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## Standard Guide for Painting Inspectors (Concrete and Masonry Substrates)<sup>1</sup>

This standard is issued under the fixed designation D6237; 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 ( $\epsilon$ ) 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 the 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 a particular job-specific project.

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

*Manual of Concrete Practice ACI 515R American Concrete Institute*<sup>2</sup>

*Manual of Coating Work for Light Water Nuclear Power Plant Primary Containment and Other Safety Related Facilities*<sup>3</sup>

**C811** Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacing<sup>4</sup>

**SSPC-PA Guide 3 – A Guide to Safety in Paint Application**<sup>5</sup>

Steel Structures Painting Manual Vol. 1 - Good Painting Practices<sup>5</sup>

Steel Structures Painting Manual Vol. 2 - Systems and Specifications<sup>5</sup>

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

~~Material~~ Safety Data Sheets (needed to insure 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 coating work in nuclear facilities. SSPC offers a training and certification program for concrete coating inspection.<sup>5</sup>

1.3 In certain cases the inspector may be required to assess the condition of the concrete substrate. SSPC has published an illustrated guide for performing a concrete condition assessment.<sup>5</sup>

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

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 whomever uses the user of this standard to consult and establish appropriate safety, health, and health environmental practices and determine the applicability of regulatory limitations prior to use.~~

1.6 This guide is arranged in the following order:

<sup>1</sup> 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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<sup>2</sup> Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.concrete.org>.

<sup>3</sup> ASTM, 1979.

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

<sup>5</sup> Available from SSPC: The Society for Protective Coatings (SSPC), 40 24th St., 6th Floor, Pittsburgh, PA 15222-4656, Coatings, 800 Trumbull Avenue, Pittsburgh, PA 15205, <http://www.sspc.org>.

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1.7 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:<sup>4</sup>

[C805 Test Method for Rebound Number of Hardened Concrete](#)

[C811 Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacing \(Withdrawn 2012\)<sup>6</sup>](#)

[D1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings](#)

~~[D1475 Test Method for Density of Liquid Coatings, Inks, and Related Products](#)~~

[D3359 Test Methods for Rating Adhesion by Tape 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](#)~~

[D4258 Practice for Surface Cleaning Concrete for Coating](#)

[D4259 Practice for Preparation of Concrete by Abrasion Prior to Coating Application](#)

[D4260 Practice for Liquid and Gelled Acid Etching of Concrete](#)

[D4262 Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces](#)

[D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method](#)

[D4285 Test Method for Indicating Oil or Water in Compressed Air](#)

[D4414 Practice for Measurement of Wet Film Thickness by Notch Gages](#)

[D4537 Guide for Establishing Procedures to Qualify and Certify Personnel Performing Coating and Lining Work Inspection in Nuclear Facilities](#)

[D4787 Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates](#)

[D5064 Practice for Conducting a Patch Test to Assess Coating Compatibility](#)

[D6132 Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Coating Thickness Gage](#)

[D6677 Test Method for Evaluating Adhesion by Knife](#)

[D7234 Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers](#)

~~[E1907D7682 Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings Test Method for Replication and Measurement of Concrete Surface Profiles Using Replica Putty \(Withdrawn 2008\)](#)~~

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

[F1869 Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride](#)

[F2170 Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes](#)

### 2.2 Occupational Safety and Health Administration (OSHA) Standard:

[29 CFR 1910.12001926.59 Hazard Communication<sup>7</sup>](#)

### 2.3 International Concrete Repair Institute (ICRI):

[Guideline No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays<sup>8</sup>](#)

### 2.4 SSPC Standards:<sup>5</sup>

~~[SSPC-SP1SSPC-AB 1 Solvent Cleaning Mineral and Slag Abrasives](#)~~

~~[SSPC-SP7/NACE No. 4 Brush-off Blast Cleaning](#)~~

~~[SSPC-PA1 Paint Application Specifications](#)~~

<sup>6</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>7</sup> Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

<sup>8</sup> Available from International Concrete Repair Institute, 3166 S. River Rd., Suite 132, Des Plaines, IL 60018, <http://www.icri.org>.

