



SLOVENSKI STANDARD

SIST EN 207:1999

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Personal eye-protection - Filters and eye-protectors against laser radiation (laser eye-protectors)

Personal eye-protection - Filters and eye-protectors against laser radiation (laser eye-protectors)

Persönlicher Augenschutz - Filter und Augenschutzgeräte gegen Laserstrahlung (Laserschutzbrillen)

Protection individuelle de l'oeil - Filtres et protecteurs de l'oeil contre les rayonnements laser (lunettes de protection laser)

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ICS:

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English version

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This European Standard was approved by CEN on 24 August 1998.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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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 supersedes EN 207:1993.

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of an identical text or by endorsement, at the latest by March 1999, and conflicting national standards shall be withdrawn at the latest by March 1999.

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.

Annexes A, B and ZA are informative.

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

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1 Scope

This European Standard applies to eye-protectors used for protection against laser radiation as defined in EN 60825-1:1994 (i.e. LED (Light Emitting Diode) radiation is included) in the spectral range 180 nm (0,18 μm) to 1 000 μm . It defines the requirements, test methods and marking. A guide is given in annex B with regard to selection and use.

EN 208 applies for laser adjustment eye-protectors.

NOTE : Before selecting eye protection according to this standard a risk assessment should first be undertaken (see annex B).

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 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 208	Personal eye-protection - Eye-protectors for adjustment work on lasers and laser systems (laser adjustment eye-protectors)
EN 60 825-1:1994	Safety of laser products - Part 1 : Equipment classification, requirements and user's guide
ISO/CIE 10526:1991	CIE standard colorimetric illuminants
ISO/CIE 10527:1991	CIE standard colorimetric observers

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3 Requirements

3.1 Spectral transmittance of filters and frames

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When tested according to 4.1, the maximum spectral transmittance for the individual scale numbers which shall not be exceeded at the laser wavelength(s) against which they afford protection shall be as given in table 1.

3.2 Luminous transmittance of filters

When assessed in accordance with 4.2, the luminous transmittance of the filter relative to the D65 standard illuminant (see ISO/CIE 10526:1991) shall be at least 20 %, unless it is recommended in the information supplied by the manufacturer to increase accordingly by the intensity of illumination at the relevant workplace.

3.3 Stability of filters and frames to laser radiation

When tested according to 4.3, the filters and frames shall meet the requirements of 3.1 and shall not lose their protective effect under the influence of laser radiation of the power (E) or energy density (H) given in table 1 for a period of at least 10 s and for 100 pulses and shall not show any induced transmission (reversible bleaching). No splinters shall come away from the side of the filter facing the eye under the influence of the laser radiation. Any melting or other damage of the surface is not considered negative if the protective effect is still ensured.

Table 1 : Scale numbers (maximum spectral transmittance and stability to laser radiation) of the filters and/or eye-protectors against laser radiations

Scale number	Maximum spectral transmittance for laser wavelength	Power and energy density (E , H) for testing the protective effect and stability to laser radiation in the wavelength range								
		180 nm to 315 nm			> 315 nm to 1 400 nm			> 1 400 nm to 1 000 μ m		
		E (W/m ²)	H (J/m ²)	E (W/m ²)	E (W/m ²)	H (J/m ²)	E (W/m ²)	E (W/m ²)	H (J/m ²)	E (W/m ²)
		For test condition								
		D	I,R	M	D	I,R	M	D	I,R	M
L1	10 ⁻¹	0,01	3·10 ²	3·10 ¹¹	10 ²	0,05	5·10 ⁷	10 ⁴	10 ³	10 ¹²
L2	10 ⁻²	0,1	3·10 ³	3·10 ¹²	10 ³	0,5	5·10 ⁸	10 ⁵	10 ⁴	10 ¹³
L3	10 ⁻³	1	3·10 ⁴	3·10 ¹³	10 ⁴	5	5·10 ⁹	10 ⁶	10 ⁵	10 ¹⁴
L4	10 ⁻⁴	10	3·10 ⁵	3·10 ¹⁴	10 ⁵	50	5·10 ¹⁰	10 ⁷	10 ⁶	10 ¹⁵
L5	10 ⁻⁵	100	3·10 ⁶	3·10 ¹⁵	10 ⁶	5·10 ²	5·10 ¹¹	10 ⁸	10 ⁷	10 ¹⁶
L6	10 ⁻⁶	10 ³	3·10 ⁷	3·10 ¹⁶	10 ⁷	5·10 ³	5·10 ¹²	10 ⁹	10 ⁸	10 ¹⁷
L7	10 ⁻⁷	10 ⁴	3·10 ⁸	3·10 ¹⁷	10 ⁸	5·10 ⁴	5·10 ¹³	10 ¹⁰	10 ⁹	10 ¹⁸
L8	10 ⁻⁸	10 ⁵	3·10 ⁹	3·10 ¹⁸	10 ⁹	5·10 ⁵	5·10 ¹⁴	10 ¹¹	10 ¹⁰	10 ¹⁹
L9	10 ⁻⁹	10 ⁶	3·10 ¹⁰	3·10 ¹⁹	10 ¹⁰	5·10 ⁶	5·10 ¹⁵	10 ¹²	10 ¹¹	10 ²⁰
L10	10 ⁻¹⁰	10 ⁷	3·10 ¹¹	3·10 ²⁰	10 ¹¹	5·10 ⁷	5·10 ¹⁶	10 ¹³	10 ¹²	10 ²¹

The symbols D, I, R and M relative to the test conditions are explained in table 4.

3.4 Refractive values of filters and eye-protectors

When assessed in accordance with 4.4, the maximum refractive values of filters and eye-protectors with no corrective effect shall be as given in table 2. They apply to the range specified in 7.1.2 of EN 166:1995.

