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Footwear — Test methods for whole shoe — Upper sole adhesion

Chaussures — Méthodes d'essai applicables à la chaussure entière — Liaison tige/semelle

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 216, *Footwear*.

This second edition cancels and replaces the first edition (ISO 17708:2003) which has been technically revised.

This document is based on EN 344.

Footwear — Test methods for whole shoe — Upper sole adhesion

1 Scope

This document describes a test method for determining the resistance to separation of the upper from the outsole, for separating adjacent layers of the outsole or for causing tear failure of the upper or the sole. It also defines conditions of ageing that can be used for production control.

This document is applicable to all types of footwear (cementing, vulcanisation, injection moulding, etc.) where the evaluation of sole adhesion on the upper is needed and where the upper is continuously assembled (closed shoe).

NOTE 1 In all cases the objective is to test the bond strength nearest to the edge of the assembly.

NOTE 2 The test need not be carried out when the bond has been made by grindery (using, for example, nails or screws) or stitching.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 18454, *Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
upper-sole adhesion
force required to separate the sole-upper bonding

4 Apparatus and material

The following apparatus and material shall be used.

4.1 Cutting device.

Sharp tool for clean cutting of the test pieces.

4.2 Tensile testing machine.

The tensile-testing machine shall comply with the requirements of ISO 7500-1 to an accuracy corresponding to class 2, with a constant rate of traverse of 100 mm/min ± 10 mm/min, and it shall be able to measure a force range of 0 N to 600 N. The machine shall be fitted with either pincer or flat jaws (depending on the type of construction of the test sample), 25 mm to 30 mm wide, capable of firmly gripping the test pieces.

A low-inertia machine having autographic force recording facilities is essential.

4.3 Measuring device.

Calibrated device for measuring of the width of the upper bonding margin, with an accuracy of at least ±0,5 mm.

5 Sampling and conditioning

5.1 Footwear conditioning

Before dismantling and cutting of the test pieces, condition the footwear according to ISO 18454 for at least 24 h, and, if required, carry out an ageing process according to Annex A.

NOTE Some adhesives cannot reach full strength for some time after application, therefore, when samples are taken directly from production, allow at least 72 h conditioning before carrying out the test.

5.2 Number of samples

For each model, the minimum number of samples shall be two items of footwear.

5.3 Preparation of test pieces

5.3.1 Upper-sole adhesion: construction type a

See Figure 1.

Take a test piece from either the inner or the outer joint region.

Cut the test piece at X-X and Y-Y with sides at right angles to the edge of the sole using a press knife or bandsaw (see 4.1) to cut through the upper, innersole or outsole to produce a test piece about 25 mm wide. The length of the upper and sole shall be about 15 mm measured from the feather line (see Figure 2). Remove the insole.

5.3.2 Upper-sole adhesion: construction types b, c, d and e

See Figure 1.

Take a test piece from either the inner or outer joint region.

Cut the upper and sole at X-X and Y-Y to produce a test piece with a width of about 10 mm and an effective stripping length from shank to tip (toe-cap). Remove the insole.

Separate the upper from the sole for a length of about 10 mm to 20 mm by inserting a hot knife in the adhesive layer (see Figure 3).

NOTE It is considered that a construction is c or d when the distance from the X-X to the upper face of the insole is at least 8 mm.

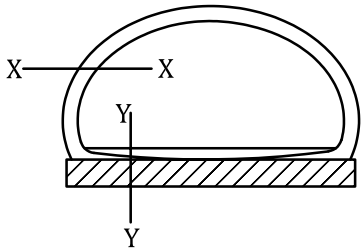
5.3.3 Sole-interlayer adhesion: construction types f and g

See Figure 1.

Take a test piece from either the inner or the outer joint region.

