

SECTION 33 46 16.16
GEOCOMPOSITE SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Prefabricated Drainage Composite.
 - 1. Types of Prefabricated Drainage Composites include:
 - a) Prefabricated drainage composite for below-grade, vertical wall applications.
 - b) Prefabricated drainage composite for below-grade, horizontal applications.
- B. Related Sections:
 - 1. Cast-in-Place Concrete: Refer to Division 03
 - 2. Structural precast concrete: Refer to Division 03
 - 3. Masonry: Refer to Division 04
 - 4. Earthwork: Refer to Division 30
 - 5. Landscaping: Refer to Division 30

1.2 REFERENCES (INDUSTRY STANDARDS)

- A. General: Refer to Division 1 References Section.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data certificates of compliance for drainage composites specified. Submit specimen copy of warranty specified herein.
- B. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including accessories for drainage composites.
- C. Samples: Submit verification samples for prefabricated drainage composites.
- D. Quality Assurance/Control Submittals
 - 1. The specified properties of drainage panels must be supported by test results from an independent laboratory, documenting the specified flow rate in the plane of the core and creep performance of the polymer core. The testing conditions shall comply with ASTM D-4716 as follows:
 - a) Hydraulic Gradient: 1.0 for vertical installations and 0.05 for horizontal installations.
 - b) Normal Pressure (pressure imposed perpendicular to the plane of the core): Equal to 3600 psf.
 - c) Creep: Model long-term compression of the prefabricated drainage composite system and determine if the drain product flow channels become restricted with time. Long-term creep/drainage performance shall be determined by measuring flow after 300 continuous hours under the above referenced normal pressure. The test method shall utilize a loading system that models the soil/drainage product interaction.

- d) Flow Direction: Flow shall be measured on only one side of the core. Where the core geometry differs in principal directions, flow shall be measured in both directions, simulating water flowing vertically down a wall and horizontally across the face of the wall to accurately determine maximum flow rate in critical principal direction.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer Qualifications: Installer experienced to perform work of this section, who has specialized in the installation of work similar to that required for this project, who can comply with manufacturer's warranty requirements, and who is an authorized applicator as determined by drainage manufacturer.
 - 2. Manufacturer Qualifications: Manufactured at an ISO 9001:2000 Facility.
- B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.
- C. Pre-Installation Testing: In accordance with manufacturer's recommendations and warranty requirements, conduct pre-installation testing of substrates to receive drainage composites.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Schedule deliveries to avoid construction delays but minimize jobsite storage.

1.6 PROJECT CONDITIONS/SITE CONDITIONS

- A. When CCW MiraDRAIN is installed in conjunction with a waterproofing product, the CCW MiraDRAIN must be compatible with the waterproofing product and installed by methods acceptable to the waterproofing product manufacturer.
- B. The outfall for any drainage pipe used with the drainage panels shall be coordinated with the site drainage.

1.7 WARRANTY

- A. Upon completion and acceptance of the work required by this section, the manufacturer will issue a warranty agreeing to promptly replace defective materials for a period of 5 years.
- B. The formation or presence of mold or fungi in a building is dependent upon a broad range of factors including, but not limited to, the presence of spores and nutrient sources, moisture, temperatures, climatic conditions, relative humidity, and heating/ventilating systems and their maintenance and operating capabilities. These factors are beyond the control of Carlisle and Carlisle shall not be responsible for any claims, repairs, restoration, or damages relating to the presence of any irritants, contaminants, vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, or the like in any building or in the air, land, or water serving the building.

PART 2-PRODUCTS

2.1 MATERIALS

- A. Prefabricated Drainage Composite: CCW MiraDRAIN, a 3-dimensional dimpled core and geotextile fabric, by Carlisle Coatings & Waterproofing Incorporated, 900 Hensley Lane, Wylie, Texas 75098, Phone: (800) 527-7092 Fax: (972) 442-0076.
 - 1. CCW MiraDRAIN 2000 for shallow-depth foundation walls and residential applications.

