BS EN 15090:2012

BSI Standards Publication

Footwear for firefighters

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National foreword

This British Standard is the UK implementation of EN 15090:2012. It supersedes BS EN 15090:2006, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PH/1, Safety, protective and occupational footwear.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Footwear for firefighters

Chaussures pour pompiers

Schuhe für die Feuerwehr

This European Standard was approved by CEN on 24 September 2011.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 15090:2012) has been prepared by Technical Committee CEN/TC 161 “Foot and leg protectors”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2012, and conflicting national standards shall be withdrawn at the latest by July 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15090:2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The main differences between this edition and EN 15090:2006 are as follows:

a) Slip resistance has been added (reference to EN ISO 20345, 5.3.5).

b) The types of footwear for firefighters (4.3) have been changed in accordance with the risks.

c) The requirements and the test method for radiant heat (6.3.2 and 7.2) have been changed.

d) The requirement for resistance to chemicals (6.5) have been slightly changed.

e) The requirements for high electrical resistance outsoles (6.6.4 in the old version) and the adequate Marking symbols in Table 9 were removed.

f) Annex B (normative) has been restructured. The criteria for the assessment of the state of footwear have been listed separately: “Insulation against heat”, “Radiant heat” and “Flame resistance”.

g) Annex D 'Testing of laces' has been deleted.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The purpose of this standard is to provide minimum performance requirements and test methods for footwear for firefighters which is intended for use for fire fighting and associated activities. A risk assessment should be used to determine whether the footwear covered by this standard is suitable for the intended use for the expected exposure. Firefighters should be trained in the use, care and maintenance of the footwear covered by this standard, including an understanding of its limitations.

1 Scope

This European standard specifies minimum requirements and test methods for the performance of three types (see 4.3) of footwear for use by firefighters for fire suppression, general-purpose rescue, fire rescue and hazardous materials emergencies.

This European standard does not cover special personal protective equipment used in high-risk situations (for example, the conditions described in ISO 15538).

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 13832-3:2006, *Footwear protecting against chemicals — Part 3: Requirements for footwear highly resistant to chemicals under laboratory conditions*

EN 50321, *Electrically insulating footwear for working on low voltage installations*

EN ISO 6942:2002, *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 6942:2002)*

EN ISO 15025:2002, *Protective clothing — Protection against heat and flame — Method of test for limited flame spread (ISO 15025:2000)*

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

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

ISO 15538, *Protective clothing for firefighters — Laboratory test methods and performance requirements for protective clothing with a reflective outer surface*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 20345:2011 apply.

4 Classification, design and type

4.1 Classification

Footwear for firefighters 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 designs B to E of Figure 3 of EN ISO 20345:2011.

4.3 Type

The types of footwear for firefighters shall be as follows:

— Type 1: Outdoor interventions, fire and wildland firefighting; no protection against penetration, no toe protection, no protection against chemical hazards;

— Type 2: All fire suppression and rescue interventions where protection against penetration, and toe protection are needed, no protection against chemical hazards;

— Type 3: All fire suppression and rescue interventions where protection against penetration and toe protection are needed, including protection against chemical hazards.

5 Sampling and conditioning

The minimum number of samples shall be that specified in Clause 6 of EN ISO 20344:2011, 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 standard and in EN 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 may 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.

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.

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

– a statistical method, e.g. that given in ISO 5725-2 [20];

– a mathematical method, e.g. that given in ENV 13005 [3].

Table 2 — Minimum number of samples and test specimens or 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	6.3.2	1 pair	See 7.2	Yes
Flame	6.3.3	1 pair	See 7.3	Yes
Compression resistance of footwear forepart	6.4	1 pair from each of three sizes	1 pair	Yes
Zipper puller attachment strength	6.8.2	3 zippers		No
Zipper lateral strength	6.8.3	3 zippers		No

[a] Table 1 of EN ISO 20344:2011 applies.

6 Requirements

6.1 Types and classifications

The permitted combinations of types of footwear for firefighters (see 4.3) and classes I and II (see 4.1) shall be as given in Table 3. As specified in 4.2, design A shall not be used.

Table 3 — Relationship between types of footwear and classes

Types of footwear	Class I of Table 1	Class II of Table 1
1	Possible	Possible
2	Possible	Possible
3	Not possible	Possible

NOTE Type 3 footwear for firefighters are suitable for use with chemical protective clothing in accordance with EN 943-2, where appropriate.

6.2 General requirements

Footwear for firefighters shall conform to the requirements specified in Table 4.

Table 4 — General requirements

		Requirements	Reference		Type 1		Type 2		Type 3	Marking symbol
			EN ISO 20345:2011	EN 15090	Class		Class		Class II	
					I	II	I	II		
General	Footwear construction	Type and classifications		4.1 and 6.1	X	X	X	X	X	
		Height of upper	5.2.1		X	X	X	X	X	
		Specific ergonomic features	5.3.4		X	X	X	X	X	
		Leakproofness	5.3.3		N/A	X	N/A	X	X	
		Water resistance	6.2.5		X	N/A	X	N/A	N/A	
	Seat region	Design B Figure 3 of EN ISO 20345:2011	5.2.2		X	X	–	–	–	
		Design C and D Figure 3 of EN ISO 20345:2011	5.2.2		X	X	X	X	X	
		Design E Figure 3 of EN ISO 20345:2011	5.2.2		N/A	N/A	N/A	X	X	
Whole footwear	Sole performance	Construction	5.3.1.1		X	N/A	X	N/A	N/A	
		Upper/outsole bond strength	5.3.1.2		X	N/A	X	N/A	N/A	
		Insulation against heat		6.3.1	X At least HI_1	X At least HI_1	X At least HI_2	X At least HI_2	X At least HI_2	HI_1 or HI_2 or HI_3
		Slip resistance	5.3.5		X	X	X	X	X	SRA SRB SRC
		Energy absorption of seat region	6.2.4		X	X	X	X	X	