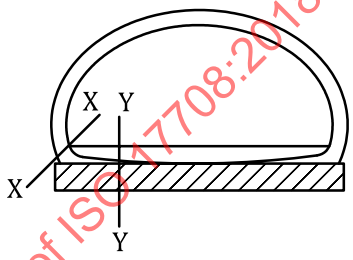
Remove the upper by cutting along the feather line at X-X. Remove the insole and other elements, such as the welt, if present. Cut a strip parallel to and including the sole edge at Y-Y to produce a test piece about 15 mm wide and at least 50 mm long.

Separate the sole layers for a length of about 10 mm to 20 mm by inserting a hot knife into the adhesive layer (see Figure 3).



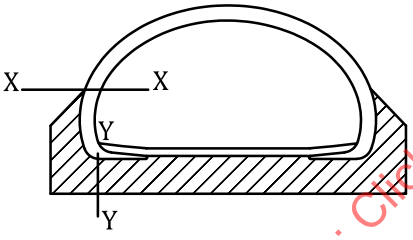
Type a: Conventional lasting

Cemented or moulded outsole having an extended edge



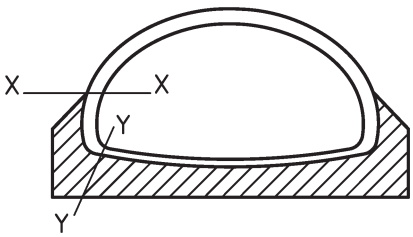
Type b: Conventional lasting

Close trimmed outsole



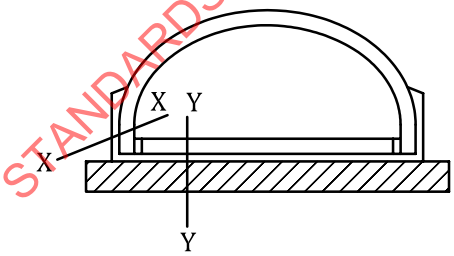
Type c: Conventional lasting

Direct injected or vulcanized outsole or cemented dished outsole

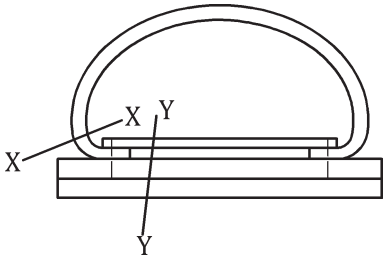


Type d: Strobel stitched

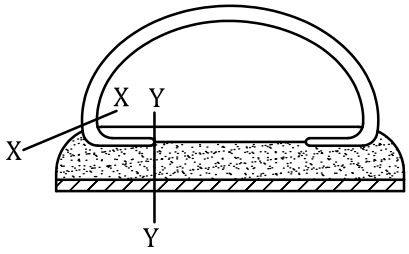
Cemented dished outsole or direct injected or vulcanised outsole



Type e: Conventional lasting or strobel stitched with rubber mudguard and cemented outsole



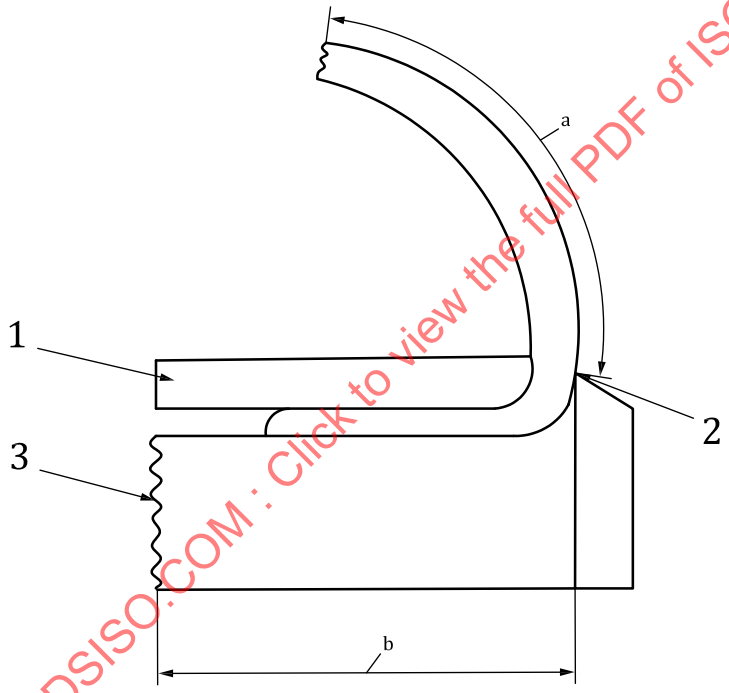
Type f: Machine sewn or welted where the outsole is bonded to the throughsole