2. CCW MiraDRAIN 5000 for double-sided drainage applications in landscaping and landfill applications.
3. CCW MiraDRAIN 6000/6200 for use over waterproofing membranes and lagging, underslab and retaining wall applications.
4. CCW MiraDRAIN 6000XL/6200XL for extended performance in all vertical applications.
5. CCW MiraDRAIN 8000 for hydrocarbon resistive applications.
6. CCW MiraDRAIN 9000 for horizontal plaza and roof deck applications.
7. CCW MiraDRAIN 9800 for planters and green roof applications.
8. CCW MiraDRAIN 9900 for vehicular traffic and other high compressive strength applications.
9. CCW QuickDRAIN functions as an edge drain/pipe collector to channel groundwater away from the structure.
10. CCW MiraDRAIN GR9200 functions as a retention/drainage composite for green roofs.
11. CCW MiraDRAIN HC is a high-flow drainage composite for french or trench drains.

B. Prefabricated Drainage Composite:

Geocomposite Sheet Drain Physical Properties Chart:

CCW MiraDRAIN Property Test Method		Unit	2000	5000	6000/6200	6000/6200XL
<i>Core</i>			-----Typical Values-----			
Thickness	ASTM D1777	in (mm)	0.25 (6.35)	0.40 (10.16)	0.40 (10.16)	0.40 (10.16)
Compressive Strength	ASTM D1621	psf (kN/m ²)	10,800 (517)	15,000 (719)	15,000 (719)	16,500 (790)
Maximum Flow Rate ¹	ASTM D4716	gpm/ft (l/min/m)	12.5 (155)	15 (188)	17 (211)	17 (211)
Installed Vertically ²	ASTM D4716	gpm/ft (l/min/m)	8.5 (106)	12.5 (155)	12.5 (155)	14.5 (180)
Installed Horizontally ³	ASTM D4716	gpm/ft (l/min/m)	§	2.4 (30)	§	§
<i>Fabric</i>						
Apparent Opening Size	ASTM D4751	US Std Sieve (mm)	40 (0.42)	40 (0.42)	40 (0.42)	40 (0.42)
Water Flow Rate	ASTM D4491	gpm/ft ² (l/min/m ²)	200 (8,148)	200 (8,148)	200 (8,148)	200 (8,148)
Grab Tensile Strength	ASTM D4632	lbs (kN)	80 (0.36)	80 (0.36)	80 (0.36)	80 (0.36)
Grab Elongation	ASTM D4632	%	60	60	60	60
Puncture Resistance	ASTM D4833	lbs (kN)	-	-	-	-
<i>System</i>						
Performance Index	*	N/A	14,050	18,250	18,250	24,100

CCW MiraDRAIN Property Test Method		Unit	8000	9000	9800	9900
<i>Core</i>			-----Typical Values-----			
Thickness	ASTM D1777	in (mm)	0.40 (10.16)	0.40 (10.16)	0.40 (10.16)	0.25 (6.35)
Compressive Strength	ASTM D1621	psf (kN/m ²)	18,000 (862)	18,000 (862)	18,000 (862)	33,000 (1,650)
Maximum Flow Rate ¹	ASTM D4716	gpm/ft (l/min/m)	21 (260)	21 (260)	17.5 (219)	13 (161)
Installed Vertically ^{2†}	ASTM D4716	gpm/ft (l/min/m)	18.5 (230)	18.5 (230)	15.5 (193)	§
Installed Horizontally ^{3†}	ASTM D4716	gpm/ft (l/min/m)	3.8 (47)	3.8 (47)	3.0 (38)	2.4 (30)
<i>Fabric</i>						
Apparent Opening Size	ASTM D4751	US Std. Sieve (mm)	40 (0.42)	40 (0.42)	80 (0.18)	40 (0.42)
Water Flow Rate	ASTM D4491	gpm/ft ² (l/min/m ²)	145 (5,907)	145 (5,907)	95 (3,866)	145 (5,907)
Grab Tensile Strength	ASTM D4632	lbs (kN)	365 (1.62)	365 (1.62)	205 (0.90)	365 (1.62)
Grab Elongation	ASTM D4632	%	24	24	50	24
Puncture Resistance	ASTM D4833	lbs. (kN)	100 (0.44)	100 (0.44)	130 (0.58)	100 (0.44)
<i>System</i>						
Performance Index	*	N/A	27,198	27,198	31,325	42,198

