BS 5131 : Section 5.11 : 1981
[Strength of buckle fastening assemblies]
UDC 685.31 : 620.1 : 685.31.2.16 : 620.17

British Standard Methods of test for

Footwear and footwear materials

Part 5. Testing of complete footwear

Section 5.11 Determination of the strength of buckle fastening assemblies

Méthodes d'essai des chaussures et des matériaux entrant dans leur confection
Partie 5. Essai de la chaussure complète
Section 5.11 Méthode pour mesurer la tenue de l'assemblage tige-boucle-bride

Prüfverfahren für Fußbekleidung und Fußbekleidungswerkstoffe
Teil 5. Prüfen der fertigen Fußbekleidung
Abschnitt 5.11 Methode zur Bestimmung der Schnallenbefestigung

NOTE. It is recommended that this Section should be read in conjunction with the information in the General introduction to BS 5131, published separately.

1. Scope

This Section describes a method for determining the strength of buckle fastenings in completed footwear. The test in the form described measures the strength of the weakest link in the functional assembly. It is not suitable for measuring any strength property of the buckle on its own.

2. Definitions

For the purposes of this Section of BS 5131, the following definitions apply.

2.1 buckle fastening assembly. The complete assembly in footwear consisting of a fastening strap passing through a buckle which is attached either to the upper directly, or indirectly via a buckle strap.

2.2 buckle strap. A strap, incorporated in some designs of shoe upper, to which the buckle is attached permanently at or near one end so that the longitudinal axis of the buckle (the direction at right angles to the centre bar of the buckle) is parallel to the length of the strap (see note 1). The attachment of the buckle by stitching (figure 5.11/1b), staples (figure 5.11/6b), a chape (figure 5.11/2b), or by the end of the strap being looped round the buckle bar and then stitched to itself or to the main part of the upper (see figure 5.11/4b and note 2). Usually the other end of the buckle strap is attached to or is integral with the main part of the shoe upper, but occasionally it is lasted under the insole.

NOTE 1. Where the buckle is attached to a strap but its longitudinal axis is not parallel to the length of the strap (e.g. as in many sling-back styles), this is not treated in this Section as a buckle strap.

NOTE 2. This last mentioned is often called a **buckle loop**, but in this Section it is tested in the same way as other forms of buckle strap.

2.3 fastening strap. The strap which is inserted through the buckle by the wearer to do the shoes up, and which normally contains several alternative fastening holes for the buckle prong to allow for variations in the girth of feet at the instep (figure 5.11/1a).

2.4 buckle prong. The prong which is inserted through the hole in the fastening strap (figure 5.11/1b).

2.5 buckle bar. The bar across the middle of the buckle to which the prong is attached in such a way that it can be rotated about this bar (figure 5.11/1b).

2.6 buckle frame. The perimeter of the buckle which gives it its shape and character (figure 5.11/1b).

2.7 roller. A metal tube surrounding that part of the frame on which the prong rests when the buckle is fastened (figure 5.11/2b). (N.B. Not all buckles have a roller.)

2.8 keeper. The side of the buckle frame opposite to the side on which the prong rests and which holds down the end of the fastening strap when the buckle is fastened (figure 5.11/1b).

2.9 chape*. A metal part in some buckles to which the buckle bar is fixed and via which the buckle is riveted to the shoe upper (figure 5.11/2b).

*Sometimes referred to as a 'clasp'.

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3. Principle

The buckle and fastening strap are fastened in the normal way, and a test piece is cut from the shoe such that the fastening strap can be gripped in one jaw of a tensile testing machine and the upper, to which the buckle or buckle strap is attached, in the other jaw. The tensile force is increased gradually until some part of the test piece fails. The force at failure and the type and position of the failure are recorded.

4. Apparatus

The following apparatus is required.

4.1 *Conditioning cabinet or room* capable of maintaining an atmosphere at 20 ± 2 °C and 65 ± 2 % relative humidity.

4.2 *Tensile testing machine* with a range of 0 N to 500 N and a jaw separation rate of 100 ± 20 mm/min. The jaws should be at least 32 mm wide for type A and type C test pieces, as explained in **6.1**, but for type B test pieces one jaw needs to be up to 80 mm wide. It is recommended that the jaws be rubber faced to reduce the risk of breaks at the jaw.

The jaws should have a jointed attachment to the testing machine to allow for any slight misalignment of the test piece on clamping.

5. Conditioning and testing atmosphere

Condition the prepared test pieces for 48 hours in an atmosphere at 20 ± 2 °C and 65 ± 2 % relative humidity. Carry out the test in this standard atmosphere, or alternatively, carry out the test under ambient conditions and report as such.

6. Test pieces

6.1 General. A number of shoe uppers incorporating buckles for fastening are shown in figures 5.11/1a, 5.11/2a, 5.11/3a, 5.11/4a, 5.11/5a, 5.11/6a, 5.11/7, 5.11/8a and 5.11/9 and enlarged views of test pieces (omitting the fastening strap for clarity) are shown in figures 5.11/1b, 5.11/2b, 5.11/3b, 5.11/4b, 5.11/5b and 5.11/6b. They do not cover all the designs which may be encountered but serve to illustrate the principles which need to be followed in preparing test pieces.

Use one of the three types of test pieces listed below, depending on the design of the upper.

Type A. For use where the buckle or buckle strap is attached to a part of the upper which is large enough to be gripped in the jaw of the tensile testing machine as shown in figures 5.11/1b, 5.11/2b, 5.11/4b, 5.11/5b, 5.11/6b and 5.11/7. Also for use where the buckle strap is integral with the shoe upper (figure 5.11/3b).

Type B. For use where the buckle or buckle strap is attached to a main strap which is not large enough to be gripped in the jaw of the tensile testing machine (see note). Strips of leather are sewn to the main strap on each side of the buckle or buckle strap, as shown in figures 5.11/8b and 5.11/8c, and these straps are gripped in the tensile machine jaw.

Type C. For use where the buckle strap is not attached to any other part of the upper.

Wherever possible prepare and test pieces taken from at least two shoes.

NOTE. If the upper design permits, use test piece type A in preference to type B. Type B test pieces will normally be needed where the distance from the rear point of the buckle attachment or buckle strap attachment to the edge of the main strap is less than 25 mm (see figure 5.11/8a).