[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-SP12/NACE No. 5SSPC Guide 23 Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating](#)  
[Field Methods for the Determination of Moisture in Concrete and Masonry Walls and Ceilings, EIFS, and Stucco](#)  
[SSPC-PA 7 Application of Coating to Concrete](#)  
[SSPC-PA 9 Measurement of Dry Coating Thickness Using Ultrasonic Gages](#)  
[SSPC-SP13/NACE No. 6 Surface Preparation of Concrete](#)

### 3. Significance and Use

3.1 This guide is intended as a reference for those concerned with the inspection of thin- or thick-film coating application to concrete and masonry substrates. It does not cover the application of cement-type coatings. ~~A checklist is included as Appendix~~ The requirements for inspection should be ~~X1.1~~. Many of the details covered may be in a specification for a particular project. A specification for coating projects should include the coatings to be used 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 sample checklist for use by inspectors is included as Appendix ~~X1.1~~.

### 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 the start of the job, the inspector should be provided information by the project engineer painting is started, the project engineer should provide the inspector with information from the official plans and specifications as to surface preparation requirements, coating type, thinner to be used, mixing ratios to be used, recommended application thickness, recommended primer, tie coat, topcoat, time between coats, method of application, ambient condition restrictions, and any special precautions to be followed. 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 Safety Data Sheets (SDS) for all products that will be used on the project, review any hazard communications program in accordance with 29 CFR ~~1910.1200~~ 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—Preparation One is one of the most important factors affecting the performance of coatings is surface preparation coatings. The specifier determines the proper level appropriate degree of surface preparation according to the expected service life and type of coating specified. Information on selection of the level of surface preparation methods can be found in SSPC-SP13/NACE No. 6 and ICRI Guideline No. 03732.~~

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

5.2.1 *Surface Condition*—Concrete and masonry have unique properties associated with them due to their physical nature and method of formation. New concrete may be very smooth and hard if hard trowel ~~finished, finished~~ or have cavities and holes at or just below the surface if poured. As with surface preparation of other substrates, contaminants must be removed and the surface suitably roughened. All protrusions should be removed by suitable hand or power tool technique prior to cleaning. Visible holes should be filled with a patching compound compatible with the coating to be applied.

5.2.2 *Cleanliness*—Many materials, if not removed from the surface, will affect the life of the coating. These include form release agents, surface hardeners, laitance, efflorescence, grease, soil, fungus, mold, and ~~mildew, which mildew that~~ make it impossible/difficult to obtain/attain proper adhesion.

5.2.3 *Moisture*—There should be no free standing water on the surface although a damp surface may be ~~allowed acceptable~~ for certain types of coatings. Moisture is required to cure concrete, but after the specified cure time has passed, the inspector should check for excessive moisture below the surface as determined by Test Method **D4263** or by use of a moisture meter. Many coating types will not adhere over entrapped moisture. Concrete slabs to which a floor coating will be applied are more commonly checked for moisture vapor transmission rate using the calcium chloride method as described in Test Method **F1869**, or in situ probes as described in Test Method **F2170**.

5.3 *Surface Preparation Procedures*—Safety precautions are not addressed separately for each of the following surface preparation methods. Each has its own safety-related hazards, and U.S. Occupational Health and Safety Administration regulations

should be followed. ~~Materials~~ Safety Data Sheets (MSDS)(SDS) for the solvents and cleaning compounds provided by the manufacturer should also be consulted for proper worker protection.

5.3.1 *Dry Surface Cleaning*—Broom, vacuum cleaners or a compressed air stream, or both, are used to remove surface dust and other loosely adherent solid contaminants in accordance with paragraphs 6.1 to 6.3 of Practice **D4258**. Compressed air should be free of water and oil. Test compressed air supply in accordance with Test Method **D4285**. Visually examine the surface for the presence of dust, debris and loosely adherent concrete.

