GEOSYNTHETICS

GEOSYNTHETIC CLAY LINERS

Mass Per Unit Area

ASTM D5261 **BS EN 14196** **ISO 9864**
ASTM D5993 **BS EN 965**

Specimens of known area are cut from the sample and weighed. Mass per unit area is calculated.

Thickness

ASTM D5199 **ISO 9863**
BS EN 964-1

The nominal thickness is determined by measuring the distance that a movable plate is displaced from a parallel surface by the material while under a specified pressure.

Swell Index

ASTM D5890
USP NFX VII

A known weight of bentonite is added in small increments at specified time intervals to a graduated cylinder containing deionised water. After all the bentonite has been added, the cylinder is left undisturbed for a minimum specified period before recording the volume level of the hydrated clay.

Swell Measurement of Clay Component of GCL

GRI GCL1

The test uses a known amount of bentonite taken from the GCL and hydrates it with distilled water. The test container is a circular mould with a porous base plate and porous cover plate with an extension rod that imposes a dead weight stress on the test material. Swelling readings are measured with a dial gauge over a known period of time.

Moisture Content

ASTM D2216

Sample material is dried in an oven at a specified temperature. The percentage moisture content is calculated from the loss in mass of the material as a percentage of the dry mass.

Bentonite Content - Methylene Blue test

API RP131
VDG P69

The methylene blue capacity is an estimate of the cation exchange capacity of the bentonite. A well dispersed sample of the bentonite is titrated with methylene blue solution until a blue "halo" appears around a drop of dyed bentonite solids on filter paper.

Note: Where two or more standards have been grouped together under one heading, the methods of test are not necessarily identical, nor would they always produce the same results.

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Water Absorption of Bentonite

ASTM E946

The amount of water absorbed over a fixed time interval by a known weight of dried bentonite is determined. The test uses a sintered aluminum oxide plate that sits in distilled water to within a specified distance from the top of the plate. The bentonite for test is placed on filter paper on top of the plate and left for a given period of time. The increase in weight of the bentonite is used to calculate the percentage water absorption.

Tensile Properties

ASTM D4595
BS 6906: Part 1
BS EN ISO 10319

Specimens, 200mm wide, are clamped across their entire width with a specified gauge length and pre-tension, and strained at a specified rate until rupture occurs. Tensile strength per unit width and extension % are measured.

Grab Tensile Strength

ASTM D4632

The central portion of a rectangular specimen is clamped at a set gauge length and an increasing load is applied at a constant speed until rupture occurs. Grab tensile strength and apparent elongation % are measured.

Peel Strength

ASTM D4632 (Mod)
ASTM D413 (Mod)

Rectangular specimens are prepared and the two layers of the composite separated by hand over a sufficient length to allow them to be clamped in the jaws of a tensile machine at a specified gauge length. The jaws are run at a set speed and the peel strength measured.

Puncture Resistance

ASTM D6241 **BS EN ISO 12236**
ASTM D4833 **DIN 54307**
BS 6906: Part 4

Specimens for test are clamped between circular rings with a specified internal diameter and a puncture probe of known material and dimensions is pushed centrally against and normal to the fabric at a specified speed until failure of the specimen occurs. Push through force and plunger displacement/elongation % (where appropriate) are measured.

Hydraulic Conductivity/Index Flux

ASTM D5084(GRI)
ASTM D5887

This test involves permeation of a circular specimen of known diameter. The specimen is set up in a flexible-wall permeameter, subjected to defined total stress and back pressure for a specified period of time. Flow is initiated using water by raising the pressure on the influent side of the specimen. The hydraulic conductivity/flux is determined when inflow and outflow are approximately equal (+/- 25%).

GEOSYNTHETICS

GEOTEXTILES & GEOTEXTILE-RELATED PRODUCTS

UKAS TESTING 1066

Sampling and Preparation of Test Specimens

BS EN 963
ISO 9862

This standard establishes general principles for sampling of geotextiles and geotextile-related products and preparation of test specimens from the samples.

Mass Per Unit Area

ASTM D5261
BS EN 965
ISO 9864

Specimens of known area are cut from the sample and weighed. Mass per unit area is calculated.

Thickness

ASTM D5199
BS EN 964-1
ISO 9863

The nominal thickness is determined by measuring the distance that a movable plate is displaced from a parallel surface by the material while under a specified pressure.

