INTERNATIONAL STANDARD

ISO 16073-6

First edition
2021-01

Wildland firefighting personal protective equipment — Requirements and test methods —

Part 6: Footwear

Équipement de protection individuelle pour la lutte contre les feux d'espaces naturels — Exigences et méthodes d'essai —

Partie 6: Chaussures

Reference number
ISO 16073-6:2021(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

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

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

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 14, *Firefighters' personal equipment.*

This first edition of ISO 16073-6, together with ISO 16073-1 to ISO 16073-8, cancels and replaces ISO 16073:2011.

The main changes are as follows:

— the content has been reviewed and separated into several parts;

— the respiratory protection has been deleted from the document.

A list of all parts in the ISO 16073 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.

Introduction

Wildland firefighting involves work carried out mostly in summer temperatures and for many hours, during which the firefighter can develop high levels of metabolic heat. As a consequence, the personal protective equipment (PPE) is required to be light, flexible and commensurate with the risks to which the firefighter can be exposed in order to be effective without introducing excessive heat stress to the wearer.

It is important to train firefighters in the selection, use, care and maintenance of the PPE covered by this document, including an understanding of its limitations.

It is intended that a risk assessment be undertaken to determine if the PPE covered by this document is suitable for its intended use and the expected exposure.

This document provides minimum performance requirements for wildland firefighters' personal protective equipment footwear designed for use for extended periods during wildland firefighting.

Wildland firefighting personal protective equipment — Requirements and test methods —

Part 6: Footwear

1 Scope

This document covers the general design, minimum performance requirements and methods of test for wildland firefighting footwear. This document does not cover PPE for structural firefighting (see ISO 11999 series), for use against chemical, biological, radiological and nuclear hazards, ISO 18639 series PPE for firefighters undertaking specific rescue activities or for use where a reflective outer surface is required (see ISO 15538).

Activities in support of wildland firefighting, such as the cutting of trees and the use of a chainsaw can require additional protection to that provided in this document. Users are directed to those relevant standards for the requirements associated with such protection.

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 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 flame — Method of test for limited flame spread*

ISO/TR 19591, *Personal protective equipment for firefighters — Standard terms and definitions*

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

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

EN 14119, *Safety of machinery. Interlocking devices associated with guards. Principles for design and selection*

EN 15090:2012, *Footwear for firefighters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 19591 apply.

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

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

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

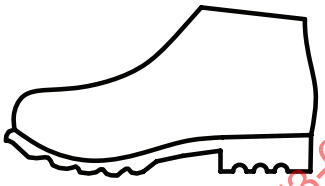
4 Footwear designs

Footwear for wildland firefighters shall be made from leather and other materials, excluding all-rubber or all-polymeric footwear.

Footwear shall be suitable for firefighting suppression action involving a fire in vegetative fuels such as a forest, crops, plantations, grass or farmland.

Footwear shall conform to designs of Figure 1 b), c) or d).

a) Low shoe - not allowed



b) Ankle boot

c) Half-knee boot

d) Knee-height boot

Figure 1 — Designs of footwear

5 Sampling and conditioning

Where not directly specified in a clause of this document, the sampling and conditioning of samples shall satisfy the requirements of 5.1 and 5.2.

5.1 Sampling

The minimum number of samples shall be those specified in ISO 20344:2011, Table 1, together with the minimum number of test pieces taken from each sample as given in Table 1.

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

Table 1 — Minimum number of samples and test specimens or test pieces

Property to be determined[a]	Referenced subclause	Number of samples	Number of test pieces from each sample	Test only on the final footwear
Radiant heat	6.3.2	1 pair	1 pair	Yes
Flame Resistance	6.3.3	1 pair	1 pair	Yes
Compression resistance of toepuff	EN 15090:2012, 6.4	1 pair from each of 3 sizes	1 pair	Yes
Zipper puller attachment strength	EN 15090:2012, 6.8.2	3 zippers		No
Zipper lateral strength	EN 15090:2012 6.8.3	3 zippers		No
Whole footwear	7.4	1 pair	1 pair	Yes
Thread	6.5 and 7.5	1 length (10 m)	1	No
Laces	6.4	3 pieces	1	No
Insulation against heat	6.3.1	1 pair	1	Yes

[a] Applies only to leather. ISO 20344:2011, Table 1 also applies.

