BRITISH STANDARD

BS 5131 :
Section 5.6 :
1991

Methods of test for

Footwear and footwear materials

Part 5. Testing of complete footwear

Section 5.6 Impact test for rigid units and shoe bottoms

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

Méthodes d'essai chaussures et matériaux pour chaussures
Partie 5. Essais de la chaussure complète
Section 5.6 Essai de flexion par choc des ensembles rigides et des semelles

Prüfung von Schuhwerk und Schuhwerkstoffen
Teil 5. Prüfung des gesamten Schuhwerks
Abschnitt 5.6 Prüfung des Schuhunterbaus und starrer Sohlen

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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 It supersedes BS 5131 : Section 5.6 : 1978, which is withdrawn.

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

Contents

Method

1 Scope

This Section of BS 5131 describes a method of test designed to reproduce the effect of the occasional heavy impacts that may occur in wear owing to stumbling or falling. The test is applicable to rigid through bottom units (often called clog units and through platform units) made from rigid plastics, rigid polyurethane, or wood, and to complete shoe bottoms containing these units, i.e. with the insole and outsole left on. It is also suitable for testing complete bottoms containing cork units, but not for testing these cork units on their own. It is not applicable to more flexible units because they bend too much on impact.

2 Principle

The unit is held rigidly in the forepart and struck a number of blows of increasing severity at the heel until failure occurs, which is usually breaking or cracking in the waist. The energy required to produce a break or crack is measured.

3 Apparatus and materials[1)]

3.1 *Lateral impact tester,* an example of a suitable apparatus being shown in figure 5.6/1. The apparatus is clamped either onto a solid built-in bench, or onto a rigid free-standing frame anchored to the floor.

NOTE. If the apparatus is not firmly mounted, there is partial loss of energy on impact, thereby producing false results.

The lateral impact tester has the following features.

(a) *Pendulum,* consisting of a circular steel bob of diameter 108 ± 1 mm and thickness 49 ± 2 mm which is fixed by a circular steel shaft of diameter 25 ± 0.5 mm to a hub of diameter 75 ± 1 mm, this hub being on a bearing axle. The distance from the centre of the bob to the centre of the hub is 432 ± 2 mm. The moment of the pendulum when it is held horizontally is 17.3 ± 0.2 N·m (1.76 ± 0.02 kgf·m).

(b) *Striker head,* consisting of a strip of metal 6.0 ± 0.5 mm thick, 25 ± 0.5 mm wide and 35 ± 2 mm long with the striking edge rounded to a radius of 3.0 ± 0.5 mm. The head is fixed rigidly to the pendulum bob so that the striker tip and centre of the bob lie on the same circle of swing of the pendulum and are 89 ± 2 mm apart.

(c) *Energy scale for the pendulum,* calibrated in increments of 0.5 J from 0 J to 20 J. A marker attached to the pendulum moves over this scale and enables the pendulum to be set up to deliver the desired energy of blow.

(d) *Base clamp,* for holding the test specimen assembly and for adjusting it vertically and horizontally so that in the test the pendulum strikes the heel part of the unit in the correct position. The base clamp is attached to a guide rail in the main frame of the apparatus. This allows horizontal movement of the base clamp within the same vertical plane as the movement of the pendulum.

3.2 *Curing resin filler,* which is fairly fast setting but does not generate too much heat when doing so.

3.3 *Silicone release agent.*

4 Preparation of units, moulds and resin blocks

4.1 If the bottom of a complete shoe is to be tested cut away the upper level with the surface of the insole.

4.2 The procedure for determining the positions for clamping the unit and applying the impacts is given in **4.3, 4.4, 4.5** and **4.6** and is illustrated in figure 5.6/2.

4.3 On the upper surface of the unit or the insole mark the extreme toe and heel points A and B, respectively. Draw in the line AB lightly and measure its length along the surface of the insole using a flexible steel ruler or tape. Mark on the line AB two points, C and D, so that CB = 2/3 AB and DB = 0.15 AB. Lightly draw a line EF through C at right angles to AB and mark its centre point I. Do the same for point D to obtain point J. Join points I and J with a heavier line and also draw lines KIL and MJN at right angles to IJ. During the test the unit will be clamped along the line KL.

