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BSI Standards Publication

Geosynthetic Barriers — Test method for the determination of the influence of freezing-thawing cycles on the permeability of clay geosynthetic barriers

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/553, Geotextiles and geomembranes.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Geosynthetic Barriers - Test method for the determination of the influence of freezing-thawing cycles on the permeability of clay geosynthetic barriers

Géosynthétiques bentonitiques - Méthode d'essai pour la détermination de l'influence de cycles gel/dégel sur la perméabilité des géosynthétiques bentonitiques

Geosynthetische Dichtungsbahnen - Prüfverfahren zur Bestimmung des Einflusses von Frost-Tau-Zyklen auf die Wasserdurchlässigkeit von geosynthetischen Tondichtungsbahnen

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Foreword

This document (CEN/TS 14418:2014) has been prepared by Technical Committee CEN/TC 189 “Geosynthetics”, the secretariat of which is held by NBN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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Introduction

This Technical Specification defines a method for testing the influence of freezing-thawing cycles on the flux of clay geosynthetic barriers. Such resistance is a requirement for many uses of these products.

The influence ratio is an indication of the behaviour of the product when exposed to repeated freezing and thawing cycles in earth constructions. The flux of saturated clay geosynthetic barriers may increase in consequence of repeated freezing-thawing cycles.

The Technical Specification does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to comply with any regulations or legislation regardless of the wording in the technical specification.

The flux determined using this test method is not considered to be representative of the in-service flux of GBR-Cs.

This test determines the influence of freezing-thawing cycles in the absence of any other phenomena, for example cation exchange.

1 Scope

This Technical Specification describes an index test to determine the influence ratio of freezing-thawing cycles on the flux through saturated clay geosynthetic barriers.

This test method is applicable to GBR-C products with no additional sealing layers attached.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 16416, *Geosynthetic clay barriers — Determination of water flux index — Flexible wall permeameter method at constant head*

EN ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696)*

EN ISO 10320, *Geotextiles and geotextile-related products - Identification on site (ISO 10320)*

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

3 Terms and definitions

For the purposes of this document, the following term and definition applies.

3.1
influence ratio
ratio of the flux of a specimen exposed to freezing-thawing cycles to that of the flux through an unexposed reference specimen, expressed in percent

4 Principle

The flux through 100 mm diameter clay geosynthetic barrier specimens is determined with a flexible wall permeameter both on specimens exposed to freezing-thawing cycles and on unexposed reference specimens.

A specimen either square with an edge length not less than 200 mm or circular with a diameter not less than 200 mm to a tolerance of ± 0,5 % is hydrated under a pressure of (4 ± 0,2) kPa for 48 h at constant room temperature. After hydration, the specimen is stored in the freezer under a pressure of (4 ± 0,2) kPa at −5 °C for 24 h. After the freezing period the specimen is allowed to thaw under a pressure of (4 ± 0,2) kPa at room temperature for 24 h. Then the specimen is hydrated again for 24 h at room temperature. This freezing-thawing cycle is performed four times before cutting the test specimen.

Eventually the test specimen and the unexposed reference specimen are tested in accordance with EN 16416.

5 Apparatus

The apparatus shall consist of the following:

— a template of known dimensions to a tolerance of ± 0,5 % either square with an edge length not less than 200 mm or circular with a diameter not less than 200 mm,

— a waterproof box large enough to accommodate the specimen,

— a rigid chemically inert pressure plate of the same dimensions as the specimen, and not less than 10 mm thick,

— sufficient weights to exert a pressure of (4 ± 0,2) kPa on the specimen (allowing for the weight of the pressure plate),

— a mechanically bonded nonwoven geotextile with a mass per unit area of (250 ± 50) g/m^2,

— a freezer capable to maintain a temperature of (−5 ± 2) °C.

6 Reagent

De-ionized water in accordance with EN ISO 3696, grade 3.

