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Standard Guide for Painting Inspectors (Metal Substrates)[1]

This standard is issued under the fixed designation D3276; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide is intended as an information aid to painting inspectors in carrying out their task efficiently. It includes the key elements of surface preparation, coatings application, and final approval for both field and shop work. The items should be selected that are pertinent to the specification of a particular job.

NOTE 1—For additional helpful information, refer to the following documents:

Manual of Coating Work for Light-Water Nuclear Power Plant Primary Containment and Other Safety-Related Facilities [2]

New Concepts for Coating Protection of Steel Structures[3]

D16 Terminology for Paint, Related Coatings, Materials, and Applications[4]

D4538 Terminology Relating to Protective Coatings and Lining Work for Power Generation Facilities[4]

Steel Structures Painting Manual Vol 1 Good Painting Practice[5]

Steel Structures Painting Manual Vol 2 Systems and Specifications[5]

Manufacturers Specifications and Instructions (made available to the inspector for reference to special requirements for proper application)

Safety Data Sheets (needed to ensure that personnel take necessary precautions in handling hazardous materials). Available from Materials manufacturer.

1.2 Certain industries or owners may require certified inspection personnel. See Guide D4537 for establishing procedures to certify inspectors for coatings work in nuclear facilities.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 This guide is arranged in the following order:

[1] This guide is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.46 on Industrial Protective Coatings.

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[2] ASTM, 1979.

[3] *ASTM STP 841*, ASTM, 1984.

[4] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[5] Available from Association for Materials Protection and Performance (AMPP), 15835 Park Ten Place, Houston, TX 77084, https://www.ampp.org.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

D16 Terminology for Paint, Related Coatings, Materials, and Applications

D1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings

D1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

D2200 Practice for Use of Pictorial Surface Preparation Standards and Guides for Painting Steel Surfaces

D3359 Test Methods for Rating Adhesion by Tape Test

D3363 Test Method for Film Hardness by Pencil Test

D4138 Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means

D4212 Test Method for Viscosity by Dip-Type Viscosity Cups

D4285 Test Method for Indicating Oil or Water in Compressed Air

D4414 Practice for Measurement of Wet Film Thickness by Notch Gages

D4417 Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

D4537 Guide for Establishing Procedures to Qualify and Certify Personnel Performing Coating and Lining Work Inspection in Nuclear Facilities

D4538 Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities

D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

D4752 Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub

D4940 Test Method for Conductimetric Analysis of Water Soluble Ionic Contamination of Blast Cleaning Abrasives

D5064 Practice for Conducting a Patch Test to Assess Coating Compatibility

D5162 Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates

D5402 Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs

D6386 Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

D6677 Test Method for Evaluating Adhesion by Knife

D6913 Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

D7127 Test Method for Measurement of Surface Roughness of Abrasive Blast Cleaned Metal Surfaces Using a Portable Stylus Instrument (Withdrawn 2021)[6]

D7393 Practice for Indicating Oil in Abrasives

E337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)

2.2 *OSHA Standard:*[5]

29 CFR 1926.59 Hazard Communication

2.3 *SSPC Standards:*[5]

SSPC-AB 1 Mineral and Slag Abrasives

SSPC-AB 2 Cleanliness of Recycled Ferrous Metallic Abrasives

SSPC-AB 3 Newly Manufactured or Re-Manufactured Steel Abrasives

SSPC-AB 4 Recyclable Encapsulated Abrasive Media

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 7/NACE No. 4 Brush-off Blast Cleaning

SSPC-SP 8 Pickling

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

SSPC-SP 11 Power Tool Cleaning to Bare Metal

SSPC-SP 14/NACE No. 8 Industrial Blast Cleaning

SSPC-SP 15 Commercial Grade Power Tool Cleaning

[6] The last approved version of this historical standard is referenced on www.astm.org.

