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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 personnelle pour pompiers — Méthodes d'essai et exigences pour les équipements de protection personnelle utilisés par les pompiers qui sont à risque d'une exposition à des niveaux élevés de chaleur et/ou de flamme quand la lutte contre les incendies survient dans les structures —

Partie 6: Chaussures

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Contents

Page

Foreword ..... **v**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **1**

4 Classification, design and performance level **1**
4.1 Classification 1
4.2 Design 2
4.3 Performance Level 2

5 Sampling and conditioning **3**
5.1 Sampling 3
5.2 Conditioning 3

6 Requirements **3**
6.1 General requirement 3
6.2 Thermal behaviour 7
6.2.1 Insulation against heat 7
6.2.2 Radiant heat 7
6.2.3 Flame resistance 7
6.3 Resistance to chemicals 7
6.3.1 Degradation resistance 7
6.3.2 Permeation resistance 8
6.4 Electrical Properties 8
6.4.1 General 8
6.4.2 Electrically insulating footwear 8
6.4.3 Antistatic footwear 9
6.5 Water resistance 9
6.6 Outsole 9
6.6.1 Cleat design 9
6.6.2 Cleat height 9
6.6.3 Cleat height in the waist area 9
6.6.4 Heel breast 9
6.7 Zipper (slide fastener) 10
6.7.1 Zipper construction 10
6.7.2 Zipper puller attachment strength 10
6.7.3 Zipper lateral strength 10

7 Test methods **10**
7.1 Insulation against heat 10
7.2 Radiant heat 10
7.3 Flame resistance test 11
7.3.1 Conditioning and sampling 11
7.3.2 Procedure 11
7.4 Zipper 12
7.4.1 Puller attachment strength 12
7.4.2 Lateral strength 12

8 Marking **13**

9 Information to be supplied **15**
9.1 General 15
9.2 Antistatic footwear 15
9.3 Electrically insulating footwear 16
9.4 Insocks 16
9.5 Information regarding penetration resistant insert 17

Annex A (normative) **Assessment of the footwear by the laboratory during testing for resistance to heat and flame** **18**
Annex B (informative) **Assessment of the footwear by the wearer** **20**
Annex C (informative) **Assessment of the performance of the footwear** **21**
Annex D (informative) **Summary of testing methodology used in 6.3** **22**
Annex E (informative) **Slip resistance** **25**
Bibliography **28**

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).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 14, *Firefighters' personal equipment*.

ISO 11999 consists of the following parts, under the general title *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*

— *Part 2: Compatibility* [Technical Specification]

— *Part 3: Clothing*

— *Part 4: Gloves*

— *Part 5: Helmets*

— *Part 6: Footwear*

— *Part 9: Fire hoods*

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 part of ISO 11999 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, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *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 heat and flame — Method of test for limited flame spread*

ISO 20344:2011, *Personal protective equipment — Test methods for footwear*

ISO 20345:2011, *Personal protective equipment — Safety footwear*

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

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

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.

4 Classification, design and performance level

4.1 Classification

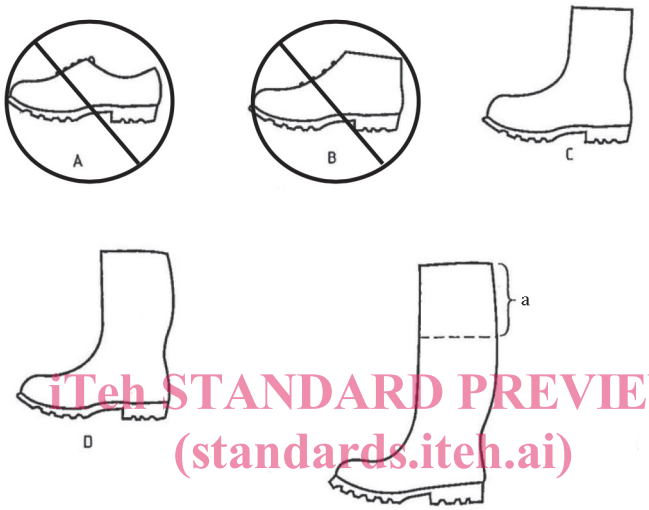
Footwear shall be classified in accordance with Table 1.

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-rubber (i.e. entirely vulcanized) or all-polymeric (i.e. entirely moulded) 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 Performance Level

This part of ISO 11999 contains two performance levels, A1 and A2. While many requirements are common to both performance levels, there are differences. Thermal requirements for each level are different.

NOTE Other parts of the ISO 11999 series dealing with other items of PPE have been developed with two levels of thermal protection, A1 and A2. It is important to select items of PPE from this part of ISO 11999 from the same thermal performance level when they are to be worn together.

5 Sampling and conditioning

5.1 Sampling

The minimum number of samples shall be that specified in ISO 20344:2011, Clause 6, together with the minimum number of test pieces taken from each sample, as given in Table 2.

Wherever possible, test pieces shall be taken from the whole footwear unless otherwise stated in this part of ISO 11999 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 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 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 48 h 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 two following approaches should be used:

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

— a mathematical method, e.g. that given in Reference ENV 13005.

