AASHTO/NSBA Steel Bridge Collaboration
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SSPC-PA Guide 13

Guide Specification for Application of Coating Systems with Zinc-Rich Primers to Steel Bridges

AASHTO/NSBA Steel Bridge Collaboration
SSPC: The Society for Protective Coatings

American Association of State Highway and Transportation Officials
AASHTO The Voice of Transportation

National Steel Bridge Alliance NSBA Founded 1995

SSPC The Society For Protective Coatings

Guide Specification for Application of Coating Systems with Zinc-Rich Primers to Steel Bridges

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Introduction

This Guide Specification represents a consensus on best industry practice for shop application of zinc rich coating systems to previously uncoated bridge steel and includes the proper preparation of the steel. To simplify the application parameters for a system based on zinc-rich primers on new steel bridges, a series of charts has been developed. These charts provide a convenient summary listing the detailed requirements for surface preparation, environmental conditions, coating application, curing, verification testing, and prevention and remediation of non-conformances. The guide specification addresses a three-coat system consisting of primer, intermediate coat, and topcoat, but is also appropriate for application of a two-coat system or primer only.

Two nonmandatory appendices have been added to this revision. Appendix A lists causes and remedies for non-conformances commonly encountered when preparing new steel for the application of coatings, and includes a list of references providing methods to verify that the problem has been corrected. Appendix B presents similar information for non-conformances encountered during application of organic and inorganic zinc-rich primers and subsequent coatings.

This document establishes and defines the functions, operations, requirements, and activities needed to achieve consistent quality in steel bridge painting. It is based on a cooperative approach to quality, where the Owner's and Contractor's representatives work together to meet their responsibilities, resulting in efficiently painted steel bridges meeting all contractual requirements. Manufacturer's recommendations shall apply when referenced herein or where the contract specifications do not provide guidance. When manufacturer recommendations do not agree with the contract specifications, the specifications shall govern.

Guide Specification acceptance does not preclude anyone, whether adopting the standard or not, from manufacturing, marketing, purchasing, or using products or procedures not addressed herein.

Environmental, containment, and safety issues referenced herein are outside the scope of this Guide Specification and should be addressed in other documents.

1 Definitions

1.1 Applicator ("Paint Shop")

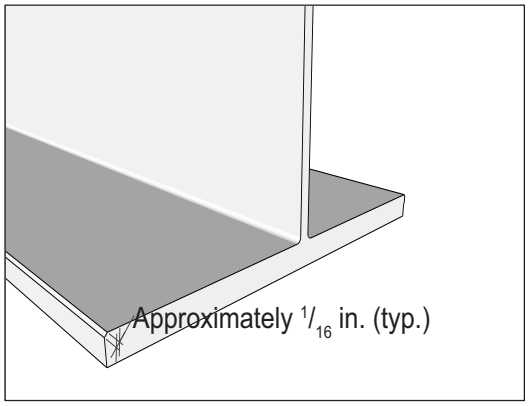
Person or contractor who applies a coating.

1.2 Breaking the Corner (Corner Chamfering)

A process by which a sharp corner is flattened by passing a grinder or other suitable device along the corner, normally in a single pass.

C1.2

The breaking (flattening) of a sharp corner is sketched below:



Care should be taken to ensure that no new sharp edges are raised by grinding.

Extensive testing has proven shop grinding of corners is unnecessary for improving coating coverage and corrosion protection when using ethyl silicate inorganic zinc-rich primer systems with minimum zinc loading of 83 percent. Limited testing has also shown that, while organic zinc-rich materials sometimes tend to draw thin on square corners, they cover well on corners that are merely flattened ("breaking the edge"). Therefore, when organic zinc-rich materials are applied to corners that have been "cut" (sawed, burned, or sheared), the corners must either be "broken" or stripe coated per SSPC-PA 1, Section 6.6, "Striping."

1.3 Checking, Crazing

That phenomenon manifested in paint films by slight breaks in the film that do not penetrate through the last applied coating.

See ASTM D660, Standard Test Method for Evaluating Degree of Checking of Exterior Paints.

1.4 Conformance Certification

A verification issued by the coating manufacturer confirming that a particular batch of product was produced in accordance with the manufacturer's standard. This standard of performance for the product must have previously been approved or accepted by the Owner.

1.5 Corner

The intersection of two surfaces.

1.6 Edge

An exposed, through-thickness surface of a plate or rolled shape. Examples include the as-rolled side face of a beam flange, channel flange, or angle leg; and the cross section of a cut piece resulting from thermal cutting, sawing, or shearing. Edges may be planar or rounded, and either perpendicular or skewed to adjacent faces.

1.7 Edge Grinding (Edge Conditioning)

Very shallow grinding or other preblast cleaning preparation of thermal cut edges (TCEs) to remove a thin, hardened layer left by resolidification. It does not include grinding required by the *D1.5 Bridge Welding Code* or ASTM A6 to remove cutting, handling, or material anomalies.

C1.7

Edge grinding can be used to remove martensite, a hardened form of steel that may occur due to rapid resolidification following thermal cutting. This layer is typically very thin, about 0.01 to 0.02 in. (0.25 to 0.50 mm) thick, and is dependent upon the steel's chemistry and thickness. Light grinding is generally sufficient to remove this material, and is only necessary if the hardness interferes with achieving the desired profile during blast cleaning. The presence of martensite and/or the small grooves normally left by thermal cutting are not a fatigue or stress concentration problem.

1.8 Fastener

A mechanical device used to attach two or more items together, e.g., a bolt, nut, and washer.

1.9 Faying Surfaces

Contact surfaces within mechanically connected joints of steel structures.

1.10 Holiday

Pinhole, skip, discontinuity, or void in a coating film that exposes the substrate.

1.11 Limited Access Areas

Partially or completely enclosed surfaces, the majority of which are not visible without the use of special devices such as mirrors, and not readily accessible for coating by routine methods.

1.12 Microcracking

Cracks, visible only under magnification, that develop in a coating at the time of application or during the drying process.

1.13 Mud Cracking

A coating defect resembling the irregular cracking of drying mud that typically arises during the curing of a relatively inflexible coating applied too thickly. Mud cracking is evident without magnification and usually penetrates the entire layer of the coating.

1.14 Pinhole

A holiday or discontinuity that extends entirely through a coating film, approximately the size of a pin, normally caused by solvent bubbling, moisture, or foreign materials.

1.15 Product Data Sheet (PDS)

Coating description document that includes surface preparation, application, curing, and other product-specific details required for good results.

1.16 Qualified Product

A coating product that has been approved based on testing to a Federal, State, or regional agency, or to a test protocol (e.g., AASHTO, NEPCOAT, NTPEP, or DOT protocol).

1.17 Sharp

An acute corner or prominence that is able or appears to be able to cut human flesh.

