BRITISH STANDARD

BS 5131 : Section 3.1 : 1991

Methods of test for

Footwear and footwear materials

Part 3. Uppers, textiles and threads

Section 3.1 Strength of upper materials and lining materials at right angles to stitch perforations

NOTE. It is recommended that this Section should be read in conjunction with BS 5131 : Part 0, published separately.

BSI STANDARDS

Foreword

This Section of BS 5131 has been prepared under the direction of the Textiles and Clothing Standards Policy Committee. It supersedes BS 5131 : Section 3.1 : 1976, which is withdrawn.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Method

1 Scope

This Section of BS 5131 describes a method for measuring the strength of an upper or lining material at the stitch line when made up into a normal seam. The method is applicable to all upper and lining materials less than 3.0 mm thick.

2 Principle

A row of needles parallel to one edge of the material is driven through the material. An increasing force, perpendicular to the row of needles, is applied to the material until the material fails.

3 Apparatus[1)]

3.1 *Conditioning cabinet or room,* maintaining an atmosphere at 20 ± 2 °C and 65 ± 2 % r.h.

3.2 *Round point needles,* (16 × 1, size 14).

3.3 *Needle-holding jig,* an example of a suitable apparatus being shown in figure 3.1/1, with the following characteristics.

(a) Accommodation for a straight row of 17 closely and evenly spaced size 14 needles. For each needle there is a matching hole in each of two metal plates (A and B in figure 3.1/1) which is large enough to accommodate the needles but does not exceed 1.3 mm in diameter. The centres of the end needle holes in both plates are 26.4 ± 0.5 mm apart. The two plates are fastened together during the test by finger-nuts and locating dowels (not shown in figure 3.1/1). The plates do not clamp onto the test specimen when it is in position between them.

(b) A means of attachment to the jaws of the tensile testing apparatus (**3.4**) so that the direction of pull is perpendicular to the row of needles.

(c) A means of adjusting and setting a parallel margin between the edge of the test specimen and the line of needle perforations (e.g. plate C in figure 3.1/1).

NOTE. Plate C can also act as a spacer between plates A and B.

3.4 *Tensile testing machine,* with a rate of traverse of 100 ± 20 mm/min and a range of 0 N to 450 N (0 kgf to 45 kgf).

4 Conditioning

Place the material to be tested in the conditioning cabinet or room (**3.1**). After 48 h, cut the test specimens (see clause **5**). Carry out the test in this atmosphere.

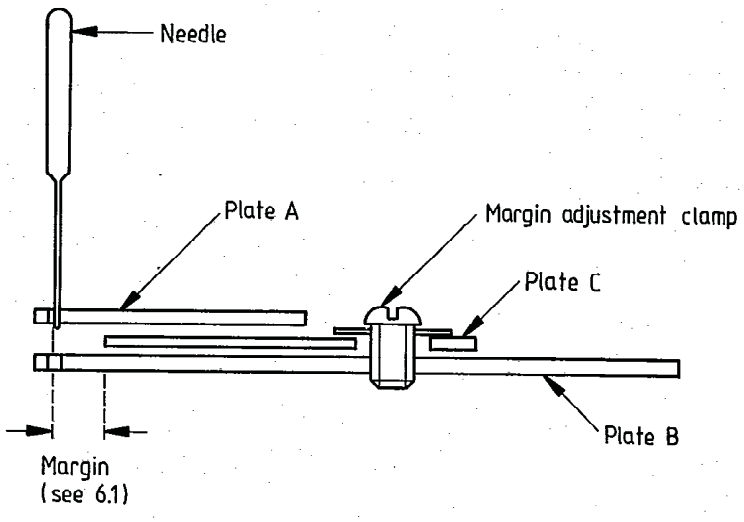


Figure 3.1/1. Diagrammatic cross section of a suitable needle-holding jig

[1)] For information on the availability of suitable apparatus to perform this test, apply to Enquiry Section, BSI, Linford Wood, Milton Keynes MK14 6LE quoting the number of this standard and the clause number referring to the items concerned. Enclose a stamped addressed envelope for reply.

