INTERNATIONAL STANDARD

ISO 17697

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Footwear — Test methods for uppers, lining and insocks — Seam strength

Chaussures — Méthodes d'essai relatives aux tiges, doublures et premières de propreté — Résistance des piqûres

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17697 was prepared by CEN (as EN 13572:2001) and was adopted, under a special “fast-track procedure”, by Technical Committee ISO/TC 216, *Footwear*, in parallel with its approval by the ISO member bodies.

For the purposes of international standardization, a list of corresponding International and European Standards for which equivalents are not given in EN 13572 has been added as Annex ZZ.

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 309 "Footwear", the secretariat of which is held by AENOR.

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of an identical text or by endorsement, at the latest by May 2002, and conflicting national standards shall be withdrawn at the latest by May 2002.

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

EN 13572:2001 (E)

1 Scope

This European Standard specifies two test methods for determining the seam strength of uppers, lining or insocks, irrespective of the material, in order to assess the suitability for the end use.

These methods are :

Method A : Needle perforations. For determining the force required to pull a row of needles through an upper material, in a direction perpendicular to the row.

Method B : Stitched seams. For determining the breaking strength of stitched seams in shoe upper and lining materials. This method is applicable to seams cut from shoes or made up to simulate footwear constructions.

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

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).*

3 Terms and definitions

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

3.1
seam strength
breaking strength of a stitched seam as determined under specified conditions using a tensile testing machine

3.2
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 made of underlying materials

3.3
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 can be flat, 2-dimensional or comprise lasted upper in the final footwear.

4 Apparatus and material

The following apparatus and material shall be used:

4.1 Method A

4.1.1 Tensile testing machine with a jaw separation rate of 100 mm/min ± 10 mm/min, a force range appropriate to the specimen under test (this will usually be less than 500 N for footwear upper materials), capable of measuring forces to an accuracy greater than 2 % as specified by Class 2 in EN ISO 7500-1.

4.1.2 Needle holding jig, see Figure 1, including the following:

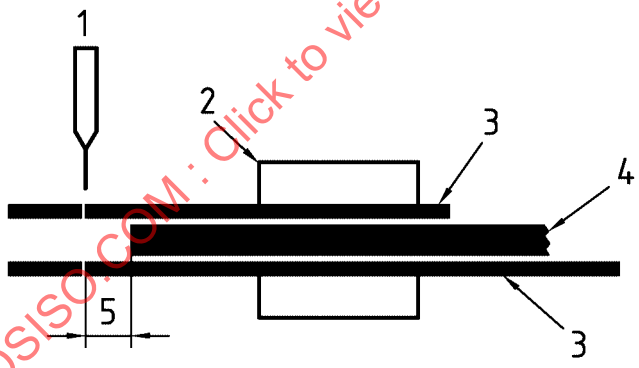
4.1.2.1 Two rectangular rigid plates each of minimum width 30 mm and maximum thickness 6 mm. Each of the two plates is drilled with seventeen holes of diameter 1,1 mm ± 0,1 mm. The holes shall be in a straight line parallel to and approximately 5 mm from one end of the plate. The holes should be evenly spaced so that the centres of the two extreme holes are 26,5 mm ± 0,5 mm apart.

4.1.2.2 One spacing plate of width similar to the drilled plates and of thickness 3,5 m ± 0,5 mm.

4.1.2.3 Means of securing the spacing plate to the surface of one of the drilled plates such that the distance between the end of the spacing plate and the centre line of the row of holes in the other plate can be adjusted and set at 3,0 mm ± 0,1 mm and 6,0 mm ± 0,2 mm. The combination will be referred to as the lower plate.

4.1.2.4 Means of securing the other drilled plate, which will be referred to as the upper plate, to the exposed surface of the spacing plate so that the holes in both of the drilled plates are aligned.

The end of one of the plates furthest from the row of holes should have means of attachment to one of the jaws of the tensile testing machine so that the rows of holes are perpendicular to the axis of the machine.

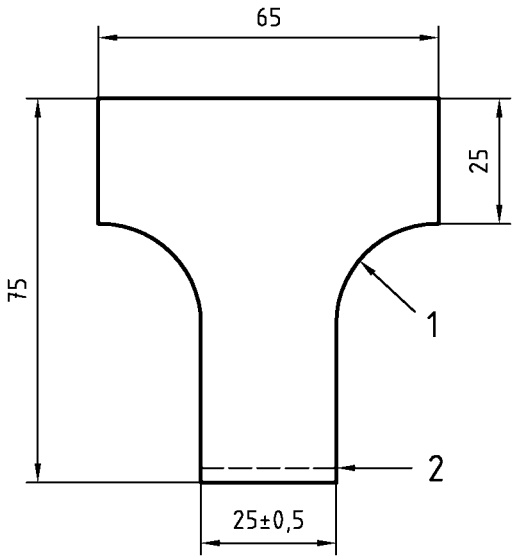


Key

1 Needle
2 Clamp
3 Drilled plate
4 Spacing plate
5 Distance (see 4.1.2.3)

Figure 1 — Schematic diagram of needle holding jig

Dimensions in millimetres



Key

1 20 (radius)
2 Line of perforations

Figure 2 — Test specimen

4.1.3 **Seventeen needles**, round point, 16 x 1, metric size 90.