		Flame resistance		6.3.3	X	X	X	X	X	
		Penetration resistance	6.2.1		O	O	X	X	X	P
	Toe protection	General	5.3.2.1		O	O	X	X	X	T (only for type 1)
		Internal length of toe caps	5.3.2.2		O	O	X	X	X	
		Impact resistance	5.3.2.3		O	O	X	X	X	
		Compression resistance	5.3.2.4		O	O	X	X	X	
		Corrosion resistance of metallic toe caps	5.3.2.5.1		O	O	X	X	X	
		Non-metallic toe caps	5.3.2.5.2		O	O	X	X	X	
		Compression resistance of toe puff		6.4	*	*	N/A	N/A	N/A	R
	Electrical properties	Electrically insulating footwear▲		6.6.2	X	X	X	X	X	See EN 50321
		Antistatic footwear ▲		6.6.3						A
	Resistance to imical environment	Cold insulation of sole complex	6.2.3.2		*	*	*	*	*	CI
		Resistance to chemicals		6.5	N/A	*	N/A	*	X	CH
	Accessories	Zipper		6.8	O	N/A	O	N/A	N/A	
		Metatarsal protection	6.2.6		*	*	*	*	*	M
		Ankle protection	6.2.7		*	*	*	*	*	AN
Upper		Thickness	5.4.2		N/A	X	N/A	X	X	
		Tear strength	5.4.3		X	N/A	X	N/A	N/A	
		Tensile properties	5.4.4		X	X	X	X	X	

		Flexing resistance	5.4.5		N/A	X	N/A	X	X	
		Water vapour permeability and coefficient	5.4.6		X	N/A	X	N/A	N/A	
		pH value	5.4.7		X	N/A	X	N/A	N/A	
		Hydrolysis	5.4.8		N/A	X	N/A	X	X	
		Chromium VI content	5.4.9		X	N/A	X	N/A	N/A	
		Water penetration and water absorption	6.3.1		X	N/A	X	N/A	N/A	
		Radiant heat		6.3.2	X	X	X	X	X	
		Flame resistance		6.3.3	X	X	X	X	X	
Lining	Vamp	Tear strength	5.5.1		X	N/A	X	N/A	N/A	
		Abrasion resistance	5.5.2		X	N/A	X	N/A	N/A	
		Water vapour permeability and coefficient	5.5.3		X	N/A	X	N/A	N/A	
		pH value	5.5.4		X	N/A	X	N/A	N/A	
		Chromium VI content	5.5.5		X	N/A	X	N/A	N/A	
	Quarter	Tear strength	5.5.1		O	N/A	O	N/A	N/A	
		Abrasion resistance	5.5.2		O	N/A	O	N/A	N/A	
		Water vapour permeability and coefficient	5.5.3		O	N/A	O	N/A	N/A	
		pH value	5.5.4		O	N/A	O	N/A	N/A	
		Chromium VI content	5.5.5		O	N/A	O	N/A	N/A	
Tongue		Tear strength	5.6.1		O	N/A	O	N/A	N/A	
		pH value	5.6.2		O	N/A	O	N/A	N/A	
		Chromium VI content	5.6.3		O	N/A	O	N/A	N/A	

		Chromium VI content	5.6.3		O	N/A	O	N/A	N/A	
Insole/insocks				See Table 5	X	O	X	O	O	
Outsole		Tear strength	5.8.2		X	X	X	X	X	
		Abrasion resistance	5.8.3		X	X	X	X	X	
		Flexing resistance	5.8.4		X	X	X	X	X	
		Hydrolysis	5.8.5		X	X	X	X	X	
		Interlayer bond strength	5.8.6		O	O	O	O	O	
		Resistance to fuel oil	6.4.2		X	X	X	X	X	
		Cleated area	5.8.1.2		X	X	X	X	X	
		Thickness	5.8.1.1		X	X	X	X	X	
		Cleat design		6.7.1	X	X	X	X	X	
		Cleat height		6.7.2	X	X	X	X	X	
		Cleat height in the waist area		6.7.3	X	X	X	X	X	
		Heel breast		6.7.4	X	X	X	X	X	
		Resistance to hot contacts	6.4.1		X	X	X	X	X	

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

X means that the requirement has to be met. In some cases the requirement relates only to particular materials within the classification, e.g. value of leather components. This does not mean that other materials are precluded from use.

O means that if the component parts exists, the requirement shall be met:

- means not allowed

* means that if the property is claimed, the requirement given in the appropriate clause shall be met.

▲ means that one of the three requirements shall be chosen.

N/A means the requirement is not applicable.

The absence of X, -, or O means that no requirement is made.

Table 5 — Basic requirements for insoles and/or insocks

Options			Component to be assessed	Requirements to fulfil in EN ISO 20345:2011					
				Thickness 5.7.1	pH 5.7.2	Water absorption desorption 5.7.3	Insole abrasion 5.7.4.2	Insock abrasion 5.7.4.2	Chromium VI 5.7.5
1	No insole or if present not fulfilling the requirements	Non-removable insock	Insock	X	X	X		X	X
2	Insole present	No insock	Insole	X	X	X	X		X
		Seat sock present							
3		Full insock, non-removable	Insock and insole	X		X			
			Insole		X			X	X
4		Full insock, removable and water permeable	Insole	X	X	X	X		X
			Insock		X			X	X
5		Full insock, removable not water permeable	Insole	X	X	X	X		X
			Insock		X	X		X	X

NOTE 1 For removable insocks see Clause 9.3.

NOTE 2 X means that the requirement shall be met.

6.3 Thermal behaviour

6.3.1 Insulation against heat

When tested in accordance with the method described in 7.1 the footwear shall meet at least one of the levels defined in Tables 6 and 7.

