Designation: D7001 – 06

Standard Specification for Geocomposites for Pavement Edge Drains and Other High-Flow Applications[1]

This standard is issued under the fixed designation D7001; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers geocomposite drainage panels used in highway, turf, and other high volume subsurface drainage applications. These products consist of a geotextile wrapped around a polymer core. These products are a minimum of 25 mm (1 in.) thick and are available in 150 mm (6 in.), 300 mm (12 in.), 450 mm (18 in.), and 600 mm (24 in.) widths.

1.2 The requirements of this specification are intended to provide a subsurface drainage geocomposite suitable for drainage of surface and subsurface water, sewerage, and leachates. Products produced in accordance with this specification and intended for pavement drainage applications shall be installed in accordance with Practice D6088.

1.3 The values as stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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 and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1777 Test Method for Thickness of Textile Materials
D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
D4354 Practice for Sampling of Geosynthetics for Testing
D4355 Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
D4439 Terminology for Geosynthetics
D4491 Test Methods for Water Permeability of Geotextiles by Permittivity
D4533 Test Method for Trapezoid Tearing Strength of Geotextiles
D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
D4716 Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
D4751 Test Method for Determining Apparent Opening Size of a Geotextile
D4833 Test Method for Index Puncture Resistance of Geomembranes and Related Products
D6088 Practice for Installation of Geocomposite Pavement Drains
D6244 Test Method for Vertical Compression of Geocomposite Pavement Panel Drains
D6364 Test Method for Determining Short-Term Compression Behavior of Geosynthetics
D6707 Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications

2.2 *Other Document:*

AASHTO M288 Geotextile Materials[3]

3. Terminology

3.1 *Definitions*—For definitions of terms relating to geotextiles, refer to Terminology D4439.

3.1.1 *geocomposite*, *n*—a product composed of two or more materials, at least one of which is a geosynthetic. **D4439**

3.1.2 *geosynthetic*, *n*—a planar product manufactured from polymeric material used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a man-made project, structure, or system. **D4439**

[1] This specification is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.03 on Permeability and Filtration.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001.

4. Classification

4.1 *General*—This specification covers geocomposite drainage products or structures intended for high flow volume subsurface drainage applications. Two distinctly different product designs are included in this specification, a Class A product composed of a cuspated or sheet and post core wrapped with a geotextile serving as the outer boundary and a drainage fabric, and a Class B product composed of a series of small round pipe connected together or a flat pipe design consisting of a full circumference core with the geotextile acting only as a drainage fabric.

4.1.1 Fittings covered by this application are normally molded. Fittings may be fabricated from sections of the drainage core by thermal welding.

4.1.2 Fittings intended to outlet these products often transition into pipe systems. These transition fittings are included, but the pipe is not.

5. Ordering Information

5.1 When ordering material in accordance with this specification, the following should be specified:

5.1.1 The product size (150 mm, 300 mm, 450 mm, or 600 mm) (6 in., 12 in., 18 in., or 24 in.).

5.1.2 The geocomposite class (Table 2 and Table 3).

5.1.3 The geotextile component class (Table 2).

5.1.4 Fittings required. Fittings may be required to couple sections together and to provide outlets, typically transitioning to round pipe.

6. Materials and Manufacture

6.1 *Basic Materials*—These products are composites of two or more materials, typically a drainage core and a geotextile filter.

6.1.1 *Core Materials*—Compounds used in the manufacture of the drainage core and fittings shall be polyethylene with a minimum cell classification of 424420C as defined and described in Specification D3350. Compounds that have a higher cell classification in one or more properties are acceptable, except for density, which must be cell Class 4, provided the product requirements are met.

6.1.2 *Reworked Materials*—Clean rework material, generated from the manufacturer's own production, may be used by the manufacturer provided that the core and fittings produced meet all requirements of this specification.

6.1.3 *Geotextile Materials*—Fibers used in the manufacture of geotextiles shall consist of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters.

6.2 *Manufacture and Assembly*—The geocomposite shall be assembled from the permitted core structures and the geotextile.

TABLE 1 Core Properties

Property	Test Method	Minimum Value
Overall Thickness (mm)	Test Method D1777	≥ 25 mm (1 in.) (Nominal)
Compression Strength (kPa)	Test Method D6364	≥ 210 kPa (30 psi) (90°)
		≥ 140 kPa (20 psi) (50°)

NOTE—Table 1 applies to both Class A and Class B cores.

TABLE 2 Geotextile Properties

Property	Test Method	Minimum Value Class A Geocomposite	Minimum Value Class B Geocomposite
Grab Strength	Test Method D4632	700 N	500 N
Elongation	Test Method D4632	>50 %	>50 %
Seam Strength	Test Method D4632	630 N	450 N
Puncture Strength	Test Method D4833	250 N	180 N
Trapezoidal Tear	Test Method D4533	250 N	180 N
Permittivity	Test Methods D4491	0.5 s^{-1}	0.5 s^{-1}
AOS	Test Method D4751	0.25 mm (max. avg. roll value)	0.25 mm (max. avg. roll value)
Ultraviolet Degradation	Test Method D4355 Breaking Strength	50 % retained at 500 h	50 % retained at 500 h

NOTE—These properties are for the geotextile for the finished product as applied to the core, including the effects of any resin bonding or calendaring done to the material. If circular knit geotextile is used, it shall meet the requirements of Specification D6707. Geotextile properties for Class A cores are listed as Class 2 in AASHTO M288; and for Class B cores are Class 3 as in AASHTO M288.