CCW MiraDRAIN Property Test Method		Unit	QuickDRAIN		GR9200
<i>Core</i>			-----Typical Values-----		
Thickness	ASTM D1777	in (mm)	0.63-1.0 (16.10-25.4)		0.40 (10.16)
Compressive Strength	ASTM D1621	psf (kN/m ²)	9,500 (455)		15,000 (718)
Maximum Flow Rate ¹	ASTM D4716	gpm/ft (l/min/m)	118 (928)		§
Installed Vertically ^{2†}	ASTM D4716	gpm/ft (l/min/m)	§		§
Installed Horizontally ^{3†}	ASTM D4716	gpm/ft (l/min/m)	§		§
<i>Fabric</i>			NW/Woven		
Apparent Opening Size	ASTM D4751	US Std. Sieve (mm)	70 (0.21)		70/40 (0.21/0.42)
Flow Rate	ASTM D4491	gpm/ft ² (l/min/m ²)	110 (4,477)		140/145 (5,698/5,907)
Grab Tensile Strength	ASTM D4632	lbs (kN)	160 (0.71)		100/365 (0.45/1.62)
Grab Elongation	ASTM D4632	%	50		50/24
Puncture Resistance	ASTM D4833	lbs (kN)	95 (0.42)		65/100 (0.30/0.44)
<i>System</i>					
Performance Index	*	N/A	17,100		N/A

CCW MiraDRAIN Property Test Method		Unit	HC Drain
<i>Core</i>			-----Typical Values-----
Thickness	ASTM D1777	in (mm)	1.0 (25.4)
Compressive Strength	ASTM D1621	psf (kN/m ²)	9,500 (455)
Maximum Flow Rate ¹	ASTM D4716	gpm/ft (l/min/m)	§
Installed Vertically ^{2†}	ASTM D4716	gpm/ft (l/min/m)	82 (1,300)
Installed Horizontally ^{3†}	ASTM D4716	gpm/ft (l/min/m)	21 (260)
<i>Fabric</i>			
Apparent Opening Size	ASTM D4751	US Std. Sieve (mm)	70 (0.21)
Flow Rate	ASTM D4491	gpm/ft ² (l/min/m ²)	135 (5,500)
Grab Tensile Strength	ASTM D4632	lbs (kN)	120 (0.50)
Grab Elongation	ASTM D4632	%	50
Puncture Resistance	ASTM D4833	lbs (kN)	65 (0.30)
<i>System</i>			
Performance Index	*	N/A	12,750

All flow rates were tested at 3600 psf.

¹In plane flow rate @ gradient of 1.0 ²Installed flow rate with soil overburden @ vertical gradient of 1.0 ^{2†}Installed flow rate with concrete overburden @ vertical gradient of 1.0 ³Installed flow rate with soil overburden @ horizontal gradient of 0.05 ^{3†}Installed flow rate with concrete overburden @ horizontal gradient of 0.05 * Drainage Performance Index is a function of ASTM D 4833, D 4632 and D 1621 § Contact Carlisle Coatings & Waterproofing for performance values in these applications.

PART 3-EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Do not proceed with drainage installation until substrate conditions are acceptable for compliance with manufacturer's warranty requirements.