Type g: Multilayered sole

It may be moulded-on sole, a moulded unit or a built unit

Figure 1 — Types of construction showing positions for preparation of the test piece for bond strength



Key

1 insole (removed)
2 feather line
3 outsole
a Approximately 15 mm.
b Approximately 15 mm.

Figure 2 — Cross section of the test piece of construction type

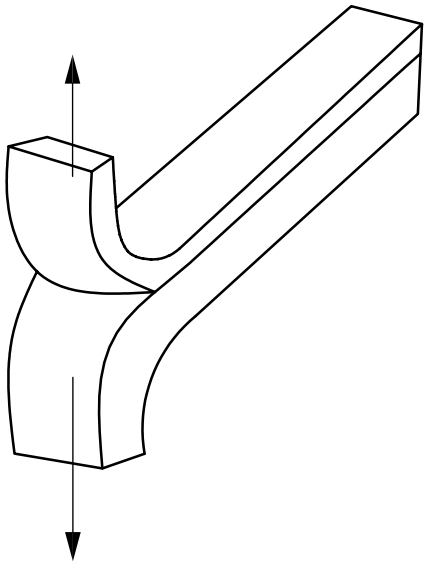


Figure 3 — Prepared test piece

6 Test method

6.1 Principle

Measurement of the force required to separate the upper from the outsole, using a tensile machine with a continuously recording load.

6.2 Procedure

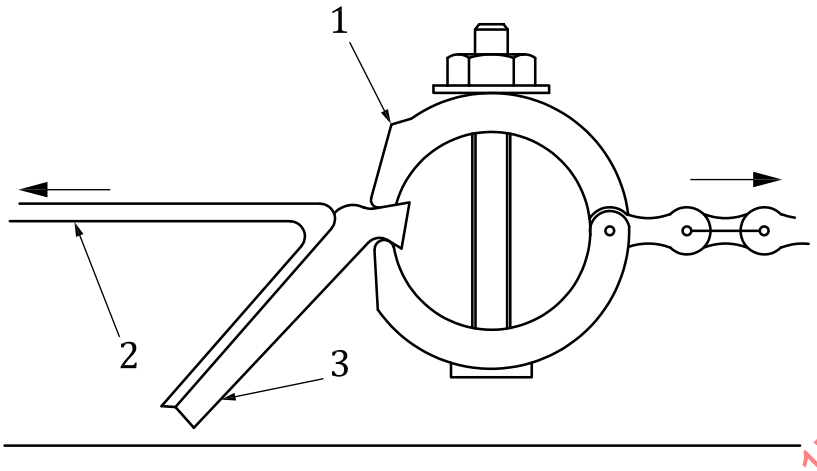
6.2.1 Before carrying out the test, measure the width of the test piece, to the nearest millimetre, at five points using a measuring device with accuracy ±0,5 mm and calculate the average value, *A*, to the nearest millimetre.

6.2.2 Then measure the upper-sole adhesion according to the following method.

6.2.2.1 Upper-sole adhesion: Construction type a. Clamp the test piece into the jaws of the tensile machine, using a pincer jaw to grip the short edge of the sole (see Figure 4), and record the force/deformation graph at a separation speed of 100 mm/min ± 20 mm/min. After testing, observe the appearance of the separated areas and classify it according to 7.2.