5.3.2 *Water and Steam Cleaning*—These procedures are intended to remove dust, dirt, and water-soluble surface contaminants. Clean, potable water is used with sufficient pressure to remove dust, dirt, and loose material. Hand scrubbing with a stiff-bristled brush may be necessary. Visually examine the prepared surface for debris, dirt, oil, grease, loosely adherent concrete, and other contaminants. Moisture content may be determined after the surface has dried in accordance with Test Method **D4263** or by use of a moisture meter.

5.3.2.1 Detergents or nonorganic solvent emulsifying agents are used with water and steam cleaning to remove oil and grease contaminants. Heavy oil grease deposits should be removed by scraping prior to cleaning. Residues of the cleaning agent should be removed by flushing the surface with clean potable water before the surface dries. ~~In some cases removal~~ Removal of the cleaning agent may be verified by measuring the surface pH in accordance with Test Method **D4262**.

5.3.2.2 Practice **D4258**, paragraphs 6.4 to 6.6 present the procedures and test methods for water and steam cleaning both with and without detergents or emulsifying agents.

5.3.3 *Mechanical Tool Cleaning*—Mechanical tool cleaning is used to remove fins and projections, laitance, glaze, efflorescence, and concrete curing compounds. It results in a sound concrete surface that is suitably roughened. Mechanical tool cleaning is presented in Practice **D4259**, paragraphs 6.1 to 6.5. Various techniques may be required by the specifier depending on the nature of the job.

5.3.3.1 *Hand Tool Cleaning* is one method used for the removal of loose or otherwise unsound concrete, by hand ~~brushing, hand sanding, hand chipping, chipping~~ or scraping using wire, fiber or bristle brushes, ~~grinding stones, sandpaper, steel wool, hand scrapers or chisels, and chipping hammers.~~

~~(a) 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.~~

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

(b) 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.

(b) 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.

5.3.3.2 *Power Tool Cleaning* is a method used for the removal of loose or otherwise defective concrete and protrusions by power wire brushes, power impact tools, power grinders, power sanders or by a combination of these methods. 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.

5.3.3.3 *Scarifying Machines* for concrete surfaces are available that either cut or chip away a thin layer. Aggregate loosened by mechanical impacting should be removed.

5.3.3.4 *Pre- and Post-Surface Preparation*—Mechanical tool cleaning requires that grease, oil and other penetrating contaminants be removed prior to cleaning and after surface preparation as described in **5.3.2.1**.

5.3.3.5 *Finished Surface*—The surface is visually inspected for dirt, dust, grease, oil, and loose contaminants. The surface should have a roughened textured appearance and aggregate may be exposed. A roughness standard may be established by mutual agreement.

5.3.4 *Blast Cleaning* is used to remove foreign materials from concrete in accordance with Practice **D4259** to provide a roughened surface. Blast cleaning is described in Practice **D4259**. Dry or wet abrasive blasting may be used or specified.

5.3.4.1 ~~Blast cleaning requires that all~~ All visible oil, grease, and other contaminants should be removed prior to ~~blasting~~ blast cleaning as described in **5.3.2.1**. The compressed air used for blast cleaning should be free of condensed water or oil. Compressed air supply can be tested in accordance with Test Method **D4285**.

5.3.4.2 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.

5.3.4.3 Blast cleaned surfaces should be examined for any traces of oil, ~~grease or smudges; grease;~~ where present, the contaminants should be removed by cleaning according to **5.3.2.1**. 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.

5.3.4.4 The finished surface should have a roughened texture ~~similar to sandpaper of the specified grit or to the ICRI Visual Standard. A roughness standard may be established by~~ based on a roughness standard established by mutual agreement. The resulting surface texture can be assessed according to Test Method **D7682** ~~mutual agreement, Method A or B, or using the ICRI~~

Concrete Surface Profilers (CSPs) referenced in ICRI Guideline No. 03732. Alternatively the surface profile can be measured using a depth micrometer that will measure up to 250 mils.

