SSPC: The Society for Protective Coatings

COATING APPLICATION GUIDE 5

Guide to Maintenance Coating of Steel Structures in Atmospheric Service

1. Scope

1.1 This guide covers procedures for developing a maintenance coating program for steel structures for atmospheric service. The guide may be used for one-time recoat programs or long-range recoat programs.

1.2 The guide is intended for owners, consultants, and contractors who perform condition surveys and write maintenance coating programs. It is not intended to be a do-it-yourself guide, but is representative of the processes that a coating specialist (such as a Protective Coating Specialist [PCS] certified by SSPC) would follow to develop a maintenance coating plan for specific facilities.

2. Description

2.1 A maintenance coating program is required to prevent corrosion of steel and deterioration of other substrates. It is also required to maintain an acceptable appearance of coated structures. Decisions on frequency and extent of recoating and type of system to be used require consideration of numerous factors, including both technical and economical alternatives.

2.2 This guide sets out specific steps that may be used, either individually or collectively, to identify and address essential elements of a maintenance coating program. These steps are summarized in Section 4. Preparation of a contract specification for coating work is covered in SSPC-TR 4/NACE 80200, "Preparation of Protective Coating Specifications for Atmospheric Service" (latest edition) and in the SSPC Technical Insight Report "Preparing and Using Protective Coating Specifications." Due to wide variations in procedures, a discussion of contracting methodologies and implementation schemes is outside the scope of this guide.

2.3 MAJOR STEPS IN MAINTENANCE COATING: This guide addresses six major steps in a maintenance coating program, which are defined as:

- Plan and Conduct Condition Assessment Survey (Section 5)
- List Potential Maintenance Painting Options (Section 6)
- Evaluate Economics of Available Options (Section 7)
- Select Appropriate Maintenance Painting Options and Establish Implementation Procedures (Section 8)
- Implement Maintenance Painting Options (Section 9)
- Plan and Implement Follow-Up Activities (Section 10)

2.4 UNITS OF MEASURE: This guide makes use of both the IEEE/ASTM SI 10,[1] "American National Standard for Metric Practice" International System Units (SI) and U.S. Customary units. The measurements may not be exact equivalents; therefore, each system shall be used independently of the other.

3. Referenced Standards

3.1. SSPC STANDARDS AND JOINT STANDARDS:

Items preceded by an asterisk (*) are referenced in the Notes or Appendices.

SSPC-ACS-1/ NACE No. 13	Industrial Coating and Lining Application Specialist Qualification and Certification Standard
SSPC-Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC-Guide 7	Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC-Guide 14	Guide for the Repair of Imperfections in Galvanized or Inorganic Zinc Coated Steel with Organic Zinc-Rich Paint
SSPC-Guide 15	Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates
SSPC-Guide 18	Specifiers' Guide for Determining Containment Class and Environmental Monitoring Strategies for Lead-Paint Removal Projects

SSPC-PA Guide 5 was first issued in July 1990 by the SSPC C.4.1 Maintenance Painting Committee. It was revised in September 2002, 2004 (editorial revision) and February 2018.

[1] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, phone int+1-610-832-9500. For referenced ASTM standards, visit the ASTM website <http://www.astm.org/>

SSPC-PA 1	Shop, Field, and Maintenance Painting of Steel
SSPC-PA 2	Determining Compliance to Dry Coating Thickness Requirements
SSPC-PA Guide 4	Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems
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 5 (WAB)/ NACE WAB-1	White Metal Wet Abrasive Blast Cleaning
SSPC-SP 6/ NACE No. 3)	Commercial Blast Cleaning
SSPC-SP 6 (WAB)/NACE WAB-3	Commercial Metal Wet Abrasive Blast Cleaning
SSPC-SP 7/ NACE No. 4	Brush-Off Blast Cleaning
SSPC-SP 7 (WAB)/NACE WAB-4	Brush-Off Wet Abrasive Blast Cleaning
SSPC-SP 10/ NACE No. 2	Near-White Metal Blast Cleaning
SSPC-SP 10 (WAB)/NACE WAB-2	Near-White Metal Wet Abrasive Blast Cleaning
SSPC-SP 11	Power Tool Cleaning to Bare Metal
SSPC-SP 14/ NACE No. 8	Industrial Blast Cleaning
SSPC-SP 14 (WAB)/ NACE WAB-8	Industrial Wet Abrasive Blast Cleaning
SSPC-SP 15	Commercial Grade Power Tool Cleaning
SSPC-SP WJ-1/ NACE WJ-1	Waterjet Cleaning of Metals - Clean to Bare Substrate
SSPC-SP WJ-2/ NACE WJ-2	Waterjet Cleaning of Metals - Very Thorough Cleaning
SSPC-SP WJ-3/ NACE WJ-3	Waterjet Cleaning of Metals - Thorough Cleaning
SSPC-SP WJ-4/ NACE WJ-4	Waterjet Cleaning of Metals - Light Cleaning

