SLOVENSKI STANDARD
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Geosintetika - Splošni preskusi za ocenitev sprememb po preskusu staranja

Geosynthetics - General tests for evaluation following durability testing

Geokunststoffe - Allgemeine Prüfverfahren zur Bewertung nach Beständigkeitsprüfungen

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Geosynthetics - General tests for evaluation following durability testing

Geokunststoffe - Allgemeine Prüfverfahren zur Bewertung nach Beständigkeitsprüfungen

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Contents

Page

Foreword

This document (prEN 12226:2010) has been prepared by Technical Committee CEN/TC 189 “Geosynthetics”, the secretariat of which is held by NBN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12226:2000.

1 Scope

This European Standard describes test methods for determining the change in specific properties of aged geosynthetics.

2 Normative references

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

EN 1849-1, *Flexible sheets for waterproofing — Determination of thickness and mass per unit area — Part 1: Bitumen sheets for roof waterproofing*

EN 1849-2, *Flexible sheets for waterproofing — Determination of thickness and mass per unit area — Part 2: Plastic and rubber sheets for roof waterproofing*

EN 14150, *Geosynthetic barriers — Determination of permeability to liquids*

EN 14415, *Geosynthetic barriers — Test method for determining the resistance to leaching*

EN 14575, *Geosynthetic barriers — Screening test method for determining the resistance to oxidation*

EN 29073-3, *Textiles — Test methods for nonwovens — Part 3: Determination of tensile strength and elongation*

EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

EN ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

EN ISO 527-4, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotopic fibre-reinforced plastic composites*

EN ISO 9862, *Geotextiles and geotextile-related products — Sampling and preparation of test specimens*

EN ISO 12311-1, *Flexible sheets for waterproofing — Part 1: Bitumen sheets for roof waterproofing — Determination of tensile properties*

EN ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method (ISO 13934-1:1999)*

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

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ISO/TS 13434, *Guidelines on durability of geotextiles and geotextile-related products*

ASTM D 5885, *Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry*

3 Principle

The test specimens are exposed to a durability test for geosynthetics. The exposure is followed by visual and, if required, microscopic inspection and by determination of changes in tensile properties, oxidative induction time, and water permeability as appropriate to the relevant standard.

NOTE For further information on relevant durability tests see ISO/TS 13434.

4 Specimens

4.1 Number of specimens

For each durability test the number of test and control specimens shall be a minimum of five, in both the machine and the cross-direction, unless the nature of the geotextile or geotextile-related product makes this inappropriate.

NOTE 1 If several durability tests are carried out simultaneously and the pre-treatment allows it, common control specimens may be used.

NOTE 2 Where specimens are exposed for more than one time duration, control specimens may be prepared for each duration.

4.2 Sampling

Prepare specimens in accordance with EN ISO 9862.

For woven fabrics, cut pairs of test and control specimens at least 60 mm wide and 300 mm long containing the same yarns in the direction of test, i.e. adjacent along the shorter dimension. Count the number of these yarns within 50 mm in the machine direction and in the cross direction. Record the numbers as n_1 and n_2 respectively.

For nonwoven fabrics, cut pairs of test and control specimens at least 50 mm wide and 300 mm long adjacent along the larger dimension.

For geogrids, cut specimens containing one or more complete ribs in width with a minimum of one junction and preferably three junctions in length. There shall be one junction at the centre of the specimen.

Composites should be tested for durability in the form of the complete product as supplied to the construction site. Where a manufacturer considers that this is not feasible, a technical justification for separation of products prior to testing including the relationship between the properties of the composite and its components must be presented.

For geosynthetic barrier materials separation of components for testing will only be permissible where so stated in the relevant application standards.

Polymeric and bituminous geosynthetic barriers shall be sampled in accordance with the relevant exposure test methods. Clay geosynthetic barriers shall be sampled as described above for composite products

NOTE The variability in the tensile strength of nonwovens may be reduced if tensile strength is assumed to correlate with the mass of the specimens. Discard the outer 10 % of the roll width together with any areas with visible faults. The specimens should then be cut or punched out with equal dimensions, weighed, and the mean mass ($\underline{m}$) and the standard deviation (s) of the mass calculated. All specimens, whose mass m_i is greater or less than one standard deviation from the mean should be discarded, amounting to about one third of the specimens.

From these specimens of mass m_i sets of n specimens for each exposure time can be compiled such that the total mass of each set Σm_i fulfils the relation:

$$n\underline{m} - s < \sum m_i < n\underline{m} + s$$

4.3 Conditioning and exposure

Expose the specimens as described in the relevant durability standard, following the guidelines of ISO/TS 13434.

Store the control samples in the dark.

Before testing, both the control and exposed test specimens shall be conditioned in the standard atmosphere for testing (at (20 ± 2) °C and (65 ± 5) % relative humidity) as defined in ISO 554.

