Preparing Activity: USACE Superseding without Revision
UFGS-31 05 22 (August 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 31 05 19.13

GEOTEXTILES FOR EARTHWORK
02/21

NOTE: This guide specification covers the requirements for furnishing, hauling, and placing the geotextile, complete, as specified and shown, and maintaining the geotextile until placement of the granular filter material, bedding material, and/or riprap cover is completed and accepted. This section was originally developed for USACE Civil Works projects.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

NOTE: This guide specification is to facilitate the preparation and review of specifications for procurement and installation of woven and nonwoven geotextiles as filter material. It is based on field performance and the laboratory testing of a limited number of geotextiles. Geotextiles possess greatly varying engineering properties and physical characteristics. Such variations require the designer to decide which testing method and what

test criteria are necessary for each application. The apparent opening size (AOS), percent open area (POA), geotextile permeability (Kg), and strength test described in the specifications that follow are physical property tests. While it is acceptable to specify minimum thickness value where it governs performance, it is inappropriate to use thickness to identify a geotextile. Result of these tests are used to judge the acceptability of a geotextile for a particular use. Prospective geotextile suppliers should furnish these test results before their geotextile will be considered for use, or before contract specifications are adjusted to permit the use of geotextiles whose properties are outside the limits imposed by this guide. For severe soil conditions and/or for a project using a large amount of geotextiles, the specifications should require that the applicable tests be run during construction, either at a specific frequency or upon demand of the Contracting Officer. For projects requiring small amounts of geotextiles under normal soil conditions the physical properties of the geotextile supported by written authentication from an authorized representative of the manufacturers may be accepted.

The actual life of geotextiles is not known, and their use in inaccessible areas must be considered carefully. Therefore geotextiles should not be used as filter material in toe drains, buried collector system, relief wells, or within any portions of embankments. Caution is advised in using geotextiles on the upstream face of earth dams or to wrap permanent piezometers.

Geotextiles are basically inert materials for typical civil engineering applications. However certain applications may expose the geotextile to chemical or biological activities that could drastically influence the filtration properties of the geotextile. Specific site conditions should be reviewed, and if such conditions exist, testing and specifications should be written to overcome it.

Geotextile strength requirements vary with intended use and construction procedures. Experience has shown that when a heavier non-woven geotextile is used, the bedding material can often be reduced in thickness or be completely eliminated. TABLE I in SI ENGLISH UNITS (1) presents the most important geotextile strength properties. It should be noted that the strength requirements listed are only a guideline to the minimum values required for survivability. Specific applications may require additional testing.

Filter design criteria for geotextiles are based on the apparent opening size (AOS, which is designated as EOS in the previous guide specification), percent

open area (POA, for woven only), geotextile permeability (Kg), and an appropriate percent passing size of the soil. For piping analysis computations, AOS must be expressed as an equivalent U.S. standard sieve opening in millimeters. To assure adequate resistance to reduction in permeability over time (clogging) and sufficient long term flow through the soil/woven geotextile system, POA criteria, as expressed in the next note, can be used.

TABLE I
RECOMMENDED GEOTEXTILE STRENGTH REQUIREMENTS IN METRIC UNITS (1)

GEOTEXTILE USE	STRENGTH REQUIREMENTS (MINIMUM VALUES)			
	ASTM D4632 TENSILE (N) (lbs)	ASTM D4355/D4355M UNTRAVIOLET DEGRADATION AT 500 HOURS (PERCENT)	ASTM D6241 PUNCTURE (N) (lbs)	ASTM D4533/D4533M TEAR (N) (lbs)
RIPRAP SLOPE PROTECTION FILTER WITH GREATER THAN 100 mm 4 INCHES BEDDING	515115	50	18040	18040
RIPRAP SLOPE PROTECTION WITHOUT BEDDING	900200	50	36080	18040
DRAINAGE TRENCH	515115	50	18040	11025
SLAB DRAIN	515115	50	18040	11025
ARTICULATED MATTRESS OR INTERLOCKING BLOCK SLOPE PROTECTION FILTER	515115	50	18040	18040

(1) Strength values are for the weaker principal direction.

The designer must specify geotextile properties which will allow retention of the soil being protected, permit sufficient flow through the textile, and prevent clogging. The designer should select the AOS, POA, and Kg, based on criteria in TABLE II. The AOS requirement should be specified as a range, to allow for manufacturing tolerance. It is preferable to specify a geotextile with opening as large as allowed by the design criteria. The smallest sieve opening size of the AOS range should not be smaller than the 0.125 mm sieve U.S. Standard sieve size No. 120.

