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# Standard Guide for the Use of Sodium Bentonite Needle-Punched Geotextile Waterproofing Systems with Cast-in-Place Concrete Below-Grade Foundation Construction<sup>1</sup>

This standard is issued under the fixed designation D8425; 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 covers general installation guidelines of waterproofing membranes produced as a composite of sodium bentonite contained within two interlocked needle-punched geotextiles for designers to consider when developing project-specific drawings and specifications. This guide covers construction applications where the waterproofing is applied to the positive side of below-grade cast-in-place concrete foundation walls, both backfilled and support of excavation (SOE) construction, and under concrete pressure slabs. This guide does not cover plaza deck construction applications, either split-slab construction or pavers on pedestals, or vegetated green roof waterproofing applications.

1.2 This guide does not cover sodium bentonite waterproofing membranes produced with a corrugation paper carrier, bentonite bonded to a geomembrane, and spray-applied bentonite systems.

1.3 For the purpose of this guide, concrete is assumed to be cast-in-place with a surface profile as recommended in Guide [D5295/D5295M](#), consolidated in accordance with applicable guidelines in ACI 309, structurally sound, able to accept the weight of anticipated loads, and meets the local building code requirements. All components of the waterproofing system are assumed to comply with any federal, state, and local environmental regulations that may be in effect at the time of installation. Expansion joints, insulation, and drainage layers are beyond the scope of this guide.

1.4 This guide does not cover sodium bentonite geotextile membranes installed on below-grade foundation walls and slabs constructed with masonry materials, precast concrete, or pneumatically applied concrete (that is, shotcrete).

1.5 The values stated in SI units are to be regarded as standard. The unit values given in parentheses are for reference information only.

<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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1.6 Different sodium bentonite geotextile membranes have different materials of composition and construction which can affect physical properties. The procedures contained in this guide, therefore, may not be universally applicable to all sodium bentonite geotextile membranes under all field conditions.

1.7 This guide does not purport to assign responsibilities of quality assurance or quality control. Specific quality assurance and quality control items should be addressed in project specifications and contract documents.

1.8 This guide does not purport to include requirements for warranties associated with the waterproofing materials or installation.

1.9 This guide does not purport to include all detailing techniques to address various conditions that can be encountered on construction projects.

1.10 *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.*

1.11 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

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

[D1079 Terminology Relating to Roofing and Waterproofing](#)

[D4439 Terminology for Geosynthetics](#)

[D5295/D5295M Guide for Preparation of Concrete Surfaces for Adhered \(Bonded\) Membrane Waterproofing Systems](#)

[D6294/D6294M Test Method for Corrosion Resistance of](#)

<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.

## Ferrous Metal Fastener Assemblies Used in Roofing and Waterproofing

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

ACI 309 Guide for Consolidation of Concrete

ACI 506.2-13(18) Specification for Shotcrete

### 3. Terminology

#### 3.1 Definitions:

3.1.1 For definitions of terms used in this guide, refer to Terminologies **D1079** and **D4439**.

3.1.2 *needle-punched geotextile composite membrane*—sodium bentonite waterproofing manufactured using needles that punch fibers from a nonwoven geotextile through the bentonite layer and then through the woven geotextile to bond the geotextiles together by means of interlocked geotextile fibers.

3.1.3 *shotcrete*—concrete or mortar conveyed through a hose and pneumatically projected at high velocity onto a surface to achieve compaction.

3.1.4 *sodium bentonite*—a natural clay mineral consisting mostly of montmorillonite (aluminum silicate) that is processed and typically treated with polymer additives. Sodium bentonite is a highly expansive mineral having characteristics of cohesion, binding, sealing, and upon hydration forms a barrier to liquid water.

3.1.5 *support of excavation (SOE) construction*—refers to the construction of a temporary or permanent wall assembly to retain soil during the excavation of the building foundation to which the waterproofing is applied prior to the building's structural foundation wall, consisting of cast-in-place reinforced concrete placed directly in contact with the waterproofing system.

### 4. Classification

4.1 The following types are used to identify the waterproofing systems included in this guide:

4.1.1 *Type I*—Needle-punched bentonite geotextile membranes consisting of minimum 4.8 kg of granular sodium bentonite per m<sup>2</sup> (1 lb per ft<sup>2</sup>) contained between two geotextiles, one woven and one nonwoven. The two geotextiles are interlocked together by means of nonwoven geotextile fibers needle-punched through the bentonite layer and woven geotextile throughout the membrane surface area.