SSPC-SP 16 Brush-Off Blast Cleaning of Non-Ferrous Metals
SSPC-SP WJ-1/NACE WJ-1 Clean to Bare Substrate
SSPC-SP WJ-2/NACE WJ-2 Very Thorough Cleaning
SSPC-SP WJ-3/NACE WJ-3 Thorough Cleaning
SSPC-SP WJ-4/NACE WJ-4 Light Cleaning
SSPC-PA 1 Shop, Field and Maintenance Painting of Steel
SSPC-PA 2 Procedure for Determining Conformance to Dry Coating Thickness Requirements
SSPC-PA Guide 11 Protecting Edges, Crevices, and Irregular Steel Surfaces by Stripe Coating
SSPC-PA 17 Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements
SSPC-VIS 1 Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blasting
SSPC-VIS 5/NACE VIS 9 Guide and Reference Photographs for Steel Surfaces Prepared by Wet Abrasive Blasting
SSPC-VIS 3 Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
SSPC-VIS 4/NACE No. 7 Visual Standard for Steel Cleaned by Water Jetting
SSPC Paint 27 Basic Zinc Chromate-Vinyl Butyral Wash Primer
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 15 Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Surfaces

2.4 *ISO Standards:*[7]

ISO 8501-4 Preparation Grades and Flash Rust Grades in Connection with High-Pressure Water Jetting
ISO 8502–3 Preparation of Steel Substrates before Application of Paints and Related Products – Tests for the assessment of surface cleanliness

2.5 *NACE International:*[5]

SP0178–2007 (formerly NACE RP0178) Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service

2.6 *ASTM Adjuncts:*

Pictorial Surface Preparation Standards for Painting Steel Surfaces [8]

3. Significance and Use

3.1 This guide is intended as a reference for those concerned with the inspection of industrial coating work. The requirements for inspection should be addressed in all protective coating and lining work specifications. This guide may be used by specification writers when selecting and establishing the inspection requirements for coating and lining specifications. A checklist for use by inspectors in the field is included in Appendix X1.

[7] Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, http://www.iso.org.

[8] The pictorial surface preparation standard Method A (ISO/Swedish Standard) is available from ASTM International Headquarters. Request Adjunct No. ADJD2200.

4. Preparation for Inspection

4.1 The guide describes the duties of the inspector and discusses inspection methods, both visual and instrumental, that can be used to determine that the specification requirements have been met by the painting contractor.

4.2 Before painting is started the project engineer should provide the inspector with information from the official plans and specifications as to coating type, thinner to be used, mixing ratios to be used, specified application thickness, primer, tie coat, topcoat, time between coats, surface preparation, method of application, and any special precautions to be followed such as limits on ambient conditions. These details should be recorded in an inspector's record book to eliminate any misunderstanding between the inspector and the contractor.

4.3 The inspector should obtain copies of the Safety Data Sheets (SDS) for all products that will be used on the project, review any hazard communications program in accordance with 29 CFR 1926.59 that will apply to the project, and review other safety information related to the work that will be performed by the contractor. The inspector should examine these materials and be supplied with appropriate protective equipment and devices.

4.4 The Product Data Sheets (PDS) for the coating products to be used, including thinners where applicable, shall be provided with the procured product. Note that the coating specification may allow only specific pre-qualified coatings to be used.

5. Surface Preparation Methods and Requirements

5.1 *Surface Preparation* is one of the most important factors affecting the performance of coatings. The specifier determines the proper level in accordance with the expected service life and type of coating specified.

5.1.1 *Pictorial Standard D2200 (SSPC-VIS 1)* should be provided to the inspector on a job involving blast cleaning of structural steel. The standard is used by the inspector to assist in determining whether the degree of surface preparation specified in a contract has been attained by the contractor. For large jobs it is recommended that before work starts, an actual steel sample of adequate size be blasted to the satisfaction of the project engineer. This blasted surface should be protected by a clear acrylic coating or encased in plastic and used for reference purposes as the work progresses.

5.2 *Factors Affecting Coating Performance*—There are a number of factors that should be considered to ensure a proper painting job.

5.2.1 *Cleanliness*—Many materials, if not removed from the surface, will affect the life of the coating. These include oil, grease, soil, weld spatter, and slag, that make it impossible to obtain proper adhesion to the metal surface. Surface soluble salts shall be removed to the degree specified or long term coating performance may be adversely affected. SSPC/NACE issues detailed surface preparation specifications that cover various methods for cleaning.

5.2.2 *Mill Scale,* The bluish-black oxide resulting from the hot-rolling process, is a constant source of trouble leading to coating failure. This scale is very brittle and can crack or

loosen due to temperature changes (both in fabricating and weathering in the field) leading to failure of the coating.

