SLOVENSKI STANDARD
SIST EN 1836:1998

01-april-1998

Osebno varovanje oļ i - Sonļ na oļ ala in sonļ ni filtri za sploġno uporabo

Personal eye protection - Sunglasses and sunglare filters for general use

Persönlicher Augenschutz - Sonnenbrillen und -schutzfilter für den allgemeinen Gebrauch

Protection individuelle de l'oeil - Lunettes solaires et filtres de protection contre les rayonnements solaires pour usage général

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ICS:

13.340.20	Varovalna oprema za glavo	Head protective equipment

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English version

Personal eye protection - Sunglasses and sunglare filters for general use

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 85 "Eye-protective equipment" the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 1997, and conflicting national standards shall be withdrawn at the latest by July 1997.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s)

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

Annex A is informative. Annexes B, C and D are normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard specifies physical properties (mechanical, optical etc.) for sunglasses and sunglare filters of nominal plano power which are not prescription lenses, intended for protection against solar radiation for general use, for social and domestic purposes, including road use and driving. Guidance for selection and use of these filters is given in (informative) annex A. For sunglasses and sunglare filters for industrial use, EN 166:1995 and EN 172:1994 apply.

This standard does not apply to eyewear for protection against radiation from artificial light sources, such as those used in solaria. EN 170:1992 applies for these filters.

This standard does not apply to ski goggles, for which EN 174:1996 applies, or other types of eye protection used for leisure activities.

This standard does not apply to sunglasses and filters that have been medically prescribed for attenuating solar radiation.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 165:1995	Personal eye protection - Vocabulary
EN 166:1995	Personal eye protection - Specifications
EN 167:1995	Personal eye protection - Optical test methods
EN 168:1995	Personal eye protection - Non-optical test methods
EN 170:1992	Personal eye protection - Ultraviolet filters - Transmittance requirements and recommended use
EN 172:1994	Personal eye protection - Sunglare filters for industrial use
EN 174:1996	Personal eye protection - Ski goggles for downhill skiing
IEC 50(845):1987	International Electrotechnical vocabulary - Chapter 845 : Lighting
CIE 85:1989	Solar spectral irradiance
ISO 8624:1991	Optics and optical instruments - Ophthalmic optics - Measuring system for spectacle frames
ISO/CIE 10526:1991	CIE standard colorimetric illuminants
ISO/CIE 10527:1991	CIE standard colorimetric observers

3 Definitions

For the purposes of this standard the definitions of EN 165:1995 and of IEC 50 (845):1987 apply together with the following:

3.1 absorptance (absorption)

Absorptance is the difference 1 minus transmittance minus reflectance.

NOTE: Some manufacturers use the term absorption and specify the value of the absorption as the difference 1 minus the luminous transmittance.

3.2 luminous transmittance of photochromic sunglare filters

Five different values of the luminous transmittance of photochromic sunglare filters are defined by this standard:

- τ_0 luminous transmittance in the faded state as reached at 23 °C after specified conditioning;
- τ_1 luminous transmittance in the darkened state as reached at 23 °C after specified irradiation simulating mean outdoor conditions;
- τ_w luminous transmittance in the darkened state as reached at 5 °C after specified irradiation simulating outdoor conditions at low temperatures;
- τ_s luminous transmittance in the darkened state as reached at 35 °C after specified irradiation simulating outdoor conditions at high temperatures;
- τ_a luminous transmittance in the darkened state as reached at 23 °C after specified irradiation simulating reduced light conditions.

3.3 photochromic sunglare filter

Filter that reversibly alters its luminous transmittance under the influence of sunlight.

NOTE: This alteration is not instantaneous, but is a function of a temperature and material dependent time constant. In this way, the luminous transmittance of the filter adjusts itself within certain limits to the ambient radiant flux.

3.4 polarizing sunglare filter

Filter of which transmittance is dependent on the polarization of the radiation.

