International Standard

ISO 11999-6

Second edition
2024-08

PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures —

Part 6: Footwear

Équipement de protection individuelle pour pompiers — Méthodes d'essai et exigences pour les équipements de protection individuelle utilisés par les pompiers qui risquent d'être exposés à des niveaux élevés de chaleur et/ou de flamme lorsqu'ils combattent des incendies dans des structures —

Partie 6: Chaussures

Reference number
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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 document 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 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 14, *Firefighters' personal equipment*.

This second edition of ISO 11999-6 cancels and replaces the first edition (ISO 11999-6:2016), which has been technically revised.

The main changes are as follows:

— Level A1 and A2 deleted to provide a single level of performance;

— insertion of updated ISO 20345:2021/Amd 1:2024 references;

— references to ISO 20344:2011 and ISO 20345:2011 have been deleted;

— chemical resistant footwear requirements and method updated.

— flame resistance requirements and method updated.

— insulation against Heat requirements updated.

— Tables 2 and 3 have been updated.

A list of all parts in the ISO 11999 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.

PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures —

Part 6: Footwear

1 Scope

This document specifies the minimum design and performance requirements for footwear as part of personal protective equipment [PPE] to be used by firefighters, primarily but not solely to protect against flame and high thermal loads while fighting fires occurring in structures.

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 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 6942:2022, *Protective clothing — Protection against heat and fire — Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat*

ISO 15025, *Protective clothing — Protection against flame — Method of test for limited flame spread*

ISO 11999-1, *PPE for firefighters — Test methods and requirements for PPE used by firefighters who are at risk of exposure to high levels of heat and/or flame while fighting fires occurring in structures — Part 1: General*

ISO 20344:2021, *Personal protective equipment — Test methods for footwear*

ISO 20344:2021/Amd 1:2024, *Personal protective equipment — Test methods for footwear — Amendment 1*

ISO 20345:2021, *Personal protective equipment — Safety footwear*

ISO 20345:2021/Amd 1:2024, *Personal protective equipment — Safety footwear — Amendment 1*

EN 13832-1:2018, *Footwear protecting against chemicals — Part 1: Terminology and test methods*

EN 13832-3:2018, *Footwear protecting against chemicals — Part 3: Requirements for footwear highly resistant to chemicals under laboratory conditions*

ISO 13994, *Clothing for protection against liquid chemicals — Determination of the resistance of protective clothing materials to penetration by liquids under pressure*

EN 50321-1:2018, *Live Working – Footwear for Electrical protection – Insulating footwear and overboots*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20344, ISO 11999-1 and EN 13832-1 apply.

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

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

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

4 Classification, design and performance level

4.1 Classification

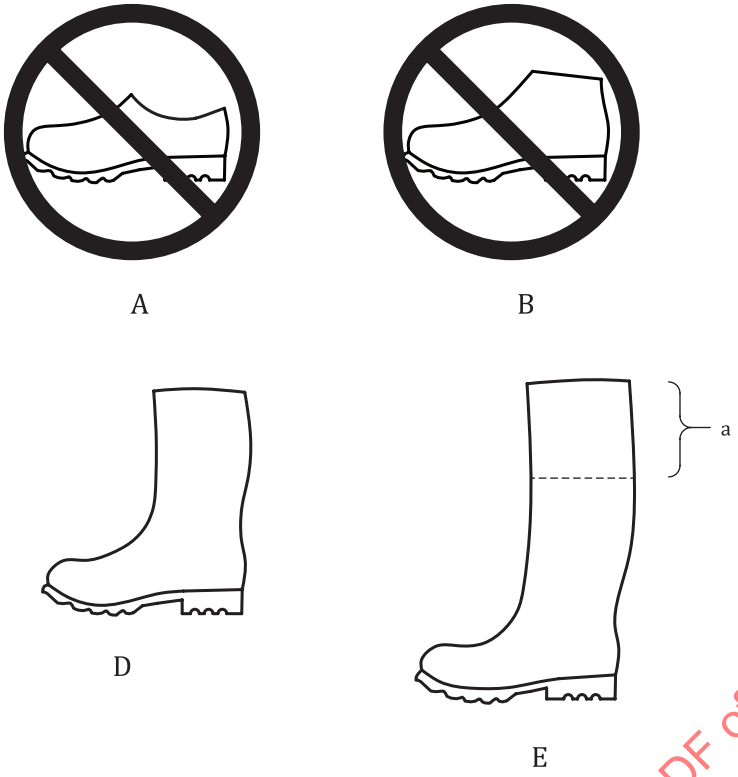
Footwear shall be classified in accordance with Table 1.

Table 1 — Classification of footwear

Classification	Description
Class I	Footwear made from leather and other materials, excluding all-rubber or all-polymeric footwear
Class II	All-polymeric (i.e. entirely moulded) including all-rubber (i.e. entirely vulcanized) footwear

4.2 Design

Footwear shall conform to one of the designs C to E given in Figure 1.



Key

A	low shoe
B	ankle boot
C	half-knee boot
D	knee-height boot
E	thigh boot
a	Variable extension which can be adapted to the wearer.

NOTE Design E can be a knee-height boot (design D) equipped with a thin impermeable material which extends the upper and which can be cut to adapt the boot to the wearer.

Figure 1 — Design of footwear

4.3 Innocuousness

Refer to ISO 20345:2021 and ISO 20345:2021/Amd 1:2024, 5.3.6.

4.4 Sizing

Manufacturers shall develop a sizing range of footwear based on anthropometric data.