The specimens can be considered to have been conditioned when the change in mass in successive weighings made at intervals of not less than 2 h does not exceed 0,25 % of the mass of the test specimen.

Conditioning and testing in standard atmosphere may only be omitted when it can be shown that results obtained for the same specific type of product (both structure and polymer type) are not affected by changes in temperature and humidity exceeding the limits.

5 Procedures

5.1 Visual examination

Inspect the exposed specimens with the naked eye and report changes relative to the control specimens, e.g. discolorations.

5.2 Microscopic examination

When required, use a microscope with a magnification of approximately 250 to give a qualitative prediction of obvious differences between the exposed specimens and the control specimens, e.g. damage to the individual fibres. Report the magnification factor.

NOTE Specimens for microscopic examination may be taken separately from the specimens for tensile testing.

5.3 Tensile properties

Test tensile properties of woven fabrics in accordance with EN ISO 13934-1 and nonwoven fabrics in accordance with EN 29073-3, but using a jaw separation speed of 100 mm/min.

NOTE Where required (see 4.2) specimens wider than 50 mm may be used.

For woven fabrics remove threads in approximately equal numbers from each of the long edges of the cut strip until the width of the exposed and control specimens contains a number of threads identical to the corresponding number n_1 or n_2 (see 4.4). For machine and cross-direction record separately the tensile strengths of the control specimens as F_{ci} and of the exposed as F_{ei} If required, record the strains at maximum load as ε_{ci} and ε_{ei} respectively, "i" indicating the specimens.

Geogrids shall be tested according to EN ISO 10319, modified as necessary for less than three ribs.

Tensile properties of GBR-P and B will be measured according to the test methods specified in the relevant required characteristics standards.

5.4 Oxidative induction time

For polyolefinic GBR-P, the oxidative induction time of a single control and a single exposed specimen shall be measured in accordance with ASTM D 5885 (high pressure OIT) or ISO 11357-6 (standard OIT). These methods may be applied to other geosynthetics that rely on additional stabiliser materials to provide resistance to oxidation.

This evaluation technique should be applied to the materials exposed according to the following ageing procedures:

— Weathering (EN 12224);

— Oxidation (EN 14575);

— Leaching (EN 14415).

5.5 Mass per unit area

All GBR-P and B exposed to the leaching test (EN 14415) shall be evaluated by measurement of the loss of mass per unit area of a single control and a single exposed specimen according to EN 1849-1 or -2.

5.6 Water permeability

All GBR-P and B exposed to the following test procedures:

— Weathering EN 12224;

— Oxidation EN 14575;

— Resistance to landfill leachate EN 14414 (Condition C only)

shall also be evaluated by measurement of change of permeability to water according to EN 14150 using a single control and a single exposed specimen (see Note in Clause 7).

6 Expression of results

6.1 Change in tensile strength

Calculate the mean tensile strength of the exposed specimens, F_e, and its standard deviation. Calculate the mean tensile strength of the control specimens, F_C, and its standard deviation.

Calculate the percentage retained strength R_F to one decimal place according to the formula:

$$R_F = \frac{F_e}{F_c} \times 100 \text{ (in \%)}$$

6.2 Change in strain at maximum load

If required, calculate the mean strain at maximum load of the exposed specimens, ε_e, and its standard deviation. Calculate the mean strain at maximum load of the control specimens, ε_C, and its standard deviation.

Calculate the percentage retained strain at maximum load R_ε to one decimal place according to the formula:

$$R_{\varepsilon} = \frac{\varepsilon_e}{\varepsilon_c} \times 100 \text{ (in \%)}$$

6.3 Change in oxidative induction time

Calculate the oxidative induction time of the exposed specimen, T_e. Calculate the oxidative induction time of the control specimen, T_c.

Calculate the percentage retained oxidative induction time R_T to one decimal place according to the formula:

$$R_T = \frac{T_e}{T_c} \times 100 \text{ (in \%)}$$

6.4 Change in mass per unit area

Calculate the mass per unit area of the exposed specimens M_e. Calculate the mass per unit area of the control specimens, M_c.

Calculate the percentage change in R_M to one decimal place according to the formula:

$$R_M = \frac{M_e}{M_c} \times 100 \text{ (in \%)}$$

6.5 Change in water permeability

Calculate the water permeability of the exposed specimens, P_e. Calculate the water permeability of the control specimen, P_c.

Calculate the percentage retained water permeability R_P to one decimal place according to the formula:

$$R_P = \frac{P_e}{P_c} \times 100 \text{ (in \%)}$$

7 Test report

The test report shall include the following information:

a) reference to this European Standard;

b) identification of the sample;

c) number and dimensions of tested specimens;

d) conditioning atmosphere;

e) type of exposure with reference to the corresponding standard;

f) results of visual examination and, if carried out, microscopic inspection, including the magnification factor;

g) mean and standard deviation of F_e and F_c and the percentage retained strength (R_F);