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Osebna oprema za varovanje oļ i ï Sonļ na oļ ala ter sonļ ni filtri za sploġno uporabo in filtri za neposredno opazovanje sonca

Personal eye-equipment - Sunglasses and sunglare filters for general use and filters for direct observation of the sun

Persönlicher Augenschutz - Sonnenbrillen und Sonnenschutzfilter für den allgemeinen Gebrauch und Filter für die direkte Beobachtung der Sonne

Équipement de protection individuelle de l'oeil - Lunettes solaires et filtres de protection contre les rayonnements solaires pour usage général et filtres pour observation directe du soleil

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13.340.20 Varovalna oprema za glavo Head protective equipment

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EUROPEAN STANDARD

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EN 1836

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English Version

Personal eye-equipment - Sunglasses and sunglare filters for general use and filters for direct observation of the sun

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This European Standard was approved by CEN on 28 July 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. 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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This European Standard (EN 1836:2005) 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of an identical text or by endorsement, at the latest by March 2006, and conflicting national standards shall be withdrawn at the latest by March 2006.

This European Standard supersedes EN 1836:1997.

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.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this European Standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European 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. This European Standard specifies also requirements for filters for the direct observation of the sun (e.g. during eclipses). Guidance for selection and use of these filters is given in Annex E. For sunglasses and sunglare filters for industrial use, EN 166 and EN 172 apply.

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

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

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

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 165:1995, *Personal eye protection - Vocabulary*

EN 166:2001, *Personal eye protection - Specifications*

EN 167:2001, *Personal eye protection - Optical test methods*

EN 168:2001, *Personal eye protection - Non-optical test methods*

EN 1811, *Reference test method for release of nickel from products intended to come into direct and prolonged contact with the skin*

ENV 14027, *Method for the simulation of wear before the detection of nickel release from coated metal and combination spectacle frames*

CIE 85:1989, *Solar spectral irradiance*

ISO 8624:2002, *Ophthalmic optics -- Spectacle frames -- Measuring system and terminology*

ISO/CIE 10526:1999, *CIE standard illuminants for colorimetry*

ISO/CIE 10527:1991, *CIE standard colorimetric observers*

IEC 60050-845:1987, *International Electrotechnical vocabulary – Lighting*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 165:1995 and IEC 60050-845:1987 and the following apply.

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
degree of polarisation, ***P***
defined as:

$$P = \frac{\tau_{\text{pmax}} - \tau_{\text{pmin}}}{\tau_{\text{pmax}} + \tau_{\text{pmin}}}$$

where

τ_{pmax} is the maximum values of luminous transmittance as determined with linearly polarised radiation;

τ_{pmin} is the minimum values of luminous transmittance as determined with linearly polarised radiation.

3.3
luminous transmittance of photochromic sunglare filters
five different values of the luminous transmittance of photochromic sunglare filters are defined by this European 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.

3.4
photochromic range, R_p
range given by the ratio of the difference of the luminous transmittance in the faded state τ_0 and the luminous transmittance in the darkened state τ_1 to the luminous transmittance in the faded state τ_0:

$$R_p = \frac{\tau_0 - \tau_1}{\tau_0}$$

3.5
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.

3.6
polarising sunglare filter
filter of which transmittance is dependent on the polarisation of the radiation

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

3.7
reference points
reference points of eye-protectors with afocal lenses are defined in EN 167:2001 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 boxed centre (see Figure 5) of the ocular takes the place of the reference point if this is not known and cannot be determined by using this method

3.8
relative visual attenuation coefficient (quotient) for signal light recognition
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;

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:

$$\tau_{\mathrm{v}} = \frac{\int_{380\ \mathrm{nm}}^{780\ \mathrm{nm}} \tau_{\mathrm{F}}(\lambda) \cdot V(\lambda) \cdot S_{\mathrm{D65}\lambda}(\lambda) \cdot \mathrm{d}\lambda}{\int_{380\ \mathrm{nm}}^{780\ \mathrm{nm}} V(\lambda) \cdot S_{\mathrm{D65}\lambda}(\lambda) \cdot \mathrm{d}\lambda}$$

