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**Foot and leg protectors —  
Requirements and test methods for  
footwear component —**

**Part 2:  
Non-metallic toecaps**

*Protecteurs du pied et de la jambe — Exigences et méthodes d'essais  
pour les composants de chaussure —  
Partie 2: Embouts non métalliques*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 3, *Foot protection*.

A list of all parts in the ISO 22568 series can be found on the ISO website.

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](http://www.iso.org/members.html).

## Introduction

ISO 20345, ISO 20346 and ISO 20347<sup>[2]</sup> are related to safety, protective and occupational footwear which define the performance and required properties of the footwear. On introducing these standards all national standards relating to safety toecaps were withdrawn leaving the manufacturers of these items with no means of demonstrating the performance of their products. This document has been prepared to allow manufacturers to demonstrate the performance level of the toecaps before being inserted into the footwear.

Non-metallic toecaps complying with the requirements of this document are suitable components of “PPE footwear”.

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# Foot and leg protectors — Requirements and test methods for footwear component —

## Part 2: Non-metallic toecaps

### 1 Scope

This document specifies requirements and test methods for non-metallic toecaps, intended to function as components of PPE footwear (e.g. as described by ISO 20345 and ISO 20346).

### 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 20345, *Personal protective equipment — Safety footwear*

ISO 20346, *Personal protective equipment — Protective footwear*

ISO 22568-1:2019, *Foot and leg protectors — Requirements and test methods for footwear component assessment — Part 1: Metallic toecaps*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20345, ISO 20346 and the following 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

##### **internal non-metallic toecap**

toecap produced from material other than metal and intended to be incorporated underneath the upper of footwear intended to provide protection against mechanical impact and compression

Note 1 to entry: External toecaps were used in the past, they are not used anymore and they are not covered by the present document.

### 4 Requirements for non-metallic toecaps

#### 4.1 General

This document defines two types of non-metallic toecaps (type A and type B) to cover the various types of footwear constructions.

For each of the required measurements performed in accordance with this document, a corresponding estimate of the uncertainty of measurement should be evaluated. One of the following approaches should be used:

- statistical method, e.g. that given in ISO 5725-2[1];
- mathematical method, e.g. that given in ISO/IEC Guide 98-3[3];
- uncertainty and conformity assessment as given in ISO/IEC Guide 98-4[4];
- JCGM 100:2008[5].

**Table 1 — Summary of requirements and number of samples**

Property	Sub clause	Number of samples
Finishing	<a href="#">4.2</a>	1 sample each size right and left
Internal length	<a href="#">4.3.1</a>	1 sample each size right and left
Width of flange	<a href="#">4.3.2</a>	1 sample each size right and left
Impact resistance	<a href="#">4.4</a>	1 sample each size right and left
Compression resistance	<a href="#">4.5</a>	1 sample each size right and left
Stability against ageing and environmental influence	<a href="#">4.6</a>	1 pair right and left for each treatment

NOTE 1 For details, see [4.2](#) to [4.6](#).

NOTE 2 The provisions of [4.2](#), [4.3](#), [4.4](#), [4.5](#) and [4.6](#) do not exclude a non-metallic toecap design incorporating perforations.

## 4.2 Finishing

Non-metallic toecaps shall be finished so as to be free from surface marks or defects and shall be free from burrs and sharp edges and defects of splitting or delaminating between material layers.

## 4.3 Dimensions

### 4.3.1 Internal length

When measured in accordance with the method described in [5.2.1](#), the internal length of non-metallic toecaps shall be not less than the appropriate value given in [Table 2](#).

**Table 2 — Minimum internal length of non-metallic toecaps**

Non-metallic toe cap size	Minimum internal length mm
≤5	34
6	36
7	38
8	39
9	40
≥10	42

NOTE The above sizing system for toecaps is not identical to any sizing system for footwear.



#### 4.3.2 Width of flange

If non-metallic toecaps are formed with a flange, the inside width of the flange,  $e$ , shall be not greater than 15 mm using the test method given in 5.2.2.

#### 4.4 Impact resistance

When non-metallic toecaps are tested in accordance with the method described in 5.3 at an energy level of either  $(100 \pm 2)$  J (non-metallic toecaps intended for protective footwear), or  $(200 \pm 4)$  J (non-metallic toecaps intended for safety footwear), the clearance under the toecap at the moment of impact shall be not less than the appropriate value given in Table 3. In addition, the non-metallic toecap shall not develop sharp edges or any cracks passing through the material (i.e. through which light can be seen) or delamination. During the assessment of the non-metallic toecap designed with perforations the criteria whether light can be seen shall not be applied to the perforations.