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
Radiant heat	6.2.2	one pair	See 7.2	Yes
Flame	6.2.3	one pair	See 7.3	Yes
Zipper puller attachment strength	6.7.2	three zippers		No
Zipper lateral strength	6.7.3	three zippers		No

[a] ISO 20344:2011, Table 1 applies.

6 Requirements

6.1 General requirement

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

Table 3 — General requirement

Requirement			Reference		Classification and performance level				Marking symbol
			ISO 20345: 2011	This part of ISO 11999	Class I		Class II		
					A1	A2	A1	A2	
General	Footwear construction	Type and classification		4.1	a		a		
		Height of upper	5.2.1		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
	Seat region	Design C and D	5.2.2		a		a		
		Design E	5.2.2		N/A		a		
Whole footwear	Sole 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	A1	A2	A1	A2	A1 or A2
					d	d	d	d	
		Slip resistance	5.3.5		a		a		SRA SRB SRC
		Energy absorption of	6.2.4		a		a		
		seat region							
		Flame resistance		6.2.3	a		a		
		Penetration resistance	6.2.1		a		a		P
	Toe protection	General	5.3.2.1		a		a		
		Internal length of toe caps	5.3.2.2		a		a		
		Impact resistance	5.3.2.3		a		a		
		Compression resistance	5.3.2.4		a		a		
		Corrosion resistance of metal toe caps	5.3.2.5.1		a		a		
		Non metallic toe caps	5.3.2.5.2		a		a		
	Electrical property	Electrically insulating footwear[d]		6.4.2	d		d		See EN 50321 5.3
		Antistatic footwear[d]		6.4.3					A
	Resistance to inimical environment	Cold insulation of sole complex	6.2.3.2		c		c		CI
		Resistance to chemicals		6.3	N/A		c	c	CH
	Accessories	Zipper		6.7	b		b		
		Metatarsal protection	6.2.6		c		c		M
		Ankle protection	6.2.7		c		c		AN

Table 3 *(continued)*

Requirement			Reference		Classification and performance level				Marking symbol
			ISO 20345: 2011	This part of ISO 11999	Class I		Class II		
					A1	A2	A1	A2	
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		
		pH value	5.4.7		a		N/A		
		Hydrolysis	5.4.8		N/A		a		
		Chromium VI content	5.4.9		a		N/A		
		Water penetration	6.3.1		a		N/A		
		water absorption							
		Radiant heat		6.2.2	a		a		
		Flame resistance		6.2.3	a		a		
		Cut resistance	6.2.8		c		c		CR
Lining	Vamp	Tear strength	5.5.1		a		N/A		
		Abrasion resistance	5.5.2		a		N/A		
		Water vapour permeability &coefficient	5.5.3		a		N/A		
		pH value	5.5.4		a		N/A		
		Chromium VI content	5.5.5		a		N/A		
	Quarter	Tear strength	5.5.1		b		N/A		
		Abrasion resistance	5.5.2		b		N/A		
		Water vapour permeability &coefficient	5.5.3		b		N/A		
		pH value	5.5.4		b		N/A		
		Chromium VI content	5.5.5		b		N/A		
Tongue		Tear strength	5.6.1		b		N/A		
		pH value	5.6.2		b		N/A		
		Chromium VI content	5.6.3		b		N/A		
Insole/insocks				See Table 4	a		b		
Outsole		Tear strength	5.8.2		a		a		
		Abrasion resistance	5.8.3		a		a		
		Flexing resistance	5.8.4		a		a		
		Hydrolysis	5.8.5		a		a		
		Interlayer bond strength	5.8.6		b		b		
		Resistance to fuel oil	6.4.2		a		a		
		Cleated area	5.8.1.2		a		a		
		Thickness	5.8.1.1		a		a		
		Cleat design		6.6.1	a		a		
		Cleat height		6.6.2	a		a		

Table 3 *(continued)*

Requirement			Reference		Classification and performance level				Marking symbol
			ISO 20345: 2011	This part of ISO 11999	Class I		Class II		
					A1	A2	A1	A2	
		Cleat height in the waist area		6.6.3	a		a		
		Heel breast		6.6.4	a		a		
		Resistance to hot contacts	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 has to be met. In some cases, the requirement relates only to particular materials within the classification, e.g. pH value of leather components. 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 Means that one of the two requirements shall be chosen.

N/A means the requirement is not applicable.

Table 4 — Basic requirements for insoles and/or insocks

Options			Compo-nent to be assessed	Requirements to fulfill in ISO 20345					
				Thick-ness	pH	Water absorption desorption	Abrasion		Chromium VI
							Insole	Insock	
1	No insole or if present not fulfilling the require-ments	Non-remov-able insock	Insock	a	a	a	N/A	a	a
2	Insole pres-ent	No insock	Insole	a	a	a	a	N/A	a
		Seat sock present							
3		Full insock, non-remov-able	Insock and insole	a	N/A	a	N/A	N/A	N/A
			Insock	N/A	a	N/A	N/A	a	a
4		Full insock, removable and water permeable	Insole	a	a	a	a	N/A	a
			Insock	N/A	a	N/A	N/A	a	a
5		Full insock, removable not water permeable	Insole	a	a	a	a	N/A	a
			Insock	N/A	a	a	N/A	a	a

NOTE 1 For removable insocks, see 9.3.

a Means that the requirement shall be met.

N/A means the requirement is not applicable.