
**Footwear — Test methods for whole
shoe — Flexing durability**

*Chaussures — Méthodes d'essai pour toute la chaussure — Durabilité
vis-à-vis de la flexion*

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Contents

	Page
Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principle	1
5 Apparatus	2
5.1 Method A	2
5.2 Method B	3
6 Sampling and conditioning	5
7 Test method	6
7.1 Method A	6
7.2 Method B	8
8 Test result	9
9 Test report	9
Bibliography	11

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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 216, *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).

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 whole shoe — Flexing durability

1 Scope

This document specifies two test methods for the determination of the flexing durability of whole shoes. The two methods might not give comparable results.

NOTE The selected test method depends on agreement between relative parties who use this test method or product standards which reference this test method.

These methods are not applicable to the whole shoes with heel height more than 50 mm, or the thickness of flexing area of the soles more than 25 mm, or flexing angle less than 45° according to ISO 17707:2005, Clause 6.

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*

3 Terms and definitions

No terms and definitions are listed in this document.

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/>

4 Principle

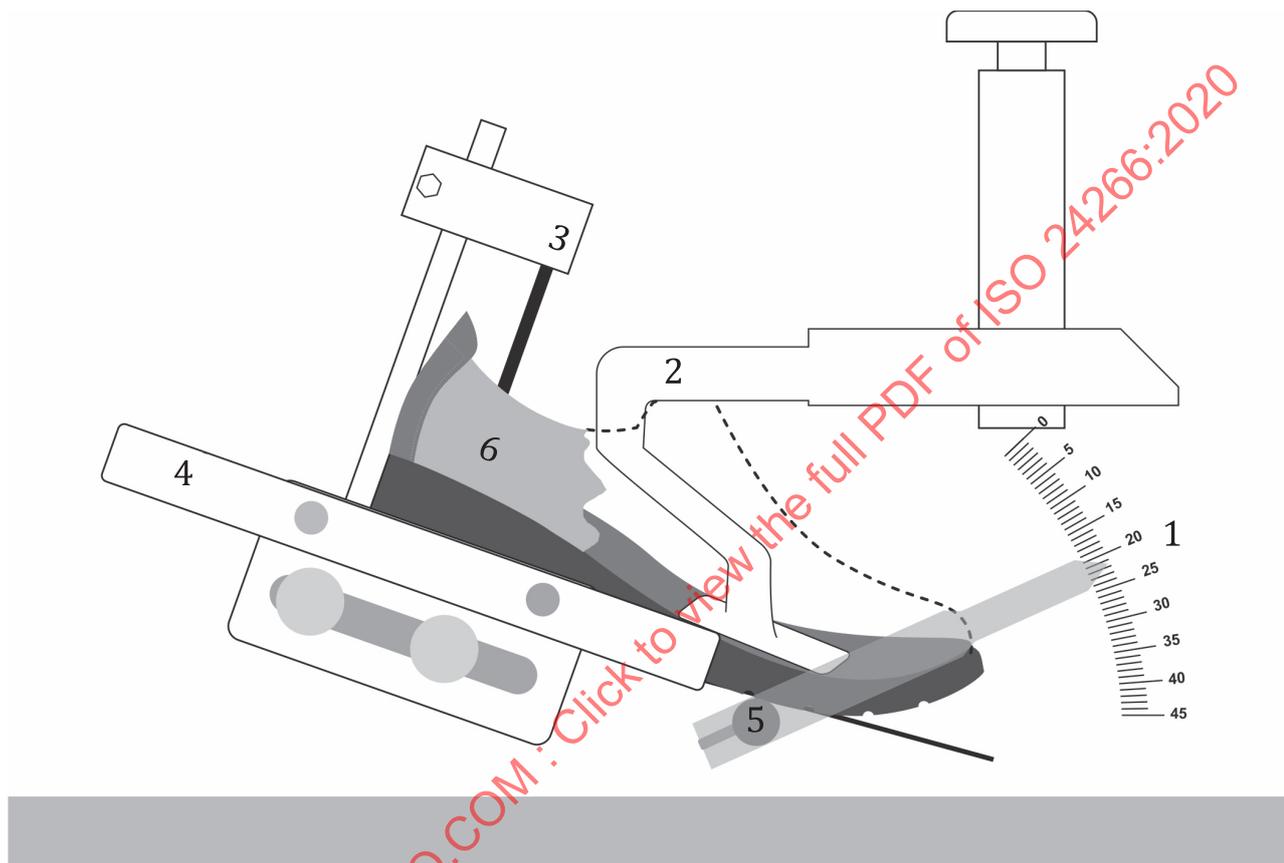
The footwear specimen is repeatedly flexed through a specified angle about its normal flexing line by a test machine. After a predetermined time or number of flexes the footwear is subjectively assessed for signs of damage.

