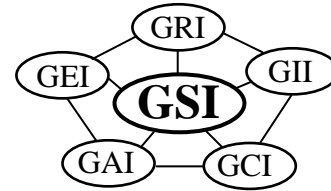


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Original: February 18, 2002

GRI Test Method GT12(a)* - ASTM Version

Standard Specification for

“Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials”

This specification was developed by the Geosynthetic Research Institute (GRI) with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

- 1.1 This specification covers nonwoven geotextile test properties for subsequent use as protection (or cushioning) materials.

Note 1: The typical use will be as a protective covering or underlayment of a geomembrane against puncture or tear due to rock, stones, concrete or other hard surfaces and/or objects.

- 1.2 This specification sets forth a set of physical, mechanical and endurance properties that must be met, or exceeded by the geotextile being manufactured.

- 1.3 In the context of quality systems and management, this specification represents a manufacturing quality control (MQC) document.

Note 2: Manufacturing quality control represents those actions taken by a manufacturer to assure that a product represents the stated objective and properties set forth in the specification.

- 1.4 This standard specification is intended to assure good quality and performance of fabrics used as geotextile protection materials but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive

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values for the tests indicated, may be necessary under conditions of a particular application.

- 1.5 This standard specification does not address installation practices or design guidance. Both of these items are addressed in the literature dealing with this particular application.

2. Referenced Documents

2.1 ASTM Standards

- D 4354 Practice for Sampling of Geosynthetics for Testing
- D 4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
- D 4533 Test Method for Trapezoidal Tearing Strength of Geotextiles
- D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
- D 4759 Practice for Determining the Specification Conformance of Geosynthetics
- D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
- D 4873 Guide for Identification, Storage and Handling of Geotextiles
- D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles
- D 5494 Test Method for the Determination of Pyramid Puncture Resistance of Unprotected and Protected Geomembranes
- D 6241 Test Method for Static Puncture Strength of Geotextiles and Geotextile Related Product Using a 50-mm Probe

2.2 AASHTO Specification

M288-00 Geotextile Specification for Highway Applications

3. Definitions

- 3.1 Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For nonwoven geotextiles, a formulation is defined as the exact percentages and types of resin(s), additives and/or carbon black.
- 3.2 Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications [ref. EPA/600/R-93/182].

Note 3: This particular specification for nonwoven protection geotextiles falls under the concept of MQC.

- 3.3 Minimum Average Roll Value (MARV) – For geosynthetics, a manufacturing quality control tool used to allow manufacturers to establish published values such that the user/purchaser will have a 97.7% confidence that the property in question will meet published values. For normally distributed data, “MARV” is calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property.
4. Material Classification and Formulation
- 4.1 This specification covers geotextiles used as protection (or cushioning) materials.
- 4.2 The type of resins are usually polypropylene, polyester or polyethylene, but other resins are also possible in this regard.
- 4.3 The type of geotextile style is designated as a nonwoven since research has shown these fabrics to be most effective in the typical applications toward which this specification is directed. While needle-punched nonwovens are usually used, heat bonded and resin dipped manufacturing styles (or others) can also be considered.
5. Specification Requirements
- 5.1 The geotextiles for use as protection (or cushioning) materials shall conform to Table 1. The table is given in English units and in SI (Metric) units. The conversion from English to SI units is “soft”.
- 5.2 Since there are a number of geotextile puncture test methods available, Table 2 is provided. Either of these tests can be considered to be an alternative test replacing ASTM D4833 in Table 1. The decision to make such a replacement must be agreed upon by the parties involved. The table is given in English units and in SI (Metric) units. The conversion from English to SI units is “soft”.
- 5.3 The required values for all properties in Tables 1 and 2 are to be minimum average roll values (MARV) except UV resistance which is a minimum value.
6. Workmanship and Appearance
- 6.1 The finished geotextile shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the geotextile, or its proper functioning.
- 6.2 General manufacturing procedures shall be performed in accordance with the manufacturer’s internal quality control guide and/or documents.

7. MQC Sampling, Testing, and Acceptance

- 7.1 Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling shall be in accordance with the most current modification of ASTM Standard D 4354, using the section titled, "Procedure for Sampling for Purchaser's Specification Conformance Testing." In the absence of purchaser's testing, verification may be based on manufacturer's certifications as a result of testing by the manufacturer of quality assurance samples obtained using the procedure for Sampling for Manufacturer's Quality Assurance (MQA) Testing. A lot size shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.
- 7.2 Testing shall be performed in accordance with the method referenced in this specification for the indicated application. The number of specimens to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV. Refer to ASTM D 4759 for more details regarding geotextile acceptance procedures.

8. MQC Retest and Rejection

- 8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Shipment and Storage

- 9.1 Geotextile labeling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.
- 9.2 Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.
- 9.3 During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition that may damage the property values of the geotextile.