6.2.1 *Core*—The core structure shall be manufactured by continuous extrusion and forming and cut to size.

6.2.2 *Fittings*—The core fittings shall be blow molded, injection molded, rotational molded, thermoformed, or fabricated by extrusion or hot plate welding.

6.2.3 *Geotextile*—The geotextile may be knitted, needle-punched non-woven, or spun-bonded non-woven.

6.2.4 *Assembly*—The geotextile must be attached to the Class A core by heat bonding or gluing; or, for Class B cores, may be formed into a sleeve and placed around the core. The geotextile sleeve may be seamed by sewing, gluing, or thermal bonding, or may be a tubular knit.

7. Physical Properties

7.1 The geocomposite materials covered by this specification shall have a nominal thickness of 25 mm (1 in.) and a nominal width of 150 mm, 300 mm, 450 mm, and 600 mm (6 in., 12 in., 18 in., and 24 in.) wide. Product length shall be as agreed to by the customer and the manufacturer.

7.2 The geocomposite products covered by this standard are available in two distinctly different forms, an open core with a geotextile wrap that acts as part of the structure as well as a filter, listed as Class A; and a fully enclosed core with a geotextile wrap that acts only as a filter, listed as Class B.

8. Mechanical and Performance Requirements

8.1 The drainage core shall have the properties shown in Table 1.

8.2 The geotextile shall have the properties shown in Table 2.

8.3 The geocomposite shall have the properties shown in Table 3.

9. Test Requirements

9.1 Compression strength tests per Test Method D6364 shall be conducted on full width samples a minimum of 300 mm (12 in.) long.

9.2 Grab Strength, Tensile Strength and Seam Strength of the geotextile shall be determined using the test methods contained in ASTM D4632. This method is not appropriate for

TABLE 3 Geocomposite Properties

Property	Test Method	Minimum Value Class A	Minimum Value Class B
Transmissivity (per 300 mm (12 in.) of width)	Test Method D4716	≥ 0.001 m^3/s (≥ 0.035 CFS)	≥ 0.001 m^3/s (≥ 0.035 CFS)
Vertical Compression	Test Method D6244	≤ 5 % loss of cross sectional area at 4450 N (1000 lbf)	≤ 5 % loss of cross sectional area at 4450 N (1000 lbf)
Flow Capacity (Vertical position) (per 300 mm (12 in.) of width)	University of Kentucky In-Plane Flow Test	>0.001 m^3/s (0.03 ft^3/s)	>0.002 m^3/s (0.067 ft^3/s)

knitted fabric. Circular knit geotextile shall meet the requirements of Specification D6707.

9.3 Puncture resistance of the geotextile shall be determined using Test Method D4833.

9.4 Trapezoidal tear resistance of the geotextile shall be determined using Test Method D4533.

9.5 Permittivity of the geotextile shall be determined using Test Methods D4491.

9.6 Ultraviolet degradation resistance of the geotextile shall be determined using Test Method D4355.

9.7 Transmissivity of the geocomposite shall be determined using Test Method D4716. Samples tested shall be full width and a minimum of 300 mm (12 in.) long.

9.8 Vertical compression strength shall be determined using Test Method D6244.

9.9 Flow capacity tests shall be conducted on the size and design to be supplied by placing the geocomposite in vertical, as installed, position with soil pressure of 15 N/cm^2(22 psi) applied to soil surface above a 2.4 m (8 ft) length and measuring the flow capacity of the product when flowing full at the inlet. (University of Kentucky Test).

10. Dimensions and Permissible Variations

10.1 *Nominal Size*—Nominal size for the assembled geocomposite shall be a minimum of 25 mm (1 in.) thick and 150 mm (6 in.), 300 mm (12 in.), 450 mm (18 in.), or 600 mm (24 in.) wide. The tolerance on the specified thickness and width shall be no more than -5 % of the specified value. Measurements shall be made in accordance with Test Method D2122.

NOTE 1—Tolerance on width is necessary because some core designs must be cut to size at specific points in their structural support pattern.

10.2 *Length*—These products are extruded and can be supplied in any length agreeable to the user. Length shall not be less than 99 % of the stated value.

10.3 *Perforations*—The drainage cores shall be perforated to permit flow into the geocomposite from both sides of the structure.

10.3.1 Class A cores shall have a minimum perforation open area of 10 % on the least open side.

10.3.2 Class B cores shall have a minimum perforation open area of 3250 mm^2 per 0.093 m^2(5 $in.^2/ft^2$) of surface area, or 3.4 % of the surface area.

10.4 *Fittings*—The inside open area of the couplings and fittings used shall be greater than that of the core. Couplings shall not damage the core structure.