5 Apparatus

5.1 Method A

5.1.1 Flexing machine. See [Figure 1](#).

5.1.1.1 A means of firmly clamping any type of footwear at the heel and toe. A number of toe clamps will be necessary to ensure all sizes of footwear can be clamped securely.



Key

- 1 flexing angle indicator
- 2 front holding clamp
- 3 rear holding clamp
- 4 shoe platform
- 5 flexing axis
- 6 test piece (whole shoe)

Figure 1 — Flexing machine (method A)

5.1.1.2 A system of flexing the footwear about its flexing line at a rate of (140 ± 10) cycles per minute through a range of flexing angles.

5.1.1.3 A means of recording either the number of flexes or the duration of the test providing the speed of the machine is constant and known.

5.1.2 Vernier callipers, to an accuracy of better than 0,02 mm.

5.2 Method B

5.2.1 Flexing machine. See [Figure 2](#).

5.2.1.1 The flexing angle can be adjusted between 0° to 55°, see [Figure 2](#).

5.2.1.2 The flexing frequency can be adjusted between 100 cycles to 300 cycles per minute.

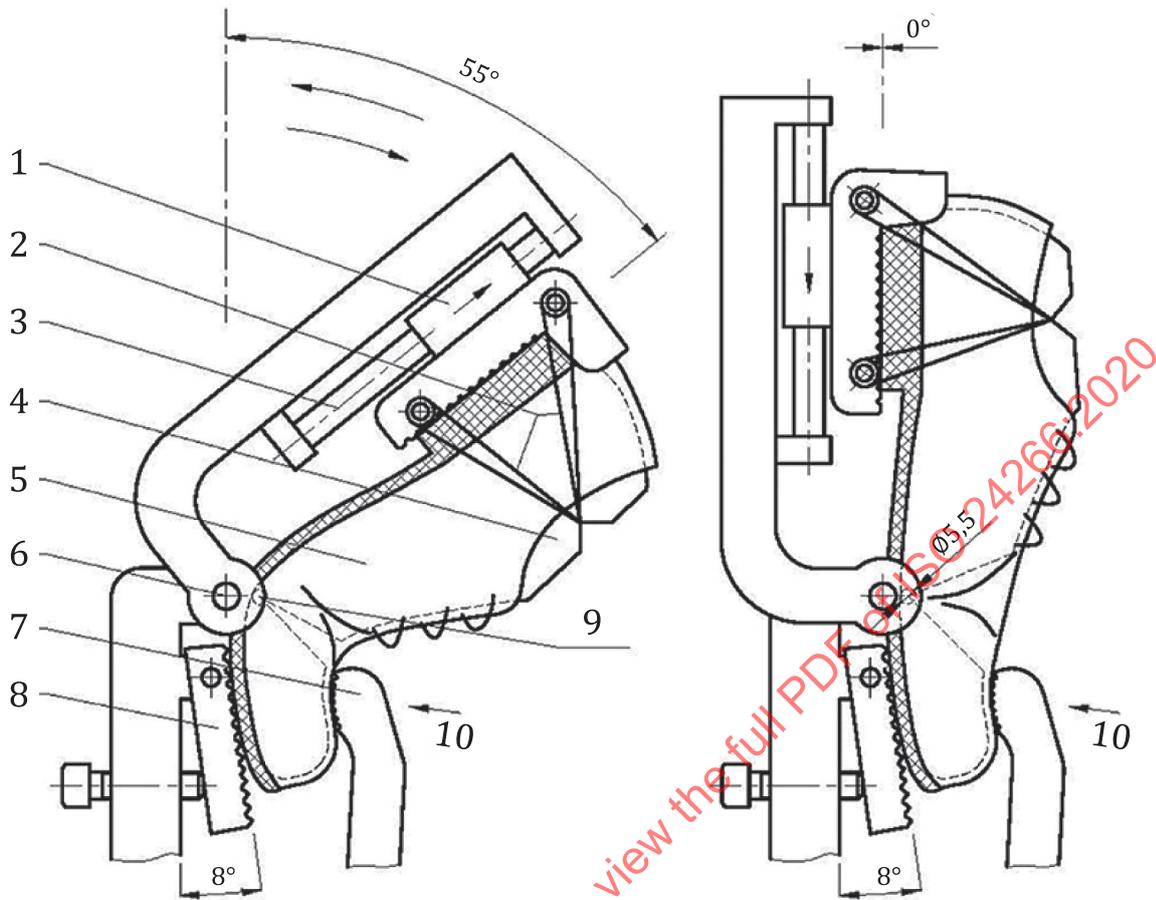
5.2.1.3 Sample holder shall be able to fasten the sample firmly to ensure it will not loosen during test. The inclination angle of sample holder is adjustable to make sure test sample can be under normal condition without flex in any directions when the machine is at the minimum flex angle.

