



## **MATERIAL SPECIFICATION FOR GEOMEMBRANES**

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This specification covers the requirements for geomembranes.

#### **1863.02 REFERENCES**

This specification refers to the following standards, specifications, or publications:

##### **ASTM International**

D1004-21	Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
D4833/D4833M-07 (R2020)	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
D5199-12 (R2025)	Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
D5994/D5994M-10 (R2021)	Standard Test Method for Measuring Core Thickness of Textured Geomembranes
D6392-25	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
D7408-12 (R2020)	Standard Specification for Non-Reinforced PVC (Polyvinyl Chloride) Geomembrane Seams
D7865-13 (R2025)	Standard Guide for Identification, Packaging, Handling, Storage, and Deployment of Fabricated Geomembrane Panels

## 1863.03

### DEFINITIONS

For the purpose of this specification, the following definitions apply:

**Duplicate Samples** means two samples taken at the same time and location, one to be used for quality assurance testing and the other for referee testing.

**Geomembrane** means an impermeable polyvinyl chloride (PVC), high-density polyethylene (HDPE), or linear low-density polyethylene (LLDPE) material used in geotechnical engineering applications for establishing a barrier preventing water ingress and redirecting the movement of water to a specified location or drainage system.

**Fabricated Geomembrane Panel** means an impermeable geosynthetic composed of one or more geomembrane sheets welded together using thermo-fusion welding methods in the production facility.

**Lat** means a length equal to the circumference of a full geomembrane roll provided by the manufacturer.

**Lot** means a specific quantity of material from a single source or a specified amount of construction assumed to be produced by the same process.

## 1863.04

### DESIGN AND SUBMISSION REQUIREMENTS

#### 1863.04.01

#### Submission Requirements

##### 1863.04.01.01

#### Geomembrane

Details of the geomembrane shall be submitted to the Contract Administrator prior to the use of the geomembrane in the Work. The details shall include the following:

- a) Name of the manufacturer;
- b) Product name;
- c) Style number;
- d) Chemical composition;
- e) Melting point;
- f) Test results for geomembrane seams as specified in the Contract Documents; and
- g) Any other pertinent information required to fully describe the geomembrane as evaluated under the manufacturer's quality control (QC) program.

The manufacturer's requirements for the storage, transportation, and installation of geomembranes shall be submitted to the Contract Administrator at least 14 Days prior to transportation to the Working Area.

Upon request, documentation describing the manufacturer's QC program shall be made available to the Contract Administrator.

## 1863.05

### MATERIALS

#### 1863.05.01

#### Geomembrane

The geomembrane shall consist of a roughened surface polyvinyl chloride (PVC), high-density polyethylene (HDPE), or linear low-density polyethylene (LLDPE) as specified in the Contract Documents.

The geomembrane shall consist of new, first quality products designed and manufactured specifically for the purpose of this work.

## **1863.07 PRODUCTION**

### **1863.07.01 General**

Geomembranes shall be sized such that sufficient material is produced to ensure that the placement limits specified in the Contract Documents are satisfied after samples specified in the Quality Assurance section have been taken.

Geomembrane shall be supplied in rolls meeting the size as specified in the Contract Documents. If the specified size of the geomembrane exceeds that available in a roll, a fabricated geomembrane panel may be produced in the production facility and welded according to the Physical Requirements of Seams subsection and folded for transportation and delivery to the Working Area.

### **1863.07.02 Physical Requirements of Geomembrane**

The geomembrane shall meet the physical property requirements specified in Table 1.

### **1863.07.03 Physical Requirements of Seams**

All seams within the fabricated geomembrane panels shall be completed by the geomembrane manufacturer within the factory and shall be completed with thermo-fusion methods. Production of field seams shall not be permitted.

The integrity of seams for HDPE, LLDPE, and PVC geomembranes shall be tested according to ASTM D6392.

The seams between adjacent geomembrane panels shall meet the physical property requirements specified in Table 2 for HDPE, Table 3 for LLDPE, and according to ASTM D7408 for PVC.

Seams/welds between panels forming the geomembrane shall be watertight.

Seams shall not be welded when liner temperatures, measured by an infrared thermometer or surface thermocouple, are below 0°C or above 75°C.

