
**Wildland firefighting personal
protective equipment —
Requirements and test methods —**

**Part 7:
Face and eye protection**

iTeh STANDARD PREVIEW
*Équipement de protection individuelle pour la lutte contre les feux
d'espaces naturels — Exigences et méthodes d'essai —
Partie 7: Protection du visage et des yeux*
(standards.iteh.ai)

ISO 16073-7:2019

<https://standards.iteh.ai/catalog/standards/sist/9395af10-997f-4299-82ee-dddc782b0cb5/iso-16073-7-2019>



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Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Eye protectors	2
4.1 General.....	2
4.2 Design and manufacturing requirements.....	2
4.2.1 General construction.....	2
4.2.2 Materials.....	2
4.2.3 Headbands.....	2
4.3 Basic, particular and optional requirements for non-mesh eye protectors.....	2
4.3.1 Basic requirements.....	2
4.3.2 Particular requirements.....	5
4.3.3 Optional requirements.....	7
4.4 Mesh eye and face protectors.....	8
4.4.1 Basic requirements.....	8
4.4.2 Design and manufacture.....	8
4.4.3 Performance.....	9
4.4.4 Requirements for eye protectors with special characteristics.....	10
4.5 Allocation of requirements, test schedules and application.....	10
4.5.1 Requirements, test methods and schedules.....	10
4.5.2 Application of eye protector types.....	10
5 Marking and labelling	15
5.1 General marking requirements.....	15
5.2 Legibility.....	15
5.3 Conformity marking requirements.....	15
5.4 Additional marking requirements.....	16
5.4.1 Eye protectors.....	16
6 Manufacturer's information	19
6.1 General.....	19
Annex A (normative) Thermal stability of eyewear at elevated temperatures	21
Bibliography	23

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 16073-7, together with ISO 16073-8 and ISO 16073-1 to ISO 16073-6 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 (PPE) face and eye protection, designed for use for extended periods during wildland firefighting.

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Wildland firefighting personal protective equipment — Requirements and test methods —

Part 7: Face and eye protection

1 Scope

This document specifies the minimum performance requirements and methods of test for personal protective equipment (PPE) face and eye protection, for wildland firefighting.

This document covers the general design of the PPE, the minimum levels of performance for the materials employed and the methods of test used. This 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

ISO 16073-7:2019

<https://standards.iteh.ai/catalog/standards/sist/9395af10-997f-4299-82ee-dddc782b0cb5/iso-16073-7-2019>

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 18526-2:—¹⁾, *Eye and face protection — Test methods — Part 2: Physical optical properties*

ISO 18526-3²⁾, *Eye and face protection — Test methods — Part 3: Physical and mechanical properties*

ISO 17493, *Clothing and equipment for protection against heat — Test method for convective heat resistance using a hot air circulating oven*

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

EN 167:2001, *Personal eye-protection — Optical test methods*

EN 170, *Personal eye-protection — Ultraviolet filters — Transmittance requirements and recommended use*

EN 172, *Personal eye protection — Sunglare filters for industrial use*

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>

1) Under preparation. Stage at the moment of publication ISO/FDIS 18526-2:2019.

2) Under preparation. Stage at the moment of publication ISO/FDIS 18526-3:2019.

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

4 Eye protectors

4.1 General

Wildland firefighters' eyes are exposed to irritants, such as smoke particles and off-gassing chemicals, which cause severe irritation and discomfort to the eyes. Eye protectors should protect the eyes from the ingress of smoke particles and other irritants. The complete eye protector should also resist fogging. Activities associated with wildland firefighting, such as chainsaw use, may require alternative forms of eye protection, such as mesh visors.

Eye protectors may need to interface with other items of PPE used for wildland firefighting, e.g. Helmet.

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

4.2 Design and manufacturing requirements

4.2.1 General construction

Eye protectors shall be free from projections, sharp edges or other defects, which are likely to cause discomfort or injury during use.

4.2.2 Materials

No part of the eye protector in contact with the wearer shall be made of materials that are known to cause any skin irritation.

4.2.3 Headbands

Headbands, if used as the principal means of retention, shall be at least 10 mm wide over any portion which may come into contact with the wearer's head. Headbands shall be adjustable or self-adjusting.

4.3 Basic, particular and optional requirements for non-mesh eye protectors

4.3.1 Basic requirements

4.3.1.1 General

All non-mesh eye protectors shall meet the basic requirements given in this subclause.

Furthermore, according to their intended use, non-mesh eye protectors shall, if appropriate, meet one or more of the particular requirements given in [4.3.2](#).

Optional requirements related to additional properties of non-mesh eye protectors are given in [4.3.3](#).

4.3.1.2 Field of vision

The size of the field of vision shall be defined in conjunction with the appropriate headform described in EN 168:2001, Clause 17.