5.2.1.4 A means of stopping the machine automatically after the specified flexing cycles.

5.2.1.5 A means of blasting air to the flexing area of sample to prevent overheating.

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Dimensions in millimetres



Key

- 1 slider
- 2 strings used to fix the back of the sample
- 3 slide rail
- 4 flexing last
- 5 sample (whole shoe)
- 6 flexing central axis
- 7 front part of the clamp
- 8 adjustable backer
- 9 flexing axis of the last
- 10 sample holder

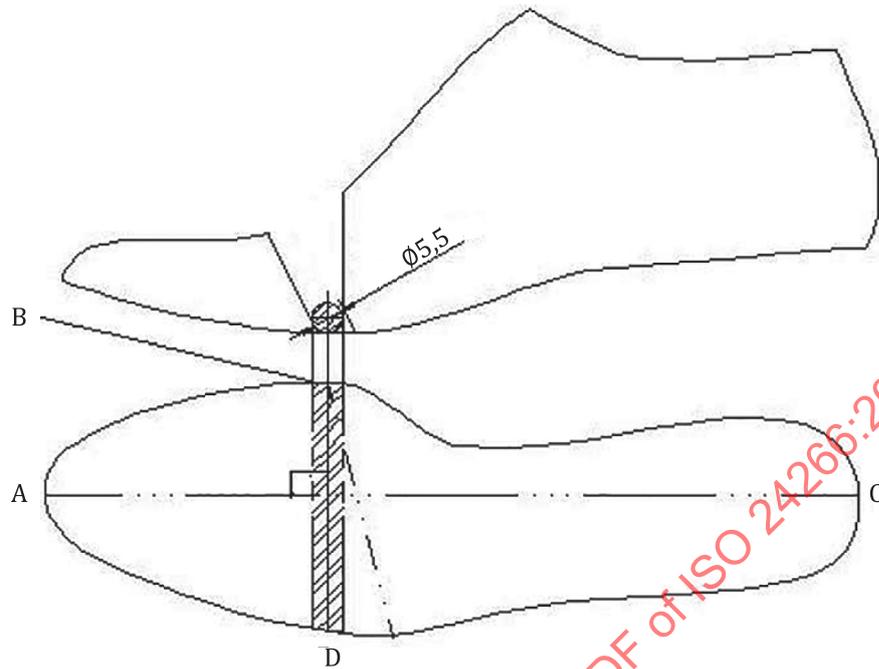
Figure 2 — Flexing machine (method B)

5.2.2 Flexing last

5.2.2.1 Steel axis in the bottom of the last should be fixed in a way that the last flexing at the joint position and the bottom of the last should be smooth when the last keeps at normal and flexing position (see [Figure 3](#)), a size of $\varnothing 5,5 \text{ mm} \times 40 \text{ mm}$ is commonly used.