4.1.2 *Type II*—Needle-punched bentonite geotextile membranes consisting of minimum 4.8 kg of granular sodium bentonite per m<sup>2</sup> (1 lb per ft<sup>2</sup>) contained between two geotextiles (one woven and one nonwoven) and an integral geomembrane bonded to the exterior surface of one geotextile, covering the entire surface area of the membrane. The two geotextiles are interlocked together by means of nonwoven geotextile fibers needle-punched through the bentonite layer and woven geotextile throughout the membrane surface area.

<sup>3</sup> Available from American Concrete Institute (ACI), 38800 Country Club Dr., Farmington Hills, MI 48331-3439, <http://www.concrete.org>.

### 5. Significance and Use

5.1 This guide outlines general installation procedures and precautions for the application of sodium bentonite needle-punched geotextile waterproofing systems.

5.2 This guide is not all inclusive and is intended only to supplement detailed drawings and specifications from designers and the installation guidelines of manufacturers. Manufacturers of some of the systems addressed by this guide require proprietary products and special procedures not described in this guide. Manufacturers' guidelines and details applicable for each site construction condition encountered on a project should therefore be considered in the application of this guide.

### 6. Delivery of Materials

6.1 Deliver materials in the manufacturer's original unopened packages and containers.

6.2 All materials or material packaging must be clearly marked in a weather-resistant manner with product name, production lot code, manufacturer's name, and other pertinent information as required by federal, state, and local regulations.

### 7. Storage and Handling of Materials

7.1 Store materials on raised platforms or pallets. Store rolls vertically or horizontally, as recommended by the manufacturer. Store materials in a dry, ventilated, and weatherproof location in a manner recommended by the manufacturer. Avoid damage or embedment of foreign materials.

7.2 Store materials to prevent system supplier's markings from being destroyed.

7.3 When used as part of the system, store mastic and other applicable accessory products in tightly closed original containers at temperatures within the temperature range guidelines of the manufacturer. Protect products from sources of ignition.

### 8. Environmental Conditions

8.1 Installation can proceed when environmental conditions agreed upon by the owner, specifier, and installer are within the guidelines of the material manufacturer.

8.2 Conditions that may interfere with the installation and performance of the waterproofing include: precipitation prior to covering the membrane with concrete or backfill, wet or frost-covered substrate surfaces, dirty or contaminated substrate surfaces, high winds, and temperatures above or below a workable range for the products to be installed.

8.3 Product use is acceptable for both hydrostatic and non-hydrostatic project site conditions within the guidelines established by the manufacturer.

8.4 Prior to installation, groundwater or soil conditions should be tested for contaminants in accordance with the material manufacturer's guidelines.

8.5 Product hydrated by groundwater infiltration into the excavated site or precipitation, prior to confinement by concrete or backfill, should be inspected for damage. Per the manufacturer's guidelines, product determined to be damaged should be documented, repaired, or replaced, and the repair documented.

8.6 A temporary installation of a mechanical system to control groundwater inflow into the site excavation may be required to provide dry conditions for installation.

8.7 Bentonite waterproofing requires confinement by means of compacted backfill for foundation wall applications or reinforced concrete coverage for under-slab and support of excavation (SOE) construction applications. Install bentonite waterproofing only in applications that comply with manufacturer's confinement guidelines.

## 9. Materials

### 9.1 *Type I:*

9.1.1 Bentonite-geotextile membrane sheet produced as a composite of sodium bentonite contained within two geotextiles interlocked by means of needle-punching.

9.1.2 *Mastic*—Trowel-grade flashing material for inside corner fillets, sealing around penetrations, and terminations.

9.1.3 *Bentonite Tubes/Granular*—Bentonite material for horizontal inside corner fillet at junction of wall and footing.

9.1.4 *Protection Board*—Material course installed to the exterior of the membrane to protect the membrane from damage after installation onto a backfilled wall or earth-covered structure.

9.1.5 *Mechanical Fasteners*—Specified for use to secure membrane into position prior to membrane confinement by concrete or compacted backfill.

9.1.6 *Mechanical Affixments at Grade*—The mechanical fasteners and stress distribution bar or strips (that is, termination bar) specified for use in the system should meet the corrosion guidelines outlined in Test Method [D6294/D6294M](#).

