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Standard Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners¹

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1. Scope

1.1 This guide covers guidelines for the acceptance testing requirements for geosynthetic clay liner (GCL) materials, describing types of tests, test methods, and recommended verifications.

1.2 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 accepted material specifications.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This guide cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This guide is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this guide be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this guide means only that the guide has been approved through the ASTM consensus process.*

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

¹ This guide is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.04 on Geosynthetic Clay Liners. Current edition approved ~~September~~ June 10, 2004₂. Published ~~November 2001~~; September 2002. Originally published as ~~E D~~ D 6495–99. Last previous edition ~~E 6495–99~~; D 6495–01.

- D 638 Test Method for Tensile Properties of Plastics²
D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting²
D 792 Test Methods for Density and Specific Gravity (Relative Density) and Density of Plastics by Displacement²
D 4595 Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method³
D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles³
D 5199 Test Method for Measuring Nominal Thickness of Geosynthetics³
D 5887 Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens and Handling of Geosynthetic Clay Liners³
D 5888 Guide for Storage and Handling of Geosynthetic Clay Liners³
D 5889 Practice for Manufacturing Quality Control Of Geosynthetic Clay Liners³
D 5890 Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners³
D 5891 Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners³
D 5993 Test Method for Measuring the Mass per Unit Area of Geosynthetic Clay Liners³
D 6072 Guide for obtaining Samples of Geosynthetic Clay Liners³
D 6243 Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method³
D 6496 Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners³
2.2 *United States EPA Document:*
EPA/600/R-93/182 Technical Guidance Document Quality Assurance and Quality Control for Waste Containment Facilities⁴

3. Terminology

3.1 *Geosynthetic Definitions:*

- 3.1.1 *geomembrane, n*—an essentially impermeable geosynthetic composed of one or more synthetic sheets.
3.1.2 *geosynthetic clay liner, n*—a manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetics.

- 3.1.3 *geotextile, n*—a permeable geosynthetic comprised solely of textiles

3.2 *Organizational Definitions:*

- 3.2.1 *agency, n*—in geosynthetics the organization who reviews the permit application for compliance with the agency's regulation and all quality assurance documentation before and after construction.

- 3.2.2 *contractor, n*—in geosynthetics the party or organization who has the responsibility for the construction of the man-made project, structure or system.

- 3.2.3 *designer, n*—in geosynthetics the person or organization who designs a man-made project, structure or system that fulfills the owner's/operator's requirements and meets or exceeds the minimum requirements of the agency.

- 3.2.4 *installer, n*—in geosynthetics the party who installs, or facilitates installation of, any materials purchased from manufacturers or suppliers.

- 3.2.5 *manufacturer, n*—in geosynthetics the group, corporation, partnership, or individual that manufactures a product.

- 3.2.6 *operator, n*—in geosynthetics the person or organization who operates the man-made project, structure or system.

- 3.2.7 *owner, n*—in geosynthetics the person or organization who owns the man-made project, structure or system.

- 3.2.8 *purchaser, n*—in geosynthetics the person, company, or organization that purchases any materials or work to be performed.

3.3 *Quality Definitions:*

- 3.3.1 *acceptance testing, n*—testing performed on a product to determine whether or not an individual lot of the product conforms with specified requirements.

- 3.3.2 *machine direction (MD), n*—the direction in the plane of the fabric parallel to the direction of manufacture.

- 3.3.3 *manufacturing quality control (MQC), n*—a planned system of activities by the manufacturer whose purpose is to provide a level of quality that meets the needs of product requirements; also, the use of such a system.

- 3.3.4 *quality assurance (QA), n*—all those planned or systematic actions necessary to provide adequate confidence that a material, product, system, or service will satisfy given needs.

4. Specifications and Use

- 4.1 This guide suggests the types of tests, the methods of the testing, and verification requirements for acceptance testing of GCL materials.

- 4.2 It should be recognized that parties, organizations or representatives may perform additional tests and/or at other frequencies than required in this standard guide. In this case, the project-specific acceptance plan will then take precedence over this standard guide.

² *Annual Book of ASTM Standards*, Vol 08.01.

³ *Annual Book of ASTM Standards*, Vol 04.13.

⁴ Available from Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

5. Procedure

5.1 The clay components, geosynthetic components and finished GCLs are typically tested during MQC (Practice D 5889) and are typically documented by means of a letter of certification and/or summarized MQC test data. These components should be verified to be in conformance with the accepted material specifications. This can be done by reviewing the letter of certification, or MQC test data, or both, or by additional quality assurance testing, or both, and acceptance testing. Acceptance testing can be done prior to GCL shipment, directly after arrival of the GCL on site, and/or prior to GCL installation. Irregularities should be noted and reported.

