

*This guide specification has been prepared by Propex Operating Company, LLC (Propex) to assist design professionals in the preparation of a specification section covering nonwoven geotextiles directly above or directly below geomembranes in waste containment applications. It may be used as the basis for developing either a project specification or an office master specification. Since it has been prepared according to the principles established in the Manual of Practice published by The Construction Specifications Institute (CSI) including the use of section numbers and titles from the 2004 Edition of MasterFormat, this guide specification may be used in conjunction with most commercially available master specifications sections with minor editing.*

*The following should be noted in using this guide specification:*

- *Optional text requiring a selection by the user is enclosed within brackets, e.g.: “Section [01 33 00] [\_\_\_\_].”*
- *Items requiring user input are enclosed within brackets, e.g.: “Section [\_\_\_\_ - \_\_\_\_].”*
- *Optional paragraphs are separated by an “OR” statement, e.g.:*

*\*\*\*\* OR \*\*\*\**

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## **1 GENERAL**

### **1.1 SECTION INCLUDES**

*Edit the following paragraph to suit project requirements.*

- A. Geotextile placed directly [above] [and] [below] geomembrane liner/cover for protection from damage due to construction and service loading.

### **1.2 RELATED SECTIONS**

*Edit the following paragraphs to coordinate with other sections of the Project Manual.*

- A. Section [31 20 00 – Earth Moving] [\_\_\_\_ - \_\_\_\_].

### **1.3 UNIT PRICES**

*Include the following article only for unit price contracts or lump sum contract with unit price adjustments. Delete for lump sum contracts.*

- A. Method of Measurement: By the square meter (or square yard as indicated in contract documents) including seams, overlaps, and wastage.
- B. Basis of Payment: By the square meter (or square yard as indicated in contract documents) installed.

#### 1.4 REFERENCES

*The following article assumes that the date of each reference standard will be the latest edition as of the date of the project specification. This provision must be defined in Division 1; coordinate with Division 1 statements.*

- A. AASHTO Test Standards:
  - 1. T 88 – Standard Test Method for Particle Size Analysis of Soils
  - 2. T 90 – Standard Test Method for Determining the Plastic Limit and Plasticity Index of Soils
  - 3. T 99 – Standard Practice for Determination of the Moisture Density Relations of Soils Using a 5.5 lb hammer and 12 in drop (Standard Proctor)
- B. American Society for Testing and Materials (ASTM):
  - 1. D 123 – Standard Terminology Relating to Geotextiles
  - 2. D 276 – Standard Test Method for Identification of Fibers in Textiles
  - 3. D 3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics.
  - 4. D 4354 - Practice for Sampling of Geosynthetics for Testing.
  - 5. D 4355 - Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
  - 6. D 4439 - Terminology for Geotextiles.
  - 7. D 4491 - Test Methods for Water Permeability of Geotextiles by Permittivity.
  - 8. D 4533 - Test Method for Index Trapezoid Tearing Strength of Geotextiles.
  - 9. D 4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - 10. D 4751 - Test Method for Determining Apparent Opening Size of a Geotextile.
  - 11. D 4759 - Practice for Determining the Specification Conformance of Geosynthetics.
  - 12. D 4833 - Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
  - 13. D 4873 - Guide for Identification, Storage, and Handling of Geotextiles.
  - 14. D 5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
- C. Environmental Protection Agency (EPA) -Technical Guidance Document, Quality Assurance and Quality Control for Waste Containment Facilities.
- D. Geosynthetic Accreditation Institute - Laboratory Accreditation Program (GAI-LAP).

#### 1.5 DEFINITIONS

- A. Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.
- B. Maximum Average Roll Value (MaxARV): Property value calculated as typical plus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will be below the value reported.
- C. Typical Roll Value: Property value calculated from average or mean obtained from test data.

1.6 SUBMITTALS

*Edit the following to coordinate with Division 1.*

- A. Submit under provisions of Section [01 33 00] [\_\_\_\_]:
  - 1. Certification:
    - a) The Contractor shall provide the Engineer a certificate stating the name of the geotextile manufacturer, product name, style, chemical compositions of filaments or yarns and other pertinent information to fully describe the geotextile.
    - b) The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.
    - c) The manufacturer's certificate shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the manufacturer's quality control program. A person having legal authority to bind the Manufacturer shall attest to the certificate.
  - 2. Manufacturing Quality Control (MQC) test results shall be provided upon request.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Geotextile labeling, shipment and storage shall follow ASTM D 4873.
- B. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number.
- C. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.
- D. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.
- E. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the outer wrap of geotextile material must be discarded before installation.
- F. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: Site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, chemicals that are strong acids or strong bases, flames, sparks, temperatures in excess of 71 deg C (160 deg F) and any other environmental condition that might damage the geotextile.