10. Certification

- 10.1 The contractor shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile.
- 10.2 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.
- 10.3 The manufacturer's certificate shall state that the finished 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.
- 10.4 Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

USA Units

Table 1(a) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property ⁽¹⁾	Test Method ASTM	Unit	Mass/Unit Area (oz/yd ²)					
Mass per unit area	D5261	oz/yd ²	10	12	16	24	32	60
Grab tensile strength	D4632	lb	230	300	370	450	500	630
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	lb	95	115	145	200	215	290
Puncture (pin) strength	D4833	lb	120	140	170	250	300	390
UV resistance ⁽²⁾	D4355	%	70	70	70	70	70	70

Notes:

- (1) All values are MARV except UV resistance; it is a minimum value.
- (2) Evaluation to be on 2.0 inch strip tensile specimens after 500 hours exposure.

Table 2(a) – Alternative Puncture Test Methods to be Considered in Place of Pin Puncture, ASTM D4833, in Table 1(a)

Property ⁽¹⁾	Test Method ASTM	Unit	Mass/Unit Area (oz/yd ²)					
Mass per unit area	D5261	oz/yd ²	10	12	16	24	32	60
Puncture (pyramid) strength	D5494	lb	300	320	410	440	510	760
Puncture (CBR) strength	D6241	lb	700	800	900	1100	1700	2400
Puncture (CBR) elongation	D6241	in.	1.5	1.5	1.5	1.5	1.5	1.5

(1) All values are MARV

S.I. (Metric) Units

Table 1(b) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property ⁽¹⁾	Test Method ASTM	Unit	Mass/Unit Area (g/m ²)					
Mass per unit area	D5261	g/m ²	340	406	542	812	1080	2000
Grab tensile strength	D4632	kN	1.02	1.33	1.64	2.00	2.25	2.80
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	kN	0.42	0.51	0.64	0.89	0.96	1.27
Puncture (pin) strength	D4833	kN	0.53	0.62	0.75	1.11	1.33	1.71
UV resistance ⁽²⁾	D4355	%	70	70	70	70	70	70

Notes:

(3) All values are MARV except UV resistance; it is a minimum value.

(4) Evaluation to be on 50 mm strip tensile specimens after 500 hours exposure.

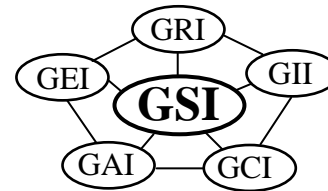
Table 2(b) – Alternative Puncture Test Methods to be Considered in Place of Pin Puncture, ASTM D4833, in Table 1(b)

Property ⁽¹⁾	Test Method ASTM	Unit	Mass/Unit Area (g/m ²)					
Mass per unit area	D5261	g/m ²	340	406	542	812	1080	2000
Puncture (pyramid) strength	D5494	kN	1.33	1.42	1.82	1.96	2.27	3.37
Puncture (CBR) strength	D6241	kN	3.11	3.56	4.00	4.90	7.56	10.60
Puncture (CBR) elongation	D6241	mm	38	38	38	38	38	38

(1) All values are MARV

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Original: March 10, 2004
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(Revision schedule on page 7)

GRI Test Method GT12(b) – ISO Version*

Standard Specification for

“Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials”

This specification was developed by the Geosynthetic Research Institute (GRI) with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 Clarification of this ISO Version

Note 1: This version of the specification is based completely on ISO Test Methods and labeled GRI-GT12(b), whereas GRI-GT12(a) is the equivalent specification based completely on ASTM Test Methods.

1.2 This specification covers nonwoven geotextile test properties for subsequent use as protection (or cushioning) materials.

Note 2: The typical use will be as a protective covering or underlayment of a geomembrane against puncture or tear due to rock, stones, concrete or other hard surfaces and/or objects.

1.3 This specification sets forth a set of physical, mechanical and endurance properties that must be met, or exceeded by the geotextile being manufactured.

1.4 In the context of quality systems and management, this specification represents a manufacturing quality control (MQC) document.

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

Note 3: Manufacturing quality control represents those actions taken by a manufacturer to assure that a product represents the stated objective and properties set forth in the specification.

1.5 This standard specification is intended to assure good quality and performance of fabrics used as geotextile protection materials but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application.

1.6 This standard specification does not address installation practices or design guidance. Both of these items are addressed in the literature dealing with this particular application.