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 less 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 document 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 ISO/IEC Guide 98-3.

6 General

6.1 Footwear conforming to the requirements specified in Table 2

Table 2 — Summary of requirements

		Requirements	Reference				Marking symbol
			ISO 20345:2011	EN 15090:2012	ISO 16073-6:2021		
General	Footwear construction	Types and Classifications		4 and 6.1		X	
		Height of upper	5.2.2			X	
		Specific ergonomic features	5.3.4			X	
		Water resistance			6.2	X	
		Flame resistance			6.3.3	X	
	Seat region	Design B Figure 3 ISO 20345	5.2.1			X	
		Design C and D Figure 3 ISO 20345	5.2.1			X	
Whole footwear	Sole performance	Construction	5.3.1.1			X	
		Upper/outsole bond strength	5.3.1.2			X	
		Insulation against heat			6.3.1	X	HI3
		Slip resistance – on ceramic tile floor with NaLS and on steel floor with glycerine	5.3.5.4		Annex D		SRC
		Energy absorption of seat region	6.2.4			X	E
		Flame resistance			6.3.3	X	
		Penetration resistance	6.2.1			O	P
	Toe protection	General	5.3.2.1			X	
		Internal length of toe caps	5.3.2.2			X	
		Impact resistance	5.3.2.3			X	
		Compression resistance	5.3.2.4			X	
		Corrosion resistance of metallic toe caps	5.3.2.5.1			X	
		Non-metallic toe caps	5.3.2.5.2			O	
		Compression resistance of toepuff		6.4		b	R
		Electrically insulating footwear[a]		6.6.2		X	I
		Antistatic footwear[a]		6.6.3		X	A
		Cold insulation of sole complex	6.2.3.2			b	CI
		Whole footwear heat resistance test			7.4	X	
		Zipper		6.8		O	
	Accessories	Metatarsal protection	6.2.6			b	M
		Ankle protection	6.2.7			b	AN
		Laces			6.4	O	
		Eyelet and stud post attachment			7.6	O	
		Threads			6.5 and 7.5	X	

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

O If the component part exists, the requirement shall be met.

[a] It is obligatory that one of the two requirements shall be chosen.

[b] If the property is claimed, the requirement given in the appropriate clause shall be met.

N/A The requirement is not applicable.

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

Table 2 *(continued)*

		Requirements	Reference				Marking symbol
			ISO 20345:2011	EN 15090:2012	ISO 16073-6:2021		
Upper		Tear strength	5.4.3			X	
		Tensile properties	5.4.4			X	
		Water vapour permeability and coefficient	5.4.6			X	
		pH value	5.4.7			X	
		Chromium VI content	5.4.9			X	
		Water penetration and water absorption	6.3			X	
		Radiant heat			6.3.2	X	
		Flame resistance			6.3.3	X	
		Cut resistance	6.2.8			X	CR
Lining	Vamp	Tear strength	5.5.1			X	
		Abrasion resistance	5.5.2			X	
		Water vapour permeability and coefficient	5.5.3			X	
		pH value	5.5.4			X	
		Chromium VI content	5.5.5			X	
	Quarter	Tear strength	5.5.1			O	
		Abrasion resistance	5.5.2			O	
		Water vapour permeability and coefficient	5.5.3			O	
		pH value	5.5.4			O	
		Chromium VI content	5.5.5			O	
Tongue		Tear strength	5.6.1			O	
		pH value	5.6.2			O	
		Chromium VI content	5.6.3			O	
Insole/ insocks					Table 3	X	
Outsole		Tear strength	5.8.2			X	
		Abrasion resistance	5.8.3			X	
		Flexing resistance	5.8.4			X	
		Hydrolysis	5.8.5			X	
		Interlayer bond strength	5.8.6			O	
		Resistance to fuel oil	6.4.2			X	FO
		Cleated area	5.8.1.2			X	
		Thickness	5.8.1.1			X	
		Cleat design		6.7.1		X	
		Cleat height		6.7.2		X	
		Cleat height in the waist area		6.7.3		X	
		Heel breast		6.7.4		X	
		Resistance to hot contact	6.4.1			X	HRO

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

O If the component part exists, the requirement shall be met.

[a] It is obligatory that one of the two requirements shall be chosen.

