

फुटवियर की परीक्षण पद्धतियाँ  
भाग 26 ऊपरी भाग के लिए तन्य शक्ति और बढ़ाव

**Methods of Test for Footwear  
Part 26 Tensile Strength and Elongation  
for Uppers**

ICS 61.060

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## NATIONAL FOREWORD

This Indian Standard (Part 26) which is identical to ISO 17706 : 2003 'Footwear — Test methods for uppers — Tensile strength and elongation' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Footwear Sectional Committee and approval of the Chemical Division Council.

This Indian Standard first published as a part of IS 8085 under the general title 'Methods of test for footwear'. This part is an adoption of ISO 17706 : 2003 which specifies a test method for determining the force required to break a test specimen from uppers irrespective of the material, in order to assess the suitability for the end use.

This Indian Standard is published in several parts. The other parts in this series are:

- Part 1 Dimensions, fitting, adhesion test, peel test, heat resistance test and ageing test
- Part 2 Footwear performance test, stiffness test for shanks, lastometer test for cracking of uppers; and performance test for upper fabrics, coated fabrics, sock lining and other lining materials.
- Part 3 Upper sole adhesion
- Part 4 Resistance to crack initiation and growth — Belt flex method
- Part 5 Longitudinal stiffness of shanks
- Part 6 Abrasion resistance of uppers, linings and insoles
- Part 7 Deformability of upper
- Part 8 Delamination resistance of uppers
- Part 9 Tear strength of uppers linings and insoles
- Part 10 Heel attachment for whole shoe
- Part 11 Attachment strength of straps, trims and accessories
- Part 12 Tensile performance of elastic materials
- Part 13 Seam strength for uppers, lining and insoles
- Part 14 Water vapour permeability and absorption for uppers and lining
- Part 15 Washability in a domestic washing machine for whole shoe
- Part 16 Flexing durability for whole shoe
- Part 17 Abrasion resistance for accessories shoe laces
- Part 18 Peel strength before and after repeated closing for accessories touch
- Part 19 Shear strength before and after repeated closing for accessories touch and close fasteners
- Part 20 Flex Resistance for uppers and lining

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*Indian Standard*

**METHODS OF TEST FOR FOOTWEAR  
PART 26 TENSILE STRENGTH AND ELONGATION FOR UPPERS**

**1 Scope**

This standard specifies a test method for determining the force required to break a test specimen from uppers irrespective of the material, in order to assess the suitability for the end use.

**2 Normative references**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12222, *Footwear - Standard atmospheres for conditioning and testing of footwear and components for footwear.*

EN ISO 7500-1, *Metallic materials – Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines – Verification and calibration of the force-measuring system (ISO 7500-1:1999).*

EN 13400, *Footwear - Sampling location, preparation and duration of conditioning of samples and test pieces.*

prEN 12987, *Leather - Chemical, physical and mechanical and fastness tests – Sampling.*

**3 Terms and definitions**

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

**3.1**

**breaking strength**

maximum tensile stress recorded in extending a test piece to breaking point

**3.2**

**tensile elongation**

tensile strain in the test length at breaking

**3.3**

**upper**

materials forming the outer face of the footwear which is attached to the sole assembly and covers the upper dorsal surface of the foot. In the case of boots this also includes the outer face of the material covering the leg. Only the materials that are visible are included, no account should be taken of underlying materials

**3.4**

**complete upper assembly**

finished upper, fully seamed, joined or laminated as appropriate, comprising the centre material and any lining(s) together with all components such as interlinings, adhesives, membranes, foams or reinforcements, but excluding toe puffs and stiffeners

NOTE The complete upper assembly may be flat, 2-dimensional or comprise lasted upper in the final footwear.

**3.5**

**thick leather**

leather with a thickness greater than 2 mm

## 4 Apparatus and material

The following apparatus and material shall be used:

**4.1** Tensile testing machine with a jaw separation rate of 100 mm /min  $\pm$  5 mm/min, a force range appropriate to the specimen under test [this will usually be less than 1 kN for textile and coated textile upper materials but may be as high as 5 kN for thick leathers (see 3.5)], capable of measuring the force to an accuracy of better than 2 % as specified by class 2 in EN ISO 7500-1.

