

SSPC: The Society for Protective Coatings

PAINT APPLICATION SPECIFICATION NO. 7

Applying Thin Film Coatings to Concrete

1. Scope

1.1 This specification covers methods and procedures for applying thin film organic coatings to concrete surfaces by brush, roller, or spray. It is not intended for coatings applied to concrete floors or similar surfaces where thick coatings or surfacings are applied by trowel or mechanical equipment. Surface preparation, pretreatments, and selection of coatings are not covered, except where application requirements are affected, since these are discussed in referenced documents.

1.2 This specification is intended for use by owners, applicators, and others in the coating industry.

2. Description

2.1 This document was prepared to meet the unique physical and chemical properties of concrete and should not be used for the coating of other substrates.

2.2 This specification is only applicable to thin-film coatings.

3. Referenced Standards

3.1 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified. Those documents marked with an asterisk (*) are referenced only in the Notes, which are not requirements of this specification.

3.2 If there is a conflict between the requirements of any of the cited referenced standards and this specification, the requirements of this specification shall prevail.

3.3 SSPC STANDARDS AND JOINT STANDARDS:

PA 1	Shop, Field, and Maintenance Painting of Steel
PA Guide 3	A Guide to Safety in Paint Application
PA Guide 5	Guide to Maintenance Painting Programs
Paint 32	Coal Tar Emulsion Coating
Paint 33	Coal Tar Mastic, Cold-Applied
*PS Guide 17.00	Guide for Selecting Urethane Painting Systems

***SP 12/NACE No. 5** Surface Preparation and Cleaning of Metals by Waterjetting Prior to Coating

***SP 13/NACE No. 6** Surface Preparation of Concrete
TU 2/NACE 6G197 Design, Installation, and Maintenance of Coating Systems for Concrete Used in Secondary Containment

3.4 ACI INTERNATIONAL (ACI) STANDARDS¹

*** 224.1R** Causes, Evaluation, and Repair of Cracks in Concrete Structures
*** 503R** Use of Epoxy Compounds with Concrete
504R Guide to Joint Sealants for Concrete Structures

3.5 ASTM INTERNATIONAL STANDARDS²

D 16 Terminology Relating to Paint Related Coatings, Materials, and Applications
*** D 2240** Standard Test Method for Rubber Property - Durometer Hardness
*** D 2583** Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
*** D 3363** Standard Test Method for Film Hardness by Pencil Test
D 4138 Standard Test Method for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means
D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
D 4285 Standard Method for Indicating Oil or Water in Compressed Air
D 4414 Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notch Gages
*** D 4541** Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
D 4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
*** D 5064** Standard Practice for Conducting a Patch Test to Assess Coating Compatibility

¹ ACI International, P.O. Box 9094, Farmington Hills, MI 48333.

² ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2951.

- * **D 5402** Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs
- D 6132** Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Over Concrete Using an Ultrasonic Gage
- E 1907** Standard Practices for Determining Moisture-Related Acceptability of Concrete Floors to Receive Moisture-Sensitive Finishes
- F 1869** Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

3.6 INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI):³

- * **Guideline No. 03732** Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

3.7 NACE INTERNATIONAL STANDARD:⁴

- RP0188** Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Surfaces

3.8 AMERICAN WATER WORKS ASSOCIATION (AWWA) STANDARD:⁵

- C-203** Coal Tar Protective Coatings and Linings for Steel Water Pipelines — Enamel and Tape - Hot-Applied

4. Definitions⁶

Bituminous Coating: A protective asphalt- or tar-based coating applied as a hot melt, solvent cutback, or water emulsion.

Bug Holes: Small regular or irregular cavities, usually not exceeding 15 mm (0.6 inch) in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and consolidation.

Coating: A thin, liquefiable, or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer. Generic term for paint, lacquer, enamel, etc.

Concrete: A composite material that consists essentially of a binding medium within which are embedded particles or fragments of aggregate, usually a combination of fine aggregate and coarse aggregate; in Portland cement concrete, the binder is a mixture of Portland cement and water.

Curing Agent: An additive component, sometimes called a hardener or (incorrectly) a catalyst, that helps a coating film or concrete cure by chemical reaction.