Table 6 — Insulation against heat: requirements for the temperature inside the footwear

Level of performance	**HI_1**	**HI_2**	**HI_3**
Thp (ºC)	150	250	250
Inside temperature of the footwear (ºC)	< 42 after 30 min	< 42 after 10 min	

Table 7 — Insulation against heat: requirements for footwear degradation

Level of performance	**HI_1**	**HI_2**	**HI_3**
Thp (ºC)	150	250	250
Total duration of the test	30 min	20 min	40 min
Assessment	After testing, the footwear shall conform to B.2.1.		

6.3.2 Radiant heat

When tested in accordance with the method described in 7.2, the temperature increase for each material combination shall be equal or less than 24 ºC. After testing, the footwear shall conform to B.2.2.

6.3.3 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 B.2.3.

6.4 Compression resistance of the toepuff

When Type 1 footwear is tested in accordance with the method described in 7.4, the clearance under the toepuff at a compression load of (500 + 10) N shall be not less than the appropriate value given in Table 8.

Table 8 — Minimum clearance under toepuff at compression

Size of footwear		**Minimum internal clearance**
Paris points	**English**	**mm**
36 and below	3 and below	12,5
37 and 38	4 and 5	13,0
39 and 40	6	13,5
41 and 42	7 and 8	14,0
43 and 44	9 and 10	14,5
45 and above	11 and above	15,0

6.5 Resistance to chemicals

The footwear shall reach the protection index 1 of EN 13832-3:2006, 6.2, for at least three of the chemicals given in Table 4. Other chemicals may be used additionally according to the intended use.

6.6 Electrical properties

6.6.1 General

Electrical properties shall conform to either 6.6.2 or 6.6.3

6.6.2 Electrically insulating footwear

Electrically insulating footwear shall fulfil EN 50321.

NOTE EN 50321 includes the requirements of EN 345 that has been withdrawn in 2004. Therefore, it is recommended to apply EN 50321 with the requirements of EN ISO 20345 instead of EN 345.

6.6.3 Antistatic footwear

Footwear shall conform to all the requirements given in 6.2.2.2 of EN ISO 20345:2011.

6.7 Outsole

6.7.1 Cleat design

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

6.7.2 Cleat height

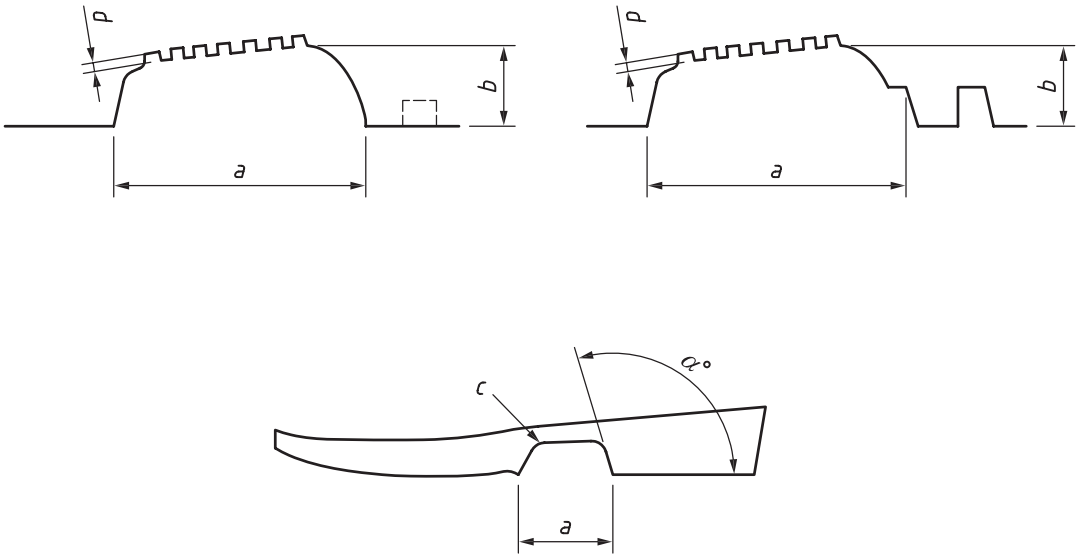
When tested in accordance with EN ISO 20344: 2011, 8.1, the cleat height d_2 shall be not less than 3 mm.

6.7.3 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 1.

6.7.4 Heel breast

The outsole shall have an inclined-breast heel. Distance 'a' (the waist area) shall be at least 35 mm, angle α shall be between 90° and 120° and dimension 'b' shall be at least 10 mm (see Figure 1).



Key
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 1 — Outsole dimensions

6.8 Zipper

6.8.1 Zipper construction

The zipper shall have an interlocking mechanism.

6.8.2 Zipper (slide fastener) puller attachment strength

When tested in accordance with the methods described in 7.5.1, each recorded value of the attachment strength of the puller shall be greater than 250 N.

6.8.3 Zipper (slide fastener) lateral strength

When tested in accordance with the methods described in 7.5.2; 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 EN ISO 20344:2011, 5.12.

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 from which the component has been

manufactured may 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 the shoe.

Test the test pieces according to EN ISO 6942:2002, method B at a heat flux density of 20 kW/m² exposing the outer surface to radiant heat for 40 s. The result expressed as temperature increase is the highest single result of ΔT rounded to 0,1 °C.