5 Sampling and conditioning

5.1 Sampling

The minimum number of samples shall be that specified in ISO 20344:2021 and ISO 20344:2021/Amd 1:2024, Clause 4, together with the minimum number of test pieces taken from each sample, as given in Table 2, unless otherwise stated within this standard.

Wherever possible, test pieces shall be taken from the whole footwear unless otherwise stated in this document or in ISO 20344.

If it is not possible to obtain a large enough test piece from the footwear, then a sample of the material or material combination from which the component has been manufactured can be used instead and this shall be noted in the test report.

Where samples are required from each of three sizes, these shall comprise of the largest, smallest and a middle size of the footwear under test.

5.2 Conditioning

All test pieces shall be conditioned in a standard atmosphere of (23 ± 2) °C and (50 ± 5) % relative humidity for a minimum of 24 hours before testing, unless otherwise stated in the test method.

The maximum time which shall elapse between removal from the conditioning atmosphere and the start of testing shall be not greater than 10 min, unless otherwise stated in the test method.

Each test piece shall individually satisfy the specific requirement, unless otherwise stated in the test method.

The uncertainty of measurement for each test method described in the present standard can be assessed. One of the following approaches should be used:

— a statistical method, e.g. as given in ISO 5725-2;

— a mathematical method, e.g. as given in ISO/IEC Guide 98-1;

— Uncertainty and conformity assessments given in ISO/IEC Guide 98-4;

— JCGM 100:2008.

Table 2 — Minimum number of samples and test pieces

Property to be determined[a]	Reference	Number of samples	Number of test pieces from each sample	Test only on the final footwear
Insulation against heat	6.2.1	one pair	See 7.1	Yes
Radiant heat	6.2.2	one pair	See 7.2	Yes
Flame resistance	6.2.3	one pair	See 7.3	Yes
Scuff cap abrasion	ISO 20345:2021 6.2.9	one scuff cap	Two test pieces	No
Zipper puller attachment strength	6.7.2	three zippers		No
Zipper lateral strength	6.7.3	three zippers		No
[a] ISO 20344:2021 and ISO 20344:2021/Amd 1:2024, Table 1, applies.				

6 Requirements

6.1 General requirement

Footwear for firefighters shall conform to the requirements specified in Table 3.

Customized safety footwear shall conform to the requirements given in ISO 20345:2021, Table 3 and Annex A.

Table 3 — General requirement

Requirement			Reference		Classification of footwear		Marking symbol
			ISO 20345:2021 and ISO 20345:2021/Amd 1:2024	This document	Class I	Class II	
General	Footwear construction	Type and classification		4.1	a	a	
		Height of upper	5.2.2		a	a	
		Specific ergonomic feature	5.3.4		a	a	
		Leakproofness	5.3.3		N/A	a	
		Water resistance		6.5	a	N/A	WR
	Heel Area	Design C, D and E	5.2.3		a	a	
Whole footwear	Constructional performance	Construction	5.3.1.1		a	N/A	
		Upper/outsole bond strength	5.3.1.2		a	N/A	
		Insulation against heat		6.2.1	a	a	
		Slip resistance	5.3.5.2 6.2.10		a	a	See Annex D
		Energy absorption of seat region	6.2.4		a	a	E
		Flame resistance		6.2.3	a	a	
		Perforation resistance	6.2.1		a	a	P PL PS
	Toe protection	General	5.3.2.1		a	a	
		Internal length of toe caps	5.3.2.2		a	a	
		Width of Toecap Flange	5.3.2.3		a	a	
		Impact resistance	5.3.2.6		a	a	
		Compression resistance	5.3.2.7		a	a	
		Corrosion resistance of metal toe caps	5.3.2.4		a	a	
		Behaviour of Toecaps (Thermal and Chemical)	5.3.2.5		a	a	
	Electrical property	Electrically insulating footwear[d]		6.4.2	N/A	a	EN 50321 -1 : 2018
		Antistatic footwear[d]		6.4.3	a	N/A	A
	Resistance to inimical environment	Cold insulation of sole complex	6.2.3.2		c	c	CI
		Resistance to chemicals		6.3.1/6.3.2	N/A	c	CH
				6.3.3	c	N/A	CH

The applicability of requirement to a particular classification is indicated in this table by the following:

[a] Means that the requirement shall be met. In some cases, the requirement relates only to particular materials within the classification,. This does not mean that other materials are precluded from use.

[b] Means that if the component parts exists, the requirement shall be met.

[c] Means that if the property is claimed, the requirement given in the appropriate clause shall be met.

[d] One of the Two shall be chosen

N/A means the requirement is not applicable.