Efflorescence: A white crystalline or powdery deposit on the surface of concrete. Efflorescence results from leaching of lime or calcium hydroxide out of a permeable concrete mass over time by water, followed by reaction with carbon dioxide and acidic pollutants.

Form Release Agents: Compounds, such as petroleum oil, wax, and silicone, applied to concrete forms to allow easy removal from placed concrete after it has cured.

Laitance: A thin, weak, brittle layer of cement and aggregate fines on a concrete surface. The amount of laitance is influenced by the type and amount of admixtures, the degree of working, and the amount of water in the concrete.

Maintenance Coating: A coating designed to protect highway and railroad structures, chemical and manufacturing plants, public utilities, and other heavy-duty industrial facilities from deterioration.

Outgassing: The spontaneous discharge of air or moisture vapor from concrete.

Pores: Small interconnected voids, such as in concrete, which allow fluids to penetrate an otherwise impervious material.

Porosity: The ratio, usually expressed as a percentage, of the volume of voids in a material to the total volume of the material including the voids.

Thin Film Coatings for Concrete: In this document, thin film coatings are defined as coatings with less than 500 μm (20 mils) dry film thickness.

5. Pre-Application Procedures

5.1 MATERIALS HANDLING AND USE

5.1.1 All coating products shall be delivered to the work site in original, unopened containers with labels intact. Minor damage to containers is acceptable if the container has not been punctured or crimped or has had the lid seal broken. Each product shall have a readily accessible material safety data sheet.

5.1.2 Each container shall be clearly marked or labeled to show coating identification, date of manufacture, batch number, basic chemical composition, special instructions, and other information as needed to meet governmental requirements.

5.1.3 All containers of coating shall remain unopened until required for use. Containers should be opened only as necessary to provide material to the painters. Any mixed material that has exceeded the stated pot life shall be disposed of promptly and not used. The data on the container label shall remain legible throughout the use of the contents. See Note 13.1 for additional information on storage temperatures.

³ International Concrete Repair Institute, 1323 Shepherd Drive, Sterling, VA 20164.

⁴ NACE International, P.O. Box 218340, Houston TX 77218.

⁵ American Water Works Association, 6666 West Quincy Ave, Denver, CO 80235.

⁶ Definitions taken from SSPC Protective Coatings Glossary (SSPC 00-02) with the exception of the definition of Thin Film Coatings.

5.1.4 Coating that has livered, gelled, or otherwise deteriorated during storage shall not be used but removed from the work site. However, thixotropic materials that can be stirred to attain normal consistency may be used.

5.1.5 No coating shall be used which has exceeded its manufacturer's listed shelf life. While this is normally one year for most conventional coatings, products such as 100% solids coatings often have longer shelf lives and some vinyl esters have much shorter shelf lives. Toward this end, the oldest container of coating shall be used first. The owner, at his own discretion, may permit a coating that has exceeded its shelf life to be used, after recertification by the manufacturer.

5.2 MIXING: In all cases, the manufacturer's written instructions for mixing shall be followed, and the products shall be checked for complete uniformity.

5.2.1 Single Component Coatings: Single component coatings shall be thoroughly mixed to obtain a uniform composition. Coating that does not have a limited pot life or does not deteriorate on standing may be mixed at any time before using, but if settling or phase separation has occurred it must be remixed immediately before using. Coating shall not remain in spray pots, painters' buckets, etc., overnight but shall be stored in a covered container and remixed before use.

5.2.2 Multiple Component Coatings: For multiple component coatings, each component shall be thoroughly mixed before combining and further mixing. Normally, catalysts, curing agents, or hardeners are added to the base resin. The manufacturer's induction time (sweat-in time) and pot life for the ambient temperature and volume of coating used shall be observed. Any unused catalyzed coating shall be discarded at the end of its pot life, or each work day, whichever occurs first.

5.2.3 Mixing Dry Pigments: Dry pigments that are separately packaged shall be mixed into coatings in such a manner that they are uniformly blended and all particles of the dry powder are wetted by the vehicle.

5.2.4 Mixing Pastes: Pastes shall be made into coatings in such a manner that the paste shall be uniformly blended and all lumps and particles broken up to form a homogenous coating.