TABLE II GEOTEXTILE FILTER DESIGN CRITERIA			
		COEFFICIENT OF PERMEABILITY (3)	
PROTECTED SOIL (1) (PERCENT PASSING 75 µm NO. 200 SIEVE)	SOIL PIPING (2)	WOVEN	NON-WOVEN
< 5	$0_{95}/D_{85} \leq 1$	POA 10 percent	Kg 5Ks
5 to 50	$0_{95}/D_{85} \leq 1$	POA 4 percent	Kg 5Ks
50 to 85	$0_{95}/D_{85} \leq 1$ $0_{95} \leq$ 0.212 mm No. 70 U.S. sieve)	POA 4 percent	Kg 5Ks
$0_{95}/D_{85} \leq 1$	$0_{95} \leq$ 0.125 No. 120 U.S. sieve)	Kg 5Ks	
(1) Recent experiences have indicated that 0_{95} (i.e. AOS) increased with increasing relative density, Dr, and it is higher for uniform soil than well graded soil of similar density and average particle size.			
(2) If the protected soil contains appreciable quantities of material retained on the 4.75 mm No. 4 U.S. sieve use only the soil passing the 4.75 mm No. 4 U.S. sieve in selecting the 0_{95} of the geotextile.			
(3) Kg is the permeability of the geotextile and Ks is the permeability of the protected soil.			

Satisfactory geotextile performance is greatly dependent on the field preparation of the surface of the protected soil and the installation procedure.

The following information is related to TABLE 1. Geotextile calculations should be based on procedure from an accepted reference. Worst placement conditions should be considered since stresses generated during installation often exceed post construction stresses.

(1) The requirement of permittivity (as defined in ASTM D4491/D4491M) should be chosen in such a manner that the permeability of the geotextile should always be at least five times greater than the permeability of the adjacent soil during the life of the protected earth structure.

(2) The minimum seam strength listed in TABLE 1 is based on the tensile strength of the parent geotextile material. Seam strength can also be considered as not less than 90 percent of the unaged grab tensile strength of the geotextile in the applicable direction.

NOTE: TO DOWNLOAD UFGS GRAPHICS

Figures described below are available on-line for download. Go to http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/for

Figure 1. Correct geotextile placement for current acting parallel to bank or for wave attack on the bank.

Figure 2. Placement of geotextile on bank subject to streamflow action. Revetment materials have not yet been placed on the geotextile.

Figure 3. Geotextile on bank subject to wave attack showing placement of vertical-wall key trench at toe and top bank. Revetment materials have not yet been placed on geotextile.

Figure 4. Key trench design used when soil conditions do not permit construction of vertical walls.

The Designer must comply with the requirements of the following Regulatory Requirements:

U.S. DEPARTMENT OF INTERIOR, BUREAU OF RECLAMATION - 7-2071 (6-48), (1992) Design Standard No. 13, "Embankment Dams", Chapter 19, "Geotextile"

U.S. DEPARTMENT OF INTERIOR, BUREAU OF RECLAMATION:

EM 1110-2-1601, (1991) "Hydraulic Design of Flood Control Channels"

EM 1110-2-1906, (1970) Laboratory Soil Testing, Appendix V, "Grain-Size Analysis", paragraph 2d "Procedure", subparagraph (1)(g)

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1.1 UNIT PRICES

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NOTE: If Section 01 20 00 PRICE AND PAYMENT PROCEDURES is included in the project specifications, this paragraph title (UNIT PRICES) should be deleted from this section and the remaining appropriately edited subparagraphs below should be inserted into Section 01 20 00.

****

1.1.1 Payment

Payment will be made at the contract unit price and will constitute full compensation to the Contractor for providing all plant, labor, material, and equipment and performing all operations necessary for the complete and satisfactory installation of the geotextile. The following items are included in the contract unit price for Geotextiles and will not be counted a second time in the process of determining the extent of geotextile placed: Material and associated equipment and operation used

in laps, seams, or extra length; securing pins and associated material, equipment, and operations; and material and associated equipment and operations used to provide cushioning layer of sand or gravel or both to permit increase in allowable drop height of stone. No payment will be made for geotextiles replaced because of waste, contamination, damage, repair, or due to Contractor fault or negligence.

1.1.2 Measurement

Installed geotextiles will be measured for payment in place to the nearest [_____] square meter feet of protected area as delineated in the drawings.

