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ISO 12312-1

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Eye and face protection — Sunglasses and related eyewear —

Part 1: Sunglasses for general use

Protection des yeux et du visage — Lunettes de soleil et articles de lunetterie associés —

Partie 1: Lunettes de soleil pour usage général

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 12312-1 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 6, *Eye and face protection*.

ISO 12312 consists of the following parts, under the general title *Eye and face protection — Sunglasses and related eyewear*:

— *Part 1: Sunglasses for general use*

The following parts are under preparation:

— *Part 2: Eye protectors for direct observation of the sun*

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Eye and face protection — Sunglasses and related eyewear —

Part 1: Sunglasses for general use

1 Scope

This part of ISO 12312 is applicable to all afocal (plano power) sunglasses and clip-ons for general use, including road use and driving, intended for protection against solar radiation.

Information on the use of sunglass filters is given in Annex A. Requirements for unmounted filters used as replacement or alternative filters are given in Annex B.

This part of ISO 12312 is not applicable to:

a) eyewear for protection against radiation from artificial light sources, such as those used in solaria;

b) eye protectors intended for specific sports (e.g. ski goggles or other types);

c) sunglasses that have been medically prescribed for attenuating solar radiation;

d) products intended for direct observation of the sun, such as for viewing a partial or annular solar eclipse.

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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.

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ISO 4007, *Personal protective equipment — Eye and face protection — Vocabulary*

ISO 8980-5, *Ophthalmic optics — Uncut finished spectacle lenses — Part 5: Minimum requirements for spectacle lens surfaces claimed to be abrasion-resistant*

ISO 12311:2013, *Personal protective equipment — Test methods for sunglasses and related equipment*

3 Terms and definitions

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

3.1
related eyewear
eyewear intended for protection in the same wavelength range as solar radiation but not necessarily originated by natural sunlight

4 Construction and materials

4.1 Construction

When tested in accordance with ISO 12311:2013, Clause 6, areas of the sunglass, including the frame and the edges of the filters, if in a rimless or semi-rimless style, that might, during intended use, come into contact with the wearer, shall be smooth and without sharp projections.

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4.2 Filter material and surface quality

When tested in accordance with ISO 12311:2013, 6.2, except in a marginal area 5 mm wide, sunglass filters shall have no material or machining defects within an area of 30 mm diameter around the reference point that might impair vision, e.g. bubbles, scratches, inclusions, dull spots, pitting, mould marks, notches, reinforced areas, specks, beads, water specks, pocking, gas inclusions, splintering, cracks, polishing defects or undulations.

4.3 Physiological compatibility

Sunglasses shall be designed and manufactured in such a way that when used under the conditions and for the purposes intended, they will not compromise the health and safety of the wearer. The risks posed by substances leaking from the device that may come into prolonged contact with the skin shall be reduced by the manufacturer to below any regulatory limit. Special attention shall be given to substances which are allergenic, carcinogenic, mutagenic or toxic to reproduction.

NOTE 1 Reactions may be generated by excessive pressure due to a poor fit on the face, chemical irritation or allergy. Rare or idiosyncratic reactions may occur to any material and may indicate the need for the individual to avoid particular types of frames.

NOTE 2 Specific national regulations with regard to restriction of certain chemical substances should be observed, e.g. on nickel release by metal parts in prolonged contact with the skin. See ISO 12870, 4.2.3, for test methods and requirements on this parameter.

5 Transmittance

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5.1 Test methods

Transmittance values shall be determined in accordance with ISO 12311:2013, Clause 7.

5.2 Transmittance and filter categories

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Depending upon their luminous transmittance at their reference point, sunglass filters for general use shall be attributed to one of five filter categories. Unless the filter is one of the following, category 0 shall not be claimed:

— a filter for which specific protection against any part of the solar spectrum is claimed;

— a photochromic filter in its faded state.

The range of the luminous transmittance of these five categories is given by the values in Table 1. An overlap of the transmittance values shall be not more than ± 2 % (absolute) between the categories 0, 1, 2 and 3. There is no overlap in transmittance values between categories 3 and 4.

