Specification for Bonding to Concrete Using Multi-Component Epoxy Adhesive

An ACI Standard
Reported by ACI Committee 548

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This Specification describes bonding fresh concrete, hardened concrete, steel, and other materials to hardened concrete with a multi-component epoxy adhesive as defined for this purpose in ASTM C881/C881M. Included are controls for adhesive labeling; storage; handling; surface evaluation and preparation; mixing and application; and inspection, safety, quality control, and testing.

Keywords: adhesive; bond; construction; epoxy; epoxy resin; fresh concrete; quality control; repair; safety; surface.

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SECTION 1—GENERAL REQUIREMENTS

1.1—Scope

1.1.1 This Specification covers the use of multi-component epoxy adhesives, meeting the requirements of ASTM C881/C881M for bonding of materials to hardened concrete as specified in 2.1.1 and 3.1.1.

1.1.2 This Specification is incorporated by Contract Documents and provides requirements for the Contractor.

1.1.3 This Specification governs for construction within its scope, except project-specific Contract Documents govern if there is a conflict.
1.1.4 This Specification governs if there is a conflict with reference standards and testing standards.

1.1.5 Contractor is permitted to submit written alternatives to any provision in this Specification for consideration.

1.1.6 Ignore provisions of this specification that are not applicable to the Work.

1.1.7 Values in this Specification are stated in inch-pound units. A companion specification in SI units is also available.

1.1.8 The Notes to Specifier are not part of this Specification.

1.2—Interpretation

1.2.1 Unless otherwise explicitly stated, this Specification shall be interpreted using the following principles.

1.2.1.1 Interpret this Specification consistent with the plain meaning of the words and terms used.

1.2.1.2 Definitions provided in this Specification govern over the definitions of the same or similar words or terms found elsewhere.

1.2.1.3 Whenever possible, interpret this Specification so that its provisions are in harmony and do not conflict.

1.2.1.4 Headings are part of this Specification and are intended to identify the scope of the provisions or sections that follow. If there is a difference in meaning or implication between the text of a provision and a heading, the meaning in the text governs.
1.2.1.5 Where a provision of this Specification involves two or more items, conditions, requirements, or events connected by the conjunctions “and” or “or,” interpret the conjunction as follows:

“and” indicates that all of the connected items, conditions, requirements, or events apply.

“or” indicates that the connected items, conditions, requirements, or events apply singularly.

1.2.1.6 The use of the verbs “may” or “will” indicates that the Specification provision is for information to the Contractor.

1.2.1.7 The phrase “as indicated in Contract Documents” means the specifier included the provision requirements in the Contract Documents.

1.2.1.8 The phrase “unless otherwise specified” means the specifier may have included an alternative to the default requirement in the Contract Documents.

1.2.1.9 The phrase “if specified” means the specifier may have included a requirement in the Contract Documents for which there is no default requirement in this Specification.

1.3—Definitions

The following definitions shall govern in this Specification.

accepted—determined by the Architect/Engineer to be in compliance with Contract Documents.

Architect/Engineer—the architect, engineer, architectural firm, or engineering firm issuing Contract Documents or administering the Work under Contract Documents, or both.

bond interface—the plane formed by an adhesive between two adjacent materials.

continuous metering and mixing—the process in which two adhesive components are continuously metered into and discharged from a mixing chamber.
Contract Documents—set of documents that form the basis of a contractual relationship between an Owner and constructor or design-builder. These documents are defined by the contractual agreement, and contain contract forms, contraction conditions, specifications, drawings, addenda, and contract changes.

Contractor—the person, firm, or entity under contract for construction of Work.

drawings—graphic representations that detail requirements for Work and may include written notes.

epoxy—a thermosetting polymer that is the reaction product of epoxy resin and a hardener.

fresh concrete—concrete that possesses enough of its original workability so that it can be placed and consolidated by the intended methods.

inspection agency—the person, firm, or entity under contract for providing inspection services.