5.2.3 *Surface Profile*—The texture of the metal surface has a significant effect on the performance of coatings, since it increases the surface area to which the coating can develop adhesion. In fact, the term "anchor pattern" is sometimes used to describe the depth of profile. Profile varies both with the type and size of the abrasive used. Coarser abrasives generally produce a coarser and deeper profile. Deep profiles are advantageous for adhesion, but require more coating to fill in the valleys and cover the peaks of the profile; they cannot be used with low-build coatings that do not cover the peaks even when several coats are applied. The angularity (sharpness) and density of the profile may affect adhesion. Methods for measuring surface profile can be found in Test Methods D4417 and D7127. Frequency of surface profile measurement and the acceptability of the measurements is described in SSPC-PA 17.

5.2.4 *Sharp Edges*—Sharp edges and rough welds can compromise coating performance, particularly in immersion service. Sharp edges and outside corners should be radiused, and rough welds should be smoothed or ground flat. NACE SP0178 and SSPC-PA Guide 11 may be used as guides. This operation should be specified during fabrication, but is frequently done by the coating contractor. The coating inspector should verify that such work has been done, if required by the coating job specification prior to other steps in surface preparation.

5.3 *Cleaning Procedures*—Safety precautions are not addressed separately for each of the following cleaning methods. Each has its own safety-related hazards, and U.S. Occupational Health and Safety Administration regulations should be followed. Safety Data Sheets (SDS) for the solvents and cleaning compounds provided by the manufacturer should also be consulted for proper worker protection.

5.3.1 *Chemical Cleaning*—Solvents are used to remove oil, grease, and related materials. The solvent is applied to the surface by wiping or scrubbing with rags or brushes. The contaminants should be removed (not simply spread out) by a thorough wiping of the affected areas with cloths saturated with clean solvent. Contaminated cloths should not be dipped into clean solvent. The cleaning should be repeated with clean rags and fresh clean solvent. Emulsions, cleaning compounds, steam cleaning, or similar methods and materials may also be used. Where emulsion cleaners, soaps, or detergents are used, they should be removed completely by washing with clean hot water. SSPC-SP 1 covers cleaning procedures using these materials.

5.3.1.1 *Solvent Vapor Cleaning* is a procedure that can be adapted to a production line or piecework operation. Vapor cleaning removes all soluble contaminants but does not disturb the natural oxide film. If this film should be removed, mechanical cleaning will be necessary as well. The part to be cleaned is placed in the saturated vapor above the heated solvent so that the solvent vapor condenses on the metal surface. Vapor degreasing does not remove particulate matter, so parts should be wiped to remove any insoluble soils. Vapor degreasing has the advantages over solvent wiping in that hot solvents are used and the solvent condensation removes oils without recontamination.

5.3.2 *Hand Tool Cleaning* is the method used for the removal of loose mill scale, loose rust, loose or otherwise defective coating, weld flux, slag and spatter from metal surfaces by hand brushing, hand sanding, hand chipping or scraping using wire, fiber or bristle brushes, sandpaper, steel wool, hand scrapers or chisels, and chipping hammers. Material is considered tightly adherent if it cannot be lifted with a dull putty knife. SSPC provides a detailed specification, SSPC-SP 2. A visual standard, SSPC-VIS 3, may be used to assist in determining compliance.

5.3.2.1 Hand tool cleaning requires that all weld flux, tar, oil and grease, and other greasy contaminants be removed first by solvent cleaning (5.3.1).

5.3.2.2 Wire brushes should be rigid enough to clean the surface thoroughly, and shaped to penetrate into all corners and joints. Brushes should be kept free of all materials that may clog the wires of the brush.

5.3.2.3 Hand scrapers should be made of tool steel, tempered and ground to a sharp edge, and should be of the proper size and shape to enable cleaning to be done as specified. Scrapers should be kept sharp at all times.

5.3.3 *Power Tool Cleaning* is a method used for the removal of loose mill scale, loose rust, loose or otherwise defective coating, and weld flux from metal surfaces by power wire brushes, power impact tools, power grinders, power sanders, or by a combination of these methods. Material is considered tightly adherent if it cannot be lifted with a dull putty knife. SSPC-SP 3 is the detailed specification for power tool cleaning. A visual standard, SSPC-VIS 3, may be used to assist in determining compliance.

5.3.3.1 Power tool cleaning requires that all oil, grease, weld flux, and other contaminants be removed first by solvent cleaning (5.3.1). Hand tool cleaning in accordance with 5.3.2 may be used prior to power tool cleaning.