1.18 Spot Priming

Application of primer paint to localized spots where the substrate is bare or where additional protection is needed because of damage to, or deterioration of, a former coat.

1.19 Stripe Coat

A coat of paint applied only to edges, corners, or welds on steel structures before or after a full coat is applied to the entire surface. The stripe coat is intended to ensure those areas receive the required dry film thickness (DFT) to resist corrosion.

1.20 Visible Coating Defects

Imperfections that may be detected by examination without magnification. These include runs, sags, lifting, chipping, cracking, spalling, flaking, mudcracking, pinholing, and checking.

1.21 Weld Spatter, Tight

Beads of metal produced during the welding process with adequate thermal energy to adhere on metal in the weld area. The droplets retain their individual shape but have sufficient fusion to resist removal by hand scraping with a putty knife, per SSPC-SP 2.

2 Reference Standards

Unless otherwise noted in the contract, the latest edition of the following standards and regulations in effect at the time of contract letting form a part of this guide. A copy of applicable reference standards shall be available at the painting facility.

2.1 American Association of State Highway and Transportation Officials (AASHTO)

2.1.1 AASHTO M 160, Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Steel Pilings, and Bars for Structural Use

2.1.2 AASHTO M 300, Standard Specification for Inorganic Zinc-Rich Primer

2.1.3 AASHTO R 31, Standard Practice for Evaluation of Coating Systems with Zinc-Rich Primers

2.2 American Society for Testing and Materials (ASTM)

2.2.1 ASTM A6, Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

2.2.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates

2.2.3 ASTM D660, Standard Test for Evaluating Degree of Checking of Exterior Paints

2.2.4 ASTM D1640, Standard Test Method for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature

2.2.5 ASTM D3359, Standard Methods for Measuring Adhesion by Tape Test

2.2.6 ASTM D3363, Standard Test Method for Film Hardness by Pencil Test

2.2.7 ASTM D4138, Standard Test Method for Measuring of Dry Paint Thickness of Protective Coating Systems by Destructive Means

2.2.8 ASTM D4285, Standard Test Method for Indicating Oil or Water in Compressed Air

2.2.9 ASTM D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages

2.2.10 ASTM D4417, Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

2.2.11 ASTM D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

2.2.12 ASTM D4752, Standard Test Method for Measuring MEK Resistance of Ethyl Silicate Zinc-Rich Primers by Solvent Rub

2.2.13 ASTM D4940, Standard Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Abrasive

2.2.14 ASTM D7127, Standard Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces Using a Portable Stylus Instrument

2.2.15 ASTM D7393, Standard Practice for Indicating Oil in Abrasives

2.3 NACE International

2.3.1 NACE 6F-166, Recommended Practices for Inspection of Linings on Steel and Concrete

2.3.2 NACE Standard SP0178 (latest edition), Standard Recommended Practice: Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to Be Lined for Immersion Service

2.3.3 NACE SP0508-2010, Methods of Validating Equivalence to ISO 8502-9 on Measurement of the Levels of Soluble Salts

2.4 SSPC: The Society for Protective Coatings

2.4.1 SSPC-AB 1, Mineral and Slag Abrasives

2.4.2 SSPC-AB 2, Cleanliness of Recycled Ferrous Metallic Abrasives

2.4.3 SSPC-AB 3, Ferrous Metallic Abrasive

2.4.4 SSPC-AB 4, Recyclable Encapsulated Abrasive Media (in a Compressible Cellular Matrix)

2.4.5 SSPC-Guide 13, Guide for the Identification and Use of Industrial Coating Material in Computerized Product Databases

2.4.6 SSPC-Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates

2.4.7 SSPC-PA 1, Shop, Field, and Maintenance Painting of Steel

2.4.8 SSPC-PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements

2.4.9 SSPC-PA 17, Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements

2.4.10 SSPC-Paint 20, Zinc-Rich Coating, Type I—Inorganic, and Type II—Organic)

2.4.11 SSPC-PS 12.00, Guide to Zinc-Rich Coating Systems

2.4.12 SSPC-SP 1, Solvent Cleaning

2.4.13 SSPC-SP 2, Hand Tool Cleaning

2.4.14 SSPC-SP 3, Power Tool Cleaning

2.4.15 SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning

2.4.16 SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning

2.4.17 SSPC-SP 10/NACE No. 2, Near-White Metal Blast Cleaning

2.4.18 SSPC-SP 11, Power Tool Cleaning to Bare Metal

2.4.19 SSPC-SP 15, Commercial Grade Power Tool Cleaning

2.4.20 SSPC-SP COM, Surface Preparation and Abrasives Commentary, SSPC Painting Manual, Volume 2, "Systems and Specifications"

2.4.21 SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

2.5 Research Council on Structural Connections (RCSC)

2.5.1 Specification for Structural Joints Using High-Strength Bolts

2.6 American Institute for Steel Construction (AISC)

2.6.1 AISC 420-10/SSPC-QP 3, Certification Standard for Shop Application of Complex Protective Coating Systems

2.7 Related Reference Documents

2.7.1 Equipment and Coating Manufacturer's Published Instructions and Product Data Sheets

2.7.2 Applicable Ordinances and Regulations

2.7.3 Good Painting Practice—SSPC Painting Manual, Volume 1

2.7.4 NSRP Report 0511, User's Guide to Selection of Blasting Abrasives, National Shipbuilding Research Program Final Report Project 3-95-7 (April 1998)

2.7.5 SSPC-Guide 12, Guide for Illumination of Industrial Painting Projects

2.7.6 SSPC-Guide 16, Guide to Specifying and Selecting Dust Collectors

2.7.7 SSPC-PA Guide 11, Guide to Protection of Edges, Crevices, and Irregular Surfaces

3 General

3.1 Qualification

When the contract requires painting more than 1,500 ft^2 (140 m^2) of steel surface, the organization(s) performing coating application must demonstrate qualification by obtaining SSPC QP 1 certification for field painting or AISC 420-10/SSPC QP-3 Certification Standard for Shop Application of Complex Protective Coating Systems. This qualification must be maintained throughout the painting portion of the project. If it expires or is revoked for any reason, immediate notification must be sent to the Owner, who may require that a qualified organization complete the coating portion of the project.

3.2 Inspection

Conduct and document inspection of the cleaning and painting operations including, at a minimum, measurements of ambient conditions, surface profile, surface cleanliness, coating material acceptability, dry film thicknesses, and visual inspection for coating continuity and defects. Record the data and make it available for the Owner's review.

3.3 Written Procedures

Maintain written standard procedures and submit to the Owner upon request, covering such items as verifying and maintaining paint manufacturer data, measuring and recording dry film thickness and cure time, protection and treatment of faying surfaces, and other information needed to successfully document and apply all coats of paint.