7.3 Flame resistance test

7.3.1 Conditioning and sampling

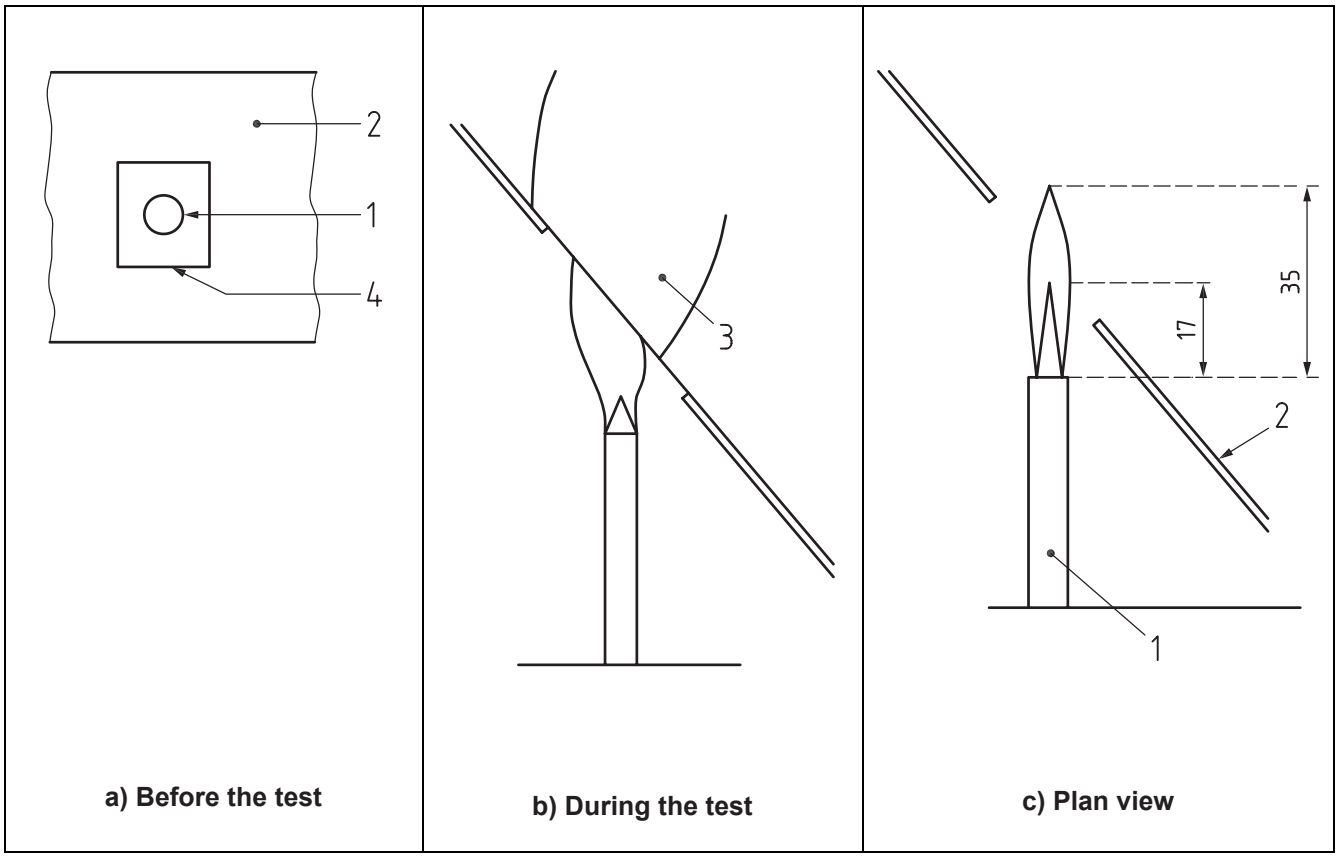
All different external materials, including external seams, labels and closing mechanisms, as provided, as a complete sample of footwear shall be tested in accordance with EN ISO 15025.

7.3.2 Procedure

7.3.2.1 Place the burner (see EN ISO 15025:2002, Figure 2) on a flat, horizontal surface with the burner and flame in a vertical position.

7.3.2.2 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 and the angle between the sample area to be tested and the horizontal plane is (45 ± 5)° (see Figure 2). The sample carrier has a square flame application aperture size of [(50 x 50) ± 1] mm.

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



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

Key

1 Burner
2 Sample carrier
3 Footwear being tested
4 Flame application aperture

Figure 2 — Equipment for flame resistance tests

7.3.2.3 Move the burner away from the sample and ignite the burner and preheat it for 2 min and adjust the flame to (35 ± 2) mm in height in accordance with EN ISO 15025.

7.3.2.4 Reposition the burner as in 7.3.2.2 and apply the flame for (10 ± 1) s to the designated area.

7.3.2.5 Remove the flame and measure the after-flame and after-glow as defined in EN ISO 15025.

7.3.2.6 Repeat procedures 7.3.2.2, 7.3.2.3 and 7.3.2.4 for all different external materials used in the construction of the footwear, external seams and closing mechanism.

7.4 Compression resistance of the toepuff

Test in accordance with the method described in EN ISO 20344:2011, 5.5 with the following change: compress with a load of 500 N.

7.5 Zipper

7.5.1 Puller attachment strength

7.5.1.1 Principle

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

7.5.1.2 Apparatus

7.5.1.2.1 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.

7.5.1.3 Procedure

Mount the slider in the lower jaw of the tensile with the puller passed through the masking plate. Clearing the end of the puller in the upper jaw of the 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 specimens shall be tested and the results recorded.

7.5.2 Lateral strength

7.5.2.1 Principle

The zipper is subjected 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.

