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Footwear — Test methods for heels — Heel pin holding strength

Chaussures — Méthodes d'essai relatives aux talons — Résistance à l'arrachement de pointe à talon

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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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 206, *Footwear*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 309, *Footwear,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 19957:2004), which has been technically revised. It also incorporates the Technical Corrigendum ISO 19957:2004/Cor 1:2005.

The main changes compared to the previous edition are as follows:

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Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Footwear — Test methods for heels — Heel pin holding strength

1 Scope

This document specifies a test method for measuring the force required to pull a single heel pin out of a heel. This test method is used both to measure the heel pin holding strength of heel materials by using a standard heel pin and a method of insertion, and to assess the heel nailing of commercial production.

This test method is applicable to testing plastics and wooden heels for women's footwear. Heels composed of layers of fibreboard or leather and low plastics heels for men's footwear cannot be tested by this method.

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 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
heel pin holding strength
force required to pull a standard pin out of the heel material divided by the effective length of pin buttressing in the material, expressed as N/mm

4 Apparatus and material

The following apparatus and material shall be used:

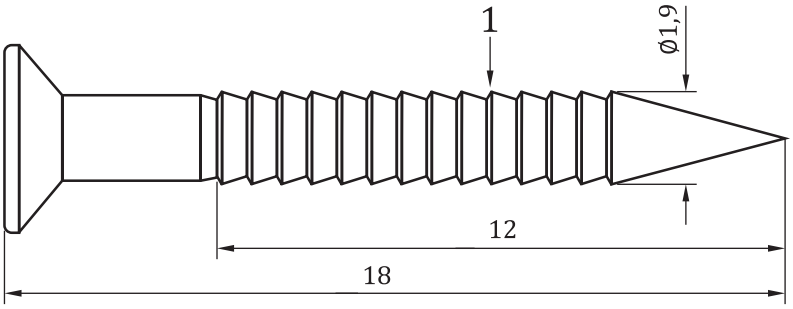
4.1 Tensile testing machine, in accordance with ISO 7500-1, class 2, with a range of approximately 0 N to 2 000 N and a constant rate of traverse of 40 mm/min ± 10 mm/min.

4.2 Small clamp or slotted hook, which can be attached to one jaw of the tensile testing machine via a flexible coupling.

4.3 Commercial heel nailing machine.

4.4 Standard heel pin (see Figure 1), with the following dimensions:

Dimensions in millimetres



a) length: 18 mm ± 0,5 mm;

b) diameter over the buttress ridges: 1,9 mm, minimum;

c) number of complete formed buttress pressure flanks (the side of the buttress that is nearly at right angles to the pin shaft): 13 minimum;

d) distance from point to the base of the first fully formed buttress groove at the head end: 12 mm, minimum.

Key

1 minimum of 13 fully formed buttress flanks

Figure 1 — Standard heel pin

4.5 Metal rod, with diameter 2 mm, and sufficient length to pass through the heel and ensure that the heel is in a suitable position when held in the tensile machine jaw (10 cm approximately).

5 Sampling and preparation

5.1 Number of test specimens

For assessing the heel pin holding properties of a heel material, prepare and test three heels each containing six inserted pins, or, if it is not possible to insert six pins, four heels each containing four pins. When testing heels already attached to shoes, where possible, also prepare three heels containing six pins each or four heels containing four pins each.

5.2 Preparation

5.2.1 To measure heel pin holding properties of heel materials

Cut from 2 mm thick cellulose insole forepart board three discs per heel of diameter about 45 mm. These take place of a single layer of insole seat board because they are easier to remove after pin insertion.

Use a stand on the heel nailing machine that will insert six pins in two rows of three (or four pins in two rows of two) so that the adjacent pins in a row are 10 mm apart.

Set the machine to insert a standard heel pin and load the stand with six (or four) of the standard heel pins. Position a stack of three fibreboard discs centrally over the heel pin positions of the heel stand with the heel inverted on top.

Adjust the machine to hold that shape of heel securely and operate it to insert the heel pins. If none of the heel pins pass through the cellulose board discs, discard the heel and prepare another heel.

