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This specification specifies **ArmorClay 600 / 1000 / 1500 Bentonite Sheet Waterproofing**. This product is manufactured by Marflex Waterproofing & Building Products. Revise section number and title below to suit project requirements, specification practices and section content. Refer to CSI MasterFormat for other section numbers and titles.

This specification utilizes the Construction Specifications Institute (CSI) Manual of Practice, including MasterFormat™, SectionFormat™ and PageFormat™. This is a manufacturer-specific proprietary product specification using the proprietary method of specifying applicable to project specifications and master guide specifications. Optional text is indicated by brackets []; delete optional text in final copy of specification. Specifier Notes typically precede specification text; delete notes in final copy of specification. Trade/brand names with appropriate symbols typically are used in Specifier Notes; symbols are not used in specification text. Metric conversion, where used, is soft metric conversion.

SECTION 071700

BENTONITE SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet membrane waterproofing.
- B. Cant strips and other accessories.
- C. Protection boards.

1.02 RELATED REQUIREMENTS

- A. Section 04 2001 - 2.04A - Masonry Veneer: Self adhering flashing membrane.
- B. Section 04 4301 - 2.03E - Stone Masonry Veneer: Self adhering flashing membrane.
- C. Section 31 2323 - Fill.
- D. Section 33 4600 (33460)-Sub-drainage: Foundation drainage.
- E. Section 07 2100 - Thermal Insulation: Insulation used for protective cover.
- F. Section 07 9005 - Joint Sealers: Sealant for joints in substrates.

1.03 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2006a.
- B. ASTM D751 - Standard Test Methods for Coated Fabrics
- C. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
- D. ASTM D5084 - Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane, flexible flashings, joint and crack sealants, and others.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- F. Water Test: When hydrostatic conditions exist, include manufacturer's report for laboratory demonstrating the activation of bentonite with the groundwater samples.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years' experience.
- B. Water Test: Supply the waterproofing manufacturer with groundwater samples from the project site at marked locations.

1.06 WARRANTY

- A. Provide to Architect signed copies of the Contractor's and Manufacturer's Warranties.
- B. Contractor shall correct defective Work within warranty period given on specific job after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide up to a ten year manufacturer material warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.
- D. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Composite HDPE/Bentonite Manufacturers:
 - 1. ArmorClay 600; Mar-flex Waterproofing & Building Products; www.mar-flex.com
 - 2. ArmorClay 1000; Mar-flex Waterproofing & Building Products; www.mar-flex.com
 - 3. ArmorClay 1500; Mar-flex Waterproofing & Building Products; www.mar-flex.com
 - 4. Substitutions: See Section 01 6000 and Section 07 1300 2.02 - Product Requirements.

2.02 MEMBRANE PROPERTIES

A. ArmorClay 600 Waterproofing Membrane. Black 4 Mil cross laminated HDPE. Comprised of green 4 mil HDPE and granular bentonite. Product to be used at all vertical foundation walls, decks, tunnels, or planters.

1. Minimum Thickness:	100-150 mils	
virgin resin HDPE	4 Mil	
Bentonite	.6 lbs per sf	
2. Sheet Width:	39 inch, minimum.	
3. Tensile Strength:	6,100 psi,	ASTM D 412
4. Ultimate Elongation:	100 percent	ASTM D 412
5. Resistance to hydrostatic pressure	174 feet	ASTM D 751
6. Water vapor transmission rate	.53 x 10 ⁻¹³ cm/sec	ASTM E96, D5084

B. ArmorClay 1000 Waterproofing Membrane. The ArmorClay 1000 membrane with an additional polypropylene non-woven fabric to protect the bentonite layer. Product can be used on all vertical foundation walls, decks, tunnels, or planters, and underslab floor or blindside applications.