[b] If the property is claimed, the requirement given in the appropriate clause shall be met.

N/A The requirement is not applicable.

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

Table 3 — Basic requirements for insoles and/or insocks

Options			Component to be assessed	Requirements to fulfil in ISO 20345					
				Thickness 5.7.1	pH[a] 5.7.2	Water absorption desorption 5.7.3	Insole abrasion 5.7.4.1	Insock abrasion 5.7.4.2	Chromium, VI 5.7.5[a]
1	No insole or if present not fulfilling the requirements	Non-removable sock	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 together	X		X			
			Insock		X			X	X
4		Full insock, removable and water permeable[b]	Insole	X	X	X	X		X
			Insock		X			X	X
5		Full insock, removable, not water permeable[b]	Insole	X	X	X	X		X
			Insock		X	X		X	X

X It means that the requirement shall be met.

[a] Applies only to leather.

[b] A water permeable sock is one that, when tested in accordance to ISO 23044:2011, 7.2 lets through water in 60 s or less.

6.2 Water resistance

When tested in accordance with ISO 20344:2011, 5.15.2, the total wetted area inside the footwear shall not be greater than 3 cm^2, after 80 min.

6.3 Thermal behaviour

6.3.1 Insulation against heat

When tested according to the procedure described in ISO 20344:2011, 5.12 the footwear shall meet the requirements for the temperature inside the footwear (see Table 4) and the requirements for resistance to degradation (see Table 5).

Table 4 — Requirement for temperature inside the footwear

Sandbath temperature °C	Requirement for inside temperature of the footwear °C
250 ± 5	<42 after 10 min

Table 5 — Requirement for resistance to degradation

Sandbath temperature °C	Test duration min	Assessment
250 ± 5	40	After testing footwear shall conform to A.2.1

6.3.2 Radiant heat

When tested in accordance with the method described in 7.1, the temperature increase for each material combination shall be equal to or less than 24 ˚C. After testing the footwear shall be in accordance with A.2.2.

6.3.3 Flame resistance

When tested in accordance with the method described in 7.2 the footwear shall neither flame for more than 2 s (after flame time) nor glow for more than 2 s (after glow time). After testing, the footwear shall be in accordance with A.2.3.

6.4 Laces

When tested in accordance with the method described in 7.3, the laces shall not melt, drip or ignite, and shall remain functional.

6.5 Threads

When tested in accordance with the method described in 7.3, all externally exposed threads shall not melt, drip or ignite and shall remain functional.

6.6 Innocuousness

Footwear shall not adversely affect the health or hygiene of the user. Footwear shall be made of materials such as textiles, leather, rubbers or plastics that have been shown to be chemically suitable. The materials shall not in the foreseeable conditions of normal use, release or degrade substances generally known to be toxic, carcinogenic, mutagenic, allergenic, toxic to reproduction or otherwise harmful. Information claiming that the product is innocuous shall be checked.

NOTE Information about critical substances in footwear and footwear components can be found in ISO/TR 16178.

7 Test methods

7.1 Radiant heat test

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, method B at a heat flux density of 20 kW/m^2 exposing the outer surface to radiant heat for 40 s. The result shall be expressed as temperature increase of the highest single result of ΔT rounded to 0,1 °C.

Inspect the test pieces for signs of serious damage, such as caused by burning, dripping, melting or foaming of the material, or deformation and disbanding, see A.2.2.

