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Personal protective equipment — Test methods for sunglasses and related equipement

Équipement de protection individuelle — Méthodes d'essai pour lunettes de soleil et équipement associé

ICS 13.340.20

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ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO-lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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Foreword

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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 12311 was prepared by Technical Committee ISO/TC 94, *Personal safety - Protective clothing and equipment*, Subcommittee SC 6, *Eye and face protection*.

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Introduction

This draft international standard supports the specific device requirements for sunglasses and related eyewear. Test methods are specified for complete sunglasses or their components.

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Personal protective equipment — Test methods for sunglasses and related equipment

1 Scope

This International Standard specifies the reference test methods for determining the sunglasses properties given in ISO 12312-1. It is applicable to all sunglasses and related equipment.

NOTE. Other test methods may be used if shown to be equivalent.

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 12312-1, *Eye and face protection — Sunglasses and related eyewear — Part 1: Sunglasses for general use*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO/DIS 4007: 2009, *Personal protective equipment — Eye and face protection — Vocabulary*

ISO/CIE 10527: 2007, *CIE standard colorimetric observers*

ISO/CIE 10526: 2007, *CIE standard illuminants for colorimetry*

CIE 85:1989, *Solar spectral irradiance*

3 Terms and definitions

For the purposes of this international Standard, the terms and definitions given in ISO/DIS 4007 apply.

4 Prerequisites

The following parameters shall be specified prior to testing (see ISO 12312-1):

— the number of specimens;

— device preparation;

— any prior conditioning or testing;

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- any deviations from the method(s);
- characteristics to be assessed subjectively (inappropriate);
- pass/fail criteria.

5 General test requirements

Unless otherwise specified, the values stated in this international standard are expressed as nominal values. Except for temperature limits, values which are not stated as maxima or minima shall be subject to a tolerance of ± 5%. Unless otherwise specified, the ambient temperature for testing shall be between 16 °C and 32 °C and any temperature limits specified shall be subject to an accuracy of ± 1 °C.

6 Test methods for assessing the construction and materials

6.1 Prior assessment of construction

Prior to applying the test methods, a visual inspection shall be carried out with normal or corrected vision, without magnification, in order to assess the sunglass, marking and information supplied by the manufacturer and safety data sheets (if applicable) or declaration relevant to the materials used in its construction.

6.2 Test method for assessment of filter material and surface quality

6.2.1 Principle

The quality of the filter material and surface is assessed by visual inspection.

6.2.2 Apparatus

A suitable apparatus is shown in Figure 1.

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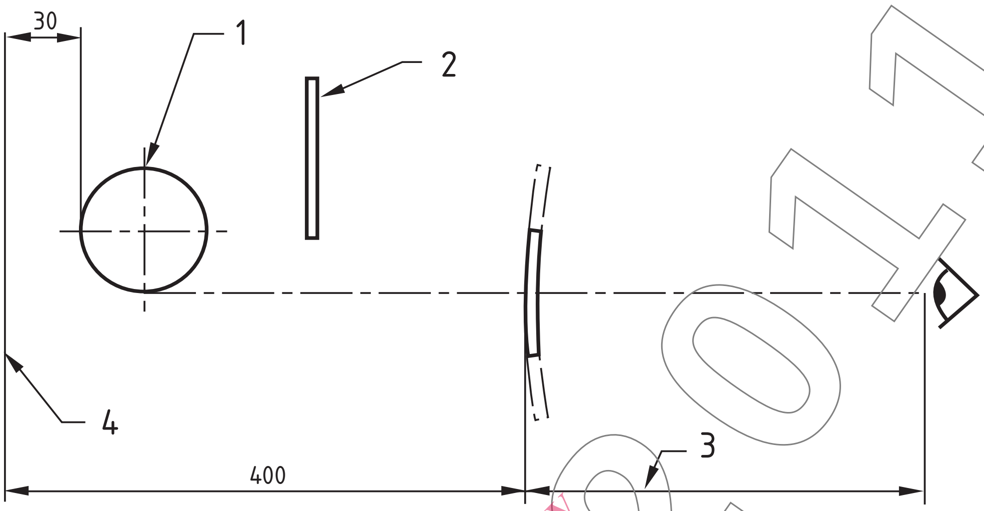
Dimensions in millimetres



Key

1	Lamp	3	Near vision distance (≈300)
2	Adjustable opaque dull black mask	4	Dull black background (200 x 360)

Figure 1 — Arrangement of apparatus for assessment of quality of material and surface

6.2.3 Test procedure

Carry out the assessment of the quality of material and surface by visual inspection with the aid of a `light box' or illuminated grid.