NOTE: Polarizing sunglare filters have a preferred plane of polarization. The plane of polarization is determined by the transmission direction and the magnetic vector of the transmitted electromagnetic wave.

3.5 reference points

The reference points of eye-protectors with afocal lenses are defined in figure 2 of EN 167:1995 by the points where the two light bundles are passing through the oculars, unless the manufacturer specifies different ones (e. g. in the case of frames for children). The geometric centre of the ocular takes the place of the reference point if this is not known and cannot be determined by using this method.

3.6 relative visual attenuation quotient for signal light recognition

This quotient Q is defined as:

$$Q = \frac{\tau_{sign}}{\tau_V}$$

Where:

τ_V is the luminous transmittance of the sunglare filter for CIE standard illuminant D 65. See ISO/CIE 10526:1991;

τ_{sign} is the luminous transmittance of the sunglare filter for the spectral power distribution of the traffic signal light.

These are given by the equations:

$$\tau_v = \frac{\int_{380\ nm}^{780\ nm} \tau_F(\lambda) \cdot V(\lambda) \cdot S_{D65\lambda}(\lambda) \cdot d\lambda}{\int_{380\ nm}^{780\ nm} V(\lambda) \cdot S_{D65\lambda}(\lambda) \cdot d\lambda}$$

$$\tau_{sign} = \frac{\int_{380\ nm}^{780\ nm} \tau_F(\lambda) \cdot \tau_s(\lambda) \cdot V(\lambda) \cdot S_{A\lambda}(\lambda) \cdot d\lambda}{\int_{380\ nm}^{780\ nm} \tau_s(\lambda) \cdot V(\lambda) \cdot S_{A\lambda}(\lambda) \cdot d\lambda}$$

Where:

$S_{A\lambda}(\lambda)$ is the spectral distribution of radiation of CIE standard illuminant A (or 3200 K light source for blue signal light).
See: ISO/CIE 10526:1991;

$S_{D65\lambda}(\lambda)$ is the spectral distribution of radiation of CIE standard illuminant D 65.
See: ISO/CIE 10526:1991;

$V(\lambda)$ is the spectral visibility function for daylight vision.
See: ISO/CIE 10 527:1991;

$\tau_S(\lambda)$ is the spectral transmittance of the traffic signal lens;

$\tau_F(\lambda)$ is the spectral transmittance of the sunglare filter.

The spectral values of the products of the spectral distributions ($S_{A\lambda}(\lambda)$, $S_{D65\lambda}(\lambda)$), of the illuminants, the spectral visibility function $V(\lambda)$ of the eye and the spectral transmittance $\tau_S(\lambda)$ of the traffic signal lenses are given in annex B.

3.7 solar blue-light transmittance τ_{sb}

The mean of the spectral transmittance between 380 nm and 500 nm weighted with the solar radiation $E_{S\lambda}(\lambda)$ at sea level for air mass 2 and the blue-light hazard function B(λ). The complete weighting function is the product of both:

$WB_\lambda(\lambda) = E_{s\lambda}(\lambda) \cdot B(\lambda)$. The values of these functions are given in annex C and may be interpolated where necessary. The definition of τ_{sb} is the following:

$$\tau_{sb} = \frac{\int_{380\ nm}^{500\ nm} \tau_F(\lambda) \cdot E_{s\lambda}(\lambda) \cdot B(\lambda) \cdot d\lambda}{\int_{380\ nm}^{500\ nm} E_{s\lambda}(\lambda) \cdot B(\lambda) \cdot d\lambda} = \frac{\int_{380\ nm}^{500\ nm} \tau_F(\lambda) \cdot WB_\lambda(\lambda) \cdot d\lambda}{\int_{380\ nm}^{500\ nm} WB_\lambda(\lambda) \cdot d\lambda}$$

3.8 solar infrared transmittance τ_{SIR}

Transmittance τ_{SIR} obtained by integration between the limits 780 nm and 2 000 nm based on the solar spectral distribution of radiation $E_{s\lambda}(\lambda)$ at sea level for air mass 2. The values of $E_{s\lambda}(\lambda)$ are given in annex D.