7.2 Flame resistance test

7.2.1 Conditioning and sampling

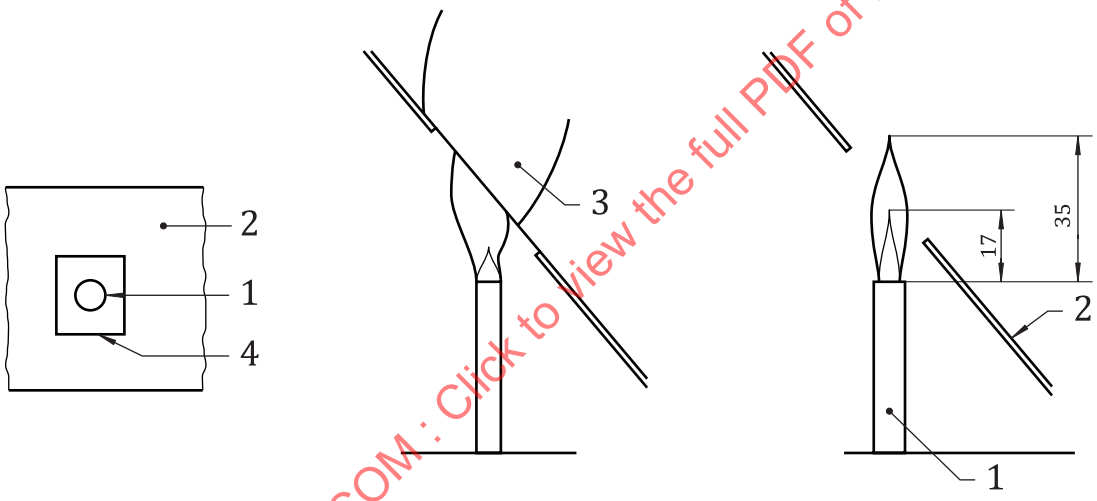
All different external materials, including external seams, labels and closing mechanisms, as provided, as a complete sample of footwear shall be tested in accordance with ISO 15025, as modified in 7.2.2.

7.2.2 Procedure

7.2.2.1 Place the burner (see Figure 2) on a flat, horizontal surface with the burner and flame in a vertical position.

7.2.2.2 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 × 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.



Key

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

Figure 2 — Equipment for flame resistance tests

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

7.2.2.4 Reposition the burner as in 7.2.2.2 and apply the flame for (10 ± 1) s to the designated area.

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

7.2.2.6 Repeat procedures 7.2.2.2, 7.2.2.3 and 7.2.2.4 for at least one test piece of each different external material used in the construction of the footwear, external seams and closing mechanism.

7.3 Thread and lace heat resistance test

7.3.1 Principle

This test method determines the melting point of thread, using a hot contact plate and magnifying glass.

7.3.2 Apparatus

7.3.2.1 **Stage**.

An electrically heated stage, having a circular depression large enough to insert a micro cover glass, with a variable transformer controlling the rate of input into the stage, and with armoured stem thermometer with a range of 150 °C to 300 °C accurate to 1 °C.

7.3.2.2 **Magnifying glass** (at least ×10).

7.3.2.3 **Two micro cover glasses**.

7.3.2.4 **Spatula**.

7.3.2.5 **Pick needle** or **other instrument for applying pressure to the cover glasses**.

7.3.2.6 **Soxhlet extraction apparatus**.

7.3.3 Specimen

The specimen shall be extracted with chloroform for a minimum of 20 extractions in a Soxhlet extractor and dried. The specimen shall then be cut into lengths of 0.2 cm or less.

7.3.4 Procedure

The apparatus shall be calibrated by determining the melting point of a pure material of a known melting point. The melting point of the pure material shall be in the range of 240 °C to 260 °C. In subsequent determinations immediately following the initial determination, the stage in each case shall be cooled to approximately 200 °C before the specimen is placed for testing. The specimen shall be placed in a small mound on a cover glass and covered with another cover glass. The cover glasses shall be pressed together gently but firmly and placed in a circular depression on the stage. The temperature of the stage shall be quickly raised to a temperature of 240 °C, and thereafter at a rate of 3 °C to 4 °C per minute until a temperature of 260 °C is reached. A slight pressure shall be applied to the top cover glass to make sure that the cover glass remains in contact with the complete fibre. The specimen shall be observed with the aid of a magnifying glass and a determination made at 260 °C whether the specimen has ignited, melted or charred. Two different specimens shall be tested.

7.3.5 Report

Specimens which show ignition, melting or charring at, or below, 260 °C shall be reported as failing the test. Specimens that do not show these characteristics at 260 °C shall be reported as passing the test.

7.4 Whole footwear heat resistance test

When tested in accordance with this clause, a complete middle size sample shall not melt, drip or ignite and remain functional.

NOTE All accessories or fittings are tested as part of the footwear e.g. zipper sections.

7.4.1 Principle

The complete item of footwear with all attachments is suspended in a hot air circulating oven at 120 °C for 4 h. Any ignition, melting, dripping, separation or shrinking of the specimen is recorded.

7.4.2 Apparatus

Forced air circulating oven, capable of maintaining the test temperature over a period of 4 h and of sufficient internal volume to allow the test specimen to be suspended as specified in 7.4.4.