3.2 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during installation operations.
- B. Concrete Surface Preparation: Prepare concrete surfaces to receive drainage composite. Surfaces shall be smooth, free of depressions, voids, protrusions, clean and free of other surface contaminants that may impair the performance of drainage and manufacturer's warranty requirements.
 - 1. Cast-in-Place Concretes: Decks shall be monolithic, smooth, free of voids, spalled areas, laitance, honeycombs, and sharp protrusions. Refer to Division 3 Concrete Section for concrete strength, density, finish, curing methods and other concrete requirements.
 - 2. Precast Concrete Decks: Decks shall be mechanically secured to minimize differential movement and each joint between precast units shall have an installed backer rod. Grout precast units as recommended by manufacturer.
 - 3. Shotcrete: Surface shall be monolithic and smooth with no undulations, irregularities or exposed wire mesh.
- C. Substrate Cleaning: Clean substrate that is to receive drainage. Remove loose debris and other harmful contaminants that will affect performance of drainage composite.

3.3 DRAINAGE COURSE INSTALLATION

- A. Vertical Surfaces: CCW MiraDRAIN 2000, 5000, 6000/6200, 6000/6200XL, MiraDRAIN HC; or Planters: CCW MiraDRAIN 9800, GR9200
 - 1. Completed Walls: Position the panel with the flat side against the wall and filter fabric toward the soil/drainage side. CCW DRAIN GRIP contact adhesive or a washer headed concrete nail may be used to attach the panel against the concrete wall. Over CCW Waterproofing Membrane: Place the CCW MiraDRAIN over the waterproofing membrane.
 - 2. Shoring Systems or Vertical Soil Excavations: Position the panel with the fabric facing the shoring or soil. Nails of sufficient length should be used to pin the panel directly against the shoring or soil. The fabric should lay flat against the shoring or soil to minimize voids. Concrete or shotcrete may be placed directly against the backside of the CCW MiraDRAIN.
 - 3. Buttress Drainage and Landslide Repair: CCW MiraDRAIN should be rolled out fabric side down onto the properly prepared subgrade. A "chimney" drain type drain pattern should be formed.
 - a) Spacing between CCW MiraDRAIN chimney drains will be dictated by the engineer. Chimney drains should be connected to the continuous horizontal collector panel by overlapping a minimum of 12" (30 cm) into the collector panel.
 - b) CCW MiraDRAIN panels may be secured to the subgrade by ballasting with soil or nailing through the CCW MiraDRAIN panel into the underlying hillside. Fabric flaps must be folded over onto the core and secured with duct tape or soil ballast.
 - 4. Edge Drain or Trench Drain:
 - a) CCW MiraDRAIN should be laid out in 50 to 500 foot lengths adjacent to the previously cut/excavated trench.