Eye protectors shall exhibit a minimum field of vision defined by the two ellipses in [Figure 1](#), when placed and centred at a distance of 25 mm from the surface of the eyes of the appropriate headform. The horizontal axis shall be parallel to, and 0,7 mm below, the height of the line connecting the centres of the two eyes. The horizontal length of the ellipses shall be 22,0 mm; the vertical width of the ellipses shall be 20,0 mm. The centre distance of the two ellipses shall be $d = c + 6$ mm, where c is the pupillary

distance. The pupillary distance is 64 mm for the medium headform and 54 mm for the small headform, if not specified differently by the manufacturer.

The test shall be carried out in accordance with EN 168:2001, Clause 18.

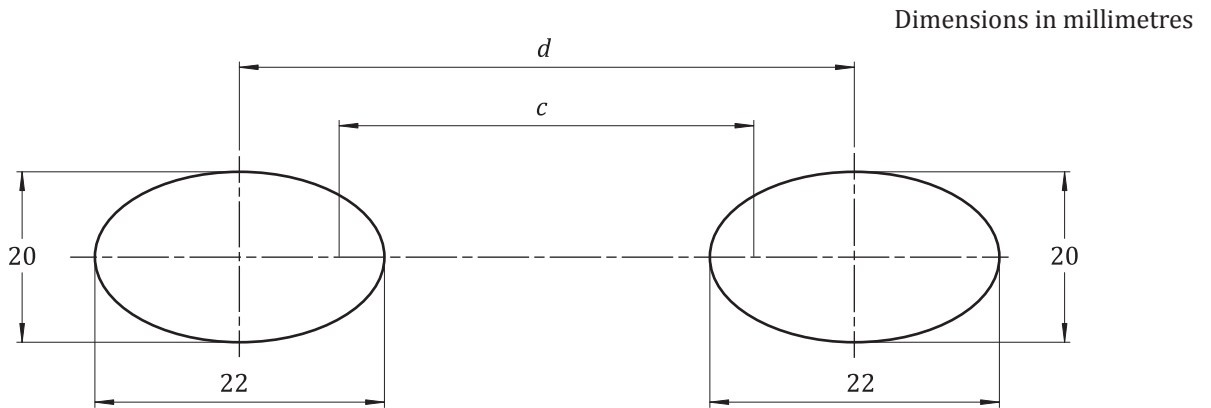


Figure 1 — Definition of the field of vision

4.3.1.3 Optical requirements

4.3.1.3.1 Spherical, astigmatic and prismatic refractive powers

The refractive powers of oculars shall be measured by the reference methods specified in EN 167:2001, Clause 3. This Clause 3 also refers to an optional method for use in specific circumstances; the details of this method are given in EN 167:2001, Annex A.

4.3.1.3.2 Mounted oculars and unmounted oculars covering both eyes

The refractive power characteristics of mounted oculars or unmounted oculars covering both eyes shall be measured by the method specified in EN 167:2001, 3.2, at the visual centre of the ocular.

The permissible tolerances for oculars without corrective effect are given in Table 1.

The difference in prismatic refractive power specified for an eye protector depends not only on the prismatic refractive power of each ocular, but also on the position of the optical axis of the ocular in relation to the axis of vision and, therefore, the shape of the frame. It is, therefore, necessary to use replacement oculars for which the difference in prismatic power remains within the permissible tolerance limits for the frame in question.

Table 1 — Permissible tolerances for refractive powers of mounted oculars without corrective effect and unmounted oculars without corrective effect covering both eyes

Optical class	Spherical refractive power $\frac{(D_1 + D_2)}{2}$ m^{-1}	Astigmatic refractive power $ D_1 - D_2 $ m^{-1}	Difference in prismatic refractive power cm/m		
			Horizontal		Vertical
			Base out	Base in	
1	±0,06	±0,06	0,75	0,25	0,25
2	±0,12	±0,12	1,00	0,25	0,25

NOTE D_1 and D_2 are the refractive powers in the two principal meridians.

4.3.1.3.3 Transmittance

4.3.1.3.3.1 Oculars without filtering action

Oculars intended to protect the eyes against mechanical or chemical hazards only, and cover plates, shall have a luminous transmittance greater than 74,4 % when measured as given in EN 167:2001, Clause 6 [based on CIE source A (2 856 K)].

4.3.1.3.3.2 Oculars with filtering action (filters) and housings for oculars with filtering action

The transmittance of oculars with filtering action shall meet the requirements given in the specific standards relating to the various types of ocular, i.e. EN 170 or EN 172.

Housings of goggles and face shields which claim to provide protection against optical radiation shall provide at least the same level of protection against optical radiation as given by a filter of any scale number declared usable with the eye protector by the manufacturer or supplier. Testing shall be in accordance with EN 167:2001, Clause 6.

4.3.1.3.3.3 Variations in transmittance — Oculars without corrective effect

NOTE Oculars without filtering action are exempt from this requirement.

Variations in luminous transmittance shall be measured in accordance with EN 167:2001, Clause 7.

The relative variations of the luminous transmittance around the visual centre(s) P1 and P2 shall not exceed the values of Table 2. The relative difference in luminous transmittance P3 between left and right eye shall not exceed the values of Table 2 or 20 %, whichever is the greater.

