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Wildland firefighting personal protective equipment — Requirements and test methods —

Part 5: Helmets

Équipement de protection individuelle pour la lutte contre les feux d'espaces naturels — Exigences et méthodes d'essai — Partie 5: Casques

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Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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 — Protective equipment*, Subcommittee SC 14, *Firefighters personal equipment.*

This first edition of ISO 16073-5, 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. Consequently, a helmet should be light 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 personal protective equipment (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 designed for use for extended periods during wildland firefighting.

Wildland firefighting personal protective equipment — Requirements and test methods —

Part 5: Helmets

1 Scope

This document specifies the minimum performance requirements and methods of test for helmets used for wildland firefighting.

This document covers the general design of wildland firefighting helmets, the minimum levels of performance for the materials employed and the methods of test used. The personal protection equipment (PPE) is not intended to provide protection during fire entrapment.

This document does not cover PPE for structural firefighting (see ISO 11999 series), for use against chemical, biological, radiological and nuclear hazards, 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 13688:2013, *Protective clothing — General requirements*

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*

EN 960, *Headforms for use in the testing of protective helmets*

CIE 54.2, *Retroreflection — Definition and measurement*

3 Terms and definitions

For the purposes of this document, the terms and definitions 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 Design and general requirements

4.1 General

Wildland firefighters require helmets to minimize the impact or penetration caused by falling tree branches as well as to provide protection to the head from flames, flying embers and radiant heat. Helmets shall also be fitted with securing mechanisms to prevent them from being dislodged during wildland firefighting operations. Recommendations for general consideration of design and construction of helmets are given in Annex B and Annex D. A summary of design and performance requirements are given in Table 1.

The helmet may be required to interface with other items of PPE used for wildland firefighting.

The helmet shall meet the requirements as detailed in ISO 13688:2013, 4.2.

NOTE For more information, see ISO/TS 11999-2.

4.2 Helmet shell

There shall be no sharp edges, roughness or projection on any part of the helmet which may cause injury to the wearer, in contact or potential contact with the wearer when it is worn.

There shall be no holes on the shell's surface that may allow ingression of flying embers or hot debris.

The profile at the front edge of the shell shall not prevent the wearing of spectacles or goggles.

4.3 Vertical clearance

The vertical clearance between the top of the headform and the inside of the shell as shown in Figure 1, when measured under the conditions given in 6.3.3, shall be no more than 50 mm.

4.4 Horizontal clearance

The horizontal clearance at the front and sides of the helmet, when measured under the conditions given in 6.3.3. shall be no less than 5 mm.

4.5 Wearing height

The wearing height, being the distance between the top of the headform and the bottom edge of the headband, when measured either at the front of the headform or at the side under the conditions given in 6.3.3, shall be no less than:

— 80 mm for helmets mounted on headform size designation 525 (as per EN 960);

— 85 mm for helmets mounted on headform size designation 555 (as per EN 960);

— 90 mm for helmets mounted on headform size designation 585 (as per EN 960).

4.6 Mass

If the mass of a complete helmet, including harness but without accessories, exceeds 800 g, this mass, determined to the nearest 30 g, shall be shown on a label attached to the helmet.

4.7 Shell conspicuity

The helmet shell shall have retroreflective markings in accordance with 4.8 adhered to the shell exterior. A minimum of 26 cm^2 of the markings shall be visible when the helmet is viewed from any angle at the reference plane (see figure footnote b on Figure 2). A material which combines both the fluorescent and

retroreflective properties may be used. Care should be exercised when selecting marking materials to ensure they will not degrade the helmet shell.

4.8 Retroreflective material

The material shall have a coefficient of luminous intensity per square meter (CIL/m^2) of not less than 85 cd/lx/m^2 when measured in accordance with CIE 54.2 with an observation angle of 0,2° and entrance angle of −4°.

4.9 Neck protector

A neck protector shall be fitted and designed to protect the wearer's neck from heat and embers and as such when fitted:

— the helmet continues to comply with requirements in this document;

— the limited flame spread test shall be performed in accordance with ISO 15025, Procedure A (Surface ignition) for an application time of 10 s with the following acceptable performance requirements:

1) no specimen shall give hole formation;

2) no specimen shall give molten or flaming debris;

3) the mean value of the afterflame time shall be ≤2 s;

4) the mean value of the afterglow time shall be ≤2 s.

— the material when tested together with the helmet in test methods given in C.4 (Test 1) and C.5 (Test 2), shall not ignite, melt or drip.

4.10 Retention system

The helmet shall be fitted with a retention system, including a chin strap. The chin strap shall be adjustable in length.

A minimum of three-point retention system shall have at least three separate points of attachment to the shell. That part of the chin strap which comes into contact with the jaw shall have a minimum width of 15 mm under an intermediate load of 250 N (see 5.3).

4.11 Accessories attached on the helmet

Any accessories, whether permanently attached on or detachable from the helmet, when fitted shall continue to meet the requirements of this standard. Accessories that are permanently attached to the helmet, e.g. lamp bracket, cable clips, mounting points, attachment rails, badges and trims, shall be considered as part of the helmet for the purpose of testing.

Certain accessories or non-integral additional protective devices like earmuffs and mesh face shield are suited only for non-firefighting activities like road clearance and wood cutting. Information should be provided by the manufacturer as to the circumstances under which such items may be used.

5 Performance requirements

5.1 Shock absorption

5.1.1 Crown impact

The helmet shall be tested to the method given in 6.4.3.1 at low temperature, high temperature, and wet conditions, and the force transmitted to the headform shall not exceed 5,0 kN, for an impact energy of (50 ± 2) J.

