

BS EN 12226:2012



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Geosynthetics — General tests for evaluation following durability testing

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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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ISBN 978 0 580 70559 5

ICS 59.080.70

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 January 2012.

Amendments issued since publication

Date	Text affected
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EUROPEAN STANDARD

EN 12226

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2012

ICS 59.080.70

Supersedes EN 12226:2000

English Version

Geosynthetics - General tests for evaluation following durability testing

Géosynthétiques - Essais généraux d'évaluation après essais de durabilité

Geokunststoffe - Allgemeine Prüfverfahren zur Bewertung nach Beständigkeitsprüfungen

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Contents

Page

Foreword.....	3
1 Scope	4
2 Normative references	4
3 Principle	4
4 Specimens	4
4.1 Number of specimens	4
4.2 Sampling	5
4.3 Conditioning and exposure	6
5 Procedures	7
5.1 Visual examination	7
5.2 Microscopic examination	7
5.3 Tensile properties	7
5.4 Compression properties	7
6 Expression of results	7
6.1 Change in maximum tensile load.....	7
6.2 Change in elongation at break (for GBR-B and GBR-P only).....	7
6.3 Change in compressive strength	8
7 Test report	8

Foreword

This document (EN 12226:2012) has been prepared by Technical Committee CEN/TC 189 "Geosynthetics", the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2012, and conflicting national standards shall be withdrawn at the latest by July 2012.

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.

This document supersedes EN 12226:2000.

The main changes compared to the previous edition are:

- a) the title and scope of the standard was extended from geotextiles and geotextile-related products to geosynthetics;
- b) normative references revised;
- c) new Table 1 "Sampling of specimens for tensile testing of geosynthetics after exposure" added;
- d) new subclause 5.4 "Compression properties" added;
- e) new subclause 6.3 "Change in compressive strength" added.

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1 Scope

This European Standard specifies 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 12311-1, *Flexible sheets for waterproofing — Part 1: Bitumen sheets for roof waterproofing — Determination of tensile properties*

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

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

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

EN ISO 9862, *Geosynthetics — Sampling and preparation of test specimens (ISO 9862)*

EN ISO 10318, *Geosynthetics — Terms and definitions (ISO 10318)*

EN ISO 10319, *Geosynthetics — Wide-width tensile test (ISO 10319)*

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)*

EN ISO 25619-2, *Geosynthetics — Determination of compression behaviour — Part 2: Determination of short-term compression behaviour (ISO 25619-2)*

ISO/TS 13434, *Geosynthetics — Guidelines for the assessment of durability*

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 or compressive properties, as appropriate.

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 geosynthetic makes this inappropriate.

4.2 Sampling

Prepare specimens in accordance with EN ISO 9862. An overview of test methods, specimen sizes and test conditions per product type is given in Table 1.

For woven and knitted geotextiles (GTX-W and GTX-K), cut pairs of test and control specimens at least 60 mm wide and 300 mm long containing the same yarns or strips in the direction of test, i.e. adjacent along the shorter dimension. Count the number of these yarns or strips within 50 mm in the machine direction and in the cross machine direction. Record the numbers as n_1 and n_2 respectively.

For woven geotextiles 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 numbers n_1 and n_2 . For machine and cross machine 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 number of specimen.

For nonwoven geotextiles (GTX-N), cut pairs of test and control specimens at least 50 mm wide and 300 mm long adjacent along the larger dimension.

For geogrids (GGR), 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. GGR shall be tested according to EN ISO 10319, modified as necessary for one rib or more in width.

For geostrips (GST), cut specimens in full width and at least 300 mm long.

For geonets (GNT), geomats (GMA) and geospacers (GSP) cut pairs of test and control specimens at least 50 mm wide and at least 300 mm long adjacent along the larger dimension.

For geocomposites (GCO) consisting of more than one geosynthetic product, the components shall be individually tested for durability. If this is not feasible, a technical justification for an alternative testing approach shall be presented and reported.

For certain products, e.g. geospacers (GSP), tensile tests are not always applicable. For those products compression tests according to EN ISO 25619-2 shall be performed. A compression test specimen shall contain at least three load bearing elements in machine direction and in cross-machine direction. If this is not feasible, a technical justification for an alternative testing approach shall be presented and reported.

For geosynthetic barriers (GBR), components will only be separately tested if so specified in the relevant application standards.

Polymeric and bituminous geosynthetic barriers (GBR-P and GBR-B) shall be sampled as test plates in accordance with the relevant exposure test methods. Clay geosynthetic barriers (GBR-C) shall be sampled as geocomposite products.

NOTE 1 GCD (drainage geocomposite) can consist of GTX and GNT or GMA or GSP.

NOTE 2 GCR (reinforcement geocomposite) can consist of GTX, GGR or a structure similar to GGR.

NOTE 3 Geocells (GCE) or other erosion control products are not included, because the harmonized standards for the application as surface erosion control are not available so far.