1. Minimum Thickness:	150-200 mils	
virgin resin HDPE	20 mil	
Bentonite	1 lbs per sf	
2. Sheet Width:	41 inch, minimum.	
3. Tensile Strength:	4,000 psi,	ASTM D 412
4. Ultimate Elongation:	700 percent	ASTM D 412
5. Resistance to hydrostatic pressure	174 feet	ASTM D 751
6. Water vapor transmission rate	5 x 10 ⁻¹² cm/sec	ASTM E96, D5084

C. ArmorClay 1500 Waterproofing Membrane. Composite HDPE/Bentonite membrane comprised of virgin 20 mil HDPE with granular bentonite and a polypropylene non-woven fabric laminated to both sides of the sheet. Product can be used in underslab floor or blindside applications and with extruded polystyrene insulation on all vertical foundation walls, decks, tunnels, or planters.

1. Minimum Thickness:	250-300 mils	
virgin resin HDPE	20 mil	
Bentonite	1.5 lbs per sf	
2. Sheet Width:	41 inch, minimum.	
3. Tensile Strength:	4,000 psi,	ASTM D 412
4. Ultimate Elongation:	700 percent	ASTM D 412
5. Resistance to hydrostatic pressure	174 feet	ASTM D 751
6. Water vapor transmission rate	5 x 10 ⁻¹² cm/sec	ASTM E96, D5084

D. Seaming Materials: 3 inch (75 mm) wide butyl seam tape as recommended by membrane manufacturer.

E. Self Adhering Flexible Flashings: Type recommended by waterproofing membrane manufacturer

F. Protection Board (optional): Type recommended by waterproof membrane manufacturer

G. Drainage board (optional): Filter fabric laminated to free-draining high-density dimpled polystyrene drainage core with HDPE backing or alternative as recommended by the waterproofing manufacturer.

H. Insulation (optional): Rigid extruded polystyrene insulation as specified in Section 07 2100.

2.03 ATTACHMENT MATERIALS

A. Mechanical Fasteners:

1. Case-hardened steel nail with fluted shank having a minimum 1" length and a minimum 1" diameter cap for use on green concrete and masonry substrates.
2. Powder shot steel pin having a minimum 3/4" diameter washer for use on hardened concrete and grouted masonry substrates.
3. Termination Bars: Poly Resin; compatible with membrane as recommended by membrane manufacturer.

B. Adhesive Fasteners:

1. Spray/roll liquid applied rubberized asphalt
2. Spray/roll liquid applied acrylic adhesive
3. Bituminous tape and primer

2.04 ACCESSORIES

A. Granular bentonite cant: ArmorClay Bentonite Granular Pack.

B. Mastic: ArmorClay Mastic

C. WaterStop: compatible waterstop devices as approved by the waterproofing manufacturer

D. Waterpellent: spray covering water repellent for ArmorClay 1000 or 1500. Provides temporary covering for inclement weather.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the existing conditions meet the manufacturer's requirements before starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

D. Report unsatisfactory conditions to the Architect in writing.

3.02 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's guidelines and instructions.
- B. All concrete shall be cured a minimum of two (2) days and be 1,500-psi in compressive strength before application of bentonite waterproofing system.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.
- E. Repair concrete as required providing proper surfaces for the waterproofing. All surfaces shall be free of voids, spalled areas, loose aggregate and sharp protrusions, with no coarse aggregate visible. "Honeycombs" over 3/8-inch in width and 3/8-inch deep shall be plugged with concrete or bentonite mastic and finished flush with surrounding surfaces. Finish shall be relatively smooth.
- F. Provide two (2) inch bentonite cant at all vertical transitions and fill excess space with granular bentonite and/or bentonite mastic for wall pipe penetrations. Refer to manufacturer's recommendations for typical installation guidelines.