Owner—the corporation, association, partnership, individual, public body, or authority for whom Work is constructed.

permitted—accepted by or acceptable to Architect/Engineer, usually pertaining to a request by Contractor, or when specified in Contract Documents.

specifications—the written document that details requirements for the Work.

submit—provide to Architect/Engineer for review.

submittal—document or material provided to Architect/Engineer for review and acceptance.

testing agency—the person, firm, or entity under contract for providing testing services.

Work—the entire construction or separately identifiable parts thereof required to be furnished under Contract Documents.
1.4—Referenced standards

Standards cited in this Specification are listed by name and designation, including year.

1.4.1 ASTM International

ASTM C42/C42M-18a Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete


ASTM C1583/C1583M-13 Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)


1.4.2 International Concrete Repair Institute

ICRI 310.2R-2013 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

1.4.3 The Society for Protective Coatings

SSPC VIS 1-2002 Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning


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SSPC SP 6/NACE No. 3-2006  Surface Preparation Specification No. 6, Commercial Blast Cleaning

1.5—Submittals

1.5.1 Certifications—Submit manufacturer’s certification verifying conformance to material specifications and compatibility to bonding surfaces.

1.5.2 Application control—Submit mixing and application procedures for acceptance prior to use.

1.5.3 Data—Submit technical data sheets and safety data sheets.

1.5.4 Additional testing—Submit additional test results if specified.

1.6—Delivery, storage, and handling

1.6.1 Delivery of materials—Deliver materials in sealed containers with labels legible and intact.

1.6.2 Labeling—Only use materials that are marked with the following information:

   a) Name of manufacturer

   b) Manufacturer’s product identification

   c) Manufacturer’s instructions for mixing

   d) Warning for handling and toxicity

   e) Expiration date and lot number

1.6.3 Storage of materials—Store materials at temperatures between 40 and 100°F, unless otherwise specified.
1.6.4 *Handling of materials*—Handle materials to avoid breaking container seals and in accordance with the manufacturer’s Safety Data Sheet and manufacturer’s recommendations.

1.7—Project conditions

1.7.1 *Environmental requirements*—Comply with manufacturer’s recommendations regarding environmental conditions under which the adhesive shall be applied, unless otherwise specified.

1.8—Quality control acceptance of work and subsequent quality assurance acceptance

1.8.1 *Metering accuracy*—If permitted, use equipment or tools for continuous (metering) or batch proportioning for the two components of the multi-component epoxy adhesive that are able to establish and maintain a ratio of the components within the tolerance specified by the manufacturer of the multi-component epoxy adhesive over the full range of operating pressures and temperatures. If the manufacturer of the epoxy adhesive does not specify a tolerance for the mixture ratio, maintain a mixture ratio within ±5 percent of the nominal mixture ratio specified by the manufacturer of the epoxy adhesive.

1.8.2 *Qualification test for metering accuracy*

1.8.2.1 When a continuous metering and mixing pump is required, test the metering accuracy of equipment before the start of the Work to demonstrate that the pump is capable of maintaining the ratio within the tolerances required in 1.8.1.

1.8.2.1.a The device used to measure metering accuracy shall be capable of controlling the discharge pressure of each of the components separately as they are simultaneously discharged into separate containers.
1.8.2.1.b Conduct test by discharging both adhesive components simultaneously into separate containers while maintaining discharge pressure on both components at anticipated discharge pressure.

1.8.2.1.c Discharge each component into separate graduated containers or into containers that can be weighed. A minimum of 7 fl oz of the larger volume component is required for an adequate ratio determination. If the ratio determination is made by mass, the volumetric ratio may be determined by calculation using the specific gravity of each component. The volumetric ratio is determined by multiplying the mass ratio by the inverse of the ratio of the specific gravities of the components.

1.8.2.2 When a prepackaged cartridge system is used, only use a dispensing tool approved by the multi-component epoxy adhesive manufacturer.