4.4 Place the unit on a flat surface and draw lines LO and NP on the edge of the unit, as shown in figure 5.6/3, so that they are at right angles to the surface. Mark points O and P. Obtain and mark similar points Q and R on the other side of the unit. Draw lines OQ and PR on the underside of the unit. During the test the unit will be struck along the line PR.

[1)] For information on the availability of suitable apparatus and materials 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.

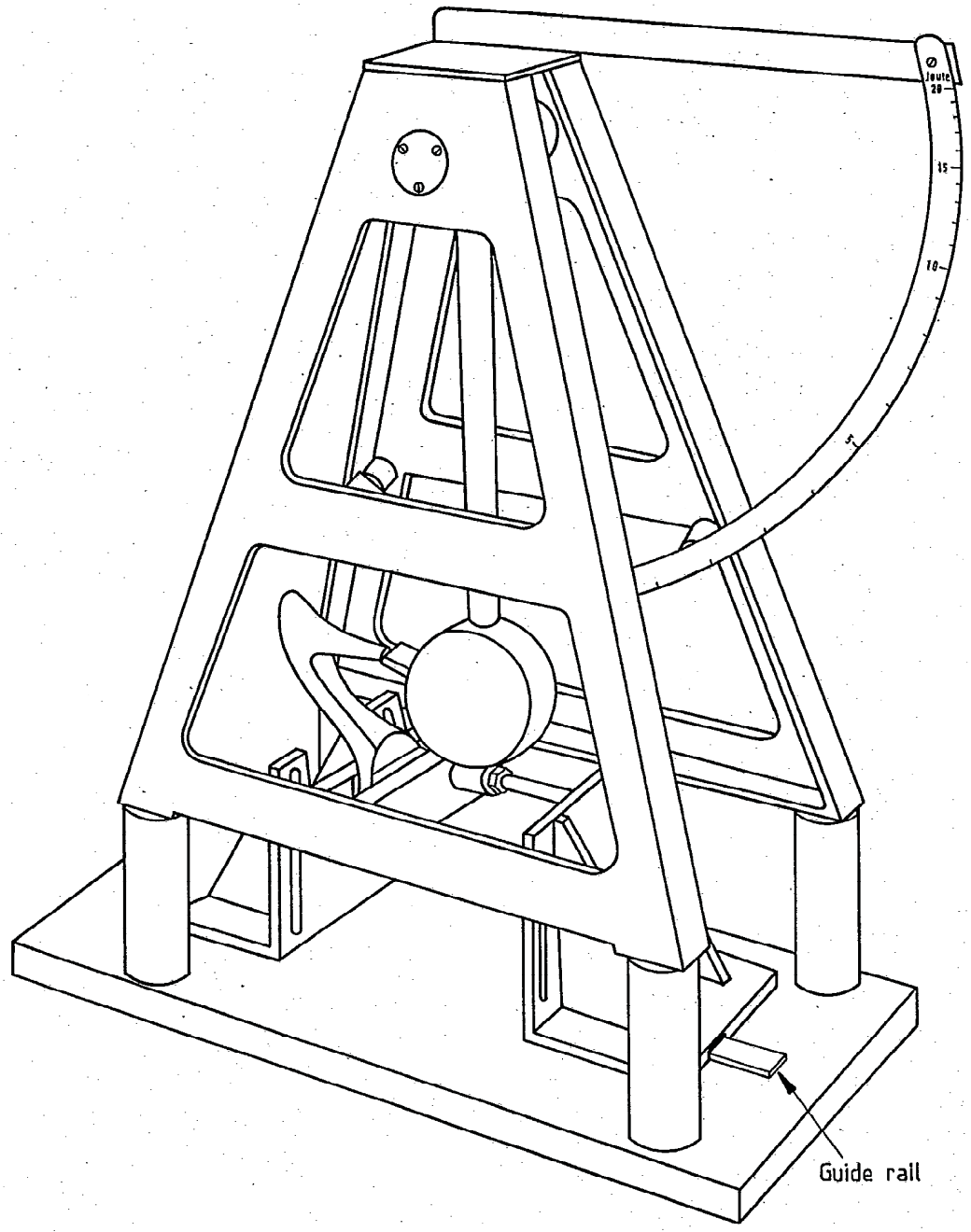

Figure 5.6/1. Lateral impact tester

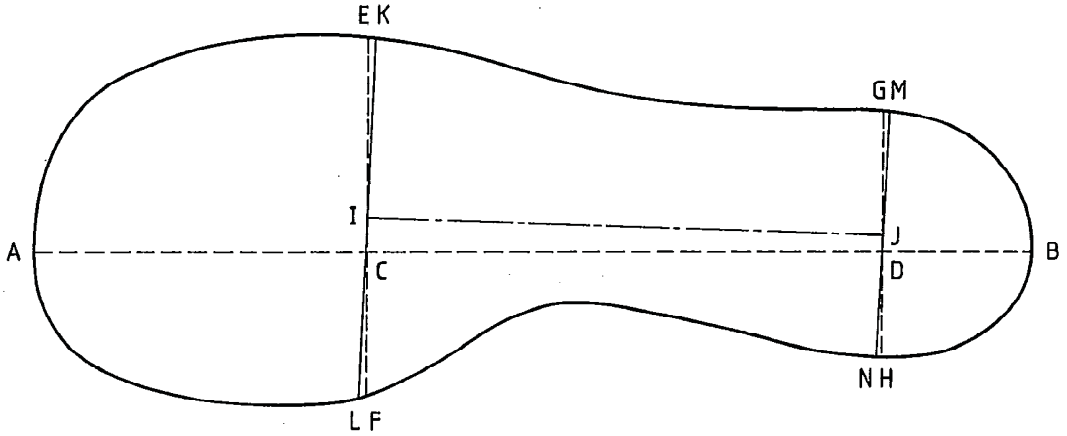

Figure 5.6/2. Determination of the clamping positions

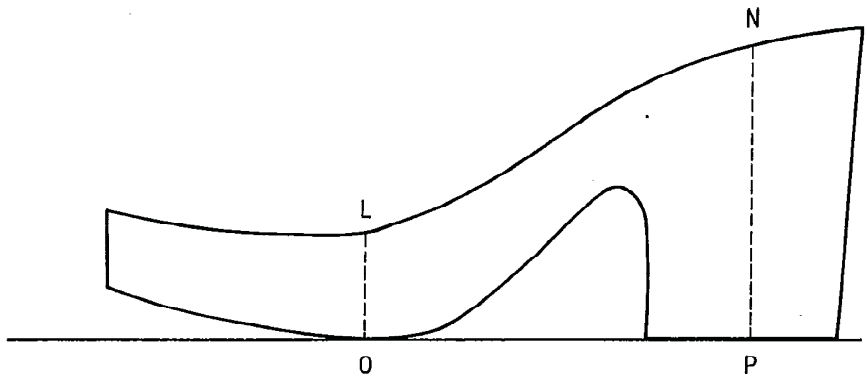

Figure 5.6/3. Determination of the positions for applying impact

4.5 Occasionally it happens that because of the design of the unit, points P and R, when determined according to **4.4**, do not fall on the heel or are very close to the front edge. In such a case locate P and R further back so that they fall on the heel and are at least 5 mm from this edge. Locate O and Q further back by the same distance so that OP is constant. Redraw the perpendicular lines OL and QK to obtain the new positions of K and L.

4.6 If it is evident that much of line PR is across a heel cavity fill this cavity with a suitable hard setting resin.

4.7 Produce a base mould as shown in figure 5.6/4 that has across it a flat bottomed trough 50 mm wide and 5 mm deep, and a rectangular top mould, 50 mm wide and longer than the width of the forepart. Using the base mould and top mould, together with the unit to be tested and the curing resin filler (**3.2**), produce a pair of blocks (moulded from curing resin filler to the shape of the upper and lower surfaces of the forepart of the unit), which will be used to clamp the unit securely and vertically in the impact tester. In order to do this, proceed as described in **4.8** and **4.9**.