4.1.4 **Press knife** or other cutting device capable of cutting a T shaped test specimen of the dimensions shown in Figure 2.

4.2 Method B

4.2.1 **Tensile testing machine** with, a jaw separation rate of 100 mm/min ± 10 mm/min, a force range appropriate to the specimen under test (this will usually be up to 2 kN), capable of measuring forces to an accuracy greater than 2 % as specified by class 2 in EN ISO 7500-1.

4.2.2 **Small sharp hand knife or scissors** for cutting test specimens.

4.2.3 If made up seams are to be tested, **a press knife** capable of cutting test specimens, (50 mm ± 2 mm) x (50 mm ± 2 mm), is useful.

4.2.4 If made up seams are to be tested, **a sewing machine and accessories**.

5 Sampling and conditioning

5.1 Method A

5.1.1 Store the shoes or the uncut sheet material or uppers in a controlled standard atmosphere specified in EN 12222 for a minimum of 24 h prior to testing and carry out the test in this atmosphere.

5.1.2 Cut six test specimens with the dimensions specified in Figure 2. Three shall be cut with the base edge of the T parallel to the along direction of the material (backbone direction for leather and selvage (warp) or machine direction for non-leather materials), and three shall be cut perpendicular to this.

Prepare test pieces from complete upper assemblies when the lining material is permanently attached to the upper material.

For materials cut test specimens from a range of positions across the full usable width and length of the sheet material. For a material with a woven structure this will ensure that no two test specimens contain the same warp or weft threads.

For test specimens cut from footwear uppers avoid any areas containing perforations, cut three test specimens with the base edge of the T parallel to the *X* axis of the upper as defined in EN 13400 and three with the base edge perpendicular to the *X* axis.

It can be impossible to cut a test specimen of sufficient size from certain types of footwear especially children's and the test specimen size shall not be reduced. If it is not possible to cut the correct size test specimen from a shoe upper the materials themselves shall be tested.

5.1.3 Mark the along direction on each of the test specimens.

5.2 Method B

5.2.1 Store the shoes or the uncut sheet material or uppers in a controlled standard atmosphere specified in EN 12222 for a minimum of 48 h prior to testing and carry out the test in this atmosphere.

5.2.2 Test specimens cut from shoes or uppers:

5.2.2.1 Where possible use the knife (see 4.2.2) to cut two rectangular test specimens of dimensions (90 ± 10) mm x (50 ± 2) mm from the upper, including any lining materials, such that the seam is approximately mid-way between the two ends of the test specimen, see Figure 3.

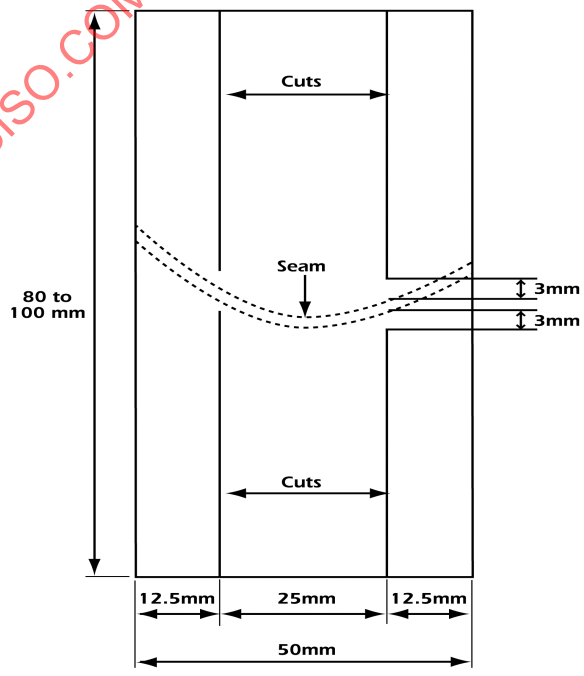


Figure 3 — Test specimen cut from shoe

5.2.2.2 If the shoe upper is too small to allow this, then the size of test specimen may be reduced but the width of the central portion, see 5.2.2.3 and Figure 3, shall not be less than 10 mm.