3.03 INSTALLATION – MEMBRANE

- A. Install membrane waterproofing either vertically or horizontally with bentonite facing the concrete according to manufacturer's recommendations and instructions, including proper substrate preparation, job site considerations and weather restrictions.
- B. Roll out membrane. Minimize wrinkles and bubbles. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- C. Seal joints and seams as recommended by the manufacturer.
- D. Installation of self-adhering flashing membrane a minimum 6" over top edge of waterproofing membrane and continue across foundation wall shelf and up vertical face of wall system as indicated on detailed drawings. This will be installed under section 04 2001 and shall be inspected by and approved by this contractor and become part of the warranted system in this section.

3.03.1 Backfilled Walls

- 1. Concrete Wall/Substrate
 - a. Remove all sharp protrusions, mud, debris, ice or any other materials that would interfere with ArmorClay's performance.
 - b. Cover any exposed reinforcing steel.
 - c. In the case of masonry walls, strike flush all joints scheduled to receive ArmorClay. (Contact Mar-flex for recommendations on specific projects.)
- 2. Trowel ArmorClay Mastic into all the holes, honeycombs, voids or irregularities that exceed 3/8" in depth.

3. Penetrations.
 - a. Fill extra space with ArmorClay Granular Pack or ArmorClay Mastic.
 - b. Trowel ArmorClay Mastic to cover penetration.
 - c. Cut ArmorClay strip: 6" wide x 2" greater than pipe circumference.
 - d. Every 1", cut a 3" flanges across the ArmorClay strip (Figure 1).
 - e. Wrap the strip around the pipe with flanges spreading out on the wall
 - f. Hold the collar with pipe clamp or Seam Tape and/or fasteners.
4. Prepare all expansion joints per manufacture's recommendations.
5. Sweep footing ledge clean.
6. Contact Mar-flex whenever conditions of acid, alkali, or salt brine exist.
7. Install a continuous 2" cant of ArmorClay Granular where wall meets footing.
8. Install a continuous 1" vertical cant of ArmorClay Mastic at all vertical corners prior to installing ArmorClay.
9. ArmorClay is installed from the base of the footing to the grade line with the bentonite side towards the concrete substrate. Securely fasten the membrane every 20" O.C. to the vertical surface just above the footing and to the horizontal surface on top the footing.
10. ArmorClay may be installed with a combination of either vertical or horizontal seams.

Vertical Installation

- a. Install ArmorClay with nails and washers 15" O.C within 1" from horizontal seam.
- b. Overlap vertical seams at least 1-1/2" and secure with nail and washer every 24" to 48" O.C.
- c. Cover the nails and tape all vertical seams with ArmorClay Seam Tape as shown.

Horizontal Installation

- a. Install ArmorClay with nails and washers 24" O.C within 1" from horizontal seam.

Note: Shingle overlap the upper sheet over on the lower sheet at least 1-1/2" with staggered vertical seams.

- b. Overlap vertical seams at least 1-1/2" and secure with a nail and a washer at 20" O.C.
- c. Cover the nails and tape all vertical seams with ArmorClay Seam Tape.

11. For inside corners:

- a. Fold overlap in the corner and securely nail to the footing.
- b. Secure with a nail.

12. For outside corners:

- a. In an 8" x 8" square of ArmorClay, cut out two triangles leaving a 2" x 4" strip from the center toward one edge and two additional flanges

- b. Secure the square at the outside corner.
- c. Cut vertical slice in the ArmorClay membrane at the footing and fold around corner.
- d. Secure flaps with nails.

13. Terminate ArmorClay at finished grade with a continuous strip of ArmorClay Termination Bar nailed every 12" O.C.

Note: Make certain that waterproofing extends up to or above finish grade.

14. Complete installation at penetrations by cutting out a circle the diameter of the pipe in the center of a 2' x 2' square of ArmorClay. Cover the pipe penetration with the ArmorClay square (if necessary, cut slit in center circle) and fasten. Tape the seam and the penetration with ArmorClay Seam Tape.