NOTE One method of inspection in current use consists of an illuminated grid as a background to be viewed through the ocular which is held at various distances from the eye. Another method is to illuminate the ocular by means of a fluorescent lamp mounted within a dull black chamber and with the amount of illumination adjusted by means of an adjustable opaque black mask. A suitable arrangement is shown in Figure 7.

If there is any doubt concerning the acceptability of the quality of the material and surface then examinine the areas in question with a light beam of 5 mm nominal diameter or use objective tests for wide angle scatter (see 7.3).

6.2.4 Test report

Except for a marginal area 5 mm wide at the edge of the eye protector, any significant defects likely to impair vision in use shall be recorded in the test report. Materials and surface shall be free of visible defects.

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7 Test methods for measuring spectrophotometric properties

7.1 Measurement of transmittance

7.1.1 Spectral transmittance

There are many appropriate methods and instruments for measuring spectral transmittance. There is no instrument or technique which may be singled out as particularly superior. Accordingly the approach in this standard is to specify maximum uncertainties of measurement acceptable in this context.

The methods of evaluating the components of uncertainty are set out in the ISO guide to the expression of uncertainty in measurement. Annex H is a guide to the sources of uncertainty in spectrophotometry, their minimisation and evaluation.

The direction of measurement of transmittance shall be as specified in ISO 12312-1. If the measurements are not made normal to the surface of the ocular, then particular attention should be paid to the effects of beam displacement, Annex H. If the direction of measurement is not specified then it shall be measured normal to the surface of the ocular or frame.

Measurements of transmittance of oculars shall be taken at the nominated position(s) on the ocular in ISO 12312-1. If this position is not specified then the geometric centre shall be used.

This standard is written on the basis that the calculations are made at 5nm intervals ($\Delta\lambda$=5nm) and the necessary data are given for this interval.

7.1.2 Luminous transmittance

Luminous transmittance is calculated from the spectral transmittances determined hereafter and with reference to a standard observer and a source or illuminate. For the purposes of this standard all calculations use the CIE 2° Standard Observer (ISO/CIE 10527:1991). Either CIE Standard Illuminate A and/or CIE Standard Illuminate D65 (ISO/CIE 10526:1999) may be specified. A thermal radiator of temperature 1900K is used in the specification of infra-red protective filters.

$$\tau_{\mathrm{V}} = 100 \times \frac{\int_{380\,\mathrm{nm}}^{780\,\mathrm{nm}} \tau_{\mathrm{F}}(\lambda)\, S_{\lambda}(\lambda) V(\lambda)\, \mathrm{d}\lambda}{\int_{380\,\mathrm{nm}}^{780\,\mathrm{nm}} S_{\lambda}(\lambda) V(\lambda)\, \mathrm{d}\lambda} \,\%$$

Where E_A and E_{D65} are defined in ISO/CIE10526, V(λ) is defined in ISO/CIE 10527 and E_{1900K} is defined in ISO/DIS 4007:2009, Table 1.

7.1.3 Test method for uniformity of luminous transmittance

7.1.3.1 Unmounted oculars covering one eye

Locate the defined reference point. If no reference point is specified, the boxed centre shall be used. Determine a circular area around the reference point with diameter d. calculated as follows:

a) for oculars more than 50 mm in vertical depth, d = (40,0 ± 0,5) mm;

b) for oculars less than 50 mm in vertical depth, d = (vertical depth of ocular (h) – 10 ± 0,5) mm.

