

SECTION 07 17 00 - BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes composite HDPE/bentonite membrane waterproofing.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for forms and for concrete placement.
 - 2. Division 07 Section "Joint Sealants" for elastomeric sealants.
 - 3. Division 31 Section "Excavation Support and Protection" for permanent below-grade support systems that require blind-side waterproofing.
 - 4. Division 33 Section "Subdrainage" for subsurface drainage systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water according to the following criteria:
 - 1. Permeability: 1 by 10^{-9} cm/sec. according to ASTM D 5084.
 - 2. Grab Tensile Strength: 95 lbf according to ASTM D 4632.
 - 3. Elongation: 75 percent according to ASTM D 4632.
 - 4. Puncture Resistance: 120 psi according to ASTM D 4833.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include product specifications and manufacturer's written installation instructions.
- B. Shop Drawings: Show installation details for interface with other work.
- C. Samples: For each of the following products, in sizes indicated:
 - 1. Waterproofing: 6 inches square.
 - 2. Flexible Flashing Membrane: 6 inches square.
 - 3. Protection Board: 6 inches square.
 - 4. Drainage Mat: 6 inches square.
- D. Material Certificates: For each type of bentonite waterproofing, signed by manufacturers.

- E. Preconstruction Test Reports: For water samples taken at Project site along with recommendations resulting from these tests.
- F. Field quality-control test reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for bentonite waterproofing.
- H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain bentonite waterproofing system through one source from a single manufacturer. Obtain accessory products used with bentonite waterproofing from sources acceptable to bentonite waterproofing manufacturer.
- B. Preconstruction Testing: Engage a qualified independent testing agency to test water for compliance with requirements.
 - 1. Obtain water samples from Project site at approximate locations where waterproofing will be installed and test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials.
 - 2. Comply with manufacturer's written instructions for testing.
- C. Mockups: Build mockups to set quality standards for fabrication and installation.
 - 1. Approval of mockups is also for other material and construction qualities specifically approved by University in writing.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by University in writing.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original unopened and undamaged containers.
- B. Store materials in a dry, well-ventilated space.
- C. Remove and replace bentonite materials that have been prematurely exposed to moisture.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.

1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
2. Placing of bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agrees to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Water penetrating the building or structure resulting from substrate cracking of up to 1/8 inch.
 - b. Deteriorated or displaced waterproofing materials.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 sieve.
- B. Bentonite Mastic: Trowelable consistency, bentonite compound, specifically formulated for application at joints and penetrations.
- C. Granular Bentonite Tubes: Manufacturer's standard 2-inch- diameter, water-soluble tube containing approximately 1.5 lb/ft. of bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
- D. Preformed Waterstop: Flexible strip of bentonite waterproofing compound in cartridge or coil form; designed specifically for vertical and horizontal joints in concrete construction.
- E. Bentonite Grout: High-solids bentonite fluid mixture formulated to be injected to stop leaks in existing below-grade structures.

2.3 COMPOSITE HDPE/BENTONITE MEMBRANE

- A. Composite HDPE/Bentonite Membrane: Minimum 90-mil- thick membrane consisting of a 20-mil- thick, HDPE geomembrane liner bonded to a layer of bentonite clay granules 78 mils thick, and with a 1.5-mil- thick siliconized release liner.
 - 1. Products:
 - a. CETCO; Swelltite.
 - b. Tremco Sealant/Waterproofing Division, an RPM company; Paraseal.
 - c. Tremco Sealant/Waterproofing Division, an RPM company; Deckseal.
 - d. Or approved equal
- B. Composite Saline/Alkaline HDPE/Bentonite Membrane: Minimum 150-mil- thick membrane consisting of a 60-mil- thick, HDPE geomembrane liner bonded to a layer of bentonite clay granules 78 mils thick.
 - 1. Available Products:
 - a. Tremco Sealant/Waterproofing Division, an RPM company; Saltwater Paraseal
 - b. Or approved equal.

2.4 COMPOSITE GEOTEXTILE-HDPE/BENTONITE MEMBRANE

- A. General: Minimum of 1.0 lb/sq. ft. of bentonite clay granules bonded to nonwoven geotextile polypropylene fabric with HDPE bonded to surface of nonwoven fabric.
 - 1. Products:
 - a. CETCO; Voltex DS.
 - b. Tremco Sealant/Waterproofing Division, an RPM company; Paraseal LG
 - c. Or approved equal.

