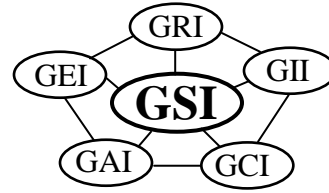


Geosynthetic Institute

475 Kedron Avenue
Folsom, PA 19033-1208 USA
TEL (610) 522-8440
FAX (610) 522-8441



Original: December 11, 2015
Rev. 1: March 13, 2016

GRI-GC14 Standard Specification *

Standard Specification for

“Test Methods, Required Properties and Testing Frequency for Polymeric Turf Reinforcement Mats”

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1. Scope

- 1.1 This generic specification covers polymeric turf reinforcement mats (TRMs) for the purpose of enhancing the soil holding properties of vegetation so as to mitigate or eliminate soil erosion.

Note 1: As will be noted several places herein soil slope erosion resulting from sheet-flow runoff is often distinguished from erosion in channels and ditches resulting from concentrated-flow runoff.

- 1.2 The specification is intended to cover all types of TRM products *provided they are polymer related* recognizing that the configuration, stiffness, thickness and conformity to the soil will vary greatly.
- 1.3 The specification does not cover erosion control products which are made partially or completely from natural fibers.

Note 2: If natural fibers are confined in a polymer matrix, such fibers can be removed and the polymer matrix evaluated as described herein.

*This GRI standard specification 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 and it is kept current on the Institute’s Website <<geosynthetic.institute.org>>.

- 1.4 This generic specification sets forth a number of physical, mechanical and endurance properties that must be met, or exceeded, by the TRM product being manufactured.
- 1.5 In the context of quality systems and management, this specification represents a manufacturing quality control (MQC) document; see definitions section.
- 1.6 This standard specification is intended to assure good quality and performance of the TRM materials involved, 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.
- 1.7 This standard specification does not address installation practices or design guidance. Both of these items are addressed in the literature dealing with this particular type of geosynthetic material.

2. Referenced Documents

2.1 ASTM Standards

- D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D 4439 Terminology for Geosynthetics
- D 4354 Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing
- D 4873 Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples
- D 6525 Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products
- D 6524 Test Method for Measuring the Resiliency of Turf Reinforcement Mats (TRMs)
- D 6566 Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats
- D 6567 Test Method for Measuring the Light Penetration of a Turf Reinforcement Mat (TRM)
- D 6575 Test Method for Determining Stiffness of Geosynthetics Used as Turf Reinforcement Mats (TRMs)
- D 6818 Test Method for Ultimate Tensile Properties of Turf Reinforcement Mats
- D 7238 Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembranes Using Fluorescent UV-Condensation Apparatus
- D 7748 Test Method for Flexural Rigidity of Geogrids, Geotextiles, and Related Products

2.2 References

AASHTO M288-06 (2006), Standard Specification for Geotextiles for Highway Applications, American Association for State Highway and Transportation Officials, Washington, DC.

EPA/600/R-93/182 (1993), “Quality Assurance and Quality Control for Waste Containment Facilities,” U.S. EPA, Cincinnati, Ohio.

Koerner, R. M. (2012), *Designing With Geosynthetics*, 6th Edition, Xlibris Publ. Co., 914 pgs.

3. Definitions

- 3.1 Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For TRMs, a formulation is defined as the exact percentages and types of resin, additives and/or carbon black. [Koerner, 2012]
- 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 [EPA/600/R-93/182].
- 3.3 Manufacturing Quality Assurance (MQA) - A planned system of activities that provide assurance that the materials were manufactured as specified in the certification documents and contract plans and specifications. MQA includes manufacturing and fabrication facility inspections, verifications, audits, and evaluation of the raw materials and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer or fabricator is in compliance with the product certification and contract plans and specifications for the project. [EPA/600/R-93/182]
- 3.4 Minimum Average Roll Value (MARV), n – For geosynthetics, a manufacturing quality control tool used to allow manufacturers to establish published values such that the user/purchaser will have a high degree of 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 sampled in accordance with ASTM D4354, Table 1, from one specific test method associated with one specific property. [ASTM D4439]

4. Material Classification and Formulations

- 4.1 This specification covers all polymeric TRMs regardless of their shape, thickness and configurations. As shown in Figure 1, there is a tremendous variety of products available and likely more to come in the future.



Figure 1 - Array of various turf reinforcement mats (TRMs).

- 4.2 The precise resin formulations of all types of TRMs are proprietary to the manufacturers. That said, the formulation shall be virgin material with no more than 25% rework. If rework is used, it must be the same formulation as the parent material.
- 4.3 No post consumer resin (PCR) of any type shall be added to the formulation.

Note 3: With sustainability and resource conservation being major societal concerns, TRMs with PCRs might be made in the future provided that the parties involved enter into such an arrangement.

5. Specification Requirements

- 5.1 The TRMs shall conform to the tests and properties of Table 1. Table 1a is in American (English) units and Table 1b is in S.I. (Metric) units. The conversions from American to S.I. units are “soft”.