$$\tau_{SIR} = \frac{\int_{780\ nm}^{2000\ nm} \tau_F(\lambda) \cdot E_{s\lambda}(\lambda) \cdot d\lambda}{\int_{780\ nm}^{2000\ nm} E_{s\lambda}(\lambda) \cdot d\lambda}$$

3.9 solar UV-transmittance τ_{SUV}

Mean of the spectral transmittance between 280 nm and 380 nm weighted with the solar radiation $E_{s\lambda}(\lambda)$ at sea level for air mass 2 and the relative spectral effectiveness function for UV radiation $S(\lambda)$. The complete weighting function is the product of both : $W(\lambda) = E_{s\lambda}(\lambda) \cdot S(\lambda)$. The weighting functions are given in annex C. The definition of τ_{SUV} is the following:

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

3.10 solar UVA-transmittance τ_{SUVA}

Mean of the spectral transmittance between 315 nm and 380 nm weighted with the solar radiation $E_{s\lambda}(\lambda)$ at sea level for air mass 2 and the relative spectral effectiveness function for UV radiation $S(\lambda)$. The complete weighting function is the product of both: $W(\lambda) = E_{s\lambda}(\lambda) \cdot S(\lambda)$. The weighting functions are given in annex C. The definition of τ_{SUVA} is as follows:

$$\tau_{SUVA} = \frac{\int_{315\ nm}^{380\ nm} \tau_F(\lambda) \cdot E_{s\lambda}(\lambda) \cdot S(\lambda) \cdot d\lambda}{\int_{315\ nm}^{380\ nm} E_{s\lambda}(\lambda) \cdot S(\lambda) \cdot d\lambda} = \frac{\int_{315\ nm}^{380\ nm} \tau_F(\lambda) \cdot W_\lambda(\lambda) \cdot d\lambda}{\int_{315\ nm}^{380\ nm} W_\lambda(\lambda) \cdot d\lambda}$$

3.11 solar UVB-transmittance τ_{SUVB}

The solar UVB-transmittance is the mean of the spectral transmittance between 280 nm and 315 nm weighted with the solar radiation $E_{S\lambda}(\lambda)$ at sea level for air mass 2 and the relative spectral effectiveness function for UV radiation $S(\lambda)$. The complete weighting function is the product of both: $W(\lambda) = E_{S\lambda}(\lambda) \cdot S(\lambda)$. The weighting functions are given in annex C. The definition of τ_{SUVB} is as follows:

$$\tau_{SUVB} = \frac{\int_{280\ \text{nm}}^{315\ \text{nm}} \tau_F(\lambda) \cdot E_{s\lambda}(\lambda) \cdot S(\lambda) \cdot d\lambda}{\int_{280\ \text{nm}}^{315\ \text{nm}} E_{s\lambda}(\lambda) \cdot S(\lambda) \cdot d\lambda} = \frac{\int_{280\ \text{nm}}^{315\ \text{nm}} \tau_F(\lambda) \cdot W_\lambda(\lambda) \cdot d\lambda}{\int_{280\ \text{nm}}^{315\ \text{nm}} W_\lambda(\lambda) \cdot d\lambda}$$

4 Filter requirements

4.1 Transmittance

For the determination of the transmittance values see 6.1.

4.1.1 Transmittance and filter categories

Sunglare filters for general use shall be attributed to five filter categories, where category 0 applies only to photochromic filters in the faded state, to gradient filters with a luminous transmittance > 80 % at the reference point, and to filters that have a luminous transmittance > 80 %, but where a specific protection against any part of the solar spectrum is claimed. 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.

If the supplier declares a luminous transmittance value, the limit deviation for this 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.

Table 1 specifies also the UV requirements for sunglare filters for general use.

Sunglare filters for which enhanced infrared absorption is claimed, shall meet the requirements of the last column of table 1.

