

**SSPC
STANDARDS
FOR SHOP
PAINTING OF
STRUCTURAL
BRIDGE
STEEL**

BIOGRAPHY

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Mr. Damiano received his B.A and M.A. in Education from the City College of the City University of New York. He has attended numerous courses dealing with coatings technology and safety and health in the coatings industry, including the OSHA 500 course, the National Board of Registration for Nuclear Safety Related Coating Engineers and Specialists Maintenance Painting Course, the and the KTA-Tator coating inspection course. He is a certified quality auditor for SSPC's Contractor Qualification programs.

SUMMARY

This paper is a brief overview of the standards SSPC has developed that are especially relevant to shop painting activities.

SSPC STANDARDS FOR SHOP PAINTING OF STRUCTURAL BRIDGE STEEL

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INTRODUCTION

Many bridge owners realize the benefits of preparing surfaces and applying coatings to structural steel members in a controlled environment. Cleaning and painting in a shop environment improves safety and access to the work, avoids interference from ambient weather conditions and reduces contamination control problems. This paper will discuss SSPC standards (including some jointly developed by SSPC and other organizations) that are particularly relevant to shop painting structural steel for bridges: shop qualification procedures and standards of practice.

QUALIFICATION STANDARDS

The SSPC qualification standards applicable to paint shops are SSPC-QP 3, Standard Procedure for Evaluating Qualifications of Shop Coating Contractors (QP 3), and SSPC-QP 6, Standard Procedure for Evaluating the Qualifications of Contractors Who Apply Thermal Spray Coatings (Metallizing) for the Corrosion Protection of Steel and Concrete (QP 6). The American Institute of Steel Construction (AISC) also offers a standard for qualification of shop applicators, the Sophisticated Painting Endorsement (SPE), with three types of endorsement available: P1-Sophisticated Paint Endorsement-Enclosed, P2-Sophisticated Paint Endorsement-Covered, and P3-Sophisticated Paint Endorsement-Outside.

SSPC-QP 3, Standard Procedure for Evaluating Qualifications of Shop Coating Contractors

QP 3 was originally issued by SSPC in 1995 to provide facility owners a tool to evaluate contractors applying coatings in permanent, fixed facilities. In 2005, SSPC revised QP 3 to enable it to align more closely with proposed revisions to AISC's SPE. These revisions will be discussed later in the presentation.

QP 3 follows the general outline of all qualification standards issued by SSPC. Contractors are evaluated in four areas: Management Procedures, Technical Capabilities (including requirements for the facility, training of personnel, and procedures for surface preparation and coating application), Quality Control (including requirements for training and experience of inspectors and procedures for inspection and maintaining inspection equipment), and Environmental Safety and Health (requirements for ensuring the safety of workers and the environment). In order to become qualified, the contractor must submit an extensive written application package and undergo a successful on-site audit by an SSPC auditor. Qualification lasts three years, with the contractor submitting a renewal package, including a self-audit, each of the two years following qualification. After three years, the qualification process begins again.

QP 3 recognizes three categories of shops: Enclosed (walls, roof, and floor), Covered (roof but not surrounded by walls), and Open (exposed to all ambient conditions). These categories define the degree to which the contractor can control ambient conditions and isolate coating operations from the weather. Enclosed shops must also provide climate control for coating material storage, application and drying areas, and some controlled ventilation for surface preparation and coating application areas. Covered shops are not required to heat or air condition application areas, but must still provide ventilation for surface preparation and application activities. Open shops have no requirements for control of ambient conditions or ventilation in application or drying and curing areas. The area where coating material is stored must have sufficient climate control to satisfy the coating manufacturer's storage condition requirements.

