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Standard Practice for Liquid and Gelled Acid Etching of Concrete[1]

This standard is issued under the fixed designation D4260; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers surface preparation of concrete to prepare the surface prior to the application of coatings.

1.2 This practice is intended to alter the surface profile of the concrete and to remove foreign materials and weak surface laitance.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4258 Practice for Surface Cleaning Concrete for Coating

D4259 Practice for Abrading 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

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

2.2 *Other Standard:*

ACI-308 Guide to Curing Concrete[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *gelled acid, n*—acid solution primarily intended for use on horizontal, vertical, and overhead surfaces.

3.1.2 *liquid acid, n*—acid solution primarily intended for use on horizontal surfaces.

4. Summary of Practice

4.1 This practice is intended to provide a clean, contamination-free, and roughened surface.

4.2 Acceptable surfaces shall be free of laitance, form release agents, curing agents, oil, grease, and other penetrating contaminants. The surface shall be free of fins, projections, and loosely adhering concrete, dirt, and dust particles.

4.3 For some applications, a minimum concrete surface strength may be required for proper coating performance.

5. Significance and Use

5.1 This practice is used to prepare concrete for coatings where optimum bond is desired for service conditions such as continuous or intermittent immersion, temperature cycling, or mechanical loading.

6. Hazards

6.1 New concrete shall be cured in accordance with ACI-308.

6.2 Concrete cure compounds, form release materials, or concrete hardeners may require abrading, in accordance with Practice D4259, as acid etching may not be effective.

6.3 All oil and grease shall be removed in accordance with Practice D4258 prior to mechanical abrading, abrasive blast cleaning, water blasting, or acid etching.

6.4 Use and disposal of materials should conform to established federal, state, local, and project requirements.

METHOD A

7. Liquid Acid Etching Procedure

7.1 *Pre-Surface Preparation:*

7.1.1 Remove grease, oil, and other penetrating contaminants (see Practice D4258).

7.1.2 Remove fins and protruding surface irregularities by mechanical means.

7.1.3 Surfaces shall be free of standing water.

7.1.4 Some curing compounds may not be removed by liquid acid etching and will require preparation by mechanical abrading, abrasive blasting, or water blasting in accordance with Practice D4259.

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[1] This practice is under the jurisdiction of ASTM Committee D33 on Protective Coating and Lining Work for Power Generation Facilities and is the direct responsibility of Subcommittee D33.05 on Application and Surface Preparation.

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

[3] Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, http://www.concrete.org.

7.1.5 When using liquid acid, proper cross ventilation and chemical respirators shall be provided.

7.2 *Suitable Surfaces:*

7.2.1 This method is primarily suited for use on horizontal surfaces.

7.2.2 Other methods of preparation may be more suitable for rough concrete surfaces and walls or overhead surfaces.

7.3 *Liquid Acid Etching Solutions:*

7.3.1 Typical solutions covered by this method are muriatic (hydrochloric), sulfamic, phosphoric and citric acids. Hydrochloric acid shall not be used where chlorides are prohibited.

7.3.2 The liquid acid concentrations of etching solutions may vary, depending on the concrete texture and degree of etching required.

7.3.3 The concrete surface shall be pre-wetted with water prior to applying etching solutions. Free-standing water shall be removed. Uniformly apply the etching solution to the wet surface. Polyethylene sprinkling cans are suitable for applying liquid acid solutions. Bubbling should be uniformly evident. If not, this indicates the presence of grease or oil contamination, or both, curing compounds or sealers, or a need to increase the concentration of the liquid acid solution. Scrub the liquid acid wetted surface with a stiff bristle brush.

7.3.4 When the etching solution bubbling begins to subside, flush surfaces to remove reaction products, and inspect for uniform roughening and removal of laitance. Repeat application of liquid acid solution to obtain required surface.

7.3.5 After the desired roughening is achieved, thoroughly flush the surface with potable water. Repeated flushing and scrubbing with a stiff-bristled brush may be necessary to remove acid residues.