5 Preparation of test specimens

5.1 Where the material is either leather or a manufactured material other than a woven fabric, cut at least three test specimens as shown in figure 3.1/2, corresponding to each of the two principal directions of the material, as follows:

(a) so that the line of needle perforations will be parallel to the machine direction in the case of manufactured materials and the backbone direction in the case of leather;

(b) so that the line of needle perforations will be parallel to the cross direction for manufactured materials and the cross backbone direction in the case of leather.

5.2 Where the material is a woven fabric, cut at least three test specimens as shown in figure 3.1/2, corresponding to each of the two principal directions of the material, as follows:

(a) so that the line of needle perforations will be parallel to the warp;

(b) so that the line of needle perforations will be parallel to the weft.

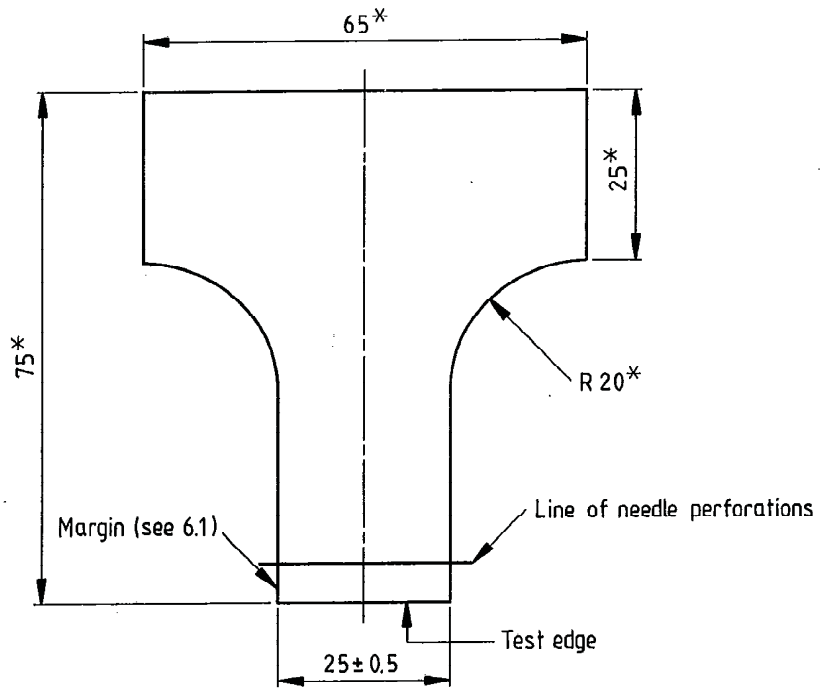
6 Procedure

6.1 Set the margin adjustment of the needle-holding jig (**3.3**) to give the appropriate margin between the perforations and the test edge of the test specimen according to the type of material as given in table 1.

Table 1. Margin dimensions

Material	Margin
	mm
Elastics and open weave fabrics	6.0 ± 0.5
All other upper and lining materials	3.0 ± 0.5

Align a test specimen in the jig so that the test edge (see figure 3.1/2) abuts against the margin stop and the end needle holes coincide with the edges of the test specimen. Push the 17 needles (**3.3**) through the test specimen while retaining this alignment, so that each needle passes through the holes in both metal plates, with its



All dimensions are in millimetres.

NOTE 1. Dimensions marked thus * need only be approximate.

Figure 3.1/2. Dimensions of the test specimen

long groove facing away from the test edge. (The end needles will just catch the edges of the test specimen.)

NOTE. The easiest way of inserting the needles will depend on the material. With plastics-coated fabrics it is easier to insert the needles, one by one, with the fabric aligned in the assembled jig; with other materials, all the needles can be positioned in one plate and the material pierced by all 17 needles simultaneously as the jig is reassembled.

