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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.

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.

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

5.1 Test methods

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

5.2 Transmittance and filter categories

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.

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.

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

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.

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.

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

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.

7.2 Frame deformation and retention of filters

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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7.4 Increased endurance of sunglasses (optional specification)

When an increased endurance is claimed, a complete sunglass is tested according to ISO 12311:2013, 9.7. The sunglass shall not:

a) fracture at any point;

b) be permanently deformed (the sunglass is considered to be permanently deformed if the original distance between the sides at the measuring points have changed by more than 5 mm after 500 cycles);

c) except for sunglasses with frames fitted with sprung joints, require more than light finger pressure to open and close the sides;

d) for sunglasses with frames that are not fitted with sprung joints, have a side that closes under its own weight at any point in the opening/closing cycle, or for sides fitted with a sprung joint, the side shall still support its weight in the open position (i.e. opened to the fullest natural extent without activating the spring mechanism).

7.5 Resistance to perspiration (optional specification)

When the sunglass is tested in accordance with ISO 12311:2013, 9.10, there shall be:

a) no spotting or colour change (excluding a loss of gloss to the surface) anywhere on the frame, excluding joints and screws, after testing for 8 h, and

b) no corrosion, surface degradation or separation of any coating layer on the parts liable to come into prolonged contact with the skin during wear, i.e. the insides of the sides, bottom and lower parts of the rim and the inside of the bridge, after testing for a total of 24 h.

Such defects shall be visible under the inspection conditions described in ISO 12311:2013, 6.2.

If the sunglass frame is made from natural materials and the manufacturer recommends a cream or wax for its maintenance, then before testing, the frame(s) shall be prepared with this cream or wax according to the manufacturer's instructions. At the end of the test when the frame is checked for colour change or surface degradation, if the frame fails this requirement, use the cream or wax and wait for one day before checking again for colour change or surface degradation. If the frame has recovered its original appearance, the sunglass frame is considered to have passed the test while if the frame remains discoloured, the frame is considered to have failed the test.

7.6 Impact resistance of the filter, strength level 2 or 3 (optional specification)

If an increased level of impact resistance strength is claimed, when tested as specified in ISO 12311:2013, 9.4 or 9.5, 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

— if applicable, the test ball passes through the filter (applicable to 7.3 and 7.5, but not 7.1).

NOTE The maximum level of impact strength that can be claimed is 3.

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

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8 Resistance to solar radiation

Following irradiation as specified in ISO 12311:2013, 9.8, the relative change in the luminous transmittance of the filters referred to the initial τ_V (for photochromic filters, in the faded state when according to the method described in ISO 12311:2013) shall be less than or equal to the values shown in Table 4.

Table 4 — Relative change in the luminous transmittance

Filter category	Relative change in the luminous transmittance $\Delta\tau_V / \tau_V = (\tau_V' - \tau_V) / \tau_V$
0	±3 %
1	±5 %
2	±8 %
3	±10 %
4	±10 %
NOTE τ_V' is the luminous transmittance after irradiation.	

In addition, the following shall be met:

a) the wide angle scattering shall not exceed the value of 3 %;

b) for photochromic filters, τ_0/τ_1 shall be ≥ 1,25;

c) the UV requirements for the initial τ_V shall continue to be satisfied;

d) all claimed transmittance requirements shall be met.

9 Resistance to ignition

When sunglasses are tested in accordance with ISO 12311:2013, 9.9, they shall not ignite or continue to glow after withdrawal of the test rod.

10 Resistance to abrasion (optional specification)

Filters or filter surfaces that are claimed to provide a basic level of abrasion resistance shall meet the requirements of ISO 8980-5.

A filter that is claimed to be abrasion resistant shall meet the requirement on both surfaces. If only one surface is claimed to be abrasion resistant, it shall be specified on the information that is supplied with the product.

The surface form of the filter is restricted for testing; however, test results are applicable to claims for filters and filter surfaces with identical properties other than the surface radius.

NOTE This part of ISO 12312 does not attempt to define the properties of filter surfaces with abrasion resistance superior to the basic level.

11 Protective requirements

11.1 Coverage area

The sunglasses shall cover two ellipses with a horizontal diameter of 40 mm and a vertical diameter of 28 mm, the centres of which are separated by 64 mm and symmetrically placed on either side of the centre of the bridge of the frame, i.e. its vertical symmetry axis.

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For sunglasses intended to be worn by children, the sunglasses shall cover two ellipses with a horizontal diameter of 34 mm and a vertical diameter of 24 mm, the centres of which are separated by 54 mm and symmetrically placed on either side of the centre of the bridge of the frame.

A different inter-pupillary distance may be used if specified by the manufacturer.