7.4.3 Specimens

Condition the material for at least 24 h in a standard atmosphere at (23 ± 2) °C and (50 ± 5) % relative humidity.

7.4.4 Procedure

The sample shall be prepared and tested as follows:

Attach a metal clip to the top centre of the specimen.

a) Heat the oven to the test temperature.

b) Open the oven door and quickly insert the specimen so that it hangs in the centre of the oven and is not less than 50 mm from any inner surface of the oven.

c) Close the door and time the exposure from the door closure.

d) After 4 h, open the oven door and remove the specimen.

The oven temperature will drop when the door is opened. The temperature throughout the 4 h exposure shall remain at or above the test temperature.

7.4.5 Report

From observation of the specimen the following shall be reported:

a) Any ignition of the specimen.

b) Any melting of the specimen: hole formation, dripping.

c) Any separation of the specimen: splitting, delamination.

d) Any shrinkage of the specimen in either length or width direction, if the shrinkage is greater than 10 % and the specimen was originally 150 mm in that direction.

7.5 Thread strength test

Samples of threads used in the construction of footwear shall be tested in accordance with ISO 2062.

Where the thread is manufactured using natural or a combination of natural and synthetic material it shall be treated to make it resistant to microbiological deterioration (rot resistance). The treated thread shall be tested in accordance with the methods described in EN 14119.

When tested in accordance with the method given in 7.5, threads used in the construction of footwear shall be capable of withstanding the appropriate force value given in Table 6.

Table 6 — Minimum thread strength

Sewing operation	Rows of stitching	Minimum thread breaking force N
Vamp to quarters	Two Three	80 50
Vamp to toecap	Two Three	80 50
Sole sewing (where applicable)	One	190
All other operations	One	20

7.6 Eyelet and stud post attachment

When tested in accordance with the method described in this clause the attachment strength shall be greater than 400 N.

7.6.1 Principle

A test specimen which includes the eyelet or stud post is cut from the footwear. The test specimen is clamped in one jaw of a tensile testing machine, a length of lace is inserted through the fastening and clamped in the second jaw. The force required to cause failure of the fastening is measured, and the measurement and the type of failure are recorded.

7.6.2 Apparatus

Tensile testing machine, with

a) jaw separation rate of (100 ± 20) mm/min,

b) capability of measuring the forces up to 1 kN, and

c) strong nylon or polyester lace of a weight that might be used with the fastening in the footwear.

7.6.3 Preparation of test specimens

The specimens shall be prepared as follows:

a) Cut at least three test specimens from the footwear.

b) Cut a rectangle from the facing as shown in Figure 3. Mark the clamping line onto the test specimen (15 ± 1) mm from the eyelet or stud post.

7.6.4 Procedure

The procedure shall be as follows:

a) Clamp the test specimen in one jaw of the testing machine.

b) Cut a piece of lace of length at least 200 mm long. Insert the lace through the eyelet or around the stud post, equalize the length of the two ends of the lace and insert side by side in the second jaw of the testing machine.

c) Operate the testing machine and stop the machine when any failure that would make the fastener inoperative in wear occurs.

NOTE 1 Types of failure include:

a) Tearing of the upper.

b) Distortion or breakage of the stud post.

c) Pulling out of the stud post eyelet or attachment rivets.

d) Breakage of the lace.

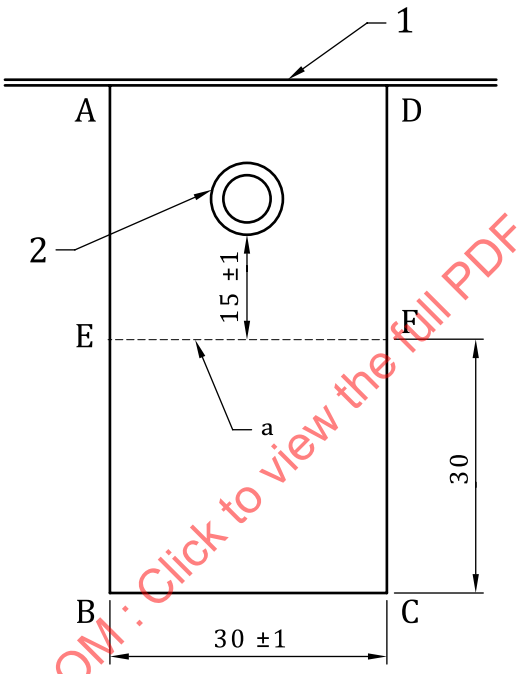
e) Record the force at which failure occurs in newtons to the nearest 5 N.

f) If breakage of the lace occurs the result is invalid unless the result obtained is well above specification. If necessary use a stronger lace.

g) Repeat Steps a) to d) two more times.

h) Calculate the arithmetic mean of the three test specimens and record this value together with the type of failure.