Remove the cellulose discs carefully one by one using pincers and a knife. The discs shall be cut to allow easy removal in those cases where they are not soft enough to be pulled over the heads of the heel pins without the pincers pressing on other heel pins. When all three discs are removed, the length of pin not inserted (including the head) shall be between 5 mm and 8 mm. If it is outside these limits, reject the heel and prepare a new one with the machine adjusted to produce the desired depth of penetration.

5.2.2 To test a made shoe

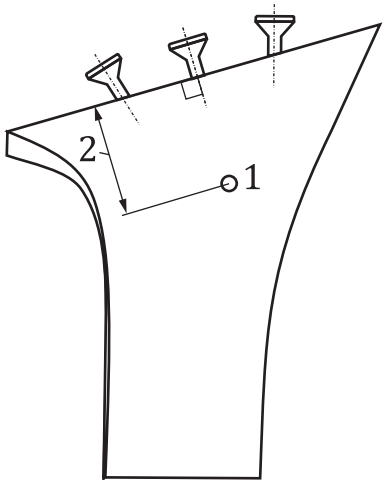
Cut away the upper at the seat and waist level with the insole. Cut through the sole and insole forward of the shank, and the sole and lasted margin forward of the heel breast. The seat board is too thick and rigid to be pulled off the heel pins in one piece, but it can be removed gradually by splitting it from the edge and removing it in layers.

NOTE If the heel is not made of wood, the seat board can be wetted, if necessary, to assist in producing delamination. If washers have been used with any of the heel pins, these can be left on, as they do not affect the test.

5.2.3 Attachment to tensile testing machine

For heels prepared in the laboratory and those from shoes, drill through the heel horizontally, from side to side, at the position shown in Figure 2 (which illustrates a six-pin heel) so that the hole is large enough to take a 2-mm rod in diameter. When the heel design is markedly undercut at the back, it can be necessary to drill the hole between 15 mm and 20 mm from the top of the heel (instead of the 20 mm to 25 mm shown in Figure 2) in order to ensure that the heel material between the hole and the back of the heel is strong enough to enable a test to be carried out. In such cases, record the distance of the hole from the top of the heel. In the case of a four-pin heel, drill the hole to lie on the line that is perpendicular to the heel seat and midway between the two pins on one side. If the heel is reinforced with a metal dowel, ensure that the drilled hole avoids it, by slight repositioning, if necessary.

In the case of heels whose seat design is excessively small and does not allow drilling into the seat, such as stiletto or narrow stem heels in women's footwear, their placement will be performed by directly clamping the heel stem, in its lower part, in the lower jaw of the tensile testing machine (see Figure 4).



Key

1 drilled hole to just clear ⌀2 mm rod

2 20 mm to 25 mm

Figure 2 — Prepared heel

6 Test method

6.1 Principle

The head of a heel pin is held in one jaw of a tensile testing machine and the heel in the other and a pulling force is applied approximately parallel to the shaft of the pin. The maximum force needed to remove the pin is then recorded.

6.2 Procedure

6.2.1 Anchor the heel by inserting a metal rod (4.5) through the hole drilled in the heel and linking the ends of the rod symmetrically to one jaw of the tensile testing machine (4.1) with material of sufficient tensile strength that it will not break when the test is carried out, as shown in Figure 3.

NOTE In practice, this can be achieved by inserting a rigid rod through the hole, attaching flexible linkages to the two ends of the rod, and clamping them to the jaw of the tensile testing machine, or by inserting a length of 2-mm welding rod through the hole, bending the ends down and clamping them to the jaw of the tensile testing machine.

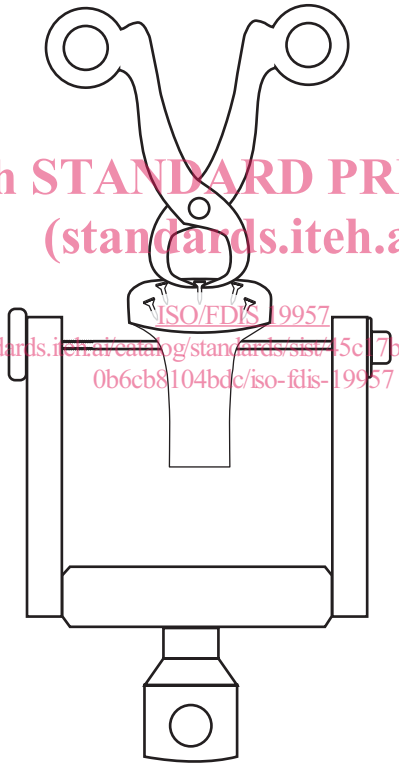


Figure 3 — Attachment to tensile testing machine by inserting metal rod.