5.1.2 Off-crown impacts

The helmet shall be tested to the method given in 6.4.3.2 at low temperature, high temperature, and wet conditions, and the force transmitted to the headform shall not exceed 5,0 kN, for an impact energy of (25 ± 1) J.

5.2 Resistance to penetration

The helmet shall be tested to the method given in 6.5, and the point of the striker shall not contact the surface of the headform, for an impact energy of (30 ± 1) J.

5.3 Retention system strength

The chinstrap on the helmet shall be tested to the method given in 6.6, and the following shall apply:

a) Maximum dynamic elongation shall not exceed 25 mm under the intermediate load (250 N);

b) Minimum width of the chin strap under an intermediate load (250 N) shall be 15 mm;

c) The release point of the retention system shall be between 500 N and 1 000 N.

5.4 Lateral rigidity

The helmet shall be tested to the method given in 6.7, where the maximum lateral deformation of the shell shall not exceed 40 mm, and the residual deformation shall not exceed 15 mm.

5.5 Flame resistance

The helmet shell shall be tested to the method given in 6.8, and the material shall not burn with the emission of flame after a period of 5 s has elapsed following removal of the flame source.

5.6 High-temperature stability

The helmet shall be tested in accordance with C.4 (Test 1), and there shall be no visible distortion of the shell.

Any failure of headbands or other internal components during this test (e.g. melting or collapse of the headband) shall not be the basis for rejection of the helmet.

NOTE The purpose of this test is to ensure the suitability of the shell material when it is exposed to high heat sources capable of raising the temperature of the helmet shell to 180 °C. Headbands within the helmet and in contact with the wearer's head are not in contact with or exposed to such sources.

5.7 High radiant heat environments

The helmet shall be tested in accordance with C.5 (Test 2), and it shall meet the following requirements.

a) no part of the helmet shell shall touch the headform;

b) no shell distortion in the posterior portion of the helmet brim shall extend more than 20 mm below the original position;

c) no distortion of the anterior and lateral portions of the helmet brim shall extend more than 15 mm below the original position;

d) no ignition of any part of the helmet assembly shall occur;

e) no melting or dripping of the helmet shell, including the labels on the interior of the helmet.

Any failure of headbands or other internal components during this test (e.g. melting or collapse of the headband), shall not be the basis of rejection of the head protective device.

NOTE The purpose of this test is to ensure the suitability of the shell material when it is exposed to radiant heat sources capable of raising the temperature of the helmet shell to 260 °C for a short period of time. Headbands within the helmet and in direct contact with the wearer's head are not in contact with or exposed to such sources.

5.8 Electrical insulation

The helmet shall be tested to the method given in 6.9, and the leakage current shall not exceed 1,2 mA.

NOTE This requirement is intended to ensure protection from voltages of up to 440 V.

5.9 Optional low-temperature tests

When (–20 ± 2) °C is selected, conditioning at –10 °C is not required. Following conditioning, helmets shall be tested for shock absorption in accordance with 6.4 and for resistance to penetration in accordance with 6.5 and shall meet the requirements of 5.1 and 5.2 respectively.

The test report shall identify the temperature used. Helmets meeting these requirements (see Table 1) shall state this fact on the label attached to the helmet.

Table 1 — Summary of design and performance requirements

Performance	Requirements	Clause	Criteria
Design	Vertical clearance	4.3	≤50 mm
	Horizontal clearance	4.4	≥5 mm
	Wearing height	4.5	≥80 mm for 525 headform ≥85 mm for 555 headform ≥90 mm for 585 headform
Mechanical	Shock absorption, crown and off-crown	5.1	≤5 kN
	Resistance to penetration	5.2	No contact with the surface of the head form
	Retention system strength	5.3	Elongation ≤25 mm at 250 N Webbing width ≥15 mm at 250 N Break between 500 N and 1 000 N
	Lateral rigidity	5.4	Lateral deformation ≤40 mm Residual deformation ≤15 mm
Thermal	Flame resistance	5.5	Self-extinguish ≤5 s
	High temperature stability	5.6	No visible distortion to shell

Table 1 *(continued)*

Performance	Requirements	Clause	Criteria
	High radiant heat	5.7	Shell not touching head form Rear brim extends ≤20 mm below the original position Front and side brim extends ≤15 mm below the original position No ignition No melting or dripping
	Low-temperature (optional)	5.9	Meet requirement of 5.1 Meet requirement of 5.2
Others	Electrical insulation	5.8	Current leakage ≤1,2 mA

6 Test requirements

6.1 Samples

Helmets shall be submitted for testing in the condition in which they are offered for sale, including attachment of any accessories for special purposes.

No helmet that has been subjected to testing shall be offered for sale. The minimum number of samples required for one set of tests is as per below:

a) one helmet for the shock absorption tests (crown and off-crown) following −10 °C conditioning (or −20 °C optional);

b) one helmet for the shock absorption tests (crown and off-crown) following 50 °C conditioning, then followed by flammability test;

c) one helmet for the shock absorption tests (crown and off-crown) following wet conditioning;

d) one helmet for the resistance to penetration test following −10 °C conditioning (or −20 °C optional);

e) one helmet for the retention system strength test then followed by electrical insulation test;

f) one helmet for the lateral rigidity test;

g) one helmet for the high temperature stability test;

h) one helmet for high radiant heat environment test.

6.2 Conditioning for testing

6.2.1 Preconditioning chamber

This shall be sufficiently large to ensure that the helmets can be positioned such that they touch neither one another nor the sides. It shall be fitted with a fan to provide effective air circulation.

6.2.2 Preconditioning

All helmets shall be preconditioned for at least 24 h at a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) %. Sample 1 to 4 shall undergo extra preconditioning with ultraviolet (UV) ageing treatments in accordance with the method below.