

SSPC: The Society for Protective Coatings

PAINT APPLICATION GUIDE NO. 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. The guide may be used for one-time recoat programs or long-range recoat programs.

1.2 The guide is intended for use primarily by owners' representatives. 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).¹ 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)

3. Referenced Standards

3.1. SSPC STANDARDS AND JOINT STANDARDS¹

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

Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
Guide 7	Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
Guide 14	Guide for the Repair of Imperfections in Galvanized or Inorganic Zinc Coated Steel with Organic Zinc-Rich Paint
PA 2	Measurement of Dry Coating Thickness with Magnetic Gauges
PA Guide 4	Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems
PA 1	Shop, Field, and Maintenance Painting of Steel
SP 1	Solvent Cleaning
SP 2	Hand Tool Cleaning
SP 3	Power Tool Cleaning
SP 5/NACE No. 1	White Metal Blast Cleaning
SP 6/NACE No. 3	Commercial Blast Cleaning
SP 7/NACE No. 4	Brush-Off Blast Cleaning
SP 10/NACE No. 2	Near-White Blast Cleaning
SP 11	Power Tool Cleaning to Bare Metal
SP 12/NACE No. 5	Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SP 14/NACE No. 8	Industrial Blast Cleaning
SP 15	Commercial Grade Power Tool Cleaning
*QP 1	Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)

¹ Joint standards may also be obtained from NACE International at <http://www.nace.org>

*QP 2	Standard Procedure for Evaluating the Qualification of Painting Contractors (Field Removal of Hazardous Coatings from Complex Industrial Structures)
*QP 5	Standard Procedure for Evaluating Qualifications of Coating and Lining Inspection Companies
TR 4/NACE 80200	Preparation of Protective Coating Specifications for Atmospheric Service
TU 3	Overcoating
TU 4	Field Methods for Retrieval and Analysis of Soluble Salts on Substrates
VIS 2	Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces

3.2 ASTM INTERNATIONAL STANDARDS:²

*D 3276	Standard Guide for Painting Inspectors (Metal Substrates)
*D 4228	Standard Practice for the Qualification of Coating Applicators for Application of Coatings to Steel Surfaces
D 610	Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces

3.3 FEDERAL STANDARD³

Code of Federal Regulations
29 CFR 1926.62 Lead (Construction Industry Standard)

4. Planning and Use of Guide

4.1 This document is based on, and is intended to be used 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 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.

4.1.1 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.

4.1.2 List Potential Maintenance Painting Options (Step 2): Section 6 reviews the various maintenance painting options available, including: spot 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.

4.1.3 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.

4.1.4 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.

4.1.5 Implement Maintenance Painting Options (Step 5) Section 9

4.1.6 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 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 and 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 11.1).

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, process, 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 (e.g., acid fallout). (See SSPC Publication 94-18, Project Design.) It is usually

² ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2859. Available online from www.astm.org.

³ FED STD 141 can be obtained from <http://astimage.daps.dla.mil/online/new/>

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 D 610, 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: 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, and chromium. 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. OSHA regulation 29 CFR 1926.62 details worker protection requirements for lead (see SSPC publication 95-06, Project Design).

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.

5.4.1 Physical Testing: See SSPC-TU 3 for detailed guidance in evaluating coating condition and risks of overcoating. These evaluations generally require certain detailed information concerning the coating type and physical condition.

5.4.2 Use of Ratings Data: In many cases, these condition ratings will be keyed directly to repair procedures (e.g., SSPC-PA Guide 4). The next two sections of this guide give the procedures for developing such a scheme.

5.5 PLAN FOR INSPECTING STRUCTURAL

COMPONENTS: A sub-unit sampling plan identifies the portions of the structure or facility that will be rated and the type of rating scheme to be used. Sub-unit sampling plans are needed for complex structures or where detailed information is required. For a process unit, (for example) the structural steel might be divided into individual tanks, piping, handrails and ladders, and structural support. On large structures, the areas could be further subdivided into sections. Because of differences in corrosion tendencies, it is often useful to have

separate ratings for edges and flat surfaces. The extent of inspection depends on how detailed a survey is desired and what resources may be available.