Table 3 *(continued)*

Requirement			Reference		Classification of footwear		Marking symbol
			ISO 20345:2021 and ISO 20345:2021/Amd 1:2024	This document	Class I	Class II	
	Accessories	Zipper		6.7	b	b	
		Metatarsal protection	6.2.6		c	c	M
		Ankle protection	6.2.7		c	c	AN
		Innocuousness	5.3.6		a	a	
Requirement							
Upper		Thickness	5.4.2		N/A	a	
		Tear strength	5.4.3		a	N/A	
		Tensile properties	5.4.4		a	a	
		Flexing resistance	5.4.5		N/A	a	
		Water vapour permeability &coefficient	5.4.6		a	N/A	
		Hydrolysis	5.4.7		N/A	a	
		Water penetration Water absorption	6.3.1		a	N/A	WPA
		Radiant heat		6.2.2	a	a	
		Flame resistance		6.2.3	a	a	
		Cut resistance	6.2.8		c	c	CR
		Scuff cap abrasion	6.2.9		b	b	SC
Lining	Vamp	Tear strength	5.5.2		a	N/A	
		Abrasion resistance	5.5.3		a	N/A	
		Water vapour permeability &coefficient	5.5.4		a	N/A	
	Quarter	Tear strength	5.5.2		b	N/A	
		Abrasion resistance	5.5.3		b	N/A	
		Water vapour permeability &coefficient	5.5.4		b	N/A	
Tongue		Tear strength	5.6.2		b	N/A	
Insole/insocks				See Table 4	a	b	
Outsole		Tear strength	5.8.3		a	a	
		Abrasion resistance	5.8.4		a	a	
		Flexing resistance	5.8.5		a	a	
		Hydrolysis	5.8.6		a	a	
		Interlayer bond strength	5.8.7		b	b	
		Resistance to fuel oil	6.4.2		a	a	
		Cleated area	5.8.2.2		a	a	
		Thickness	5.8.2.1		a	a	
		Cleat design		6.6.1	a	a	

The applicability of requirement to a particular classification is indicated in this table by the following:

[a] Means that the requirement shall be met. In some cases, the requirement relates only to particular materials within the classification,. This does not mean that other materials are precluded from use.

[b] Means that if the component parts exists, the requirement shall be met.

[c] Means that if the property is claimed, the requirement given in the appropriate clause shall be met.

[d] One of the Two shall be chosen

N/A means the requirement is not applicable.

Table 3 *(continued)*

Requirement		Reference		Classification of footwear		Marking symbol
		ISO 20345:2021 and ISO 20345:2021/Amd 1:2024	This document	Class I	Class II	
	Cleat height		6.6.2	a	a	
	Cleat height in the waist area		6.6.3	a	a	
	Heel breast		6.6.4	a	a	LG
	Resistance to hot contact	6.4.1		a	a	

The applicability of requirement to a particular classification is indicated in this table by the following:

[a] Means that the requirement shall be met. In some cases, the requirement relates only to particular materials within the classification. This does not mean that other materials are precluded from use.

[b] Means that if the component parts exists, the requirement shall be met.

[c] Means that if the property is claimed, the requirement given in the appropriate clause shall be met.

[d] One of the Two shall be chosen

N/A means the requirement is not applicable.

Table 4 — Basic requirements for insoles and/or insocks

Options			Component to be assessed	Requirements to fulfill in ISO 20345:2021/Amd 1:2024			
				Thickness	Water absorption desorption	Abrasion	
						Insole	Insock
1	No insole or if present not fulfilling the requirements	Non-removable insock	Insock	a	a	N/A	a
2	Insole present	No insock	Insole	a	a	a	N/A
		Seat sock present	Seat sock	N/A	N/A	N/A	a
3		Full insock, non-removable	Insock and insole	a	a	N/A	N/A
			Insock	N/A	N/A	N/A	a
4		Full insock, removable and water permeable	Insole	a	a	a	N/A
			Insock	N/A	N/A	N/A	a
5		Full insock removable not water permeable	Insole	a	a	a	N/A
			Insock	N/A	a	N/A	a

NOTE 1 For removable insocks, see 9.4.

[a] Means that the requirement shall be met.

N/A means the requirement is not applicable.

6.2 Thermal behaviour

6.2.1 Insulation against heat

When tested in accordance with the method described in 7.1, the footwear shall meet the respective requirements for performance in Table 5 and Table 6.

Table 5 — Insulation against heat: requirements for the temperature inside the footwear

Level of performance for each requirements	Performance requirement
Sand bath temperature (°C)	$250\ (^{+5}_{0})$
Inside temperature of the footwear (°C)	<42 after $(10\ ^{+0,5}_{0})$ min

Table 6 — Insulation against heat: requirements for footwear degradation

Level of performance for each requirements	Performance requirement
Sand bath temperature (°C)	$250\ (^{+5}_{0})$
Total duration of the test	$40\ (^{+0,5}_{0})$ min
Assessment	After testing, the footwear shall conform to A.2.1.

6.2.2 Radiant heat

When tested in accordance with the method described in 7.2, the temperature increase for each material combination (final temperature T' – initial temperature T_1) shall be equal or less than 24 °C. After testing, the footwear shall conform to A.2.2.

6.2.3 Flame resistance

When tested in accordance with the method described in 7.3, the footwear shall neither flame for more than 2 s (after-flame time) nor glow more than 2 s (after-glow time). After testing, the footwear shall conform to A.2.3.

6.3 Resistance to chemicals

6.3.1 Degradation resistance

When tested in accordance with EN 13832-3:2018, 6.2.1.2, footwear with resistance to chemicals shall meet the degradation requirement with at least three chemicals. Other chemicals can be used additionally according to the intended use.

The sole and upper shall both be tested with the same chemicals. After degradation, the test pieces shall be tested according to EN 13832-3:2018, Table 8.

Samples that are too strongly affected by the degradation test do not need to be tested and shall be considered to fail the test. For example, when the test pieces

— have holes,

— are swollen and distorted, or

— become brittle.

6.3.2 Permeation resistance

When tested in accordance with EN 13832-3:2018, 6.2.1.2, footwear uppers shall achieve a permeation resistance at or above 121 min with at least three of the chemicals. The same chemicals as used in 6.3.1 shall be used.