3.03.2 Blindsided Lagging-ArmorClay 1500

1. Steel piles and wood lagging

- a. Remove all sharp protrusions, mud, debris, ice or any other materials that would interfere with ArmorClay 1500's performance.
- b. Cover any exposed reinforcing steel.
- c. Flatten the nails from the lagging boards.
- d. Fill irregularities and voids between the lagging boards with concrete grout, plywood, ArmorClay Mastic or Granular Pack.
- e. Cover lagging boards and soldier piles vertically with drainage layer or with 20 mil HDPE and 4" overlap.

2. Utility Penetrations.

- a. Fill voids with concrete grout, ArmorClay Granular Pack and/or Mastic.
- b. For drainage board, cut circle in barrier the size of utility penetration. For HDPE backing, cut star shape or 8-piece pie shape into membrane. Ensure a tight fit around the utility penetrations.
- c. Trowel ArmorClay Mastic to fill voids and to cover penetration.
- d. Cut ArmorClay 1500 strip: 6" wide to wrap the pipe with 2" overlap. Every 1", cut 3" flanges across the ArmorClay 1500 strip.
- e. Wrap the strip around the pipe with flanges spreading out on the membrane.
- f. Hold the collar with pipe clamp, Seam Tape or fasteners.

3. Integrate below-slab, below-footings, and/or other structures waterproofing membranes with lagging wall membrane to create the complete waterproofing envelope.

4. Install ArmorClay 1500 horizontally, or as alternative, ArmorClay 1000 with drainage layer.

- a. Hang ArmorClay 1500 with nails and washers 24" O.C. within 1" from the horizontal seam.
- b. Stagger and overlap seams at least 4".

- c. Secure vertical edge every 20" O.C.
 - d. Secure horizontal overlaps with staples every 6".
5. Overlap the seams at least 4". Fasten as described previously.
6. Use double layer of ArmorClay 1500 membrane horizontally over construction joints and vertically at the corners, or ArmorClay 1000 alternative.
7. Complete installation at utility penetrations
- a. Cut out a circle the diameter of the pipe in the center of a 2' x 2' square of ArmorClay 600.
 - b. Cover the pipe penetration with the ArmorClay 1500 square (if necessary, cut slit in center circle) and fasten.
 - c. Fill voids with ArmorClay mastic or granular packs
8. Lagging Tiebacks.
- a. Thoroughly coat all tieback penetrations with ArmorClay Mastic.
 - b. Fill ArmorClay Tieback Cover with ArmorClay Mastic.
 - c. Fasten the Tieback Cover over tie-backs with nails.
- Note: Contact Mar-flex Technical Service for alternative tieback designs.
9. Soldier Piles
- a. Cut a hole for each tie-back in the vertical ArmorClay 1500 sheet.
 - b. Hang ArmorClay 1500 down the soldier pile, matching the Tieback Cover with the holes, while ensuring a 4" overlap with horizontal membranes and a 4" shingle overlap on vertical sheets.
 - c. Secure with nails.
 - d. Fill voids (particularly around the Tieback Covers) with ArmorClay Mastic or Granular Pack.
10. Terminations
- a. At grade: Finish ArmorClay 1000 or 1500 and the drainage sheet/HDPE layers, with a continuous strip of ArmorClay Termination Bar nailed every 12" O.C. and optional flashing. Note: Make certain that waterproofing extends up to or above finish grade.
 - b. Intersecting deck: Finish ArmorClay 1500 (or ArmorClay 1000 alternative) with a 6" overhang of horizontal membrane past the construction joint.

3.03.3 Decks, Tunnels, Planters

1. Concrete deck/wall/substrate
 - a. Remove all sharp protrusions, mud, debris, ice or any other materials that would interfere with ArmorClay's performance.
 - b. Cover any exposed reinforcing steel.