3.4 Miscellaneous

Surfaces to be painted and the coating system to be used shall be as indicated on plans and/or contract documents. Unless otherwise noted, paint is not required on flange surfaces that will be embedded in concrete, or inside bolt holes, although overspray is permitted on flange surfaces and inside bolt holes.

3.5 Protective Coating System

3.5.1 The contractor shall use only Owner-approved coating systems meeting the applicable slip, creep, and other contract requirements.

3.5.2 Coating products suitable for use shall meet the test requirements of AASHTO M 300, AASHTO R 31, SSPC-Paint 20 or SSPC-Paint 30, or other acceptable qualified product testing protocols meeting Owner acceptable criteria. SSPC-PS Guide 12.00 provides additional information about selecting coating materials.

3.5.3 All coatings shall be supplied by the same coating manufacturer and designated by the coating manufacturer for use as a recommended system, unless otherwise approved by the Owner.

3.5.4 Coating thickness shall be as specified by the Owner and within the manufacturer's published allowable thickness ranges. Coating thickness ranges on faying surfaces are limited to the maximum allowable thickness defined in the test certification according to RCSC (see Section 2.5) for the given product.

C3.5.4 Dry film coating thicknesses (DFT) in excess of those permitted, although constituting a specification non-conformance, should be considered on a case-by-case basis. Occasional excursions, especially at inside corners and other areas prone to high DFT due to pattern overlap may be acceptable if the coating is well adhered and free of the deficiencies listed in Appendix B. Attempting to reduce DFT in an otherwise acceptable coating may result in significant problems or extensive, unnecessary rework. The applicator should be notified of the problem and amend procedures to avoid recurrences. Inspectors should document the deficiencies noted, any corrections required, and resulting changes in the applicator's practices, consistent with the resolution of any other non-conforming item.

3.6 Coating Repairs

Submit repair procedures conforming to the coating manufacturer's written recommendations for the Owner's approval. Repairs to the final coat must result in acceptable, uniform gloss and color on visible surfaces. The Owner shall have final authority concerning the coating's uniformity and acceptable appearance.

3.7 Paint Storage

Paint shall be stored in accordance with manufacturers' instructions.

3.8 Steel Storage after Painting

Handle steel members with care to minimize damage to or contamination of the coating. Handle large members with synthetic slings, padded chains and lifting clamps, or other non-injurious methods, and store them on padded or otherwise protected blocking. Small assemblies and pieces may be bundled utilizing cushioners (e.g., cardboard, template paper, carpeting, etc.) or other means to avoid or minimize metal-to-metal contact of painted areas. Paint must be dry-to-handle in accordance with the coating manufacturer's PDS before lifting or placing on supports to avoid paint damage or foreign material adhering to painted surfaces.

C3.8

While members may be moved from the paint "skids" when the coating is "dry to handle," the coating must be thoroughly cured prior to bundling, storing, and shipping to minimize damage from the handling during these processes.

4 Material Acceptance

4.1 Paint

4.1.1 All paint materials shall satisfy composition and testing requirements, shall be in conformance with the Owner-approved Qualified Products List or other applicable requirements, and shall not exceed the manufacturer's specified shelf life before use.

4.1.2 Provide batch samples of all coating material components to the Owner as required or requested.

4.1.3 Materials will be rejected if the material arrives at the application site in other than original, unopened containers; if a container has a break in the lid seal or a puncture; or if the coating materials have begun to polymerize, solidify, gel, or deteriorate in any manner.

C4.1.1 The issues surrounding the testing and selection of actual coating materials are not addressed in this document because AASHTO maintains a testing protocol and database of testing results as part of AASHTO NTPEP (National Transportation Product Evaluation Program) initiative.

4.2 Abrasive Media Condition

Abrasive cleaning material shall meet the requirements of SSPC-AB 1, Mineral and Slag Abrasives; SSPC-AB 2, Cleanliness of Recycled Ferrous Metallic Abrasives; or SSPC-AB 3, Ferrous Metallic Abrasive. The condition and cleanliness of recycled abrasives shall be confirmed in accordance with the applicator's approved quality control program as per AISC 420-10/SSPC QP 3.

5 Surface Preparation

5.1 Material Anomalies

5.1.1 Corner Condition—Remove all sharp corners prior to painting with either organic or inorganic zinc-rich primer by creating a small chamfer. With inorganic zinc rich primers, corners less acute than the definition of "sharp" need no further treatment prior to final cleaning (profiling) and painting. Sharp corners may usually be removed by a single pass with a grinder. For organic zinc-rich primer-based systems, all corners resulting from sawing, or burning, or finishing following shearing operations must be broken and a primer stripe coat shall be applied to those corners.

C5.1.1 Some corner "softening" (flattening) occurs during blast cleaning; however, blast cleaning alone will not sufficiently break a sharp corner. Corners in the as-rolled condition are not normally in need of any treatment. See further discussion in the commentary to Section 1.2.

5.1.2 Preparation of Thermal Cut Edges—Before blast cleaning, condition thermal cut edges (TCEs) to be painted by light grinding, if necessary to achieve proper blast cleaning profile.

5.1.3 Base Metal Surface Irregularities—Remove all visually evident surface defects in accordance with ASTM A6 or AASHTO M 160 prior to blast cleaning steel. When material defects exposed by blast cleaning are removed, restore the blast profile either by blast cleaning or by using mechanical tools in accordance with SSPC-SP 11 or SP 15.

5.1.4 Weld Irregularities or Spatter—Remove or repair all sharp weld prominences, and all heavy, sharp, or loose weld spatter. Occasional individual particles of rounded tight weld spatter may remain, but widespread, sharp, or clustered particles of tight weld spatter must be removed.

C5.1.4 While the removal of all weld spatter is recommended, it is recognized that absolute compliance may present difficulties, often leading to unnecessary rework. As a practical matter, occasional tightly adhered spatter may remain as long as paint coverage and adhesion are not adversely affected, and field assembly is not impaired.

5.2 Precleaning

Prior to blast cleaning, remove all substances from areas to be painted that would be deleterious to the adhesion of coating in accordance to SSPC SP 1, including oil, grease, bolt lubricant, and excess dye.

C5.2

Paint stick marking or other material that will be removed during surface preparation may remain.

5.3 Abrasive Blast Cleaning

5.3.1 Abrasive blast clean the entire surface to be coated in accordance with the cleanliness and profile required by the manufacturer's PDS and the contract requirements.

5.3.2 If the material for the project is heavily rusted or pitted, or as directed by the Owner, measure for the presence of non-visible deleterious contaminants after blasting and remove to a level in accordance with contract requirements. See Table 5.2, row 4 and footnotes.

5.3.3 Assess the profile per SSPC-PA 17.

5.4 Bolts (Fasteners)

5.4.1 When bolts are to be installed and final tightened before priming, prepare them as necessary so that after the steel is abrasive blast cleaned, exposed bolt surfaces will satisfy the requirements outlined in Table 5.1.