6.2 Clamp the jig centrally in the movable jaws of the tensile testing machine (**3.4**) and clamp the free end of the first test specimen centrally in the other jaws so that the pull is perpendicular to the row of needles. Start the machine traverse at a rate of 100 mm/min and record the force continuously. Note the force at which failure occurs in the test specimen and which of the following types of failure has taken place:

(a) tearing along the line of needle perforations;

(b) pulling off of those yarns which are parallel to the needle perforations and which lie between the needles and the test edge of the test specimen;

(c) tearing by each needle through the material to the test edge;

(d) failure of the material at such a distance from the needle perforations that the failure was not associated with the seam.

NOTE. The failure given in (d) above is not directly relevant to the strength of the seam, and consequently for the purposes of this test it is referred to as an invalid failure. However, there are materials for which it is the only type of failure that occurs.

6.3 Repeat the procedure on the second and third test specimens cut in the same direction with respect to the sheet run of the material. Examine each of the three test specimens and determine which type of failure has occurred (i.e. (a), (b), (c) or (d) of **6.2**). Do not carry out any further tests if either of the following apply.

(a) All three test specimens exhibit the same type of failure (i.e. (a), (b), (c) or (d) of **6.2**).

(b) Two test specimens exhibit the same type of valid failure (i.e. (a), (b) or (c) of **6.2**) and the third test specimen exhibits an invalid failure (i.e. (d) of **6.2**).

Cut two additional test specimens in the same direction as the three specimens already tested with respect to the sheet run of the material and repeat the procedure described in **6.2** on both of these two additional test specimens, if any of the following apply.

(1) Two test specimens exhibit the same type of valid failure and one test specimen exhibits a different type of valid failure.

(2) The three test specimens each exhibit a different type of valid failure.

(3) Either one or two of the test specimens exhibits invalid failure but item (b) above does not apply i.e., two specimens exhibit different types of valid failure.

NOTE. The purpose of this additional testing is to reveal which type of valid failure is most common and to obtain force readings for this type of failure.

6.4 Carry out the procedure described in **6.1, 6.2** and **6.3** on those test specimens which were cut in the other principal direction of sheet run of the material.

7 Calculation and expression of results

Calculate and record the mean force at the time of failure where more than one test specimen exhibits the same type of failure (see **6.2**) for each type of failure observed. Repeat this for each principal direction of the material. Where only one test specimen exhibits a particular type of failure, discard the result.

Where the tensile testing machine is calibrated in newtons, multiply each mean value by 0.04 and express the result, in each case, in newtons per millimetre width of the test specimen. (Where the tensile testing machine is calibrated in kilogram–force, multiply each mean value by 0.4 and express the result, in each case, in kilogram–force per centimetre width of the test specimen.)

8 Test report

The test report shall include the following items :

(a) results, expressed in accordance with clause **7**;

(b) type(s) of failure occurring as defined in **6.2**;

(c) width of margin (3.0 mm or 6.0 mm);

(d) nature and full identification of the material;

(e) reference to this method of test, i.e. BS 5131 : Section 3.1;

(f) date of testing.

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Textiles and Clothing Standards Policy Committee (TCM/-) to Technical Committee TCM/39, upon which the following bodies were represented:

British Footwear Manufacturers' Federation
British Leather Confederation
British Rubber Manufacturers' Association
British Steel plc
Consumer Standards Advisory Committee of BSI
Cork Industry Federation
Footwear Components Federation
Footwear Distributors' Federation
Institute of Trading Standards Administration
Iron and Steel Trades Confederation
Lancashire Footwear Manufacturers' Association
Mail Order Traders' Association of Great Britain
Ministry of Defence
National Union of Footwear, Leather and Allied Trades
Office of Fair Trading
SATRA Footwear Technology Centre

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Adhesives and Sealants Association
British Paper and Board Industry Federation
British Plastics Federation
Multiple Shoe Retailers' Association
RAPRA Technology Ltd.

This British Standard, having been prepared under the direction of the Textiles and Clothing Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on
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