BRITISH STANDARD

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Surfaces for sports areas — Determination of tensile strength of synthetic yarns

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ICS 97.150; 97.220.10

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National foreword

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English version

Surfaces for sports areas - Determination of tensile strength of synthetic yarns

Sols sportifs - Détermination de la résistance à la traction des fibres synthétiques

Sportböden - Bestimmung der Zugfestigkeit von synthetischen Garnen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

This document (EN 13864:2004) has been prepared by Technical Committee CEN/TC 217 “Surfaces for sports areas”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by January 2005, and conflicting national standards shall be withdrawn at the latest by January 2005.

This standard is based on ISO 2062 and ISO 5079, noting that synthetic turf fibres are not 'classical' fibres and therefore have to be treated as both textile as well as plastics products.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard describes two methods for the determination of the tensile properties of pile yarns in the construction of synthetic turf. Method A is used for determining the tensile properties of synthetic yarns taken from packages prior to the manufacture of synthetic turf. Method B is used for determining the tensile properties of pile yarns from the manufactured synthetic turf. The results from the two methods are not comparable and method B is less accurate.

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 ISO 2062:1995, *Textiles – Yarns from packages – Determination of single-end breaking force and elongation at break (ISO 2062:1993)*

EN ISO 5079:1995, *Textiles - Fibres – Determination of breaking force and elongation at break of individual fibres (ISO 5079:1995)*

ISO 5893, *Rubber and plastics test equipment – Tensile, flexural and compression types (constant rate of traverse) – Specification*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 2062:1995, EN ISO 5079:1995 and the following apply.

3.1
package
length of yarn in a form suitable for use, handling or storage

3.2
initial length
length of a test piece under specified pre-tension, at the beginning of a test

NOTE For a tensile test, the initial length is measured between the two effective clamping points and is expressed in millimetres.

3.3
breaking force
maximum force applied to a test piece carried to rupture during a tensile test under specified conditions

NOTE 1 See A_1 in Figure 1

NOTE 2 The breaking force is expressed in Newtons (N) or centiNewtons (cN)

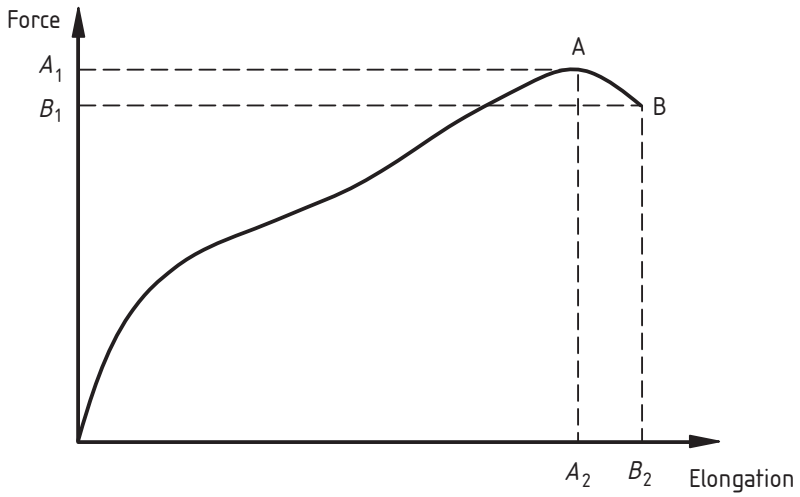

Figure 1 — Typical force/elongation curve

3.4
elongation at break
elongation of a test piece produced by the breaking force, expressed as a percentage of the initial length

NOTE See A_2 in Figure 1

3.5
pre-tension
tension applied to a test piece at the beginning of the tensile test

3.6
gauge length (type A test pieces)
distance between the two effective clamping points of a testing device

3.7
gauge length (type B test pieces)
distance between the margin points of gluing between the plastic sheets

3.8
breaking tenacity
ratio of a yarn's breaking force to its linear density

NOTE The breaking tenacity is usually expressed in centiNewtons per tex (cN/tex)

4 Principle

A test piece of synthetic yarn of a given length is subjected to a tensile stress, transmitted to it by means of a suitable device. A stress-strain (or force-elongation) curve is plotted, from which a number of parameters are deduced.

5 Apparatus and materials

5.1 Means of measuring tensile strength

5.1.1 Tensile strength apparatus, in accordance with ISO 5893, having an accuracy in accordance with grade A of ISO 5893, providing suitable clamps for gripping individual fibres at the required initial length, a

means for stretching the fibre to rupture at constant speed of testing and a means of recording the force applied to the fibre and the corresponding elongation.

5.1.2 Clamps and jaws, to grip individual fibres at the required initial length and prevent slipping or cutting of the specimens or breaks at the jaws.

NOTE Satisfactory gripping can be accomplished by a number of means. Pneumatic clamps and jaws for plastics material with flat-faced unlined metal surfaces or those with a wavy-profiled cross section have proved suitable. If these cannot prevent slippage, lined jaws can be used.

5.1.3 Elongation measuring device, either an extensometer having a contact edge made of elastomeric material in order to prevent damage to the fibre, measuring to an accuracy of 0,2 mm for method A on gauge lengths of 250 mm or to an accuracy of 1% for all other tests, e.g. method B on short gauge lengths, and applied to the plastics sheets for method B tests to ensure a minimum gauge length of at least 15 mm, or an optical measuring device that measures to at least the same accuracy.