5.3.3.2 All equipment should be suitable for the configuration of the work to be cleaned and maintained free of material that clogs the wire or disks making them ineffective. All impact tools should be kept sharp.

5.3.4 *Power Tool Cleaning to Bare Metal* is a method used for the total removal of coating, rust, and mill scale. It also requires a minimum of 1-mil anchor profile. Surface cleaning, power tools, and surface profile producing media are used to

TABLE 1 Comparison of Surface Preparation Standards

Preparation Guide	SSPC	ASTM D2200		NACE
		Method A[A]	Method B[B]	
Blast clean to white metal	SSPC-SP 5	Sa 3	SP 5	1
Blast clean to near-white metal	SSPC-SP 10	Sa 2½	SP 10	2
Commercial blast cleaning	SSPC-SP 6	Sa 2[C]	SP 6	3
Brush-off blast cleaning	SSPC-SP 7	Sa 1	SP 7	4
Industrial blast cleaning	SSPC-SP14	...	...	8

[A] Method A is ISO/Swedish Standard.
[B] Method B is SSPC- VIS-1.
[C] Pictorial Standard Sa 2 shows mill scale and conflicts with SSPC definition of commercial blast (SP 6), which does not allow mill scale.

TABLE 2 Comparison of Water Jetting Standards

Cleanliness Description	SSPC/NACE	ISO
Clean to Bare Metal	SSPC-WJ-1/NACE WJ-1	Wa 3
Very Thorough Cleaning	SSPC-WJ-2/NACE WJ-2	Wa 2.5
Thorough Cleaning	SSPC-WJ-3/NACE WJ-3	Wa 2
Light Cleaning	SSPC-WJ-4/NACE WJ-4	Wa 1

obtain the specified finish. Surface cleaning power tools consist of non-woven abrasive wheels and discs, coated abrasive discs or sanding pads, coated abrasive fly wheels, and coated abrasive bands. Surface profile producing media consist of rotary impact flap wheel assemblies and needle guns. SSPC-SP 11 is the detailed specification for power tool cleaning to bare metal.

5.3.4.1 Depending on the initial condition of the surface and existing profile conditions, it may be necessary to use one or both of the types of power tools. All oil, grease, weld flux, and other contaminants should be removed first by solvent cleaning (5.3.1). Hand tool cleaning (5.3.2) or power tool cleaning (5.3.3) may be used prior to power tool cleaning to bare metal.

5.3.4.2 All equipment should be suitable for the configuration of the work to be cleaned and maintained free of material that clogs the wire or discs making them ineffective. For example, needle guns require 2 mm diameter needles to produce a suitable surface profile.

5.3.4.3 The finished surface should be bare, bright metal. Slight residues of rust and paint may remain in the lower portions of pits if the original surface was pitted. SSPC-VIS 3 is a visual standard to assist in determining compliance. Surface profile is determined by procedures in 10.1.1.

5.3.4.4 *Commercial Grade Power Tool Cleaning, SSPC-SP 15*is performed in a manner similar to SSPC-SP 11. The finished surface should be bare, bright metal. Staining is allowed on 33 percent of the evaluation unit area, and slight residues of rust and paint may remain in the lower portions of pits if the initial surface was pitted. It also requires a minimum of 1 mil anchor profile.

5.3.5 *Blast Cleaning* is used to remove coating, rust and mill scale from a metal surface and to provide a roughened surface by striking the surface with a stream of small, hard abrasive particles such as (dry) sand, grit, or shot.

5.3.5.1 One method utilizes compressed air, special blast nozzles, and abrasive. Water may be injected into the air stream to control dust, and a rust inhibitor may be needed (5.3.6). In another method used primarily in fabricating shop, wheels propel the abrasive centrifugally against the work. The minimum and maximum particle size of the abrasive may be specified as a means of controlling the surface profile. The particle size can be verified by sieve test in accordance with Test Method D6913.

5.3.5.2 Blast cleaning requires that all oil, grease, and weld flux be removed by solvent cleaning (5.3.1). The compressed air used for blast cleaning should be free of condensed water or oil by making certain that separators and traps are in working order. Test the compressed air supply in accordance with Test Method D4285. The abrasive material should be free of soluble contaminants when tested in accordance with Test Methods D4940, D7393, or the appropriate SSPC abrasive specification (AB 1, AB 2, AB 3, or AB 4) for the type of abrasive material.