4.8 Spray the base mould, top mould and the surfaces of the forepart of the unit with silicone release agent (**3.3**). Mix sufficient curing resin filler (**3.2**) following the maker's instructions. Fill the trough in the base mould with this resin so that the amount filled is a little wider than the forepart of the unit. Place the unit in the base mould as shown in figure **5.6/4**, so that line OQ on the underside of the unit coincides with the rear edge of the trough. Press the unit down to exude excess resin until the unit rests on this rear edge. Remove most of the excess resin. Apply a band of resin to the top surface of the unit approximately 50 mm wide so that its rear edge overlaps the line KL on that surface. Place the top mould on the resin so that it is horizontal and its edges are vertically above the edges of the trough in the base mould. Press the top mould down gently to exude resin until the minimum thickness of resin is about 5 mm.

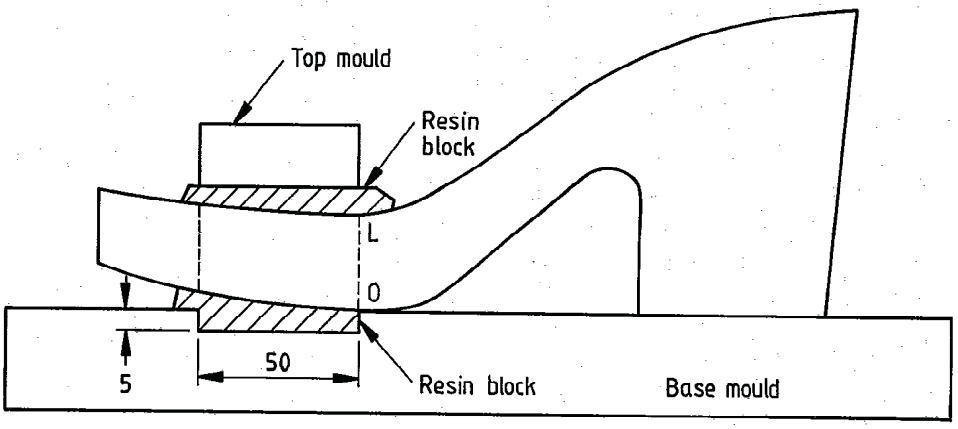

Figure 5.6/4. Position of the unit in the base mould for the formation of the resin blocks

4.9 Leave the resin to harden. If the compound used is fairly fast curing, dismantle the mould as soon as the resin is firm so as to avoid the possibility that the heat generated during the rest of the curing process might damage the unit. When the resin blocks are fully hardened, grind off excess material along their rear edges so that they fit accurately along the lines KL and OQ on the unit.

5 Procedure

5.1 Clamp the lateral impact tester (**3.1**) to a firm mounting using either screws or G clamps. Choose a position where, if the unit breaks and flies when tested, there is no risk of injury or damage to personnel or other equipment. Slacken the four nuts that tighten the clips that hold the unit clamp assembly, and slide this assembly from under the pendulum framework along the guide rail.

5.2 Place the two moulded resin blocks in position on each side of the unit and insert the unit and blocks between the jaws SS of the clamp assembly (see figure 5.6/5) so that the underside of the heel faces the pendulum and the top edges of the blocks and jaws are in line with lines LO and KQ on the unit. Also ensure that the line IJ on the upper surface of the unit is central with respect to jaws SS and perpendicular to their upper edges. Tighten the nut T on each threaded rod. If the distance between nuts T and U on each threaded rod is greater than 80 mm, undo nut U, remove bolt W, and slide frame X nearer to the unit until bolt W can be inserted in a suitable threaded hole in the case of the assembly.

5.3 Slacken the nuts U, V and Y and adjust the height of the jaws SS until the line PR on the heel of the unit is at the same height as the tip of the pendulum striker, either by using a ruler, or sliding the whole unit clamp assembly back to check against the pendulum. Make sure that the two threaded rods remain horizontal and that the line IJ on the unit remains vertical. Tighten the nuts Y, then the nuts U and V together. Slide the unit clamp assembly back under the pendulum framework until the line PR on the underside of the heel just touches the tip of the striker when the pendulum is hanging freely. Reposition the four clips that hold the assembly to the base of the machine and tighten them firmly.