SECTION 2—BONDING HARDENED CONCRETE, STEEL, AND OTHER MATERIALS TO HARDENED CONCRETE

PART 2.1—GENERAL

2.1.1 Scope

2.1.1.1 This specification covers the bonding of hardened concrete, steel, and other materials to hardened concrete with a multi-component epoxy adhesive. This specification does not apply to anchoring dowels or adhesively bonded anchors in concrete. This specification does not apply to bonding carbon or glass fabric or composites to concrete.
PART 2.2—PRODUCTS

2.2.1 Materials

2.2.1.1 Multi-component epoxy adhesive—Use ASTM C881/C881M Type IV for load-bearing applications or Type I for non-load-bearing applications, unless otherwise specified. Curing temperature requirements (Class) shall be determined by supplier and Contractor based on specified project conditions. Use Grade 2 (medium viscosity) or Grade 3 (nonsag) for bonding horizontal or vertical mating surfaces. Use Grade 3 for overhead and for nonmating surfaces.

2.2.1.2 Fillers—If permitted, fillers may be used to thicken the multi-component epoxy adhesive or provide additional inert mass to fill voids. Use of fillers, both in composition and amount, must be approved by the multi-component epoxy adhesive manufacturer. Manufacturer must provide test results verifying the mixture of the multi-component epoxy adhesive combined with the specified amount of filler meets performance requirements.

PART 2.3—EXECUTION

2.3.1 Preparation

2.3.1.1 Preparation of concrete surfaces

2.3.1.1.a Concrete surfaces to which epoxies are to be applied shall be newly prepared concrete free of loose and unsound materials. Prepare surfaces to ICRI 310.2R concrete surface profile as indicated in Contract Documents by blast-cleaning or scarifying, unless otherwise specified.

2.3.1.1.b Minimize exposure to silica and concrete dust in accordance with regulations. Common methods to reduce exposure to dust include use of water on the surface during preparation, dust filters on equipment, exhaust ventilation, and personal protective equipment.
2.3.1.1.c Remove and dispose of residue material resulting from surface preparation in accordance with state and local regulations.

2.3.1.2 Preparation of carbon steel surfaces

2.3.1.2.a Prior to blast-cleaning, clean surfaces according to SSPC SP 1, SP 2, and SP 3, as required.

2.3.1.2.b Blast-clean carbon steel surfaces using SSPC SP 6/NACE No. 3 to provide a surface condition corresponding to ASa2, BSa2, and CSa2 of SSPC VIS 1, depending on the initial surface condition of the steel surface. Use sand abrasive media, unless otherwise specified.

2.3.1.2.c Remove blast-cleaning residue with compressed air from an oil- and water-free compressed air source or by vacuuming.

2.3.1.3 Preparation of galvanized steel surfaces

2.3.1.3.a Scrub galvanized steel surfaces thoroughly in accordance with SSPC SP 1.

2.3.1.3.b For galvanized steel surfaces showing signs of subsurface corrosion, blast-clean as specified in 2.3.1.2 for carbon steel.

2.3.1.4 Preparation of aluminum surfaces

2.3.1.4.a Scrub aluminum surfaces thoroughly with a nonchlorinated cleaner and then etch with proprietary chromate treatment in strict compliance with manufacturer’s application instructions and safety warnings.

2.3.1.4.b After etching, wash surface with distilled water and then dry thoroughly.

2.3.1.5 Preparation of copper and copper-alloy surfaces

2.3.1.5.a Blast-clean copper and copper-alloy surfaces as specified in 2.3.1.2 for carbon steel.

2.3.1.5.b Where blast-cleaning is not practicable, clean the copper or copper-alloy surfaces with aqueous household ammonia, wash surfaces with distilled water, and then dry thoroughly.
### 2.3.1.6 Preparation of wood surfaces

**2.3.1.6.a** Clean wood surfaces of all visible loose or foreign particles or contaminants by sanding.

Remove sanding or filling dust by wiping with an alcohol-soaked rag, or clean with oil-and-water-free compressed air.

**2.3.1.6.b** Ensure moisture content of wood is within tolerances required by the multi-component epoxy adhesive manufacturer.

### 2.3.2 Inspection and testing

#### 2.3.2.1 Inspection of concrete surfaces

**2.3.2.1.a** Inspect all concrete surfaces prior to application of epoxy adhesive.

**2.3.2.1.b** Surfaces shall be free of deleterious materials including laitance, curing compounds, dust, dirt, oil, and other material that may prevent bonding. Materials resulting from surface preparation shall be removed.

