SLOVENSKI STANDARD
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Ophthalmic optics - Uncut finished spectacle lenses - Part 3: Transmittance specifications and test methods (ISO/DIS 8980-3:2021)

Augenoptik - Rohkantige fertige Brillengläser - Teil 3: Transmissionsanforderungen und Prüfverfahren (ISO/DIS 8980-3:2021)

Optique ophtalmique - Verres de lunettes finis non détourés - Partie 3: Spécifications relatives au facteur de transmission et méthodes d'essai (ISO/DIS 8980-3:2021)

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Ophthalmic optics — Uncut finished spectacle lenses —

Part 3: Transmittance specifications and test methods

Optique ophtalmique — Verres de lunettes finis non détourés —

Partie 3: Spécifications relatives au facteur de transmission et méthodes d'essai

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 7, *Ophthalmic optics and instruments*.

This fourth edition cancels and replaces the third edition (ISO 8980-3:2013), which has been technically revised.

A list of all parts in the ISO 8980 series can be found on the ISO website.

Ophthalmic optics — Uncut finished spectacle lenses —

Part 3: Transmittance specifications and test methods

1 Scope

This part of ISO 8980 specifies requirements for the transmittance properties of uncut and unmounted finished spectacle lenses, including attenuation of solar radiation.

This part of ISO 8980 is not applicable to

— spectacle lenses having specific transmittance or absorption characteristics prescribed for medical reasons;

— products to which specific personal protective equipment transmittance standards apply;

— products intended for direct observation of the sun, such as for solar-eclipse viewing.

NOTE 1 By reference to ISO 21987 and ISO 14889, this document also applies to lenses mounted in spectacles.

NOTE 2 Optical and geometric requirements are specified for uncut finished spectacle lenses in ISO 8980-1 and ISO 8980-2, and for mounted lenses, in ISO 21987.

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 11664-1, *2019, Colorimetry — Part 1: CIE standard colorimetric observers*

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

ISO 13666:2019, *Ophthalmic optics — Spectacle lenses — Vocabulary*

ISO 14889:2013+A1 2017, *Ophthalmic optics — Spectacle lenses — Fundamental requirements for uncut finished lenses*

ISO 18526-2:2020, *Eye and face protection — Test methods — Part 2: Physical optical properties*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13666 apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

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

Note 1 to entry For the convenience of the reader, equations are presented in Annex F in summation form.

4 Symbols

The symbols for the characteristic luminous transmittances of photochromic lenses are given in Table 1.

Table 1 — Symbols for the characteristic luminous transmittances of photochromic lenses

Symbols	Characteristic luminous transmittances
$\tau_{v\,0}$	Luminous transmittance in the faded state as reached at (23 ± 2) °C after specified conditioning.
$\tau_{v\,1}$	Luminous transmittance in the darkened state as reached at (23 ± 2) °C after specified irradiation simulating mean outdoor conditions.
$\tau_{v\,W}$	Luminous transmittance in the darkened state as reached at (5 ± 2) °C after specified irradiation simulating outdoor conditions at low temperatures.
$\tau_{v\,S}$	Luminous transmittance in the darkened state as reached at (35 ± 2) °C after specified irradiation simulating outdoor conditions at high temperatures.
$\tau_{v\,R}$	Luminous transmittance in the darkened state as reached at (23 ± 2) °C after specified irradiation simulating reduced light conditions.

NOTE 1 When describing a photochromic lens, the luminous transmittance refers to the faded state, before exposure to optical radiation, and the darkened state, after exposure to optical radiation.

NOTE 2 The symbol for the luminous transmittance in reduced light conditions, $\tau_{v\,R}$, has been changed from $\tau_{v\,A}$ which is in ISO 13666. This is to avoid possible confusion with the luminous transmittance measured in CIE standard illuminant A, which is also frequently given the symbol $\tau_{v\,A}$.

5 Classification

Spectacle lenses are classified with respect to transmittance as follows:

a) clear lenses, with no intended colour/tint in transmission;

b) uniformly tinted lenses;

c) gradient-tinted lenses;

d) photochromic lenses;

e) polarizing lenses.