5.4 The unit is now ready to be tested. Draw the pendulum back to the 0.5 J mark on the energy scale and release it so that the striker tip hits the underside of the heel. Catch the pendulum on its rebound to prevent a second blow. If there is no sign of cracking repeat the procedure, increasing the impact energy at each blow by 0.5 J until cracking (or a complete break) occurs (usually in the waist). A break or a crack along the line OQ where the unit is clamped is a valid result. Stop the test if a blow of 20 J does not produce a failure. Record the total number of blows delivered.

5.5 If the unit deforms to such an extent that on impact the striker slides off the heel, this indicates that the unit is too flexible for the test to be appropriate.

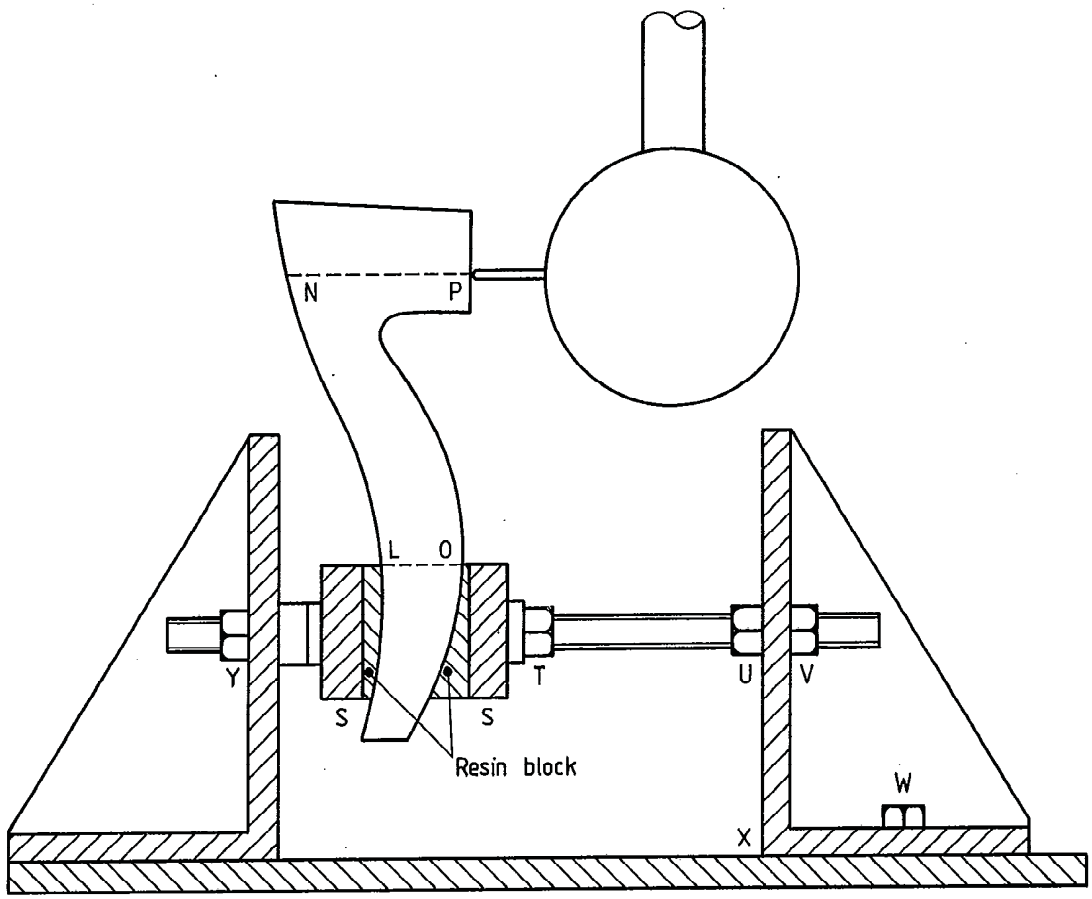

Figure 5.6/5. Position of the unit and the resin blocks in the clamped assembly for testing

6 Expression of results

Record the number of blows and the setting on the energy scale of the blow that produces a break or crack. If a blow of 20 J does not produce a failure, record this as 'no crack obtained after the 20 J blow'.

7 Test report

The test report shall include the following items :

(a) results, expressed in accordance with clause 6;

(b) nature and full identification of the sample(s);

(c) reference to this method of test, i.e. BS 5131 : Section 5.6;

(d) 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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