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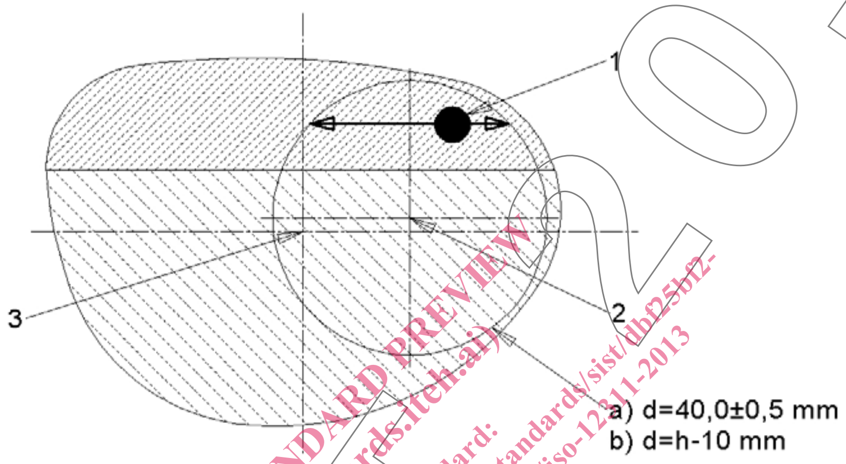
Scan this circular area with a 5 mm nominal diameter light beam whilst at the same time measuring the luminous transmittance.

The method may specify a portion around the edge of the ocular that is not to be included.

For oculars with bands or gradients of different luminous transmittance, the requirement for variations in luminous transmittance applies in this circular area but perpendicular to the gradient (see Figure 2).

Dimensions in millimetres



Key

1 Light beam 5mm diameter

2 Visual centre

3 Geometrical centre

Figure 2 — Luminous transmittances bands on the ocular

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The ocular and the light beam are positioned so that the incident light falls normally on the surface of the ocular or parallel to the line of sight.

Measure and record the maximum value of luminous transmittance $\tau_{v\ max}$, the minimum value of luminous transmittance $\tau_{v\ min}$, and the value of luminous transmittance at the centre τ_{vc}. Calculate the values of Δ_1, and Δ_2 from the following equations

$$\Delta_1(\%) = \frac{(\tau_{v\max} - \tau_{vc})}{\tau_{vc}} x100$$

$$\Delta_2(\%) = \frac{(\tau_{vc} - \tau_{v\min})}{\tau_{vc}} x100$$

Where: $\tau_{v\ max}$ is the maximum value of luminous transmittance, $\tau_{v\ min}$ is the minimum value of luminous transmittance , and τ_{vc} is the value of luminous transmittance at the centre.

Record the greater of Δ_1 or Δ_2 as the uniformity of luminous transmittance.

7.1.3.2 Mounted oculars and unmounted oculars covering both eyes

Locate the defined reference points. If no reference points are specified, the points 32mm either side of the midline on the horizontal boxed midline shall be used. Define two circular areas around the reference points with diameter d, calculated as follows:

Circular areas are determine around each of these centres with diameters d, calculated as follows:

a) for oculars more than 50 mm in vertical depth, d = (40,0 ± 0,5) mm;

b) for oculars less than 50 mm in vertical depth, d = (vertical depth of ocular (h) – 10 ± 0,5) mm.

Scan each area with a 5 mm nominal diameter light beam whilst at the same time measuring the luminous transmittance.

The method may specify a portion around the edge of the ocular that is not to be included.

For oculars with bands or gradients of different luminous transmittance, the requirement for variations in luminous transmittance applies in each circular area but perpendicular to the gradient.

For the left ocular, measure and record the maximum value of luminous transmittance τ_{Lmax}, the minimum value of luminous transmittance τ_{Lmin}, and the value of luminous transmittance at the centre τ_{Lc} Calculate the values of Δ_{L1}, and Δ_{L2} from the following equations;

$$\Delta_{L1}(\%) = 100 \times \frac{(\tau_{L\max} - \tau_{Lc})}{\tau_{Lc}}$$

$$\Delta_{L2}(\%) = 100 \times \frac{(\tau_{Lc} - \tau_{L\min})}{\tau_{Lc}}$$

Where: $\tau_{v\ max}$ is the maximum value of luminous transmittance, $\tau_{v\ min}$ is the minimum value of luminous transmittance , and τ_{vc} is the value of luminous transmittance at the centre.