5.2.2.2 The maximum flexible angle of the flexing last is no less than 50° .

Dimensions in millimetres

**Key**

- AC central line
 B ball point at the medial points of the last
 BD steel axis

Figure 3 — Flexing last

5.2.3 Vernier callipers, to an accuracy of better than 0,02 mm.

5.2.4 Cutting tool.

The cutting tool is shown in [Figure 4](#).

Means of firmly clamping the footwear is advisable to minimize the risk of breaking the cutting tool as it is withdrawn from the outsole.

6 Sampling and conditioning

6.1 Use at least one pair of whole shoes for each test.

6.2 Place all test pieces in a standard controlled atmosphere in accordance with ISO 18454 for at least 4 h prior to test. The test shall also be carried out under this controlled atmosphere.

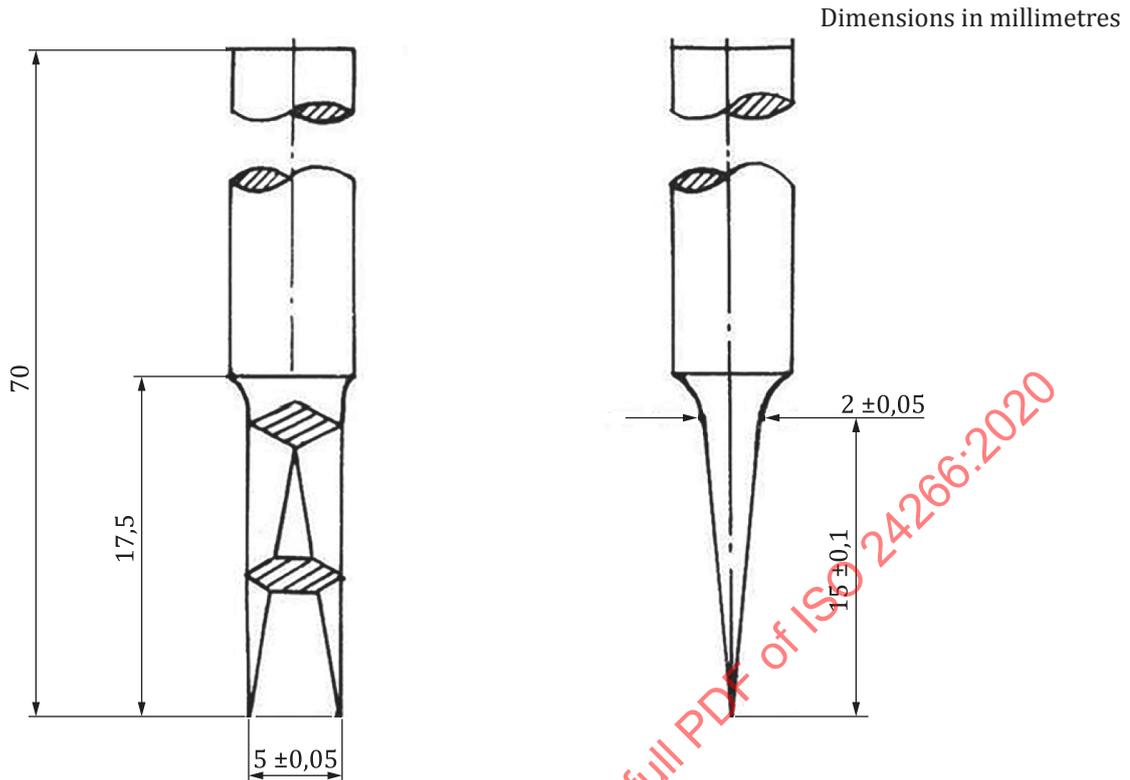


Figure 4 — Schematic diagram of cutting tool

7 Test method

7.1 Method A

7.1.1 Check the surface of shoes. Clean the surface of samples with gauze and ethanol if it is dirty.

7.1.2 Draw a line down the length of the footwear insole from the centre of the heel toward the centre of the toecap.

7.1.3 Mark point B on line A (see [Figure 5](#)). The distance from the centre of the heel to point B is given in [Table 1](#). This corresponds to the typical position of the metatarsophalangeal joint from the wearer's foot.