NOTE b) or c) may be combined with d) and/or e).

6 Requirements

6.1 General

The fundamental requirements for uncut finished lenses, including reference to 6.3 in this part of ISO 8980, are in ISO 14889. For other than photochromic lenses, the requirements shall apply at a temperature of (23 ± 5) °C, and shall apply at the design reference point unless specified otherwise. For photochromic lenses, the applicable temperatures are given in Table 1.

6.2 General transmittance requirements

6.2.1 Tint descriptions, categories, and UV transmittance requirements

Spectacle lenses shall be attributed to one of five tint descriptions or luminous transmittance categories as specified in Table 2. Lenses shall be tested as described in Clause 7.

A spectacle lens categorized by the manufacturer as having a luminous transmittance τ_v that is in category 0, 1, 2 or 3 shall have a luminous transmittance at its design reference point that shall not lie outside the limits of the stated category by more than 2 % absolute.

A spectacle lens categorized by the manufacturer as having a luminous transmittance τ_v that is in category 4 shall have a luminous transmittance τ_v at its design reference point that shall not lie outside the limits of that category by more than 20 % relative to the stated luminous transmittance.

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

A lens categorized by the manufacturer as having a luminous transmittance τ_v that is in a particular category shall comply with the ultraviolet (UV) transmittance requirements of that category, regardless of the actual luminous transmittance. For example, a lens nominated to have a luminous transmittance in category 2 but actually having a luminous transmittance of 45 % (category 1, or category 2 allowing for the 2 % tolerance) shall comply with the UV transmittance requirements of a category 2 lens.

Any lens that does not meet the UV transmittance requirements in Table 2 must include the warning indicated in 8 f).

6.2.2 Tolerances on luminous transmittance of tinted lenses

It is recommended that a tint should be ordered by reference to a manufacturer's sample. Such a tint should not be visibly different from the tint of the sample and its assessment is not restricted to its luminous transmittance τ_v measured by spectrophotometer.

A lens ordered by a specific luminous transmittance τ_v shall have a measured τ_v at the design reference point within ± 8 % absolute of that ordered.

The tint of the two lenses of a pair should not be visibly different.

Table 2 — Categories for luminous transmittance and the related permissible transmittance in the ultraviolet solar spectral range

		Visible spectral range	Ultraviolet spectral range	
		380 nm to 780 nm	315 nm to 380 nm UV-A	280 nm to 315 nm UV-B
Tint description	**Luminous transmittance category**	Range of luminous transmittance τ_v	Maximum value of solar UV-A transmittance τ_{SUVA}	Maximum value of solar UV-B transmittance τ_{SUVB}
Clear or very light tint	0	$\tau_v > 80$ %	τ_v	0,05 τ_v
Light tint	1	43 % < $\tau_v \leq$ 80 %	τ_v	0,05 τ_v
Medium tint	2	18 % < $\tau_v \leq$ 43 %	0,5 τ_v	1,0 % absolute or 0,05 τ_v, whichever is greater
Dark tint	3	8 % < $\tau_v \leq$ 18 %	0,5 τ_v	1,0 % absolute
Very dark tint	4	3 % < $\tau_v \leq$ 8 %	1,0 % absolute or 0,25 τ_v, whichever is greater	1,0 % absolute

6.3 Spectral transmittance requirements of spectacle lenses intended for driving and road use

6.3.1 General

Spectacle lenses having a luminous transmittance τ_v less than or equal to 8 % are not intended for driving and road use. This clause therefore does not contain requirements for such lenses.

6.3.2 Spectral transmittance

The spectral transmittance $\tau(\lambda)$ at any wavelength in the range 475 nm to 650 nm shall be not less than 0,20 τ_v.

6.3.3 Daylight use

The luminous transmittance τ_v of spectacle lenses for driving and road use during daylight shall be more than 8 % at the design reference point.