5.2.5 Manual (Hand) Mixing: Most of the vehicle shall be poured off into a clean container. The pigment in the coating shall be lifted from the bottom of the container with a broad, flat paddle, lumps shall be broken up, and the pigment thoroughly mixed with the remaining vehicle. The poured-off vehicle shall be returned to the coating with simultaneous stirring, or boxed until the composition is uniform. "Boxing" is the process of mixing coating by pouring from one container to another. The maximum container size for "boxing" shall be five gallons.

5.2.6 Power Mixing: The coating manufacturer's instructions shall be followed when power mixing (see Note 13.2).

5.2.7 Straining: All pigmented coating shall be strained after mixing except where application equipment is provided with strainers. Strainers shall be of a size to remove only skins and undesirable matter but not to remove the pigment.

5.2.8 Skins: Where a skin has formed in the container, the skin shall be cut loose from the sides of the container, removed, and discarded. If the volume of such skins is visually estimated to be more than 2% of the remaining coating, the coating shall not be used.

5.2.9 Ventilation: Mixing of solvent-containing coatings in open containers shall be done in a well-ventilated area away from sparks or flames.

5.2.10 Air Mixing: Coating shall not be mixed or kept in suspension by means of an air stream bubbling under the coating surface.

5.2.11 Plural Component Spray: When plural component spray equipment is used for application, each component of the coating shall be thoroughly mixed in accordance with the manufacturer's instructions and then applied by the plural component equipment in the ratio recommended by the manufacturer.

5.3 THINNING

5.3.1 No thinner shall be added to the coating unless necessary for proper application (see Note 13.3).

5.3.2 The type of thinner shall be that recommended by the coating manufacturer, and the amount of thinning shall not exceed that recommended by the manufacturer.

5.3.3 Each coating, after thinning, must conform to published government regulations regarding volatile organic compound (VOC) content.

6. Factors Affecting Application of Coatings to Concrete

6.1 MOISTURE

6.1.1 The moisture in the concrete shall be tested by the plastic sheet test (ASTM D 4263), by a calcium chloride test (ASTM E 1907 or ASTM F 1869), or by a moisture meter approved by the owner to establish that it meets the manufacturer's requirements for the specific coating used (see Note 13.4).

6.1.2 Coating shall not be applied in rain, fog, or mist or when the surface temperature is less than 3 C° (5 F°) above the dew point.

6.1.3 For moisture-curing coatings, waterborne coatings, or other moisture-sensitive coatings, the humidity shall remain within the range recommended by the coating manufacturer.

6.2 TEMPERATURE

6.2.1 Coating shall not be applied when the temperature of the substrate, coating, or surrounding air is outside the manufacturer's recommended range without the written approval of the manufacturer and the owner. If no recommendation is given, use a minimum of 13°C (55°F) for chemically curing coatings, and 4°C (40°F) for others, and a maximum of 38°C (100°F) (see Note 13.5).

6.2.2 Unless otherwise recommended by the manufacturer, no coating shall be applied when the temperature of the concrete substrate exceeds the surrounding air temperature by more than 10 C° (18 F°) (see Note 13.5).

6.3 TOPCOATING OR OVERCOATING

6.3.1 Each coat of a multiple coat system shall be in a proper state of drying or curing before application of the succeeding coat, in accordance with the manufacturer's recommendation.

6.3.2 When the maximum recoat time is exceeded or when topcoating an existing fully cured coating, the existing coating shall be mildly abraded, solvent washed, or otherwise treated according to the manufacturer's recommendation before applying the next coat.

6.3.3 In a multiple coat system, with the exception of floors, different colored coats shall be used to produce enough contrast to indicate complete hiding of the undercoat.

6.4 SURFACE POROSITY

6.4.1 Concrete pores shall be filled or sealed as directed by the contract specification (see Note 13.6).

6.4.2 The prime coat for rough concrete surfaces shall be applied by brush or as directed by the contract specification. If the contract document does not address the application of the primer, the manufacturer's instructions shall be followed.

6.5 JOINTS: Isolation, expansion, construction, or contraction joints shall receive any special treatment specified (see ACI 504R and SSPC-TU 2).