5.4.2 Black bolts, nuts, and washers, including flat faces of nuts and bolt heads facing adjacent material, may require spot blast cleaning or other surface preparation before general blast cleaning in order to assure that the proper surface profile to obtain adhesion of the primer has been achieved.

C5.4.2 The extra cleaning specified in Article 5.4.2 may be required because of surface hardness, limited blast media access, etc.

5.4.3 If the zinc coating on mechanically- or hot dip-galvanized fasteners is damaged during abrasive blast cleaning or tightening, it may be left "as is" if the entire coating system (including the zinc-rich primer) will be applied over the fasteners. If mechanically- or hot dip-galvanized fasteners will not be subsequently primed with adjacent steel, then zinc coating areas removed during installation must be spot primed with an approved surface tolerant coating compatible with subsequent coatings.

C5.4.3 For areas not being prime coated after fastener installation, galvanizing that has been deformed or smeared during tightening is still present and effective so spot priming is not necessary except where bare steel is exposed. Organic zinc primer or aluminum filled epoxy mastic may be proposed if the contract does not identify a spot priming material.

5.4.4 Nuts for hot dipped- or mechanically-galvanized high strength fasteners require a lubricant which is colored to verify its presence. The lubricant on exposed surfaces of installed nuts must be removed before painting. The identity of solvents

C5.4.4 Removal of the lubricant wax and nonabsorbed dye (typically blue for mechanically galvanized and green for hot dip galvanized) has been easily accomplished with an alkaline household cleaner such as ammonia. Care should be

and methods needed to remove the lubricant is obtained from the galvanizer and provided to the General Contractor, shop and field painters, the Owner, and other interested parties, with a description of the cleanliness necessary for coating adhesion. Perform periodic evaluation to ensure that lubricant and excess dye are adequately removed.

taken to ensure that no residue from the cleaner remains after cleaning that might affect subsequent coating adhesion; typically ammonia will evaporate by the time the coating is applied. Any dye coloring remaining on galvanized nuts after weathering or the required surface preparation is not believed to be detrimental to subsequent coating performance or appearance. A white cloth wipe test with no color transfer can be used to confirm that all lubricant and non-absorbed dye has been removed, leaving only the residual "stain" on the surface.

5.4.5 When zinc-coated twist-off tension control or lock-pin-and-collar fasteners are used, coat the sheared ends with an approved surface tolerant coating compatible with subsequent coatings. Apply the coating to the non-rusted surface on the same day that the bolt is installed. The coating shall be compatible with the subsequently applied coating.

C5.4.5 Organic zinc primer or aluminum-filled epoxy mastic may be proposed if the contract does not identify a material to coat the fractured ends.

Table 5.1—Surface Preparation Requirements for Fasteners

Item	Fasteners Installed Prior to Cleaning and Primer Application		Fasteners Installed after Primer Application	
	Coating System	**Surface Prep**	**Coating System**	**Surface Prep**
Black Iron Bolts	OZ[1] or IOZ[2]	Section 5.4.2	OZ[1], IOZ[2]	SSPC-SP 1, 10
			Other Specified	SSPC-SP 1 and as required to achieve the proper degree of cleaning specified
Galvanized (Mechanical or Hot Dip)	OZ[1] or IOZ[2]	SSPC-SP 1	Intermediate Coat	SSPC-SP 1, 2, 3, and/or SP 12

Notes:

1. OZ = Organic Zinc-Rich Coating
2. IOZ = Inorganic Zinc-Rich Coating

5.5 Summary

Table 5.2 summarizes the requirements for precleaning, cleaning, profile, and surface cleanliness of structural steel.

Table 5.2—Surface Preparation Summary Table

Requirement	Basis for Acceptance	Minimum	Maximum	Frequency/Extent of Inspection
1. Preclean	Visual	SSPC-SP 1	N/A	100%
2. Degree of Cleaning	Visual	PDS	N/A	100%
3. Profile (ASTM D4417)	Test	PDS	PDS	Once every shift for automated operations and twice per shift for each nozzle, and whenever the operating media mix is changed
4. Surface Cleanliness (SSPC-Guide 15)[1]	Test	N/A	Per Owner requirements	Varies[2]
6. Fasteners	Test			
	Black iron	SP 1, SP 10	SP 1, SP 10	100%
	Mechanically or hot dip-galvanized	SP 1	SP 1	See Section 5.4.4

Notes:

1. The test methods indicated in SSPC-Guide 15 vary in their sensitivity and the particular test method used should be specified by the Owner. If surface contamination testing is anticipated, the contract should provide guidance on extent and methods of testing, methods and criteria for remediation, and basis of payment.
2. Only needed on heavily rusted or pitted steel as described in SSPC-VIS 1 Conditions C and D, unless otherwise specified.

6 Paint Application

6.1 General

6.1.1 Apply coatings in accordance with the Contract requirements, SSPC-PA 1, and the coating manufacturer's instructions.

6.1.2 Conduct and document ongoing inspection of the materials; prepared surfaces; and the prime, intermediate, and topcoat painting per Tables 6.1 to 6.3 (at the end of Section 6).

6.1.3 Record the daily storage temperature range for coating materials and verify conformance with the coating manufacturer's PDS. Use materials within their shelf life. Record the coating batch numbers from the mixed components, the amount and type of thinner used, and the date applied in the application log.

Verify that the coating has been applied to provide a continuous, uniform film of the specified thickness; is free of laps, streaks, sags, or other visually evident defects; and was applied within the manufacturer's specified pot life.

6.1.4 Areas that fail to meet any required criteria shall be addressed in accordance with Section 3.6. See Appendices A and B for guidance.

6.1.5 Tables 6.1, 6.2, and 6.3 show information related to ambient conditions; surface cleanliness; and mixing, application, and cure. The charts show the specific source of relevant control information, as well as minimum and maximum tolerances. Also indicated are inspection frequency requirements.

6.2 Coatings on Faying Surfaces

Coatings or coating systems applied to slip critical contact surfaces shall satisfy RCSC requirements for the specified slip friction coefficient (see RCSC Section 2.5) and the temperature-adjusted cure time. Prior to bolting, verify that the coating dry film thickness on faying surfaces is within the range certified by testing for the specified slip coefficient, and the coat is properly cured in accordance with the certification and manufacturer's requirements.

6.3 Intermediate and Topcoat

The color of the topcoat shall be as specified in the contract documents. If an intermediate coat is used, its color shall contrast with both the primer and final coat, as approved by the Owner. Coating materials used to apply piecemarks shall be compatible with the existing and any subsequent coats or the piece marks shall be removed as a contaminant.

C6.3

Under extreme exposure conditions, the Owner may specify stripe coating for intermediate and/or topcoat.