NOTE 4 The variability in the tensile strength of nonwovens may be reduced if tensile strength is assumed to correlate with the mass of the specimens. The outer 10 % of the roll width together with any areas with visible faults should be discarded. The specimens should then be cut or punched out with equal dimensions, weighed, and the mean mass (\bar{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 can be compiled for each exposure time such that the total mass of each set ($\sum m_i$) fulfils the relation:

$$nm - s < \sum m_i < nm + s$$

Table 1 — Sampling of specimens for tensile testing of geosynthetics after exposure

Product type ^a	Test Method	Specimen Size (specimen length x specimen width)	Test Conditions (distance between the clamps L; width B of test specimen or test specimen type; test speed or strain rate; elongation measurement technique)
GTX-N	EN 29073-3	300 mm x 50 mm	L = 200 mm, B = 50 mm, 100 mm/min, grip separation measurement
GTX-W, GTX-K	EN ISO 13934-1	300 mm x 60 mm	L = 200 mm, B = 50 mm, 100 mm/min, grip separation measurement
GGR	following EN ISO 10319	width: ≥1 rib, length: 300 mm to 500 mm	L ≥ 200 mm, 20 % L/min, grip separation measurement
GST	following EN ISO 10319	full width, length: 300 mm	L = 200 mm, 20 % L/min, grip separation measurement
GNT	following EN ISO 13934-1	300 mm x 50 mm	L = 200 mm, B = 50 mm, 100 mm/min, grip separation measurement
GMA	following EN ISO 13934-1	300 mm x 50 mm	L = 200 mm, B = 50 mm, 100 mm/min, grip separation measurement
GSP	following EN ISO 13934-1	300 mm x 50 mm, depending on the studs	L = 200 mm, B = 50 mm, 100 mm/min, grip separation measurement
GCO	following EN ISO 13934-1; each component to be tested separately as GTX or GTP	300 mm x 50 mm	L = 200 mm, B = 50 mm, 100 mm/min, grip separation measurement ^a
GBR-C	following EN ISO 13934-1; each component to be tested separately (see GCO)	300 mm x 50 mm	L = 200 mm, B = 50 mm, 100 mm/min, grip separation measurement
GBR-B	EN 12311-1	300 mm x 50 mm	L = 200 mm, B = 50 mm, 100 mm/min, gauge length L ₀ = 180 mm ^a
GBR-P, homogeneous	EN ISO 527-3	test plate (130 mm x 180 mm)	Type 5, L = 80 mm, 100 mm/min, gauge length L ₀ = 25 mm ^a
GBR-P, reinforced	EN ISO 527-4	300 mm x 50 mm	Type 2, L = 150 mm, 5 mm/min, gauge length L ₀ = 50 mm ^a
^a to be measured with extensometer			

4.3 Conditioning and exposure

Store the control specimens in the dark.

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

Before testing, both the control and exposed specimens shall be conditioned in the standard atmosphere as defined in the relevant test standards.

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

Test both control specimens and exposed specimens together one after the other after finalizing of exposure.

5 Procedures

5.1 Visual examination

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

5.2 Microscopic examination

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

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

5.3 Tensile properties

Test tensile properties according to Table 1.

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

5.4 Compression properties

The compression properties of geospacers shall be tested according to EN ISO 25619-2.

6 Expression of results

6.1 Change in maximum tensile load

Calculate the mean maximum tensile load 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 tensile strength R_F to one decimal place according to the following equation:

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

6.2 Change in elongation at break (for GBR-B and GBR-P only)

If required, calculate the mean elongation at break of the exposed specimens, \mathcal{E}_e , and its standard deviation. Calculate the mean elongation at break of the control specimens, \mathcal{E}_c , and its standard deviation.

Calculate the percentage retained elongation at break $R_{\mathcal{E}}$ to one decimal place according to the following equation:

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

6.3 Change in compressive strength

Calculate the mean compressive strength of the exposed specimens, σ_e , and its standard deviation. Calculate the mean compressive strength of the control specimens, σ_c , and its standard deviation.

Calculate the percentage retained compressive strength R_{σ} to one decimal place according to the following equation:

$$R_{\sigma} = \frac{\sigma_e}{\sigma_c} \times 100 \text{ (in \%)}$$

7 Test report

The test report on durability characteristics shall include the following information:

- a) reference to this European Standard;
- b) identification of the sample;
- c) number and dimensions of tested specimens;
- d) test method and test conditions (see 4.2);
- e) conditioning atmosphere;
- f) type of exposure with reference to the corresponding standard;
- g) results of visual examination and, if carried out, microscopic inspection, including the magnification factor;
- h) mean and standard deviation of F_e and F_c and the percentage retained tensile strength R_F ;
- i) mean and standard deviation of σ_e and σ_c , and the percentage retained elongation at break, R_{ε} ;
- j) mean and standard deviation of σ_e and σ_c and the percentage retained compressive strength R_{σ} ;
- k) deviations from this European Standard;
- l) date of the test.

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