7.1.4 Mark a second point on the line drawn (5 ± 1) mm closer to the heel than the point marked as point B in [Figure 5](#).

7.1.5 Draw a line across the width of the insole passing through the second point and at 90° to the first line. This is the flexing line of the footwear (see [Figure 5](#)).

7.1.6 Set the flexing machine to the footwear through an angle of $(30 \pm 1)^\circ$ similar to that experienced during normal walking.

7.1.7 Secure the footwear in the machine to make the flexing line pass under the centre of both holes in the toe clamp (see [Figure 5](#)).

7.1.8 Operate the flexing machine. After approximately 500 cycles, check to assure that the footwear is still securely clamped. Run the machine again.

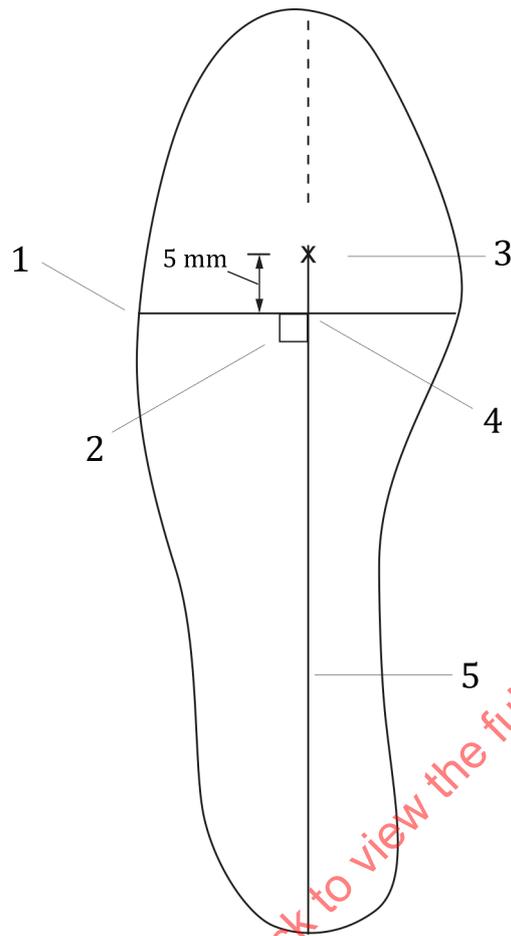
7.1.9 Conclude the test when the footwear has been subjected to a total of 50 000 flexing cycles (flexing speed of 140 cycles per minute).

NOTE Optional intermediate inspections are possible under customer request.

Different number of total cycles may be tested under customer request.

Table 1 — Average distance from the heel end of the insole to the metatarsophalangeal joint position of the foot

Mondopoint / EUR size	Heel/ball length on insole
	mm
125 / 20	82
130 / 21	87
135 / 22	92
/ 23	97
/ 24	102
155 / 25	107
160 / 26	112
165 / 27	116
/ 28	120
180 / 29	125
185 / 30	130
190 / 31	135
/ 32	139
205 / 33	143
/ 34	147
220 / 35	152
/ 36	157
/ 37	164
240 / 38	166
/ 39	172
/ 40	174
260 / 41	180
/ 42	184
/ 43	189
280 / 44	193
/ 45	197
/ 46	201
300 / 47	207



Key

- 1 flexing line
- 2 90° angle between the two lines
- 3 typical position of ball joint (point B)
- 4 second point (C)
- 5 line A

Figure 5 — Marked insole

7.2 Method B

7.2.1 Check the surface of shoes. Clean the surface of samples with gauze and ethanol if it is dirty.

7.2.2 Fix the corresponding flexing last (5.2.2) in the shoes, using preferably a last 5 mm smaller than the size of the sample.

7.2.3 Flex the sample, mark the flexing point at both sides of the shoe and draw a flexing line between the 2 points, along the sole.

7.2.4 Clamp the sample in the flexing machine (5.2.1) firmly. The flexing line, steel axis of flexing last and the axis of sample holder should be all aligned at the horizontal level.