7 Procedure

7.1 Specimen preparation

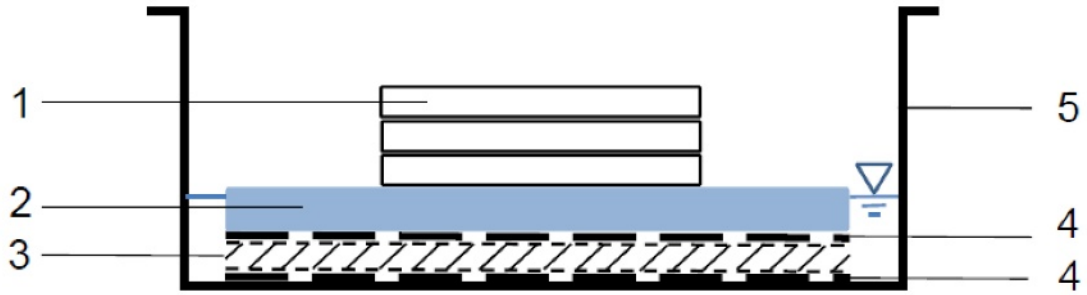
Inspect the bulk clay geosynthetic barrier specimen to be tested and record any disturbance, irregularity or damage. Choose two representative sections of the specimen for testing, one for the reference specimen and one for the test specimen to be submitted to the freezing-thawing cycles. Place the template on the selected section. Cut the specimens to the exact size of the template with a sharp knife or any other suitable instrument. Remove the specimens carefully to avoid loss of bentonite.

The specimen size may be limited by safety restrictions on the total mass of the weights where these are to be transported manually.

Seal the edges of the clay geosynthetic barrier specimens with waterproof tape or self-adhesive aluminium foil to prevent bentonite loss during further handling.

7.2 Specimen hydration

Fill a waterproof box with water. Place a piece of mechanically bonded nonwoven geotextile with a mass per unit area of (250 ± 50) g/m^2 on the bottom of the box and manually remove any air bubbles. Place the GBR-C sample on the nonwoven and then put a further piece of similar nonwoven geotextile on top of the GBR-C and manually remove any air bubbles. Place a pressure plate on the “sandwich” of specimens. Place weights on the pressure plate to obtain a required pressure of (4 ± 0,2) kPa.



Key

1 dead load

2 pressure plate

3 GBR-C sample

4 mechanically bonded nonwoven geotextile

5 waterproof box

Figure 1 — GBR-C hydration setup

NOTE The use of drainage mats instead of nonwoven geotextile results in unevenness in the surface of GBR-Cs. This could lead to incorrect measurements.

Add de-ionized water to the box so that the water level is not above the top of the pressure plate. In order to maintain the GBR-C specimen submerged, add water at the rate it is absorbed by the GBR-C specimen. Keep the specimen submerged at room temperature selected according to ISO 554 and at a pressure of (4 ± 0,2) kPa.

7.3 Specimen freezing

After 48 h, remove the excess water from the box.

Preset the freezer to a temperature of (−5 ± 2) °C prior to placing specimen inside it.

Move the box containing the test specimen with the weights and the pressure plate to the freezer.

Allow the test specimen to freeze for 24 h. The freezer temperature shall be (−5 ± 2) °C.

7.4 Specimen thawing

After the freezing period allow the specimen to thaw for 24 h at room temperature selected according to ISO 554 without adding any water. Then add water again according to the procedure described in 7.2.

Submerge the specimen again for a minimum of 24 h at room temperature selected according to ISO 554 without adding any water unless it can be shown that omitting this point has no influence on the test result.

7.5 Repetition

Repeat steps from 7.2 to 7.4 a further three times.

7.6 Preparation of specimen for flux testing

Remove the weights and the nonwoven geotextile pieces and the clay geosynthetic barrier specimen from the box and carefully place the specimen on a flat smooth surface.

Take a (100 ± 2) mm diameter specimen and perform the test in accordance with EN 16416.

Perform the test in accordance with EN 16416 on an unexposed reference specimen.

8 Calculation and expression of results

8.1 Recording of data

The following data shall be recorded for each test:

a) the duration of the different conditioning periods (saturation, freezing, thawing);

b) the freezer temperature;

c) all flux values determined and the corresponding time periods.

8.2 Calculation and expression of results

Calculate the influence ratio R of freezing-thawing cycles as follows:

$$R = 100\,(\frac{q_{\text{test}}}{q_{\text{reference}}})$$

where

q_{test} is the flux value (in $m^3/(m^2.s)$) of the test specimen after exposure to the wetting-drying cycles;

$q_{\text{reference}}$ is the flux value in ($m^3/(m^2.s)$) of the reference specimen.

9 Test Report

The test report shall include the following particulars:

a) number and date of this standard;

b) identification of the sample in accordance with EN ISO 10320, date of receipt and date of testing;

c) conditioning atmosphere;

d) the results obtained, expressed in accordance with 8.2.

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