5.2 The table is subdivided into two different categories (Classes 1, 2, or 3 and Classes A, B, or C) of TRMs depending on their application.

5.2.1 For *soil slope erosion control* the classifications listed are Class 1 greater than 1:1 slope (most severe), Class 2 (1:1 to 3:1 slope), and Class 3 (less than 3:1 slope) (least severe).

Note 4: A 1(H)-to-1(V) slope is 45° to the horizontal. A 3(H)-to 1(V) slope is 18.4° to the horizontal.

5.2.2 For *channel and ditch erosion control* the classifications are based on vegetated maximum allowable shear stresses as follows:

Class "A" - Max. Allow. Shear Strength = >10 lb/ft² (>480 Pa)

Class "B" - Max. Allow. Shear Strength = 10 to 6 lb/ft²
(480 to 290 Pa)

Class "C" - Max. Allow. Shear Strength = <6 lb/ft² (<290 Pa)

5.3 The number of test specimens required to arrive at an average test value per roll is contained in each of the specific test method designations.

5.4 All values in Table 1 are minimum average roll values, in the minimum principle direction, unless otherwise stipulated in the footnotes.

5.5 The table also lists minimum test frequencies for quality control purposes. If the manufacturer's internal quality control requirements are more restrictive than those listed they (the manufacturer's) will control.

6. Workmanship and Appearance

6.1 The finished TRM product shall have good appearance qualities. It shall be free from defects that would affect the specific properties of the product, 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 TRM products shall be subject to manufacturing quality control (MQC) sampling and testing to demonstrate conformance with this specification as set forth in the specific test methods within Table 1. In the absence of purchaser's testing, verification may be based on manufacturer's certifications.

7.2 Testing shall be performed in accordance with the method referenced in this specification for the indicated application, i.e., soil slope erosion or channel/ditch erosion.

- 7.3 In addition to the required tests and limiting values, Table 1 also provides minimum testing frequency for the various TRM properties. If the manufacturer's quality control documents are more restrictive, they shall apply.
8. MQC Retest and Rejection
- 8.1 If the results of any MQC 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 control documents. In general, if any roll fails only the roll bracketed by passing rolls needs to be rejected.
9. Shipment and Storage
- 9.1 TRM labeling, shipment, and storage shall follow ASTM D 4873 for Rolled Erosion Control Products. Product labels shall clearly show the manufacturer or supplier name, style, roll number and date of production. Each shipping document should include a notation certifying that the material is in accordance with this specification.
- 9.2 TRM rolls shall be adequately covered to protect them from the following: 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 (70°C), root intrusion, and any other environmental condition that may damage the property values of the product involved.
10. Certification
- 10.1 The manufacturer shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, and the composition of the TRM.
- 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 TRM meets 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 the products involved in this specification.

Table 1a. Turf Reinforcement Mat Specification; American (English) Units

Property	Units	Test Method	Class "1" or "A"	Class "2" or "B"	Class "3" or "C"	Frequency
Mass per unit area	oz/yd ²	D6566	12	10	8	per D4354
Thickness	mil	D6525	130	130	130	per D4354
Stiffness	g-cm	D7748	450	450	450	per D4354
Specific gravity	g/cc	D792	0.9	0.9	0.9	1/year
Resiliency	%	D6524	70	70	70	1/year
Tensile strength	lb/ft	D6818	150	125	100	per D4354
Tensile elongation	%	D6818	10	10	10	per D4354
Light penetration	%	D6567	60	60	60	per D4354
UV resistance	% ret @ 3,000 hr	D7238	80	80	80	1/year

Table 1b. Turf Reinforcement Mat Specification; S.I. (Metric) Units

Property	Units	Test Method	Class "1" or "A"	Class "2" or "B"	Class "3" or "C"	Frequency
Mass per unit area	g/m ²	D6566	400	330	270	per D4354
Thickness	mm	D6525	3.3	3.3	3.3	per D4354
Stiffness	g-cm	D7748	450	450	450	per D4354
Specific gravity	g/cc	D792	0.9	0.9	0.9	1/year
Resiliency	%	D6524	70	70	70	1/year
Tensile strength	kN/m	D6818	2.2	1.8	1.5	per D4354
Tensile elongation	%	D6818	10	10	10	per D4354
Light penetration	%	D6567	60	60	60	per D4354
UV resistance	% ret @ 3000 hr	D7238	80	80	80	1/year

Notes: Classes 1, 2 and 3 (most severe to least severe) are for soil slope erosion control TRM's.

Classes A, B and C (most severe to least severe) are for channel and ditch erosion control TRM's.

Values are Minimum Average Roll Values (MARV) except for specific gravity, resiliency and UV resistance. In these cases they are minimum average values. Stiffness is a maximum average value and is listed as gram-centimeters.

Adoption and Revision Schedule

Adopted: December 11, 2015

Revision 1: March 11, 2016 - Changed stiffness value from 300 to 450 g-cm.