6.3.3 Resistance to limited contact with chemicals

Tested according to ISO 13994, procedure C1, Class I footwear uppers, upper seams and vamp seams shall show no penetration of the following liquids for (60 ± 5) min:

a) 40 % sodium hydroxide (NaOH) at (20 ± 2) °C;

b) 36 % hydrochloric acid (HCl) at (20 ± 2) °C;

c) 37 % sulfuric acid (H_2SO_4) at (20 ± 2) °C;

d) 100 % *o*-xylene at (20 ± 2) °C.

This requirement does not preclude footwear being tested against additional chemicals to those stipulated within this document. Any additional chemicals tested against shall be tested under the same conditions and reported in the same way as this standard specifies.

6.4 Electrical properties

6.4.1 General

Electrical properties shall conform to either 6.4.2 or 6.4.3.

6.4.2 Electrically insulating footwear

Electrically insulating Class II footwear shall fulfil the requirements given in EN 50321-1:2018

Footwear shall conform to Class 0 or Class 00.

6.4.3 Antistatic footwear

Footwear shall conform to all the requirements given in ISO 20345:2021, 6.2.2.2

6.5 Water resistance

When tested in accordance with ISO 20344:2021 and ISO 20344:2021/Amd 1:2024, 5.18 or 5.19, no water penetration inside the footwear shall be detected.

6.6 Outsole

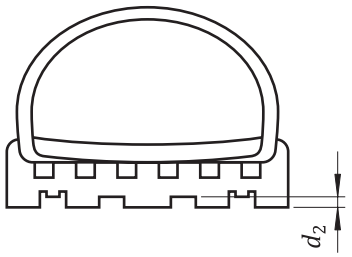
6.6.1 Cleat design

The cleat design (excluding waist area) shall be such that there are no continuous linear transverse valleys across the sole.

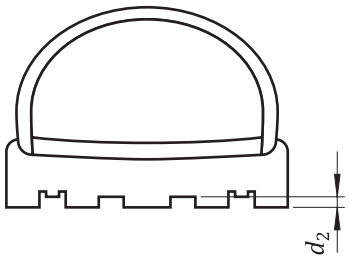
6.6.2 Cleat height

When tested in accordance with ISO 20344:2021, 8.2.3, the cleat height d_2 shall be not less than 3 mm.

NOTE For the measurement site of d_2, it is described in Figure 2.



a) Cemented construction (cleated)



b) Direct vulcanised or injected (cleated)

Figure 2 — Cleat height of direct injected, vulcanised and cemented outsole

6.6.3 Cleat height in the waist area

The outsole shall have transverse cleat with a height of at least 1,5 mm in the waist area (see Figure 3).

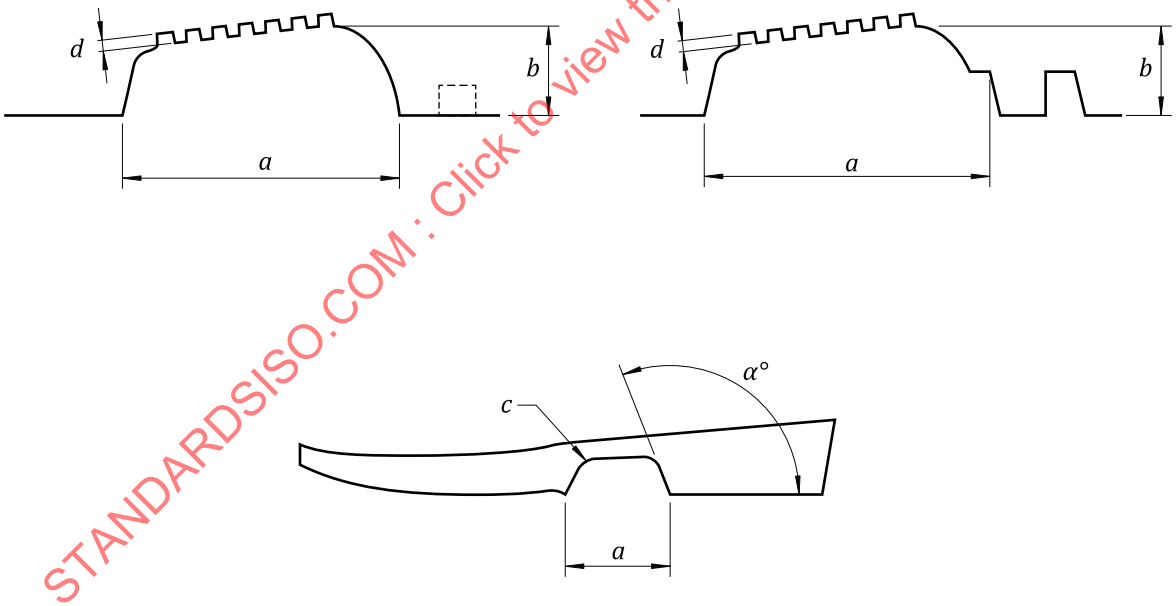
6.6.4 Heel breast

The outsole shall have an inclined-breast heel. Distance “a”

a) (the waist area) shall be at least 35 mm,

b) angle α shall be between 90°and 120° and dimension;

c) “b” shall be at least 10 mm (see Figure 3).



a Waist area.

b Heel breast.

c Cleat profile.

d Cleat height in the waist area.

NOTE Design is an example, only the dimensions are requirements.

Figure 3 — Outsole dimensions

6.7 Zipper (slide fastener)

6.7.1 Zipper construction

The zipper, if present shall have an interlocking mechanism.

6.7.2 Zipper puller attachment strength

When tested in accordance with the methods described in 7.4.1, each recorded value of the attachment strength of puller shall be greater than 250 N.