7. Application

7.1 GENERAL: The methods of application covered by this specification are brush, roller, air spray, airless spray, plural component spray, hot spray, or any combination of

these methods. Methods of application not covered by this specification are dipping, troweling, flow coating, and fluidized bed. Daubers, natural or synthetic wool mitts, or other applicators may be used for places of difficult access when no other method is practical (see Note 13.7). See Section 9 for application methods unique to specific generic types of coatings. In all cases, application shall occur as soon as practical after surface preparation and before the surfaces become contaminated by dirt, dust, grease, oil, or other interference material (see Notes 13.8 to 13.11). Cleaning and coating shall be so programmed that detrimental amounts of dust or other contaminants do not fall on wet, newly coated surfaces.

7.1.3 Coating shall be worked into all crevices and corners (see Section 7.3.2).

7.1.4 All runs or sags shall be brushed out (see Section 7.6.4).

7.1.5 An attempt shall be made to minimize brush marks, roller marks, and other surface irregularities.

7.1.6 Surfaces not intended to be coated shall be suitably protected from the effects of cleaning and coating operations.

7.2 COATING THICKNESS: Whichever application method is used, the dry film thickness of each coat shall meet the requirement of the specification or the manufacturer's recommendation, whichever has precedence, as agreed upon by the contracting parties. Thickness requirements for polyureas and other coatings which dry immediately upon application are determined by use of dry film thickness readings alone. Dry film thicknesses of coatings shall be measured in accordance with ASTM D 6132 (nondestructive) or ASTM D 4138 (destructive). For coatings which have longer dry times, wet film thickness shall be measured periodically in accordance with ASTM D 4414 to determine if the specified dry film thickness will be met. This test will require repair of the damaged wet coating. ASTM D 4414 gauges may be difficult to use on some rough surfaces.

7.3 CONTINUITY: All coatings shall be applied so that the cured film is continuous, i.e., breaks in the cured film are not visible without magnification.

7.3.1 When specified, the dried/cured film of coating shall be inspected for discontinuities in accordance with ASTM D 4787 or NACE RP0188. Any discontinuities found or areas damaged during this testing shall be repaired satisfactorily for the owner.

7.3.2 If a continuous film, as defined above, is not required, the contracting parties must agree on the size, type, and frequency of allowed discontinuities.

7.4 CURE: The adequacy of cure of coatings shall be determined by a test method specified by the owner. Inadequately cured coatings shall be replaced or properly cured as specified by the owner.

7.5 BRUSH APPLICATION: Brushes shall be of a style and quality that will enable proper application of coating. Round or oval brushes are generally considered most suitable for irregular surfaces and rough or pitted concrete. Wide, flat brushes are suitable for large flat areas, but they should not have a width over five inches (12.5 cm). The brushing shall be done so that a smooth coat as uniform in thickness as possible is obtained.

7.6 ROLLER APPLICATION

7.6.1 Rolling shall be done so that a smooth coat as uniform in thickness as possible is achieved.

7.6.2 Roller covers shall be selected that do not shed fibers into the paint. Their nap shall be appropriate for the particular surface roughness.

7.6.3 Roller application may be used on flat or slightly curved surfaces and shall be in accordance with the recommendations of the coating manufacturer and the roller manufacturer. Coating rollers shall be of a style and quality that will enable proper application of coating having the continuity and thickness required.

7.6.4 Roller application shall not be used on irregular surfaces such as rough spots, pits, crevices, corners, or edges, unless otherwise specified. When permitted, however, the coating applied by roller on these irregular surfaces shall be subsequently brushed out to form a continuous and unbroken film (see Note 13.12).

7.7 SPRAY APPLICATION (GENERAL)

7.7.1 The equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the coating to be applied, and shall be equipped with suitable pressure regulators and gauges. The equipment shall be maintained in proper working condition. Spray equipment shall meet the material transfer requirements of the local air pollution or air quality management district.

7.7.2 Coating ingredients shall be kept uniformly mixed in the spray pots or containers during coating application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

7.7.3 Spray equipment shall be kept sufficiently clean so that dirt, dried coating, and other foreign materials are not deposited in the coating film. Any solvents left in the equipment shall be removed before the equipment is used.

7.7.4 Coating shall be applied in a uniform layer with overlapping at the edges of the spray pattern. During application, the gun shall be held perpendicular to the surface and at a distance that will ensure that a wet layer of coating is deposited on the surface.