5.2 Supplied GCL rolls should be observed on site in order to identify any damage to the rolls or the wrapping. In case of any damage Guide D 5888 should be followed. Any damage should be noted and reported.

5.3 Before storing or unrolling GCL rolls, or both, the individual roll identification should be verified and should be compared with the packing list. Irregularities should be noted and reported.

5.4 If sampling of GCL material is necessary, for example, for testing purposes, Guide D 6072 should be followed.

5.5 The recommended acceptance tests and test methods for GCL materials are given in Table 1. The tests are performed on the finished GCL and should be compared with the accepted material specifications. Irregularities should be noted and reported.

5.6 GCL rolls not in compliance with the accepted material specifications may be rejected.

6. Report

6.1 All activities on product acceptance should be recorded on a suitable data sheet. Recorded activities may take the form of notes, charts sketches, photographs, or a combination of these.

6.1.1 Report the following information:

- 6.1.1.1 Manufacturer’s letter of certification and/or MQC data,
- 6.1.1.2 Description or title of product acceptance activity, or both,
- 6.1.1.3 Location, date and time of acceptance activity,
- 6.1.1.4 Procedure used for acceptance activity,
- 6.1.1.5 GCL roll and lot numbers, brand name and other GCL specific information,
- 6.1.1.6 Results of acceptance activity,
- 6.1.1.7 Company of involved personnel,

TABLE 1 Types of Acceptance Tests and Methods for GCL Materials^{A,B}

NOTE 1—MD = machine direction.
MARV = minimum average roll value.

Test Designation	Test Method	Frequency of Acceptance Testing ^A	Report Value
(1) Clay mass per unit area (dried)	D 5993	project specific	MARV
(2) Swell Index	D 5890	project specific	MARV
(3) Fluid Loss	D 5894	project specific	MARV
(3) Fluid Loss	D 5891	project specific	maximum value
(4) Grab tensile strength (MD) or wide-width strength (MD) ^C	D 4632	project specific	maximum value
(4) Grab tensile strength (MD) or wide-width strength (MD) ^C	D 4632 or D 4595	project specific	MARV
(5) Tensile strength of geomembrane support/backing ^{D,C}	D 638 or D 882	project specific	MARV
(6) Thickness of geomembrane support/backing ^D	D 5199	project specific	MARV
(7) Density of geomembrane support/backing ^D	D 792	project specific	MARV
(8) Bonding peel strength	D 6496	project specific	MARV
(8) Index flux ^E	D 5887	project specific	MARV

^AFrequencies may change on the size or sensitivity of the project. On small projects tests may be replaced by a letter of certification. Example for project (size 50 000 m²(500 000 ft²)) specific acceptance testing:

Clay mass per unit area (dried)	every 10 000 m ² (100 000 ft ²)	
Free swell	every 10 000 m ² (100 000 ft ²)	
Fluid loss	every 10 000 m ² (100 000 ft ²)	
Grab tensile strength (MD) or Tensile Properties by the Wide-width strip ^E	every 25 000 m ² (250 000 ft ²)	
Tensile strength—	of geomembrane support/backing	every 25 000 m ² (250 000 ft ²)
Thickness of geomembrane support/backing	every 10 000 m ² (100 000 ft ²)	
Density of geomembrane support/backing	every 10 000 m ² (100 000 ft ²)	
Bonding peel strength	every 10 000 m ² (100 000 ft ²)	
Index flux	every 25 000 m ² (250 000 ft ²)	

^BAdditional acceptance tests may be required depending on the application. For example, in applications where shear strength is critical, direct shear tests (Test Method D 6243) may be applicable.

^CThe correct test method should be agreed on prior to testing

^DApplicable only for geomembrane-supported and geomembrane-backed GCLs.

^EThis test may not be applicable for geomembrane-supported and geomembrane-backed GCLs.

- 6.1.1.8 Signature and printed name of acceptance inspector,
- 6.1.1.9 Summarized test results of acceptance activities,
- 6.1.1.10 Irregularities discovered during acceptance activities, and
- 6.1.1.11 Roll number of rejected GCL rolls.

7. Keywords

- 7.1 acceptance; geosynthetics; geosynthetic clay liner; testing; verification

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