- b) Panel end laps may be connected by overlapping the panels and applying locking clips or buttoning of the dimples. Flexible, corrugated polyethylene or rigid PVC pipe, which has been wrapped with filter fabric, should be placed in the bottom of the trench. The CCW MiraDRAIN panel should be lowered into the trench beside the pipe and temporarily secured to the trench wall by nailing or propping. The fabric side of the panel must face the direction from which the water is flowing. Fabric overlaps on the top of the CCW MiraDRAIN panels should be draped over the back of the core and if there is insufficient fabric, the core shall be cut out from the fabric by a depth of 3 dimples to provide excess fabric for wrapping the core. Backfilling should be completed immediately.
5. Connecting Adjacent Panels: Connect adjacent panels at the longitudinal edge by pulling the filter fabric back to expose the flange. The panel edge should be butted to the edge of the adjacent panel dimple to dimple or the edge of the next panel may be placed over two dimples and interlocked. Panel ends are to be attached in the same manner. Connections should be completed in shingle fashion so that moisture will flow with the overlap and not against it. Overlap fabric in the direction of water flow. Cover all terminal edges with the filter fabric flap by tucking in behind the core and if there is insufficient fabric, the core shall be cut out from the fabric by a depth of 3 dimples to provide excess fabric for wrapping the core.
- B. Horizontal Surfaces: CCW MiraDRAIN 9000, 9800, 9900 or 8000 (hydrocarbon-resistive applications), GR9200
1. Plaza Decks, Parking Decks, and other Split-Slab Construction:
- a) Attach the CCW MiraDRAIN panels by either placing temporary ballast on top of the CCW MiraDRAIN or adhering the panels to the waterproofing membrane with CCW DRAIN GRIP contact adhesive or SecurTape two-sided tape.
 - b) Connect adjacent panels at the longitudinal edge by pulling the filter fabric back to expose the flange. The panel edge should be butted to the edge of the adjacent panel dimple to dimple or the edge of the next panel may be placed over two dimples and interlocked. Panel ends are to be attached in the same manner. Connections should be completed in shingle fashion so that moisture will flow with the overlap and not against it. Overlap fabric in the direction of water flow. Cover all terminal edges with the filter fabric flap by tucking the fabric behind the core.
 - c) CCW MiraDRAIN should be channeled into an internal drain or perimeter drain system.
 - d) Concrete, sand, grout, or pavers may be placed directly on the CCW MiraDRAIN woven fabric side. Caution should be taken not to place point loads on the CCW MiraDRAIN that might puncture the filter fabric on the CCW MiraDRAIN. When concrete is poured against CCW MiraDRAIN, use proper chuting techniques and avoid high drop heights.
2. Floor Slabs and Concrete-Lined Channels:
- a) The subgrade shall be graded to a 2% minimum slope and clear of rubble, rock, large soil clods, etc. The CCW MiraDRAIN should be placed woven fabric side down, directly on the subgrade. Installation should proceed from the higher elevation of the slope and work downward. Connection of panel ends shall be achieved with four-row dimple overlapping and taping of terminal edges.
3. Planters:
- a) CCW MiraDRAIN should be placed fabric side to the inside (soil side) of the planter. The planter walls should be covered with CCW MiraDRAIN. Allow a 3" (75 mm) fabric overlap at the bottom of vertical panels in order to cover the intersection of wall and bottom sections. Any exposed panel edges must be covered with supplemental pieces of fabric to prevent soil intrusion into the flow channels.

3.4 DISCHARGE CONNECTIONS

- A. Drainage:
 - a) Foundation/Retaining Wall: Install CCW QuickDRAIN prefabricated drainage collection system in a vertical foundation wall to a horizontal footing configuration. Adhere CCW QuickDRAIN to the substrate using CCW DRAIN GRIP contact adhesive or SecurTape tape. Place the hinged portion of the CCW QuickDRAIN against the vertical/horizontal transition and press into place. Connect adjacent panels by pulling filter fabric back to expose the flange. Overlap the flange of the core of edge drain on to the flange of the preceding drain core. Cover the joint with the filter fabric. Install CCW MiraDRAIN in shingle fashion by overlapping the flange of the CCW QuickDRAIN in the direction of water flow and cover with filter fabric. Cover all terminal edges of the core with the fabric flap by tucking it behind the core.
Discharge Connection Installation: Leaving the filter fabric in place, slide the CCW QuickDRAIN Connector outlet over the horizontal portion of the CCW QuickDRAIN and wrap with filter fabric.
 - b) Where drainpipe is indicated, place the drainpipe next to the core. Wrap the drainpipe or rock-pipe drain combination with an auxiliary piece of filter fabric.
- B. Weep holes: Cut a hole in the core corresponding to the size and location of the weep hole. Avoid cutting a hole in the fabric by cutting the backside of the core between the dimples. A four dimple square area cut between the dimples (2 ½ square inch) should be sufficient for most applications.
- C. Plaza Drains: Create openings in the CCW MiraDRAIN core to correspond with all discharge holes in the drain at the structural deck level. Fabric must be placed over these holes to prevent intrusion of soil, grout, sand, or concrete into the drainage core.
- D. Terminal Connections and Protrusions: Cover all terminal edges with the integral fabric flap by tucking it around the edge of the core and securing it. At protrusions, cut the core around the protrusion, cut an "X" in the fabric, and tape the fabric around the protrusion. Dirt and concrete must not infiltrate the core.

3.5 CLEANING AND PROTECTION

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- B. Protection: Protection installed products finished surfaces from damage during construction.