2.5 INSTALLATION ACCESSORIES

- A. Molded-Sheet Drainage Panels: Prefabricated, composite drainage panels, manufactured with a permeable geotextile facing laminated to a molded-plastic, three-dimensional sheet drainage core.
 - 1. Products:
 - a. CETCO; Aquadrain.
 - b. MiraDRI Moisture Protection Products, TC MiraDRI; MiraDRAIN 8000
 - c. Or approved equal.
- B. Termination Bar: Extruded-aluminum or formed-stainless-steel bars with upper flange to receive sealant.

- C. Plastic Protection Sheets: Polyethylene sheeting complying with ASTM D 4397; thickness as recommended in writing by waterproofing manufacturer to suit application but at least 6 mils thick.
- D. Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch- diameter washers under fastener heads.
- E. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Division 07 Section "Joint Sealants."
- F. Tapes: As recommended in writing by waterproofing manufacturer for joints between sheets or panels.
- G. Adhesive: Water-based adhesive used to secure membrane to both vertical and horizontal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of bentonite waterproofing.
 - 2. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify that substrate is complete and that all work that will penetrate waterproofing is complete and rigidly installed. Verify locations of waterproofing termination.

3.2 PREPARATION

- A. Coordinate work in the vicinity of waterproofing to ensure proper conditions for installing the waterproofing system and to prevent damage to waterproofing after installation.
- B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cementitious patching material according to manufacturer's written instructions.
- C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch, honeycomb areas, and other defects with bentonite mastic or cementitious patching material according to manufacturer's written instructions.
- D. Excavation Support and Protection or Stable Excavation: If water is seeping, use plastic sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and

spaces 1/8 inch wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

- A. Install waterproofing and accessories according to manufacturer's written instructions, standard details, and recommended practices.
 - 1. Apply linear joint-sealing tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
 - 2. Apply granular bentonite around penetrations in horizontal surfaces according to manufacturer's written instructions.
- B. Static Construction Joints: Protect construction joints with bentonite preformed waterstop flexible strips. Either place concrete directly over flexible strips or press strips into preformed cavities. Comply with manufacturer's written instructions where joint waterproofing is not otherwise indicated.
- C. Apply granular bentonite continuously at base of wall waterproofing (on footing, against wall) according to manufacturer's written instructions.
- D. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer's written instructions.
- E. Apply sealants to comply with requirements specified in Division 07 Section "Joint Sealants" and with manufacturer's written instructions.

3.4 COMPOSITE HDPE/BENTONITE MEMBRANE INSTALLATION

- A. Horizontal Concrete, Roof Slabs, Plazas, and between Slabs: Starting at lowest point, install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 2 inches.
 - 1. Prime concrete substrate with primer, applied according to manufacturer's written instructions at a rate of 150 to 300 sq. ft./gal.. Primer may be omitted on concrete surfaces that comply with manufacturer's written instructions for dryness, surface texture, and freedom from imperfections.
 - 2. Install bentonite side up.
 - 3. Install bentonite side down.
 - 4. Terminations at Vertical Surfaces: Provide a fillet or cant at intersection of horizontal and vertical substrates. Extend waterproofing membrane to top of curb or to a minimum of 6 inches above plane of waterproofing; secure with tape recommended in writing by manufacturer.
- B. Vertical Concrete or Masonry Walls: Apply mastic around penetrations and form continuous 2-inch cant at intersection of footings and walls with mastic.

1. Starting at lowest point, install a layer of waterproofing membrane horizontally, extending a minimum of 6 inches onto the footing. Lap membrane ends and edges a minimum of 2 inches.
 2. Secure membrane to wall with adhesive or washer-headed fasteners and terminate membrane at grade with tape, according to manufacturer's written instructions.
- C. Excavation Support and Protection (Permanent Shoring): Cut, clean, and treat tiebacks and similar projections according to waterproofing manufacturer's written instructions. Encase tieback rods, nuts, and plates according to waterproofing manufacturer's written instructions for each configuration. If water is present, cover shoring and lagging with plastic protection sheets.
1. Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped and nailed to shoring.
 2. Cover waterproofing with a plastic slip-sheet.