### **1863.07.04 Protection during Shipment and Storage**

Packaging during shipment of the geomembrane and storage of the material prior to installation shall be according to ASTM D7865 and the manufacturer's specifications.

Geomembranes shall be protected against excessive ultraviolet (UV) light exposure and contamination from dirt, dust, moisture, and any other deleterious materials, until they are installed. All geomembranes shall be wrapped in an opaque protective covering from the time of manufacture to the time of installation. The geomembranes and protective wrapping shall be free of tears and punctures.

Geomembranes intended to be covered by soil, rock, earth, or other materials shall not be exposed to direct sunlight for more than 72 hours following the removal of the protective wrap.

Geomembranes shall be protected from a maximum temperature indicated by the manufacturer specifications.

Geomembranes shall not be unrolled or installed at temperatures below 0°C, unless permitted by the manufacturer specifications.

## **1863.07.05 Identification**

Each fabricated geomembrane panel shall be clearly marked according to ASTM D7865 with a permanent, legible identification label placed directly on the material after fabrication and one label attached to the outside of the packaging. Product labels shall include the following:

- a) Name of the manufacturer or supplier;
- b) Product number and type;
- c) Panel number; and
- d) Date of manufacture.

## **1863.08 QUALITY ASSURANCE**

### **1863.08.01 Inspection**

The Owner reserves the right to carry out inspections at such times as the Owner may consider necessary to ensure that the geomembrane supplied is as specified in the Contract Documents.

The Contract Administrator shall be permitted free entry to the fabrication plants, as well as the finished product storage and loading areas for inspection purposes.

### **1863.08.02 Sampling**

#### **1863.08.02.01 General**

Sampling shall be carried out by the Contractor, in the presence of the Contract Administrator.

All samples shall be duplicate samples taken side-by-side.

Each sample shall be rolled and placed into separate UV-protective containers (e.g., sealed cardboard box or opaque plastic bag). If a rolled sample is too large to fit within a UV-protective container, it may be folded in a manner that minimizes the number of folds required to fit the sample into the container.

Each sample shall be accompanied with a copy of the roll label or identification tag, as well as the appropriate contract-related information and testing requirements, as specified in the Contract Documents. All such information shall be placed in a moisture-proof envelope directly attached to or within each UV-protective container.

All samples shall be completely dry, free of damage, dust, or other contamination, at all times.

Testing shall be carried out at a laboratory designated by the Owner. The Owner shall be responsible for all costs associated with testing.

#### **1863.08.02.02 Sampling of Geomembrane**

Samples of geomembranes shall be submitted to the Contract Administrator at a rate of three samples per 1,000 m<sup>2</sup> of geomembrane area, when requested.

If geomembrane used in the Work is produced and shipped from different production plants, take three samples per 1,000 m<sup>2</sup> of each separately shipped geomembrane to verify that the material meets the requirements of this specification.

When the quantity of a geomembrane used for one structure is less than the quantity specified above, a minimum of three samples of geomembrane per each structure and per manufacturer in the work shall be tested to verify that the material meets the requirements of this specification.

Samples of geomembranes shall be the full width of the roll. If a fabricated geomembrane panel consisting of multiple rolls welded together is required, samples shall be the full width of the panel and shall be at least 2.0 m in length.

When samples are taken from a roll of material for testing, at least one full lat of the material from that roll shall be discarded prior to sampling.

#### **1863.08.02.03                    Sampling of Fabricated Geomembrane Panel Seams**

Samples taken for destructive testing of geomembrane seams shall be according to ASTM D6392 for HDPE and LLDPE geomembranes or ASTM D7408 for PVC geomembranes. When seams are used to connect adjacent rolls into a geomembrane panel, three samples per seam shall be taken. The sample shall have a width of 0.3 m and a length of 0.45 m and shall be centered on the seam.

The location of the destructive sample shall be repaired according to the Defects and Deficiencies subsection.

#### **1863.08.03                    Acceptance**

##### **1863.08.03.01                General**

Acceptance shall be according to this specification, including satisfactory completion of all replacement and repair actions associated with identified deficiencies.