7.5.2.2 Apparatus

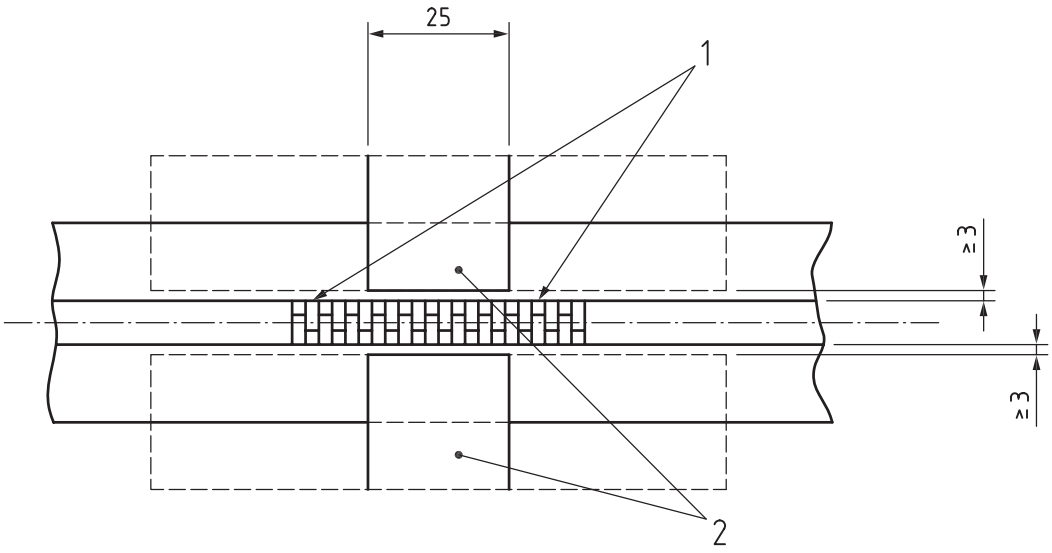
7.5.2.2.1 Tensile machine with a jaw separation rate of (100 ± 20) mm/min having a facility to record the force throughout the test and gripping jaws of 25 mm wide, constructed and finished so as no to damage the tape of the zipper.

7.5.2.3 Test specimens

Three test pieces from one or more zippers so that the minimum length of closed chain for each test is 75 mm.

7.5.2.4 Procedure

Clamp the test specimen in the jaws of the testing machine so that there is at least 25 mm of closed chain either side of the jaws. The jaws shall be positioned 3 mm from the chain. Figure 3 shows the arrangement. Set the machine in 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 3 —Zipper test

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) year and, at least the quarter of manufacture;

e) number and year of this standard, i.e. EN 15090;

f) marking symbol(s) from Table 4 appropriate to the protection provided which is not covered by the symbol(s) of the pictogram (see Figure 4);

g) pictogram shown in Figure 4, at a size of at least 30 mm x 30 mm, attached in a visible position on the outside of the footwear; one of the symbols given in Table 9 shall be marked in the bottom right hand corner of the pictogram;

Figure 4 — Pictogram indicating types and protection of footwear for firefighters

Table 9 — Marking symbols

Footwear type	Symbol	Properties signified [a]
For Type 1:	F1A	All normative requirements of Table 4 and the requirements for antistatic properties
	F1PA	All normative requirements of Table 4 and the requirements for penetration resistance and for antistatic properties
	F1I	All normative requirements of Table 4 and the requirements for electrical insulating properties
	F1PI	All normative requirements of Table 4 and the requirements for penetration resistance and electrical insulating properties
For Type 2:	F2A	All normative requirements of Table 4 and the requirements for antistatic properties
	F2I	All normative requirements of Table 4 and the requirements for electrical insulating properties
For Type 3	F3A	All normative requirements of Table 4 and the requirements for antistatic properties
	F3I	All normative requirements of Table 4 and the requirements for electrical insulating properties
[a] The normative requirements of Table 4 are those signified by '(X)'.		

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) number of the standard;

c) explanation of any pictograms, markings and levels of performance. A basic explanation of the tests that have been applied to the footwear, if applicable;

d) instructions for use:

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

2) fitting; how to put on and take off the footwear, if relevant;

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

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

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

6) instructions for cleaning and/or decontamination; obsolescence deadline or period of obsolescence;

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 EN ISO 20345:2011, 8.2;

h) information on insocks in accordance with EN ISO 20345:2011, 8.3; if applicable

i) information on chemical resistance of footwear in accordance with EN 13832-3:2006, 9.3; if applicable

j) information on assessment of the state of footwear for the wearer.

See Annex C for an example.

9.2 Antistatic footwear

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

“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 any electrical apparatus or live parts has not been completely eliminated. **It should be noted, however, that antistatic footwear cannot guarantee an adequate protection against electric shock as it introduces only a resistance between foot and floor.** If the risk of electric shock has not been completely eliminated, additional measures to avoid this 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.

Experience has shown that, for antistatic purposes, the discharge path through a product should normally have an electrical resistance of less than 1 000 MΩ at any time throughout its useful life. A value of 100 kΩ is specified as the lowest limit of resistance of a product when new, in order to ensure some limited protection against dangerous electric shock or ignition in the event of any electrical apparatus becoming defective when operating at voltages of up to 250 V. However, under certain conditions, users should be aware that the footwear might give inadequate protection and additional provisions to protect the wearer should be taken at all times.

The electrical resistance of this type of footwear can be changed significantly by flexing, contamination or moisture. This footwear will not perform its intended function if worn in wet conditions. It is therefore necessary to ensure that the product is capable of fulfilling its designed function of dissipating electrostatic charges and also of giving some protection during the whole of its life. The user is recommended to establish an in-house test for electrical resistance and use it at regular and frequent intervals.

Classification I footwear can absorb moisture if worn for prolonged periods and in moist and wet conditions can become conductive.

If the footwear is worn in conditions where the soling material becomes contaminated, wearers should always check the electrical 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.

In use, no insulating elements should be introduced between the inner sole of the footwear and the foot of the wearer. If any insert is put between the inner sole and the foot, the combination footwear/insert should be checked for its electrical properties".

9.3 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.

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 fitting an insock can affect the protective properties of the footwear.

Annex A
(informative)

Example of guidelines and considerations for performing a risk

A.1 General

The role of personal protective equipment (PPE) for firefighters is not only to protect the firefighter but also to enable the firefighters to achieve their objectives. However, in emergency situations where the firefighters are unable to achieve their objectives, the PPE should also provide sufficient protection to enable the firefighter to escape without receiving unacceptable injury. The type of PPE and the protection it offers should be selected on the basis of a risk assessment specific to PPE use for identifying hazards, evaluating those hazards, and selecting specific performance requirements which eliminate or reduce these hazards.

The three major steps of the risk assessment process are given in A.2.

NOTE The following example is only one of a number of risk assessment processes. Three types of footwear for firefighters are available (see A.4).