1.1.3 Unit of Measure

Unit of measure: [_____] square meter feet.

1.2 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D123	(2015b; R 2017) Standard Terminology Relating to Textiles
ASTM D4354	(2012; R 2020) Sampling of Geosynthetics for Testing
ASTM D4355/D4355M	(2014) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491/D4491M	(2017) Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4533/D4533M	(2015) Standard Test Method for Trapezoid

	Tearing Strength of Geotextiles
ASTM D4632/D4632M	(2015a) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2020) Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D4873/D4873M	(2017) Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D4884/D4884M	(2014a) Strength of Sewn or Thermally Bonded Seams of Geotextiles
ASTM D6241	(2014) Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-2-1601	(1991; 1994 Change 1) Engineering and Design -- Hydraulic Design of Flood Control Channels

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL

PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Geotextiles

Minimum of [_____] [60] days prior to the beginning of installation of the same textile

SD-06 Test Reports

Geotextiles
Site Verification

SD-07 Certificates

Geotextiles
Needle Punched Geotextile

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver only approved geotextile [rolls][, panels,][_____] to the project site. Label, ship, store, and handle all geotextile in accordance with ASTM D4873/D4873M. Do not use hooks, tongs, or other sharp instruments for handling geotextile.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General

****

NOTE: Nonwoven geotextiles are suitable for filtering fine-grained soils whereas woven or nonwoven are suitable for well graded granular soils.

****

Provide geotextile that is a [woven][non-woven] pervious sheet of plastic yarn as defined by ASTM D123 matching or exceeding the minimum average roll values listed in TABLE 1. Strength values indicated in the table are for the weaker principal direction.

TABLE 1 MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	N lb	[_____]	ASTM D4632/D4632M
SEAM STRENGTH	N lb	[_____]	ASTM D4632/D4632M
PUNCTURE	N lb	[_____]	ASTM D6241
TRAPEZOID TEAR	N lb	[_____]	ASTM D4533/D4533M
PERMEABILITY	cm/sec	[_____]	ASTM D4491/D4491M
APPARENT OPENING SIZE	U.S. SIEVE	[_____]	ASTM D4751
PERMITTIVITY	sec -1	[_____]	ASTM D4491/D4491M
ULTRAVIOLET DEGRADATION	Percent	50 at 500 Hrs	ASTM D4355/D4355M

2.1.2 Geotextile Fiber

Use fibers consisting of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, polyesters, or polyamides. Add stabilizers and/or inhibitors to the base polymer, if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Do not add reclaimed or recycled fibers or polymer to the formulation. Form geotextile into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Finish the edges of the geotextile to prevent the outer fiber from pulling away from the geotextile.

2.1.3 Seams

****

NOTE: Most geotextiles are manufactured in widths of 1.8 to 5.5 m 6 to 18 feet, but to reduce the number of overlaps, wider sections may be produced by attaching narrow sections together. Pre-assembled sections of 11-m 36-foot widths or more are preferred to keep the number of overlaps to a minimum.

****

Sew the seams of the geotextile with thread of a material meeting the chemical requirements given above for geotextile yarn or bond the seams by cementing or by heat. Attach the sheets of geotextile at the factory or another approved location, if necessary, to form sections not less than [_____] meter [_____] feet wide. Test seams in accordance with method ASTM D4884/D4884M. Seam strength less than 90 percent of the required grab tensile strength of the unaged geotextile in any principal direction is not permitted.

2.1.4 Securing Pins

****

NOTE: The use of security pins should be restricted as much as possible since holes in geotextile allow

pin boils to form and remove material from beneath geotextile and cause failure of system.
****

Secure the geotextile to the embankment or foundation soil by pins to prevent movement prior to placement of revetment materials. Other appropriate means to prevent movement such as staples, sand bags, and stone could also be used. Insert securing pins through both strips of overlapped geotextile along the line passing through midpoints of the overlap. Remove securing pins as placement of revetment materials are placed to prevent tearing of geotextile or enlarging holes. Maximum spacing between securing pins depends on the steepness of the embankment slope. Provide maximum pins spacing equal to or less than the values listed in TABLE 2. When windy conditions prevail at the construction site, increase the number of pins upon the demand of the Contracting Officer. Anchor terminal ends of the geotextile with key trench or apron at crest, toe of the slope and upstream and downstream limits of installation.