Tensile Properties/Seam properties

ASTM D4595
BS 6906: Part 1
BS EN ISO 10319
BS EN ISO 10321(seams)

Specimens, 200mm wide, are clamped across their entire width with a specified gauge length and pre-tension, and strained at a specified rate until rupture occurs. Tensile strength per unit width and extension % are measured.

Grab Tensile Strength

ASTM D4632

The central portion of a rectangular specimen is clamped at a set gauge length and an increasing load is applied at a constant speed until rupture occurs. Grab tensile strength and apparent elongation % are measured.

Compressive Properties

ASTM D1621

This standard provides information regarding the behaviour of materials under compressive loads. A load, evenly distributed across a whole specimen of known dimensions, is applied at a specified rate and the compressive properties are measured.

Compressive Creep Properties

BS EN 1897

A specimen is placed on the fixed base of a compression machine with an upper loading plate, and a compressive load (either a normal load or combined normal and shear load) is applied and the change in thickness with time is recorded. Compressive strain and compression creep are calculated.

Trapezoid Tearing Strength

ASTM D4533

A specimen for test is clamped in a tensile testing machine, with a specified gauge length, along the nonparallel sides of a trapezoid shape that has been marked on a rectangular specimen with an initial cut. The machine is operated at a constant speed so that the initial tear propagates across the specimen.

Puncture Resistance

ASTM D4833
ASTM D6241
BS 6906: Part 4
BS EN ISO 12236
DIN 54307

Specimens for test are clamped between circular rings with a specified internal diameter and a puncture probe of known material and dimensions is pushed centrally against and normal to the fabric at a specified speed until failure of the specimen occurs. Push through force and plunger displacement/elongation % (where appropriate) are measured.

Resistance to Perforation (Cone Drop Test)

BS 6906: Part 6
BS EN 918

The specimen for test is clamped between circular rings with a known internal diameter and a 45° steel cone of given weight is dropped point first, through a specified distance on to the centre of the specimen. The degree of penetration is measured by inserting a narrow angle graduated cone into the hole.

Abrasion Damage Simulation

BS EN ISO 13427

A test specimen mounted on a fixed platform is rubbed by an abradant with specified surface characteristics using controlled conditions of pressure and abrasive action. Resistance to abrasion is expressed as the percentage loss of tensile strength.

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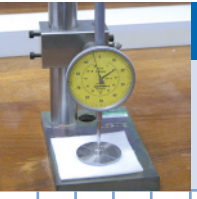

GEOSYNTHETICS

Cylinder Test

Environment Agency Methodology for cylinder testing of protectors for geomembranes

This test determines the effectiveness of a material in protecting a geomembrane against long term effects of static point loads, under the conditions expected to be encountered at waste management sites.
Load is applied through the proposed drainage aggregate and protector material on to the geomembrane, which is supported on a simulated standard subgrade for a specified time. The local and incremental strain experienced by the geomembrane are recorded and measured.

Apparent Pore Size Distribution (dry sieving)

BS 6906: Part 2

The pore size distribution is obtained by determining the percentages of each of a number of different sizes of glass spheres which are retained on the geotextile when shaken through it employing the geotextile as a sieve. Sieve size, mass of glass beads, amplitude of shaker and test duration are all specified.

Characteristic Opening Size (wet sieving)

BS EN ISO 12956

The characteristic opening size is obtained by determining the particle size distribution of a graded granular material that is washed through a single layer of geotextile using the geotextile as a sieve. The test specifies a specimen pre-treatment, minimum sieve size, mass of granular material, sieve amplitude and test duration. The granular material passing through the specimens is combined and a particle size distribution carried out following the guidance given in ISO 2591-1.

Determination of Water Flow / Permeability (normal to the plane)

BS 6906: Part 3
BS EN ISO 11058

A constant head of water is applied to the specimen for test that is clamped between circular flanges with a known exposed area. The water passing through the specimen is collected for a given period of time and flow rate/ permeability calculated.

Determination of Water Flow Capacity in the Plane (Transmissivity)

BS 6906: Part 7
BS EN ISO 12958

The flow of water in the plane of the material is measured under varying normal compressive stresses, typical hydraulic gradients and defined contact surfaces (used to model field conditions).

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Durability Tests

As part of CE marking of geotextiles and geotextile-related products, the manufacturer is required to make a durability statement relating to the product. The following standard tests are used to assess the durability.