Table 1: Transmittance for sunglare filters for general use

<table>
<tr><th rowspan="4">Filter category</th><th colspan="6">Requirements</th></tr>
<tr><th colspan="3">Ultraviolet spectral range</th><th colspan="2">Visible spectral range</th><th>Enhanced infrared absorption 1)</th></tr>
<tr><th colspan="2">Maximum value of spectral transmittance $\tau_F(\lambda)$</th><th>Maximum value of solar UVA transmittance τ_{SUVA}</th><th colspan="2">Range of luminous transmittance τ_V</th><th rowspan="2">Maximum value of solar infrared transmittance τ_{SIR}</th></tr>
<tr><th>280 nm to 315 nm</th><th>over 315 nm to 350 nm</th><th>315 nm to 380 nm</th><th>from over %</th><th>to %</th></tr>
<tr><td>0</td><td rowspan="5">$0,1 \cdot \tau_V$</td><td rowspan="3">τ_V</td><td rowspan="3">τ_V</td><td>80,0</td><td>100</td><td rowspan="5">τ_V</td></tr>
<tr><td>1</td><td>43,0</td><td>80,0</td></tr>
<tr><td>2</td><td>18,0</td><td>43,0</td></tr>
<tr><td>3</td><td rowspan="2">$0,5 \cdot \tau_V$</td><td rowspan="2">$0,5 \cdot \tau_V$</td><td>8,00</td><td>18,0</td></tr>
<tr><td>4</td><td>3,00</td><td>8,00</td></tr>
<tr><td colspan="7">1) Only applicable to sunglare filters recommended by the manufacturer as a protection against infrared radiation</td></tr>
</table>

4.1.2 General transmittance requirements

4.1.2.1 Uniformity of luminous transmittance

Apart from a marginal zone 5 mm wide, 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 greater, 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 centre takes the place of the reference point if this is not known.

In the case of gradient filters, this requirement applies in a section perpendicular to the gradient.

In the case of mounted gradient filters, this requirement applies in a section parallel to the connection line of the two reference points.

For mounted filters the relative difference between the luminous transmittance value of the filters at the visual centre for the right and left eye shall not exceed 20 % (relative to the lighter filter).

Changes of luminous transmittance that are caused by thickness variations due to the design of the lens are permitted.

4.1.2.2 Requirements for road use and driving

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

4.1.2.2.1 Spectral transmittance

For wavelengths between 500 nm and 650 nm the spectral transmittance of filters suitable for road use and driving shall be not less than 0,2· τ_V.

4.1.2.2.2 Recognition of signal lights

The relative visual attenuation quotient Q of filters of categories 0, 1, 2 and 3 suitable for driving and road use shall be not less than 0,80 for red and yellow signal lights, not less than 0,40 for the blue signal light and not less than 0,60 for the green signal light.

4.1.3 Special transmittance requirements

4.1.3.1 Photochromic filters

The category of a photochromic filter shall be determined by its luminous transmittance in its faded state τ_0 and its luminous transmittance in its darkened state τ_1 achieved after 15 min irradiation according to 6.1.3.1. In both states, the requirements specified in 4.1.1 and 4.1.2 shall be met.

For photochromic filters $\frac{\tau_0}{\tau_1}$ shall be ≥ 1,25.

4.1.3.2 Polarizing filters

Where sunglasses are fitted with polarizing filters, these shall be fitted in the frame so that the plane of polarization does not deviate from the horizontal direction by more than ± 5°. The misalignment between the plane of polarization of the left and right filters shall not be greater than 6°.

The plane of polarization of uncut polarizing sunglare filter shall be marked.

For polarizing filters, the ratio of the luminous transmittance values parallel and perpendicular to the plane of polarization shall be greater than 8 : 1 for filter categories 2, 3, 4 and greater than 4 : 1 for category 1.

4.1.3.3 Gradient filters

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

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

4.1.4 Claimed transmittance properties

In the case where specific transmittance values are claimed, these claims shall be in accordance with 4.1.4.1 and 4.1.4.2.