**4.2** Press knife or other means of cutting rectangular test specimens of length 160 mm  $\pm$  10 mm and width as

- Materials which can be frayed: 35 mm  $\pm$  2 mm
- Materials which cannot be frayed: 25 mm  $\pm$  0,5 mm

**4.3** Device for measuring distances up to 100 mm to an accuracy of 0,5 mm. A steel rule or vernier callipers is suitable.

## 5 Sampling and conditioning

**5.1** For test specimens cut from footwear uppers avoid any areas containing seams or perforations.

**NOTE** It may not be possible to cut a test specimen of sufficient size from certain types of footwear, especially children, and the test specimen size should not be reduced. If it is not possible to cut the correct size test specimen from a shoe upper, the materials themselves must be tested. Prepare test pieces from complete upper assemblies when the lining material is permanently attached to the upper material.

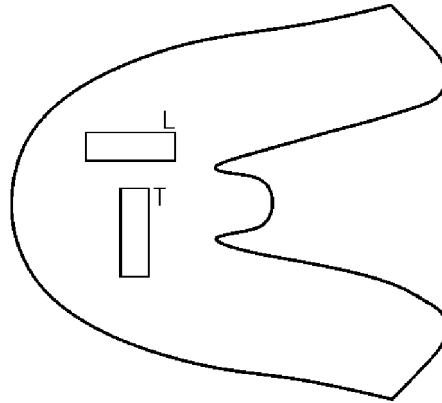
**5.2** For materials which can be frayed (for example textiles):

**5.2.1** Cut six rectangular test specimens of length 160 mm  $\pm$  10 mm and width 35 mm  $\pm$  2 mm, three with their longer edges parallel to the along direction of the material (machine direction for sheet materials), or X axis of the upper as defined in EN 13400, and three with their longer edges perpendicular to this.

**5.2.2** Remove approximately the same number of threads from both of the longer edges of each test specimen until the width of the specimen is reduced to 25,0 mm  $\pm$  0,5 mm.

**5.3** For materials which cannot be frayed, cut six rectangular test specimens of length 160 mm  $\pm$  10 mm and width 25 mm  $\pm$  0,5 mm, three with their longer edges parallel to the along direction, or X axis of the upper as defined in EN 13400, and three with their longer edges perpendicular to this.

For leather use prEN 12987 to select the sampling position from the butt region of the skin or side and the along direction shall be taken as the backbone direction (see Figure 1).



**Key**

- L Longitudinal (Along direction)
- T Transversal (Across direction)

**Figure 1 – Along and across directions**

**5.4** On each test specimen mark two lines which are a similar distance from the centre of the test specimen, at 90° to the longer edges of the test specimen, 100 mm ± 1 mm apart. Also mark the along direction on each test specimen.

**5.5** Measure and record the width of each test specimen to the nearest 0,5 mm.

**5.6** Store the cut test specimens in a standard controlled environment as specified in EN 12222 for at least 48 h before testing and carry out the test in this environment.

## **6 Test method**

### **6.1 Principle**

A rectangular test specimen is gradually stretched, by a tensile testing machine, until it fails. The breaking strength and the tensile elongation are both determined.

### **6.2 Procedure**

**6.2.1** Adjust the tensile testing machine (4.1) so that the jaws are 100 mm ± 1 mm apart.

**6.2.2** Insert one end of a test specimen in each of the jaws of the tensile testing machine and clamp it<sup>1</sup>, so that the lines (see 5.4) are aligned with the clamping edges of the jaws, the test specimen is neither taut nor slack, a similar area of the test specimen is clamped in each jaw.