3.5 COMPOSITE GEOTEXTILE-HDPE/BENTONITE MEMBRANE INSTALLATION

- A. General: Install a continuous layer of waterproofing membrane with ends and edges lapped a minimum of 3 inches. Stagger end joints between membranes. Fasten seams by stapling to adjacent sheet or nailing to substrate.
- B. Below Structural Slabs-on-Grade: Apply waterproofing membrane with HDPE side down and staple ends and edges.
1. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches up or beyond perimeter slab forms.
 2. Protect waterproofing from damage caused by chairs with sharp edges.
- C. Concrete Walls: Starting at bottom of wall, apply waterproofing membrane with HDPE side facing Installer; overlap sheets 3 inches. Secure with powder-actuated fasteners or case-hardened nails, spaced according to manufacturer's written instructions. Extend to bottom of footing, grade beam, or wall and secure as recommended in writing by manufacturer.
1. Termination at Grade: Extend waterproofing membrane to within 2 inches of finish grade, unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
- D. Excavation Support and Protection (Permanent Shoring): Cut, clean, and treat tiebacks and similar projections according to waterproofing manufacturer's written instructions. Encase tieback rods, nuts, and plates according to waterproofing manufacturer's written instructions for each configuration. If water is present, cover shoring and lagging with plastic protection sheets; remove plastic sheets before placing concrete.
1. Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped and mechanically secured to shoring.
 2. Inspect and repair waterproofing membrane after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.

- E. Horizontal Slabs, Roofs, and Plazas: Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped and taped a minimum of 3 inches.
 - 1. Clean overlap area and apply waterproof tape, rolling the exposed edge to seal to sheet below.
 - 2. Turn edges up and seal to vertical surfaces.
 - 3. Cover waterproofing with a plastic slip-sheet.

3.6 BENTONITE PANEL INSTALLATION

- A. General: Install a continuous layer of bentonite waterproofing panels with ends and edges lapped a minimum of 1-1/2 inches, unless otherwise indicated. Stagger joints in adjoining panel rows.
 - 1. When subjected to a hydrostatic pressure of 33 feet water column or more, install a double layer of waterproofing panels, with ends and edges butted instead of lapped and with second layer of joints staggered over first. Staple panels together to hold them in place.
- B. Below Structural Slabs-on-Grade: Place plastic protection sheets on compacted subgrade with joints lapped a minimum of 6 inches.
 - 1. Lay standard panels with ends and edges lapped and stapled. Cover with a lapped course of plastic protection sheets.
 - 2. Install a layer of waterproofing panels under footings, grade beams, and pile caps; or continue waterproofing panels through key joints between footings and foundation walls, and extend a minimum of 8 inches up or beyond perimeter slab forms.
- C. Concrete Walls: Starting at bottom of wall, apply waterproofing panels with ends and edges lapped and with vertical joints staggered. Secure with fasteners or adhesive recommended in writing by manufacturer. Extend to bottom of footing, grade beam, or wall.
 - 1. Horizontal-to-Vertical Transitions: Install granular bentonite tubes immediately before backfilling and compact backfill over the joint.
 - 2. Termination at Grade: Extend waterproofing panels to within 2 inches of finish grade, unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar according to manufacturer's written instructions.
 - 3. Termination at Grade: Fasten top edge of waterproofing panels to wall and protect top edge with sheet metal counterflashing.
 - 4. Cover waterproofing panels with a lapped course of plastic protection sheets; remove plastic sheets before backfilling.
- D. Excavation Support and Protection (Permanent Shoring): Cut, clean, and treat tiebacks and similar projections according to waterproofing manufacturer's written instructions. Encase tieback rods, nuts, and plates according to waterproofing manufacturer's written instructions for each configuration. If water is present, cover shoring and lagging with plastic protection sheets; remove plastic sheets before placing concrete.
 - 1. Starting at lowest point, install a layer of waterproofing panels to shoring, with ends and edges lapped and nailed.

2. Inspect and repair waterproofing panels after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to panels.
- E. Horizontal Roofs, Planters, Plazas, and between Slabs: Starting at lowest point, install a layer of waterproofing panels, with ends and edges lapped a minimum of 2-1/2 inches.
1. Prime concrete substrate with primer applied at a rate of 150 to 300 sq. ft./gal., or 1/8 inch of granular bentonite. Primer may be omitted on concrete surfaces that comply with manufacturer's written instructions for dryness, surface texture, and freedom from imperfections.
 2. Terminations at Vertical Surfaces: Provide a fillet or cant at intersection of horizontal and vertical substrates. Extend waterproofing panels to top of curb or to a minimum of 6 inches above plane of waterproofing; secure with termination bar. Apply sealant to top edge of termination bar.

3.7 FIELD QUALITY CONTROL

- A. Inspection: Arrange for manufacturer's representative to inspect completed installation and provide written report that installation complies with manufacturer's written instructions.
1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.
- B. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch but not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of membrane flashings.
 2. Flood each area for 48 hours.
 3. After flood testing, repair leaks, repeat flood test, and make further repairs until waterproofing installation is watertight.
- C. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 07 17 00