6.2 Type A test pieces. For shoes with closed-in quarters, mark on the upper the approximate position and direction of the longitudinal axis of the buckle or buckle strap (the direction being at right angles to the buckle bar). Draw two new lines about 25 mm on each side of the axis and parallel to it. Cut through the whole upper (including stiffener and lining) along these lines from the top line to the feather edge (see figures 5.11/1a, 5.11/2a, 5.11/3a, 5.11/4a and 5.11/5a). Then cut through the upper along the feather edge to remove a panel to which the buckle or buckle strap is attached.

For shoes or sandals with a sling-back or similar strap, cut through this strap both at the back of the heel and close to the feather edge (see figures 5.11/6a and 5.11/7).

Flatten the cut off strap or cut out panel (the stiffener may be removed from it if it plays no part in the buckle attachment) and draw the buckle or buckle strap longitudinal axis more accurately. Draw two lines parallel to and 15 mm on either side of the longitudinal axis. These mark the sides of the test piece.

Draw a line across the test piece 15 mm behind the rear point of the attachment of the buckle or buckle strap, i.e. the rear of the buckle staples or thread bar tack (as shown in figures 5.11/1b, 5.11/3b and 5.11/6b), or the rear of the buckle chape attachment (figure 5.11/2b), or the rearmost row of stitching attaching the buckle strap to the upper (figures 5.11/4b and 5.11/5b). If, however, this line passes over the underlay of the buckle strap, draw it immediately behind the end of the underlay. This is the clamping line which is aligned with the front edge of the jaws of the tensile machine during the test.

If this clamping line cannot be drawn on the upper of a sling-back strap because it is too small, or if any part of the clamping line is within 10 mm of that edge of the sling-back strap which is further from the buckle (see figure 5.11/6b) then the standard size type A test piece cannot be cut and the type B test piece is recommended instead. However, if there are difficulties in preparing a type B test piece, it is still permissible to use a type A test piece with the clamping line moved nearer the rear point of the buckle/buckle strap attachment, provided this distance is not less than 5 mm and the jaw does not clamp on a buckle strap underlay. Where this distance is not 15 mm, state its value in the report.

After verifying that a type A test piece can be used, cut along the marked side lines of the test piece.

NOTE 1. It is suggested that the first test piece be tested before the others are cut along the marked side lines, in case their dimensions need to be modified (see clause 7).

NOTE 2. In the case of an integral strap, it is likely that the test piece will not be 30 mm wide at the clamping line, e.g. as in figure 5.11/3b, but this will not prevent a valid test being carried out.

NOTE 3. If no part of the test piece in the clamp is 30 mm wide then the preparation procedure just described produces a type C test piece.

Cut off the fastening strap about 60 mm behind the second fastening hole (see figures 5.11/1a to 5.11/9). Insert the

fastening strap through the buckle and do up with the buckle prong through the second fastening hole.

6.3 Type B test pieces. These will normally only be required for shoe uppers in which the buckle or buckle strap is attached to a narrow main strap such as a sling-back strap (figure 5.11/8a shows an example).

Cut through the sling-back or similar strap both at the back of the heel and close to the feather edge. Flatten the cut off piece of strap and mark on it the longitudinal axis of the buckle or buckle strap. For each test piece, cut two strips of upper leather (side leather 1.5 mm to 2.0 mm thick should be suitable) 80 mm long and 25 mm wide. Sew these to the main strap on each side of the buckle or buckle strap, as shown in figures 5.11/8b and 5.11/8c, so that the distance between the edge of the strips and the attachment of the buckle or buckle strap is 7 mm. Draw a clamping line across both strips which is 15 mm behind the rear point of the buckle or buckle strap attachment to the main strap.

In some shoe designs the buckle strap ends in a loop which can slide along the main strap (figure 5.11/9 shows an example). In these cases, determine where the buckle strap would normally be by trying the shoe on a suitable foot and sew the additional strips on either side of this position.

Cut off the fastening strap and attach it to the buckle, as described in **6.2.**

6.4 Type C test pieces. For the standard size test piece, cut off the buckle strap at least 25 mm behind the rear point of the buckle attachment. Mark a clamping line 15 mm behind this rear point of attachment. Where the buckle strap is not long enough to provide the standard size of test piece, it is permissible to reduce the length of strap cut off, provided the reduced distance from the clamping line to the rear point of the buckle attachment is not less than 5 mm and the distance from the clamping line to the cut off end of the strap is 10 mm.

In some upper designs the buckle strap is lasted under the insole and has a sling-back strap sewn to it. In such cases it is recommended that the clamping line be drawn 15 mm behind this stitching so that this attachment is included in the test.

Cut off the fastening strap and attach it to the buckle, as described in **6.2.**

7. Procedure

Insert the buckle half of the test piece centrally in one jaw of the tensile machine so that the edge of the jaw aligns with the clamping line drawn across the test piece. Check that the jaws do not clamp on any part of a buckle strap underlay. If they do, move the test piece out until the underlay is clear of the jaws. Also check that they grip along the front edge when tightened. If they do not appear to be doing this, insert a packing piece of a suitable thickness in the rear half of the jaws so that they close correctly. Alternatively, if a packing piece is not possible, it is permissible to move the line of clamping nearer to the buckle attachment if this causes the jaws to close correctly, provided the reduced distance is not less than 5 mm (compared with the 15 mm specified), does not cause the jaws to clamp on the underlay, and is recorded in the report.

Insert the fastening strap in the other jaw and clamp so that the jaw is approximately 10 mm from the adjacent edge of the buckle frame.

Separate the jaws at 100 mm/min and observe the force (in newtons) at which failure of some part of the buckle fastening assembly occurs. If tearing occurs from the buckle prong hole along the fastening strap, allow the tear to propagate as far as the first hole and then stop the test.

Remove the test piece and note the type of failure.

If, with the normal 30 mm wide test piece, a type of failure is produced which appears to be caused by the cut sides of the test piece and probably would not have occurred in wear, then where possible, make further tests to establish whether a wider test piece produces a valid type of failure. Such a test piece should however be tapered, away from the buckle region, down to the standard 30 mm width at the clamp. If the wider test piece produces what is judged to be a valid failure, report these test results instead of those for the standard width of test piece.

Test the duplicate test piece in the same way.