7.7.5 Excessive runs and sags as defined by the specification shall be brushed out immediately, and if not, the coating shall be removed and the surface repainted. The wet film may be removed or allowed to dry and removed by sanding after curing.

7.7.6 Cracks, crevices, blind areas, and all other areas that are difficult to access shall be coated by brush or daubers.

7.7.7 Particular care shall be observed with respect to type of thinner, amount of thinner, coating temperature, and operating techniques in order to avoid deposition of coating which is too viscous, too dry, or too thin. It may be necessary to use an approved different coating material or other equipment to resolve these problems.

7.8 AIR ATOMIZING SPRAY APPLICATION: Air atomizing spray application of coating shall be in accordance with all the provisions of Section 7.7 and in addition shall comply with the following:

7.8.1 The air caps, nozzles, and needles shall be those recommended by the manufacturers of the material being sprayed and the manufacturers of the equipment being used.

7.8.2 Traps or separators shall be provided to remove any oil or condensed water from the air. The traps or separators must be of adequate size and must be bled continuously or drained periodically during operations. The air from the spray gun shall show no condensed water or oil as tested in accordance with ASTM D 4285.

7.8.3 The coating pressure to the gun shall be adjusted for optimum spraying effectiveness. The pressure on the material in the pot shall be adjusted when necessary for changes in elevation of the gun with respect to the elevation of the pot. The atomizing air pressure at the gun shall be high enough to properly atomize the coating but not so high as to cause excessive fogging of coating, excessive evaporation of solvent, or loss by overspray.

7.9 AIRLESS SPRAY APPLICATION: Airless or high pressure spray application of coating shall be in accordance with all of the provisions of Section 7.7 and in addition shall comply with the following:

7.9.1 Fluid tips shall be of proper orifice size and fan angle and the fluid control gun of proper construction, as recommended by the manufacturer of the material being sprayed and the manufacturer of the equipment being used. Fluid tips

shall be of the safety type, with shields to prevent accidental penetration of the skin by the high-pressure stream of coating.

7.9.2 The coating pressure at the pump shall be adjusted so that the coating pressure to the gun is proper for optimum spraying effectiveness. This pressure shall be sufficiently high to properly atomize the coating. Pressures considerably higher than those necessary to properly atomize the coating should not be used.

7.9.3 Spraying equipment shall be kept clean and shall utilize proper filters in the high-pressure line so that dirt, dry coating, and other foreign materials are not deposited in the coating film. Any solvents left in the equipment shall be completely removed before applying coating.

7.9.4 The trigger of the gun should be pulled fully open and held fully open during all spraying to ensure proper application of coating (see Note 13.13).

7.9.4 Airless coating spray equipment shall always be provided with an electric ground wire in the high-pressure line between the gun and the pumping equipment. Further, the pumping equipment shall be suitably grounded to avoid the buildup of any electrostatic charge on the gun. The manufacturer's instructions are to be followed regarding the proper use of the equipment. SSPC-PA Guide 3 provides information on how to use airless spray equipment safely.

7.10 HOT AIR SPRAY APPLICATION: Hot air spray application shall be in accordance with the provisions of Sections 7.7 and 7.8.

7.11 HOT AIRLESS SPRAY APPLICATION: Hot airless spray application shall be in accordance with Sections 7.7 and 7.9.

7.12 PLURAL COMPONENT SPRAY APPLICATION: Plural-component spray shall be in accordance with all the provisions of Section 7.7 and use either fixed or variable ratio systems depending upon the ratio of components.

7.13 HIGH-VOLUME LOW-PRESSURE SPRAY: High-volume low-pressure spray shall be in accordance with all the provisions of Section 7.7 (see Note 13.14).

8. Maintenance Coating

SSPC-PA Guide 5 provides other useful information on maintenance coating.

8.1 SURFACE PREPARATION

8.1.1 All loose, cracked, brittle, or non-adherent coating shall be removed in cleaning, unless otherwise specified, until

only tightly adhered coating remains (see Notes 13.15 and 13.16).