5.2.2.3 Make cuts in each test specimen parallel to the longer edges from points 3 mm from the seam to the edges of the material, to provide a test specimen having a central portion of width 25 mm ± 0,5 mm and two edge pieces of width 12,5 mm ± 0,5 mm, see Figure 3.

5.2.3 Test specimens prepared by making up seams:

5.2.3.1 Use either the hand knife or scissors (see 4.2.2) or press knife (see 4.2.3) to cut pieces, (50 mm ± 2 mm) x (50 mm ± 2 mm), of each material to be used in the construction. The number of pieces of material required will vary according to the construction of the seam. This may consist of two pieces of the same or different upper materials stitched together and may include one or more lining materials. Reinforcing tapes may also be included. Cut sufficient pieces to allow the preparation of three seamed test specimens for each direction of test. If required materials may be skived before seaming.

The test direction, along or across, is at 90° to the direction of the seam. The number of directions of test will vary according to the upper construction. Separate tests in the along and across directions can be sufficient but in some cases test specimens can need to be prepared with along and across directions combined or with material cut on the bias.

For non-leather materials cut test specimens from a range of positions across the full usable width and length of the sheet material. For a material with a woven structure this shall prevent any two test specimens containing the same warp or weft threads.

5.2.3.2 Use the sewing machine (see 4.2.4) to stitch together the squares of material to produce three test seams for each direction of test. The choice of type of seam, needle size and type, thread and stitch density shall be selected to simulate the shoe construction of interest. Where these are not known guidance can be obtained from Table 1. Set the sewing machine thread tension such that the stitch lock is in the desired position.

Table 1 — Guidance on seam constructions

		Uppers			Linings
		Leather	Coated fabric	Textiles	
Needle	size metric (UK)	100 (16)	100 (16)	100 (16)	100 (16)
	type	narrow wedge or other cutting point	round point, round triangular tipped or extra narrow wedge	round point, round triangular tipped or extra narrow wedge	as for upper
Thread	type	polyamide, polyester or core spun	polyamide, polyester or core spun	polyamide, polyester or core spun	polyamide, polyester or core spun
	ticket nº.	36 or 40	36 or 40	36 or 40	36 or 40
	TEX	85 or 75	--	--	--
Stitches per 25 mm		14 to 16	14 to 16	14 to 16	14 to 16
Seam	type	lapped or closed	lapped or closed	lapped or closed	--
	allowance	2 mm	3 mm	3 mm	as for upper
Underlay allowance		9 mm	9 mm	9 mm	--

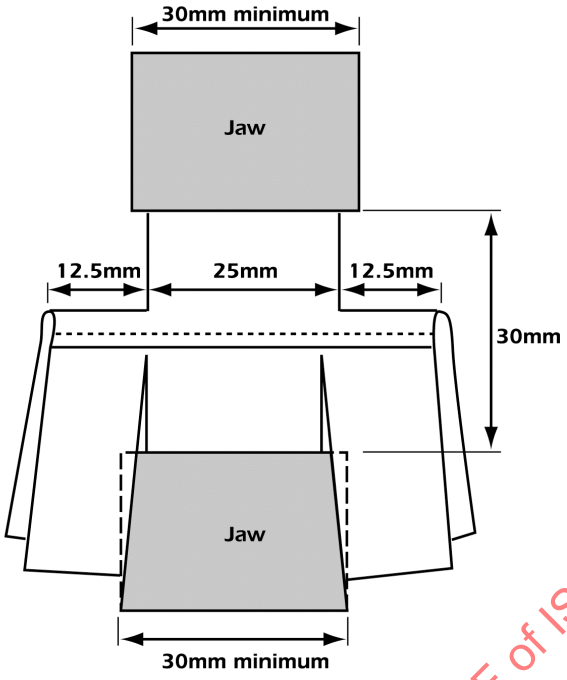


Figure 4 — Clamped test specimen

5.2.3.3 Make cuts in each test specimen perpendicular to the seam from points 3 mm from the seam to the edges of the material, to provide a test specimen having a central portion of width 25 mm ± 0,5 mm and two edge pieces of width 12,5 mm ± 0,5 mm, see Figure 4.

6 Test method

6.1 Method A

6.1.1 Principle

A straight row of needles is pushed through the full thickness of a T-shaped test specimen so that it is parallel to and a fixed distance from the base of the T. A tensile force is then applied perpendicular to the row of needles to pull the test specimen free. The maximum force recorded is divided by the width of the test specimen to give the strength perpendicular to the needle perforations.