The maximum deviation for declared luminous transmittance value shall be ± 3 % absolute for the transmittance values falling in categories 0 to 3 and ± 30 % relative to the stated value for the transmittance values falling in category 4.

When describing the transmittance properties of photochromic filters, two categories for transmittance values are generally used. These two values correspond to the faded state and to the darkened state of the filter.

In the case of gradient filters, the transmittance value at the reference point shall be used to characterize the luminous transmittance and the category of the filter.

For gradient filters, the overlap in luminous transmittance allowed between categories shall be double that for uniformly tinted filters.

Table 1 also specifies the UV requirements for sunglass filters for general use and, when the filters are claimed by the manufacturer to protect against IR radiation, the IR requirements.

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Table 1 — Transmittance for sunglass filters for general use

Consumer label	Technical label	Requirements			
Descriptive label	Filter category	Ultraviolet spectral range		Visible spectral range	Enhanced infrared absorption[a]
		Maximum value of solar UV-B transmittance τ_{SUVB} 280 nm to 315 nm	Maximum value of solar UV-A transmittance τ_{SUVA} 315 nm to 380 nm	Range of luminous transmittance τ_V 380 nm to 780 nm	Maximum value of solar IR transmittance τ_{SIR} 780 nm to 2 000 nm
Light tint sunglasses	0	0,05 τ_V	τ_V	$\tau_V > 80$ %	τ_V
	1	0,05 τ_V	τ_V	43 % < $\tau_V \leq 80$ %	τ_V
General purpose sunglasses	2	1,0 % absolute or 0,05 τ_V, whichever is greater	0,5 τ_V	18 % < $\tau_V \leq 43$ %	τ_V
	3	1,0 % absolute	0,5τ_V	8 % < $\tau_V \leq 18$ %	τ_V
Very dark special purpose sunglasses	4	1,0 % absolute	1,0 % absolute or 0,25 τ_V, whichever is greater	3 % < $\tau_V \leq 8$ %	τ_V

NOTE The upper limit of UV-A at 380 nm coincides with that taken in ophthalmic optics and in ISO 20473, *Optics and photonics — Spectral bands.*

[a] Only applicable to sunglass filters recommended by the manufacturer as a protection against infrared radiation.

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5.3 General transmittance requirements

5.3.1 Uniformity of luminous transmittance

The relative difference in the luminous transmittance value between any two points of the filter within a circle 40 mm in diameter around the reference point or to the edge of the filter less the marginal zone 5 mm wide, whichever is less, shall not be greater than 10 % (relative to the higher value), except for category 4 where it shall not be greater than 20 %.

The geometric or boxed centre takes the place of the reference point if this is not known.

In the case of mounted gradient filters, this requirement shall be limited to sections parallel to the line connecting the two reference points.

For mounted filters, the relative difference between the luminous transmittance value of the filters at the reference point for the right and left eyes shall not exceed 15 % (relative to the lighter filter).

Changes of luminous transmittance that are caused by thickness variations due to the design of the filter are permitted. For verification, the test method in ISO 12311:2013, Annex L shall be used.

5.3.2 Requirements for road use and driving

5.3.2.1 General

Filters suitable for road use and driving shall be of categories 0, 1, 2 or 3 and shall additionally meet the following three requirements.

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5.3.2.2 Spectral transmittance

For wavelengths between 475 nm and 650 nm, the spectral transmittance of filters suitable for road use and driving shall be not less than 0,2 τ_v.

5.3.2.3 Detection of signal lights

The relative visual attenuation quotient Q of filters of categories 0, 1, 2 and 3 suitable for road use and driving shall be not less than 0,80 for red signal light, not less than 0,60 for yellow, green and blue signal lights. The relative spectral distribution of radiation emitted by incandescent signal lights shall apply in accordance with ISO 12311:2013, 7.8.

5.3.2.4 Driving in twilight or at night

Sunglass filters with a luminous transmittance of less than 75 % shall not be used for road use and driving in twilight or at night. In the case of photochromic sunglass filters, this requirement applies when tested in accordance with ISO 12311:2013, 7.11.