TABLE 2
MAXIMUM SPACING FOR SECURING PINS

EMBANKMENT	SPACING, meter feet
STEEPER THAN 1V ON 3H	0.62
1V ON 3H TO 1V ON 4H	1.03
FLATTER THAN 1V ON 4H	1.55

2.2 INSPECTIONS, VERIFICATIONS, AND TESTING

2.2.1 Manufacturing and Sampling

Provide geotextiles and factory seams meeting the requirements specified in TABLE 1.

2.2.1.1 Conformance Testing

Perform conformance testing in accordance with the manufacturers approved quality control manual. Submit manufacturer's quality control conformance test results.

2.2.1.2 Factory Sampling

Randomly sample geotextiles in accordance with ASTM D4354 (Procedure Method A). Sample factory seams at the frequency specified in ASTM D4884/D4884M. Provide all samples from the same production lot as will be supplied for the contract, of the full manufactured width of the geotextile by at least 3 m 10 feet long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 1.5 m 5 feet. Identify samples submitted for testing by manufacturers lot designation.

2.2.1.3 Needle Punched Geotextile

For needle punched geotextile, provide manufacturer certification that the geotextile has been inspected using permanent on-line metal detectors and

does not contain any needles.

2.2.1.4 Manufacturer Certification

[Upon delivery of the geotextile, submit duplicate copies of the written certificate of compliance signed by a legally authorized official of the manufacturer. State that the geotextile shipped to the site meets the chemical requirements and exceeds the minimum average roll value listed in TABLE 1.] [All brands of geotextile and all seams to be used will be accepted on the basis of mill certificates or affidavits. Submit duplicate copies of the mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. Attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification.]

2.2.2 Site Verification and Testing

****

NOTE: The need for, and amount of, site verification testing should be based on the severity of site conditions and the amount of textile being placed.

****

Collect samples at approved locations upon delivery to the site [at the request of the Contracting Officer][in accordance with ASTM D4354 (Procedure Method B)][at a frequency of once per 9290 square meters 100,000 square feet]. Test samples to verify that the geotextile meets the requirements specified in TABLE 1. Identify samples by manufacturers name, type of geotextile, lot number, roll number, and machine direction. Perform testing at an approved laboratory. Submit test results from the lot under review for approval prior to deployment of that lot of geotextile. Immediately rewrap rolls which are sampled in their protective covering.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Prepare surface, on which the geotextile will be placed, to a relatively smooth surface condition in accordance with the applicable portion of this specification and must be free from obstruction, debris, depressions, erosion feature, or vegetation. Remove any irregularities so as to ensure continuous, intimate contact of the geotextile with all the surface. Remove loose material, soft or low density pockets of material; grade erosion features such as rills and gullies out of the surface before geotextile placement.

3.2 INSTALLATION OF THE GEOTEXTILE

****

NOTE: This paragraph describes installation in an open area and on generally planar surfaces. For installation of geotextiles in drainage systems or about collector pipes, additional specification requirements may need to be added. The use of geotextiles to wrap collector pipes should be avoided whenever possible.

Minimum overlaps should be specified at 300 to 450 mm 12 to 18 inches depending on the specified orientation of the overlap to the direction of wave attack, velocity, or seepage. For under-water placement, minimum overlap should be 900 mm 3 feet.

Geotextiles will bridge small surface features in the slope and allow erosion to occur beneath the geotextile. Surface drainage should be directed away from the top of slope to prevent erosion under the geotextile. Surface flow should be brought downslope at controlled points such as lined ditches.

****

3.2.1 General

Place the geotextile in the manner and at the locations shown. At the time of installation, reject the geotextile if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage.

3.2.2 Placement

****

NOTE: The placement of the geotextile relative to this paragraph may follow the following general procedures. (FIGURES referenced in this note are available on-line, see the note above).

(1) For current acting parallel to the bank the geotextile will be placed with the long dimension parallel to the current (Fig. 1a). Geotextile placement must be started from the bottom up with upper strips overlapping lower strips, and the upstream strips must overlap the downstream strips. The overlaps at the end of strips will be staggered at least 1.5 m 5 feet. Revetment and geotextile materials should be extended at least below the mean low water to minimize erosion at the toe (Fig. 2). If construction schedule permits, a period of low streamflow should be selected for the geotextile installation.

