BRITISH STANDARD

BS 5131 :
Section 5.1 :
1990

Methods of test for

Footwear and footwear materials

Part 5. Testing of complete footwear

Section 5.1. Adhesion of stuck-on and moulded-on soles

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

Méthodes d'essai des chaussures et matériaux pour chassures
Partie 5. Essais de la chaussure complète
Section 5.1 Adhérence des semelles collées ou moulées

Prüfung von Schuhwerk und Schuhwerkstoffen
Teil 5. Prüfung des vollständigen Schuhwerks
Abschnitt 5.1 Haftfestigkeit von angeklebten oder anvulkanisierten Sohlen

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 It supersedes BS 5131 : Section 5.1 : 1976, which is withdrawn.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 procedure for measuring the strength of adhesion at the toe and at the heel of a stuck-on or moulded-on sole with an extended edge. The main use of the method is as a non-destructive in-plant check that sole adhesion is of the required strength but it can also be applied as a laboratory test to determine destructively the strength of adhesion of the sole at the toe and the heel.

The method is based on an apparatus specially designed to measure the strength of adhesion of the sole. This apparatus uses the deflection of a cantilever beam as a direct measure of force, but in practice there is not an exact linear relationship between the two. Nevertheless, errors due to this cause can be minimized by making the testers so that percentage errors are at a minimum in the middle of the force range. Since the force is applied manually, it is difficult to attain a uniform and controlled rate of application of increasing force. For these reasons the test results are to be interpreted with caution, but the test is useful if applied both in routine quality control of footwear of normal construction and materials and also in specifying the performance of footwear whose materials and method of construction are very similar. It is not suitable for use in comparing sole adhesion strengths where either the styles or the materials or the methods of construction are different.

When using the method as a non-destructive test to confirm that the strength of adhesion in a finished shoe is adequate, the force applied is limited to the required pass/fail value so that footwear with satisfactory sole adhesion remains intact and usable.

2 Principle

A steadily increasing force is applied manually to the toe (or heel) of the sole of the complete footwear on its last until either a predetermined pass/fail value is reached, or the sole begins to separate from the upper. A dial gauge measuring the deflection of the beam records the maximum force applied.

3 Apparatus [1)]

3.1 *Sole adhesion tester*

NOTE 1. Figure 5.1/1 is a cross-sectional illustration of the force measuring device and its associated components, together with the forepart of the shoe and the anvil, as set up for toe adhesion testing. Figure 5.1/2 is an isometric drawing, omitting the details of the force measuring device and its associated components (which are the same as for toe adhesion testing) but illustrating the rear part of the shoe and the stirrup, as set up for heel adhesion testing.

NOTE 2. Features common to the toe adhesion testing apparatus and the heel adhesion testing apparatus are described in **3.1.1**, **3.1.2**and **3.1.5**. Features relating to the toe adhesion testing apparatus are given in **3.1.3**. Features relating to the heel adhesion testing apparatus are given in **3.1.4**.

3.1.1 *Force-measuring device,* in which the deflection of a high tensile steel beam (A), clamped rigidly at one end between cast iron bolsters (B), is measured by a gauge (C), calibrated to give a direct reading of the deflecting force applied at the free end of the beam. For testing of toe adhesion a range of 0 N to 450 N (0 kgf to 45 kgf) is suitable, and for testing of heel adhesion a range of 0 N to 900 N (0 kgf to 90 kgf) is suitable.

3.1.2 *Detachable toe piece (D),* which is clamped to the free end of the beam and transmits to it the upwards force exerted by the footwear on its last. The edge of the toe piece in contact with the toe or heel of the footwear is curved and shaped to fit in the featherline groove between the sole and upper. Several different shaped toe pieces may therefore be needed to test a range of footwear. For every shape of toe piece the arc length of the curved edge is 22 ± 1 mm and the length of the toe piece is 12.7 ± 1.0 mm from the centre of the arc to the vertical wall that is in contact with the end of the cantilever beam.

3.1.3 *Detachable anvil (E),* (for toe adhesion test only), upon which the sole of the specimen rests. The anvil is rigidly located on the base of the instrument and can be adjusted in height by means of packing pieces (F).

3.1.4 *Detachable stirrup (G),* (for heel adhesion test only), which, when in position, accommodates the heel of the specimen so that its rear touches the toe piece. A suitable attachment is shown in figure 5.1/2. Packing pieces of resin rubber or similar material are required for adjustment of the specimen to the correct level in the stirrup.