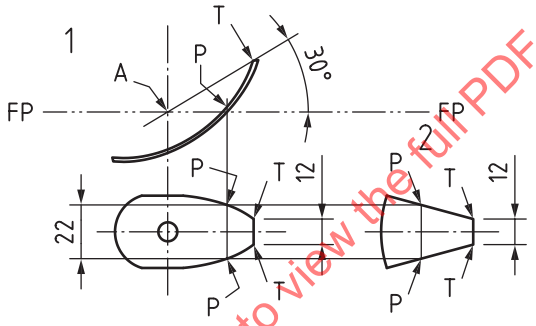
11.2 Temporal protective requirements

Very dark special purpose sunglasses (filter category 4) shall provide temporal shielding such that the ultraviolet and visible transmittances of the sunglass filter, frame and side are not greater than their values at the visual point at the following locations (see Figure 1):

a) in the line of intersection of the frontal plane (tangent to the apex of the cornea) with the inner surface of the sunglass structure, to elevations of 11 mm above and below the horizontal plane through the reference point; and

b) in a vertical line in the inner structure of the sunglass that is 30° back from the frontal plane and relative to the apex of the cornea, and to elevations of 6 mm above and below the horizontal plane through the reference point.

Dimensions in millimetres



Key

FP frontal plane – vertical plane tangent to the apex of the cornea

A apex of the cornea

P – P minimum height of sunglass at the intersection with the frontal plane

T – T minimum height of sunglass at the temple, 30° behind frontal plane relative to the apex of the cornea

Figure 1 — Required eye coverage for category 4 sunglasses

12 Information and labelling

12.1 Information to be supplied with each pair of sunglasses

The manufacturer shall provide information for the user with each pair of sunglasses. This information shall be in the form of markings on the frame or separate information on labels, packaging, etc., that accompanies the sunglasses at the point of sale. Where pictograms are used, an explanation of the significance of these pictograms shall also be available.

NOTE National regulations with respect to the content of the user information should be observed.

The user information shall contain following items:

a) Identification of model.

b) Name and address of the manufacturer.

c) Reference to this part of ISO 12312.

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d) Type of filter, if photochromic and/or polarizing.

e) Number of the filter category (in both the faded and darkened states for photochromic filters) marked preferably on the frame or on the filter.

f) Description of the filter category in the form of a symbol and/or verbal description as given in Table 5. The minimum height of the symbols shall be 5 mm.

g) Restrictions of use, which shall include at least the following:

not for direct observation of the sun;

not for protection against artificial light sources, e.g. solaria;

not for use as eye protection against mechanical impact hazards (for products not satisfying the requirements of 7.3 or 7.5);

any other restrictions deemed appropriate to be communicated by the manufacturer, e.g. increased or decreased transmittance of photochromic glasses due to high or low temperatures or to low light conditions.

h) When the filter does not meet the necessary requirements for driving and for filter category 4, the following warning: "Not suitable for driving and road use" in the form of the symbols shown in Figure 2 and/or in writing. The minimum height of the symbol shall be 5 mm.

i) When the filter has a luminous transmittance of less than 75 % and higher than 8 %, the following warning: "Not suitable for driving in twilight or at night" or "Not suitable for driving at night or under condition of dull light". The same warning applies to photochromic filters for which the luminous transmittance in the faded conditions is less than 75 %.

j) If relevant, instructions for care and cleaning if the wrong use of cleaning products might damage the sunglasses and a list of damaging products not suitable for cleaning.

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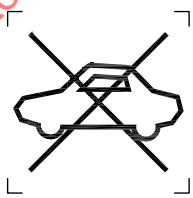

ISO 7000-2952A

ISO 7000-2952B

Figure 2 — Symbol: "Not suitable for driving and road use"

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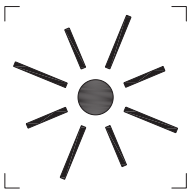
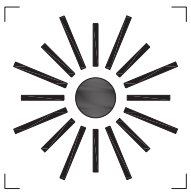
Table 5 — Description of filter categories and assigned symbols

Filter category	Description	Usage	Symbol
0	Light tint sunglasses	Very limited reduction of sunglare	 IEC 60417-5955
1		Limited protection against sunglare	 ISO 7000-2948
2	General purpose sunglasses	Good protection against sunglare	 ISO 7000-2949
3		High protection against sunglare	 ISO 7000-2950
4	Very dark special purpose sunglasses, very high sunglare reduction	Very high protection against extreme sunglare, e.g. at sea, over snowfields, on high mountains, or in desert	 ISO 7000-2951
NOTE The wording and/or the pictograms may be used.			

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12.2 Additional information

The following information shall be available from the manufacturer on request.

a) An explanation of the trademarks that are not universally recognized or foreseen by the users of this part of ISO 12312.

b) The position of the reference point when different from the one defined in this part of ISO 12312.

c) The country of origin (e.g. “made in .....”).

d) The nominal value of luminous transmittance.

e) Transmission requirements applicable to this product.