6.7.3 Zipper lateral strength

When tested in accordance with the methods described in 7.4.2, each recorded value of the lateral strength shall be greater than 500 N.

7 Test methods

7.1 Insulation against heat

The test shall be conducted according to the procedure described in ISO 20344:2021 and ISO 20344:2021/Amd 1:2024, 5.15.

7.2 Radiant heat

Two test pieces shall be tested from all different material combinations including seams, label and any closing mechanism. Take the samples from the upper of at least one pair of footwear.

If it is not possible to obtain a large enough test piece from the footwear, then a sample of the material or material combination from which the component has been manufactured can be used instead and this should be noted in the report. This test piece shall include the same arrangement of layers, e.g. padding and lining, as found in footwear.

Test the test pieces according to ISO 6942:2022, method B with the following deviation:

— Heat flux density of 20 kW/m^2

— The outer surface shall be exposed to radiant heat for (40 ± 1) s

7.3 Flame resistance test

7.3.1 Conditioning and sampling

All different external materials, including external seams, labels and closing mechanisms, as provided, as a complete sample of footwear shall be tested in accordance with ISO 15025 as modified in 7.3.2.

7.3.2 Procedure

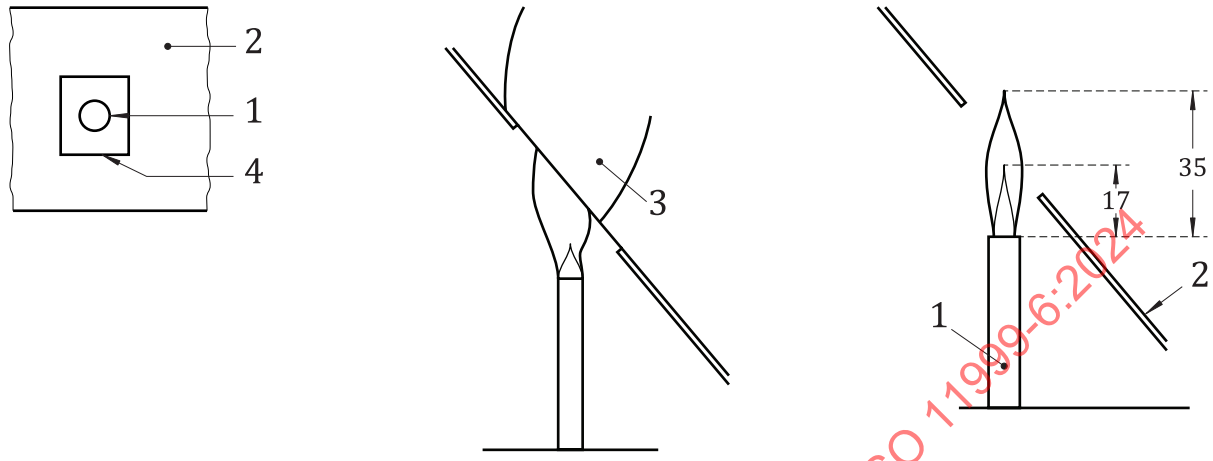
7.3.2.1 Test the complete footwear as provided.

7.3.2.2 A simple clamp commonly used for holding test tubes on a metal stand or a sample carrier can be used to hold the footwear.

7.3.2.3 The sample carrier has a square flame application aperture size of [(50 × 50) ± 1] mm (see Figure 4 a).

7.3.2.4 The angle between the sample area to be tested and the horizontal plane is (45 ± 5)° (see Figure 4 b)

7.3.2.5 Clamp the part of the footwear to be tested so that the minimum distance from the top of the burner to the footwear surface is (17 ± 1) mm (see Figure 4 c). The flame shall strike the footwear in an upward direction (see Figure 4 b).



a) Plan view **b) During the test** **c) Before the test**

Key

1 burner
2 sample carrier
3 footwear being tested
4 flame application aperture

Figure 4 — Equipment for flame resistance tests

7.3.2.6 Move the burner away from the sample and ignite the burner and preheat it for 2 min and adjust the flame height in accordance with ISO 15025.

7.3.2.7 Reposition the burner as in 7.3.2.3, 7.3.2.4 and 7.3.2.5 and apply the flame for (10 ± 1) s to the designated area.

7.3.2.8 Remove the flame and measure any after-flame and/or after-glow as defined in ISO 15025.

7.3.2.9 Repeat procedures 7.3.2.3 to 7.3.2.7 for at least one test piece of each different external material used in the construction of the footwear, external seams and closing mechanism.

7.4 Zipper

7.4.1 Puller attachment strength

7.4.1.1 Principle

The puller is subjected to tension whilst the slider is rigidly supported.

7.4.1.2 Apparatus

Tensile machine which produces a constant rate of jaw separation of (100 ± 20) mm/min and a plate to mask the slider so that tension is confined to the puller and its attachment to the slider.

7.4.1.3 Procedure

Mount the slider in the lower jaw of the tensile machine with the puller passed through the masking plate. Clearing the end of the puller in the upper jaw of tester so that tension is applied perpendicular to the slider, set the testing machine in use until failure occurs. Record the maximum force to cause failure. Three test pieces shall be tested and the results recorded.

7.4.2 Lateral strength

7.4.2.1 Principle

The zipper is subject to a lateral force to measure the resistance of the closed zip to opening. The force required to cause failure of the zipper is measured.