**Table 3 — Minimum clearance under non-metallic toecaps at impact and compression**

Non-metallic toecap number	Internal non-metallic toecap minimum clearance Type A	Internal non-metallic toecap minimum clearance Type B
	mm	mm
$\leq 5$	19,5	23,5
6	20,0	24,0
7	20,5	24,5
8	21,0	25,0
9	21,5	25,5
$\geq 10$	22,0	26,0

NOTE The above sizing system for toecaps is not identical to any sizing system for footwear.

#### 4.5 Compression resistance

When non-metallic toecaps are tested in accordance with the method described in 5.4, the clearance under the non-metallic toecap at a compression load of either  $(10 \pm 0,1)$  kN (non-metallic toecaps intended for protective footwear) or  $(15 \pm 0,15)$  kN (non-metallic toecaps intended for safety footwear) shall not be less than the appropriate value given in Table 3. In addition, the non-metallic toecap shall not develop sharp edges or any cracks passing through the material (i.e. through which light can be seen) or delamination. During the assessment of the non-metallic toecap designed with perforations the criteria whether light can be seen shall not be applied to the perforations.

#### 4.6 Stability against ageing and environmental influence

When non-metallic toecaps are subject to each single one of the treatments described in 5.5 and thereafter tested in accordance with the method described in 5.3 at an energy level of either  $(100 \pm 2)$  J (toecaps intended for protective footwear) or  $(200 \pm 4)$  J (toecaps intended for safety footwear), the clearance under the toecap at the moment of impact shall be not less than the appropriate value given in Table 3. In addition, the non-metallic toecap shall not develop sharp edges or any cracks passing through the material (i.e. through which light can be seen) or delamination. During the assessment of the non-metallic toecap designed with perforations the criteria whether light can be seen shall not be applied to the holes.

### 5 Test methods for non-metallic toecaps

#### 5.1 General

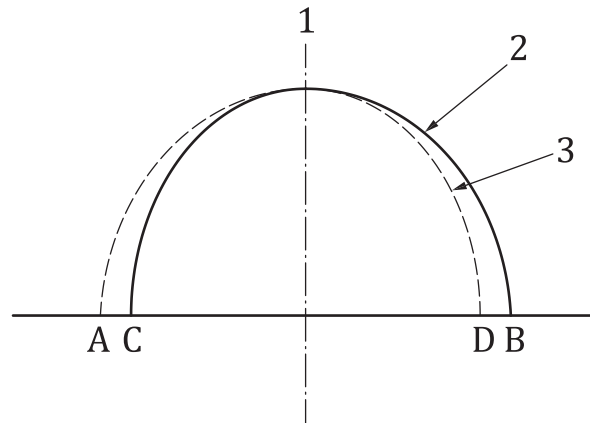
One pair of samples of each size shall be tested. Exceptions are made for some properties, as specified in Table 1.

**5.2 Determination of dimensions**

**5.2.1 Determination of internal non-metallic toecap length**

**5.2.1.1 Determination of the test axis**

Position the left non-metallic toecap with its rear edge in line with a base line and draw its outline. Repeat the exercise with the right non-metallic toecap of the pair, positioning it at the same base line in such a manner that the outlines at the toe end of the non-metallic toecaps coincide (see [Figure 1](#)).



**Key**

- 1 test axis
- 2 right toecap
- 3 left toecap

A, B, C, D points where the outlines of the right and left non-metallic toecaps intersect on the base line

**Figure 1 — Determination of test axis (schematic illustration)**

Mark the four points A, B, C and D where the outlines of the right and left non-metallic toecaps intersect on the base line. Construct the perpendicular from the base line at the midpoint of AB or CD. This constitutes the test axis of both non-metallic toecaps.

**5.2.1.2 Procedure**

Place the non-metallic toecap, open side down, on a flat surface. With an appropriate gauge, measure the internal length  $l$ , along the test axis from the front inside to the vertical projection of the back edge between 3 mm and 10 mm above and parallel to the surface upon which the non-metallic toecap rests, taking the longest distance as the length,  $l$  (see [Figure 2](#)).

**5.2.2 Width of flange**

Determine the inside width of the flange,  $e$ , as shown in [Figure 3](#).