8.1.2 After spot removal of deteriorated coatings, the edges of the intact coating shall be feather-edged (beveled), so that the repair patch extending one inch (2.5 cm) beyond them onto intact coating will have a smoother transition and better bonding to the intact coating. The specifier is responsible for determining if it is necessary to roughen the surface of the existing coatings to achieve proper adhesion of the overcoating material.

8.2 COMPATIBILITY: Unless otherwise specified, the specifier is responsible for determining the compatibility of all coatings to be applied over existing coatings (see Notes 13.17 and 13.18).

9. Special Application Procedures for Generic Groups of Coatings

9.1 GENERAL: This section covers special application techniques recommended for specific generic types. In case of a conflict, the manufacturer's recommendation shall govern. For multiple-component thermosetting coatings, the induction, pot life, and recoat times recommended by the manufacturer shall be observed. Coatings for concrete secondary containment systems shall be applied by the method recommended by their manufacturers (see SSPC-TU 2).

9.2 VINYL AND CHLORINATED RUBBER COATINGS: Vinyls and chlorinated rubber coatings shall be applied by spray, with application by brush limited to small areas and touch-up (see Note 13.19). When brushing, application shall be made with a minimum of brush strokes to avoid lifting or softening of undercoats.

9.3 BITUMINOUS COATINGS: Application methods for bituminous coatings vary greatly with the type of formulation used. These are fully described in SSPC-PA 1 and summarized below. For additional information, refer to SSPC-Paints 12, 32, and 33.

9.3.1 Thin Film (<500µm/20 mils) Bituminous Coating of Low Viscosity: These coatings shall be applied in the same manner as conventional coatings.

9.3.2 Cold-Applied Bituminous Mastic (Extra Thick Film): These coatings shall be applied by brush, troweling, or spraying with a heavy-duty pump.

9.3.3 Bituminous Emulsion Coatings: These coatings (e.g., SSPC-Paint 32) shall be applied by brush, trowel, or spray.

9.3.4 Coal Tar Primer and Enamel Coatings: These coatings shall be applied in accordance with the requirements of AWWA C-203, unless otherwise specified.

9.4 POLYURETHANE AND POLYUREA COATINGS: Since polyurethane and polyurea coatings are sensitive to moisture, their exposure to moisture should be limited as much as possible before, during, and immediately after application (see Note 13.20). In the case of moisture-curing urethanes, follow manufacturer's written instructions regarding exposure to moisture. Because of their extremely rapid dry time, polyurea coatings must be applied using plural component spray equipment.

9.5 LATEX COATINGS

9.5.1 A latex primer shall not be applied at a temperature below 10°C (50°F) or above 49°C (120°F) unless specifically recommended by the manufacturer.

9.5.2 Stored latex coating shall not be allowed to reach a temperature of 49°C (120°F) or be subjected to repeated freezing and thawing.

10. Drying/Curing of Applied Coating

10.1 No coating shall be applied until the preceding coat has dried/cured to the extent recommended by the manufacturer (see Notes 13.21 and 13.22). A coating shall not be applied to a dried coating that has exceeded the "maximum time to recoat" recommended by the manufacturer (see Note 13.23).

10.2 No coating shall be force-dried in a manner that will cause checking, wrinkling, blistering, formation of pores, or otherwise adversely affect the appearance or the protective properties of the coating.

10.3 Coated concrete shall be protected from all detrimental effects and materials, such as rain, condensation, contamination, snow, and freezing, until drying/curing has occurred to the extent that no damage will occur to the protective film.

10.4 No coating shall be subjected to immersion conditions until it is thoroughly dried/cured in accordance with manufacturer's written instructions.

11. Inspection

8.1 Unless otherwise specified in the procurement documents, the contractor or material supplier is responsible for quality control to assure that the requirements of this document are met. Work and materials supplied under this standard are also subject to inspection by the purchaser or an authorized representative. Materials and work areas shall be accessible to the inspector.

8.2 Conditions not complying with this standard shall be corrected. In the case of a dispute, an arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then a procedure mutually agreeable to purchaser and material supplier (or contractor) shall be used.

12. Disclaimer

12.1 While every precaution is taken to ensure that all information furnished in SSPC standards and specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility nor incur any obligation resulting from the use of any materials, coatings, or methods specified herein, or of the specification or standard itself.

