



Designation: D5295/D5295M – 18

# Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems<sup>1</sup>

This standard is issued under the fixed designation D5295/D5295M; 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 provides recommendations for the preparation of concrete surfaces prior to the application of adhered (bonded) waterproofing.

1.2 This guide is directed primarily toward installations of new concrete, but is also applicable for existing concrete installations. (See also ACI 116 and ACI 546.)

1.3 This guide does not apply to loose laid systems, bentonite systems, lead, or the like.

1.4 This guide does not apply to applications involving insulating concrete.

1.5 This guide does not apply to applications involving lightweight structural concrete.

NOTE 1—Once installed, it is difficult to visually identify the difference between normal weight and lightweight concrete. It is recommended that a review of contract documents, concrete batch or delivery tickets or similar effort be performed to identify the concrete type.

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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

1.8 *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.*

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.22 on Waterproofing and Dampproofing Systems.

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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

D1079 Terminology Relating to Roofing and Waterproofing

D4258 Practice for Surface Cleaning Concrete for Coating

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

F2659 Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter

### 2.2 ACI Standards:<sup>3</sup>

ACI 116 Cement and Concrete Terminology

ACI 301 Specifications for Structural Concrete for Buildings

ACI 311 Guide to Inspection of Concrete

ACI 515 A Guide to the Use of Waterproofing, Dampproofing, Protective and Decorative Barrier Systems for Concrete

ACI 546 Repair of Concrete

### 2.3 ICRI Standard:<sup>4</sup>

ICRI Technical Guideline No. 310.2R (2013) Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

## 3. Significance and Use

3.1 The success of a waterproofing application depends on, among other things, the type, smoothness, and cleanliness of the concrete surface being coated. This guide describes conditioning or repairing of the concrete surface by the removal of other constructive modification of those surface defects that can affect the performance of the waterproofing system. It covers surface preparation by mechanical, chemical, and blast

<sup>2</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>3</sup> Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333.

<sup>4</sup> Available from International Concrete Repair Institute (ICRI), 10600 West Higgins Rd., Suite 607, Rosemont, IL 60018, [www.icri.org](http://www.icri.org).

cleaning methods in order to provide good adhesion between the waterproofing system and the concrete as well as the effect and control of various surface contaminants. It also addresses the evaluation of concrete moisture content to ensure optimal initial bond. (See also ACI 515.)

3.2 This guide is not intended to offer guidelines for the selection of a suitable waterproofing system; the use of specific application techniques; or the design and installation of flashing, terminations, expansion joint details, etc. (For definitions of terms, see Terminology **D1079**.)

3.3 This guide is not intended to offer guidelines for the control of water vapor drive through the concrete which could affect long term performance of the bond between the concrete and waterproofing.

3.4 The recommended procedures described herein are minimums; the waterproofing materials manufacturer may require more strict or specific procedures for the preparation of concrete surfaces for the application of the manufacturer's specific system.

#### **4. Adhesion Inhibitors**

4.1 *General*—Among the items that inhibit the initial adhesion of membrane waterproofing systems are form release agents, concrete curing compounds, admixtures, laitance, concrete surfacing compounds, grease or oils, moisture, and for some membrane types, surface roughness of the concrete.

4.2 Form release agents, such as oil, grease, wax, and silicones, will transfer from the forms to the surface of the concrete during casting. These can cause poor adhesion of waterproofing systems. Since these agents are almost invisible, it is difficult to detect their presence. Any procedure for the removal of such materials will be specific to that material. Proprietary form coating materials should be accepted prior to use and after evaluation by the specifier to determine that they are appropriate for use with the proposed waterproofing materials and systems. Proprietary paint systems applied to the forms that are non-transferable and formulated to prevent contamination of the concrete surface should be used whenever possible.

4.3 Concrete curing compounds may contain waxes, resins, chlorinated rubber, or film formers of various types. If such materials must be used, the specifier should be certain that the materials can be completely removed or that the waterproofing system manufacturer has evaluated them for use with the manufacturer's system to determine that they are acceptable for such use. These materials should be accepted prior to use and after evaluation by the specifier to determine that they are appropriate for use with the proposed waterproofing materials and system.