Record the greater of Δ_{L1} or Δ_{L2} as the value of the uniformity of luminous transmittance for the left ocular.

Similarly, for the right ocular, record the greater of Δ_{R1} or Δ_{R2} as the value of the uniformity of luminous transmittance for the right ocular

Divide the lower value of the luminous transmittance at one of the two reference points by the higher value of the luminous transmittance at the other reference point and express the difference of this ratio to 1, as a percentage. Record this percentage as P.

7.1.4 Ultraviolet transmittance

7.1.4.1 Solar UV-transmittance τ_{SUV}

Solar UV-transmittance is the result of the mean of the spectral transmittance between 280 nm and 380 nm and approriate weighting functions.

The calculation of τ_{SUV} is:

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$$\tau_{SUV} = 100 \times \frac{\int_{280\,nm}^{380\,nm} \tau_F(\lambda) E_{s\lambda}(\lambda) S(\lambda)\, d\lambda}{\int_{280\,nm}^{380\,nm} E_{s\lambda}(\lambda) S(\lambda)\, d\lambda} = 100 \times \frac{\int_{280\,nm}^{380\,nm} \tau_F(\lambda) W_\lambda(\lambda)\, d\lambda}{\int_{280\,nm}^{380\,nm} W_\lambda(\lambda)\, d\lambda} \%$$

Where $E_s(\lambda)$ is the solar radiation at sea level for air mass 2 and $S(\lambda)$is the relative spectral effectiveness function for UV radiation defined by ICNIRP. The complete weighting function is the product of both : $W(\lambda) = E(\lambda).S(\lambda)$. The weighting functions are given in Annex E.

7.1.4.2 Solar UVA-transmittance τ_{SUVA}

Solar UVA-transmittance is the result of the mean of the spectral transmittance between 315 nm and 380 nm and approriate weighting functions..

The calculation of τ_{SUVA} is as follows:

$$\tau_{SUVA} = 100 \times \frac{\int_{315nm}^{380nm} \tau_F(\lambda) E_{S\lambda}(\lambda) S(\lambda)\, d\lambda}{\int_{315nm}^{380nm} E_{S\lambda}(\lambda) S(\lambda)\, d\lambda} = 100 \times \frac{\int_{315\,nm}^{380\,nm} \tau_F(\lambda) W_\lambda(\lambda)\, d\lambda}{\int_{315\,nm}^{380\,nm} W_\lambda(\lambda)\, d\lambda} \%$$

Where $Es\lambda(\lambda)$ is the solar radiation at sea level for air mass 2 and $E_S(\lambda)$ is the relative spectral effectiveness function for UV radiation and $W(\lambda) = E(\lambda)$. $S(\lambda)$ is the complete weighting function is the product of both. The weighting functions are given in Annex E.

7.1.4.3 Solar UVB-transmittance τ_{SUVB}

Solar UVB-transmittance is the result of the mean of the spectral transmittance between 280 nm and 315 nm and approriate weighting functions.

The calculation of τ_{SUVB} is as follows:

$$\tau_{SUVB} = 100 \times \frac{\int_{280\,nm}^{315\,nm} \tau_F(\lambda) E_{S\lambda}(\lambda) S(\lambda)\, d\lambda}{\int_{280\,nm}^{315\,nm} E_{S\lambda}(\lambda) S(\lambda)\, d\lambda} = 100 \times \frac{\int_{280\,nm}^{315\,nm} \tau_F(\lambda) W_\lambda(\lambda)\, d\lambda}{\int_{280\,nm}^{315\,nm} W_\lambda(\lambda)\, d\lambda} \%$$

Where $E_S(\lambda)$ is the the solar radiation at sea level for air mass 2, $S(\lambda)$is the relative spectral effectiveness function for UV radiation and $W(\lambda) = E(\lambda)$. $S(\lambda)$ is the complete weighting function is the product of both. The weighting functions are given in Annex E.

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