12.2 This specification does not attempt to address problems concerning safety associated with its use. The user of this specification, as well as the user of all products or practices described herein, is responsible for instituting appropriate health and safety practices and for ensuring compliance with all governmental regulations.

13. Notes

Notes are not requirements of this specification.

13.1 Storage at temperatures between 10 and 32°C (50 and 90°F) is generally acceptable, unless otherwise stated by the manufacturer. 100-percent-solids coatings are more commonly stored between 21 and 32°C (70 and 90°F).

13.2 Power mixing will usually give better mixing in a much shorter time than mixing by hand. Some materials for coating concrete should not be mixed by hand and must be mixed with a power mixer.

13.3 Coatings to be applied by brush usually require no thinning. Some coatings may give the user the option of brush or spray application; however, the spray application option may require thinning of the coating. Thinning should be done slowly during the final mixing process, using the product recommended by the manufacturer.

13.4 The plastic sheet test (ASTM D 4263) is a simple test to indicate the presence of moisture in concrete. ASTM E 1907 and ASTM F 1869 provide actual moisture transmission rates. Moisture meters give only qualitative results but do so quickly. For some types of moisture meters, only the surface moisture is recorded unless nails are driven into the concrete.

13.5 The requirement that the concrete temperature fall within 10 C° (18 F°) of the surrounding air temperature is a

general caveat to prevent outgassing for rising temperatures and the detrimental curing or skinning of the coating being applied. Additionally, the concrete may still have a temperature below 0°C (32°F) when the air temperature is adequate for the coating application. This can develop condensation on the underside of the coating in which case it may not adhere to the concrete. This can be a particular problem with latex coatings. The exact temperatures will vary among manufacturers for the various formulations, but this can be used as a general rule of thumb.

Outgassing can be minimized by avoiding application when the surface temperature is rapidly rising.

13.6 Larger pores or “bug holes” may have to be fully opened to expose the interior before repairing prior to painting. SSPC-SP 13 provides additional information on preparing concrete surfaces for coating.

13.7 Coatings on concrete are generally applied by brush or spray. Either method is satisfactory if properly performed and the coating is formulated for the application method being used. The variations are slight and often overshadowed by variations in workmanship.

Brushing of primers has the advantage of working coating into cracks and crevices and other surface irregularities. It may create brush marks, however, with coatings having limited leveling.

Lacquer-type coatings, such as vinyls, may be applied by brush with considerable difficulty. The priming coat brushes on with the least difficulty and results in better adhesion to the surface than spraying. Finish coats of lacquer type coating tend to lift underlying coats by solvent action and brushing combined; for this reason such finish coatings are best applied by spraying.

With many types of coatings, properly used high-pressure spray methods can result in a thicker, less permeable film. Spray operators must be properly selected and trained. Careful supervision and inspection are necessary with the various spray application methods to insure against such imperfections as dirty surfaces, dry spray, pinholes, holidays, missed areas, blind spots, contamination of coating or air, wind loss, or excessive outdoor overspray.

Several advantages are possible with the various high-pressure airless methods of coating application, both hot and cold spray. These include labor savings because of reduced application time and a greater thickness per coat. Additional savings also can be traced to less flowback, less overspray, power (compressor) savings, use of higher solids in coating formulations, and less sensitivity to changes in ambient temperature during application.

13.8 BELOW-GRADE CONCRETE

13.8.1 New Construction: Concrete slabs and walls at or below grade to be internally coated with relatively impervious

systems should receive a moisture barrier such as a sheet membrane on the side of the concrete in contact with the soil or rock. Use of penetrating waterproofing systems may be helpful.

13.8.2 Existing Structures: Concrete slabs and walls at or below grade that do not have an effective vapor barrier in place are generally not acceptable substrates over which to apply impervious coating systems. Moisture testing in accordance with ASTM E 1907 should be conducted to determine specific suitability for manufacturer acceptance.

13.9 PRE-SURFACE PREPARATION

13.9.1 The soundness (surface tensile strength) of the concrete surface should be tested prior to cleaning for coating for conformance to project specification requirements (see ASTM D 4541; ACI 503R, Appendix A; and Note 13.24). All structural concrete members should be inspected by a professional engineer or authorized project quality control personnel prior to coating to avoid masking any structural defects or deficiencies.