A.2 General approach for conducting a risk assessment

A.2.1 Risk identification

For every aspect of the operation of the fire department or brigade, list potential problems and hazards. The following are examples of sources of information that can be useful in the process:

a) a list of the risks to which members are or can be exposed;

b) records of previous accidents, illnesses, and injuries, both locally and nationally;

c) facility and apparatus surveys, inspections, etc.

A.2.2 Risk evaluation

Evaluate each item listed in the risk identification process using the following questions:

a) What is the level or potential severity of the occurrence?

b) What is the potential frequency or likelihood of the occurrence?

c) What are the potential consequences of the occurrence?

This will help to set priorities in the developing specifications for PPE performance. Some sources of information which can be useful are:

d) safety audits and inspection reports;

e) prior accident, illness, and injury statistics;

f) application of national data to local circumstances and

g) professional judgment in evaluation risks unique to the jurisdiction.

A.2.3 Risk control

Once the risks are identified and evaluated, a control for each should be implemented and documented. In the case of PPE, this should include determining the appropriateness of specific tests and requirements for eliminating or reducing risk. Normally, the two primary methods of controlling risk, in order of preference, are as follows:

a) wherever possible, totally eliminate/avoid the risk or activity that presents the risk;

b) where it is not possible or practical to avoid or eliminate the risk, steps should be taken to control it (such as developing appropriate PPE specifications).

Specification of appropriate PPE should be part of any overall safety program which includes Standard Operating Procedures, training, and inspections. As with any program, it is important to evaluate whether the plan is working. Periodic evaluations should be made, and if the program elements are not working satisfactorily, then modifications to the program should be made. If the methods are changed, a new risk assessment should be performed.

A.3 Recommended factors for identifying and evaluating fire fighter risks

A.3.1 General

In using this standard for purchasing appropriate footwear for firefighters, some of the factors which should be considered in a risk assessment include those given in A.3.2 to A.3.9.

A.3.2 Level of firefighter training and experience

Well-trained and experienced firefighters are more likely to recognize fire ground hazards and appropriately respond in ways to minimize their potential for injury. The quality, amount, and frequency of training will also affect the firefighter's potential for injury. Firefighters should be specifically trained in the use of the selected PPE.

A.3.3 Level of fitness and health of the firefighter

Firefighters who are in good health and physical condition are more likely to respond safely and be less subject to stress-related injuries on the fire ground than firefighters having poor health and physical condition.

A.3.4 Function of the firefighter at the incident scene

Firefighters who make aggressive interior attacks at structural fires can be at more risk of burn injury than firefighters who assume defensive positions outside of burning structures. Some organizations can segregate firefighter responsibilities at the fire scene and subsequently require different levels of protection. Other organizations can require each firefighter to be equipped to perform any function at the fire scene, recognizing the possibility that any individual can be required to respond under emergency conditions.

In all cases, the specific activities of firefighters in responding to fires or other emergencies should be accounted for in determining risk of injury.

Examples can include equipping firefighters with PPE that is designed for aggressive interior attack as compared to functions where firefighters' activities are primarily defensive.

A.3.5 Environmental conditions at the incident scene

Hot and humid conditions as well as cold conditions can affect firefighter protection at the response scene. In addition, the physical environment in which the response is conducted and its impact on firefighters performing assigned duties should be accounted for. For example, firefighters using hoses can become wet.

Water inside clothing systems has both positive and negative impacts on the performance of the clothing system.

A.3.6 Specific hazards to be faced at the incident scene

Thermal as well as physical and other hazards should be considered in evaluating response risks. The type, level, and duration of heat exposure as well as the physical environment in which it is contained will have a significant effect on the potential risks faced by firefighters. Other hazards such as potential for flame contact, low visibility, fire ground chemicals, and rough physical surfaces create additional risks for injury at the fire scene.

A.3.7 Known limitations of footwear for firefighters and other PPE

Where as footwear for firefighters is designed to prevent or minimize injury, the specific limitations of the footwear in providing protection under all situations should be recognized.

Footwear performance can be limited, based on certain design features or material performance characteristics and including weight of such footwear. In addition, these characteristics can be diminished as the footwear is worn. Footwear for firefighters should be properly maintained to ensure continued performance. Methods for integrating other PPE such as garments, helmets, gloves, and self-contained breathing apparatus should be done in a manner that provides complete protection to the wearer.

A.3.8 Appropriate fit of footwear for firefighters

Footwear should fit correctly to provide adequate protection to the firefighter. Footwear that is too loose or too tight will affect mobility and performance. Firefighters should ensure that their footwear adequately fits by examining how the footwear fits on their feet and assessing their ability to perform tasks while wearing the footwear. Firefighters should initially fit themselves with the appropriate size footwear by checking their feet dimensions against manufacturer's recommendations, but can have to measure and/or try on different sizes to find the “best” fitting footwear.

A.3.9 Type and application of command system at the incident scene

The amount of discipline and coordination of firefighters at the accident/response scene can affect the risk for injury. Firefighters who have well-defined responsibilities and are closely supervised are less likely to be injured as compared to firefighters who act more independently and in a less coordinated fashion.

Consideration should also be given to the build-up of heat stress by prolonged use of the PPE in firefighting and associated activities. Heat stress and other stress-related injuries are one of the more frequent causes of firefighter fatalities and injuries. Heat stress is affected by a number of factors that include all of the factors described above.

A.4 Types of footwear for firefighters

The types of footwear for firefighters shall be as follows:

— *Type 1*

Suitable for general-purpose rescue (example Type 1, HI_1), fire suppression (example Type 1,HI2) firefighting suppression action involving a fire in vegetative fuels such as forest (example Type 1, HI3) crops, plantations, grass or farmland.

— *Type 2*

Suitable for fire rescue (example Type 2, HI_2), fire suppression, and property conservation in buildings, enclosed structures (example Type 2, HI_3), vehicles, vessels, or like properties that are involved in a fire or emergency situation. Type 2 covers all risks of type 1.