1.8 QUALITY ASSURANCE SAMPLING, TESTING, AND ACCEPTANCE

- A. Geotextile:
  - 1. Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with ASTM D 4354.
  - 2. Acceptance shall be in accordance with ASTM D 4759 based on testing of either conformance samples obtained using Procedure A of ASTM D 4354, or based on manufacturer's certifications and testing of quality control samples obtained using Procedure B of ASTM D 4354.
- B. Sewn Seams (if required):
  - 1. For seams that are to be sewn in the field, the Contractor shall provide at least a 2 meter length of sewn seam for sampling by the Engineer before the geotextile is installed.
  - 2. For seams that are sewn in the factory, the Engineer shall obtain samples of the factory seams at random from and roll of geotextile that is to be used on the project.
  - 3. If seams are to be sewn in both directions, samples of seams from both directions shall be provided.

4. For seams that are field sewn, the seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams.
5. The seam assembly description shall be submitted by the Contractor along with the sample of the seam. The description shall include the seam type, sewing thread, and stitch density.

**2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Propex Operating Company, LLC, Chattanooga, Tennessee, 37419 USA, Phone (800) 621-1273.

*Edit the following to coordinate with Division 1.*

- B. Substitutions: Under provisions of Section [01 25 00] [\_\_\_\_\_].

**2.2 MATERIALS**

- A. GEOTEX<sup>®</sup> 451:

1. The geotextile construction shall be a nonwoven, staple fiber, needlepunched, polypropylene geotextile; the fibers are needed together to form a stable network that retains dimensional stability relative to each other.
2. The geotextile should be resistant to UV degradation and biological and chemical environments normally encountered in soils.
3. The geotextile should meet the following Minimum Average Roll Values (MARV) for nonwoven geotextile:

Property	Test Method	Units	Property Requirement
Mass Per Unit Area	ASTM D 5261	g/sm (oz/sy)	135 (4.0)
Thickness	ASTM D 5199	mm (mils)	-
Grab Tensile Strength	ASTM D 4632	N (lbs)	445 (100)
Elongation	ASTM D 4632	percent	60
CBR Puncture	ASTM D 6241	N (lbs)	1112 (250)
Trapezoidal Tear	ASTM D 4533	N (lbs)	200 (45)
UV Resistance	ASTM D 4355	percent	70 at 500 hrs
Apparent Opening Size (AOS)	ASTM D 4751	mm (US Std. Sieve)	0.212 (70)
Permittivity	ASTM D 4491	sec <sup>-1</sup>	1.8
Permeability	ASTM D 4491	cm/sec	-
Water Flow Rate	ASTM D 4491	l/min/m <sup>2</sup> (gpm/ft <sup>2</sup> )	4889 (120)

\*\*\*OR\*\*\*

- B. GEOTEX<sup>®</sup> 651

1. The geotextile construction shall be a nonwoven, staple fiber, needlepunched, polypropylene geotextile; the fibers are needed together to form a stable network that retains dimensional stability relative to each other.
2. The geotextile should be resistant to UV degradation and biological and chemical environments normally encountered in soils.
3. The geotextile should meet the following Minimum Average Roll Values (MARV) for nonwoven geotextile:

<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>Property Requirement</b>
Mass Per Unit Area	ASTM D 5261	g/sm (oz/sy)	203 (6.0)
Thickness	ASTM D 5199	mm (mils)	2.0 (80)
Grab Tensile Strength	ASTM D 4632	N (lbs)	756 (170)
Elongation	ASTM D 4632	percent	50
CBR Puncture	ASTM D 6241	N (lbs)	1936 (435)
Mullen Burst	ASTM D 3786	kPa (psi)	-
Trapezoidal Tear	ASTM D 4533	N (lbs)	311 (70)
UV Resistance	ASTM D 4355	percent	70 at 500 hrs
Apparent Opening Size (AOS)	ASTM D 4751	mm (US Std. Sieve)	0.212 (70)
Permittivity	ASTM D 4491	sec-1	1.5
Permeability	ASTM D 4491	cm/sec	0.38
Water Flow Rate	ASTM D 4491	l/min/m2 (gpm/ft2)	4482 (110)

\*\*\*OR\*\*\*

C. GEOTEX<sup>®</sup> 1071

1. The geotextile construction shall be a nonwoven, staple fiber, needlepunched, polypropylene geotextile; the fibers are needed together to form a stable network that retains dimensional stability relative to each other.
2. The geotextile should be resistant to UV degradation and biological and chemical environments normally encountered in soils.
3. The geotextile should meet the following Minimum Average Roll Values (MARV) for nonwoven geotextile:

Property	Test Method	Units	Property Requirement
Mass Per Unit Area	ASTM D 5261	g/sm (oz/sy)	339 (10.0)
Thickness	ASTM D 5199	mm (mils)	2.7 (105)
Grab Tensile Strength	ASTM D 4632	N (lbs)	1201 (270)
Elongation	ASTM D 4632	percent	50
CBR Puncture	ASTM D 6241	N (lbs)	3226 (725)
Mullen Burst	ASTM D 3786	kPa (psi)	-
Trapezoidal Tear	ASTM D 4533	N (lbs)	467 (105)
UV Resistance	ASTM D 4355	percent	70 at 500 hrs
Apparent Opening Size (AOS)	ASTM D 4751	mm (US Std. Sieve)	0.150 (100)
Permittivity	ASTM D 4491	sec-1	1.2
Permeability	ASTM D 4491	cm/sec	0.30
Water Flow Rate	ASTM D 4491	l/min/m <sup>2</sup> (gpm/ft <sup>2</sup> )	3463 (85)