**2.3.2.1.c** At the time of installation, surface temperature of the concrete shall be within the limits recommended by the adhesive manufacturer. Additionally, surface temperature for ASTM C881/C881M Classes A and B multi-component epoxy adhesives shall be at least 40°F to permit wetting of concrete surface by adhesive, unless otherwise specified; for ASTM C881/C881M Class C multi-component epoxy adhesives, the surface temperature shall be at least 60°F.

**2.3.2.1.d** Evaluate moisture content of concrete in accordance with ASTM D4263, except a 4 ft by 4 ft polyethylene sheet shall be used. Do not apply epoxy adhesive until the test results indicate no moisture within the epoxy curing time period, as reported by the manufacturer for the environmental conditions anticipated.

#### 2.3.2.2 Inspection of metal surfaces

**2.3.2.2.a** Inspect all metal surfaces prior to application of epoxy adhesive.

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2.3.2.2. Metal surfaces shall be dry, sound, and free of loose material.
2.3.2.2.c At the time of installation, surface temperature of the metal shall be within the limits recommended by the adhesive manufacturer.

2.3.2.3 Inspection of wood surfaces
2.3.2.3.a Inspect all wood surfaces prior to application of epoxy adhesive.
2.3.2.3.b Wood surfaces shall be sound and free of loose material. Moisture content of the wood shall be within limits recommended by the manufacturer.
2.3.2.3.c At the time of installation, temperature of the wood shall be within the limits recommended by the adhesive manufacturer.

2.3.2.4 Testing of concrete and metal surfaces
2.3.2.4.a Concrete surfaces shall have an average pull-off strength of at least 250 psi based on the average three tests at each location when tested in accordance with ASTM C1583/C1583M, as indicated in Contract Documents. Test locations shall represent no greater than 500 yd$^2$ of prepared surface.
2.3.2.4.b If specified, metal surfaces shall be tested in accordance with ASTM D4541 for adhesion with the multi-component epoxy adhesive at the anticipated environmental condition during application.

2.3.3 Adhesive mixtures
2.3.3.1 Mix epoxy components in accordance with manufacturer’s recommendations.
2.3.3.2 Condition epoxy components to a temperature consistent with manufacturer’s recommendations.
2.3.3.3 Blend epoxy components to a uniform and homogeneous mixture.

2.3.4—Adhesive application
2.3.4.1 Apply epoxy adhesive to concrete surface by brush, roller, broom, squeegee, or spray equipment. The application method should not entrap air. Apply epoxy adhesive at a thickness sufficient to fill, with slight excess, the gap between the substrate and the element to be bonded. Do not exceed the manufacturer’s thickness recommendations. Protect concrete surfaces against spillage beyond limits of surface receiving adhesive.

2.3.4.2 Fasten or shore elements to be bonded when movement is likely to occur, such as elements on sloping, vertical, or overhead positions. Shoring and bracing elements should not induce deflections that may cause the elements to debond when removed.

2.3.4.3 Apply epoxy adhesive and position elements to be bonded within the contact time of the epoxy adhesive as recommended by the manufacturer. If epoxy compound cures to the extent of losing its tack before elements are in contact with the adhesive, follow the manufacturer’s recommendations with respect to removing or slightly abrading the first coat and applying a second coat.

2.3.4.4 Do not disturb elements being bonded until the adhesive has cured in accordance with manufacturer’s recommendations for the environmental conditions.

2.3.5 Cleanup

2.3.5.1 Remove any epoxy adhesive applied or spilled beyond desired areas. Perform cleanup with material designated by epoxy adhesive manufacturer. Avoid contamination of work area.

2.3.5.2 Unused materials shall be disposed in accordance with manufacturer’s recommendations and state and local regulations.

2.3.6 Safety

2.3.6.1 Advise applicators to avoid contacting epoxy compounds with eyes and skin, inhalation of vapors, and ingestion. Make protective and safety equipment available on site. Refer to safety
data sheets and heed all label warnings by manufacturer. Minimize exposure to dust as stated in

2.3.1.1.b.