5.3.3 Wide angle scattering

When tested in accordance with ISO 12311:2013, 7.9, at the reference point, the wide angle scattering of the filters in the condition as supplied by the manufacturer shall not exceed the value of 3 %.

5.3.4 Additional transmittance requirements for specific filter types

5.3.4.1 Photochromic filters

The categories of the photochromic filter shall be determined by its luminous transmittance in its faded state τ_{v0} and its luminous transmittance in its darkened state τ_{v1} achieved after 15 min irradiation according to ISO 12311:2013, 7.11. In both states, the requirements specified in 5.2 and 5.3.2 shall be met. For photochromic filters, τ_{v0}/τ_{v1} shall be ≥ 1,25.

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5.3.4.2 Polarizing filters

If the filters in the sunglasses are claimed to be polarizing, when tested in accordance with ISO 12311:2013, 7.10.1, the filters shall be fitted in the frame so that their planes of transmission do not deviate from the vertical, or from the specified direction if different from the vertical, by more than ± 5°. Additionally, any misalignment between the planes of transmission of the left and right filters shall not be greater than 6°.

In the case of clip-ons, the misalignment shall be tested in the position assumed to be taken when mounted on the sunglasses.

When tested in accordance with ISO 12311:2013, 7.10.2, the polarization efficiency shall be > 78 % for filter categories 2, 3, 4 and > 60 % for filter category 1. Filters of category 0 do not have any useful polarizing effect.

NOTE These values are equivalent to ratios of the transmittance values parallel and perpendicular to the plane of transmission of approximately 8:1 and 4:1 respectively.

5.3.4.3 Gradient filters

5.3.4.3.1 General

Gradient filters shall meet the transmittance requirements within a 10 mm radius circle, around the reference point.

Uniformity of transmission is subject to the requirements of 5.3.1.

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5.3.4.3.2 Determination of the filter category

The filter category of gradient filters shall be determined by the luminous transmittance value at the reference point.

The filter category determined at the reference point shall be used to define whether the filters are suitable for road use and driving according to 5.3.2.

5.3.5 Claimed transmittance properties

For reference, see Annex A.

5.3.5.1 Blue-light absorption/transmittance

5.3.5.1.1 Blue-light absorption

In the case where it is claimed that a filter has x % blue-light absorption, the solar blue-light transmittance, τ_{sb}, of the filter shall not exceed (100,5 - x) %.

5.3.5.1.2 Blue-light transmittance

In the case where it is claimed that a filter has less than x % blue-light transmittance, the solar blue-light transmittance, τ_{sb}, of the filter shall not exceed (x + 0,5) %.

5.3.5.2 UV absorption/transmittance

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5.3.5.2.1 General

Requirements for the transmittance of filters for sunglasses in UV-A and UV-B shall be as given in Table 1. In cases where it is claimed that a product reaches a certain percentage of UV absorption or UV transmittance, the relevant requirement(s) below shall apply.

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5.3.5.2.2 Solar UV absorption

In the case where it is claimed that a filter has x % UV absorption, the solar UV transmittance of the filter τ_{SUV} shall not exceed (100,5 - x) %.

5.3.5.2.3 Solar UV transmittance

In the case where it is claimed that a filter has less than x % UV transmittance, the solar UV transmittance of the filter τ_{SUV} shall not exceed (x + 0,5) %.

5.3.5.2.4 Solar UV-A absorption

In the case where it is claimed that a filter has x % UV-A absorption, the solar UV-A transmittance of the filter τ_{SUVA} shall not exceed (100,5 - x) %.

5.3.5.2.5 Solar UV-A transmittance

In the case where it is claimed that a filter has less than x % UV-A transmittance, the solar UV-A transmittance of the filter τ_{SUVA} shall not exceed (x + 0,5) %.

5.3.5.2.6 Solar UV-B absorption

In the case where it is claimed that a filter has x % UV-B absorption, the solar UV-B transmittance of the filter τ_{SUVB} shall not exceed (100,5 - x) %.

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5.3.5.2.7 Solar UV-B transmittance

In the case where it is claimed that a filter has less than x % UV-B transmittance, the solar UV-B transmittance of the filter τ_{SUVB} shall not exceed (x + 0,5) %.