4.4 Admixtures such as water-immiscible chemical curing agents are sometimes used in concrete. These should be avoided unless the specifier has determined that they are acceptable for use with the intended primer or waterproofing materials, or both. These materials should be accepted prior to use and after evaluation by the specifier to determine that they are appropriate for use with the proposed waterproofing materials and system.

4.5 Concrete surfacing compounds typically applied on cast concrete decks to aid in mechanical surfacing of initially placed concrete, can inhibit and impair primer or waterproofing membrane adhesion, or both. These compounds should be avoided unless the specifier has determined that they are acceptable for use with the intended waterproofing materials. These materials should be accepted prior to use and after evaluation by the specifier to determine that they are appropriate for use with the proposed waterproofing materials and system.

4.6 Laitance, dust and dirt, moisture, and grease and oil can inhibit or impair adhesion of the waterproofing system. These must be removed; controlled in a manner acceptable to the waterproofing materials manufacturer; or found by the manufacturer, specifier, or representative(s) of the owner to be non-detrimental to the adhesion and performance of the waterproofing system to be employed.

4.7 Moisture contained within the matrix of the concrete as well as surface moisture present from curing or precipitation events can impair adhesion of the waterproofing system. Where possible, the concrete surface to receive waterproofing should be protected from precipitation for a minimum of 48 h prior to application of the waterproofing. The moisture content of the surface of the concrete should be evaluated and recorded in accordance with waterproofing manufacturer's recommendations prior to membrane application. Encapsulated moisture within the concrete matrix will continue to dissipate for extended periods of time following initial curing based on various factors.

4.8 For waterproofing membranes that gain adhesion properties through mechanical bond to the face of the concrete, the amplitude, or final concrete surface finish should be evaluated by the specifier or representative(s) of the owner in accordance with the manufacturer's recommendations and instructions. A minimum surface texture equal to CSP 4 to 6 as determined in the ICRI Technical Guideline No. 310.2 (formerly No. 03732) document is recommended. Surface texture equal to CSP 2 to 4 is recommended for cold-applied, liquid waterproofing membranes.

#### **5. Repair of Surface Defects**

5.1 *General*—Surface defects that may impair adhesion include honeycomb, fins, "snots," tie holes, "bug holes," sharp offsets from displaced forms, rutted cracks, ragged corners, deviations in the surface plane, and other similar concrete defects, along with spalling and delaminations of the concrete surface. (See also, Concrete Manual.<sup>5</sup>)

5.2 Fins, protrusions, or similar irregularities should be cut back to the surface by chipping, grinding, bushhammering, needlegunning, or wirebrushing. Avoid polishing of the concrete surface by these techniques.

5.3 Sharp offsets in the surface, such as those caused by formwork misalignment, should be cut back to an even surface

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<sup>5</sup> Available from U.S. Bureau of Reclamation, Denver, CO, *Concrete Manual*, 8th Edition, 1975, pp. 393–429.

by chipping, grinding, bushhammering, needlegunning, wirebrushing, or transitioning with grout or patching mortar. This could also be performed in accordance with the applicable provisions of ACI 301 and 311. Avoid polishing the concrete surface by any of these techniques.

5.4 Sharp offsets between precast sections should be corrected as indicated in 5.5.

5.5 Defective concrete areas should be removed down to sound concrete, preferably by chipping; if grinding is necessary, care must be taken to avoid “polishing” the surfaces. If sizable areas or amounts of unsound concrete are found, a structural engineer shall specify appropriate corrective action. Cracks exceeding 2 mm [ $\frac{1}{16}$  in.] should be investigated to determine whether they are still active. Such cracks should be chipped or routed out before being patched, and edges should be undercut slightly, in accordance with the suggestions and recommendations of applicable portions of ACI 301 and 311, or as recommended by the manufacturer of the patching material. No feathered edges shall be permitted. Tie holes and “bug holes” larger than 16 mm [ $\frac{5}{8}$  in.] in diameter or deeper than 3 mm [ $\frac{1}{8}$  in.], or both, should be prepared similarly for patching.