11. Workmanship, Finish and Appearance

11.1 The geocomposite material shall consist of a drainage core and appropriate geotextile covering. The drainage core shall be uniform in shape and color, square cut at the ends, and cleanly perforated. The geotextile wrap or sleeve shall fit snugly without sagging into the void areas of the core. The geotextile shall be free of punctures, tears, or separated seams.

12. Sampling

12.1 Product may be sampled at the production plant or at the jobsite. Sampling shall be in accordance with Practice D4354.

13. Number of Tests and Retests

13.1 Flow capacity and transmissivity tests are product qualification tests and need only be done at a frequency agreeable to the manufacturer and the purchaser.

13.2 Compression testing (Test Method D6364) and measurements of thickness, perforations, width, and length shall be done on every lot.

14. Product Marking

14.1 The product core shall be clearly marked at intervals of not more than 6 m, and fittings and couplings shall be clearly marked, as follows:

14.1.1 Manufacturer's name or trademark,

14.1.2 Nominal size or height,

14.1.3 Specification designation ASTM X XXXX,

14.1.4 Plant designation code, and

14.1.5 The date of manufacture or an appropriate code.

15. Quality Assurance

15.1 When the product or product packing is marked with the ASTM designation X XXXX, the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

15.2 Upon request of the user, the manufacturer shall provide certification that the product was produced and tested in accordance with this specification. Certification shall be furnished at the time of shipment.

16. Keywords

16.1 edgedrain; geocomposite; geosynthetic; geotextile; pavement edgedrain; polyethylene; underdrain

APPENDIX

(Nonmandatory Information)

X1. FLOW TEST/COMPRESSION TEST OF PAVEMENT EDGE PANEL DRAINS—KENTUCKY METHOD

X1.1 Scope

X1.1.1 This method covers a procedure for determining the flow capacity of edge panel drains while under vertical compression, and while encapsulated in a sand backfill. The test measures the flow capacity of the edge drain panel while placed on a 3 % grade and under a 22 psi vertical load.

X1.1.2 *Application*—This method shall apply to all panel or fin-type pavement edge drains. This may include but not be limited to all cuspated types, those types with posts, types that are similar to deformed pipe, and any other design.

X1.2 Apparatus

X1.2.1 *Flow/Compression Box*—The flow/compression box must be capable of holding the specimen and sand backfill, and it must be capable of supporting a minimum vertical load of 22 psi. The box shall be constructed of clear acrylic sheets, one-half inch in thickness. The design of the box shall conform to Figs. X1.1-X1.4.

X1.2.2 *Sand*—A sufficient amount of sand to fill the compression box. Natural sand is recommended. The sand shall have a gradation conforming to the following:

Sieve Size	Percent Passing
⅜ in.	100
No. 4	90–100
No. 16	45–80
No. 50	5–25
No. 100	0–8

X1.2.3 *Load Jacks*—The load shall be applied by hydraulic screw jacks.

X1.2.4 *Load Cells*—The load shall be measured by means of a series of electronic or hydraulic load cells capable of measuring to the nearest 0.25 pounds.

X1.2.5 *Large Container for Collecting Water*—Water outflow from the sample shall be collected in a container with a minimum volume of 20 gallons.

X1.2.6 *Stop Watch*—A stop watch capable of reading to the nearest 0.5 s shall be used.

X1.3 Sample

X1.3.1 The edge drain sample shall be approximately 12 in. in height and 8 ft in length.

X1.3.2 The geotextile covering the core shall be intact. There shall not be any tears or punctures, and if the textile is normally glued to the core for a particular design, it shall remain glued for this test.

X1.4 Procedure

X1.4.1 The 12 in. tall edge drain sample shall be cut to approximately 8 ft 3 in.; this will allow approximately 1.5 in. of material to be caulked into place at each end of the chamber.

X1.4.2 The sample shall be placed firmly against wall of the chamber and caulked into place, at both ends, to ensure that no leakage occurs at the inlet or outlet end of the chamber. Allow the caulk to cure for at least 24 h before proceeding to the next step.

X1.4.3 Backfill the around the panel drain with the sand. Sand shall be placed approximately 4 inches above the panel and densified by flooding the sand with water.

X1.4.4 Place the loading plate (Fig. X1.1) onto the sand surface, and then place the loading jacks onto the loading plate.

X1.4.5 Begin loading the sand backfill and core at a rate of 5 psi per minute until the maximum load of 22 psi is reached.

X1.4.6 Fill the inlet reservoir of the chamber until a one-inch head is reached. The load and the water level shall be held constant throughout the test.

X1.4.7 Move the large container listed in X1.2.5 under the outlet end of the panel drain and collect the water discharge for a period of one minute. Measure the discharge from the outlet end to the nearest 0.1 gallon. Record the rate of flow in gallons/minute.

X1.4.8 Repeat step X1.4.7 ten times, recording the flow rate each time.

X1.5 Report

X1.5.1 Report the average flow rate under the conditions of the test in gallons per minute. Report the standard deviation of the ten trials.