6.3.4 Driving in twilight or at night

Spectacle lenses with a luminous transmittance τ_v less than 75 % shall not be used for driving and road use in twilight or at night. In the case of photochromic spectacle lenses, this requirement applies when tested in accordance with 7.5.3.5.

6.3.5 Relative visual attenuation coefficient (quotient) for incandescent traffic signal light detection

Spectacle lenses for driving and road use shall have a relative visual attenuation coefficient (quotient), Q_{signal}, not less than:

a) 0,80 for Q_{red};

b) 0,60 for Q_{yellow};

c) 0,60 for Q_{green};

d) 0,40 for Q_{blue}.

The relative visual attenuation coefficients (quotients), Q_{signal}, shall be calculated according to ISO 13666:2019, 3.17.8, using the spectral data in Annex A. An alternative calculation can be made in summation form according to F.6 using the spectral data in Annex A.

6.4 Additional transmittance requirements for special types of spectacle lenses

6.4.1 Photochromic spectacle lenses

6.4.1.1 General

Photochromic spectacle lenses are usually attributed to two categories, corresponding to the faded state and to the darkened state. Additional lens states may be specified under various temperatures (see 6.4.1.3) and moderate light levels (see 6.4.1.4). Transmittances shall be determined according to the method in 7.5. The UV transmittance in any state shall conform to the values specified for that category in Table 2.

6.4.1.2 Photochromic response

When tested by the methods described in 7.5.3.1 to 7.5.3.3, the ratio of the luminous transmittance of a photochromic lens (see 7.5.1) in its faded state $\tau_{v\,0}$ and, after 15 min irradiation, in its darkened state $\tau_{v\,1}$ shall be at least 1,25, i.e.

$$\frac{\tau_{v\,0}}{\tau_{v\,1}} \geq 1{,}25$$

6.4.1.3 Photochromic response at various temperatures

If the influence of temperature on photochromic response is stated, it shall be determined by measuring the luminous transmittance of the lens (see 7.5.1) in the darkened state using the procedure described in 7.5.3.6 at 5 °C ($\tau_{v\,W}$), 23 °C ($\tau_{v\,1}$) and 35 °C ($\tau_{v\,S}$).

The manufacturer can use additional temperatures, provided this information is made available.

6.4.1.4 Photochromic response at moderate light levels

If the photochromic response at moderate light levels is stated, it shall be determined by measuring the luminous transmittance of the lens (see 7.5.1) in the darkened state $\tau_{v\,R}$ using the procedure described in 7.5.3.4.

6.4.2 Polarizing spectacle lenses

6.4.2.1 Polarizing efficiency

When tested according to the method in 7.6, the polarizing efficiency shall be > 78 % for luminous transmittance categories 2, 3, 4 and > 60 % for luminous transmittance category 1.

6.4.2.2 Orientation

When tested according to the method in 7.6, the actual plane of transmittance shall be at (90 ± 5)° from the reference.

This reference is constituted by:

- the permanent alignment reference markings for power-variation lenses and position-specific single-vision lenses;

- the dividing line for straight-top and E-line multifocal lenses, and to the tangent to the mid-point of the dividing line of curved-top multifocal lenses in their intended orientation;

- the marking according to 6.4.2.3 for single-vision and multifocal lenses with no other geometric orientation properties;

- for finished lenses, the horizontal line joining the boxed centres of the lenses when fitted to the intended frame.

6.4.2.3 Marking

Polarizing finished single-vision and multifocal lenses with no other geometric orientation properties shall include permanent or non-permanent marking on the horizontal meridian to identify clearly the intended horizontal orientation.

Alternatively, if manufacturers or suppliers choose to include marking on the vertical meridian of the finished lenses to indicate the plane of transmission, this alternative marking shall be clearly identified. In this case, the same tolerance as stated in 6.4.2.2 (± 5°) applies for the difference between the marking and the actual plane of transmittance.

6.4.3 Gradient-tinted spectacle lenses

The requirements for gradient-tinted spectacle lenses shall be determined at the design reference point of the spectacle lens. It is recommended that gradient tints be ordered by reference to a manufacturer's sample lens, identification code, name or reference number.