Table 6.1—Zinc-Rich Prime Coat Inspection

Verification/Record Requirement	Basis for Acceptance	Minimum	Maximum	Frequency/Extent
1. Current Painter Qualification Verified	Applicator Quality Plan	As Required by SSPC/ AISC	N/A	Every painter/project
2. Ambient Temperature	Product Data Sheet	As Required	As Required	Every 4 hours[1]
3. Dew Point and Relative Humidity	Product Data Sheet	As Required	As Required	Every 4 hours[1]
4. Surface Temperature	Product Data Sheet	As Required	As Required	Every 4 hours[1]
5. Primer Component Batch Number	Owner-Approved Batch Numbers[2]	N/A	N/A	Every paint kit
6. Verification of Surface Cleanliness and absence of rust	SSPC-SP 10	N/A	N/A	Examine visually and with cloth within 1 hour prior to priming
7. Date and Time	N/A	N/A	N/A	Each lot of work[3]
8. Piece Mark or Bundle	N/A	N/A	N/A	Each lot of work[3]
9. Temperature of Mixed Primer	Product Data Sheet	As Required	As Required	When mixing components[4]
10. Proper Mixing and Straining	Product Data Sheet	As Required	N/A	Every pot mix[4]
11. Coating Induction and Reaction Time[5]	Product Data Sheet	N/A	N/A	Every pot mix[4]
12. Primer Pot Life[5]	Product Data Sheet	N/A	As Required	Every pot mix[4]
13. Primer Stripe Coat[6,7]	Product Data Sheet	N/A	N/A	N/A
14. Primer Recoat Window Time	Product Data Sheet	As Required	Acceptable[7]	Each lot of work[3]
15. Primer Cure Time	Product Data Sheet	As Required	As Required	Each lot of work[3]
16. Primer Cure Verification[6]	Product Data Sheet or Owner Spec	As Required	As Required	Prior to next coat application.
17. Dry Film Thickness	Product Data Sheet or Owner Spec	As Required	As Required	SSPC-PA 2
18. Visual Inspection	SSPC-PA 1	No defects	N/A	100%
19. Primer Coat Evaluation and Repair	SSPC PA 1 and Approved Procedure	As Required	N/A	Visual, 100% of each element
20. Primer Recoat Time	Product Data Sheet	As Required	Acceptable[6]	Each lot of work[3]

(Footnotes follow Table 6.3.)

Table 6.2—Intermediate Coat Inspection

Verification/Record Requirement	Basis for Acceptance	Minimum	Maximum	Frequency/Extent
1. Current Painter Qualification Verified	Applicator Quality Plan	As required by SSPC/ AISC	N/A	Every painter/project
2. Ambient Temperature	Product Data Sheet	As Required	As Required	Every 4 hours[1]
3. Dew Point and Relative Humidity	Product Data Sheet	As Required	As Required	Every 4 hours[1]
4. Surface Temperature	Product Data Sheet	As Required	As Required	Every 4 hours[1]
5. Intermediate Coat Component Batch Number	Owner Approved Batch Numbers[2]	N/A	N/A	Every paint kit
6. Primer Recoat Time	Product Data Sheet	Full Cure[6]	Acceptable[6]	Each lot of work[3]
7. Verification of Primer Surface Cleanliness	SSPC-SP 1	As Required	N/A	Initial and every 4 hours of painting
8. Date and Time	N/A	N/A	N/A	Each lot of work[3]
9. Piece Mark or Bundle	N/A	N/A	N/A	Each lot of work[3]
10. Temperature of Mixed Inter. Coat	Product Data Sheet	As Required	As Required	When mixing components[4]
11. Intermediate Coat Mixing and/or Straining	Product Data Sheet	As Required	N/A	Every pot mix[4]
12. Coating Induction and Reaction Time[5]	Product Data Sheet	N/A	N/A	Every pot mix[4]
13. Intermediate Coat Pot Life[5]	Product Data Sheet	N/A	As Required	Every pot mix[4]
14. Intermediate Coat DFT	Owner spec or PDS[8]	As Required	As Required	SSPC-PA 2
15. Visual Inspection	SSPC-PA 1	No Defects	N/A	100%
16. Intermediate Coat Evaluation and Repair	SSPC PA 1 and Approved Procedure	As Required	N/A	Visual, 100% of each element
17. Intermediate Coat Recoat Time	Product Data Sheet	Full Cure	As Required	Each lot of work[3]

(Footnotes follow Table 6.3.)

Table 6.3—Top Coat Inspection

Verification/Record Requirement	Basis for Acceptance	Minimum	Maximum	Frequency/Extent
1. Current Painter Qualification Verified	Applicator Quality Plan	As Required by SSPC/ AISC	N/A	Every painter/project
2. Ambient Temperature	Product Data Sheet	As Required	As Required	Every 4 hours[1]
3. Dew Point and Relative Humidity	Product Data Sheet	As Required	As Required	Every 4 hours[1]
4. Surface Temperature	Product Data Sheet	As Required	As Required	Every 4 hours[1]
5. Top Coat Component Batch Number	Owner Approved Batch Numbers[2]	N/A	N/A	Every paint kit
6. Intermediate Coat Recoat Time	Product Data Sheet	Full Cure	Acceptable	Each lot of work[3]
7. Verification of Int. Coat Surface Cleanliness	SSPC-SP 1	As Required	N/A	Initial and every 4 hours of painting
8. Date and Time	N/A	N/A	N/A	Each lot of work[3]
9. Piece Mark or Bundle	N/A	N/A	N/A	Each lot of work[3]
10. Temperature of Mixed Top Coat	Product Data Sheet	As Required	As Required	When mixing components[4]
11. Top Coat Mixing and/or Straining	Product Data Sheet	As Required	N/A	Every pot mix[4]
12. Coating Induction and Reaction Time[5]	Product Data Sheet	N/A	N/A	Every pot mix
13. Top Coat Pot Life[5]	Product Data Sheet	N/A	As Required	Every pot mix[4]
14. Topcoat Dry Time	Product Data Sheet	Full Cure	N/A	Each lot of work[3]
15. Top Coat DFT	Owner Spec or PDS[8]	As Required	As Required	SSPC-PA 2
16. Visual Inspection	SSPC-PA 1	No Defects	N/A	100%
17. Paint System Final Evaluation and Repair	SSPC PA 1 and Approved Procedure	As Required	N/A	Visual, 100% of each element

Notes:

1. Based on weather conditions, more or less frequent testing may be stipulated by the Owner.
2. Owner approval may be based on sampling and testing or the coating manufacturer's certification that batch compositions conform to previously approved standards. Primer for faying (contact) surfaces of high strength bolted connections (for slip-critical, frictional transfer of load) must satisfy RCSC requirements for the specified slip coefficient, based on certified tests by the coating manufacturer or applicator.
3. All items in each lot that were coated with the same batch of paint must be identified. Small items may be identified by bundle or shipping container number.
4. Inspector must document acceptance by initials or signature, and form must include time/date and batch component numbers.
5. Multi-component coatings are activated when components are mixed. Some may be applied immediately after thorough mixing while others require induction (aka sweat-in) prior to application. Consult manufacturer's data sheet to determine the requirement and the duration of induction.