2.3.7—Field quality performance requirements

2.3.7.1 Architect/Engineer will evaluate bonding to existing concrete after the multi-component epoxy adhesive has cured in accordance with the manufacturer’s recommendations for the environmental conditions.

2.3.7.2 Suspect areas shall be tested for adhesion or by coring as appropriate, unless otherwise specified. Adhesion shall be performed in accordance with ASTM C1583/C1583M and shall penetrate the bonded area. Coring shall be performed in accordance with ASTM C42/C42M and shall include as much bond interface as possible. Core diameter shall be minimum 4 in. nominal diameter and length of cores shall be twice the core diameter, unless otherwise specified.

2.3.7.3 Cores shall be visually inspected and further testing, if required, will be determined by Architect/Engineer.

SECTION 3—BONDING FRESH CONCRETE TO HARDENED CONCRETE

PART 3.1—GENERAL

3.1.1 Scope

3.1.1.1 This Specification covers the bonding of fresh concrete to hardened concrete with a multi-component epoxy adhesive as indicated in Contract Documents.

PART 3.2—PRODUCTS

3.2.1 Materials
3.2.1.1 Multi-component epoxy adhesive—Use ASTM C881/C881M Type II for non-load-bearing or Type V for load-bearing applications, unless otherwise specified. Curing temperature requirements (class) and viscosity (grade) shall be determined by supplier and Contractor based on specified project conditions.

3.2.1.2 Fresh concrete—As indicated in Contract Documents.

3.2.1.2 Fillers—If specified, fillers may be used to thicken the multi-component epoxy adhesive. Use of fillers, both in composition and amount, must be approved by the multi-component epoxy adhesive manufacturer. Manufacturer must provide test results verifying the mixture of the multi-component epoxy adhesive combined with the specified amount of filler meets performance requirements.

PART 3.3—EXECUTION

3.3.1 Preparation

3.3.1.1—Preparation of concrete surfaces

3.3.1.1.a Concrete surfaces to which epoxies are to be applied shall be newly prepared concrete free of loose and unsound materials. Prepare surfaces to ICRI 310.2R concrete surface profile as indicated in Contract Documents by blast-cleaning or scarifying, unless otherwise specified.

3.3.1.1.b Minimize exposure to silica and concrete dust in accordance with regulations. Common methods to reduce exposure to dust include use of water on the surface during preparation, dust filters on equipment, exhaust ventilation, and personal protective equipment.

3.3.2 Inspection

3.3.2.1 Inspect concrete surfaces prior to application of adhesive.
3.3.2.2 Surfaces shall be free of deleterious materials including laitance, curing compounds, dust, dirt, oil, and other material that may prevent bonding. Materials resulting from surface preparation shall be removed.

3.3.2.3 Concrete surfaces shall have a moisture content not exceeding saturated surface-dry condition.

3.3.2.4 At the time of installation, surface temperature of the concrete shall be within the limits of recommended by the adhesive manufacturer. Additionally, surface temperature for ASTM C881/C881M Classes A and B multi-component epoxy adhesives shall be at least 40°F to permit wetting of concrete surface by adhesive, unless otherwise specified; for ASTM C881/C881M Class C multi-component epoxy adhesives, the surface temperature shall be at least 60°F.

3.3.2.5 Concrete surfaces shall have an average pull-off strength of at least 250 psi based on three tests at each location when tested in accordance with ASTM C1583/C1583M, as indicated in Contract Documents. Test locations shall represent no greater than 500 yd² of prepared surface.

3.3.3 Adhesive mixtures

3.3.3.1 Mix epoxy components in accordance with manufacturer’s recommendations.

3.3.3.2 Condition epoxy components to a temperature consistent with manufacturer’s recommendations.

3.3.3.3 Blend epoxy components to a uniform and homogeneous mixture.

3.3.4 Adhesive application and concrete placement

3.3.4.1 Do not apply adhesive if ambient temperature and hardened concrete temperature are not within the adhesive manufacturer’s allowable range. Placement of fresh concrete shall conform to ambient temperature requirements as indicated in Contract Documents.
3.3.4.2 Apply adhesive to concrete surface by brush, roller, broom, squeegee, or spray equipment. Apply adhesive at a thickness recommended by manufacturer.