**6.2.3** Operate the tensile testing machine so that the jaws separate at a speed of 100 mm/min ± 5 mm/min.

**6.2.4** Stop the machine when the test specimen fails and examine the type of failure and the alignment of the lines (see 5.4) with the clamping edges of the jaws. If any test specimen slips asymmetrically in the jaws by more than 2 mm or fails within 5 mm of either jaw, then reject the results and repeat the test with fresh specimens. If, however, three test specimens cut in the same direction fail within 5 mm of either jaw, then do not reject the results

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<sup>1</sup> To minimise the chances of the test specimen slipping in the jaws, or failing at the clamping edge, during testing it is important that the clamping force and type of jaw used are suitable for the specimen under test.

but instead report the fact and quote the strength of the material as being better than or equal to the mean breaking strength calculated in 7.2.

**6.2.5** Record from the graph of force versus extension:

- a) Breaking force  $F$ , in newtons, to the nearest 2 N.
- b) Elongation at break  $E$ , in millimetres, to the nearest 1 mm.

**6.2.6** Repeat the procedure in 6.2.1 to 6.2.5 for the other test specimens.

## 7 Expression of results

**7.1** For each test specimen calculate the breaking strength, in N/mm, using the formula:

$$\text{Breaking strength} = \frac{F}{W}$$

where:

$F$  is the breaking force, in N, recorded in 6.2.5;

$W$  is the width of the test specimen, in mm.

**7.2** Calculate the arithmetic mean of the three breaking strength values (see 7.1) in each test direction.

**7.3** For each test specimen calculate the percentage tensile elongation, using the formula:

$$\text{Tensile elongation} = \frac{E \cdot 100}{GL} \%$$

where:

$E$  is the elongation at break, in mm, recorded in 6.2.5;

$GL$  is the initial jaw separation of the tensile testing machine, in mm (see 6.2.1)

**7.4** Calculate the arithmetic mean of the three tensile elongation values (see 7.3) in each test direction.

## 8 Test report

The test report shall include the following information:

- a) the mean breaking strength for each principal direction as determined in 7.2;
- b) the tensile elongation for each principal direction as determined in 7.4;
- c) if testing finished footwear or uppers, a description of the style of shoe tested including commercial style codes;
- d) a description of the material, including commercial reference if known;



- e) a description of any lining or other reinforcement present;
- f) reference to the method of test;
- g) date of testing;
- h) any deviations from this standard test method.

## Annex ZZ (normative)

### List of corresponding International and European Standards for which equivalents are not given in the text

EN 12222:1997	ISO 18454:2001, <i>Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear</i>
prEN 12987	ISO 2418, <i>Leather — Chemical, physical and mechanical and fastness tests — Sampling location</i>
EN 13400:2001	ISO 17709:— <sup>1)</sup> , <i>Footwear — Sampling location, preparation and duration of conditioning of samples and test pieces</i>

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<sup>1)</sup> To be published.

(Continued from second cover)

- Part 21 Strength of slide fastener pullers
- Part 22 Attachment strength of end stops
- Part 23 Resistance to repeated opening and closing
- Part 24 Lateral Strength for slide fasteners
- Part 25 Slip resistance
- Part 27 Flex resistance of outsoles
- Part 28 Top piece retention strength heels and top pieces

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions and terminologies are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and
- b) Comma (,) has been used as a decimal marker in the International Standard, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
EN ISO 7500-1 : 2018 Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system	IS 1828 (Part 1) : 2022/ISO 7500-1 : 2018 Metallic materials — Calibration and verification of static uniaxial testing machines: Part 1 Tension/Compression testing machines — Calibration and verification of the force-measuring system ( <i>fifth revision</i> )	Identical

The Committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard.

<i>International Standard</i>	<i>Title</i>
EN 12222	Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear
EN 13400	Footwear — Sampling location, preparation and duration of conditioning of samples and test pieces
prEN 12987	Leather — Chemical, physical and mechanical and fastness tests — Sampling

In this adopted standard, reference appears to certain International Standards where the standard atmospheric conditions to be observed are stipulated which are not applicable to tropical/subtropical countries. The applicable standard atmospheric conditions for Indian conditions are (27 ± 2) °C and (65 ± 5) percent, relative humidity and shall be observed while using this standard.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

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### Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website- [www.bis.gov.in](http://www.bis.gov.in) or [www.standardsbis.in](http://www.standardsbis.in).

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