6. Verification of primer cure is required prior to shop application of intermediate or stripe coat, or if adding extensive organic zinc primer to increase initial DFT. (Not required for spot priming.) See the coating manufacturer's thinning requirements if repriming previously coated surface. Primer cure must be verified before handling and shipping. For inorganic zinc, if testing is required to verify cure and the PDS does not have a specified cure test, then ASTM D4752 shall apply.
7. Stripe coat(s) may be applied either before or after the full coat to ensure adequate coverage on outside corners, edges, and other areas specified in the applicator's coating plan. Note that striping IOZ is not normally recommended.
8. Based on difference between average DFT of coats applied and previous readings for similar areas. For example, webs, stiffeners, flanges, cross frames, and bearings may each have different averages due to application patterns.

Commentary: Table Note 7

Stripe coating, when specified, is normally performed as outlined in SSPC-PA 1 Subsection 6.6, "Striping," and in accordance with the coating manufacturer's recommendations. The purpose of the stripe coat is to assure that adequate coating thickness is deposited on designated surfaces. Apply the stripe coat either before or after the full prime coat, by spray application or by brush or roller in accordance with the coating manufacturer's recommendation.

Nonmandatory Appendix A
Surface Preparation Non-Conformance to Project Specification—Newly Fabricated Steel Structures

Surface preparation must comply with specifications and the primer manufacturer's requirements. Surface preparation specifications reference cleanliness and profile (i.e., texture) standards. Verification is accomplished with visual comparators such as the SSPC-VIS 1 reference photographs for cleanliness, and the use of various tools to determine blast profile. Recommendations for repair are provided. All repairs must be in conformance with the Owner's specified repair procedures.

Note: Surface preparation problems can be significantly reduced by

1. Hiring shops qualified to the AISC 420-10/SSPC-QP 3 standard.
2. Establishing a process control procedure and a job standard (test area) prior to startup of work.
3. Use of inspectors with appropriate training and certification.

See Table A.1 for non-conformances resulting from the surface preparation process and Table A.2 for non-conformances resulting from activities that occur after original surface preparation.

Table A.1—Conditions, Causes, and Remedies for Non-Conformances Resulting from the Surface Preparation Process

Condition	Cause	Remedy	Standard/Method
General Inadequate Cleanliness	Blast equipment settings, blast cleaning pattern, work travel speed, blast energy, abrasive quality (hardness, sieve size, worn, or contaminated), improper proportioning of shot and grit, improper mixing of pre-proportioned abrasive, contaminated substrate, moisture or oil in compressed air supply.	Adjust according to cause. Consult SOPs for blast machine and components; consult SOP for abrasive recycling equipment; and consult maintenance, repair, and troubleshooting guide and abrasive selection guide. Check compressed air supply for blast nozzle and blowdown. Also, check on adequacy of lighting (see SSPC-Guide 12, Table 1).	ASTM C136 ASTM D4285 ASTM D4940 ASTM D7393 SSPC-AB 1, 2, 3, 4 SSPC-Guide 12 SSPC-Guide 15 SSPC-Guide 16 SSPC-SP 1
Localized Inadequate Cleanliness or Profile	Wheel configuration, wheel maintenance (for centrifugal blast equipment) Operator effectiveness (for nozzle blast equipment) Geometry (i.e., "shadow" from stiffener) Clogged filters or ineffective dust collector.	For misadjusted centrifugal blast equipment, align, repair, or replace. For "shadow," may need to preblast difficult-to-reach areas, run the piece through again in another configuration, or readjust wheels. For extremely difficult geometry, may need to use hand or power tool surface preparation. Consult SOPs for blast machine and components; SOP for abrasive recycling equipment; maintenance, repair, and troubleshooting guide for the equipment; and abrasive selection guide. Also, check on adequacy of lighting (see SSPC-Guide 12, Table 1).	ASTM C136 ASTM D4285 ASTM D4940 ASTM D7393 NSRP Report 0511 SSPC-AB 1, 2, 3, 4 SSPC-Guide 12 SSPC-Guide 16 SSPC-SP 2, 3, 11, 15 SSPC-VIS 3 (if power tools used)

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Table A.1 (continued)

Condition	Cause	Remedy	Standard/Method
General Inadequate Profile	Abrasive selection or quality, blast settings, surface hardness, especially on HPS or quenched and tempered steel.	Consult SOPs for blast machine and components; SOP for abrasive recycling equipment; maintenance, repair, and troubleshooting guide for the equipment; and abrasive selection guide. Also, check on adequacy of lighting (see SSPC-Guide 12, Table 1). Thicker plate or higher grades may require special consideration.	ASTM D4417 ASTM D7127 SSPC-AB 1, 2, 3, 4
Low Edge Profile	Wheel settings; martensite from thermal cutting plates results in harder surfaces	Grind martensite before blasting. Surface hardness before blasting may be an indicator of whether adequate blast profile can be achieved. Verify with hardness test (e.g., Rockwell or Vickers). Consult blasting equipment troubleshooting guide. See Note 1.	
Fins and Slivers	Steel anomalies	Grind. Consult blasting equipment troubleshooting guide. See Note 1. Restore profile if ground after blasting.	

(continued on next page)

Table A.1 (continued)

Condition	Cause	Remedy	Standard/Method
Excessive Profile	Abrasive selection or quality, blast settings, operator technique	Address the abrasive mix, blaster settings, etc. Remedies are limited for existing excessive profile; test patches are highly recommended to avoid this situation. Applying adequate primer to cover the profile will in many cases be acceptable; however, consult with coating manufacturer for recommendations, then consult Owner for request for deviation from specification.	ASTM C136 ASTM D4285 ASTM D4940 ASTM D7393 NSRP Report 0511 SSPC-AB 1, 2, 3, 4 SSPC-Guide 17 SSPC-SP 2, 3, 11, 15 SSPC-VIS 3 (if power tools used)
Rust-Back	Timing between blasting and coating, contamination of surface	Restore material to specified surface cleanliness; adjust process, including storage conditions, to protect the substrate from rust-back.	