7.4.2.2 Apparatus

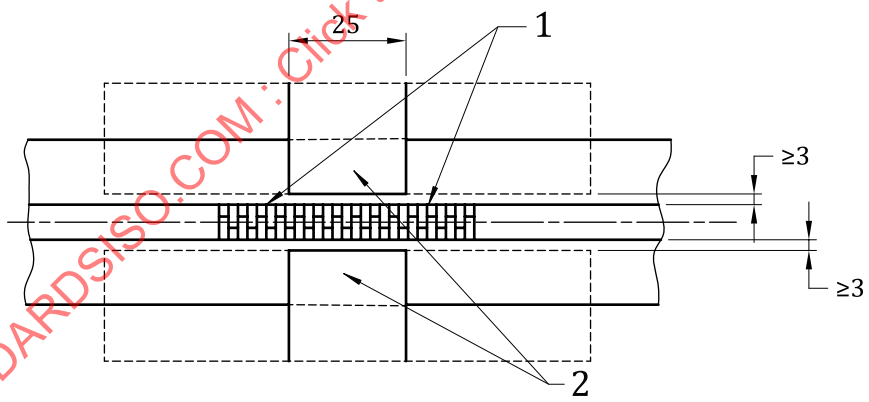
7.4.2.2.1 Tensile machine, with a jaw separation rate of (100 ± 20) mm/min having a facility to record the force throughout the test and gripping jaws of 25 mm wide, constructed and finished so as not to damage the tape of the zipper.

7.4.2.2.2 Test pieces.

Three test pieces with a minimum length of closed chain for each test of 75 mm. No more than one test piece shall be taken from a single zipper.

7.4.2.3 Procedure

Clamp the test piece in the jaws of the testing machine so that there is at least 25 mm of closed chain either side of the jaw. The jaw shall be positioned 3 mm from the chain. Figure 5 shows the arrangement. Set the machine in the operation and measure the force to induce failure. Three test pieces shall be tested and the results recorded.



Key

1 at least 25 mm of closed chain either side of the jaws

2 clamps

Figure 5 — Zipper test (example)

8 Marking

Each item of footwear for firefighters shall be clearly and permanently marked, for example, by embossing or branding, with the following:

a) size;

b) manufacturer's identification mark;

c) manufacturer's type designation;

d) at least year and month of manufacture;

e) number and year of this document, i.e. ISO 11999:—;

f) marking symbol(s) from Table 3 appropriate to the protection provided which is not covered by the symbol(s) of the pictogram (see Figure 6);

g) pictogram shown in Figure 6, at a size of at least 30 mm × 30 mm, attached in a visible position on the outside of the Left and Right footwear.

NOTE Other letter markings relating to other standards could be present in the bottom right hand corner of the pictogram.

Figure 6 — Symbol ISO 7000:2019 - 2418

Footwear protecting against chemicals shall be supplied to the customer with additional necessary information. The following information shall be given in the marking.

a) The use of the "operating instructions" symbol is mandatory and shall be as in Figure 7.

b) The use of the "protection against chemicals" symbol is mandatory and shall be as in Figure 8. The letter codes of the tested chemicals shall be listed directly under the symbol.

NOTE If the footwear fulfils all the requirements of ISO 20345, this standard can be marked on the product in addition to this document.

Figure 7 — Symbol ISO 7000:2019 - 1641

Figure 8 — Symbol ISO 7000:2019 - 2414

9 Information to be supplied

9.1 General

Footwear for firefighters shall be supplied to the customer with information written at least in the official language(s) of the state/country of destination. All information shall be unambiguous. The following information shall be given:

a) name and full address of the manufacturer and/or the manufacturer's authorized representative;

b) a reference to this document, i.e. ISO 11999:—;

c) explanation of any graphical symbol (pictogram) and markings. A basic explanation of the test that have been applied to the footwear, if applicable;

d) instruction for use

   1) Inspection to be carried out by the wearer before use, if required;

   2) fitting, how to put on and take off the footwear, if relevant; (e.g. mechanical closing systems)

   3) application, basic information on possible uses and, where detailed information is available, the source;

   4) limitations of use (e.g. temperature range, contact with chemicals etc.);

   5) instructions for storage and maintenance, with maximum periods between maintenance checks (if important, drying procedures to be specified);

   6) instructions for cleaning and/or decontamination; obsolescence deadline or period of obsolescence according to ISO 20345:2021, 8.5 or manufacturer's instructions.

   7) if appropriate, warnings against problems likely to be encountered (modifications can invalidate the type approval, e.g. orthopaedic footwear);

   8) if helpful, additional illustrations, part numbers, etc.;

e) reference to accessories and spare parts, if relevant;

f) the type of packaging suitable for transport, if relevant;

g) information on electrical properties in accordance with 9.2 or 9.3;

h) information on insocks in accordance with 9.4;

i) information on chemical resistance of footwear in accordance with this part of ISO 11999, if applicable;

j) information on assessment of the state of footwear for the wearer, in accordance with Annex B.

   NOTE See Annex B for an example.

k) information on perforation resistance properties in accordance with ISO 20345:2021 and ISO 20345:2021/Amd 1:2024, 8.4, if applicable.

l) Information on slip resistance properties of the footwear in accordance with ISO 20345:2021, Annex D.