(2) When revetment material and geotextile filter are selected to protect against wave attack, the geotextile strips must be placed vertical to the slope of the bank with the upper strips overlapping the lower strips (Fig. 1b). The geotextile must be keyed at the toe to prevent uplift or undermining (Fig. 3). The key trench should be located below the mean low water to prevent erosion of the soil adjacent to the trench. When it is not possible to maintain vertical trench walls, the geotextile must be keyed to an excavated trench with stable slopes (Fig. 4). A key at the top of the bank will be installed where there is an overbank drainage problem.

Allowing the geotextile to drape or be free of high

tensile stress during placement will require larger quantities of geotextiles than the actual slope length.
****

Place the geotextile with the long dimension [parallel] [perpendicular] to the [centerline of the channel][shoreline][trench] and laid smooth and free of tension, stress, folds, wrinkles, or creases. Place the strips to provide a minimum width of [_____] mm inches of overlap for each joint. The placement procedure requires that the length of the geotextile be approximately [_____] percent greater than the slope length. Adjust the actual length of the geotextile used based on initial installation experience. Temporary pinning of the geotextile to help hold it in place until the [bedding layer][riprap] is placed will be allowed. Remove the temporary pins as the [bedding][granular material][riprap] is placed to relieve high tensile stress which may occur during placement of material on the geotextile. Design protection of riprap in compliance with EM 1110-2-1601. Perform trimming in such a manner that the geotextile is not damaged in any way.

3.3 PROTECTION

****
NOTE: All geotextiles can be damaged if stone is dropped on it from a height greater than 900 mm 3 feet. Some geotextiles can be damaged with lesser drop heights. When stone is heavy and angular it may cause punctures in the geotextile even if dropped from a height of 300 mm 1 foot. Tension in the geotextile must be minimized to prevent puncture.
****

Protect the geotextile at all times during construction from contamination by surface runoff; remove any geotextile so contaminated and replaced with uncontaminated geotextile. Replace any geotextile damaged during its installation or during placement of [granular filter materials][bedding materials][riprap] at no cost to the Government. Schedule the work so that the covering of the geotextile with a layer of the specified material is accomplished within [_____][7] calendar days after placement of the geotextile. Failure to comply will require replacement of geotextile. Protect the geotextile from damage prior to and during the placement of riprap or other materials.[This may be accomplished by limiting the height of drop to less than 300 mm 1 foot, by placing a cushioning layer of sand or gravel on top of the geotextile before placing the material, or other methods deemed necessary. Care should be taken to ensure that the utilized cushioning materials will not impede the flow of water.] Before placement of riprap or other materials, demonstrate that the placement technique will not cause damage to the geotextile. Do not allow equipment on the unprotected geotextile.

3.4 PLACEMENT OF CUSHIONING MATERIAL

Perform placing of cushioning material in a manner to ensure intimate contact of the geotextile with the prepared surface and with the cushioning material. Do not damage the geotextile, including tear, puncture, or abrasion, during placement. On sloping surfaces place the cushioning material from the bottom of the slopes upward. During placement, the height of the drop of riprap material greater than 300 mm 12 inches is not permitted. Uncover any geotextile damaged beneath the

cushioning material, as necessary, and replaced at no cost to the Government.

3.5 OVERLAPPING AND SEAMING

3.5.1 Overlapping

****

NOTE: In general, overlapping is sufficient where the primary purpose is to hold the material in place during installation. However, where the design requires the geotextile to resist tensile stresses, seams should be sewn. A 300-mm 12-inch overlap specified in this section is considered minimum for all cases. The Contractor has the option of field sewing instead of overlapping.

****

The overlap of geotextile [rolls] [panels] [_____] must be [300][600][900][_____] mm [12][24][36][_____] inches. Appropriate measures will be taken to ensure required overlap exists after cushion placement.

3.5.2 Sewn Seams

****

NOTE: The Designer must specify appropriate seam test requirements. ASTM D1683, the previously used test standard, has been discontinued with no replacement designated.

****

High strength thread should be used so that seam test conforms to ASTM D4884/D4884M. Provide thread meeting the chemical, ultraviolet, and physical requirements of the geotextile, and provide color different from that of the geotextile. Provide seam strength equal to the strength required for the geotextile in the direction across the seam. Overlapping J-type seams are preferable over prayer-type seams as the overlapping geotextile reduces the chance of openings to occur at the seam. Use double sewing, specially for field seams, to provide a safety factor against undetected missed stitches.

3.6 [FIELD TESTING

****

NOTE: The need for field testing should be based on the size and importance of the project. Field testing should be performed if the geotextile will be in tension.

****

Field test geotextile[in tension].]

-- End of Section --