- c. In the case of masonry walls, strike flush all joints scheduled to receive ArmorClay. (Contact Mar-flex for recommendations on specific projects.)
2. Trowel ArmorClay Mastic or mortar into all the holes, honeycombs, voids or irregularities that exceed 3/8" in depth. Note: ArmorClay Mastic should not be used as a full-wall trowel grade waterproofing.
3. Penetrations.
 - a. Fill extra space with ArmorClay Granular Pack or ArmorClay Mastic.
 - b. Trowel ArmorClay Mastic to cover penetration.
 - c. Cut ArmorClay strip: 6" wide x pipe circumference plus 2" overlap. Every 1", cut 3" flanges across the
ArmorClay strip.
 - d. Wrap the strip around the pipe with flanges spreading out on the wall
 - e. Hold the collar with pipe clamp or Seam Tape and/or fasteners.
4. Drain Pipes
 - a. Fill any void with ArmorClay Mastic or Bentonite Granular Pack.
 - b. Cut out the inside diameter of the drain bowl in the center of a 2' x 2' square of HDPE. Place over drain bowl.
 - c. Clamp flashing collar into place and bolt down the adjustable strainer.
5. Use double layer of ArmorClay membrane over construction joints with backfill cover or with pavers.
6. Sweep deck clean.
7. Contact Mar-flex whenever conditions of acid, alkali, or salt brine exist.
8. Pour a 2" cant of ArmorClay Granular Pack at vertical/horizontal transitions.
9. Unroll ArmorClay membrane on the deck with the bentonite side towards the concrete substrate, starting from the lowest points and moving to the highest points. Overlap and stagger the seams 1-1/2" to 3".
10. Overhang horizontal to vertical transition with 6" of ArmorClay (or past the construction joint).
11. For inside corners:
 - a. Cut vertical slice in the ArmorClay at the footing and fold overlap in the corner.
 - b. Secure with a nails.
12. For outside corners against the deck:
 - a. In an 8" x 8" square of ArmorClay, cut out two triangles leaving a 2" x 4" strip from the center toward one edge and two additional flanges.
 - b. Secure the square at the outside corner.

- c. Cut vertical slice in the ArmorClay membrane at the footing and fold around corner.
 - d. Secure flaps with nails.
13. For outside corners:
- a. Cut vertical slice in the ArmorClay at the corner and fold overlap in the corner.
 - b. Secure with a nails.
14. Tape all seams with ArmorClay Seam Tape as shown.
15. Terminate ArmorClay at finished grade with a continuous strip of ArmorClay Termination Bar nailed every 12" O.C.
- Note: Make certain that waterproofing extends up to or above finish grade.
16. Complete installation at penetrations by cutting out a circle the diameter of the pipe in the center of a 2' x 2' square of ArmorClay. Cover the pipe penetration with the ArmorClay square (if necessary, cut slit in center circle) and fasten. Tape the seam and the penetration with ArmorClay Seam Tape.

3.03.4 UnderSlab Floors-ArmorClay 1500

1. Prepare substrate/base/substratum/subgrade
 - a. Level and compact the original earth, or a granular base.
2. HDPE barrier.
 - a. Cover compacted base with 10 or 20 mil HDPE. If aggregate base, use 20 mil HDPE. If clean-earth fill, 10 mil HDPE is acceptable.
 - b. Cut HDPE around any penetrations.
 - c. Overlap seams 3-4".
 - d. Staple the seam every 6"-12".
3. Mud Slab (an alternative installation, if specified)—Install as recommended by the Architect and Engineer.
4. Utility Penetrations
 - a. Pour cant of ArmorClay Granular Pack around the penetration.
 - b. Cut ArmorClay 1500 strip: 6" wide to wrap the pipe with 2" overlap. Every 1", cut 3" flanges across the ArmorClay 1500 strip.
 - c. Wrap the strip around the pipe with flanges spreading out on the membrane.
 - d. Hold the collar with pipe clamp or Seam Tape and/or other fasteners.
 - e. Trowel ArmorClay Mastic to fill voids and to cover penetration.