~~5.3.5 Water Blast Cleaning—Jetting—A high pressure water blast, either with or without abrasive injected into the stream, is used as an alternative to open abrasive blasting since it reduces the release of dust into the atmosphere. Water blast cleaning is cleaning/jetting is described in Practice D4259, Section 7. Low-pressure water cleaning per SSPC-SP12/NACE No. 5 (<34 MPa (<5,000 psi)) alone is usually considered a satisfactory procedure for decorative painting, but for protective barrier coatings, low-pressure water cleaning without abrasive injection may not remove enough weak surface material. High-pressure water cleaning per SSPC-SP12/NACE No. 5 (34 MPa (5,000 psi) to 69 MPa (10,000 psi)) is usually needed. It should be noted that water introduced into the concrete will lengthen the drying time needed. The surface should have a roughened textured appearance.~~

5.3.6 Acid Etching—This method uses acids such as muriatic (hydrochloric), citric, phosphoric or sulfamic to remove foreign materials and weak surface laitance, and to roughen the surface. Acid etching is described in Practice D4260. It is only performed on horizontal surfaces.

5.3.6.1 Fins and protrusions, oil, grease, concrete curing compounds, form release agents, and concrete hardeners should be removed prior to acid etching by one or more of the techniques in 5.3.1 – 5.3.5. The surface is pre-wetted prior to application of the acid and free-standing water removed.

5.3.6.2 Bubbling should be uniformly evident after the etching solution is applied. The concentration of the etching solution may have to be increased if bubbling is not evident. Curing compounds, sealers, oil, grease, and hardeners inhibit acid etching. Areas where bubbling does not occur should be mechanically cleaned to remove these contaminants and the acid reapplied.

5.3.6.3 The surfaces should be flushed with clean potable water. Repeated flushing and scrubbing with a stiff-bristled brush may be needed to remove acid residues and perhaps neutralization. Test the surface pH in accordance with Test Method D4262 for removal of the etching solution.

5.3.6.4 The acid-etched surface should be uniformly roughened similar in appearance to a medium or coarse grade sandpaper.

5.3.6.5 It may necessary to test for moisture content in accordance with Test Method D4263 prior to applying the coating.

5.4 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 system of alternately cleaning and painting short sections by one ~~workman/craftsperson~~ is not good practice.

5.4.1 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 be necessary at times to use some of the specified methods for cleaning surfaces of newly applied coating between the various coats.

5.4.2 Some areas to be painted or repainted may be exposed to chemical fumes and should be washed with water before painting. Washing may also be necessary between coats of paint. If there is reason to suspect the presence of chemicals, the surfaces should be tested before applying subsequent paints.

5.4.3 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 containment and disposal requirements, especially site storage requirements, ~~are may~~ be part of a coating inspector's activities. SSPC-Guide 6 and SSPC-Guide 7 present information useful to the inspector and sections of these guides may be referenced in the specification.

5.5 Inspection of Surfaces Prior to Field Painting—It should be emphasized that the first coat should be applied to the cleaned surfaces before any soiling or deterioration can occur. The cleaned surface should be inspected to ensure all visible contaminants have been removed. The substrate should be suitably roughened if mechanical tool cleaning, blast cleaning, water blast cleaning, or acid etching is used. Excessive roughness and exposed aggregate ~~is~~ are just as deleterious as too smooth a finish.

5.5.1 New Construction—The strength of the concrete at or near the surface may affect the adhesion of the coating system. A pull-off adhesion tester as described in Test Method D7234 may be used. Alternatively, the soundness of the concrete surface can be assessed in accordance with Test Method C805 using a rebound hammer.

5.5.2 Maintenance Repainting—In most cases, maintenance painting 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 painting 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 be spot-cleaned areas should overlap the old, adjacent coating by 50 mm (2 in.) ~~in order to assure~~ ensure full coverage of the cleaned areas. Before the overall finish coat is applied, the inspector must ~~ensure~~ verify that oil, grime, dust, and other contaminants are cleaned from the old coating surfaces.

5.5.2.3 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.