8. Test report

Include the following items in the test report:

(a) the type of test piece used;

(b) construction details of the buckle fastening assembly, including details of any attachment of a buckle strap to the rest of the upper and the nature of the upper materials;

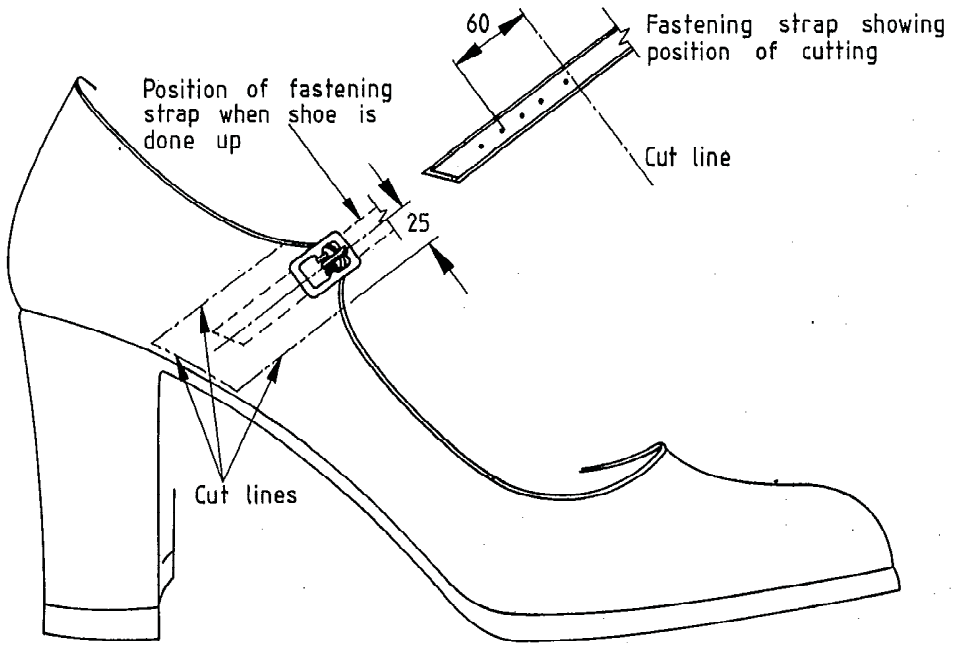
(c) the force (in newtons) at failure for each test piece individually;

(d) details of the corresponding types of failure;

(e) details of any deviations from the prescribed conditions or test procedure (variations of up to 2 mm in the specified dimensions need not be reported);

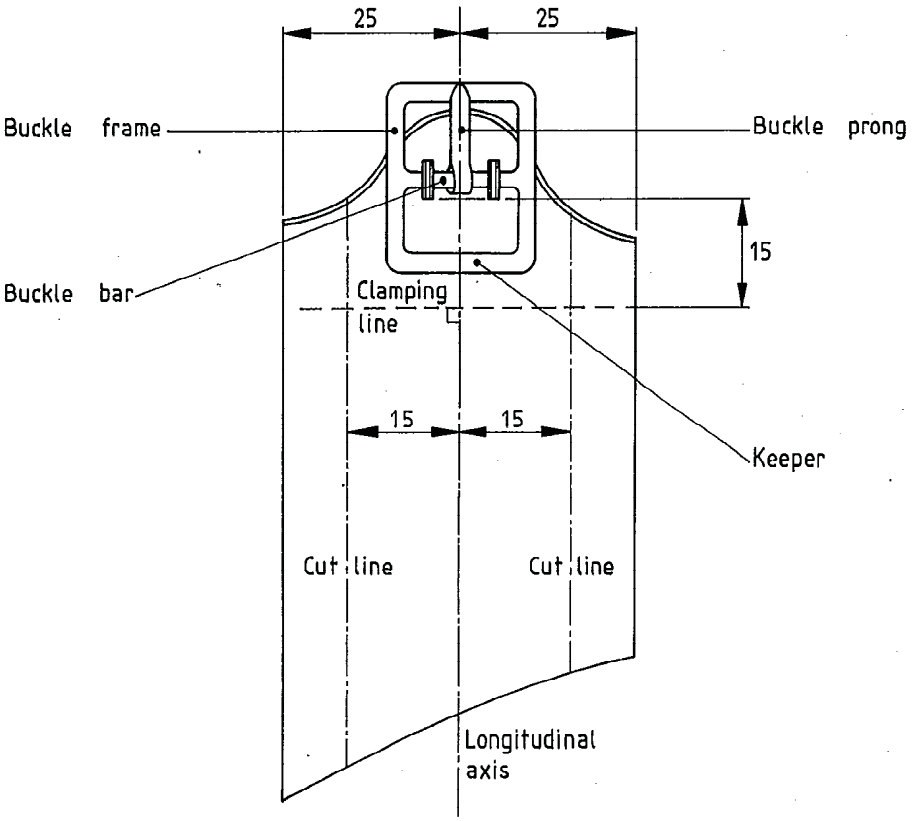
(f) reference to the method of test (i.e. BS 5131 : Section 5.11);

(g) the date of testing.



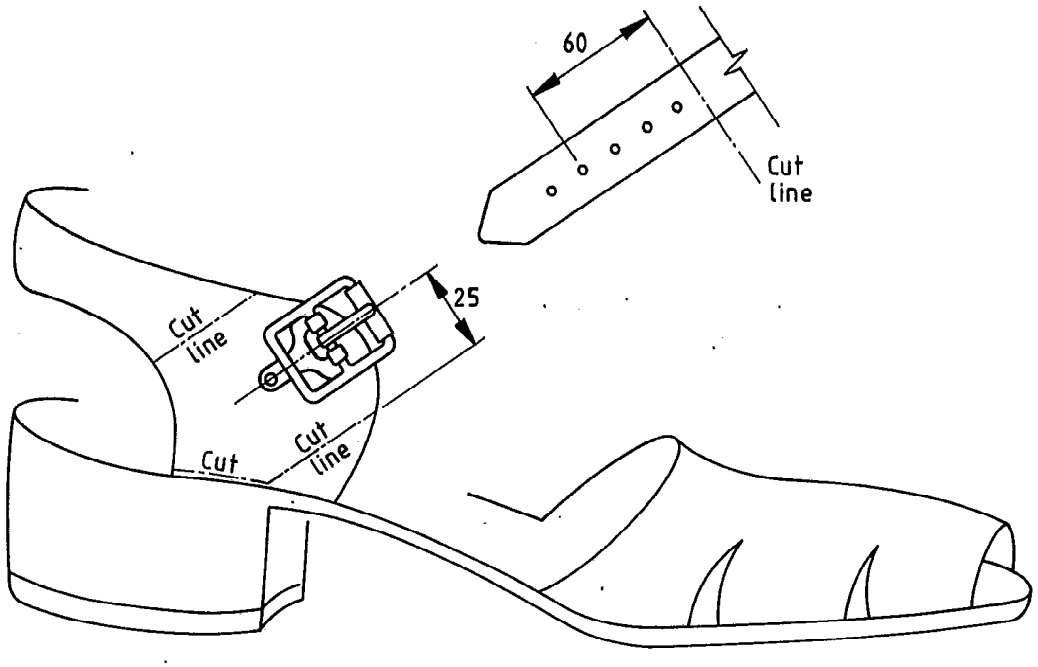
Dimensions are in millimetres.