6.2.2.2 Upper-sole adhesion: Construction types b, c, d and e and sole-interlayer adhesion: construction types f and g. Clamp the separated ends of the test piece in the flat jaws and record the

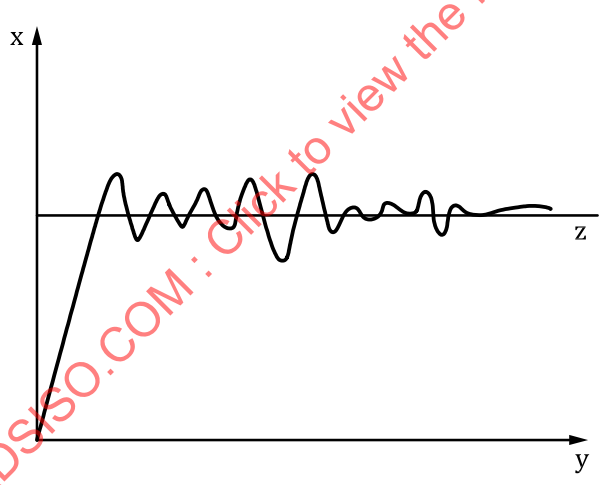
force/deformation graph (see Figure 5) at a jaw separation speed of 100 mm/min ± 20 mm/min. After testing, observe the appearance of the separated areas and classify it according to 7.2.



Key

1 pincer jaw for sole edge
2 upper
3 sole

Figure 4 — Pincer jaw showing the position of the test piece



Key

x peeling force, N
y deformation
z average

NOTE In case of a material failure occurs and the use of the cutter were necessary, take the maximum forces, not mediums.

Figure 5 — Example of force/deformation graph

7 Expression of results

7.1 Determination of the upper-sole adhesion

Calculate the upper-sole adhesion, R, in newtons per millimetre, by the formula:

$$R=\frac{F}{A} \quad (1)$$

where

F is the average force, in newtons, estimated from the force/deformation graph recorded according to 6.2.2.2;

A is the average width determined according to 6.2.1.

Round the results off to the nearest tenth of a millimetre.

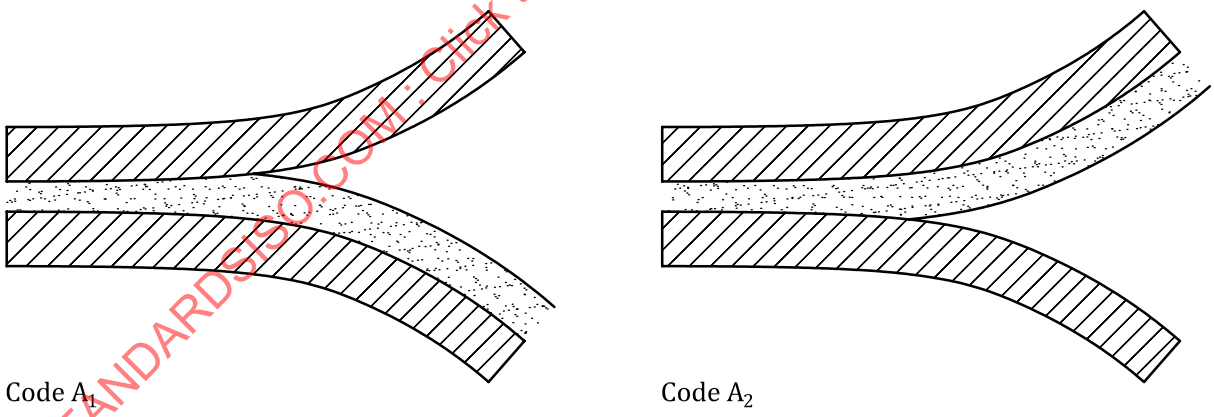
NOTE For footwear where the bonding margins vary, proceed differently. Note the strength after the unsticking of 10 mm and note the corresponding assembling margin. Then, calculate the local upper-sole adhesion, R_i.

Calculate the average value of R_i.

7.2 Evaluation of the mode of the bond failure

The appearance of the separated areas (see 6.2.2) shall be classified according to the following codes.