5.5.1 The areas to be patched, along with a band at least 150 mm [6 in.] wide surrounding it, should be dampened before the patching application to prevent rapid absorption of water from the bonding grout and the patching mortar, or this can be performed in accordance with the applicable provisions of ACI 301 and 311.

5.5.2 Immediately after the surface water has evaporated from the dampening step, a bonding grout or bond coat, consisting of approximately one part of cement to one part of fine sand passing No. 30 mesh sieve with an amount of water sufficient to obtain a consistency of thick cream, should be brushed thoroughly into the surface, or this can be performed in accordance with the applicable provisions of ACI 301 and 311.

5.5.3 The patching mortar should be made from the same materials and in the same proportions as the concrete, with the exception of coarse aggregate. (In any case, use no more than one part cement to 2.5 parts sand.) Mix the patching mortar thoroughly with an amount of water sufficient only to obtain the stiffest consistency that will permit placement. Apply the mortar as soon as the bonding coat begins to lose the water sheen. Mortar should be worked thoroughly into place and struck off slightly higher than the surrounding area to allow for some initial shrinkage. Such patches should set for at least 1 hour before surface finishing and then be damp-cured for seven days. Any tie holes or “bug holes” should be filled completely with mortar. This can also be performed in accordance with the applicable provisions of ACI 301 and 311.

5.5.4 Proprietary materials may be used either in lieu of or in addition to the patching materials described in 5.5.3. Such compounds must be used in accordance with the manufacturer’s instructions. These proprietary materials must be compatible with, and not interfere with, adhesion of the waterproofing system to be employed. Proprietary patching materials should be accepted prior to use and after evaluation by the specifier to

determine that they are appropriate for use with the proposed waterproofing materials and system.

## 6. Surface Preparation

6.1 *General*—Most waterproofing systems depend on good adhesion to the concrete. This, in turn, depends on proper surface preparation. The concrete surfaces must be free of loose, weak, and unsound materials (including laitance), as well as any chemical contamination that may adversely affect the bond. Some tests for the adequacy of the surface preparation are reviewed (see also 7.5). The preparation and testing of the concrete surfaces could also be performed in accordance with the applicable provisions of ACI 301 and 311. When there is doubt concerning selection of a preparation method, a small trial installation using one or more preparation methods followed by a patch test should be performed. (Refer also to Practice D4258 for additional cleaning methods.)

6.2 Scraping is a technique used frequently to remove a thin, top layer of unsound concrete, for example, using a straight, flat edge blade to remove laitance. It does not gouge the surface but still returns to a sound substrate. It is used instead of sanding because sanding tends to drive the dust from the surface into the pores, thereby providing an interfacing or parting film. Cleaning the surface after scraping is usually performed by air blast using oil-free compressed air. If materials do not adhere to such surfaces, a primer will frequently be required.

6.3 Chemical cleaning may be necessary prior to blast cleaning or acid etching, in order to remove surface contaminants such as oil, grease, and dirt. Solutions of 10 % caustic soda or of trisodium phosphate may be used as well as proprietary detergents specially formulated for use on concrete. They should be applied with vigorous scrubbing, followed by flushing with water to remove all traces of both the detergent and the contaminant, until the surface is neutral or only slightly alkaline, as indicated by litmus or pH paper. Solvents must be avoided because they dissolve the oil, grease, etc. and spread the contamination over a larger area.

6.4 Mechanical cleaning procedures are normally considered to be scarification and blast cleaning.

6.4.1 Scarification by a mechanical impacting device is used on concrete surfaces to remove thick overlays of dirt, previous waterproofing membranes, or weak surface material. After scarification, water or sand-blasting is required to remove aggregates weakened by mechanical impacting. If the scarification process produces a surface too coarse or too uneven for proper adhesion, it should be made smooth with patching mortar.

6.4.2 Blast cleaning is an effective method for the removal of laitance, dirt, efflorescence, and weak surface material. There are three types of blast cleaning methods: dry sandblasting, wet sandblasting, and high-pressure water jetting. Dry and wet sandblasting are usually the most effective. Abrasive cleaning techniques can also be used, provided the abrasive used does not contaminate the surface being prepared. Oils or greases should be removed prior to blast cleaning. If compressed air is used, it must be clean and free of water or oil.