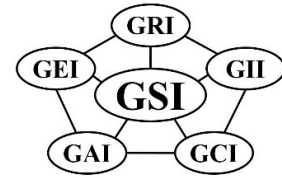


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GRI-GS35 Standard Specification*

Standard Specification for

“Test Methods, Required Properties and Testing Frequency for Geomats Drainage Composites”

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 It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part.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 generic specification covers geomats drainage geocomposites. Geomats are open three-dimensional mats and composite structures constructed of continuous polymeric fibers fused where they intersect. They can be used to transmit liquids within the manufactured plane of the material.
- 1.2 Both polypropylene Table 1 and polyamide Table 2 geomats drainage geocomposites will be covered in the specification. These cores can be coupled to a geotextile filter on one or both sides to form a drainage geocomposite. These materials combine drainage, protection, and filtration all in one product. Photographs of geomats appear in Figures 1 and 2.
- 1.3 This specification sets forth a set of physical, mechanical, hydraulic, and endurance properties that must be met, or exceeded by the product being manufactured.

*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>>

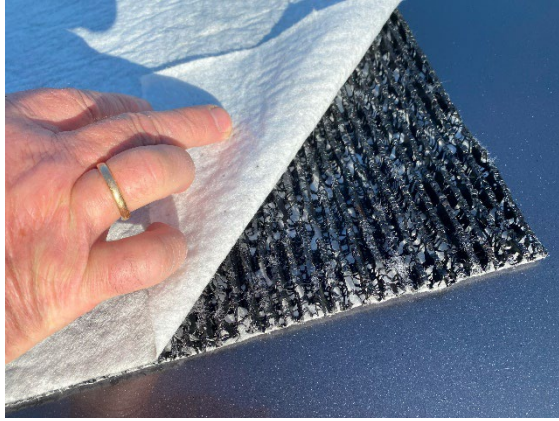


Fig 1 – Polypropylene Geomat with geotextile



Fig 2 – Polyamide Geomat with egg carton shape core

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

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to assure that a product represents the stated objective and properties outlined in the specification.

Note 2: The specification is based on tap water being the transmitted liquid. It can be modified to accommodate other liquids as agreed upon by the parties involved.

Note 3: The focused flow parameter is the flow rate per unit area under a given compressive stress and at a given hydraulic gradient. This experimental value can be used to calculate a transmissivity value (to be described later) as requested by the specifier or purchaser.

1.5 This standard specification is intended to assure good quality and performance of materials involved but is possibly not sufficient 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 these materials in a particular application.

2. Referenced Documents

2.1 ASTM Standards

- C 424 Standard Test Method for Cracking Resistance by Autoclave Treatment
- D 792 Test Methods for Density and Specific Gravity of Plastics by Displacement
- D 1505 Test Method for Density of Plastics by the Density-Gradient Method
- D 1603 Test Method for Carbon Black in Olefin Plastics
- D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
- D 4354 Practice for Sampling of Geosynthetics and Rolled Erosion Control (RECPs)
- D 4491 Test Methods for Water Permeability of Geotextiles by Permittivity
- D 4533 Test Method for Trapezoidal Tearing Strength of Geotextiles
- D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
- D 4716 Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- D 4751 Test Method for Determining Apparent Opening Size of a Geotextile
- D 4873 Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples
- D 5199 Test Method for Measuring the Nominal Thickness of Geosynthetics
- D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles
- D 6241 Standard Test Method for Static Puncture Strengths of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
- D 7361 Standard Test Method for Accelerated Compressive Creep of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method
- D 7406 Standard Test Method for Time-Dependent Compressive Deformation Under Constant Pressure for Geosynthetic Drainage Products

2.2 AASHTO Specification

M288-16 Geotextile Specification for Highway Applications

3. Definitions

- 3.1 Formulation - The mixture of a unique combination of ingredients identified by type, properties, and quantity. 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 that 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].

- 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 97.5% 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.
- 3.4 Maximum Average Roll Value (MaxARV) – The complimentary values to MARV except now defining a maximum, rather than minimum, value.

4. Specification Requirements

- 4.1 The geomats drainage composites (wherein a geotextile covers one, or both, surfaces of the drainage core) shall conform to either Table 1 for Polypropylene or Table 2 for Polyamide, which is given in four nominal thicknesses. Other thicknesses are possible and information is available from the respective manufacturers.

Note 4: In a drainage geocomposite, the geomat serves the primary function of in-plane drainage, whereas the geotextile(s) serves the dual functions of separation and filtration.

Note 5: Compressive creep and deformation properties are indicative of the material's ability to maintain its structural integrity and drainage functionality over time. Excessive compressive deformation can compromise the flow pathways within the geocomposite, leading to reduced drainage efficiency. By considering these factors during design, the longevity of the drainage system is ensured, and deformation under load is minimized, thereby preserving the intended drainage performance.

- 4.2 The minimum frequency for testing is given in Table 1 for Polypropylene and Table 2 for Polyamide. Manufacturers should also provide ongoing statistical data. For example, use of minimum average roll values (MARV)
- 4.3 The geotextile that is commonly used for geomat composites is a needle-punched or heat-bonded nonwoven polypropylene fabric bonded to the geomat core in the manufacturing facility.

5. Workmanship and Appearance

- 5.1 The finished geomat drainage composite shall have good appearance qualities. It shall be free from such defects that would affect the specific properties or its proper functioning.
- 5.2 General manufacturing procedures shall be performed in accordance with the manufacturer’s internal quality control guide and/or documents.