7.2.1 Separation of the adhesive film from one of the materials (defective adhesion, see Figure 6): Code A



Code A_1 Code A_2

Figure 6 — Defective adhesion

7.2.2 Separation in the adhesive film without unsticking (defective cohesion, see Figure 7): Code C

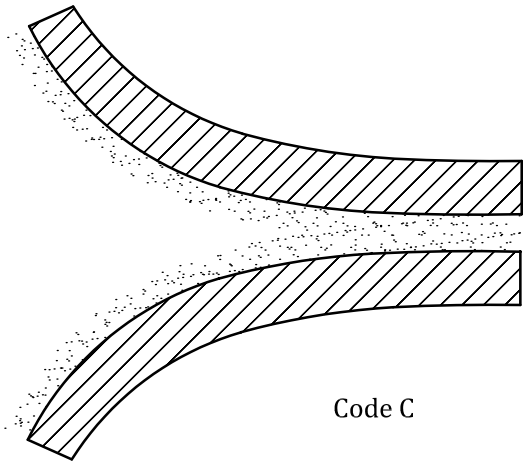


Figure 7 — Defective cohesion

7.2.3 Wrong joining of the two adhesive films (defective coalescence, see Figure 8): Code N

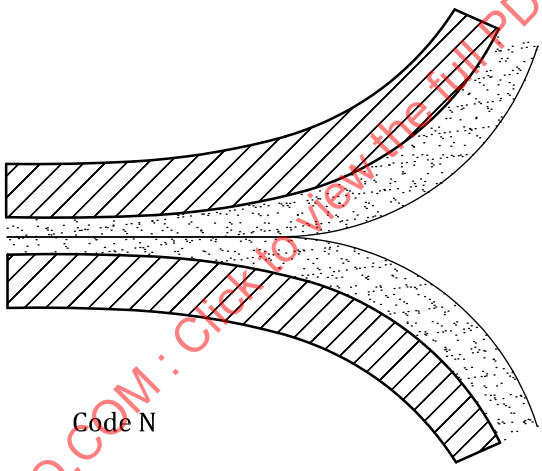


Figure 8 — Defective coalescence

7.2.4 Delamination of material (see Figure 9): Code S

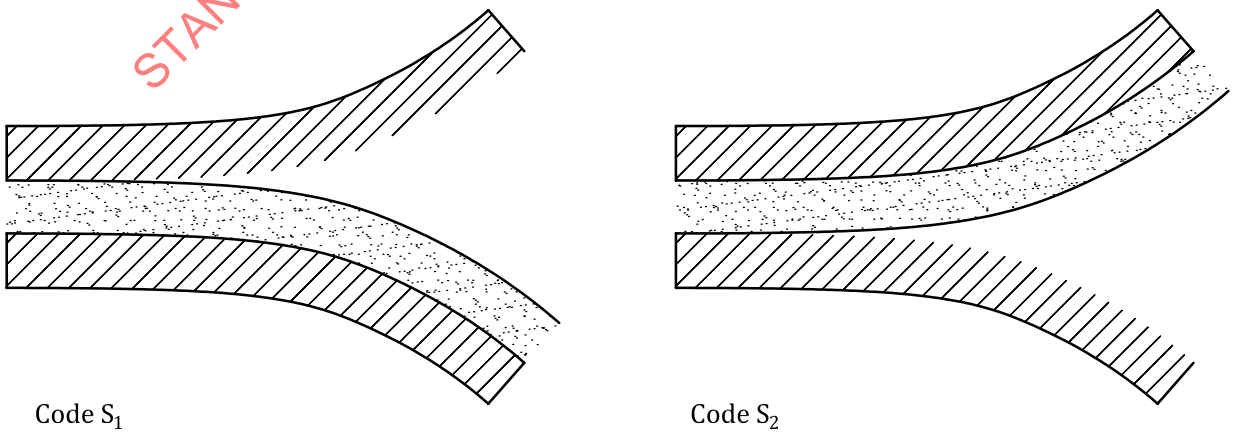


Figure 9 — Material delamination