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## Eye and face protection for occupational use —

### Part 2: Additional requirements for protectors used during welding and related techniques

*Protection des yeux et du visage pour les loisirs —*

*Partie 2: Exigences complémentaires relatives aux protecteurs utilisés pour le soudage et les techniques connexes*

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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](http://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](http://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 on 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 the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

The committee responsible for this document is ISO/TC 94, *Personal safety - Protective clothing and equipment*, Subcommittee SC 6, *Eye and face protection*.

This document cancels and replaces the ISO 4850:1979 which has been technically revised.

A list of all parts in the ISO 16321- series can be found on the ISO website.

## Introduction

This family of documents was developed in response to the worldwide stakeholders' demand for minimum requirements and test methods for eye and face protectors traded internationally. ISO 4007 gives the terms and definitions for all the various product types. The test methods are in the ISO 18526-series, while the requirements for occupational eye and face protectors are in the ISO 16321- series. Eye protection for specific sports is mostly dealt with by the ISO 18527- series. A guidance document for the selection, use and maintenance of eye and face protectors is in preparation.

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# Eye and face protection for occupational use —

## Part 2:

# Additional requirements for protectors used during welding and related techniques

## 1 Scope

This document specifies additional material, design, performance and marking requirements for eye and face protectors designed to provide protection for the eyes and faces of persons against occupational hazards during welding and related techniques, such as optical radiation, impacts from flying particles and fragments, and hot solids. The other applicable requirements for welding protectors are given in ISO 16321-1.

This document also applies to those products of eye and face protection used for occupational-type tasks but not performed as part of an occupation, e.g. "do-it-yourself".

## 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 4007, *Eye and face protection — Vocabulary*

ISO 18526-1<sup>1)</sup>, *Eye and face protection — Test methods — Part 1: Geometrical optical properties*

ISO 18526-2<sup>2)</sup>, *Eye and face protection — Test methods — Part 2: Physical optical properties*

ISO 18526-3<sup>3)</sup>, *Eye and face protection — Test methods — Part 3: Physical and mechanical properties*

ISO 18526-4<sup>4)</sup>, *Eye and face protection — Test methods — Part 4: Head forms*

ISO 16321-1, *Eye and face protection for occupational use — Part 1: General requirements*

ISO 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers*

ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4007 apply.

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

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

— ISO Online browsing platform: available at <http://www.iso.org/obp>

1) Under preparation (Stage at the time of publication ISO/DIS 18526-1)

2) Under preparation (Stage at the time of publication ISO/DIS 18526-2)

3) Under preparation (Stage at the time of publication ISO/DIS 18526-3)

4) Under preparation (Stage at the time of publication ISO/DIS 18526-4)

For the purposes of this document, “welding protector” is used as a synonym for welding helmets, welding hand shields, welding goggles, welding spectacles and the associated frames and mountings.

## 4 Requirements

### 4.1 General

Only those requirements that are different from or supplement the ISO 16321-1 specifications are given in this document.

The following requirements from ISO 16321-1:— shall be met:

- [Clause 4](#): General requirements for protectors
- [Clause 5.2](#): Refractive power and prismatic deviation
- [Clause 6.1](#): Detection of signal lights, optional
- [Clause 6.4](#): Uniformity of luminous transmittance (not for automatic welding filters)
- Clause 7.2: Headbands and harnesses
- Clause 7.3: Quality of material and surface of lenses
- Clause 7.4: Basic Impact Level (for welding helmets, hand shields, frames or mountings)
- Clause 7.7: Resistance to corrosion, where applicable
- Clause 7.8: Resistance to ignition
- Clause 7.9: Penetration of vents, where applicable
- Clause 7.10: High-speed impact resistance, Impact Level C, D, E, optional
- Clause 7.11: High mass impact, Impact Level HM, optional

The additional requirements given in this document shall be met.

The welding protectors described in this document are intended for use at temperatures from -5 °C to +55 °C. Physical and mechanical requirements are generally specified at normal temperatures (23 ± 5) °C. Where critical aspects of protection are likely to be affected by temperatures towards the extremes of the normal range of occupational environments (from -5 °C to +55 °C), physical and mechanical requirements are included (sometimes optionally) to ensure the protection is not compromised. Physical and mechanical requirements are provided for validation of claims for protection at extremes of temperature.

### 4.2 Headforms

Unless the manufacturer defines the headforms according to ISO 18526-4 that are compatible with the welding protector, the test methods where headforms are required shall use the headform 1-M as the default headform.

### 4.3 Field of view

Welding protectors, in the as-worn position, shall have a minimum unobstructed field of view in front of each eye of 8° temporally and 15° nasally in the horizontal meridian, and 24° total in the vertical meridian, when measured at the corneal apex of the headform according to ISO 18526-3:—, [6.2](#).

The field of view of peripheral awareness welding filters shall begin no less than 45° temporally from the straight ahead position of gaze. This requirement shall be measured according to ISO 18526-3:—, [6.2](#), by using the appropriate headform.



## 4.4 Physical optical requirements for welding filters

### 4.4.1 General

Welding filters are intended to protect against radiation generated by various welding processes, which emit a significant amount of radiation in the UV, visible and IR wavelength regions. Therefore requirements in the UV and IR and for glare in the visible exist that are taken into account by requiring specific scale numbers.

Welding filters shall be tested according to ISO 18526-2:—, [Clauses 6, 7, 8](#) and 10, and classified according to Table 1.