### 9.2 *Type II:*

9.2.1 Bentonite-geotextile membrane sheet produced as a composite of sodium bentonite contained within two geotextiles interlocked by means of needle-punching with an integral geomembrane liner bonded to the exterior surface of one geotextile.

9.2.2 *Mastic*—Trowel-grade flashing material for inside corner fillets, sealing around penetrations, and terminations.

9.2.3 *Bentonite Tubes/Granular*—Bentonite material for horizontal inside corner fillet at junction of wall and footing.

9.2.4 *Seam Tape*—Tape for seaming membrane overlap edges of backfilled wall and earth-covered roof installations where the geomembrane component of the Type II membrane is accessible prior to backfilling.

9.2.5 *Protection Board*—Material course installed to the exterior of the membrane to protect the membrane from damage after installation onto a backfilled wall.

9.2.6 *Mechanical Fasteners*—Specified for use to secure membrane into position prior to membrane confinement by concrete or compacted backfill.

9.2.7 *Mechanical Affixments at Grade*—The mechanical fasteners and stress distribution bar or strips specified for use in the system should meet the corrosion guidelines outlined in Test Method [D6294/D6294M](#).

## 10. Substrate Preparation

10.1 Contaminants such as dirt, debris, loose materials, water, ice, or surface irregularities which would interfere with satisfactory installation of the system should be removed.

10.2 For backfilled wall applications, prepare and evaluate cast-in-place concrete surface profile to be in accordance with Guide [D5295/D5295M](#). Concrete surface can be “surface saturated dry” condition because this type of waterproofing is not adhered with primers or adhesives and can be installed on freshly placed concrete as soon as the forms are removed, as approved by the project engineer.

10.3 For under pressure slab installations with compactible earth substrate, the substrate should be compacted to suit site conditions, construction, and should be in accordance with manufacturer's guidance. Gravel subgrade should consist of aggregate size meeting the manufacturer's guidelines and should be rolled with a smooth-drum compactor of sufficient weight to compact and remove any abrupt grade changes such as tire ruts or footprints. All protrusions extending more than 12 mm (½ in.) from the subgrade surface should either be removed or made smooth with the subgrade surface.

10.4 For under pressure slab installations with concrete mud slabs, mud slabs should have a steel or wood float finish profile to provide a planar surface without sharp angular depressions, voids, or raised features.

10.5 For support of excavation (SOE) construction, shoring wall assembly should extend to the lowest level of the waterproofing installation, with any voids or cavities exterior of the shoring filled with compacted soil or cementitious material. Interior surface of shoring should be planar and without gaps or voids greater than 25 mm (1 in.). Excessive gaps or irregular surface conditions should be filled with cementitious material, extruded polystyrene foam, drainage dimple sheet composite, or other solid material per project specifications or manufacturer's guidelines.

10.6 Verify that all plumbing, electrical, mechanical, or other penetrations passing through the plane of the waterproofing are positively secured in their final positions and sealed, as applicable, per project specifications prior to waterproofing system installation.

10.7 Project-specified expansion joint product should be compatible with the waterproofing and should be installed per project specification and manufacturer's guidelines.

## 11. Installation

### 11.1 *General—Types I and II:*

11.1.1 Use care during installation to avoid damaging the waterproofing membrane. Protect installed membrane from construction traffic. Repair or replace damaged materials per manufacturer's guidelines.

11.1.2 Protect adjacent substrate and building components from damage or contamination.

11.1.3 Unless otherwise specified by project documents or manufacturer's guidelines, for all installations overlap adjoining membrane sheet edges a minimum 100 mm (4 in.) and

secure membrane edges tight against substrate with washer-head mechanical fasteners installed maximum 600 mm (24 in.) on center. Install additional washer-head fasteners throughout field of membrane as necessary to secure it tight against the substrate at changes of plane and other site conditions.

#### 11.2 *Under Pressure Slab Application—Types I and II:*

11.2.1 Install membrane sheets directly on properly prepared substrate. System should continuously cover substrate without interruption.

11.2.2 Install waterproofing system at all grade beams, pile caps, and other detail areas in accordance with project specifications and manufacturer's guidelines. For hydrostatic conditions, install waterproofing encapsulating entire footing, grade beams, and pile caps; extend membrane a minimum 300 mm (12 in.) onto subgrade to allow under-slab waterproofing installation to overlap a minimum 100 mm (4 in.) in accordance with project specifications and manufacturer's guidelines.