3.1.5 *Means of attachment,* of the whole apparatus to a bench in such a way that the anvil position is over the working edge of the bench.

3.2 *Lasts,* to fit the footwear under test.

[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.

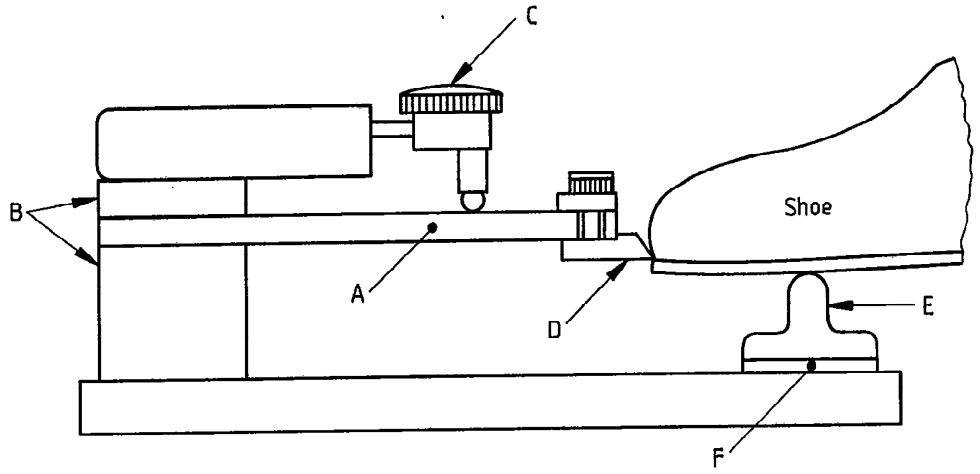

Figure 5.1/1 Sole adhesion tester, as set up for toe adhesion testing

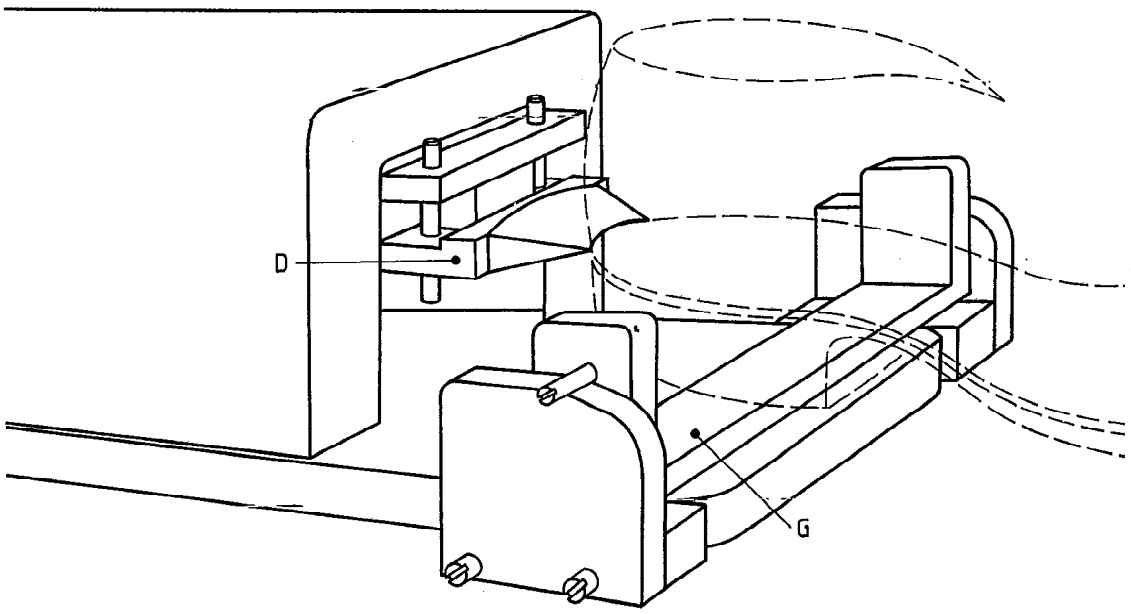

Figure 5.1/2 Sole adhesion tester, as set up for heel adhesion testing

4 Procedure

NOTE. Before carrying out the procedure, it is common practice to carry out preliminary tests to determine a suitable time interval between attaching the sole and testing its adhesion, together with a minimum adhesive strength at the end of that time interval. This is particularly relevant when footwear is to be tested on the day of manufacture. A time interval of 6 h is recommended as a satisfactory compromise between the need for early test results and the need to allow the adhesive bond to approach its full strength. Alternatively, when sufficient time is available, the footwear may be left long enough (several days or a week, depending on the adhesive) for the adhesive bond to attain its full strength. Results obtained at the end of different time intervals are not, of course, the same.