In the case of heels with a narrow seat that do not allow drilling, such as stiletto or narrow stem heels in women's footwear, it is suggested to place the heel in the tensile testing machine by directly holding the heel stem in the lower clamp, as shown in Figure 4.

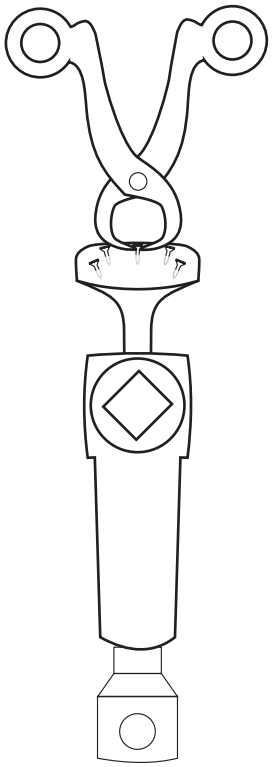


Figure 4 — Attachment to tensile testing machine by holding in the clamp

6.2.2 Attach the clamp or slotted hook (4.2) to one heel pin head and attach it via a flexible linkage to the other jaw of the testing machine ensuring that the pulling force is approximately parallel to the shaft of the pin.

6.2.3 Run the machine at a constant rate of traverse of 40 mm/min ± 10 mm/min and record the maximum value of the load applied in pulling the pin out of the heel. Number the test position on the heel and the result so that the two can be linked when examining all the results. Test the other five (or three) pins in that heel, and the other two (or three) heels in the same way.

6.2.4 Measure the depth of each hole by inserting a fine wire. Grip the wire at the level of the heel surface, withdraw it and measure the length of wire in the hole to the nearest 0,5 mm. Record this as the depth of pin penetration, *d* (7.1).

6.2.5 Cut each heel in two with a vertical cut along the heel/toe centreline so that the plastics near the tips of the pin holes can be seen. If the heel is reinforced with a metal dowel, make two such cuts, one on each side of the dowel.

6.2.6 Inspect the pin holes. A pin is considered to have been incorrectly inserted if, after insertion, it terminated in a cavity in the heel or was close to a cavity wall. The pin is considered to have been close to a cavity wall when the shape of that cavity has been modified as a consequence of the presence of the pin (for example, if the pin was sufficiently close to the cavity wall that the pin did not enter the cavity but caused the plastics to bulge into the cavity).

Should there proves to be fewer than twelve individual valid results for correctly inserted pins, test further heels until at least twelve such results are obtained.

7 Expression of results

7.1 Heel pin holding strength of the heel material

The heel pin holding strength, h, in N/mm to the nearest 0,1 N/mm, is given by the following formula:

$$h = F / (d - 4)$$

where

F is the maximum load recorded in pulling the pin from the heel, in N;

d is the measured depth of the hole, in mm.

NOTE The effective length of buttressing has been found to be 4 mm less than the measured penetration depth.

Calculate the heel pin holding strength for all pins that have been inserted correctly and record the average of these calculated values as the heel pin holding strength of the material.

7.2 Average depth of pin penetration

Calculate the average of the pin hole depth for all pins that have been inserted correctly.

7.3 Heel nailing of commercial production

If required, calculate the average pull out load for all pins that were inserted correctly and record this as the “average heel pin pull out load”.

NOTE This quantity can be regarded as the normal value when the heels are attached correctly.

List the type of pin and all the individual pull out loads for pins that were incorrectly inserted, with comments as to what was faulty about the insertion. In this way, by comparing them with the normal results, the weakening effect of incorrect pin insertion on the strength of attachment of the heel can be judged.

8 Test report

8.1 For heel pin holding strength the test report shall include the following information:

a) a reference to this document, i.e. ISO 19957:—;

b) the heel pin holding strength, in accordance with 7.1;

c) the average depth of pin penetration, in accordance with 7.2;

d) the test material reference;

e) the reference to the method of test;

f) Any deviations from the procedure;

g) Any unusual features observed;

h) The date of the test.