BS EN 12226
General Tests for Evaluation following Durability Tests
BS EN 12224
Determination of the Resistance to Weathering
BS EN 12225
Determining the Microbiological Resistance by a Soil Burial Test
BS EN 12447
Screening Test Method for Determining the Resistance to Hydrolysis in Water
DD ENV ISO 13438
Screening Test Method for Determining the Resistance to Oxidation
BS EN 14030
Screening Test Method for Determining the Resistance to Acid and Alkaline Liquids

GEOMEMBRANES

Thickness

ASTM D751
ASTM D5199
BS EN 964-1
BS EN 1849-2
ISO 9863

The nominal thickness is determined by measuring the distance that a movable plate is displaced from a parallel surface by the material while under a specified pressure.

Thickness

ASTM D1593

Specimens of known size are cut and weighed. Using the weight, area and density (determined by ASTM D1505 or D792), thickness is calculated.

Density

ASTM D792
ASTM D1505

ASTM D1505 - Specimens are immersed in a density gradient column and their height in the column compared with standards of known density. ASTM D792 – A specimen is weighed in air. It is then immersed in liquid, the loss in weight upon immersion is determined and its density calculated.

Carbon Black Content

ASTM D1603

Specimens of known weight are heated to 600 °C in a nitrogen atmosphere; the polymer decomposes leaving carbon black. The residue is weighed and % carbon black calculated.

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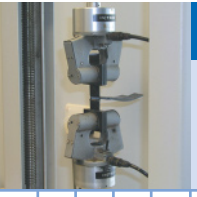

GEOSYNTHETICS

Carbon Black Dispersion

ASTM D3015 (NSF Mod)
ASTM D5596

Very thin slices of geomembrane are cut and examined microscopically (100x) for quality of pigment dispersion. The appearance is compared to a dispersion reference chart.

Melt Flow Index

ASTM D1238

This test measures the rate of extrusion of molten polymer through a die of specified length and diameter at specified conditions of temperature, load, and piston position in the barrel as a timed measurement is made.

Dimensional Stability

ASTM D1204

This test measures the changes in linear dimensions of specimens of known size, when exposed to specific conditions of elevated temperature and time.

Tensile Properties

ASTM D638
ASTM D6693
EN ISO 527-1 and 527-3

Dumbbell shaped specimens are extended to break at a constant speed; tensile strength and extension at both yield and break are measured.

Tear Resistance

ASTM D1004

This test method is designed to measure the force required to initiate tearing at a low rate of loading. The specimen geometry of this test produces a stress concentration in a small area of the specimen. The maximum stress, usually found near the outset of tearing, is recorded as tear resistance.

Puncture Resistance

ASTM D4833
ASTM D6241
BS 6906: Part 4
BS EN ISO 12236
DIN 54307
FTMS 101C/2065

Specimens for test are clamped between circular rings with a specified internal diameter and a puncture probe of known material and dimensions is pushed centrally against and normal to the fabric at a specified speed until failure of the specimen occurs. Push through force and plunger displacement/elongation % (where appropriate) are measured.

Resistance to Stress Cracking using Notched Constant Tensile Load Test

ASTM D5397

This test consists of subjecting a dumbbell shaped notched specimen to a constant tensile load in the presence of a surface-active agent at an elevated temperature. The time to failure of the test specimen is recorded.

Environmental Stress Cracking

ASTM D1693

Bent specimens of the material, having a controlled imperfection on one surface, are exposed to the action of a surface active agent at an elevated temperature for a specified period of time. The specimens are examined at regular intervals for any signs of cracking.

Water Absorption

ASTM D570

This test measures the amount of water absorbed by the sample under defined conditions of time and temperature.

Integrity of Geomembrane Seams

ASTM D413 (NSF Mod)
ASTM D4437 (NSF Mod)
ASTM D6392

Ten specimens of known dimensions are taken from the seamed sample. Five specimens are subjected to the T-Peel test and five to the shear test, all under specified conditions.

Oxidative Induction Time (OIT)*

ASTM D3895

OIT is determined by Differential Scanning Calorimetry. The sample for test and a reference material are heated at a constant rate in an inert gaseous environment. When the specified temperature has been reached, the atmosphere is changed to oxygen maintained at the same flow rate. The specimen is then held at constant temperature until the oxidative reaction is displayed on the thermal curve. The time interval from when the oxygen flow is first initiated to the oxidative reaction is referred to as the induction period. The end of the induction period is signalled by an abrupt increase in the specimen's evolved heat and may be observed by a Differential Scanning Calorimeter (DSC). The OIT is determined from the data recorded during the isothermal test.

Low Temperature Brittleness*

ASTM D746

This test method covers the determination of the temperature at which plastics exhibit brittle failure under specified impact conditions.
* Sub-contracted

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