Figure 5.11/1a. Buckle attached directly to a closed-in quarter
(Upper marked for the cutting of a type A test piece. Position of cutting of fastening strap also shown.)



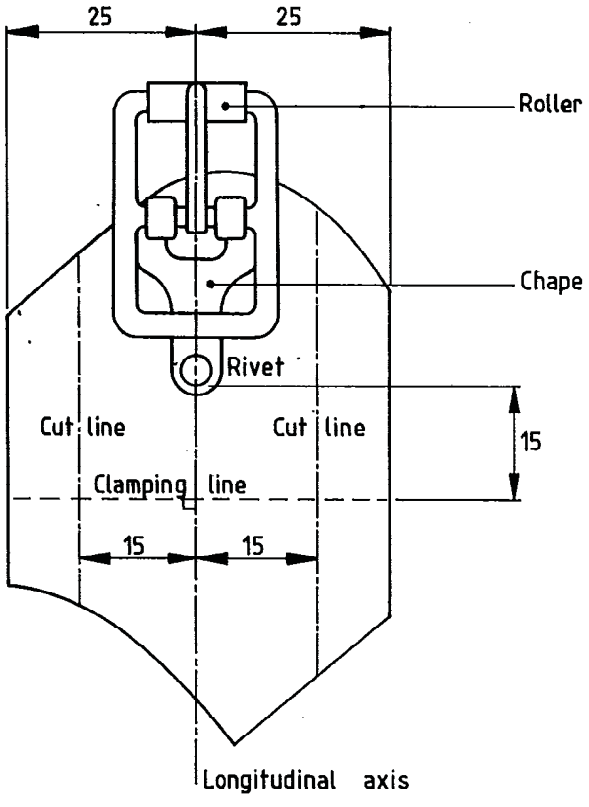
Dimensions are in millimetres.

Figure 5.11/1b. Type A test piece cut from the upper of figure 5.11/1a



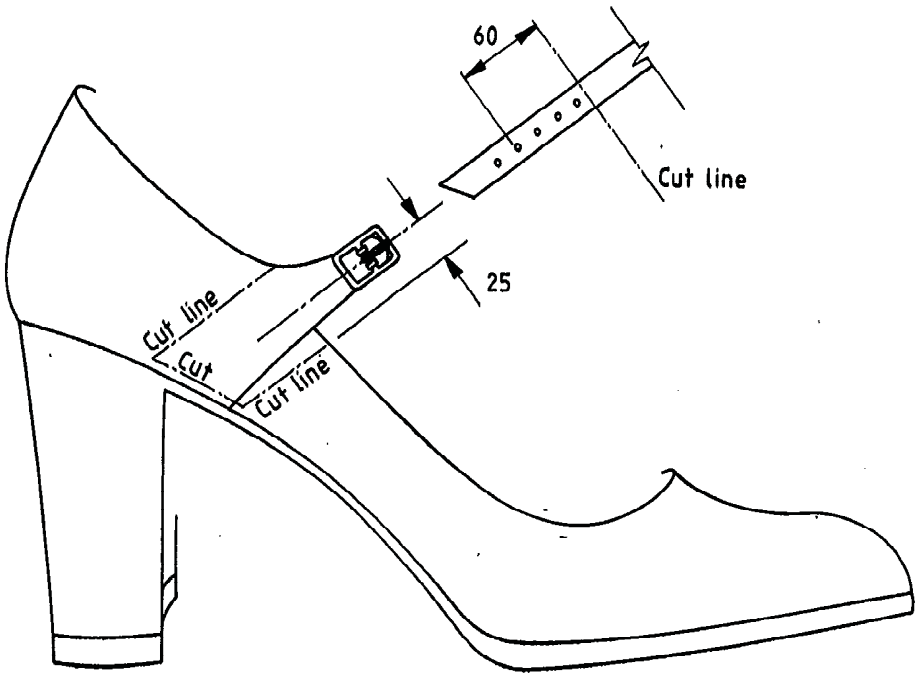
Dimensions are in millimetres.

Figure 5.11/2a. Buckle attached by a chape to a sling-back strap (Strap wide enough to enable a type A test piece to be cut)



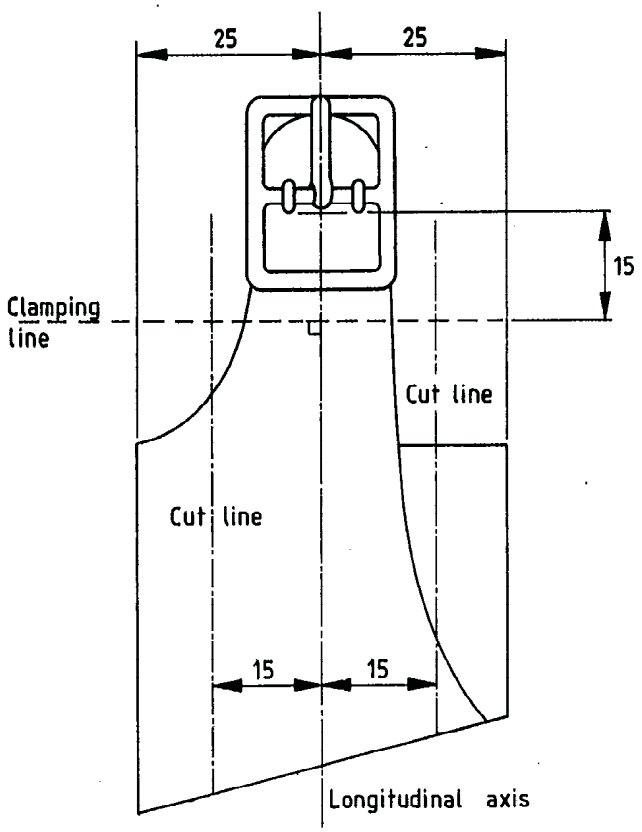
Dimensions are in millimetres.

