This may be done over a wide temperature range provided the film is properly baked or cured, or both, as required by the paint system to be applied. The resultant coating provides a corrosion-resistant film that increases the adhesion of applied paint films.

5.4 *Method D, Acid-Curing Resinous Treatment (Vinyl Wash Primer) (See SSPC-Paint No. 27)*—This surface treatment is based on the application of an acid-curing resinous film of approximately 8 to 13- μm (0.3 to 0.5-mil) thickness. The treatment is based on three primary components: a hydroxyl-containing resin, a pigment capable of reacting with the resin and an acid, and an acid capable of insolubilizing the resin by reacting with the resin, the pigment, and the zinc surface. The film is usually applied by spray, but may be applied by brush, dip, or roller coater. Under normal conditions it will dry sufficiently for recoating within 30 min, and within 8 h it will not be softened by organic solvents commonly used in paint coatings. The film has good adhesion to the metal substrate and promotes good adhesion of most subsequent organic coatings to itself. Two types of this treatment are available: (1) two-package material to be used the day it is mixed and (2)

⁴ *Wet Storage Stain* (1997), available from American Galvanizers Association, 6881 South Holly Circle, Suite 108 Centennial, Colorado 80112, <http://www.galvanizeit.org>.