

ASTM STANDARDS FOR GCLs

Following are the Standards passed to date by ASTM International Subcommittee D35.04 on Geosynthetic Clay Liners (GCLs). Some of these standards have similar standards in related areas, such as D18 Soil and Rock, whereby the standard was modified to more adequately address the nuisances of testing GCL properties. Thus, it is important to utilize D35.04 standards whenever dealing with GCLs, especially, to update specifications and permits to reflect the current state of the practice.

ASTM D 5887, “Standard Test Method for Measurement of the Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This method describes the specimen preparation, stress and gradient conditions, and testing procedures to be used for determining the flux (flow per unit area) through GCLs. Adherence to the specimen preparation procedures presented will help to minimize sidewall leakage, a common problem when testing thin barriers. This is an index test designed to determine product acceptability and uses a maximum confining stress of 35 kPa (5 psi) and a hydraulic gradient of 14 kPa (2 psi).

ASTM D 5888, “Standard Guide for Storage and Handling of Geosynthetic Clay Liners,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This is a guide for the safe handling of GCL rolls at a job site, identifying the equipment and techniques typically employed to unload the material from delivery trucks and to place it in a dedicated storage area. Procedures are also presented for proper storage of the GCL in order to minimize the potential for product damage while in storage.

ASTM D 5889, “Standard Practice for Quality Control of Geosynthetic Clay Liners,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

Test methods and testing frequencies are presented for manufacturing quality control (MQC) of GCLs. This standard practice includes conformance tests to be performed on the GCL components (bentonite and geotextiles and/or geomembranes) as well as tests to be performed on the finished GCL product. Special procedures for GCL permeability/flux testing require the manufacturer to provide an historical database to demonstrate the consistency of the hydraulic performance of the finished product and to justify the reduced need for frequent MQA permeability testing.

ASTM D 5890, “Standard Test Method for Swell Index Measurement of Clay Mineral Component of Geosynthetic Clay Liners,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This test method was adapted from the basic elements of a swell test presented in the USP/NF (United States Pharmacopeia/National Formulary). Two grams of dried and powdered bentonite are slowly dropped into a graduate cylinder containing 100 mL of distilled water. The swell value in mL is recorded after 24 hours, by reading the value on the graduate cylinder at the clay/water interface.

ASTM D 5891, “Standard Test Method for Measurement of Fluid Loss of Clay Mineral Component of Geosynthetic Clay Liners,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This test method was adapted from the API (American Petroleum Institute) Procedure 13A/13B for bentonite. A bentonite slurry is created, aged, and then filtered in a pressurized cell. The amount of water passing through the filter cake in a specified time interval is recorded as the filtrate loss or fluid loss. The test indicates the clay's general ability to function as a barrier to liquids.

ASTM D 5993, “Standard Test Method for Measuring the Mass per Unit Area of Geosynthetic Clay Liners,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This test method describes how to measure the bentonite mass per unit area of a GCL sample. A GCL specimen of a certain minimum area is weighed, oven-dried, and weighed again. The dry weight of the specimen, minus the nominal weight of the geosynthetic component(s), is then divided by the area of the specimen. The moisture content of the specimen is determined by subtracting the dry weight from the wet weight.

ASTM D 6072, “Standard Guide for Obtaining Samples of Geosynthetic Clay Liners,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

Presents procedures for obtaining representative samples of GCL material for laboratory testing purposes. These sample may be obtained either at the factory or in the field. Procedures for packaging and protecting the sample are also included to prevent the possibility of damage in transit to the laboratory.

ASTM D 6102, “Standard Guide for Installation of Geosynthetic Clay Liners,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

Provides detailed recommendations for the proper installation of GCLs. Discusses the necessary site conditions, equipment, and techniques for installing GCLs without damaging them. Includes recommendations on panel placement, overlaps, and special considerations for slopes. Also discusses the preferred types of soil cover and equipment used to apply this cover.

ASTM D 6141, “Standard Guide for Screening the Clay Portion of a Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

Provides a procedure for obtaining a test liquid from a soil, which can then be used to perform a comparative study with clean water. Free swell and fluid loss testing are recommended for the screening process; differences in these test results between clean water and the test liquid should indicate potential compatibility issues, which can be evaluated in further detail.

ASTM D 6243, “Standard Test Method for determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This method provides a procedure for determining the internal shear resistance of a GCL or the interface shear resistance between the GCL and an adjacent material. A constant normal stress representative of field stresses is applied to the specimen, and a tangential (shear) force is applied to the apparatus. The peak shear stresses for a minimum of three different normal stresses are plotted against the applied normal stresses to get a line whose slope is the coefficient of friction and y-intercept is the cohesion intercept.

ASTM D6495, “Standard Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This guide provides guidelines for the acceptance testing requirements of geosynthetic clay liner (GCL) materials, describing types of tests, test methods, and recommended verifications. This guide is intended to aid purchasers, installers, contractors, owners, operators, designers and agencies in establishing a minimum level of effort for product acceptance testing and verification. This is intended to assure that the supplied GCL rolls meet acceptance material specifications.

ASTM D6496, “Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners”,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This test method covers the laboratory determination of the average bonding peel strength between the top and bottom layers of needle-punched geosynthetic clay liner (GCL). The average bonding strength test for the top and bottom layers of the needle-punched GCL is intended to be an index test.

ASTM D6766, “Standard Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Liquids”,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This test method covers the laboratory determination of both flux and hydraulic conductivity of a geosynthetic clay liner (GCL) specimen permeated with chemical solutions and leachates utilizing a flexible-wall permeameter.

ASTM D6768, “Standard Test Method for Tensile Strength of Geosynthetic Clay Liners”,” *Annual Book of ASTM Standards, Vol. 4.13*, ASTM International, W. Conshohocken, PA.

This test method covers the laboratory procedure for the determination of the tensile strength of geosynthetic clay liners (GCLs). This is strictly an index test.