In 1998, SSPC and AISC signed a “Memorandum of Understanding” in which the two organizations agreed that the SSPC-QP 3 and the AISC Sophisticated Paint Endorsement (SPE) were “equivalent in intent.” Both organizations revised their qualification procedures in 2005. SSPC has proposed a revision to its SSPC-QP 3 that creates two classes of certification. Although Certification Class A will continue to require compliance with Environmental Health and Safety requirements, creation of a Certification Class B, which does not contain Environmental Health and Safety requirements, has been proposed. As of mid-October 2005, SSPC and AISC are assessing the differences between the requirements of SSPC QP 3 Certification Class B and the 2005 AISC Sophisticated Paint Endorsement to determine whether the QP 3 Class B and SPE 2005 requirements are still equivalent in intent and the MOU can be extended.

SSPC-QP 6, Standard Procedure for Evaluating the Qualifications of Contractors Who Apply Thermal Spray Coatings (Metallizing) for the Corrosion Protection of Steel and Concrete

SSPC issued QP 6 in 2004. Unless otherwise specified, qualification to either SSPC-QP 1 (for field application) or QP 3 is a prerequisite for QP 6 qualification. Therefore, QP 6 contains only requirements specific to thermal spray application and inspection. The applicant must also undergo an on-site audit of its thermal spray application and inspection procedures. Contractors may apply for QP 6 qualification to apply thermal spray coatings onto either steel or concrete, or be certified for both materials.

QP 6 contains specific requirements for training and experience of thermal spray applicators, supervisors, and inspectors. Applicators must provide evidence of training in accordance with AWS C2.16/2.16M, Guide for Thermal-Spray Operator Qualification, and its Annex A (Safety Information for Thermal Spray). The requirements for qualification testing vary depending on the substrate. Supervisors must have experience in abrasive blasting and thermal spray coating application to steel or concrete, or both for dual certification, and must provide documentation of training in the use of the specific thermal spray equipment they use. They must also be qualified according to AWS C2.16/C.216M. The contractor must provide documentation of the procedures for training and qualifying its thermal spray inspectors.

In addition, the contractor’s quality control program must meet the requirements of SSPC-CS 23.00/AWS C.2.23/NACE No. 12, which is discussed later in this presentation.

STANDARDS OF PRACTICE

The SSPC standards commonly used by paint shops cover surface preparation, coating application, coating materials, and reference photographs.

SSPC has twelve surface preparation (SP) standards, of which seven are normally encountered in shop coating work. These are: SSPC-SP 1, “Solvent Cleaning,” SSPC-SP 2, “Hand Tool Cleaning,” SSPC-SP 3, “Power Tool Cleaning,” SSPC-SP 5/NACE No. 1, “White Metal Blast Cleaning,” SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning,” SSPC-SP 10/NACE No. 2, “Near-White Blast Cleaning,” and SSPC-SP 7, “Brush-Off Blast Cleaning.” (NACE: National Association of Corrosion Engineers International)

SP 1 is intended to remove visible deposits of dirt, grease and oil from a surface to minimize their embedment during blast cleaning and contamination of recycled blast cleaning abrasives. Solvent, detergent, steam, or alkali cleaners may be used. The solvent may be wiped, or applied by spray or vapor. In some cases, the item to be cleaned is immersed in a solvent bath. After removal of any visible deposits, a rinse with clean solvent is required. The rinse solvent may be a different type than that initially applied, depending on the type of contamination. All SSPC/NACE joint blast cleaning specifications require SP 1 cleaning before blast cleaning begins.

The blast cleaning specifications were originally developed by SSPC and later adopted by NACE: the reason for their dual numbering system. SSPC published SP 5 as the first of the blast cleaning series, and numbered subsequent specifications in order of publication, while NACE numbered them according to the degree of cleanliness produced.

Before the application of thermal spray coatings, SSPC-SP 5/NACE No. 1, “White Metal Blast Cleaning,” is nearly always mandated and it requires solvent cleaning to SP 1 before blast cleaning. White metal blast cleaning requires the removal of all visible foreign matter from the steel surface, and produces the cleanest surface. In addition to clean steel, metallizing requires a sharp, angular profile to mechanically anchor on the steel surface, so grit is normally used for blasting.