Table A.2—Conditions, Causes, and Remedies for Non-Conformances Resulting From Activities that Occur after Original Surface Preparation

Condition	Cause	Remedy	Standard/Method
Welding Needs to Be Performed after Blast Cleaning	Fabrication sequence, e.g. tub girder fillet welds, box girder internal welds	SP 1, SP 3, SP 11; use acceptable surface tolerant spot primer.	NACE SP 0178 SSPC-PA Guide 11
Visible Contamination, Oil, Grease	Various	Use appropriate cleaning before any blasting or coating	SSPC SP 1
Weld Spatter	Welding after surface preparation, or spatter that survived the initial surface preparation process	Consult applicable specifications for requirements for allowing tightly adhering weld spatter to remain. Where spatter must be removed, scrape or grind to remove the spatter, and then blow off grind dust and loosened spatter. See Note 2.	NACE SP 0178 SSPC-PA Guide 11
Raised Fins and Slivers	Steel anomalies exposed by blasting	Grind as necessary, blow off grind dust, and restore profile as needed with spot blasting, power tools, or other methods.	NACE SP 0178 SSPC-PA Guide 11 SSPC-SP 5, 6, 10
Grinding Resulting in Unacceptably Reduced Profile	Grinding to address base metal or weld defects	Avoid polishing with grinder. Re-profile as needed with spot blasting, power tools, or other methods. One mil is typically adequate for zinc-rich primers. Establishing criteria ahead of time for the size of ground areas that need to be re-profiled is recommended.	Review SSPC-PA 2 and PA 17

Notes:

1. Grinding should be performed before blasting when possible. Remove martensite, then blast; however, wheel alignment must be effective on edges. Grind with coarse abrasive so as to avoid polishing and provide some profile for primer application.
2. Internal welds of tubs and boxes performed after priming are often not efficiently blasted. Techniques such as power tool cleaning to bare metal (SSPC-SP 11) are recommended to allow for use of a high-performance zinc-rich primer. To address this, some specifications allow for surface tolerant primers and preparation other than abrasive blasting. This should be considered whenever possible. The effect of the selected surface preparation method on the overall service life of the structure must be considered.

Nonmandatory Appendix B
Coating or Primer Damage and Non-Conformance to Project Specification

The most widely used method to prevent corrosion today is the application of protective coatings. Properly applied coatings can provide corrosion protection that will extend the service life of a structure for decades. Today's high-performance coatings give a superb return on investment, reduce life-cycle costs, and can often be applied without major disruption to other operations. However, to provide optimum protection, the coating system must be applied properly. This Appendix provides criteria to identify application defects and their causes, and provides suggestions for repair of non-conformities. It is important to address application non-conformities, especially at the primer stage, to prevent premature coating failure and the cost of doing rework after installation of the complete coating system.

Note: Coating non-conformance can be significantly reduced by

1. Hiring shops qualified to the AISC 420-10/SSPC-QP 3 standard.
2. Establishing a process control procedure and a job standard (test area) prior to startup of work.
3. Use of qualified coating inspectors.

Damage prevention should be addressed in the quality management system, describing the procedures and protective materials to be used to prevent damage to paint coats.

See Table B.1 for inorganic zinc primer, Table B.2 for organic zinc primer, and Table B.3 for intermediate and finish coats.

Table B.1—Conditions, Causes, and Remedies for Inorganic Zinc Non-Conformance

Condition	Cause	Remedy	Standard/Method
Mudcracking	Excessive thickness	Mudcracked material must be removed. Prepare these areas to the degree of cleanliness as specified in the contract documents while providing or maintaining the proper surface profile (zinc may remain in original profile). Use masking or other practical means to protect adjacent areas of sound coating from being damaged by the removal operation. Microcracking is not considered a non-conformance.	Visual SSPC PA 1 SSPC PA 2
Drip, Sag, Run, Dry Spray or Excessive Film Build	Improper application technique	Where possible, remove to specified film thickness (for example, by rubbing with a plastic or aluminum wire screen). Care must be taken not to burnish the steel or coating surface, thereby reducing the profile/anchor pattern for subsequent coats.	Visual SSPC PA 2
Checking or Crazing	Thick film, drying/curing condition	If visible to the naked eye, screen surface (see Drip, Sag, Run… remedy), to remove appearance. Confirm dry film thickness, reapply as necessary, according to Insufficient Film Build remedy. If visible only under magnification, no action is necessary.	Visual ASTM D660 SSPC PA 1 SSPC PA 2
Insufficient Film Build	Improper application technique	Apply IOZ thinned as recommended by coating manufacturer to the specified film thickness. Some manufacturers might not endorse IOZ over IOZ but instead recommend recoating with OZ. Confirm acceptability of remedy with Owner. Field touch-up specification may require OZ regardless. Thinned IOZ increases volatile organic compounds (VOCs).	SSPC PA 1 SSPC-PA 2
Improper Cure	Insufficient cure time, low humidity, lack of ventilation, low temperature	Correct environmental conditions by water misting, use of humidifiers, or other means to achieve proper curing humidity. Provide for ample cure time in those conditions. Confirm cure before topcoating or shipping. If the pencil hardness test (ASTM D3363) is used, consult the coating manufacturer (or Owner's specification) for the recommended hardness.	ASTM D3363 ASTM D4752 SSPC-PS 12.00

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Table B.1 (continued)

Condition	Cause	Remedy	Standard/Method
Holidays (Voids)	Improper application technique; foreign matter in the material, on the substrate, or in the coating pump or line	Apply IOZ reduced as recommended by coating manufacturer to the specified film thickness and to facilitate tie-in with adjoining coated areas. Follow manufacturer's recommendations for touch-up. Some manufacturers might not endorse IOZ over IOZ but might recommend OZ instead. Confirm acceptability of remedy with Owner. Field touch-up specification may require use of OZ or surface tolerant product.	Visual
Delamination, Adhesive (Coating Separates from Previous Coat)	Surface contamination, excessive film build, insufficient surface profile, insufficient surface cleanliness, dry spray	Remove, determine and correct root cause, and reapply. Prepare these areas to the degree of cleanliness as specified in the contract documents while providing or maintaining the proper surface profile. Use masking or other practical means to protect adjacent areas of sound coating from being damaged by the removal operation.	Visual SSPC PA 1 SSPC PA 2
Delamination, Cohesive (Coating Splits, Leaving Portions on Its Substrate and Subsequent Coat)	Excessive film build, surface contamination, improper cure, adulteration of coating material, improper mixing, excessive thickness of subsequent coats	Remove, determine and correct root cause, and reapply. If due to excessive thickness, remove to sound coating material and apply to achieve specified thickness. See Insufficient Film Build. For all other causes, remove and replace.	Visual SSPC PA 1 SSPC-PA 2
Contaminants in Paint	Contaminated paint pot or air supply, residue in spray lines, and pre- or post-application fallout	Remove, determine and correct root cause, and reapply.	Visual SSPC-Guide 15
Physically Damaged or Rusted Areas	Various	Use appropriate hand or power tools to prepare these areas to the degree of cleanliness specified in the contract documents while providing or maintaining the proper surface profile. Protect adjacent areas of sound material from being damaged by the removal operation by masking or other practical means.	Visual