5.2 Means of measuring linear density of the pile

5.2.1 Rule, measuring length to within 1 mm for measurements on yarns from packages or a calliper measuring to within 0,1 mm for measurements on piles pulled out of a carpet.

5.2.2 Analytical balance, measuring mass to within 0,1 mg.

5.3 Means of measuring width and thickness of test pieces

5.3.1 Dial gauge, for measuring pile thickness to within 1 µm.

5.3.2 Optical means of measuring pile width to within 50 µm.

5.4 Material

For tests of type B, glue and plastics sheets, to attach the ends of short piles pulled out from a carpet between the jaws.

6 Sampling and preparation of test pieces

6.1 Sampling

6.1.1 Sampling from yarns from packages (Method A)

The sampling regime shall be agreed between the interested parties, taking into consideration EN ISO 2062.

6.1.2 Sampling from a manufactured synthetic turf (Method B)

For test pieces to be taken from a manufactured synthetic turf, a piece of the turf, of at least 0,5 m², shall be taken, if no specific sampling is required.

6.2 Preparation of test pieces

6.2.1 General

A sufficient number of test pieces shall be prepared to obtain a minimum of ten valid results (see **7.6**).

All test pieces (but especially those of type B) shall be assessed visually before testing, in case of dispute, using optical instruments (e.g. a magnifier or microscope) in order to reject samples which are already damaged.

Glue test pieces of type B that have a length less than 75 mm onto plastic sheets before testing and mark the margin points of gluing in order to measure the gauge length.

6.2.2 Dimensions

For test pieces of type A, test pieces taken from a package of yarn shall be long enough to obtain a gauge length of 250 mm.

NOTE The total length depends on the kind of gripping by the jaws.

For test pieces of type B, the gauge length of test pieces taken from piles of carpets shall be as long as possible but no less than 15 mm.

6.3 Conditioning and test conditions

Conditioning and testing shall be carried out at a temperature of (23 ± 2) °C and (50 ± 5) % relative humidity.

Test pieces shall be conditioned for at least 24 h before testing.

7 Procedure

7.1 For method A, measure the linear density of the test piece by recording its length, to the nearest 0,1 mm, and mass to the nearest 0,1 mg.

For method B, measure the width and the thickness of the pile.

7.2 Programme the tensile strength apparatus (**5.1**) using the specified parameters.

7.3 Mount the test piece in the clamps of the testing machine. Ensure that the filament lies flat and along the axis of extension of the machine. Subject the test piece to a pre-tension of (0,5 ± 0,1) cN/tex.

NOTE 1 This is equivalent to a pre-force of 5 N for a standard turf pile material of 1000 tex. Such a pre-tension is carried out in order to remove crimp from the test piece.

To check that a type A test piece does not slip between the jaws, mark the ends of the specimen at the margin in contact with the jaws.

NOTE 2 A suitable pen the colour of which does not affect the fibre is recommended for this purpose.

7.4 Measure the initial gauge length to the nearest 0,5 mm for type A or the nearest 0,2 mm for type B test pieces.

7.5 Perform tensile tests at a speed of testing equivalent to 50% of the gauge length of the test piece per minute.

NOTE This corresponds to a speed of testing of 125 mm/min for 250 mm gauge length test pieces of type A.

7.6 During the test, check that the test piece does not slip between the jaws. Disregard the results of tests where slippage occurs. Also disregard results of tests where breaks occur within 5 mm from the jaws. Carry out a sufficient number of tests to obtain at least 10 valid results.

8 Calculation and expression of results

8.1 The elongation at break is given by

$$\varepsilon = \frac{\Delta l}{l_0} \times 100 \qquad (1)$$

where

ε is the elongation at break, in % (see **3.4**);

Δl is the change in length, in millimetres;

l_0 is the gauge length, in millimetres (see **3.6**).

8.2 Calculate the individual values and arithmetic mean of the following properties:

a) linear density for method A or the cross section for method B;

b) breaking force;

c) elongation at breaking force.

For method A, calculate the individual values of the breaking tenacity (see **3.8**) using the individual values of F_{max} (see figure 1) and the arithmetic mean of linear density. Express the breaking tenacity in to the nearest 0,01 cN/tex.

For method B, calculate the individual values of the breaking tenacity (see **3.8**) using the individual values of F_{max} (see figure 1) and the arithmetic mean of the cross section. Express the breaking tenacity in to the nearest 0,01 N/mm².

9 Test report

The test report shall include the following information:

a) reference to this European Standard, i.e. EN 13864:2004;

b) method used (A or B);

c) complete identification of the product tested, including type, source, colour, manufacturer's reference and previous history;

d) date of sampling or delivery;

e) number of test pieces tested and number of test pieces disregarded;

f) speed of testing;

g) date of the test;

h) individual values, and mean values of:

1) linear density, expressed in tex, to three significant figures for method A and two significant figures for method B;

2) breaking force, expressed in Newtons, to the nearest 0,1 N;

3) elongation at break, expressed in %, to two significant figures;

4) breaking tenacity, expressed either in cN/tex, to the nearest 0,1 cN/tex or in N/mm² to the nearest 0,1 N/mm²

Bibliography

EN ISO 291, *Plastics – Standard atmospheres for conditioning and testing*

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