For the determination of luminous transmittance of welding filters in this document, the luminous transmittance values are based on the spectral distribution of CIE standard illuminant A (see ISO 11664-1 and ISO 11664-2).

### 4.4.2 Transmittance requirements and scale numbers

#### 4.4.2.1 Luminous transmittance and scale numbers

The scale numbers of welding filters are defined based on the value of the luminous transmittance in Table 1.

**Table 1 — Transmittance requirements for welding filters**

Scale number	Spectral transmittance $\tau(\lambda)$			Luminous transmittance $\hat{\sigma}_{vA}$ 380 nm < $\lambda$ ≤ 780 nm		IR-A transmittance $\tau_{IRA}$	Near IR transmittance $\tau_{NIR}$
	200 nm ≤ $\lambda$ ≤ 313 nm Maximum %	313 nm < $\lambda$ ≤ 365 nm Maximum %	365 nm < $\lambda$ ≤ 400 nm Maximum %	Maximum %	Minimum %	780 nm < $\lambda$ ≤ 1400 nm Maximum %	780 nm < $\lambda$ ≤ 3000 nm Maximum %
W 1,2	0,0003	50	$\hat{\sigma}_{vA}$	100	74,4	30	30
W 1,4	0,0003	35		74,4	58,1	25	25
W 1,7	0,0003	22		58,1	43,2	20	20
W 2	0,0003	14		43,2	29,1	15	15
W 2,5	0,0003	6,4		29,1	17,8	12	12
W 3	0,0003	2,8		17,8	8,5	9	9
W 4	0,0003	0,95		8,5	3,2	5	5
W 5	0,0003	0,30		3,2	1,2	3,5	3,5
W 6	0,0003	0,10		1,2	0,44	1,5	1,5
W 7	0,0003	0,050		0,44	0,16	1	1
W 8	0,0003	0,025		0,16	0,061	1	1
W 9	0,0003	0,012		0,061	0,023	1	1
W 10	0,0003	0,006		0,023	0,0085	1	1
W 11	0,0003	0,0032		0,0085	0,0032	1	1
W 12	0,0003	0,0012	0,0032	0,0012	1	1	
W 13	0,0003	0,00044	0,0012	0,00044	1	1	

NOTE The measurement of spectral transmittance values between 2800 nm and 3000 nm might require the purging of the spectrophotometer with dry nitrogen to reduce the influence of water molecules in the air on the transmittance values.

**Table 1** (continued)

Scale number	Spectral transmittance $\tau(\lambda)$			Luminous transmittance $\hat{\sigma}_{vA}$ 380 nm < $\lambda$ ≤ 780 nm		IR-A transmittance $\tau_{IRA}$	Near IR transmittance $\tau_{NIR}$
	200 nm ≤ $\lambda$ ≤ 313 nm Maximum %	313 nm < $\lambda$ ≤ 365 nm Maximum %	365 nm < $\lambda$ ≤ 400 nm Maximum %	Maximum %	Minimum %	780 nm < $\lambda$ ≤ 1400 nm Maximum %	780 nm < $\lambda$ ≤ 3000 nm Maximum %
W 14	0,00016	0,00016		0,00044	0,00016	1	1
W 15	0,000061	0,000061		0,00016	0,000061	1	1
W 16	0,000023	0,000023		0,000061	0,000023	1	1

NOTE The measurement of spectral transmittance values between 2800 nm and 3000 nm might require the purging of the spectrophotometer with dry nitrogen to reduce the influence of water molecules in the air on the transmittance values.

NOTE 1 The IR transmittance values are determined from the spectral transmittance or by a broadband method.

**4.4.2.2 Marking of welding filters**

Welding filters that meet the transmittance requirements given in Table 1 shall be marked by code letter W. The code letter W refers to welding filters that can affect detection of signal lights and do not have enhanced reflectance in the infrared spectral range. The code letter WC refers to welding filters with minimally altered detection of signal lights, the code letter WR to welding filters with enhanced infrared reflection, and the code letter WRC to welding filters that both show minimally altered colour perception and enhanced infrared reflection.

NOTE 2 Information on the appropriate scale numbers to use for specific welding and related applications are given in ISO 19734.

**4.4.2.3 Spectral transmittance requirements**

The spectral transmittance requirements are given in Table 1 and the following:

- the blue-light transmittance  $\tau_B$  shall be less than the luminous transmittance  $\tau_{vA}$

**4.4.2.4 Additional requirements for peripheral awareness welding filters**

In addition to the mechanical and thermal requirements of the complete welding protector, peripheral awareness welding filters shall satisfy the following requirements when the transmittances are measured according to ISO 18526-2:—, [Clause 6](#), using relevant test methods according to ISO 18526-2:—, [Clauses 7](#) to 10.

The manufacturer shall identify the darkest welding filter that may be used with the welding protector that is fitted with peripheral awareness welding filters.

- The blue-light transmittance of a peripheral awareness welding filter  $\tau_B$  shall be less than 5000 times the luminous transmittance of the darkest filter identified by the manufacturer.
- The maximum spectral transmittance in the ultraviolet and the near infrared transmittance  $\tau_{NIR}$ , as given in Table 1, required for the darkest filter identified by the manufacturer, shall apply to the peripheral awareness welding filter.

NOTE In situations when other welders are working beside and in situations where reflected light can be transmitted through the peripheral awareness welding filter, it can be preferable to cover these filters.