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where

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

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

$V(\lambda)$ is the spectral luminous efficiency for daylight vision. See: ISO/CIE 10527;

$\tau_{\mathrm{S}}(\lambda)$ is the spectral transmittance of the traffic signal lens;

$\tau_{\mathrm{F}}(\lambda)$ is the spectral transmittance of the sunglare filter.

The spectral values of the products of the spectral distributions ($S_{\mathrm{A}\lambda}(\lambda)$, $S_{\mathrm{D65}\lambda}(\lambda)$) of the illuminants, the spectral luminous efficiency $V(\lambda)$ of the eye and the spectral transmittance $\tau_{\mathrm{S}}(\lambda)$ of the traffic signal lenses are given in Annex B.

3.9

solar blue-light transmittance τ_{sb}

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

$$WB_{\lambda}(\lambda) = E_{s\lambda}(\lambda) \times B(\lambda)$$

The values of these functions are given in Annex C and may be interpolated where necessary. The definition of τ_{sb} is the following:

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

3.10

solar luminous reflectance ρ_v

ratio ρ_v of the luminous flux reflected by the filter to the incident flux. The basis for calculation this is the spectral luminous efficiency $V(\lambda)$. The values of the spectral luminous efficiency $V(\lambda)$ are given in ISO/CIE 10527

$$\rho_v = \frac{\int_{380\,nm}^{780\,nm} \rho(\lambda) \cdot S_{D65\lambda}(\lambda) \cdot V(\lambda) \cdot d\lambda}{\int_{380\,nm}^{780\,nm} S_{D65\lambda}(\lambda) \cdot V(\lambda) \cdot d\lambda}$$

where

$\rho(\lambda)$ is the spectral reflectance of the filter at wavelength λ..

3.11

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

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

3.12

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 : $W(\lambda) = E_{s\lambda}(\lambda) \times S(\lambda)$. The weighting functions are given in Annex C.

The definition of τ_{SUV} is the following:

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

3.13

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: $W(\lambda) = E_{s\lambda}(\lambda) \times S(\lambda)$ The weighting functions are given in Annex C.

The definition of τ_{SUVA} is as follows:

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

3.14

solar UVB-transmittance τ_{SUVB}

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: $W(\lambda) = E_{s\lambda}(\lambda) \times S(\lambda)$. The weighting functions are given in Annex C. The definition of τ_{SUVB} is as follows:

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

4 Filter requirements

4.1 Transmittance

4.1.1 General

For the determination of the transmittance values see 6.2.

4.1.2 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 except for gradient lenses, where the double value is permitted for the above specified categories.

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 characterise 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[a]</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">$0,1 \times \tau_v$</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">$0,5 \times \tau_v$</td><td rowspan="2">$0,5 \times \tau_v$</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">a Only applicable to sunglare filters recommended by the manufacturer as a protection against infrared radiation.</td></tr>
</table>

4.1.3 General transmittance requirements

4.1.3.1 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 boxed 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.

4.1.3.2 Requirements for road use and driving

4.1.3.2.1 General

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

4.1.3.2.2 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 $0{,}2 \times \tau_v$.

4.1.3.2.3 Recognition of signal lights

The relative visual attenuation coefficient (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.

4.1.4 Special transmittance requirements

4.1.4.1 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 6.2.3.1. In both states, the requirements specified in 4.1.2 and 4.1.3 shall be met.

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

4.1.4.2 Polarising filters

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

The plane of polarisation of uncut polarising sunglare filter shall be marked.

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

4.1.4.3 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. The filter category determined at the reference point shall be used to define if the filters are suitable for road use and driving, according to 4.1.3.2.