Figure 5.11/2b. Type A test piece cut from the upper of figure 5.11/2a



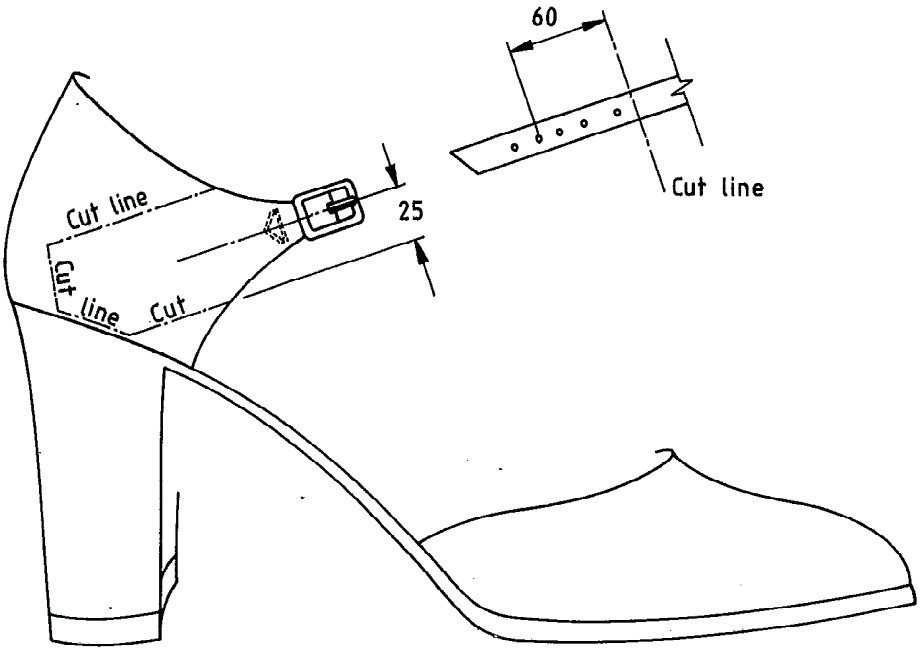
Dimensions are in millimetres.

Figure 5.11/3a. Buckle attached to an integral strap



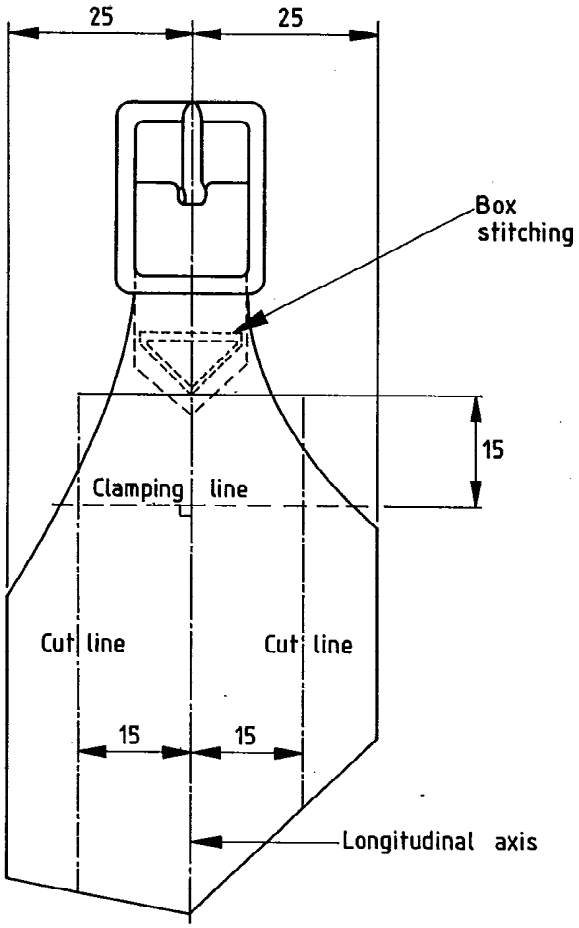
Dimensions are in millimetres.

Figure 5.11/3b. Type A test piece cut from the upper of figure 5.11/3a (Because of the dimensions of this integral strap the test piece is not 30 mm wide at the clamping line.)



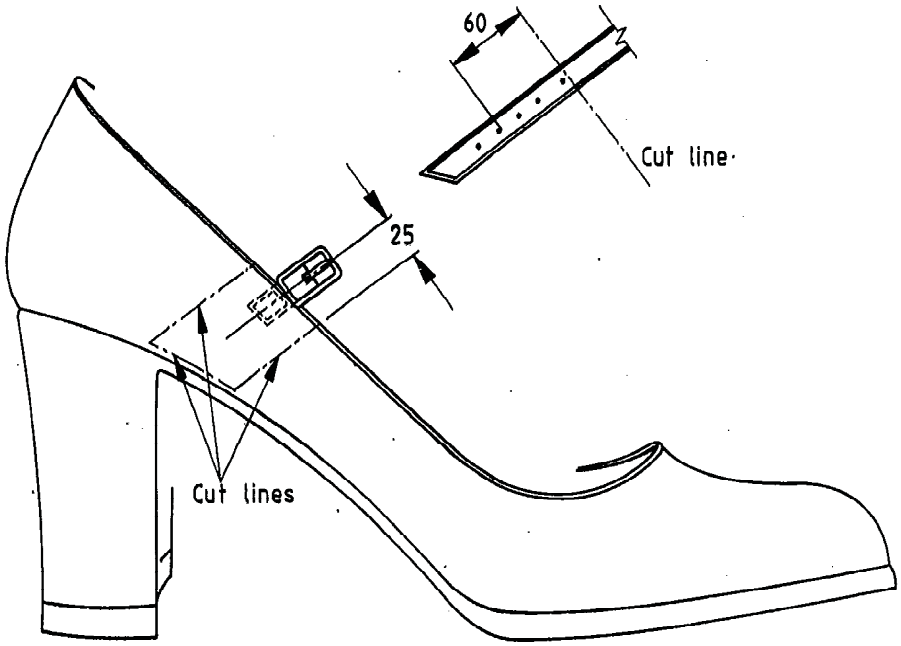
Dimensions are in millimetres.