— *Type 3*

Hazardous materials emergencies involving the release or potential release of hazardous chemicals into the environment that can cause loss of life, personnel injury, or damage to property and the environment. Suitable also for fire rescue, fire suppression, and property conservation in aircraft, buildings, enclosed structures, vehicles, vessels, or like properties that are involved in a fire or emergency situation.

Annex B
(normative)

Assessment of the footwear by the laboratory during testing of thermal behaviour

B.1 General

The following list and drawings are provided to assess the performance of the footwear for fire fighters when thermal behaviour is tested in accordance with 6.3.

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

B.2.1 Insulation against heat

Footwear for fire fighters shall be failed when tested in accordance with 7.1. if any of the following signs of deterioration identified below are found:

— 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);

— pronounced deformation of the outsole still present when the footwear is at ambient temperature again.

To assess any pronounced deformations, the ergonomic requirements of EN ISO 20345:2011, 5.3.4 shall be satisfied.

B.2.2 Radiant heat

Footwear for fire fighters 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 B.1 a));

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

— the sample shows split seams (component get apart) (Figure B.1 c));

— the complete closing mechanism is not 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).

B.2.3 Flame resistance

Footwear for fire fighters 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 B.1 a));

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

— the upper shows split seams (components get apart) (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);

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

Dimensions in millimetres

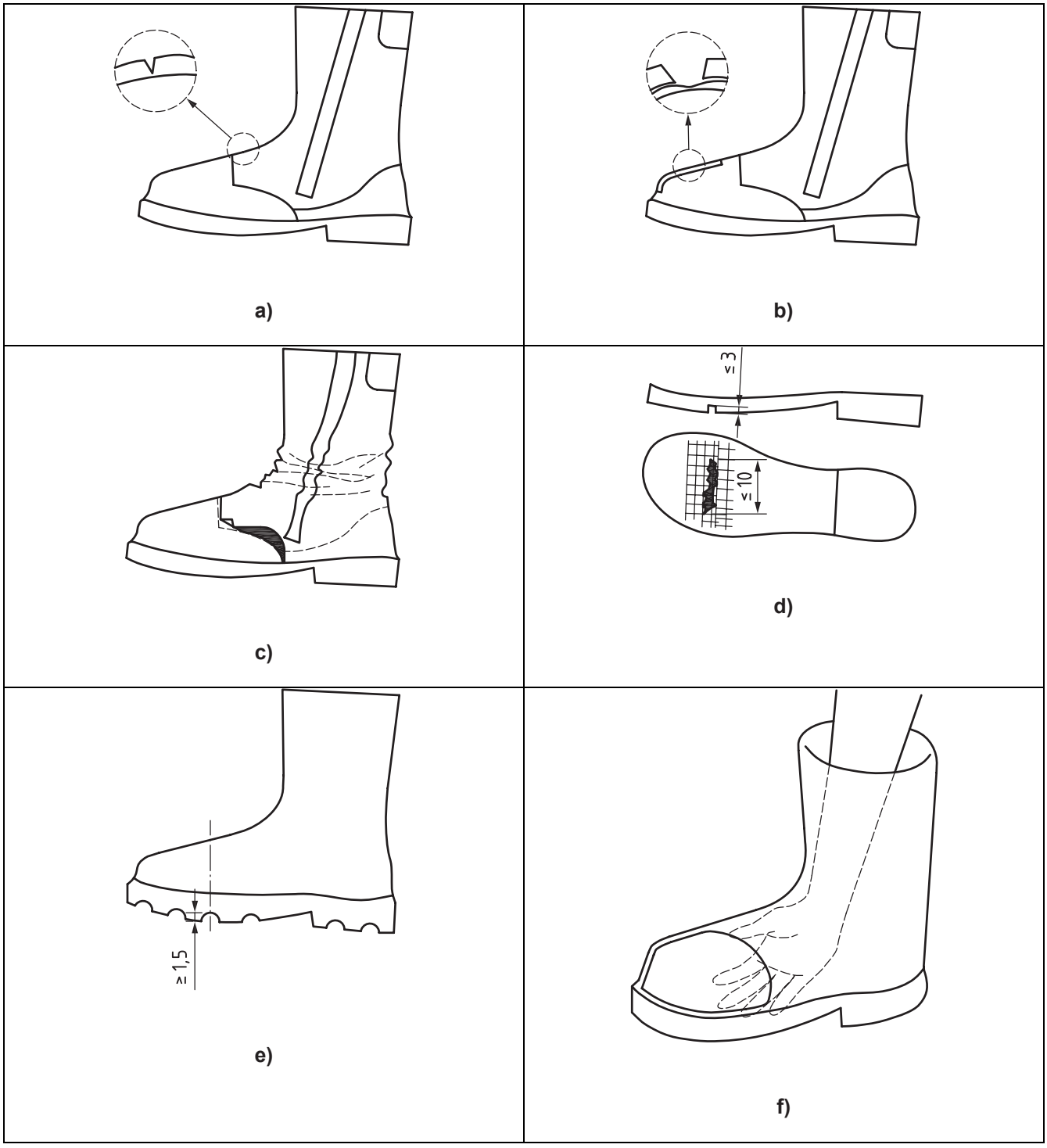


Figure B.1 — Criteria for the assessment of the state of footwear for firefighters

Annex C
(informative)

Assessment of the footwear by the wearer

C.1 General

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

C.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 C.1 a));

— Strong abrasion of the upper material, especially if the toepuff or the toecap is revealed (Figure C.1 b));

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

— The outsole shows cracks higher than 10 mm long and 3 mm deep (Figure C.1 d)); upper/sole separation of more than 10 mm-15 mm long and 5 mm wide (deep);

— Cleat height in the flexing area lower than 1,5 mm (Figure C.1 e));

— Original insock (if any) showing pronounced deformation and crushing;

— It is convenient to check manually the inside of the footwear from time to time, aiming at detecting destruction of the lining or sharp borders of the toe protection which could cause wounds (Figure C.1 f));

— The closing mechanism is 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.