*	SSPC-QP 1	Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures
*	SSPC-QP 2	Standard Procedure for Evaluating the Qualification of Painting Contractors (Field Removal of Hazardous Coatings from Complex Industrial Structures)
*	SSPC-QP 5	Standard Procedure for Evaluating Qualifications of Coating and Lining Inspection Companies
*	SSPC-QP 6	Standard Procedure for Evaluating the Qualifications of Contractors Who Apply Thermal Spray (Metallizing) for Corrosion Protection of Steel and Concrete Structures
*	SSPC-QP 8	Standard Procedure for Evaluating the Qualifications of Contracting Firms That Install Polymer Coatings and Surfacings on Concrete and Other Cementitious Substrates
*	SSPC-QP 9	Standard Procedure for Evaluating Qualifications of Painting Contractors Who Apply Architectural Paints and Coatings
*	SSPC-TR 4/ NACE 80200	Preparation of Protective Coating Specifications for Atmospheric Service
	SSPC-TU 3	Overcoating Existing Coating Systems Applied to Steel Substrates
	SSPC-VIS 2/ ASTM D610	Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces

3.2 ASTM INTERNATIONAL STANDARDS:[2]

*	ASTM D3276	Standard Guide for Painting Inspectors (Metal Substrates)
*	ASTM D4228	Standard Practice for the Qualification of Coating Applicators for Application of Coatings to Steel Surfaces
	ASTM D610	Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces

[2] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, phone int+1-610-832-9500. For referenced ASTM standards, visit the ASTM website <http://www.astm.org/>

3.3 FEDERAL STANDARD[3]
Code of Federal Regulations

29 CFR 1910.1025	Lead (General Industry)
29 CFR 1910.134	Respiratory Protection
29 CFR 1915.1025	Lead (Shipyard Employment)
29 CFR 1926.62	Lead (Construction Industry)
29 CFR 1926.1118	Arsenic
29 CFR 1926.1126	Chromium (VI)
29 CFR 1926.1127	Cadmium
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification1910 (2013) and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions

3.4 International Organization for Standardization (ISO) Standard[4]

ISO 4628	Paints and varnishes -- Evaluation of degradation of coatings -- Designation of quantity and size of defects, and of intensity of uniform changes in appearance

4. Planning and Use of Guide

4.1 This document is based on, and is intended for use with, the technical principles outlined in SSPC-TU 3. Planning and implementation of maintenance coating programs for steel structures are presented in a logical sequence of six specific steps. These steps range from planning and conducting a condition assessment to follow-up activities required for implementing an on-going maintenance program. Each step is designed such that it may be utilized in sequence with the other steps, or independently for those with interest in only one or a few aspects of the program. A summary of each step follows.

4.1 Plan and Conduct Condition Assessment Survey (Step 1): Section 5 provides a general approach for organizing surveys to evaluate the condition of the structure. Three different types of surveys (general overview, detailed visual survey, and physical inspection) are covered, along with a proposed plan for assessing sub-units of a larger, more complex structure, and a description of procedures and documentation needed.

4.2 List Potential Maintenance Painting Options (Step 2): Section 6 reviews the various maintenance painting options available, including spot repair, zone repair overcoating, and complete recoat, as well as the rationale for selecting these maintenance painting options and the types of information needed for the decision.

4.3 Evaluate Economics of Available Options (Step 3): Section 7 provides guidance in evaluating the initial and life-cycle costs of available maintenance painting options. Each decision has potential impact on the life cycle cost of the coating system and must be identified and evaluated.

4.4 Select Appropriate Maintenance Painting Options and Establish Implementation Procedures (Step 4): Section 8 reviews the factors and considerations necessary to establish specifications for the two major maintenance painting options of spot repair and complete recoat, including identification of relevant factors for coating system selection, and surface preparation selection, depending on whether complete removal and recoat, spot repair, or a combination of spot repair and overcoating is selected as a strategy.

4.5 Implement Maintenance Painting Options (Step 5) Section 8.4 covers the development of the specifications that will detail the required surface preparation and coatings system needed for the specific project based on the information gathered during Steps 1 through 4. The specifications should also outline the requirements for environmental compliance as needed based on the existing coating system if it contains hazardous materials. Detailed quality control requirements should also be included.

4.6 Plan and Implement Follow-Up Activities (Step 6): Section 10 describes procedures and review actions after the job is completed, including documentation, short- and long-term condition inspections, and preventative maintenance measures.

5. Plan and Conduct Condition Assessment Survey (Step 1)

5.1 PURPOSE OF CONDUCTING A CONDITION ASSESSMENT SURVEY: Condition assessments can be used for several purposes, i.e., to determine the need for recoating, to determine the extent of corrosion damage, to determine the performance of various coating systems, or to prioritize coating requirements where insufficient funds are available to do all the desired work (see Note, Section 11).