6.1.2 Procedure

6.1.2.1 Adjust the needle jig (see 4.1.2) so that the distance between the end of the spacing plate and the centre line of the rows of holes in the other two plates is:

Elastics and loose fabrics 6,0 mm ± 0,2 mm

All other materials 3,0 mm ± 0,1 mm

6.1.2.2 Place one of the needles (see 4.1.3) into each of the seventeen holes in the upper plate (see 4.1.2.1) so that none of the needle points are protruding beyond the inner side of this plate, and the thread groove of each needle faces towards the spacing plate.

6.1.2.3 Place one of the test specimens in the needle jig so that the base of the T abuts against the end of the spacing plate and the central hole of the rows in the plates (see 4.1.2.1) is in line with the centre of the width of the test specimen.

6.1.2.4 Push each of the seventeen needles through the full thickness of the test specimen and the hole in the other plate until the shoulder of the needle prevents further movement. Take care to ensure that the position of the test specimen relative to the needle jig remains unchanged as the needles are inserted.

6.1.2.5 Clamp the needle jig centrally in one jaw of the tensile testing machine so that the row of needles are perpendicular to the axis of the machine. Clamp at least 20 mm of the free length of the test specimen in the centre of the other jaw.

6.1.2.6 Zero the force measuring system of the tensile testing machine and operate it so that the jaws separate at a speed of 100 mm/min ± 10 mm/min.

6.1.2.7 Record the maximum force exerted on the jaws during the test in newtons, to the nearest 1 N, and the type of failure of the test specimen as:

a) tearing along the line of needle perforations;

b) pulling off of yarns running parallel to the row of needles;

c) tearing of each needle through the material;

d) failure away from the needle perforations.

Occasionally a test specimen can fail in more than one way, in which case record all the types of failure together with an indication of their relative amounts.

6.1.2.8 Repeat the procedure in 6.1.2.3 to 6.1.2.7 for the remaining five test specimens.

6.2 Method B

6.2.1 Principle

A test specimen containing a stitched seam is gradually stretched by a tensile machine in a direction perpendicular to the seam until failure occurs. The breaking strength and type of breakdown are determined.

6.2.2 Procedure

6.2.2.1 Measure the width of the central portion of the test specimens in mm to the nearest 0,5 mm, and record this value as *W*.

6.2.2.2 Adjust the tensile testing machine (see 4.2.1) so that the jaws are approximately 30 mm apart.

a) For test specimens cut from uppers which have a lining which is not attached to the reverse side, peel the lining away from the outer to allow the outer to be gripped in the jaws of the tensile machine. The lining shall not be peeled away over the seam.

b) For test specimens cut from uppers which have an attached lining grip both upper and lining in the jaws.

6.2.2.3 Clamp, midway between the jaws, the central portion of a test specimen between the jaws such that the seam is 15 mm from each jaw and is parallel to the clamping edges. The 12,5 mm edge strips shall not be clamped. They will hang free, see Figure 4.

6.2.2.4 Operate the tensile testing machine so that the jaws separate at a speed of 100 mm/min ± 10 mm/min.

6.2.2.5 When the test specimen fails, record the force in newtons, to the nearest 1 N, at which failure occurs (breaking force).

6.2.2.6 Note the type(s) of failure as:

a) Material failed at seam

b) Thread pulled out from seam

c) Thread failed

d) Material failed, away from seam.

6.2.2.7 Repeat the procedure in 6.2.2.3 to 6.2.2.5 for the remaining test specimens.

7 Expression of results

7.1 Method A

7.1.1 Calculate the arithmetic means of the maximum forces recorded in 6.1.2.7 for the three test specimens cut in the along direction and the three test specimens cut in the across direction.

7.1.2 For each direction: divide the arithmetic mean maximum force (7.1.1) by the width of the test specimen, 25 mm, to give the strength, in N/mm, perpendicular to the needle perforations.

7.2 Method B

7.2.1 For each test specimen calculate the seam strength, in N/mm to the nearest 1 N/mm, by dividing the breaking force (see 6.2.2.5) by the test specimen width *W* (see 6.2.2.1).

7.2.2 For made up seams, calculate the arithmetic mean of the seam strengths for each direction of test (see 5.2.3.1).

8 Test report

The test report shall include the following information:

8.1 Method A

a) the strength of the material in each direction, as calculated in 7.1.2;

b) the types of failure that occurred, as recorded in 6.1.2.7;

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 material or other reinforcement present;

f) reference to the method of test;

g) date of testing;

h) any deviations from this standard test method.

8.2 Method B

a) for seams cut from shoes, the individual seam strength values, as calculated in 7.2.1;