Integrate the below-slab waterproofing membrane with other structures waterproofing membranes to enclose the entire waterproofing envelope

5. Tie-in under slab to backfilled wall with footings
 - a. Footings- wrap inside the forms for the footing with 10-20 mil HDPE.
 - b. Wrap ArmorClay 1500 membrane up the footing above the form to provide for proper tie-in to vertical membrane. Overlap the seams 4" as a shingle. Or, alternatively, use ArmorClay 1000 under the footing.
6. Tie-in mud slab to lagging walls
 - a. Extend ArmorClay 1500 upward on the lagging wall a minimum 6" or above the cold joint from mud slabs to provide for proper overlaps with the vertical membrane.
7. Tie-in under slab to lagging walls with footings or to piling.
 - a. Footings- hang the 20 mil HDPE down the lagging wall and inside the forms for the footings.
 - b. Concrete pilings- Cut 20 mil HDPE tightly around the piling. Pour cant and fill void area around piling with ArmorClay Granular Pack and/or ArmorClay Mastic. Use waterstop on top of piling.
 - c. Wrap the form with ArmorClay 1500 membrane, extending up the vertical surface-above the cold joint and up the footing above the form. Overlap the seams 4"

Cover the entire field with ArmorClay 1500 membrane

8.1 Over subgrade

- a. Install HDPE vapor barrier over stable, smoothed and compacted subgrade up to the footing. Overlap seam 6" and staple down.
- b. Pour ArmorClay Granular Pack bentonite cant along vertical to horizontal transition.
- c. Install ArmorClay 1500 membrane along the footings extending up the vertical surface.
- d. Install ArmorClay 1500 membrane over the entire field with minimum 3" overlap, stagger sheets; securely fasten seams with staples every 6" on center. Alternative: Install ArmorClay 1000 over the entire field with minimum 3" overlap, stagger sheets; securely fasten seams with staples every 6" on center or with ArmorClay Seam Tape.

8.2 Over Mud slab

- a. Pour ArmorClay Granular Pack bentonite cant along vertical to horizontal transition.
- b. Install ArmorClay 1500 membrane along the footings extending up the vertical surface.
- c. Install ArmorClay 1500 membrane with minimum 3" overlap, stagger end laps; securely fasten seams with nails every 24" O.C. and staple 6" O.C. Alternative: Install ArmorClay 1000 over the entire field with minimum 3" overlap, stagger sheets; securely fasten seams with nails every 24" O.C. and staple 6" O.C. and seal the joint with ArmorClay Seam Tape.

Complete details.

9. Expansion Joints

a. In addition to the expansion joint system (provide by others), use a double layer of ArmorClay 1500 (or ArmorClay 1000 alternative) at mid-floor expansion joints.

Note: ArmorClay Products does not warranty the expansion joints.

10. Complete installation at utility penetrations and floor drain.

a. Cut out a circle the diameter of the pipe in the center of a 2' x 2' square of ArmorClay 1500.

b. Cover the pipe penetration with the ArmorClay 1500 square (if necessary, cut slit in center circle).

c. Fill voids with mastic or granular packs

11. Terminations at vertical surfaces with a continuous strip of ArmorClay Termination Bar nailed every 12" O.C.

3.04 INSTALLATION - PROTECTION BOARD, DRAINAGE BOARD, INSULATION (optional)

A. Place protection board, drainage board, and insulation directly against membrane; butt joints. Scribe and cut boards around projections, penetrations, and interruptions. Fasten as recommended by the manufacturer.

3.05 FIELD QUALITY CONTROL

A. Monitor finishing layer installation and backfill operations to assure no damage is done to the waterproofing membrane. Alert all parties concerned of any activities which might adversely affect the performance of the waterproofing system.

B. General Contractor shall advise waterproofing contractor, if a penetration will be made through the applied waterproofing system and take appropriate steps to waterproof such penetration without jeopardizing the warranty at no additional cost to the Owner.

END OF SECTION

BENONITE SHEET WATERPROOFING