Dimensions in millimetres

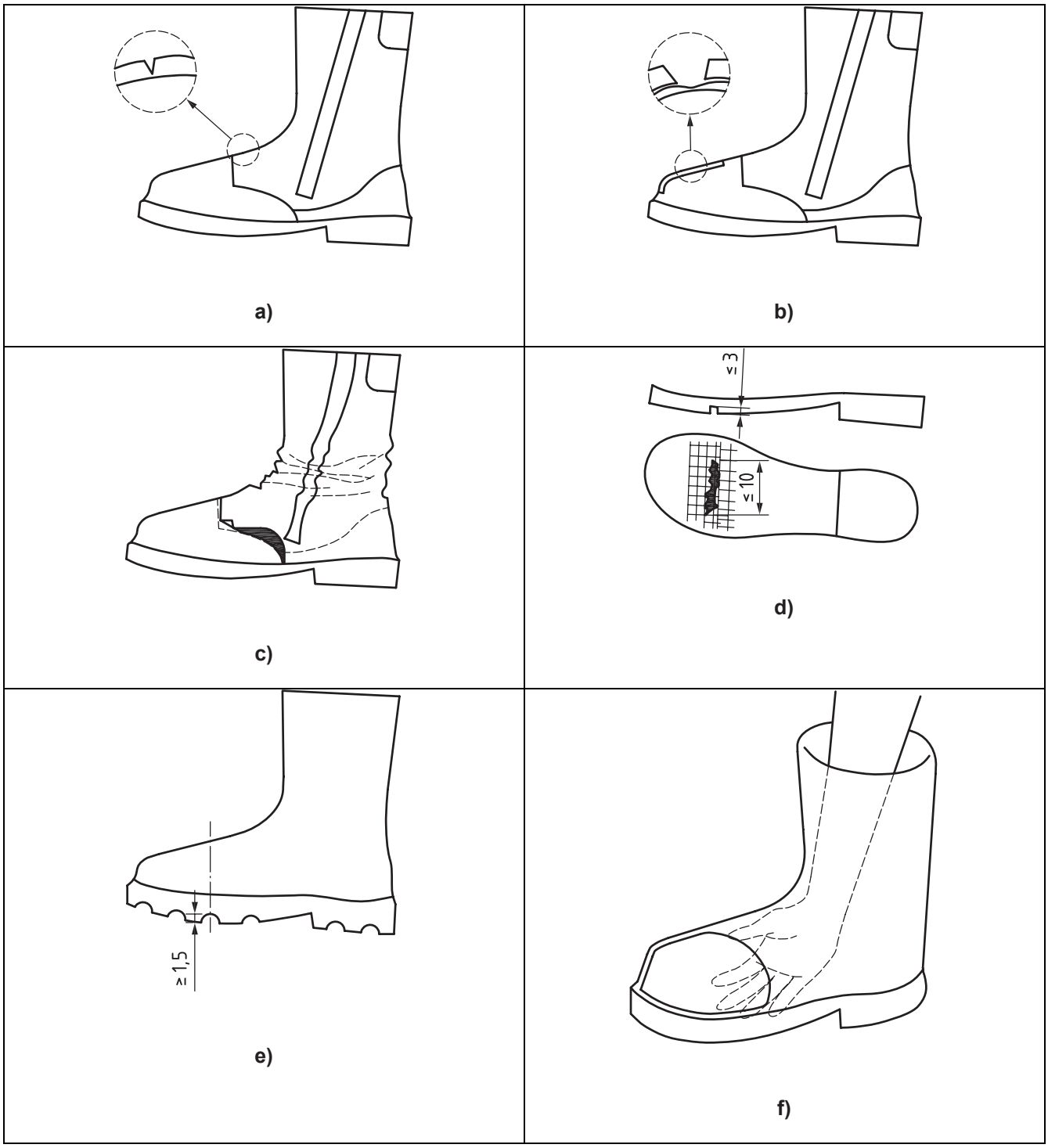


Figure C.1 — Criteria for the assessment of the state of footwear for firefighters

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC, Personal Protective Equipment.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 shows the relationship between relevant requirements of the Directive 686/EEC and clauses of this European Standard.

The relationship between requirements of the Directive and the basic requirements specified in EN ISO 20345 also applies to this standard.

Table ZA.1 — Correspondence between this European Standard and Directive 89/686/EEC

Essential Requirements (ERs) of Directive 89/686/EEC	**Clause of this EN**
1.1.2.2 Classes of protection appropriate to different levels of risk	4.3
1.2.1 Absence of risks and other ‘inherent' nuisance factors	6.8.1
1.3.2 Lightness and design strength	6.3.1 Table 7
1.3.2 Lightness and design strength	6.8.2
1.3.2 Lightness and design strength	6.8.3
1.4 Information supplied by the manufacturer	9
2.6 PPE for use in explosive atmospheres	6.6.3
2.12 PPE bearing identification marks related to health and safety	8
3.2 Protection against (static) compression of part of the body	6.4
3.6.1 Protection against heat and/or fire. PPE constituent materials and other components	6.3.2
3.6.1 Protection against heat and/or fire. PPE constituent materials and other components	6.3.3
3.6.2 Protection against heat and/or fire. Complete PPE ready for use	6.3.1 Table 6
3.8 Protection against electric shock	6.6.2
3.10.2 Protection against dangerous substances and infective agents. Protection against cutaneous and ocular contact	6.5

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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[2] EN 943-2, *Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles — Part 2: Performance requirements for "gas-tight" (Type 1) chemical protective suits for emergency teams (ET)*

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

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[7] EN ISO 3376, *Leather — Physical and mechanical tests — Determination of tensile strength and percentage extension (ISO 3376:2002)*

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[17] ISO 2023, *Rubber footwear — Lined industrial vulcanized-rubber boots — Specification*

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[20] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

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