Figure 5.11/4a. Buckle attached to a closed-in counter by a buckle loop



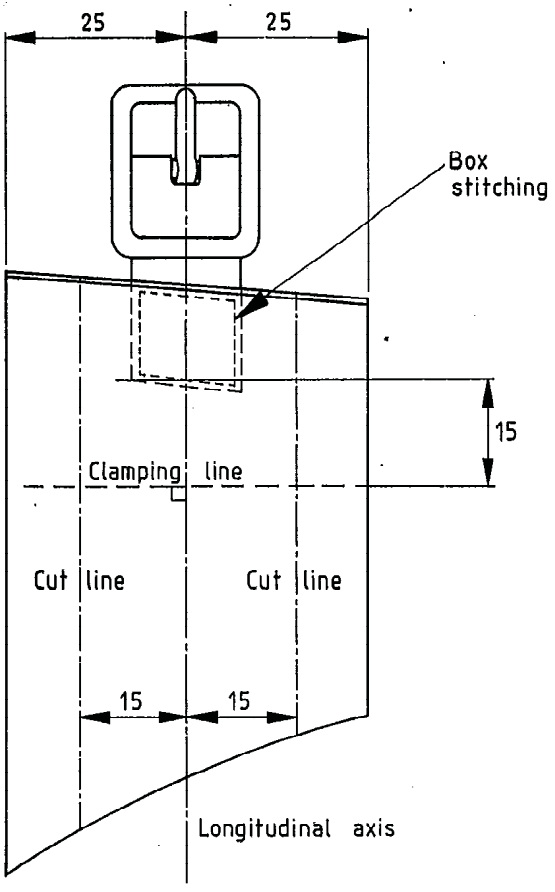
Dimensions are in millimetres.

Figure 5.11/4b. Type A test piece cut from the upper of figure 5.11/4a



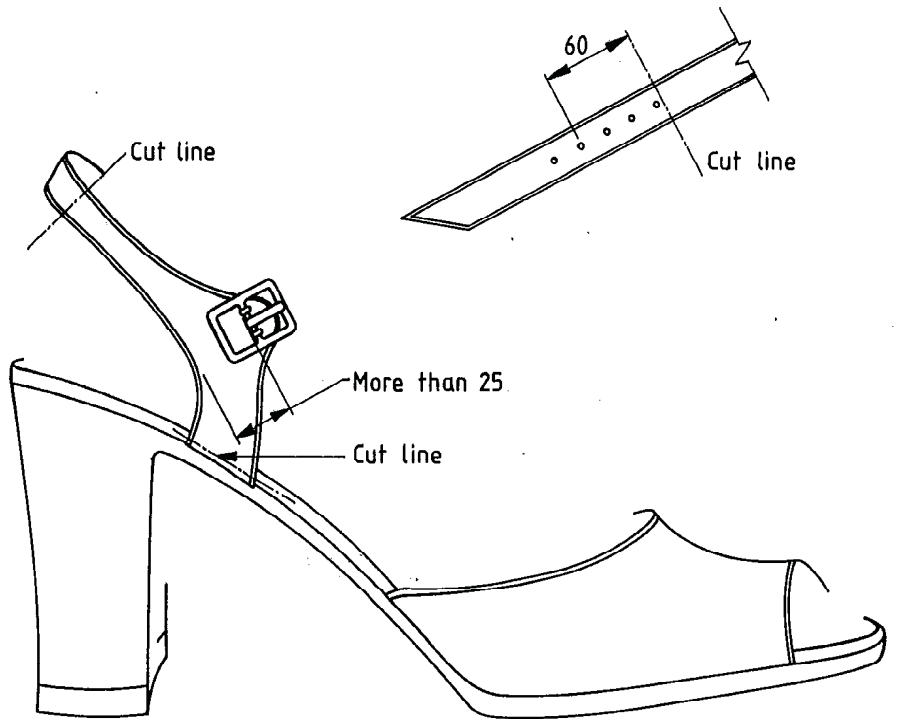
Dimensions are in millimetres.

Figure 5.11/5a. Buckle attached to a closed-in quarter via a separate buckle loop
(Upper marked for the cutting of a type A test piece.)



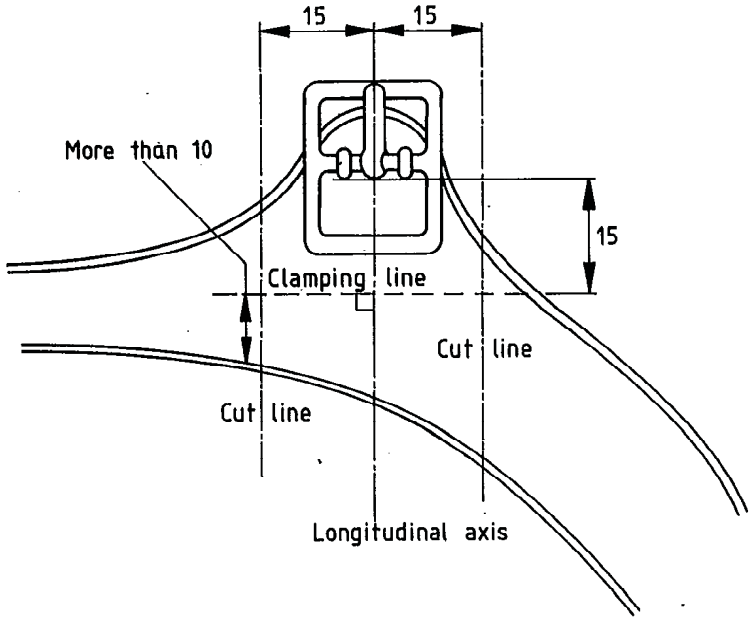
Dimensions are in millimetres.

Figure 5.11/5b. Type A test piece cut from the upper of figure 5.11/5a



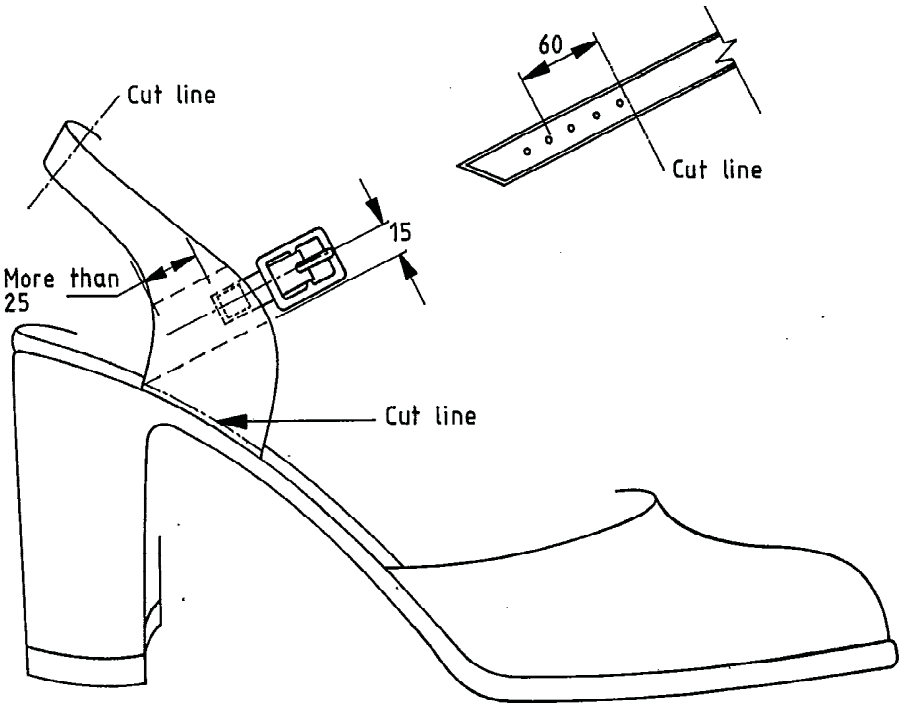
Dimensions are in millimetres.

