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Footwear — Test method for the determination of the resistance of elastic materials for footwear to repeated extension — Fatigue resistance

Chaussures — Méthode d'essai pour la détermination de la résistance des élastiques de chaussures à des extensions répétées — Résistance à la fatigue

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Foreword

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Footwear — Test method for the determination of the resistance of elastic materials for footwear to repeated extension — Fatigue resistance

1 Scope

This International Standard specifies a test method for the determination of the resistance of elastic materials for footwear, to repeated extension produced during normal walking. The test can be carried out before and after accelerated ageing. This method is applicable to any elastic material used for footwear.

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.

ISO 10765, *Footwear — Test method for the characterization of elastic materials — Tensile performance*

ISO 18454, *Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
elastic
tape, cord or fabric containing rubber or a similar substance allowing it to stretch and return to its original shape

NOTE Generally elastic materials are used in upper construction in the quarters or in the straps to hold the shoe on the foot.

4 Apparatus and materials

4.1 Sewing machine, with a round point needle metric size 90s or 70s, a nylon or polyester thread (approximately tex 17/3) and operating at 6 stitches/cm.

4.2 Repeated extension machine, with a minimum separation of (60 ± 10) mm, a maximum separation that is fully adjustable up to a distance equal to the minimum separation plus 150 mm, a method of applying a simple harmonic reciprocating action to increase the distance between the clamps from the minimum to the maximum separation and back again at a rate of (60 ± 5) cycles per minute and a means of recording the number of cycles.

4.3 Chamber, at (70 ± 2) °C for the accelerated ageing process.

4.4 Steel ruler or **callipers.**

4.5 Polyurethane (PU) coagulated woven fabric, of thickness of approximately 1 mm.

5 Sampling and conditioning

5.1 Sampling

5.1.1 The dimensions of test pieces are shown in Figure 1.

5.1.2 Cut three test pieces of elastic, measuring (65 ± 5) mm. If accelerated ageing is going to be carried out, cut three more test pieces. The width dimension must be suitable to the dimension of the clamps so that the sample can be clamped properly in the fatigue equipment.

5.1.3 Mark on the test pieces a (15 ± 0,5) mm line parallel to both ends by means of the steel ruler (4.4).

5.1.4 For each test piece cut four pieces of the coagulated fabric, with the following dimensions:

— length of 30 mm;

— width equal to sample width plus 10 mm (minimum 30 mm).

5.1.5 On each of the square pieces, mark a line that is parallel to the width edge and 5 mm from it (AB, in Figure 1).

5.1.6 Stick a piece of double-sided tape on the uncoated side of one of the coated fabric squares. Place it on the elastic test piece so that the line drawn on the elastic is perfectly aligned with the edge of the square piece where the AB line has been drawn. Turn the sample around and place another coated fabric square on the elastic, now with the coated side facing upwards. The two coated fabric squares should be in line with each other. Press the assembly to ensure that they are bonded. Repeat the process on the other end of the test piece.

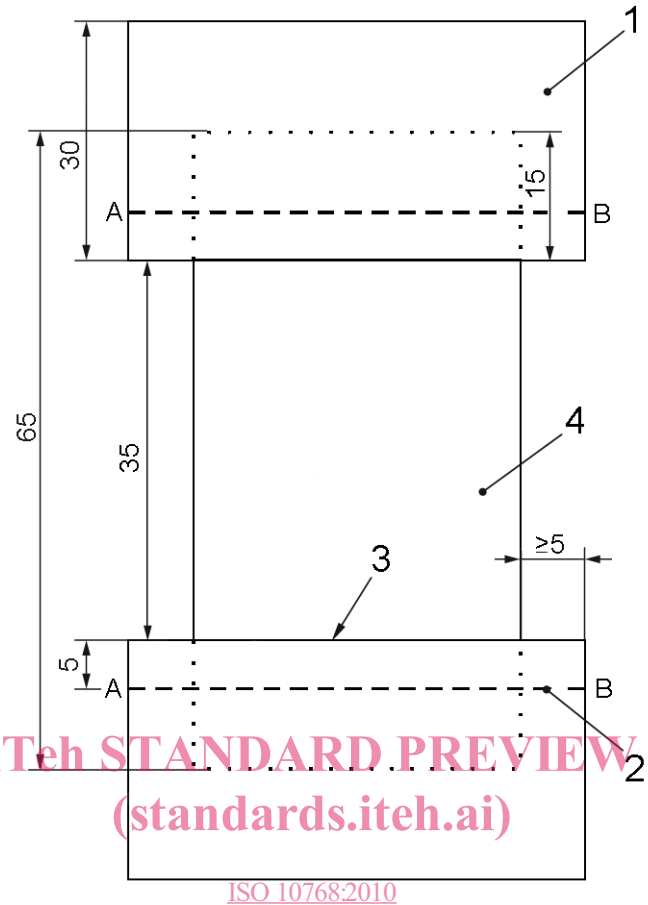
5.1.7 Prepare the other two samples in the same way.

