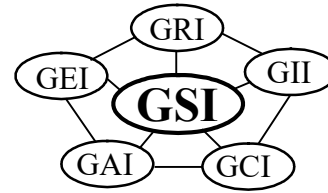


Geosynthetic Institute

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



Revision 1: December 7, 2023

GRI – GM38 Standard Specification*

Standard Specification for

“Test Methods, Test Properties and Testing Frequency for
Bituminous Geomembranes (BGM)”

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 It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part.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 bituminous geomembranes (BGM) which are factory produced materials in the form of rolls or sheets used to mitigate fluid loss.
- 1.2 This specification sets forth a set of minimum, physical, mechanical, chemical and endurance properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.
- 1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).
- 1.4 This standard specification is intended to ensure good quality and performance of BGM in general applications, but is possibly not adequate for use as a complete specification when applied to specific situations. Additional tests, or more restrictive values for test indicated, may be necessary under conditions of a particular application.

2. Referenced Documents

*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>>.

2.1 ASTM Standards

D1079 Standard Terminology Relating to Roofing and Waterproofing
D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheet or Film at Elevated Temperature
D1603 Test Method for Carbon Black in Olefin Plastics
D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials used as Steep Roofing underlayment for Ice Dam Protection
D4439 Terminology for Geosynthetics
D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D5147 Test Methods for Sampling and Testing Modified Bituminous Sheet Material
D5261 Test Method for Measuring Mass per Unit Area of Geotextiles
D5721 Test Method for Air Oven Aging of Polyolefin Geomembranes
D5884 Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes
D7238 Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
D7275 Test Method for Tensile Properties of Bituminous Geomembranes (BGM)

2.2 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3. Definitions

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

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) 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 is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

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

Nominal - Representative value of a measurable property determined under a set of conditions, by which a product may be described. Abbreviated as nom. in Tables 1 and 2.

Batch – Total area of the same grade manufactured over a twenty-four (24) hour period.

4. Physical, Mechanical and Chemical Property Requirements

4.1 The BGM shall conform to the test property requirements prescribed in Tables 1a and 1b. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

4.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

4.3 Leaching of compounds from the BGM into the environment is of a concern. Because polycyclic aromatic hydrocarbons (PAHs) and heavy metal may be present in some BGMs, static and dynamic leach tests may need to be performed when using this material in some sensitive applications. This testing should be performed as instructed by the US EPA's SW-846 Test Method 1311: Toxicity Characteristic Leaching Procedure (TCLP). This testing may be a prerequisite to shipment of the BGM. It should be clearly stated that PAHs and heavy metals are associated with coal tar and coal derivatives which are rarely manufactured today in lieu of natural gas derived bitumen. Modern elastomeric bitumen is most often petroleum derived. In fact, testing has revealed little evidence of leaching of these compounds from BGM. Test results also can be provided in the form of potable water tests, AS4020 and NSF 61, as well as raw water leachate testing.

4.4 The properties of the BGM shall be tested at the minimum frequencies shown in Tables 1a and 1b. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

5. Workmanship and Appearance

5.1 The BGM shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the BGM. It should not have surface agglomerates, cracks, protrusions or tears in any of the materials. In addition, there shall be no factory seams in the finished BGM roll goods.

5.2 There shall be no voids in the bitumen or incomplete impregnation of the BGM.

- 5.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.
6. MQC Sampling
- 6.1 Sampling shall be in accordance with the specific test methods listed in Tables 1a and 1b. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width or in accordance with D5147 Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
- 6.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1a and 1b.
- 6.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."
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 manual.
8. Packaging and Marketing
- 8.1 The BGM shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.
- 8.2 Unless otherwise agreed upon between the supplier and purchaser, each roll shall be covered with a wrapping material for protection from damage due to shipment, water, sunlight, or contaminants while being shipped, stored or handled.
- 8.3 Each roll shall also include at least one label identifying the manufacturer, style and/or commercial designation, unique roll identification (such as roll number), length and width of the roll, as well as a statement regarding conformance to the appropriate type and grade of this standard specification.
9. Certification
- 9.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