\*\*\*OR\*\*\*

D. GEOTEX<sup>®</sup> 1291

1. The geotextile construction shall be a nonwoven, staple fiber, needlepunched, polypropylene geotextile; the fibers are needled together to form a stable network that retains dimensional stability relative to each other.
2. The geotextile should be resistant to UV degradation and biological and chemical environments normally encountered in soils.
3. The geotextile should meet the following Minimum Average Roll Values (MARV) for nonwoven geotextile:

Property	Test Method	Units	Property Requirement
Mass Per Unit Area	ASTM D 5261	g/sm (oz/sy)	407 (12.0)
Thickness	ASTM D 5199	mm (mils)	2.9 (115)
Grab Tensile Strength	ASTM D 4632	N (lbs)	1424 (320)

Elongation	ASTM D 4632	percent	50
CBR Puncture	ASTM D 6241	N (lbs)	4116 (925)
Mullen Burst	ASTM D 3786	kPa (psi)	4274 (620)
Trapezoidal Tear	ASTM D 4533	N (lbs)	556 (125)
UV Resistance	ASTM D 4355	percent	70 at 500 hrs
Apparent Opening Size (AOS)	ASTM D 4751	mm (US Std. Sieve)	0.150 (100)
Permittivity	ASTM D 4491	sec-1	0.8
Permeability	ASTM D 4491	cm/sec	0.29
Water Flow Rate	ASTM D 4491	l/min/m <sup>2</sup> (gpm/ft <sup>2</sup> )	2445 (60)

\*\*\*\* OR \*\*\*\*

E. GEOTEX<sup>®</sup> 1701

1. The geotextile construction shall be a nonwoven, staple fiber, needlepunched, polypropylene geotextile; the fibers are needled together to form a stable network that retains dimensional stability relative to each other.
2. The geotextile should be resistant to UV degradation and biological and chemical environments normally encountered in soils.
3. The geotextile should meet the following Minimum Average Roll Values (MARV) for nonwoven geotextile:

Property	Test Method	Units	Property Requirement
Mass Per Unit Area	ASTM D 5261	g/sm (oz/sy)	542 (16.0)
Thickness	ASTM D 5199	mm (mils)	4.2 (165)
Grab Tensile Strength	ASTM D 4632	N (lbs)	1735 (390)
Elongation	ASTM D 4632	percent	50
CBR Puncture	ASTM D 6241	N (lbs)	5006 (1125)
Mullen Burst	ASTM D 3786	kPa (psi)	5515 (800)
Trapezoidal Tear	ASTM D 4533	N (lbs)	690 (155)

UV Resistance	ASTM D 4355	percent	70 at 500 hrs
Apparent Opening Size (AOS)	ASTM D 4751	mm (US Std. Sieve)	0.150 (100)
Permittivity	ASTM D 4491	sec-1	0.7
Permeability	ASTM D 4491	cm/sec	0.27
Water Flow Rate	ASTM D 4491	l/min/m <sup>2</sup> (gpm/ft <sup>2</sup> )	2037 (50)

4. Quality Control:
  - a) Manufacturing Quality Control: Testing shall be performed at a laboratory accredited by GAI-LAP for tests required for the geotextile, at frequency exceeding ASTM D 4354.

F. Sewing Thread (if required)

1. Sewing thread shall consist of high strength polypropylene or polyester (Nylon shall not be used).
2. The thread shall be of a contrasting color to the geotextile.

**3 EXECUTION**

3.1 PREPARATION

- A. Prepare surfaces to receive geotextile to smooth condition as indicated or as directed by Engineer.
- B. Fill depressions; remove debris and obstructions that could damage the geotextile.

3.2 INSTALLATION

- A. Install geotextile at elevation and alignment as indicated or as directed by Engineer and in accordance with EPA Technical Guidance Document.
- B. Protect underlying layers upon which geotextile will be placed.
- C. If substrate is soil, use equipment selected to minimize rutting should. Excess rutting will be defined and quantified by the Engineer.
- D. Prevent entrapment of stones, excessive dust, and moisture within and beneath geotextile that could damage geomembrane, causing clogging of drains or filters, or hampers subsequent seaming.
- E. On side slopes, anchor geotextile at top, then unroll to prevent wrinkles and folds.
- F. Cut geotextile using upward cutting hook blade.
- G. Use lightweight woven geotextile between nonwoven geotextile and textured geomembrane to prevent sticking. Remove after positioning geotextile.
- H. Use sandbags or equivalent to provide resistance against wind uplift.



3.3 PROTECTION

- A. Atmospheric exposure of the geotextile to the elements following laydown shall be limited to 14 days to prevent damage.
- B. Vehicles and construction equipment shall not be operated directly over installed geosynthetics without approval of the Engineer.

**END OF SECTION**