5.3.5.3 Blast-cleaning operations should be performed so that no damage is done to the completed portion of the work. Blast cleaning is often performed from the top to bottom of the structure and should only be carried on downwind from any recently painted areas. Dry blast cleaning operations should not be conducted on surfaces that will be wet after blasting and before painting. Steel temperature should be at least 3 °C (5 °F) above the dew point temperature.

5.3.5.4 The degree of blast cleaning required should be at least equal to the appropriate surface preparation specification and the applicable visual standard. Standards from ASTM, SSPC, and National Association of Corrosion Engineers (NACE) are listed in Table 1. Note that Pictorial Surface Preparation Standards D2200 is divided into two methods for abrasive blasting. Method A describes photographic standards available from International Standards Organization (ISO) Pictorial Surface Preparation Standards. Method B describes photographic standards available from SSPC. The two sets of photographs are not directly comparable.

5.3.5.5 Blast cleaned surfaces should be examined for any traces of oil, grease, or smudges; where present, the contaminants should be removed by solvent cleaning (5.3.1). Surfaces that have been dry blasted should be brushed with clean brushes, blown with compressed air free of oil and moisture, or vacuum cleaned to eliminate any traces of blast products, dust, or dirt from the surface. This also serves to remove abrasive from pockets and corners.

5.3.5.6 Blast cleaned surfaces should be further treated, primed or painted on the same day they are blasted, preferably within 8 h, or in any event before any visible flash rusting occurs. Reblasting will be necessary on any surface if rust bloom forms before coating can be applied.

5.3.6 *Pressurized Water Cleaning*—A high-pressure water blast using potable water, either with or without an abrasive injected into the stream, is used as an alternative to open blasting, since it reduces the release of dust into the atmosphere. Pressures over 137 900 KPa (20 000 psi) are needed to achieve total coating removal when using only water. Pressurized water alone will not remove mill scale efficiently, or impart an anchor profile. Inhibitors may be added to the water to prevent flash rusting. The surface should be dried or allowed to dry before coating. Table 2 contains a comparison of the SSPC/NACE water jetting standards to the ISO 8501-4 standard. SSPC-VIS 4/NACE No. 7 is a visual standard to assist in determining compliance with the SSPC/NACE joint standard. It includes photographs with three levels of rustback, if allowed by the specification.

5.4 *Cleaning and Preparation of Various Surfaces*—Before application of any coating, all surfaces to be coated should be thoroughly cleaned and properly prepared to the requirements of the specification. All dust, dirt, oil, grease, moisture, soot, tar, or other contaminants should be removed from unpainted surfaces. Previously painted surfaces should be similarly cleaned of all foreign matter; all deteriorated coating should be removed as well. Mortar or cement drippings from earlier repairs should be removed by mechanical or chemical means.

Tree limbs or other growth obstructing the structure should be cut away to provide ready access.

5.4.1 *Steel Surfaces*—Removal of rust and scale should be done in the manner and to the degree specified, that is, hand, power tool, or blast cleaned.

5.4.1.1 On complex structures, all dirt and debris should be removed from pockets, crevices, obstructed areas such as gusset plates and connections, and tops of horizontal surfaces. Blasting debris that accumulates on horizontal surfaces should be removed. Special attention should be placed on examining hard to reach areas, the back side of nuts and bolts, sides of members in close proximity to other members or walls, and undersides of members.

5.4.2 *Galvanized Surfaces* that are to be painted should be cleaned and then treated in accordance with the specified method in Practice D6386. Alternatively, the surface may be allowed to weather a minimum of 6 months before cleaning and painting. The method and inspection of brush-off blast cleaning of galvanized surfaces is presented in SSPC-SP 16.

5.4.3 *Aluminum Surfaces:*

5.4.3.1 Complete removal of oil and grease and, for unanodized aluminum, treatment is essential. Vapor degreasing or immersion in an alkaline or acid cleaning solution are commonly used in shop work. In the field, water wash followed by solvent, steam or detergent cleaning is a good starting point. Consult SSPC-SP 16 if brush-off blast cleaning is performed.

5.4.3.2 Vinyl wash primer is one of the metal pretreatments commonly used on unanodized aluminum. The material is described in Practices D1730, Type B, Method 8 and is covered by SSPC in Paint 27. Lead pigmented primers should never be used over aluminum surfaces. The minimum treatment for aluminum is Type B, Method 3 of Practices D1730, which describes the use of an alcoholic phosphoric acid cleaner.