3.3.4.3 Place fresh concrete while adhesive is still tacky. If the adhesive cures to the extent of losing its tack before fresh concrete is placed, remove or abrade first coat and apply a second coat.

3.3.4.4 Consolidate freshly placed fresh concrete as indicated in Contract Documents.

3.3.4.5 Upon completion of finishing operations, cure concrete as indicated in Contract Documents.

3.3.5 Cleanup

3.3.5.1 Protect concrete surfaces beyond limits of surface receiving adhesive against spillage.

3.3.5.2 Remove any adhesive applied or spilled beyond desired areas. Perform cleanup with material designated by adhesive manufacturer. Avoid contamination of work area.

3.3.5.3 Unused materials shall be disposed in accordance with manufacturer’s recommendations and applicable regulations.

3.3.6 Safety

3.3.6.1 Advise applicators to avoid contacting adhesive with eyes and skin, inhalation of vapors, and ingestion. Make protective and safety equipment available on site. Refer to material safety data sheets and heed label warnings by manufacturer.

3.3.7 Field quality performance requirements

3.3.7.1 Architect/Engineer will evaluate bonding of fresh concrete to existing concrete after the fresh concrete has cured for at least 28 days.

3.3.7.2 The evaluation will be performed by sounding in accordance with ASTM D4580/D4580M, unless otherwise specified.
3.3.7.3 Detection of a hollow sound or other indication of delamination in any area shall be reason to suspect inadequate bonding. Contractor shall core suspected area, as requested by Architect/Engineer, to determine bonding adequacy.

3.3.7.4 Coring shall be performed in accordance with ASTM C42/C42M and shall penetrate through the new concrete and into the existing concrete. Core diameter shall be minimum 4 in. nominal diameter, unless otherwise specified. Length of cores shall be twice the core diameter, or twice the thickness of new concrete.

3.3.7.5 Cores shall be visually inspected and further testing, if required, will be determined by Architect/Engineer.

NOTES TO SPECIFIER

General notes

G1. ACI Specification 548.13-19 is to be used by reference or incorporation in its entirety in the Project Specification. Do not copy individual sections, parts, articles, or paragraphs into the Project Specification, because taking them out of context may change their meaning.

G2. If Parts or Parts of ACI Specification 548.13-19 are copied into the Project Specification or any other document, do not refer to them as an ACI Specification because the Specification has been altered.

G3. A statement such as the following will serve to make ACI Specification 548.13-19 a part of the Project Specification:

“Work on (Project Title) shall conform to all requirements of ACI Specification 548.13-19, “Specification for Crack Repair by Epoxy Injection,” published by the American Concrete Institute, Farmington Hills, Michigan, except as modified by these Contract Documents.”

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4. Each technical Part of ACI Specification 548.13-19 is written in the three-part section format of the Construction Specifications Institute, as adapted for ACI requirements. The language is imperative and terse.

5. If ACI Specification 548.13-19 is used with another ACI specification that contains overlapping provision, identify which requirements are in conflict and state in the Contract Documents which requirements control.

Foreword to Checklists

F1. This Foreword is included for explanatory purposes only; it does not form a part of ACI Specification 548.13-19.

F2. ACI Specification 548.13-19 may be referenced by the Specifier in the Project Specification for any building project, together with supplementary requirements for the specific project. Responsibilities for project participants must be defined in the Project Specification. ACI Specification 548.13-19 cannot and does not address responsibilities for any project participant other than the Contractor.


F4. The Mandatory Requirements Checklist indicates work requirements regarding specific qualities, procedures, materials, and performance criteria that are not defined in ACI Specification 548.13-19. The Specifier must include these requirements in the Project Specification.