##### **1863.08.03.02                Geomembrane**

Material represented by a quality assurance sample failing to meet the requirements of this specification shall be rejected.

##### **1863.08.03.03                Geomembrane Seams**

The geomembrane seams shall be considered acceptable when the physical property requirements for seams in fabricated geomembrane panels are according to Table 2 for HDPE geomembranes, Table 3 for LLDPE geomembranes, or ASTM D7408 for PVC geomembranes.

##### **1863.08.03.04                Geomembrane Seams**

Acceptance of the geomembrane shall be based on the satisfactory completion of all repairs to seams, if applicable.

The Contract Administrator shall conduct a visual inspection and/or other testing deemed necessary to assess the effectiveness and acceptability of the repairs.

#### **1863.08.04                    Referee Testing**

The Contractor may invoke referee testing for one or more attributes by submitting a written request to the Contract Administrator, within 5 Business Days following notification that a sample representing a lot of geomembrane does not meet the requirements of this specification. The notification shall include the type of geomembrane and the specific attribute or attributes for which the referee testing is being requested.

The retained duplicate samples shall be used for referee testing.

Referee testing shall be carried out, as specified herein and elsewhere in the Contract Documents.

All referee test results for a lot shall replace the respective QA tests for acceptance of the applicable lot and shall be binding on both the Owner and the Contractor.

When the referee result confirms the physical property requirements for acceptance, the Contractor shall be charged the cost of the referee testing.

When the referee result does not confirm the physical property requirements for acceptance, the Owner shall bear the cost of the referee testing.

If a material is considered rejectable based on the referee test results, then the Contractor shall also be responsible for the cost of the referee testing of that material, including the cost of transporting the samples to the referee laboratory, at the rates specified in the Contract Documents. In all other cases, the Owner shall bear the cost of the referee testing and the cost of transporting the samples of that material.

**1863.08.05 Defects and Deficiencies**

Geomembrane failing to comply with the physical property requirements specified in the Contract Documents shall be rejected and replaced.

**1863.08.06 Repair of Geomembrane Seams**

When permitted by the Owner, locations of damage and defects to the geomembrane seams shall be repaired at no additional cost to the Owner. A proposal for repair shall be submitted to the Contract Administrator for review. The Contractor shall not proceed with repairs until approval of the proposal has been received.

Defects and deficiencies shall be repaired with the same material of geomembrane as the geomembrane being repaired.

When a defect in the geomembrane seam is to be repaired, the area to be patched shall be prepared and cleaned as per manufacturer specifications, the patch shall have a minimum of 152 mm overlap extending beyond the damaged area, and the patch shall be attached through thermo-fusion welding methods according to the manufacturer's requirements. All edges of the patch and repair materials shall be rounded. The patch should be continuously welded in place flat over the damaged area. The welded area shall be a minimum of 25 mm wide.

**TABLE 1**  
**Physical Property Requirements for Geomembranes**

Property	Test Method	Unit	Required Degree of Survivability	
			Medium <sup>Note 1</sup>	Very High <sup>Note 2</sup>
Thickness	ASTM D5994/D5994M	mm	0.75	1.0
Tear Resistance	ASTM D1004	N	45	90
Puncture Resistance	ASTM D4833/D4833M	N	140	200
Notes:				
1. Refers to placement on machine-graded subgrade with medium loads. Soil fills have a maximum particle size of 19.0 mm (3/4 inch).				
2. Refers to placement on machine-graded subgrade of very poor texture. Soil fills have a maximum particle size exceeding 19.0 mm (3/4 inch).				

**TABLE 2**  
**Physical Property Requirements for HDPE Geomembrane Seams**

Property	Unit	Geomembrane Nominal Thickness	
		0.75 mm	1.0 mm
Shear strength	N/25 mm	250	350
Shear elongation at break	%	50	50
Peel strength	N/25 mm	197	263
Maximum Peel separation	%	25	25

**TABLE 3**  
**Physical Property Requirements for LLDPE Geomembrane Seams**

Property	Unit	Geomembrane Nominal Thickness	
		0.75 mm	1.0 mm
Shear strength	N/25 mm	197	263
Shear elongation at break	%	50	50
Peel strength	N/25 mm	166	219
Maximum Peel separation	%	25	25