SP 10/NACE No. 2, “Near-White Blast Cleaning,” is frequently specified for preparation of steel substrates that will be coated with high-performance coatings such as inorganic zinc. It also requires SP 1 solvent cleaning, followed by removal of all corrosion products, paint, mill scale, and other foreign matter from at least 95% of each 9 square inches of the surface area. If the steel surface is pitted, slight stains are permitted in the bottoms of the pits.

SP 6/NACE No. 3, “Commercial Blast Cleaning,” is often specified when more surface tolerant coatings (such as alkyds and epoxies) are to be applied. After solvent cleaning and commercial blast cleaning are completed, all rust, corrosion products, old paint, mill scale, and other foreign matter must be removed from at least 33% of each 9 square inches of the surface area. The materials that do remain on the steel surface must be evenly distributed over the entire surface, not concentrated in one area that might be less accessible to cleaning.

SP 7/NACE No. 4, “Brush-Off Blast Cleaning,” is used to remove loose foreign material, such as mill scale, rust, dirt or flaking paint, from steel. It may be used to slightly roughen existing intact coating prior to application of additional coating, or to prepare galvanized surfaces for coating. Solvent cleaning must be performed before brush-off blasting. SP 7 requires that the entire surface to be cleaned be subjected to the abrasive blast, not just areas where dirt or loose material is visible. SP 2, “Hand Tool Cleaning” and SP 3, “Power Tool Cleaning” may also be specified for removal of loose foreign material from surfaces when abrasive blasting is not feasible. SP 2 permits use of scrapers, sandpaper, or wire brushes to remove loose material, and impact tools such as hammers to remove stratified rust or weld slag. SP 3 requires power tools such as needle guns, abrasive discs and wheels, or rotary peening devices to remove loose material. Both SP 2 and SP 3 require the cleaned surface to be free of dust and residue before coating.

Reference Photographs

SSPC’s color reference photographs are intended to illustrate levels of cleanliness defined by the written surface preparation standards. Each set of photographs illustrates surfaces prepared by a different surface preparation technique: dry abrasive blast cleaning, waterjetting, power tool cleaning, and wet abrasive blast cleaning. Of these four techniques, the most common in shops are dry abrasive blast cleaning, illustrated in SSPC-VIS 1, and hand or power tool cleaning, illustrated in SSPC-VIS 3.

SSPC VIS 1 contains photographs of uncleaned steel in five initial conditions. Four show steel that has never been painted, exhibiting intact mill scale, rusted mill scale, completely rusted surfaces, and rusted surfaces with pitting. The fifth initial condition illustrates previously painted and exposed steel showing aged weathered coatings, rust, and pitting. Each initial condition is then cleaned to each of the 5 degrees of abrasive blast cleaning: brush-off blast (removes loose material); industrial blast (allows islands of tightly adherent material to remain on the surface); commercial blast, near-white blast, and white metal blast (all foreign material removed from the steel). Note that the reference photographs are intended to supplement the written blast cleaning standards, not to replace them. They should not be used in place of the written standards.

VIS 3 illustrates surfaces cleaned by hand or power tool cleaning. Seven initial conditions are shown, four showing unpainted surfaces, three showing painted surfaces in various degrees of deterioration. Each initial condition is cleaned using hand wire brushing, power wire brushing, power sanding, and rotary peening devices. Because different tools produce different appearances, a surface cleaned by a sanding disc and a surface cleaned by power wire brushing will look quite different, though in both cases all loose material has been removed.

Abrasive Specifications

Shops must apply applicable SSPC specifications for mineral and slag abrasives, ferrous metallic abrasives, and/or cleanliness of recycled abrasives.

Requirements for mineral and slag abrasives are provided in SSPC-AB 1. Three classes of abrasives are discussed, based on the level of crystalline silica in the abrasive. Abrasives covered by Class 1 contain less than 1% crystalline silica, those in Class 2 contain less than 5% crystalline silica, and those in class 3 have unrestricted crystalline silica content. The specification contains requirements for both physical properties (specific gravity, hardness) and chemical properties of the abrasive (water soluble contaminants, moisture content).