5.4.4 *Precautions in Preparing Unpainted and Previously Painted Surfaces*—Cleaning should proceed by sections, bays, or other readily identifiable parts of the work. The cleaning of each section, bay, or part of the work should be entirely completed, inspected, and accepted before any coating is applied. The specification should contain limits on the amount or area that can be cleaned and painted at one time. The system of alternately cleaning and painting short sections by one workman is not good practice since this can lead to surface or intercoat contamination.

5.4.4.1 If traffic, or any other source, produces an objectionable amount of dust, it is customary to control the dust by using tarpaulins, etc., for a sufficient distance around the structure and take any other precaution necessary to prevent dust and dirt from coming into contact with the cleaned or freshly painted surfaces. It may sometimes be necessary to clean newly coated surfaces using some of the specified methods between the various coats.

5.4.4.2 Some areas to be painted or repainted may be exposed to chemical fumes and, if so, should be washed with water before painting. Washing may also be necessary between coats of paint. Be aware that standing water on uncured paint can result in early failure.

5.4.4.3 Residual contaminants present on pitted steel can be a problem. Chloride from deicing salts or a marine environment, and sulfate contamination from air pollution have been recognized as main factors in premature breakdown of existing coating systems. High-pressure water blasting is often used to remove these contaminants.

5.4.4.4 Current regulations require containment and collection of surface preparation debris for disposal. When the existing coating contains regulated heavy metals such as lead or chromium, or other regulated compounds such as organotin, special precautions and handling of debris may be necessary. Inspection of contaminant and disposal requirements, especially site storage requirements, are part of a Coating Inspector's activities. SSPC Guides 6 and 7 present information useful to the inspector and sections of these guides may be referenced in the specification. On lead removal projects, inspectors should be familiar with OSHA requirements for their own health and safety.

5.5 *Inspection of Surfaces Prior to Field Painting:*

5.5.1 *New Construction*—It should be emphasized that the first coat should be applied to the cleaned surfaces before any soiling or deterioration can occur. If painting is done outside, the cleaned areas should receive the first protective coat well before nightfall brings lower temperatures and possible moisture condensation on the surfaces. When surface preparation and painting are carried on indoors, overnight delays between coating and painting may be permissible except on blast-cleaned surfaces.

5.5.1.1 Shop-coated steel that has been shipped to the erection site should be stored on blocks to prevent contact with the ground, and where it is least likely to be marred, scratched, or subjected to harmful contamination by grease, oil, salt, etc. Insofar as practicable, the steel should be stored to avoid the formation of waterholding pockets. If outdoor storage lasts for several months, the inspector should check the integrity of the coating from time to time and verify that deficiencies are corrected in accordance with the contract document. The length of time between shop priming and erection and subsequent topcoating should be kept to a minimum to avoid the problem of intercoat adhesion.

5.5.1.2 Immediately before applying the first field coat, the shop-coated surfaces should be cleaned of dust. If necessary to remove grime and oil substances, they can be wiped, steam cleaned, power washed with detergents or cleaned with solvents selected so as not to soften the film appreciably. Miscellaneous scratches and breaks in the shop coat, including those occasioned by field welds, bolts, or rivets, should be cleaned, feathered and touched-up as specified before the steel receives the first overall field coat.

5.5.1.3 The inspector should ensure that field rivets have been cleaned of slag and weld spatter. It is important that every coat of the system be applied over dry, soil-free surfaces, and that all previous coats be free of mechanical damage. Great care should be exercised to prevent trapping corrosive salts under or between coats.

5.5.1.4 The inspector should determine whether the specifications are being followed with reference to the painting or prohibition of painting of contact surfaces in bolted or riveted surfaces of construction. He should ensure that surfaces not in contact but that will be made inaccessible by assembly or

erection, have received the full number of specified coats before they become inaccessible.

5.5.2 *Maintenance Repainting*—In most cases, maintenance repainting will consist of spot-cleaning and priming of small isolated areas of deterioration, followed by application of one overall new finish coat to all surfaces of the structure. The inspector of maintenance repainting should be alert for several conditions not encountered in the painting of new work.

5.5.2.1 Sound coating not intended to be removed should not be damaged by cleaning operations on adjacent areas. This is particularly important with spot-blast cleaning.