Table 2 — Variations in luminous transmittance

Luminous transmittance		Permissible relative variation
less than %	up to %	
100	17,8	±5
17,8	0,44	±10
0,44	0,023	±15
0,023	0,001 2	±20
0,001 2	0,000 023	±30

4.3.1.3.4 Scattering of light

The percentage value of wide angle scatter (haze) shall not exceed 3,0 %, when measured according to ISO 18526-2:—, 14.1.

4.3.1.4 Quality of material and surface

Except for a marginal area 5 mm wide, oculars shall be free from any significant defects likely to impair vision in use, such as bubbles, scratches, inclusions, dull spots, pitting, mould marks, scouring, grains, pocking, scaling and undulation.

The assessment shall be carried out in accordance with the method specified in EN 167:2001, Clause 5.

4.3.1.5 Resistance to ageing

4.3.1.5.1 Stability at an elevated temperature

Assembled eye protectors shall show no apparent deformation when tested by the method specified in [A.4](#) (test 1).

4.3.1.5.2 Resistance to ultraviolet radiation — Oculars only

Oculars shall be subjected to the test for resistance to ultraviolet radiation in accordance with the method specified in EN 168:2001, Clause 6. At the end of the test, oculars shall meet the following requirements.

- a) The relative change of luminous transmittance shall not be greater than the values specified in [Table 3](#).
- b) The value of the reduced luminance factor shall not exceed the permissible limits given in [4.3.1.3.4](#).

Table 3 — Permissible relative change in luminous transmittance following the ultraviolet radiation test

Luminous transmittance		Permissible relative change %
less than %	up to %	
100	17,8	±5
17,8	0,44	±10
0,44	0,023	±15
0,023	0,001 2	±20
0,001 2	0,000 023	±30

4.3.1.6 Resistance to corrosion

After having undergone the test for resistance to corrosion specified in EN 168:2001, Clause 8, all metal parts of the eye protector shall display smooth surfaces, free from corrosion, when examined by a trained observer.

4.3.1.7 Resistance to ignition

Eye protectors shall be tested in accordance with the method specified in EN 168:2001, Clause 7 and shall be considered to be satisfactory if no part of the eye protector ignites or continues to glow after removal of the steel rod.

4.3.2 Particular requirements

4.3.2.1 Protection against high-speed particles

Eye protectors intended to provide protection against high-speed particles shall withstand the impact of a 6 mm nominal diameter steel ball of 0,86 g minimum mass, striking the oculars and the lateral protection at one of the speeds given in [Table 4](#).

Table 4 — Requirements relating to protection against high-speed particles

Type of eye protector	Impact speed of ball		
	Low-energy impact F 45 ^{+1,5} ₀ m/s	Medium-energy impact B 120 ⁺³ ₀ m/s	High-energy impact A 190 ⁺⁵ ₀ m/s
Goggles	+	+	Not applicable
Face shields	+	+	+

The test shall be in accordance with the method specified in EN 168:2001, Clause 9.

It shall not be possible for the ball to strike the lateral impact point without first striking the lateral protection.

On so testing, the following defects shall not occur.

- a) Ocular fracture: an ocular shall be considered to have fractured if it cracks through its entire thickness into two or more pieces, or if more than 5 mg of the ocular material becomes detached from the surface away from the one struck by the ball, or if the ball passes through the ocular.
- b) Ocular deformation: an ocular shall be considered to have been deformed if a mark appears on the white paper on the opposite side to that struck by the ball.
- c) Ocular housing or frame failure: an ocular housing or frame shall be considered to have failed if it separates into two or more pieces, or if it is no longer capable of holding an ocular in position, or if an unbroken ocular detaches from the frame, or if the ball passes through the housing or frame.
- d) Lateral protection failure: the lateral protection shall be considered to have failed if it fractures through its entire thickness into two or more separate pieces, or if one or more particles becomes detached from the surface remote from the impact point, or if it allows the ball to penetrate completely, or if it partially or totally detaches from the eye protector, or if its component parts become separated.

Eye protectors offering protection against high-speed particles shall provide lateral protection.

4.3.2.2 Protection against droplets and splashes of liquids

Eye protectors for use against droplets (goggles) and splashes of liquids (face shields) shall be tested in accordance with the methods specified in EN 168:2001, Clause 12. The results shall be considered to be satisfactory if:

- a) no pink or crimson colouration appears in the ocular regions defined by the two circles when assessing goggles for protection against droplets; no account shall be taken of any such coloration up to a distance of 6 mm inside the edges of the eye protector;
- b) face shields cover the eye-region rectangle of the appropriate headform, as described in EN 168:2001, 10.2.2.2 and as assessed in accordance with EN 168:2001, 10.2.

Additionally, face shields for protection against splashes of liquids shall have a viewing area with a minimum vertical centreline depth of 150 mm when mounted in the appropriate housing.

4.3.2.3 Protection against large dust particles

Eye protectors for use against large dust particles shall be tested in accordance with the method specified in EN 168:2001, Clause 13. The result shall be considered to be satisfactory if the reflectance after the test is not less than 80 % of its value before the test.