



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

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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”)

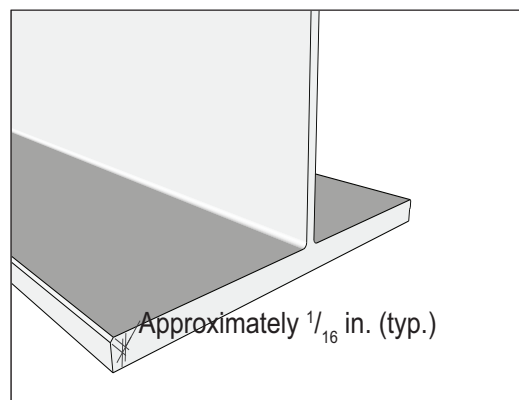
Person or contractor who applies a coating.

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 *DI.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 ft² (140 m²) 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.