4.1 Determination of the toe load

4.1.1 Insert the correct last (**3.2**) into the specimen. Select the toe piece which conforms to the curvature of the toe of the specimen and attach this toe piece to the end of the beam of the appropriate sole adhesion tester (**3.1**). Adjust the height of the anvil using the packing pieces, so that when the specimen is in position, the forepart of the sole is either horizontal or sloping slightly downward toward the toe. Check the zero setting of the gauge and correct it if necessary.

4.1.2 Place the specimen on its last in position on the anvil so that the toe piece is inserted in the featherline groove between the sole and the upper. Ensure that the upper material of the specimen is not trapped by the toe piece thus ensuring that the upper material does not interfere with the measurement of sole bond strength.

NOTE 1. When a rubber or PVC sole is under test, the specimen should be pushed hard against the toe piece to prevent disengagement from the toe piece during the test. However in all cases care should be taken to ensure that the toe piece does not trap a part of the upper and thereby cause the upper material to contribute to a spuriously high load reading.

Grasp the lasted specimen firmly and, while keeping the toe properly engaged with the toe piece, apply a steadily increasing downward force to the back of the last. For a non-destructive test, increase the force until either the gauge reading reaches a predetermined pass/fail value, or the sole starts to separate from the upper, whichever happens first. For a destructive test, continue to increase the force until the sole starts to separate from the upper. In cases where the sole starts to separate from the upper, record the gauge reading at which this occurs.

NOTE 2. The gauge reading is usually at a maximum when separation starts, decreasing as separation proceeds.

Then maintain the downward force until the sole and upper have separated at some point in the tested region for a distance of approximately 3 mm measured at right angles to the featherline groove. Ensure that approximately 3 s has elapsed since the downward force was first applied.

4.1.3 Examine and record the type of separation as follows:

(a) failure in either material (sole or upper);

(b) failure of adhesion to either material;

(c) cohesive failure of the adhesive;

(d) incomplete coalescence of the adhesive films.

NOTE. In recording the separation, information additional to the above may be included.

4.2 Determination of the heel load

4.2.1 Insert the correct last (**3.2**) into the specimen. If the specimen is a shoe, tack the upper to the last at the back. Select the toe piece which conforms to the curvature of the heel and attach the toe piece to the end of the beam of the appropriate sole adhesion tester (**3.1**). Add sufficient packing pieces to the stirrup to ensure that, when the specimen is positioned at the start of testing, the toe piece is level with the groove between heel and upper. Check the zero setting of the gauge and correct it if necessary.

4.2.2 Position the specimen by pulling the bottom of the stirrup forward (i.e. toward the forepart), resting the heel on the stirrup, and pushing the heel groove firmly against the toe piece. Grasp the specimen securely and, while maintaining engagement of the toe piece, apply a steadily increasing downward force to the forepart of the shoe. For a non-destructive test, increase the force until either the gauge reading reaches a predetermined pass/fail value, or the heel starts to separate from the upper, whichever happens first. For a destructive test, continue to increase the force until the heel starts to separate from the upper. In cases where the heel starts to separate from the upper, record the gauge reading at which this occurs (see note 2 to **4.1.2**).

4.2.3 Examine and record the type of separation as follows (see note to **4.1.3**).

(a) failure in either material (sole or upper);

(b) failure of adhesion to either material;

(c) cohesive failure of the adhesive;

(d) incomplete coalescence of the adhesive films.

5 Expression of results

Express the results in newtons of the toe load or heel load of the specimen as appropriate.

6 Test report

The test report shall include the following items:

(a) results, expressed in accordance with clause **5**;

(b) time interval between sole attachment and testing;

(c) type of separation which has taken place;

(d) nature and full identification of the specimen;

(e) reference to this method of test, i.e. BS 5131 : Section 5.1;

(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 31 January 1991

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