5.6 ESTABLISH PROCEDURES AND ASSEMBLE RELATED DOCUMENTS

5.6.1 A specific procedure should be established for a condition assessment, which should include a budget and schedule, including equipment and crews. The availability of funds will determine the extent of the survey that can be undertaken. A schedule should be established based on the number of hours or days required to prepare the structure (e.g., notify other trades) or arrange for access (i.e., coordinate schedules of other individuals). This includes identifying support crews and equipment that may be required to assist with the condition assessment. Personnel requirements must also be established (i.e., identify individuals who will conduct the survey such as in-house inspectors, engineers, outside consultants, coating contractors, or coating manufacturers). If a condition assessment survey is to be performed by a consultant or contractor, a written contract should be prepared. If a coating manufacturer offers to do the assessment at no cost, the firm should be asked to submit a written description of the plan for the owner's review, modification, and approval. There are numerous contracting methods available for acquiring condition assessments, structural inspections, and coating work, including options ranging from acquiring each facet of work by different contracts to using "turnkey" type contracts to perform all inspection, structural repair, and coating work. When more than one facet of work is included in a single contract, steps should be taken to ensure the validity of each facet prior to proceeding to the next facet.

5.6.2 Required standards (e.g., standards such as SSPC VIS 2, ASTM D 610, or equivalent) as well as field equipment such as tape recorders, inspection forms, and a camera must be available.

5.7 CONDUCT ASSESSMENT SURVEY: The survey should be conducted after the schedule and the standards have been established. The owner's representative should ensure that all elements of the survey have been properly performed, recorded correctly, and distributed to predetermined personnel.

6. List Potential Maintenance Painting Options (Step 2)

6.1 REVIEW SURVEY DATA AND COATING OBJECTIVES AND CRITERIA

6.1.1 The corrective action to be taken is based on the results of the previous surveys, the short and long-term objectives of the coating program, special limitations, and other relevant factors.

6.1.2 The data to be analyzed are those that have been previously collected from an overview, visual inspection, or physical inspection. If no formal survey was taken, use the best information available (e.g., coating historical records) to estimate the overall condition ratings.

6.2 CONSIDER ALTERNATIVE OPTIONS: After the data is reviewed, the available alternative actions should be considered. These range from not coating to complete coating removal and recoating.

6.3 NO MAINTENANCE REQUIRED FOR THREE YEARS OR LONGER: In one possible scenario, the coating is in good shape and no corrosion or deterioration requires attention. In a second scenario, the coating may be providing some protection but may be in too poor a condition to salvage. Eventually, total coating removal will be needed, but maintenance can be delayed without any significant harm to the structure. This option may be considered under the following circumstances:

6.3.1 The structure is in a mild environment and little corrosion activity is expected at breaks in the coating film over the next few years.

6.3.2 The extent of discoloration, topcoat erosion, or general degradation is not very important, due to the locations on the structure. In general, the coating is intact and protection is still being provided.

6.3.3 The structure is being assigned a low priority for maintenance because of economics, aesthetics, or other reasons.

6.3.4 The structure is scheduled for major coating repair or complete replacement within 3 years. The additional time is not expected to add significantly to the corrosion metal loss or the surface preparation cost.

6.3.5 The structure is due for demolition.

6.4 SPOT REPAIR ONLY: Spot repair entails surface preparation and touch-up coating of localized areas of deteriorated coating and corrosion. The surface preparation may be accomplished by hand or power tool cleaning, high- or ultrahigh pressure waterjetting, or abrasive blasting. Several specialized materials and procedures are available for localized surface preparation, including composite media (sponge), sodium carbonate slurries, plastic media, walnut shells, corncobs, etc. The intact coating surrounding the degraded area should be feathered and lightly sanded 2.5 to 5 cm (1 to 2 inches) onto the intact coating to permit a smooth transition. The cleaned areas are primed with a coating compatible with the existing coating system and spot topcoated to conform to the required DFT. In this particular option, the remaining (e.g., intact) coating is not overcoated. It should be noted that the spot repair method is primarily a stopgap method. It is recommended that the structure