Table 2 : Maximum refractive values of filters and eye-protectors with no corrective effect

Spherical power m ⁻¹	Astigmatic power m ⁻¹	Prismatic power difference		
		horizontal		vertical
		Base out cm/m	Base in cm/m	cm/m
± 0,09	± 0,09	0,75	0,25	0,25

NOTE : The requirements of the national standards apply to laser radiation protection filters with a corrective effect up until such times as corresponding European Standards have been prepared.

3.5 Quality of material and surface of filters

3.5.1 Material and surface defects

The material and surface defects of filters shall be assessed in accordance with 4.5.1.

Except for a marginal area of 5 mm wide, filters shall be free from any material or surface defects likely to impair the intended use, such as bubbles, scratches, inclusions, dull spots, mould marks, scoring or other defects originating from the manufacturing process. No holes are allowed anywhere in the filters.

3.5.2 Scattered light

The reduced luminous coefficient l^* of a filter, determined in accordance with 4.5.2, shall not be greater than :

$$l^* = 0,50 \frac{\text{cd/m}^2}{\text{lx}}$$

3.6 Stability of filters and eye-protectors to ultraviolet radiation and elevated temperature

3.6.1 Stability to ultraviolet radiation

When exposed to ultraviolet radiation in accordance with 4.6, the properties of filters and eye-protectors shall not change to such an extent that they can no longer satisfy the requirements of 3.1 and 3.3 to 3.5. The relative change in the luminous transmittance shall be $\leq \pm 10 \%$:

$$\left| \frac{\Delta \tau_v}{\tau_v} \right| \leq 10 \%$$

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The spectral transmittance for the laser wavelengths shall, however, in no case exceed the maximum spectral transmittance corresponding to the indicated scale number.

3.6.2 Stability at elevated temperature

After the filters and eye-protectors have been stored for 5 h in a climatic cabinet at a temperature of (55 ± 2) °C and a relative humidity of at least 95 %, and then stored for at least 2 h at room temperature, they shall satisfy the requirements of 3.1 to 3.5. The relative change in the luminous transmittance shall be $\leq \pm 5$ % :

$$\left| \frac{\Delta \tau_v}{\tau_v} \right| \leq 5 \%$$

The spectral transmittance for the laser wavelength shall, however, in no case exceed the maximum spectral transmittance corresponding to the indicated scale number.

3.7 Resistance of filters and frames to ignition

When tested in accordance with 4.7, the filters and frames shall not ignite or continue to glow.

3.8 Field of vision of eye-protectors

Eye-protectors shall have a clear field of vision of at least 40° in the vertical and horizontal directions for each eye when measured in accordance with 4.8 (see figure 1).

3.9 Construction of filters

Filters shall be constructed so that when tested in accordance with 4.3 and 4.9 no splinters are detached from the side of the filter facing the eye. If the filters consist of several individual filters, they shall be assembled in such a way that they cannot be interchanged.

3.10 Frames

Filters shall not be interchangeable in the frame. The frame shall be designed so that no laser radiation can penetrate from the side unintentionally.

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3.11 Mechanical strength of eye-protectors (standards.iteh.ai)

3.11.1 Basic requirement SIST EN 207:1999

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Filters for protection against laser radiation shall be of at least 1,4 mm thickness or satisfy the static bending requirement as specified in 7.1.4.1 of EN 166:1995.

The frames of the eye-protectors shall satisfy the requirements of 7.1.4.2 or 7.2.2 of EN 166:1995.

3.11.2 Optional requirements

If the mechanical strength of filters and eye-protectors against laser radiation is to satisfy more stringent requirements, the requirements specified in 7.1.4.2 or the requirements specified in 7.2.2 of EN 166:1995 shall be met.

4 Testing

The testing schedule in table 3 shall be applied to type testing of filters, frames and complete eye-protectors. The sequence of testing 1 to 9 may be changed. The sequence of testing 13 to 16 may be changed. At least 16 filters or 8 complete eye-protectors are required for testing. If testing for several wavelengths (wavelength ranges) or testing conditions according to 4.3 and/or several optional requirements has to be done, more than 16 samples may be necessary.

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Table 3 : Type examination test schedule for filters, frames and complete eye-protectors for protection against laser radiation

Order of testing	Requirement	According to clause	Filter/frame number			
			1-3	4-6	7-16	depends on specification/ requirement
1	Marking	6	+	+		
2	Material an surface defects	3.5.1	+	+		
3	Field of vision	3.8	1 frame			
4	Construction of filters	3.9	+	+		
5	Frames	3.10	+	+		
6	Scattered light	3.5.2	+	+		
7	Luminous transmittance	3.2	+	+		
8	Refractive values	3.4	+	+		
9	Prismatic power difference	3.4	3 frames			
10	Spectral transmittance at wavelength λ	3.1	+	+	3 filters/ frames per λ and test condition	3 filters/ frames per λ and test condition
11	Stability to UV radiation	3.6.1		+		
12	Stability at elevated temperature	3.6.2	+			
13	Material and surface defects	3.5.1	+	+		
14	Scattered light	3.5.2	+	+		
15	Luminous transmittance	3.2	+	+		
16	Refractive values	3.4	+			
17	Spectral transmittance	3.1	+	+		
18	Mechanical strength	3.11			+	
19	Stability to laser radiation and spectral transmittance at wavelength λ	3.3			3 filters/ frames per λ and test condition	3 filters/ frames per λ and test condition
20	Ignition	3.7			filters/ frames 7-9	
21	Optional requirements as given in EN 166:1995	according to applicable clause of EN 166:1995				depends on requirement/ test procedure

Explanation of the symbols : + Testing to be carried out on the indicated specimen
Empty field No testing specified