13.9.2 Prior to actual surface preparation of concrete for coating, surface conditions and irregularities must be addressed. All projections, cracks, and other surface irregularities should be repaired before cleaning (see SSPC-SP 13 and ACI 224.1R) to meet project specification requirements and to permit application of protective coatings.

13.9.3 Many coating manufacturers recommend a moisture emission rate of less than 15 g/m² (3.0 lb/1000 ft²) per 24 hours as measured in accordance with ASTM E 1907.

13.9.4 Generally, all efflorescence and laitance should be removed from the concrete surface by mechanical surface preparation (see SSPC-SP 13). The surface should be repaired as necessary to permit good primer adhesion. Some coatings do not require the removal of “all” laitance.

13.10 SURFACE PREPARATION

13.10.1 The concrete surface should be cleaned as specified in the procurement documents to remove form release agents, curing agents, dirt, grease, and other deleterious contaminants. In the event that no cleaning has been specified, the surface preparation should be no less than the coating manufacturer’s recommendations for the intended service environment. High pressure water cleaning and waterjetting (SSPC-SP 12) are often used to clean concrete (see SSPC-SP 13 for surface preparation alternatives).

13.10.2 The surface of the bare concrete should be roughened to the profile recommended by the manufacturer of the primer. (ICRI Guide No. 03732 provides information on

the proper concrete profile for different coating thickness and how to obtain the profile.)

13.11 New concrete generally requires a minimum of 28 days curing time unless both parties agree to a lesser time. Additives, admixtures, type of cement, sand, and aggregate can influence shrinkage and may require a longer cure time. During this period, most of the shrinkage cracks occur. Certain coatings, however, are designed to be applied over “damp” or “green” concrete and can be used as curing membranes

13.12 With roller application of coating on concrete, high production rates approaching that of conventional spraying may be possible. The method works best on large smooth areas such as tanks or walls. Difficulties may be encountered when coating rough spots, pits, edges, corners, etc. to ensure that adequate coating is applied. Supplementary brush coating is mandatory for those areas on concrete, even though special rollers for these areas are available for general work. The requirements are generally the same as for brush and spray coating. Excellent results have been achieved, and it is possible to build up specified film thicknesses by this method. Roller coating is particularly useful where spraying cannot be undertaken due to the hazards from overspray or the flammability of solvent.

13.13 Except for plural component spray, the trigger of the gun should be released at the end of each stroke. There is a possibility that the mix ratio in the initial discharge from a plural component spray may not be correct.

13.14 High-volume low-pressure spray has a high transfer efficiency and can be used where other equipment with lower transfer efficiency is not permitted, as well as under less restrictive conditions.

13.15 Loose, cracked, or brittle coating can usually be removed by moderate pressure with a dull putty knife.

13.16 The bond strength of the coating to the concrete should be measured in accordance with ASTM D 4541 or ACI 503R, Appendix A. These methods will require patching of damaged coating and may require patching of concrete.

13.17 A convenient field test for coating compatibility is ASTM D 5064.

13.18 In all cases, coatings applied to concrete must be compatible with the alkali normally present on concrete. SSPC-TU 2 provides data on the chemical and physical properties of commonly used generic types of coatings.

13.19 Lacquers, such as vinyls and chlorinated rubbers, are not used much today because of their high VOC content

13.20 SSPC-PS Guide 17.00 provides additional information on polyurethane coatings.

13.21 Application of coating before the preceding coat has dried/cured may result in such adverse effects as lifting, wrinkling, or loss of adhesion of undercoats.

13.22 If the maximum time for topcoating is exceeded, the undercoat will require complete removal or a special surface treatment, such as light sanding, as recommended by the coating manufacturer.

13.23 Suitable test methods to determine the extent of curing include solvent rub (ASTM D 5402), pencil hardness (ASTM D 3363), Barcol hardness (ASTM D 2583) for thick film coatings, or the durometer test (ASTM D 2240).

13.24 “The Inspection of Coatings and Linings, A Handbook of Basic Practice for Inspectors, Owners, and Specifiers” (SSPC publication 97-07) provides information on testing of concrete for soundness. Information on the inspection of concrete and coatings on concrete can be found in “The Inspection of Coatings and Linings.”