5.3.5.3 Antireflective coated sunglasses

In the case where sunglasses are claimed to be antireflective coated, the luminous reflectance ρ_v of the filter as measured from the eye-side of the filter shall be less than 2,5 %.

5.3.5.4 Enhanced infrared absorption

Sunglass filters for which enhanced infrared absorption is claimed shall meet the requirements as given in column 6 of Table 1.

6 Refractive power

6.1 Spherical and astigmatic power

The requirements apply in the "as-worn" position and the sunglass shall be tested according to ISO 12311:2013, 8.1.

The spherical power and astigmatic power shall not exceed the tolerances given in Table 2, where D_1 and D_2 are the powers in the two principal meridians of the sunglass filter.

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Table 2 — Spherical and astigmatic power

Spherical power	Astigmatic power
Mean value of the optical power values (D_1, D_2) in the two principal meridians. $(D_1+D_2)/2$ dioptres	Absolute difference between the optical power values (D_1, D_2) in the two principal meridians. ID_1-D_2I dioptres
± 0,12	≤ 0,12

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The difference between the spherical powers of the right and the left filters in the mounted state shall not exceed 0,18 dioptres.

6.2 Local variations in refractive power

If during the measurements using the telescope a doubling or other aberration of the image is observed then the filters shall be tested at the reference point according to ISO 12311:2013, 8.3. The local values shall comply with the limit listed in Table 2. The measurement shall be made with a 5 mm aperture within a 20 mm circle centred on the reference point.

6.3 Prism imbalance (relative prism error)

The complete sunglass shall be tested in the "as-worn" position according to ISO 12311:2013, 8.2.

For adults' sunglasses, use the diaphragm LB_2 with X^b = (32,0 ± 0,2) mm

For children's sunglasses, use the diaphragm LB_2 with X^b = (27,0 ± 0,2) mm

Alternatively, a diaphragm with a different X^b may be used if specified by the manufacturer.

The prismatic power difference shall not exceed the values in Table 3.

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Table 3 — Prism imbalance

Horizontal		Vertical
Base out prism dioptres	**Base in** prism dioptres	prism dioptres
1,00	0,25	0,25

7 Robustness

7.1 Minimum robustness of filters

For complete sunglasses, including the filter portion of those where the sunglass frame and filter are integral parts of each other, when tested as specified in ISO 12311:2013, 9.1, none of the following defects shall appear.

a) Filter fracture. A filter is considered to have fractured when

   — it cracks through its entire thickness and across a complete diameter into two or more separate pieces, or

   — a person with a visual acuity of at least 1,0 (6/6 or 20/20) can see, when viewing without magnification but wearing the appropriate correction, if any, for near vision, either a piece of material that has become detached from the filter surface or a corresponding surface defect.

b) Filter deformation. A filter is considered to have been deformed if a mark appears on the white paper on the opposite side to that contacted by the ball.

For clip-ons neither a) nor b) are applied.

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7.2 Frame deformation and retention of filters

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When tested in accordance with ISO 12311:2013, 9.6, the frame fitted with filters shall not:

a) fracture or crack at any point;

b) be permanently deformed from its original configuration by more than 2 % of the distance, *c*, between the boxed centres of the sunglass frame, that is the residual deformation *x* shall not exceed 0,02*c* (see Figure 18 in ISO 12311:2013);

c) neither filter shall be displaced from the frame.

7.3 Impact resistance of the filter, strength level 1 (optional specification)

When tested in accordance with ISO 12311:2013, 9.3, the filter shall not fracture. A filter is considered to have fractured when

— it cracks through its entire thickness and across a complete diameter into two or more separate pieces, or

— a person with a visual acuity of at least 1,0 (6/6 or 20/20) can see, when viewing without magnification but wearing the appropriate correction, if any, for near vision, either a piece of material that has become detached from the filter surface or a corresponding surface defect, or

— the test ball passes through the filter.

This requirement also applies to the filter portions of complete sunglasses where the frame and the filters are integral parts of each other.

If this requirement is met, testing according to 7.1 (minimum robustness) is not necessary.

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