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f) Polarization efficiency in cases of polarizing filters.

g) The base material of filters and frame.

13 Selection of test samples

13.1 General

The minimum level of conformity testing requires samples to be selected at random. These specimens shall be selected by the manufacturer or its representative, and shall be identified as reported in Table 6, and shall be conditioned as described in 13.2 before testing.

NOTE When compliance to this part of ISO 12312 is claimed, the manufacturer or its representative has the responsibility to ensure that compliance of the product with this part of ISO 12312 is valid during the lifetime of manufacture, and not only at its first launch on the market.

13.2 Preparation and conditioning of test samples

Immediately before starting the series of tests, the test samples shall be conditioned for at least 4 h at an ambient temperature of 23 °C ± 5 °C, in the as-received condition from the manufacturer or supplier, without prior realignment, adjustment or lubrication.

The testing schedule in Table 6 shall be applied to type testing of complete sunglasses with the same filter type. At least 4 (6 if the nickel release test was performed) samples are required for testing. If additionally testing for optical requirements has to be done, more than 8 samples may be necessary. See Table 7 for testing schedule for unmounted filters used as replacement or alternative filters and Table 8 for testing schedule for complete clip-ons.

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Table 6 — Testing schedule for complete sunglasses

Order of testing	Requirements	According to clause/ subclause	Sunglasses number					
			1	2	3	4	5 to 6	7 to 8
1	Construction	4.1	+					
2	Filter material and surface quality	4.2	+					
3	Physiological compatibility	4.3					+ 3)	
4	Transmittance and filter categories	5.2	+ 1)					
5	General transmittance requirements	5.3	+ 1)					
6	Refractive power	6		+				
7	Minimum robustness of filters	7.1			+ 1)			
8	Frame deformation and retention of filters	7.2				+		
9	Impact resistance of the filter, strength 1 (optional specification)	7.3			+ 1) 2)			
10	Increased endurance of sunglasses (optional specification)	7.4				+		
11	Resistance to perspiration (optional specification)	7.5		+				
12	Impact resistance of the filter, strength 2 or 3 (optional specification)	7.6						+ 4)
13	Resistance to solar radiation	8	+ 1)					
14	Resistance to ignition	9			+			
15	Resistance to abrasion (optional specification)	10						+ 5)
16	Coverage area	11.1			+			
17	Temporal protective requirements	11.2			+			

Explanation of the symbols:

+ Testing to be carried out on the indicated specimen.

Empty field: No testing specified.

1) One filter from the left and one filter from the right eye.

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

3) Nickel release testing is conducted for those parts of metal and combination sunglass frames which come into direct and prolonged contact with the skin of the wearer.

4) Left filter from sample 8 and right filter from sample 7.

5) Left filter from sample 7 and right filter from sample 8.

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Table 7 — Testing schedule for unmounted filters used as replacement or alternative filters

Order of testing	Requirements	According to clause/ subclause	Filters pairs for oculars covering one eye or filters for unmounted oculars covering both eyes					
			1	2	3	4		
1	Construction	4.1	+					
2	Filter material and surface quality	4.2	+					
4	Transmittance and filter categories	5.2	+ 1)					
5	General transmittance requirements	5.3	+ 1)					
6	Refractive power	6		+				
7	Minimum robustness of filters	7.1			+ 1)			
8	Impact resistance of the filter, strength 1 (optional specification)	7.3			+ 1) 2)			
9	Resistance to solar radiation	8	+ 1)					
10	Resistance to ignition	9			+			
11	Resistance to abrasion (optional specification)	10				+		

Explanation of the symbols:

+ Testing to be carried out on the indicated specimen

Empty field: No testing specified

1) One filter from the left and one filter from the right eye

2) If this specification is met, testing according to 7.1 (minimum robustness) is not necessary

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Table 8 — Testing schedule for complete clip-ons

Order of testing	Requirements	According to clause/ subclause	Clip-ons number				
			1	2	3	4	5 to 6
1	Construction	4.1	+				
2	Filter material and surface quality	4.2	+				
3	Physiological compatibility	4.3					+ 3)
4	Transmittance and filter categories	5.2	+ 1)				
5	General transmittance requirements	5.3	+ 1)				
6	Refractive power	6		+			
7	Minimum robustness of filters	7.1			+ 1)		
8	Impact resistance of the filter, strength 1 (optional specification)	7.3			+ 1) 2)		
9	Resistance to perspiration (optional specification)	7.5		+			
10	Resistance to solar radiation	8	+ 1)				
11	Resistance to ignition	9			+		
12	Resistance to abrasion (optional specification)	10				+ 1)	
13	Coverage area	11.1		+			
14	Temporal protective requirements	11.2		+			

Explanation of the symbols:

+ Testing to be carried out on the indicated specimen.