[3] The U.S. Code of Federal Regulations (CFR) may be obtained online at <https://www.ecfr.gov>

[4] International Organization for Standardization (ISO), Case Postale 56, Geneva CH-1211, Switzerland. In the United States, ISO standards may be obtained from the American National Standards Institute (ANSI) at <http://www.ansi.org>

5.2 IDENTIFY AND INVENTORY STRUCTURES TO BE SURVEYED: A written description of the structures requiring maintenance coating should be obtained or prepared. The description should include location, dimensions, type of substrate, configuration, service environment, previous surface preparation and coating plans, specifications, history, and any other pertinent information. Examples of the latter would include proximity to sensitive areas, planned new construction or other activities nearby, and types of exposures (see SSPC-Guide 18). It is usually most economical to consider all structures in similar condition within a given area for maintenance at the same general time.

5.3 DETERMINE THE EXTENT OF ASSESSMENT REQUIRED: The survey may vary considerably in the extent and detail of the information required. Among the types of survey to be considered are:

5.3.1 General Coating Condition Assessment: In this assessment, usually only one or two parameters are rated (e.g., general condition or rusting). The structure is normally observed from the ground (i.e., without scaffolding). The assessment is at best a qualitative rating of the condition (e.g., good, fair, poor). Only the major features of a structure or facility are rated (e.g., a full span of a bridge or a side of a storage tank). This type of assessment is usually done in a few hours or less and is suitable for identifying overall condition of the coating.

5.3.2 Detailed Visual Assessment: This type of assessment also relies exclusively on visual observations, but these are performed more systematically than for a general assessment. Numerous structural elements (e.g., support beams, connections, edges) are separately rated according to SSPC-VIS 2/ASTM D610, ISO 4628 or equivalent and combined to provide an overall structure or facility rating. Often, several condition parameters (e.g., loss of topcoat, cracking, rust staining) and several corrosion parameters (e.g., rusting, blistering, scaling, loss of metal) are recorded. With this survey, one can obtain a semi-quantitative rating of the percent of surface deteriorated. This type of survey may be used to develop preliminary cost estimates for recoating.

5.3.3 Physical Coating Testing: Physical testing, visual assessment, and the general assessment are often performed simultaneously. Visual assessment gives no information on the film adhesion, thickness, brittleness, or underfilm corrosion. Physical testing is required to determine whether the coating can be overcoated or repaired, or whether it is too weak to accept another coating layer. This assessment should be performed prior to specifying the maintenance painting options and requires direct access to the surface at several locations on the structure. SSPC-TU 3 provides discussion of the value of physical testing, as well as the procedures for testing.

Identification of the generic type of the existing finish coating is important when selecting compatible coatings for maintenance coating, if part of the existing coating is to remain. A laboratory technique, Fourier Transform Infrared Spectroscopy (FTIR), is frequently used to determine the generic coating type. This requires only a tiny sample chip of paint to identify the coating type, and is available at a nominal price. Alternatively, patch tests of the proposed system or systems may be applied to the existing coating to establish compatibility.

5.3.4 Hazardous Content Assessment (for work in the U.S.): Unless previous coating history and specifications are known, laboratory testing needs to be performed to determine if any hazardous elements are present. These include, but are not limited to, lead, cadmium, arsenic, mercury, and chromium VI. U.S. OSHA (U.S. Occupational Safety and Health Administration) regulation 29 CFR 1926.62 details worker protection requirements specific to lead hazards in construction work (which includes industrial coating projects), while OSHA 29 CFR 1910.1025 details worker protection requirements for lead in general industry work, and CFR 1915.1025 applies to lead in shipyard work. OSHA 29 CFR 1910.134 contains requirements specifically for respiratory protection. Hazardous metals are addressed in 29 CFR 1926.1118 Arsenic; 1926.1126 Chromium (VI); 1926.1127 Cadmium; OSHA (Occupational Safety and Health Administration) requirements for worker exposure and RCRA (Resource Conservation and Recovery Act) requirements for disposal with its implied containment should be incorporated into the contract to protect workers and lessen potential claims. SSPC-Guide 6 and Guide 7 provide details relevant to containment and disposal. Local regulations and facility owner requirements for hazardous materials also apply if the survey is being performed outside of the U.S.

5.3.5 Structural Inspection: Coating assessment should be included as part of any general structural inspection for loss of metal, broken joints, or other structural defects. A relatively small additional inspection time is required to evaluate and record the ratings of individual structures or structural elements. This information will normally prove extremely valuable in evaluating maintenance painting options, especially in developing the most cost effective life-cycle maintenance strategy. Numerous public and private entities have been successful in using scheduled facility inspections, such as bridge safety inspections, as the “first cut” in determining coating condition.

5.4 DETERMINE THE CONDITION RATING SCHEME: For both visual inspection and physical testing, it is necessary to use a standard rating system and format for recording data. SSPC-TU 3 discusses the salient characteristics of a rating scheme that is based on the technical merits of coating condition and overcoating.