5.1.8 Using the sewing machine (4.1), sew the three test pieces at each end, along the AB line.

5.2 Conditioning

Samples and test pieces shall be conditioned for at least 24 h at (23 ± 2) °C and (50 ± 5) % of relative humidity (RH) before testing, in accordance with ISO 18454.

Dimensions in millimetres



Key

1 coated fabric
2 stitching
3 line drawn on elastic
4 elastic

Figure 1 — Dimensions of a standard test piece in millimetres

6 Procedure

6.1 Damage of the elastic is evaluated after being submitted to repeated extensions of 150 % of its initial length or until the limit of useful extension (see ISO 10765).

6.2 Once the test pieces are prepared, measure the distance between the seams at both ends as well as the test piece width, to the nearest 0,5 mm. There should not be more than a 2 mm difference in the measurements. Calculate the arithmetic mean of the three values to the nearest 0,5 mm.

6.3 Before starting the test, examine the test piece under bright lighting conditions and record the number of elastic threads of the sample.

6.4 The limit of useful extension of the elastic material is needed so as to know the maximum stretch that can be applied. It is determined in accordance with ISO 10765.

If the useful extension is $\geqslant$ 150 %, the maximum stretch to apply is 150 %. If the useful extension is $<$ 150 %, the maximum stretch to apply is equal to the useful extension value.

6.5 Clamp the test piece in the equipment. The jaws should be on the minimum separation, so that the length of the sample is at right angles to the edge of the jaws. When clamped, the test piece should be neither stretched nor slack. Furthermore, the seams must not be clamped.

6.6 Once the test piece is clamped, calibrate the equipment so that the maximum distance between the jaws during each cycle corresponds to the maximum elongation value.

6.7 Switch on the machine at a test speed of (60 ± 5) cycles per minute until 2 000 cycles have been completed. Then, examine the test piece again and record the amount of broken elastic threads, as well as any signs of visible damage, such as wrinkling.

6.8 If more than 10 % of the test piece's elastic threads are broken or if it has wrinkled severely, the test is complete.

6.9 If the test piece does not appear to be damaged, carry out another 2 000 cycles and examine it once more. Continue this process until 10 000 cycles have been carried out or until any damage appears.

6.10 Repeat the procedure for the other two samples.

6.11 When test pieces are subjected to ageing, store the cut test pieces at 70 °C for 7 d. Take out the samples after 7 d, and leave them to condition in a controlled atmosphere at (23 ± 2) °C and (50 ± 5) % relative humidity (RH), for at least 48 h. Prepare the test pieces and test them according to the procedure described in 6.1 to 6.10.

7 Expression of results

The results are expressed as a percentage of the broken threads at the end of the test and shall be calculated using Equation (1).

$$\% = \frac{n_b}{n_0} \times 100 \quad (1)$$

where

n_b is the number of elastic thread broken;

n_0 is the number of elastic thread at the start of the test.

The final result shall be the arithmetic mean of the three test pieces. If it is not possible to distinguish the elastic threads, the test result will be an evaluation of the material's damage after a determined number of cycles.

8 Test report

The test report shall include, at least, the following information:

a) reference to this test standard (i.e. ISO 10768:2010);

b) a full description of the elastic material;

c) the total number of extension cycles;

d) a description of damage [wrinkling, elastic threads broken (%), etc.];

e) if accelerated ageing was carried out, the values of number of extension cycles and the amount of damage for the test after accelerated ageing;

f) any deviations from this method.