Figure 5.11/6a. Buckle attached directly to a sling-back strap (Strap wide enough to enable a type A test piece to be cut.)



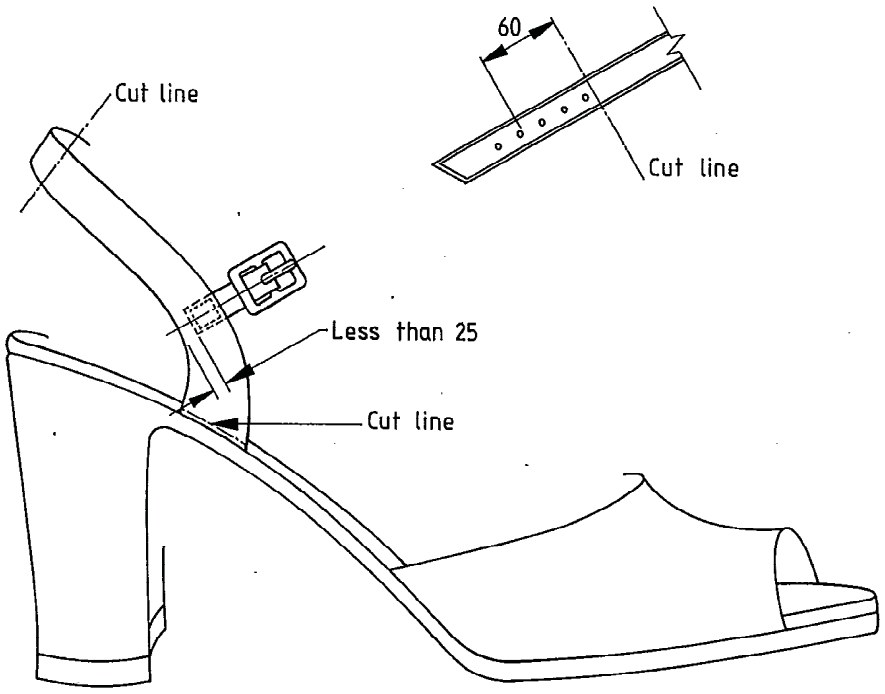
Dimensions are in millimetres.

Figure 5.11/6b. Type A test piece cut from the upper of figure 5.11/6a



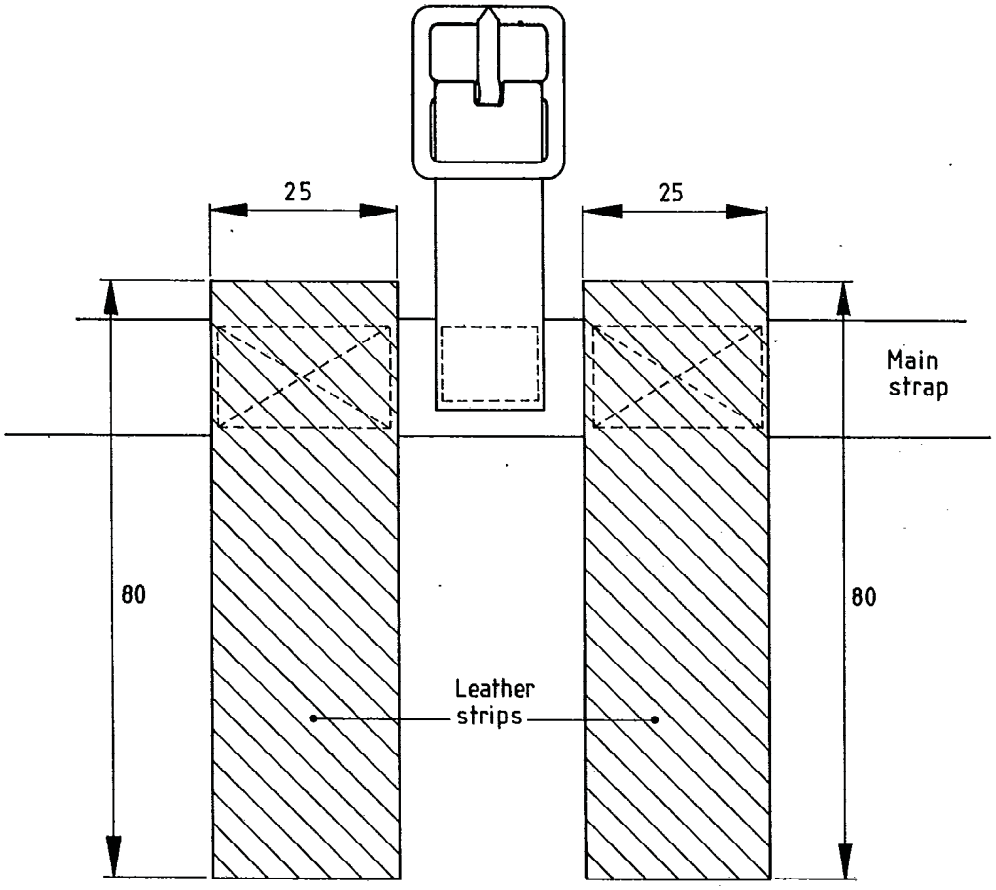
Dimensions are in millimetres.

Figure 5.11/7. Buckle strap attached to a sling-back strap (Strap wide enough to enable a type A test piece to be cut.)