7.4 *Appearance of Prepared Surface:*

7.4.1 The intent is to remove sufficient material in order to achieve a sound concrete surface free of laitance, glaze, efflorescence, and incompatible concrete curing compounds or form release agents.

7.4.2 The liquid acid etched surface shall be uniformly roughened to a degree similar in appearance to a medium to coarse grade sandpaper. A roughness standard may be established by mutual agreement.

METHOD B

8. Gelled Acid Etching Procedure

8.1 *Pre-Surface Preparation:*

8.1.1 Remove grease, oil, and other penetrating contaminants (see Practice D4258).

8.1.2 Remove fins and protruding surface irregularities by mechanical means.

8.1.3 Surfaces shall be free of standing water.

8.1.4 Some curing compounds may not be removed by gelled acid etching and will require preparation by mechanical abrading, abrasive blasting, or water blasting in accordance with Practice D4259.

8.1.5 When using gelled acid, proper cross ventilation and chemical respirators shall be provided.

8.2 *Suitable Surfaces:*

8.2.1 This method is suited for use on horizontal, vertical, and overhead surfaces.

8.2.2 Other means of preparation may be more suitable for rough concrete surfaces.

8.3 *Gelled Acid Etching Solutions:*

8.3.1 Typical solutions covered by this method are muriatic (hydrochloric), sulfamic, phosphoric and citric acids. Hhydrochloric acid shall not be used where chlorides are prohibited.

8.3.2 The gelled acid concentrations of etching solutions may vary depending on the concrete texture and the degree of etching required.

8.3.3 The concrete surface can be pre-wetted with water prior to applying etching solutions. Free-standing water shall be removed. Uniformly apply the etching solution to the wet surface using an acid resistant sprayer, non-metallic scrub brush, low-nap roller or squeegee. Bubbling should be uniformly evident. If not, this indicates the presence of grease or oil contamination or both curing compounds or sealers or a need to increase the concentration of the gelled acid solution. Scrubbing the gelled acid wetted surface with a stiff bristle brush will increase the depth of the surface profile and expose more of the gelled acid solution to the concrete surface.

8.3.4 When the etching solution bubbling begins to subside, flush surfaces to remove reaction products and inspect for uniform roughening and removal of laitance. Repeat application of gelled acid to obtain required surface profile.

8.3.5 After the desired roughening is achieved, thoroughly flush the surface with potable water. Repeated flushing and scrubbing with a stiff-bristled brush may be necessary to remove acid residues.

8.4 *Appearance of Prepared Surface:*

8.4.1 The intent is to uniformly remove sufficient material in order to achieve a sound concrete surface free of laitance, glaze, efflorescence, and incompatible concrete curing compounds or form release agents.

8.4.2 The gelled acid etched surface shall be uniformly roughened to a degree similar in appearance to a medium to coarse grade sandpaper. A roughness standard may be established by mutual agreement.

9. Inspection

9.1 Visually examine the prepared surface for loose adhering concrete, thin crusts bridging voids, fins, and projections.

9.2 Visually examine the prepared surface for oil, grease, and markings.

9.3 Test surfaces cleaned by liquid and gelled acid etching for pH in accordance with Test Method D4262 and may be tested for moisture content in accordance with Test Method D4263 prior to applying coating.

9.4 If required, surface strength may be determined in accordance with Method D4541 or other agreed upon method.

10. Acceptance

10.1 Acceptable surfaces shall be free of laitance, oil, grease, and other materials incompatible with the coating. The surface shall also be free of fins, projections, and loosely adhering concrete, dirt, and dust particles.

10.2 The surface shall have a roughened, textured appearance. Aggregate may be exposed. Bug holes shall be opened.

10.3 A roughness standard may be established by mutual agreement.

10.4 If specified, the treated surface shall meet the surface strength requirements.

11. Keywords

11.1 concrete; gelled; gelled acid etching; laitance; liquid; liquid acid etching; surface preparation; thixotropic; viscosity