Dimensions in millimetres



Key

1 edge of facing

2 eyelet or other fastener

a Clamping line.

Figure 3 — Eyelet and stud sample

8 Marking

Each item of safety footwear shall be clearly and permanently marked, e.g. by embossing or branding, with the following:

a) size;

b) manufacturer's identification mark;

c) manufacturer's unique model/design identification;

d) year and month of manufacture;

e) a reference to this document, i.e. ISO 16073-6:2021;

f) marking symbols for any optional requirements that are met, see Table 2.

9 Information to be supplied

9.1 General

Safety footwear shall be supplied to the customer with information written at least in the official language(s) of the country of destination. All information shall be unambiguous and shall include the following:

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

b) name and full address of the authority certifying compliance with this document;

c) reference to this document, i.e. ISO 16073-6:2021;

d) explanation of any pictograms, markings and levels of performance;

e) basic explanation of the tests that have been applied to the footwear, if applicable;

f) instructions for use:

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

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

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

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

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

   6) instructions for cleaning and/or decontamination;

   7) obsolescence deadline or period of obsolescence;

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

   9) if helpful, additional illustrations, part numbers, etc.

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

h) type of packaging suitable for transport, if relevant.

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 minimise electrostatic build-up by dissipating electrostatic charge, thus avoiding the risk of spark ignition of, for example flammable substances.

ATTENTION — 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 program 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 such 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 test it at regular 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 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 50321:1999[1)], 6.3 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, worn and 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 while 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

1) EN 50321:1999 is withdrawn, but applies only for this specific point. It was replaced by EN 50321-1:2018 which takes precedence for the other cases.

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.

9.5 Information regarding penetration resistant insert

Each pair of penetration resistant footwear shall be supplied with a leaflet containing the following wording: "The penetration resistance of this footwear has been measured in the laboratory using a truncated nail of diameter 4,5 mm and a force of 1 100 N. Higher forces or nails of smaller diameter will increase the risk of penetration occurring. In such circumstances alternative preventative measures should be considered. Two generic types of penetration resistant insert are currently available in PPE footwear. These are metal types and those from non-metal materials. Both types meet the minimum requirements for penetration resistance of the standard marked on this footwear but each has different additional advantages or disadvantages including the following:

Metal: Is less affected by the shape of the sharp object/hazard (i.e. diameter, geometry, sharpness) but due to shoemaking limitations does not cover the entire lower area of the shoe

Non-metal: May be lighter, more flexible and provide greater coverage area when compared with metal but the penetration resistance may vary more depending on the shape of the sharp object/hazard (i.e. diameter, geometry, sharpness)

For more information about the type of penetration resistant insert provided in your footwear please contact the manufacturer or supplier detailed on these instructions"

9.6 Assessment of the footwear by the wearer

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. See Annex B.

Annex A
(informative)

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

A.1 General

The following list and the drawings shown in Annex C are provided to assess the resistance to heat and flame tested in accordance with 6.3, thermal behaviour of footwear for firefighters undertaking wildland firefighting activities.

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

A.2.1 Insulation against heat

When tested in accordance with 6.3.1 of this document, footwear for firefighters shall be failed 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);

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

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

A.2.2 Radiant heat

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

— 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 the footwear off easily).

A.2.3 Flame resistance

When tested in accordance with 6.3.3, footwear for firefighters shall be failed if any of the 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 more than the half of upper thickness;

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

— the outsole shows cracks 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);

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

Annex B
(informative)

Assessment of the footwear by the wearer

B.1 General

The following list and drawings given in Annex C are 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 C.1 a);

— strong abrasion of the upper material, especially if 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 greater than 10 mm long and 3 mm deep (Figure C.1 d); upper/sole separation of more than 10 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.