F5. The Optional Requirements Checklist identifies Specifier choices and alternatives. The checklists identify the Parts, and Articles of ACI Specification 548.13-19 and the action required or available to the Specifier. The Specifier should review each of the items in the checklist and make
adjustments to the needs of a particular project by including those selected alternatives as mandatory requirements in the Project Specification.

**F6.** Recommended references—Documents and publications that are referenced in the Checklists of ACI Specification 548.13-19 are listed. These references provide guidance to the Specifier and are not considered to be part of ACI Specification 548.13-19.

7  *ASTM International*

8  ASTM D4258-05(2017)  Standard Practice for Surface Cleaning Concrete for Coating


11  *International Concrete Repair Institute*

12  ICRI 310.2R-2013  Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

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**MANDATORY REQUIREMENTS CHECKLIST**

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<th>Part/Article</th>
<th>Notes to Specifiers</th>
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<tr>
<td>1.1.1</td>
<td>Specify specific scope of work.</td>
</tr>
<tr>
<td>2.3.1.1.1</td>
<td>Specify limitations, if any, on use of mechanical abrasion. Specify which ICRI 310.2R chip face is acceptable.</td>
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<tr>
<td>2.3.2.3.1</td>
<td>Specify number and frequency of testing and minimum strength. If the test results are not in failure of the concrete but in cohesion of the epoxy resin adhesive, or any failure</td>
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</table>
in adhesion, the test shall be repeated. Repeated failures in adhesion, or cohesion in the adhesive, indicate improper cleaning of the concrete, incorrect adhesive, or faulty adhesive application techniques.

### 3.2.1.2
Specify concrete requirements.

### 3.3.1.1
Specify limitations, if any, on use of mechanical abrasion. Specify which ICRI 310.2R chip face is acceptable.

### 3.3.2.5
Specify number and frequency of testing and minimum strength. If the test results are not in failure of the concrete but in cohesion of the epoxy resin adhesive, or any failure in adhesion, the test shall be repeated. Repeated failures in adhesion, or cohesion in the adhesive, indicate improper cleaning of the concrete, incorrect adhesive, or faulty adhesive application techniques.

### 3.3.4.1
Specify ambient temperature requirements for concrete placement.

### 3.3.4.4
Specify concrete consolidation requirements.

### 3.3.4.5
Specify concrete cure requirements.

#### OPTIONAL REQUIREMENTS CHECKLIST

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<th>Notes to Specifiers</th>
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<tr>
<td>1.5.4</td>
<td>Identify additional required testing.</td>
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<tr>
<td>1.6.3</td>
<td>Specify storage temperature as epoxy components are affected by temperature.</td>
</tr>
<tr>
<td>1.7.1</td>
<td>Specify any project conditions that would specifically affect this work.</td>
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</table>
Performance of epoxy systems may be affected by temperature, humidity, and surface water. Strict adherence to the manufacturer’s recommendations should be maintained. Where other unusual conditions are encountered, the material manufacturer should be consulted before application.

2.2.1.1 Specify class and grade of epoxy. Specify additional or alternative performance requirements, acceptable suppliers, or both.

2.3.1.1.1 Specify alternate methods for preparing surfaces, such as in accordance with other methods in ICRI 310.2R, ASTM D4258, or ASTM D4259.

2.3.1.2.2 Specify if alternative abrasive material, such as grit or shot, is required.

2.3.7.2 Specify if field quality testing is required and type of testing. If coring, specify core size.

3.2.1.1 Specify class and grade of epoxy. Specify additional or alternative performance requirements, acceptable suppliers, or both.

3.3.1.1.1 Specify alternate methods for preparing surfaces, such as in accordance with other methods in ICRI 310.2R, ASTM D4258, or ASTM D4259.

3.3.2.4 Some epoxy adhesives may be capable of wetting the concrete surface at temperatures below 40°F. The specification should allow such use only if test data is available that conclusively demonstrates adequate bond at the actual concrete temperature expected.

3.3.7.4 Specify alternate diameter of cores to be obtained. Minimum 4 in. nominal diameter cores are recommended for testing. Nominal 2 in. cores may be adequate if they are only used for visual inspection.