6. MQC Sampling, Testing, and Acceptance

- 6.1 Geomats drainage composite shall be subject to sampling and testing in order to verify conformance with this specification, see Table 1 for Polypropylene or Table 2 for Polyamide. In the absence of purchaser's testing, verification may be based on the manufacturer's certifications as a result of testing by the manufacturer of quality assurance samples obtained using ASTM D4354; Sampling for Manufacturer's Quality Control (MQC) Testing.
- 6.2 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.
- 6.3 In addition to the required tests and limiting values, Table 1 or 2 also provides minimum testing frequency for the various geomat drainage composite properties. If the manufacturer's quality control documents are more restrictive, they shall apply.

7. MQC Retest and Rejection

- 7.1 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 control documents. In general, if any roll fails, only the roll bracketed by passing rolls needs to be rejected.

8. Shipment and Storage

- 8.1 Geomat drainage geocomposite 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 should include a notation certifying that the material is in accordance with this specification.
- 8.2 Each geomat drainage geocomposite roll shall be wrapped with a material that will protect the roll, 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.
- 8.3 Ideally, geomat drainage geocomposite rolls should be elevated off the ground during storage. Alternatively, rolls can be stored on clean concrete or asphalt pavement without being elevated off the ground surface. In all cases, they should 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 (71°C), root intrusion, and any other environmental condition that may damage the property values of the product involved.

9. Certification

- 9.1 The contractor shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the geonet and geotextiles involved, and other pertinent information to fully describe the product.
- 9.2 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.
- 9.3 The manufacturer's certificate shall state that the finished geomat drainage geocomposite meets minimum average values and the 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.
- 9.4 Either mislabeling or misrepresentation of materials shall be reason to reject the products involved in this specification.

Table 1 – Polypropylene GeoMat drainage geocomposite Specification (**Metric UNITS**)

Properties	Test Method	GRADE		GRADE		GRADE		GRADE		Frequency
		Class 1		Class 2		Class 3		Class 4		
(a) Geomat (before lamination)										
Thickness (min. ave.) - mm	D5199	4.7		5.5		8.1		8.4		22,000 kg
Mass per unit area (min. ave.) – g/m ²	D5261	400		450		800		950		22,000 kg
(b) Geotextile (before lamination)										
		Option A B		Option A B		Option A B		Option A B		
Mass/Unit Area, g/m ² (MARV)	D5261	140	200	140	200	140	200	140	200	Per ASTM D4354 ⁽¹⁾
Grab Strength, N (MARV)	D4632	500	700	500	700	500	700	500	700	
Grab Elongation, % (MARV)	D4632	50	50	50	50	50	50	50	50	
Tear Strength, N (MARV)	D4533	180	250	180	250	180	250	180	250	
Puncture Strength, kN (MARV)	D6241	0.99	1.37	0.99	1.37	0.99	1.37	0.99	1.37	
Permittivity, sec-1 (MARV)	D4491	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
AOS, mm (MaxARV) ⁽²⁾	D4751	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
UV Stability, %ret. (500hr)	D7238	50	50	50	50	50	50	50	50	
(c) Geocomposite (double-sided laminated)										
Transmissivity (min. ave.) – l/(m.s) ⁽³⁾	D4716	1.0		1.5		2.5		3.5		90,000 kg

(1) Geotextile values are MARV, the statistics needed to obtain such values dictate the frequency of testing per ASTM D4354

(2) Please note that AOS is reported in a MaxARV not a MARV. 0.25mm equals a #60 sieve size opening.

(3) Shall be tested for ASTM D4716 transmissivity/flow rate between rigid/soft platens, at a hydraulic gradient of 1.0, a pressure of 100 kPa, and at a seating dwell time of 15 min. Test values are for machine direction only.

Table 2 – Polyamide GeoMat Specification (**Metric UNITS**)

Properties	Test Method	GRADE				Frequency
		Class 1	Class 2	Class 3	Class 4	
Thickness (min. ave.) - mm	D6525	7 mm	15 mm	30 mm	45mm	Per roll
Mass per unit area (min. ave.) – g/m ²	D6566	280	340	520	820	Per roll
Formulated Density (min. ave.) – g/cc	D792	1.10	1.10	1.10	1.10	22,000 kg
Water Adsorption - % (max. ave.)	D570	1.0	1.0	1.0	1.0	22,000 kg
Tensile Properties (min. ave.) (1) • Strength - kN/m • elongation - %	D6818	2.0 50	2.2 50	2.5 50	3.0 50	22,000 kg
Resiliency (min. ave.) - %	D 6524	>80	>80	>80	>80	45,000 kg
Transmissivity (min. ave.) – m ² /sec (2)	D 4716	5E-4	8E-4	1E-3	1.3E-3	90,000 kg
Autoclave Resistance (3) % Strength after 500 hours	C424	70%	70%	70%	70%	Per formulation

- (1) Regardless of machine direction (MD) or cross machine direction (XMD).
- (2) Shall be tested for ASTM D4716 transmissivity between rigid platens top and bottom, at a hydraulic gradient of 1.0, a pressure of 100 kPa, and at a seating dwell time of 15 min. Test values are for machine direction only.
- (3) The practice and conditions of the Autoclave exposure should be maintained at to 70 ± 3° C and 100 ± 5 kPa for the duration of the exposure.

Adoption and Revision Schedule for GRI-GS35

**“Test Methods, Required Properties and Testing Frequency for Geomats
Drainage Composites”**

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