Ferrous metallic abrasives are the subject of SSPC-AB 3. This standard is intended for previously unused metallic abrasives. There are two classes, one for steel abrasive, the other for iron abrasive. Each class may include both shot and grit. Requirements vary by class and include physical properties (size, hardness, etc.), particle shape (percentage of round and elongated particles), and durability test requirements. Requirements for chemical properties, conductivity, and oil content are the same for both classes.

SSPC-AB 2 addresses the cleanliness of ferrous metallic abrasives, and covers testing requirements and procedures for evaluating recycled work mixes. It provides maximum levels for non-abrasive content (rust, scale, paint, fines from fractured abrasive, etc.), lead content, and oil content, and describes how a work mix must be periodically tested during in-process operations to assess the amount of contaminants.

Application Specifications

Standards related to coating application that interest paint shops include SSPC-PA 1, Shop, Field and Maintenance Coating of Steel, SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages, and a joint standard developed by AASHTO/NSBA (American Assoc. of State Highway and Transportation Officials/National Steel Bridge Alliance) Collaboration Task Group G8.1, "Guide for the Application of Coating Systems with Zinc-Rich Primers".

PA 1 contains general information on application of conventional liquid coatings. It discusses proper handling, mixing, and storage of coating materials, surface preparation, factors affecting coating application, various methods and techniques for applying coatings, and inspection of applied coatings. Thermal spray application is not covered. PA 1 is frequently referenced in project specifications.

PA 2 addresses measuring the dry film thickness (DFT) of applied coatings. It discusses the proper use of several types of magnetic film thickness gages, and provides a procedure for inspecting dry coatings to determine if specified film thickness requirements have been met. PA 2 was revised in 2004 to include several additional appendices that illustrate how to take measurements on various surface configurations such as beams, and, of particular interest, an example illustrating measurement of DFT on shop assembled members.

Many may be aware of the AASHTO/NSBA collaboration that has produced a number of guides and draft specifications for owners to adopt. The "Guide for Application of Coating Systems with Zinc-Rich Primers" is intended for use in conjunction with other AASHTO/NSBA Collaboration publications. After initial development by Collaboration Task Group 8, the draft was balloted through the SSPC C.3 Application Methods Group Committee and through the AASHTO Bridge Committee. It references other AASHTO and SSPC standards and provides procedures for surface preparation, coating storage and mixing, coating application, assessing cure for overcoating, and inspection of each step when zinc-rich primers have been specified. Much of the information is provided in a series of tabular checklists for use by workers and a quick reference for Quality Control and Quality Assurance inspectors.

Coating System Specification

SSPC-CS 23.00/AWS C2.23/C.2.23M/NACE No. 12 is a specification for thermal spray coatings on steel substrates. It was jointly developed and balloted through SSPC, the American Welding Society, and NACE International, and first issued in 2003. SSPC classifies it as a coating system specification, because it also contains requirements for surface preparation, application of sealers and topcoats, and inspection, as well as for the material to be thermally sprayed. A mandatory appendix provides a list of inspection hold points and items to be checked at each. Non-mandatory appendices include models of procurement specifications (“job specs”) and job control records, as well as instructions for calibrating portable test instruments to measure the thermal spray coating’s adhesion.

SUMMARY

This paper is intended to provide an introduction to the SSPC standards most frequently encountered by steel fabricators and paint shops: qualification procedures, surface preparation specifications, visual reference photographs, and coating application and materials specifications. Field painting contractors have long been aware of SSPC specifications and procedures, but they may not be as familiar to contractors working in a shop environment. As shop coating processes become more sophisticated and owner requirements become more stringent, SSPC hopes its standards will continue to assist both owners and contractors in improving shop coating surface preparation, application, and performance.