5.5.2.2 The junctions between sound coating and spot-cleaned areas should present a smooth, feathered appearance. The application of coating to spot-cleaned areas should overlap the old, adjacent coating to a slight extent to ensure full coverage of the cleaned areas. Before the overall finish coat is applied, the inspector should ensure that oil, grime, dust, and other contaminants are cleaned from the old coating surfaces.

5.5.2.3 Salt contamination of the substrate for both total coating removal and overcoating can be an issue. Some specifications put limits on the allowable amount of surface soluble salts. Inspectors may be called upon to measure soluble salt concentrations on the substrate surface. SSPC Guide 15 presents several methods for extracting salts from the surface and several methods for measuring the salt concentration in the extract. Surface soluble salt concentrations should be measured in areas where salt would most likely be present such as pitted areas.

5.5.2.4 Adhesion of the newly applied coat to the old coating should be carefully checked. Practice D5064 presents the procedure for evaluating adhesion of maintenance coatings.

5.5.2.5 Under the direction of the engineer, the inspector may explore beneath the surface of the existing or new coating film for covered-over rust or loosening of the old film, and where he discovers such conditions, require that the surface be cleaned and repainted.

5.5.2.6 The effect of the newly applied coating on the old underlying coating should be noted. Any coating that shows curling, lifting, or wrinkling should be reported to the engineer immediately since it may have to be removed and the area repainted. If the defects are general, rather than existing in a few isolated areas, use of a different type of coating may be necessary.

6. Coating Storage and Handling

6.1 *Storage of Coating and Thinner*—All coatings and thinners should be stored in areas or structures that are well-ventilated and not subject to excessive heat, open flames, electrical discharge, or direct rays of the sun. Storage should be in compliance with applicable regulations and the manufacturer's written instructions. Materials susceptible to damage at low temperatures should be stored to prevent freezing, such as in heated areas. Too high a storage temperature reduces the shelf life of the coating. If a coating is stocked for a considerable length of time (several months), it is desirable to invert the containers at monthly intervals. This will prevent hard settling and thus make mixing quicker and easier when the coating is to be used.

6.1.1 Coating containers should remain unopened until needed, and the oldest should be used first. The manufacturer's written instructions should be followed regarding shelf life. Coatings that have livered, gelled, skinned, or otherwise deteriorated during storage should not be used. If a particular material is in question, do not use it until it has been tested by the manufacturer or independent laboratory and found to be satisfactory.

6.1.2 Where a skin has formed in the container, the skin should be cut loose from the sides of the container, removed, and discarded. If it is felt that the skins are thick enough to have a practical effect on the composition, the remaining paint should not be used until it has been tested and found to be satisfactory.

6.2 *Mixing of Coatings*—All coatings should be thoroughly and completely mixed in the containers in which they were supplied. When it is not possible to use the supplied containers other clean containers may be used for mixing. Where there is noticeable settling, and mixing is done either by power agitators or by hand, most of the vehicle should be poured off into a clean container. The pigment is then lifted from the bottom of the container with a clean, broad, flat paddle, lumps broken up and the pigment thoroughly mixed with the vehicle present. The poured-off vehicle should be returned slowly to the original container with simultaneous agitation. It is also useful at this point to mix or pour repeatedly from one container to another (boxing) until the composition is uniform. The bottom of the original container should be inspected for the unmixed pigment. Two component paints should be mixed by agitation only, and not with boxing. After the individual components are homogenous, they are intermixed with agitation in the order stated in the manufacturer's instructions, that is, add Part B to Part A. The coating should not be mixed or kept in suspension by means of an air stream bubbling under the coating surface.

6.2.1 Some coatings may require straining after mixing, to ensure homogeneity and to remove skins and foreign matter. The strainers should be of a type to remove only skins, etc., but not to remove pigment. For example, a 297-µm (50-mesh) strainer is normally satisfactory for most coatings, unless some specific size is required in the specification. Containers should be covered when not in use, to reduce volatile losses and skinning.

6.2.2 Coatings should be agitated enough during application to ensure homogeneity. Some materials may even require constant agitation during use.

6.2.3 Coating materials which cure by chemical reaction may require an induction time to allow the components to partially react prior to thinning or application.

6.2.4 The components of plural component coatings should be thoroughly mixed as described in 6.2.1 and then pre-heated to the temperature recommended by the coating manufacturer. The two components are subsequently pumped in the required volume ratio by plural component equipment through heated or insulated lines coating lines to specialized mixing equipment located immediately before the spray gun.