Table B.2—Conditions, Causes, and Remedies for Organic Zinc Non-Conformance

Condition	Cause	Remedy	Standard/Method
Pinholes	Surface contamination, improper solvents, improper application technique, inadequate profile coverage	Confirm allowable pinhole condition from the specification. "Pinhole free" is impractical and unnecessary for zinc-primed systems in atmospheric service. Repair will depend on cause. If due to insufficient coverage, apply more coating. If due to contamination, remove, remedy, and replace. Repair: Apply additional coating in accordance with coating manufacturer recommendations to remedy pinholes. Take care to avoid excessive thickness, sags, etc. Consider leaving minor pinholes to not reduce overall quality. Prevention: Change thinning practice to address observed conditions.	Visual SSPC-PA 2 Pinholes are described in NACE Publication 6F-166 Page 78.
Drip, Sag, Run, Dry Spray, Excessive Film Build	Improper application technique	Where possible, remove to specified film thickness (for example, sanding). Take care not to burnish the steel or coating surface, thereby affecting adhesion of subsequent coats. Correct application technique.	Visual SSPC PA 1 SSPC-PA 2
Insufficient Film Build	Improper application technique	Apply OZ reduced as recommended by coating manufacturer to the specified film thickness. Correct application technique.	SSPC PA 1 SSPC-PA 2
Improper Cure	Improper mixing, insufficient cure time, low humidity, lack of ventilation, low temperature, excess thinning, wrong thinner, excess film build	Determine root cause. If determined that temperature, humidity, or cure time is the cause, proper time, temperature, and humidity will remedy the problem. For other causes, remove and reapply.	ASTM D1640

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Table B.2 (continued)

Condition	Cause	Remedy	Standard/Method
Holidays (Voids)	Improper application technique; foreign matter in the material, on the substrate, coating pump, or line	Determine root cause and remedy. Repair will depend on cause. If insufficient coverage, apply more coating. If due to contamination, remove, remedy, and replace. Apply OZ reduced as recommended by coating manufacturer to facilitate tie-in with adjoining coated areas. Follow manufacturer's recommendations for touch-up.	Visual
Delamination, Adhesive (Coating Separates from Previous Coat)	Surface contamination, excessive film build, insufficient surface profile, insufficient surface cleanliness, dry spray	Remove coating, determine and correct root cause, and reapply. Prepare these areas to the degree of cleanliness as specified in the contract documents while providing or maintaining the proper surface profile. Protect adjacent areas of sound material from being fractured by the removal operation by masking or other practical means.	Visual, SSPC-PA 1 SSPC-PA 2
Delamination, Cohesive (Coating Splits, Leaving Portions on Its Substrate and Subsequent Coat)	Excessive film build, surface contamination, improper cure, adulteration of coating material, improper mixing, excessive thickness of subsequent coats	Remove, determine and correct root cause, and reapply. Prepare these areas to the degree of cleanliness as specified in the contract documents while providing or maintaining the proper surface profile. Protect adjacent areas of sound material from being fractured by the removal operation by masking or other practical means.	Visual, SSPC PA 1 SSPC-PA 2
Contaminants in Paint	Contaminated paint pot, residue in spray lines, pre- or post-application fallout	Remove, determine and correct root cause, and reapply. Prepare these areas to the degree of cleanliness as specified in the contract documents while providing or maintaining the proper surface profile. Protect adjacent areas of sound material from being fractured by the removal operation by masking or other practical means.	Visual
Physically Damaged or Rusted Areas	Various	Use appropriate hand or power tools to prepare these areas to the degree of cleanliness specified in the contract documents while providing or maintaining the proper surface profile. Protect adjacent areas of sound material from being damaged by the removal operation by masking or other practical means.	Visual

Table B.3—Conditions, Causes and Remedies for Intermediate and Finish Coat Non-Conformance

Condition	Cause	Remedy	Standard/Method
Excessive Film Build	Improper application technique	Remove to specified thickness by sanding or similar method. Monitor thickness during the process. Confirm there is no solvent entrapment (solvent smell evident). If solvent is entrapped, consult coating manufacturer for options.	SSPC-PA 2
Pinholes	Intercoat contamination, improper thinning practice, improper application technique, excessive thickness in prior coats, dry spray on prior coat, environmental conditions (surface temperature, wind)	Confirm allowable pinhole condition from the specification. "Pinhole free" is impractical and unnecessary for zinc-primed systems in atmospheric service. Repair will depend on cause. If insufficient coverage, can apply more coating. If due to contamination, remove, remedy, and replace. Repair: Apply additional coating in accordance with coating manufacturer recommendations to remedy pinholes. Avoid excessive thickness, sags, etc. Consider leaving minor pinholes to not reduce overall quality. Prevention: Can change thinning practice to address environmental conditions. Use mist coat technique.	Visual; pinholes are described in NACE Publication 6F-166, page 78.
Drip, Sag, Run, Dry Spray	Improper application technique	These defects can be removed to specified film thickness (for example, by rubbing with sandpaper or abrasive pad). Consult coating manufacturer, as runs and sags are often not detrimental; might consider leaving in place if other application quality (thickness) is acceptable and aesthetic requirements are satisfied.	Visual
Insufficient Film Build	Improper application technique	Apply additional material as recommended by coating manufacturer to the specified film thickness.	SSPC-PA 2

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Table B.3 (continued)

Condition	Cause	Remedy	Standard/Method
Improper Cure	Insufficient cure time, wrong humidity, temperature, improper mixing	Should be able to keep curing if problem is due to environmental conditions and they are corrected. For other causes, remove and replace.	ASTM D1640
Holidays (Voids)	Improper application technique; foreign matter in the material, on the substrate, coating pump, or line	Determine root cause and remedy. Repair will depend on cause. If insufficient coverage, apply more coating. If due to contamination, need to remove, remedy, and replace. Apply touch-up coating as recommended by coating manufacturer to facilitate tie-in with adjoining coated areas.	Visual
Delamination, Adhesive (Coating Separates from Previous Coat)	Surface contamination, excessive film build, insufficient surface profile, insufficient surface cleanliness, improper cure, improper mixing	Remove, determine and correct root cause, and reapply. Prepare these areas to the degree of cleanliness as specified in the contract documents while providing or maintaining the proper surface profile. Protect adjacent areas of sound material from being fractured by the removal operation by masking or other practical means.	Testing to determine causes: visual, various contaminant tests. Confirm adhesion complies with specifications.
Delamination, Cohesive (Coating Splits, Leaving Portions on Its Substrate and Subsequent Coat)	Excessive film build, surface contamination, improper cure of underlining coat, excessive thickness of subsequent coats, adulteration of coating material, improper mixing	Remove, determine and correct root cause, and reapply. Prepare these areas to the degree of cleanliness as specified in the contract documents while providing or maintaining the proper surface profile. Protect adjacent areas of sound material from being fractured by the removal operation by masking or other practical means.	Testing to determine causes: visual, various contaminant tests. Confirm adhesion complies with specifications.