11.2.3 At all pipe, rebar, structural, or other penetrations, install waterproofing system with flashing and membrane products overlapping in accordance with project specification and manufacturer's guidelines to form a continuous system.

#### 11.3 *Support of Excavation (SOE) Construction Application—Types I and II:*

11.3.1 Beginning at the bottom of the SOE wall, install bottom membrane sheet horizontally oriented with the bottom sheet edge extending a minimum 300 mm (12 in.) onto the subgrade and the top sheet edge extending up onto the SOE wall a minimum 300 mm (12 in.) above the elevation of the slab surface. Subsequent sheet courses can be installed horizontally or vertically oriented. Overlap adjoining sheets and secure to SOE wall per manufacturer's guidelines for project conditions. System should continuously cover SOE wall substrate without interruption to grade termination elevation indicated in project drawings and specifications.

11.3.2 Install waterproofing system at soldier piles, tie-back heads, and other detail areas in accordance with project specifications and manufacturer's guidelines.

11.3.3 At all pipe, rebar, structural, or other penetrations, install waterproofing system with flashing and membrane products overlapping in accordance with project specification and manufacturer's guidelines to form a continuous system.

11.3.4 Terminate waterproofing system at finished grade elevation using all applicable accessory and flashing products for specific project conditions per project specifications and manufacturer's guidelines.

11.3.5 For backfill, refer to Section 14. Note that with SOE construction there can be areas along the foundation that are shallow over excavated conditions created by either site construction conditions or building code requirements to remove SOE elements near grade. At these conditions it may be required to place and compact soils to complete the grade termination.

#### 11.4 *Backfilled Wall Application—Types I and II:*

##### 11.4.1 *Substrate Treatment Prior to Installing Sheets:*

11.4.1.1 At inside corners install a 19 mm ( $\frac{3}{4}$  in.) continuous fillet (cant) of mastic and extend the mastic a minimum of

150 mm (6 in.) in each direction from the corner at minimum 2.3 mm (90 mil) thickness.

11.4.1.2 For footing to wall inside corner, install a continuous 38 mm (1½ in.) fillet (cant) of granular bentonite or bentonite-filled tubes per project specifications and manufacturer's guidelines.

11.4.1.3 Seal all concrete joints, cracks, and form-tie details with mastic or other product in accordance with project specifications and manufacturer's guidelines.

11.4.2 Beginning at the bottom of the wall, install corner transition sheet horizontally oriented with the bottom sheet edge extending a minimum 150 mm (6 in.) onto the concrete footing and terminate bottom sheet edge per manufacturer's guidelines. Subsequent membrane sheet courses can be installed horizontally or vertically oriented. Overlap adjoining sheets and secure to substrate. System should continuously cover concrete wall substrate without interruption to grade termination elevation indicated in project drawings and specifications.

11.4.3 At all pipe, rebar, structural, or other penetrations, install waterproofing system in accordance with project specification and manufacturer's guidelines.

11.4.4 With Type II sheets installed on backfilled walls, seal all membrane overlaps with seam tape in accordance with project specification and manufacturer's guidelines.

11.4.5 Terminate waterproofing system at finished grade elevation using all applicable accessory and flashing products for specific project conditions in accordance with project specifications and manufacturer's guidelines.

11.4.6 Install protection course over bentonite needle-punched geotextile waterproofing in accordance with project specification and manufacturer's guidelines.

11.4.6.1 Specify installation of a protection course over the bentonite geotextile waterproofing to suit project site conditions and construction, considering the manufacturer's guidelines.

11.4.7 For backfill, refer to Section 14.

## 12. Inspection, Repair, and Testing

12.1 Substrate preparation should be inspected, verified, and documented to be in accordance with project specifications and manufacturer's guidelines.

12.2 The waterproofing installation should be inspected during the work and prior to and during backfilling or placement of concrete to verify that the system is installed in accordance with the project specifications and manufacturer's guidelines, and that it is not damaged.

### 12.3 *Damaged Membrane Repair:*

12.3.1 For under-slab and support of excavation (SOE) construction applications, inspect and repair the membrane as required prior to concrete placement. Patch punctures, tears, open seams, and other deficiencies with membrane material and applicable accessory products in accordance with membrane manufacturer guidelines.

12.3.2 For backfilled wall applications, inspect and repair the membrane as necessary prior to protection course and backfill placement. Repair punctures, tears, open seams, and