9.2 Antistatic footwear

Additional information shall be given regarding antistatic properties:

Antistatic footwear should be used if it is necessary to minimize electrostatic build-up by dissipating electrostatic charges, thus avoiding the risk of spark ignition of, for example, flammable substances and vapours, and if the risk of electric shock from mains voltage equipment cannot be completely eliminated from the workplace. Antistatic footwear introduces a resistance between the foot and ground but may

not offer complete protection. Antistatic footwear is not suitable for work on live electric installations. It should be noted, however, that antistatic footwear cannot guarantee adequate protection against electric shock from a static discharge as it only introduces a resistance between foot and floor. If the risk of static discharge electric shock, has not been completely eliminated, additional measures to avoid the risk are essential. Such measures, as well as the additional tests mentioned below, should be a routine part of the accident prevention programme at the workplace.

Antistatic footwear will not provide protection against electric shock from AC or DC voltages. If the risk of being exposed to any AC or DC voltage exists, then electrical insulating footwear shall be used to protect from against serious injury.

The electrical resistance of antistatic footwear can be changed significantly by flexing, contamination or moisture. This footwear might not perform its intended function if worn in wet conditions.

Class I footwear can absorb moisture and can become conductive if worn for prolonged periods in moist and wet conditions. Class II footwear is resistant to moist and wet conditions and should be used if the risk of exposure exists.

If the footwear is worn in conditions where the soling material becomes contaminated, wearers should always check the antistatic properties of the footwear before entering a hazard area.

Where antistatic footwear is in use, the resistance of the flooring should be such that it does not invalidate the protection provided by the footwear."

It is recommended to use antistatic socks.

"It is therefore, necessary to ensure, that the combination of the footwear its wearers and their environment is capable, to fulfil the designed function of dissipating electrostatic charges, and of giving some protection during its entire life. Thus, it is recommended, that the user establish an in-house test for electrical resistance, which is carried out at regular and frequent intervals".

9.3 Electrically insulating footwear

Footwear with insulating properties provides limited protection against the inadvertent contact with damaged electrical apparatus and therefore each pair shall be supplied with a leaflet containing the following wording.

a) Electrically insulating footwear shall be worn if there is a danger of electric shock, for example, from damaged live electrical apparatus.

b) Electrically insulating footwear cannot guarantee 100 % protection from electric shock and additional measures to avoid this risk are essential. Such measures, as well as the additional tests mentioned below, should be part of a routine risk assessment program.

c) The electrical resistance of footwear should meet the requirements of EN 50321-1, at any time throughout the life of the footwear.

d) This level of protection can be affected during service by the footwear becoming damaged by nicks, cuts, abrasions, or chemical contamination. Regular inspections are necessary and worn or damaged footwear should not be used.

e) If footwear is worn in conditions where the soling material becomes contaminated, for example, by chemicals, caution should be taken when entering hazardous areas, as this can well affect the electrical properties of the footwear.

f) It is recommended that the users establish an appropriate means of having the electrical insulating properties of footwear inspected and tested whilst in service.

9.4 Insocks

If the footwear is supplied with a removable insock, it should be made clear in the leaflet that testing was carried out with the insock in place. A warning shall be given that the footwear shall only be used with the insock in place and that the insock shall only be replaced by a comparable insock supplied by the original footwear manufacturer or supplied by an insocks manufacturer which will supply insocks that fulfil the properties of this standard in combination with the foreseen safety footwear.

If the footwear is supplied without an insock, it should be made clear in the leaflet that testing was carried out with no insock present. A warning shall be given that only insocks that fulfil the properties of this standard in combination with the identified safety footwear can be fitted.

9.5 Information regarding perforation resistant insert

In accordance with ISO 20345:2021/Amd 1:2024, 8.4.

Each pair of perforation resistant footwear shall be supplied with a leaflet containing the following wording.

“The perforation resistance of this footwear has been measured in the laboratory using a standardized nails and forces. Nails of smaller diameter and higher static or dynamic loads will increase the risk of perforation occurring. In such circumstances, additional preventative measures should be considered. Three generic types of perforation resistant insert are currently available in PPE footwear. These are metal types and those from non-metal materials, which shall be chosen on basis of a job-related risk assessment. All types give protection against perforation risks, but each has different additional advantages or disadvantages including the following:

— Metal (e.g. S1P, S3) is less affected by the shape of the sharp object/hazard (i.e. diameter, geometry, sharpness) but due to shoemaking techniques may not cover the entire lower area of the foot.

— Non-metal (PS or PL or category e.g. S1P, S3L): May be lighter, more flexible and provide greater coverage area but the perforation resistance may vary more depending on the shape of the sharp object/hazard (i.e. diameter, geometry, sharpness)Two types in terms of the protection afforded are available. Type PS may offer more appropriate protection from smaller diameter objects than type PL.

For more information about the type of perforation resistant insert provided in your footwear, contact the manufacturer or supplier detailed on these instructions.”

Annex A
(normative)

Assessment of the footwear by the laboratory during testing for resistance to heat and flame

A.1 General

The following list and drawings are provided to assess the performance of footwear for firefighters tested for resistance to heat and flame in accordance with 7.1, 7.2 and 7.3.

A.2 Criteria for the assessment of the state of footwear

A.2.1 Insulation against heat

Footwear for firefighters shall be failed when tested in accordance with 7.1, if any of the signs of deterioration identified below are found:

— the outsole shows cracks greater than 10 mm long and 3 mm deep [Figure C.1 d)];

— upper/outsole separation of more than 15 mm long and 5 mm wide (deep) [Figure C.1 g)];

— pronounced deformation of the outsole still present when the footwear is at ambient temperature again. [Figure C.1 i)];

— Signs of outsole material melting

To assess any pronounced deformations, the ergonomic requirements of ISO 20344 shall be satisfied.

