

SSPC: The Society for Protective Coatings

Technology Guide No. 19

Selection of Protective Coatings for Use Over Galvanized Substrates

1. Scope

This guide contains recommendations for selection of protective coatings over new, partially-weathered, fully-weathered or deteriorated hot-dip galvanizing on steel substrates. The service environment, the condition of the galvanized surface, and the extent and degree of surface preparation required will affect the type of coating selected. This guide assumes that the decision to coat the galvanized surface has already been made and focuses on selection of the coating to be applied.

2. Background and Use

Hot-dip galvanizing consists of a layer of zinc applied over a steel substrate to provide corrosion protection to the underlying steel and offers effective long-term corrosion protection for steel in chemically neutral atmospheric service. However, in service environments where rapid depletion of the zinc (galvanized) layer can occur, protective coatings are frequently applied over the galvanized surface to provide a more effective corrosion protection system. Protective coatings are also used to overcoat aging and deteriorating galvanizing to restore corrosion protection to steel no longer fully protected by the sacrificial zinc (galvanized) layer. Overcoating allows a variety of finish colors to be applied to galvanized surfaces for safety, identification and aesthetic purposes. This guide will assist owners and specifiers in selecting coatings for use over galvanized steel by following the steps below:

1. Determine the service environment for the coating to be applied (Section 4).
2. Determine the condition of the galvanized steel over which the coating will be applied and the surface preparation required (Section 5).
3. Refer to Table 1 to select an appropriate coating or coating system based on the service environment and the current condition of the galvanized steel (Section 6).

3. Referenced Documents

3.1 SSPC and Joint Standards:

SP 1	Solvent Cleaning
SP 5/NACE No. 1	White Metal Blast Cleaning
SP 7/NACE No. 4	Brush-Off Blast Cleaning
SP 10/NACE No. 2	Near-White Metal Blast Cleaning
SP 11	Power Tool Cleaning to Bare Metal

SP 16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

Guide 14 Guide for the Repair of Imperfections in Galvanized, Organic, or Inorganic Zinc-Coated Steel Using Organic Zinc-Rich Coatings

VIS 2/ASTM D 610 Standard Method of Evaluating Degree of Rusting on Painted Steel Substrates

3.2 ASTM International Standards:¹

D 6386 Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Products and Hardware Surfaces for Painting

D 7091 Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

4. Determine Service Environment

The first step in the coating selection process is to characterize the service environment and identify the requirements for a coating that will provide optimum protection in that service environment. Service environments for coatings over galvanized steel may be generally classified as:

4.1 Chemical Atmospheric (pH under 5.0 or above 10.0): In these service environments, the coating selected must protect the galvanized surface from premature zinc depletion as a result of exposure to acidic or alkaline chemical fumes and condensation. (Note 2 to Table 1 provides additional information.)

4.2 Buried: In this service environment, the coating selected must protect the galvanized surface from premature depletion of the zinc as a result of high levels of moisture, alkalinity, or acidity in the soil.

4.3 Marine Atmospheric: In this service environment, the coating selected must protect the galvanized surface from

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19380. For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For an AASHTO Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

premature depletion of the zinc due to high levels of humidity and salt mist, as well as be resistant to ultraviolet light and moisture penetration.

4.4 Immersion in Fresh or Salt Water: In this service environment, the coating selected must seal the pores of the galvanized surface to prevent premature depletion of the zinc due to the presence of constant moisture.

4.5 Under Insulation: In this service environment, the coating selected must seal the pores of the galvanized surface to provide protection from corrosive conditions resulting from condensation in insulation materials at anticipated service temperatures.

4.6 Aesthetic Concerns, Atmospheric Exposure: Galvanizing is only available in a matte grey finish. A different finish color or gloss is required for improved appearance, safety designation (safety colors) or service designation.

The actual service environment may overlap one or more of the categories above, requiring a combination of protection features.

5. Determine Condition of Galvanized Substrate and Surface Preparation Method Required

The condition of the galvanized substrate will affect surface preparation requirements prior to coating application. It is essential that the galvanized surface be properly prepared to support additional coatings and ensure optimum coating adhesion over a long service life.

New, Partially Weathered, and Weathered Galvanized Surfaces: ASTM D 6386 provides definitions of new, weathered, and partially weathered galvanized surfaces as well as information on appropriate surface preparation techniques for each of these substrate conditions. It is recommended that SSPC-SP 16 be referenced in place of SSPC-SP 7/NACE No 8 for brush-off blast cleaning of galvanized substrates prior to coating. SSPC-SP 16 contains information on brush-off blast cleaning of non-ferrous metals (including galvanized surfaces). The surface preparation method used and the service environment will affect coating selection. If the galvanized layer shows no signs of deterioration, a full overcoat of the selected coating will provide optimum protection (see Table 1, Note 2).

Deteriorated Substrates: Reddish brown discoloration on galvanized surfaces may indicate either (a) the complete loss of galvanizing and rusting of the underlying steel or (b) that the reddish-brown layer of zinc-iron alloy (the "intermetallic layer") which forms at the interface between the galvanizing and the steel substrate has been exposed due to the loss of surface zinc. A dry film thickness gage can be used in accordance with ASTM D 7091 to check for the presence of zinc in discolored areas. If the gage is capable of measuring surface duplex coatings, it may also determine if any coating is present above the zinc.

If no rust is present or suspected, the intermetallic layer can be left undisturbed and will still protect the steel, provided that organic contaminants are removed prior to application of a repair coating. When individual areas of damage or deterioration are less than 1 square foot in size, but the overall condition of the galvanized item permits spot cleaning and repair, damaged areas are typically prepared for coating by power tool cleaning per SSPC-SP 11. The coating selected would therefore be one suitable for use in spot repairs (see Table 1 Notes 1 and 6).

If the galvanized surface exhibits depletion of the zinc layer and rust on 10% of the surface of a defined area, as illustrated in SSPC VIS 2, restoration of corrosion protection can be accomplished by application of a full coat(s) of the selected coating over the entire surface. Localized abrasive blast cleaning to SSPC-SP 5/NACE No. 1 or SSPC-SP 10/NACE No. 2 may be required prior to application of a repair coating. In these circumstances, inorganic zinc coatings may be an additional option for use as a repair coating (see Table 1 and Notes 1 and 5).

6. Selection of Coatings

Table 1 shows the generic coating materials typically used in conjunction with hot dip galvanizing in various service environments. As shown, the condition of the existing galvanizing and the need for spot repair or full overcoat should be considered when selecting a coating.

7. Disclaimer

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