Empty field: No testing specified.

1) One filter from the left and one filter from the right eye.

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

3) Nickel release testing is conducted for those parts of metal and combination sunglass frames which come into direct and prolonged contact with the skin of the wearer.

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Annex A
(informative)

Use of sunglass filters

A.1 Daytime

The main purpose of sunglass filters is to protect the human eye against excessive solar radiation and to reduce eye strain and improve visual perception. The choice of filters depends on the ambient light level and the individual's sensitivity to glare. If in doubt, professional ophthalmic advice should be sought. Besides the reduction of visible glare, protection of the eye should be ensured in the ultraviolet spectrum. These requirements are taken into account for filters complying with this part of ISO 12312. Filter shape and size are often matters of fashion but in some circumstances wrap-around filters in sunglasses or side shields are appropriate, particularly with both extra-dark filters or special-purpose filters that block blue light.

WARNING — Filters complying with this part of ISO 12312 are not suitable for direct observation of the sun (e.g. during eclipses).

Table 5 summarizes the filter categories and their description.

A.2 Reduced light

In reduced light, sunglass filters intended for bright daylight reduce visual perception. The lower the luminous transmittance value of the sunglass filter, the more vision is impaired. Sunglass filters with a luminous transmittance of less than 75 % are not suitable for use in twilight or at night. Photochromic sunglass filters are considered suitable for use in twilight or at night if they reach a luminous transmittance of 75 % or more after testing as follows:

a) filters are conditioned as described in ISO 12311:2013;

b) filters are then exposed to (15 000 ± 1 500) lux at (23 ± 1) °C for 15 min;

c) filters are then stored in the dark at (23 ± 1) °C for 60 min.

A.3 Photochromic sunglass filters

The luminous transmittance value of photochromic sunglass filters depends quite considerably on the intensity of radiation, temperature and other parameters. Thus luminous transmittance values can result in special conditions of use which differ from those expressed by the filter category range. These are in particular:

a) decreased transmittance τ_{vw} at low temperatures, e.g. in winter;

b) increased transmittance τ_{vs} at high temperatures, e.g. in high summer, the tropics;

c) increased transmittance τ_{va} at reduced irradiation, e.g. when driving.

A.4 Blue-light hazard

If solar radiation on the ground is evaluated with currently used limit values even under extreme illuminance conditions except for snow surfaces, an acute risk from exposure to the blue part of the spectrum is not to be expected. Therefore this part of ISO 12312 contains no mandatory specifications

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in this respect. But opinion is divided whether there could be a long-term risk. In order to allow a correct description of the blue-light attenuations by sunglass filters, a definition of the blue light transmittance is included. However, it should be noted that direct viewing of the sun is hazardous because of the high content of blue-light in the solar spectrum.

A.5 Infrared risk

If solar radiation on the ground is evaluated with currently used limit values even under extreme illuminance conditions, no risk by the infrared part of the radiation is to be expected. Hence this part of ISO 12312 contains no mandatory specifications in this respect. Prolonged exposure in desert environments may, however, pose some risk according to some scientists. It is therefore warranted to provide a definition of infrared transmittance in order to allow a correct description of the attenuation of infrared radiation by sunglass filters.

A.6 UV risk

The eyes have a natural aversion response to bright light that limits outdoor filter exposure when one is not wearing sunglasses. This aversion response that provokes squinting limits filter exposure greatly, but sunglasses without side shields may permit peripheral exposure of biological significance due to the Coroneo effect: the analytic characterization of ultraviolet skylight,[12] as adapted for calculating corneal irradiance,[13] show that the largest influence on filter exposure in temperate regions is the seasonal variation of solar irradiance as adjusted by ground reflectance and the time from solar noon.[14] Diffuse sky radiation decreases with increasing altitude[15][16] and corneal irradiation varies significantly with lid opening and ground cover.[19] The adopted transmittance limits are based on calculations of the biologically weighted exposure doses. The ultraviolet transmittance limits for sunglasses will keep these doses below a recognized safe limit even for exceptional daily exposure except over snow.[14][17] Further margins of safety to account for tropical conditions or walking over snowfields in late spring have been incorporated. This has been done by adding additional safety factors to those implicit in the exceptional exposure experiences at mid-latitudes over normal terrain. The specification of spectral (instead of average or weighted) transmittance limits provides a further very large increase in the margin of safety.[18]

A.7 Road use and driving

This part of ISO 12312 specifies the requirements for filters for road use and driving in normal conditions, where category 4 sunglasses are considered unsuitable for road use and driving. Nevertheless in extremely high luminance conditions, such as desert and snowfields under full sunlight, the use of category 4 filters may be recommended.

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