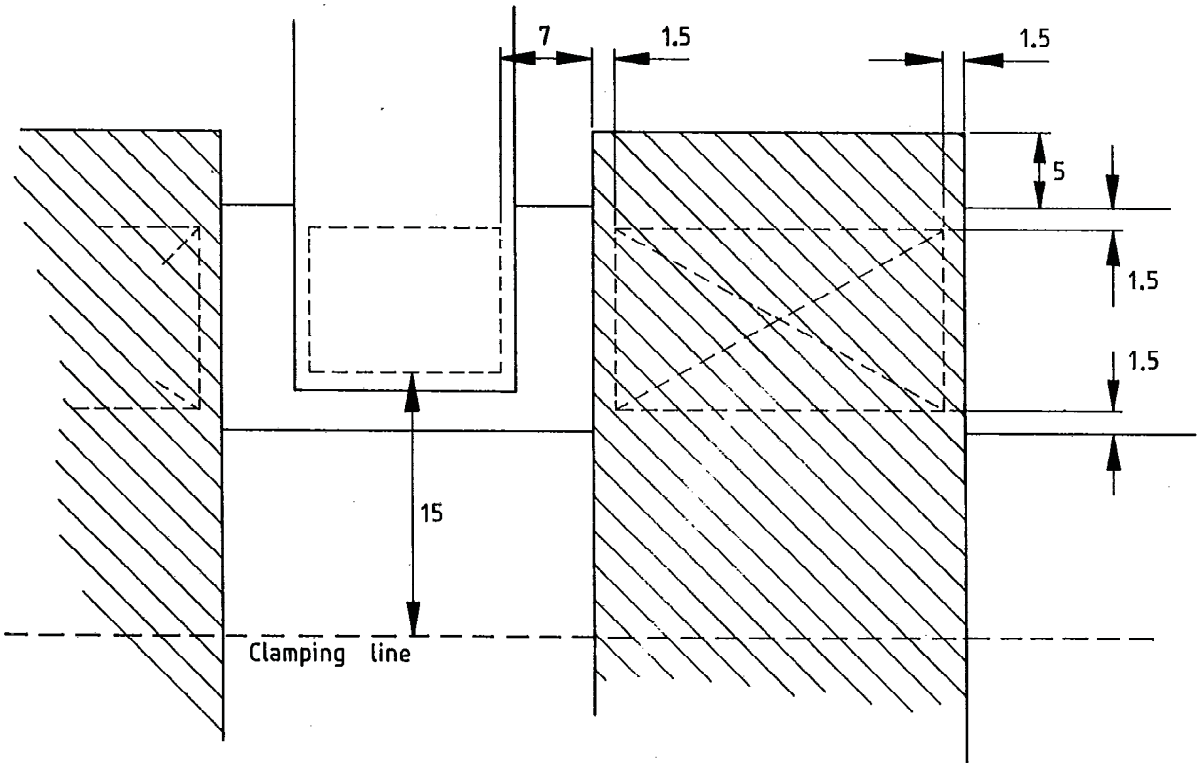
Dimensions are in millimetres.

Figure 5.11/8a. Buckle strap attached to a sling-back strap (Strap not wide enough to enable a type A test piece to be cut. The type B test piece shown in figure 5.11/8b and 5.11/8c needs to be used.)



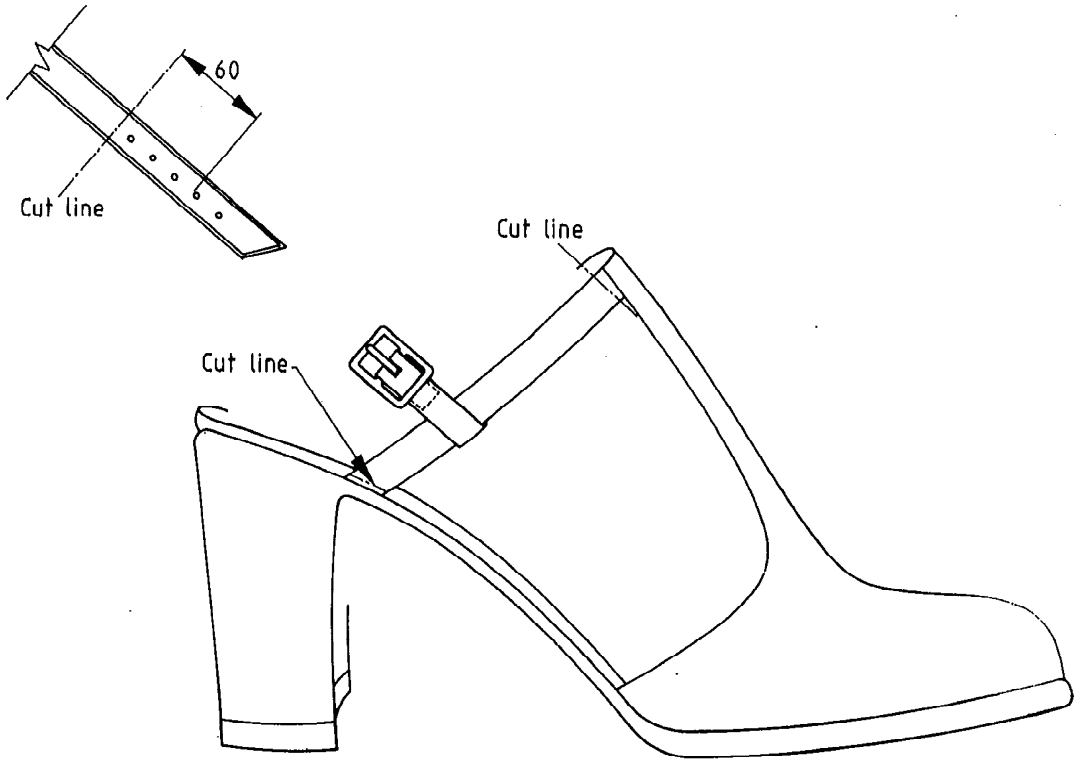
Dimensions are in millimetres.

Figure 5.11/8b. General view of type B test piece cut from the upper of figure 5.11/8a showing the two strips which need to be sewn on



Dimensions are in millimetres.

Figure 5.11/8c. Enlargement of part of figure 5.11/8b showing the position of attachment of the strips



Dimension is in millimetres.

Figure 5.11/9. Buckle strap ending in a loop which can slide along the main strap.

This British Standard, having been prepared under the direction of the Clothing Standards Committee, was published under the authority of the Board of BSI and comes into effect on 30 November 1981.

ISBN 0 580 12387 1

The following BSI references relate to the work on this standard:
Committee reference CLT/7 Draft for comment 78/35761 DC

Amendments issued since publication

Amd. No.	Date of issue	Text affected