A.2.2 Radiant heat

Footwear for firefighters shall be failed when tested in accordance with 7.2, if any signs of wear identified below are found:

— beginning of pronounced and deep cracking affecting half of the sample material thickness [Figure C.1 a)];

— ignition and melting of the upper affecting more than half of the sample thickness (exception: melting of reflective material, label);

— the sample shows split seams [separation of components; Figure C.1 c)]

— the complete closing mechanism is no longer closed or cannot be opened easily (the footwear shall remain in place and the wearer shall be able to take off the footwear easily).

  — The closing mechanism is no longer functional

A.2.3 Flame resistance

Footwear for firefighters shall be failed when tested in accordance with 7.3, if any of the following signs of deterioration identified below are found:

— beginning of pronounced and deep cracking affecting half of the upper material thickness [Figure C.1 a)];

— ignition and melting of the upper affecting to more than half of the upper thickness;

— the upper shows split seams [separation of components; Figure C.1 c)];

— the outsole shows cracks of more than 10 mm long and 3 mm deep [Figure C.1 d)];

— upper/outsole separation of more than 15 mm long and 5 mm wide (deep); [Figure C.1 g)];

— the closing mechanism is no longer closed or cannot be opened easily.

Note References to Figure C.1 can be found in Annex C.-

Annex B
(informative)

Assessment of the footwear by the wearer

B.1 General

The following list and drawing can be provided to assist in assessing the performance of firefighting footwear.

B.2 Criteria for the assessment of the state of footwear

Footwear for firefighters should be assessed at regular intervals by inspection and should be replaced when any of the signs of wear identified below are found. Some of these criteria can vary according to the type of footwear and materials used:

— beginning of pronounced and deep cracking affecting half of the upper material thickness [Figure B.1 a)];

— Strong abrasion of the upper material, especially if the toe puff or toecap is revealed [Figure B.1 b)];

— The upper shows areas with deformations, burns, fusions, bubbles, or split seams in the leg [Figure B.1 c)];

— The outsole shows cracks higher than 10 mm long and 3 mm deep [Figure B.1 d)];

— Upper/outsole separation of more than 15 mm long and 5 mm wide (deep) [Figure B.1 g)];

— Cleat height for cleated outsoles at a any point lower than 1,5 mm [Figure B.1 e)];

— Original insock/s (if any) showing pronounced deformation and crushing.

— Destruction of the lining or sharp borders of the toe protection which could cause wounds [Figure B.1 f)];

— Delamination of the soling materials (Figure B.1 h);

— Pronounced deformation of the outsole due to heat exposure any of the following causes [Figure B.1 i)];

  — joining of 2 or more cleats due to the material melting;

  — decrease of the height of any cleat to less than 1,5 mm;

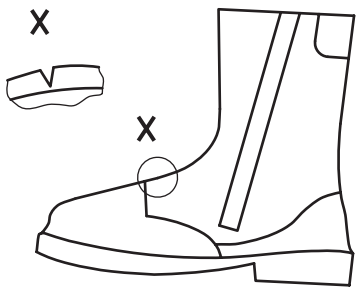
  — melting of the outside of the cleat and the midsole becomes visible;

— the closing mechanism is not in working order (zip, laces, eyelets, touch and close system);

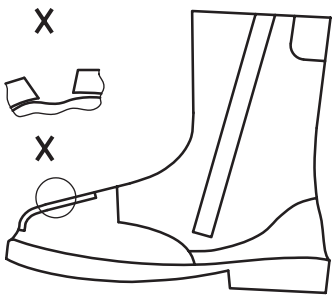
— the obsolescence deadline should not be exceeded;

— the footwear durability depends on the level of use and remarks made above.

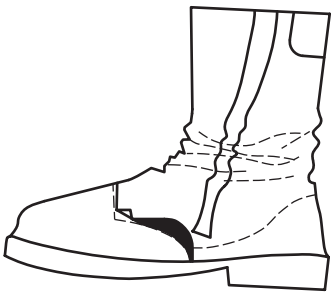
NOTE Replacement of footwear for firefighters in this context means also replacement of damaged parts, which are attached to the footwear, e.g. insocks, zippers, tongues, laces.



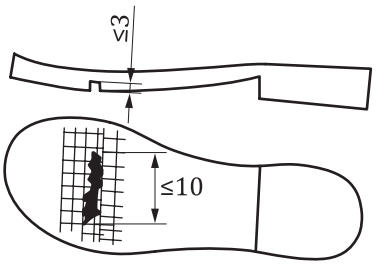
a) Deep cracks in the upper



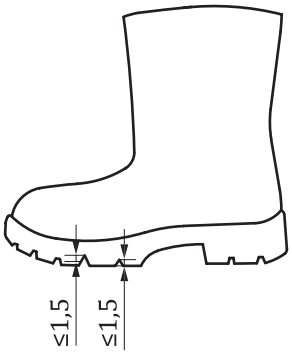
b) Strong abrasion of the upper



c) Separation of upper material

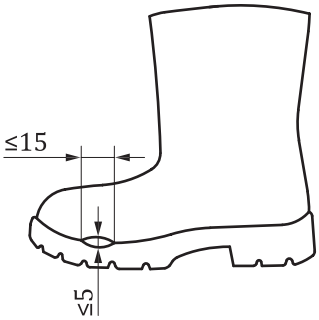


d) Cracks in the outsole



e) Decreased cleat height

f) Destruction of lining; sharp edges



g) Upper/outsole separation

h) Delamination of the sole

i) Pronounced deformation

Figure B.1 — Examples for criteria for the assessment of the state of safety footwear