Table 1a – Bituminous Geomembranes (BGM) (ENGLISH UNITS)

| Properties | Test Method | English Imperil | English Imperil | English Imperil | Frequency (minimum) |
|--|-------------|------------------|-------------------|-------------------|---------------------|
| | | 125 mil | 150 mil | 200 mil | |
| Grade * | | Grade 1 | Grade 2 | Grade 3 | |
| Thickness (min. ave.) - mils • lowest individual of 10 values - % | D5199 | nom. -10 | nom. -10 | nom. -10 | Per roll |
| Fabric Scrim Mass per unit area (min. ave.) | D5261 | 120 osy | 145 osy | 175 osy | Per roll |
| Tensile Properties (min. ave.) (I) • strength • elongation | D7275 | 85 lbf/in 50% | 110 lbf/in 50% | 130 lbf/in 50% | 100,000 lbs. |
| Trouser Tear Resistance (min. ave.) (I) | D 4073 | 95 lbf | 150 lbf | 180 lbf | 100,000 lbs. |
| Puncture Resistance (min. ave.) | D 4833 | 100 lbf | 130 lbf | 145 lbf | 100,000 lbs. |
| Low Temperature Flexibility @ -20°F (-28°C) | D1970 | Pass | Pass | Pass | 500,000 lbs. |
| Ash Content (range) | D 1603 | 5-15 % | 5-15 % | 5-15 % | 500,000 lbs. |
| Oven Aging @ 85°C % Retained Strength after 90 Days | D5721 | 80% | 80% | 80% | Per formulation |
| UV Resistance % Retained Strength after 90 Days | D7238 | 70% | 70% | 70% | Per formulation |
| Thermal Stability | D1970 | Pass | Pass | Pass | Per formulation |
| Dimensional Stability @ 250°F (121°C) | D5147 | <0.5% | <0.5% | <0.5% | Per formulation |

(I) Regardless of machine direction (MD) or cross machine direction (XMD).

* This table of values is for Manufacturing Quality Control (MQC) purposes and is not intended for design guidance. See clause 1.4 of this document.

Table 1b – Bituminous Geomembranes (BGM) (METRIC UNITS)

| Properties | Test Method | Metric | Metric | Metric | Frequency (minimum) |
|--|-------------|------------------|------------------|------------------|---------------------|
| | | 3.18 mm | 3.81 mm | 5.08 mm | |
| Grade * | | Grade 1 | Grade 2 | Grade 3 | |
| Thickness (min. ave.) - mils • lowest individual of 10 values - % | D5199 | nom. -10 | nom. -10 | nom. -10 | Per roll |
| Fabric Scrim Mass per unit area (min. ave.) | D5261 | 4069 g/m2 | 4916 g/m2 | 5934 g/m2 | Per roll |
| Tensile Properties (min. ave.) (I) • strength • elongation | D7275 | 14.9 kN/m 50% | 19.3 kN/m 50% | 22.8 kN/m 50% | 45,360 kg |
| Trouser Tear Resistance (min. ave.) (I) | D 4073 | 95 N | 667 N | 801 N | 45,360 kg |
| Puncture Resistance (min. ave.) | D 4833 | 445 N | 578 N | 645 N | 45,360 kg |
| Low Temperature Flexibility @ -20°F (-28C) | D1970 | Pass | Pass | Pass | 226,796 kg |
| Ash Content (range) | D 1603 | 5-15 % | 5-15 % | 5-15 % | 226,796 kg |
| Oven Aging @ 85°C % Retained Strength after 90 Days | D5721 | 80% | 80% | 80% | Per formulation |
| UV Resistance % Retained Strength after 90 Days | D7238 | 70% | 70% | 70% | Per formulation |
| Thermal Stability | D1970 | Pass | Pass | Pass | Per formulation |
| Dimensional Stability @ 250°F (121°C) | D5147 | <0.5% | <0.5% | <0.5% | Per formulation |

(I) Regardless of machine direction (MD) or cross machine direction (XMD).

* This table of values is for Manufacturing Quality Control (MQC) purposes and is not intended for design guidance. See clause 1.4 of this document.

**Adoption and Revision Schedule
for
Bituminous Geomembranes (BGM) Specification per GRI-GM38**

“Test Methods, Test Properties, Testing Frequency for
Bituminous Geomembranes”

Original: August 12, 2023

Revision 1: December 7, 2023
Changed name from Bituminous Geosynthetic Barrier (BGB) to Bituminous Geomembranes (BGM), changed GRI standard GS32 to GM38, added ASTM D1079 reference, added definition of “batch”, clarification of section 4.3 on non-leaching of constituents, struck that seams were acceptable in finished roll goods, changed table 1a and 1b from typical, moderate and severe to grade 1-3 and added footnote.