2. Referenced Documents

2.1 ISO Standards

- ISO 09864 Test Method for Determination of Mass per Unit area
- ISO 10319 Test Method for Determination of Wide Width Tensile Strength of Geotextiles and Geogrids
- ISO 13937 Test Methods for Tear Properties of Fabrics – Part 4: Determination of Tear Force of Tongue-Shaped Test Specimens (Double Tear Test)
- ISO 12236 Test Method for Determination of Static CBR Puncture Strength
- ISO 12959 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon Arc Type Device)

2.2 European Standards

- EN 12224 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon Arc Type Device)

3. Definitions

3.1 Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For nonwoven geotextiles, a formulation is defined as the exact percentages and types of resin(s), additives and/or carbon black.

3.2 Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications

Note 4: This particular specification for nonwoven protection geotextiles falls under the concept of MQC.

- 3.3 Minimum Average Roll Value (MARV) – For geosynthetics, a manufacturing quality control tool used to allow manufacturers to establish published values such that the user/purchaser will have a 97.7% confidence that the property in question will meet published values. For normally distributed data, “MARV” is calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property.
4. Material Classification and Formulation
- 4.1 This specification covers geotextiles used as protection (or cushioning) materials.
- 4.2 The type of resins are usually polypropylene, polyester or polyethylene, but other resins are also possible in this regard.
- 4.3 The type of geotextile style is designated as a nonwoven since research has shown these fabrics to be most effective in the typical applications toward which this specification is directed. While needle-punched nonwovens are usually used, heat bonded and resin dipped manufacturing styles (or others) can also be considered.
5. Specification Requirements
- 5.1 The geotextiles for use as protection (or cushioning) materials shall conform to Table 1. The table is given in SI (Metric) units and English units. The conversion SI Units to English Units is “soft”.
- Note 5: The puncture test referred to in Table 1 is the CBR puncture method. An alternative method is the pyramid puncture method standardized as ASTM D5494. If a suitable calibration is made and agreed upon by the parties involved, it can be used as a replacement test.
- 5.2 The required values for all properties in Tables 1 and 2 are to be minimum average roll values (MARV) except UV resistance which is a minimum value.
6. Workmanship and Appearance
- 6.1 The finished geotextile shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the geotextile, or its proper functioning.
- 6.2 General manufacturing procedures shall be performed in accordance with the manufacturer’s internal quality control guide and/or documents.

7. MQC Sampling, Testing, and Acceptance

- 7.1 Geotextiles shall be subject to sampling and testing to verify conformance with this specification. In the absence of purchaser's testing, verification may be based on manufacturer's certifications as a result of testing by the manufacturer of quality assurance samples obtained using the procedure for Sampling for Manufacturer's Quality Assurance (MQA) Testing. A lot size shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.
- 7.2 Testing shall be performed in accordance with the method referenced in this specification for the indicated application. The number of specimens to test per sample is specified by each test method. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV.

8. MQC Retest and Rejection

- 8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Shipment and Storage

- 9.1 Geotextile labeling, shipment, and storage shall follow acceptable manufacturers practice. Product labels shall clearly show the manufacturer or supplier name, style, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.
- 9.2 Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.
- 9.3 During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition that may damage the property values of the geotextile.

10. Certification

- 10.1 The contractor shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile.
- 10.2 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.
- 10.3 The manufacturer's certificate shall state that the finished 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.
- 10.4 Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

S.I. (Metric) Units

Table 1(a) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property	Test Method	Unit	Class					
Mass per unit area	ISO 09864	g/m ²	350	400	600	800	1000	2000
Tensile Properties								
• strength	ISO 10319	kN/m	16	21	27	32	36	45
• strain at max. load	ISO 10319	%	50	50	50	50	50	50
Trapezoidal Tear Strength	ISO 13937	kN	0.42	0.51	0.66	0.89	0.96	1.32
CBR Puncture	ISO 12236							
• max. force		kN	3.1	3.6	4.1	4.9	7.6	11.0
• elongation at max. force		mm	38	38	38	38	38	38
UV resistance ⁽²⁾	ISO 12959 or EN 12224	%	70	70	70	70	70	70

USA Units

Table 1(b) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property	Test Method	Unit	Class					
Mass per unit area	ISO 09864	oz/yd ²	10	12	18	24	30	60
Tensile Properties								
• strength	ISO 10319	lb/in.	92	120	155	183	206	260
• strain at max. load	ISO 10319	%	50	50	50	50	50	50
Trapezoidal Tear Strength	ISO 13937	lb	95	115	150	200	215	300
CBR Puncture	ISO 12236							
• max. force		lb	700	810	925	1100	1700	2500
• elongation at max. force		in.	1.5	1.5	1.5	1.5	1.5	1.5
UV resistance ⁽²⁾	ISO 12959 or EN 12224	%	70	70	70	70	70	70

Adoption and Revision Schedule for GRI-GT12(b)

Adopted: March 10, 2004

Revision #1: February 8 2008: Corrected mistaken tear test from ISO 13434 to ISO 13937. The original data (double tear test) was performed according to 13937 and mistakenly reported as 13434.