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English version

Personal eye-protection - Specifications

Protection individuelle de l'oeil - Spécifications

Persönlicher Augenschutz - Anforderungen

This European Standard was approved by CEN on 2 September 2001.

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 Management Centre 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 Management Centre 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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EN 166:2001 (E)

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Foreword

This document 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of an identical text or by endorsement, at the latest by May 2002, and conflicting national standards shall be withdrawn at the latest by May 2002.

This European Standard replaces EN 166:1995.

This document 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 document.

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 specifies functional requirements for various types of personal eye-protectors and incorporates general considerations such as:

- designation;
- classification;
- basic requirements applicable to all eye-protectors;
- various particular and optional requirements;
- allocation of requirements, testing and application;
- marking;
- information for users.

The transmittance requirements for various types of filter oculars are given in separate standards (see clause 2).

This European Standard applies to all types of personal eye-protectors used against various hazards, as encountered in industry, laboratories, educational establishments, DIY activities, etc. which are likely to damage the eye or impair vision, with the exception of nuclear radiation, X-rays, laser beams and low temperature infrared (IR) radiation emitted by low temperature sources.

The requirements of this standard do not apply to eye-protectors for which separate and complete standards exist, such as laser eye-protectors, sunglasses for general use, etc. unless such standards make specific reference to this standard.

The requirements of this standard apply to oculars for welding and allied processes but do not apply to equipment for eye and face protection for welding and allied processes, requirements for which are contained in EN 175.

Eye-protectors fitted with prescription lenses are not excluded from the field of application. The refractive power tolerances and other special characteristics dependent upon the prescription requirement are specified in EN ISO 8980-1 and EN ISO 8980-2.

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 (including amendments).

EN 165, *Personal eye-protection — Vocabulary.*

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

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

EN 169, *Personal eye-protection — Filters for welding and related techniques — Transmittance requirements and recommended utilisation.*

EN 170, *Personal eye-protection — Ultraviolet filters — Transmittance requirements and recommended use.*

EN 171, *Personal eye-protection — Infrared filters — Transmittance requirements and recommended use.*

EN 172, *Personal eye-protection — Sunglare filters for industrial use.*

EN 175, *Personal protection — Equipment for eye and face protection during welding and allied processes.*

EN 379, *Specification for welding filters with switchable luminous transmittance and welding filters with dual luminous transmittance.*

EN ISO 8980-1, *Ophthalmic optics — Uncut finished spectacle lenses - Part 1: Specifications for single-vision and multifocal lenses (ISO 8980-1:1996).*

EN ISO 8980-2, *Ophthalmic optics — Uncut finished spectacle lenses - Part 2: Specifications for progressive power lenses (ISO 8980-2:1996).*

EN ISO 8980-3, *Ophthalmic optics — Uncut finished spectacle lenses — Part 3 : Transmittance specifications and test methods (ISO 8980-3 :1999).*

3 Terms and definitions

For the purpose of this European Standard, the terms and definitions given in EN 165 and the following apply.

3.1

visual centre

the point on the ocular corresponding to the intersection of the horizontal and vertical planes through the pupil of the appropriate head-form specified in clause 17 of EN 168:2001 when the eye-protector is fitted to it in accordance with the manufacturers instructions

4 Classification

4.1 Function of eye-protectors

The function of eye-protectors is to provide protection against:

- impacts of different severities;
- optical radiations;
- molten metals and hot solids;
- droplets and splashes;
- dust;
- gases;
- short circuit electric arc;

or any combination of these.

4.2 Types of eye-protectors

NOTE Refer to definitions given in EN 165.

4.2.1 Spectacles with or without lateral protection

4.2.2 Goggles

4.2.3 Face-shields

NOTE Face-shields normally incorporate a suitable headband, browguard, helmet, protective hood or other appropriate mounting device.

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4.3 Types of ocular

4.3.1 Mineral oculars (glass)

4.3.1.1 Untoughened mineral oculars

4.3.1.2 Toughened mineral oculars, toughened chemically, thermally or by other processes to give superior resistance to impact in comparison with untoughened mineral oculars.

4.3.2 Organic oculars (plastic)

4.3.3 Laminated oculars

Oculars made in multiple layers joined together by a binder.

NOTE All types of oculars may be further classified into filtering types (for example according to EN 169, EN 170, EN 171, EN 172 and EN 379). They may also be classified as oculars with corrective effect and oculars without corrective effect. They may also have coatings on their surface(s) to give additional characteristics.

5 Designation of filters

The transmittance characteristics of a filter are represented by a scale number.

The scale number is a combination of the code number and the shade number of the filter, joined together by a dash.

The scale number for welding filters does not include a code number, it comprises the shade number only.

Table 1 gives the designation of the various types of filters specified in this European Standard.

Table 1 — Scale numbers for filters

Welding filters	Ultraviolet filters		Infrared filters	Filters for sunglare	
	No number code	Code number 2	Code number 3	Code number 4	Code number 5
Scale number					
1,2	2 – 1,2	3 – 1,2	4 – 1,2	5 – 1,1	6 – 1,1
1,4	2 – 1,4	3 – 1,4	4 – 1,4	5 – 1,4	6 – 1,4
1,7		3 – 1,7	4 – 1,7	5 – 1,7	6 – 1,7
2		3 – 2	4 – 2	5 – 2	6 – 2
2,5		3 – 2,5	4 – 2,5	5 – 2,5	6 – 2,5
3		3 – 3	4 – 3	5 – 3,1	6 – 3,1
4		3 – 4	4 – 4	5 – 4,1	6 – 4,1
4a					
5		3 - 5	4 - 5		
5a					
6			4 - 6		
6a					
7			4 – 7		
7a					
8			4 – 8		
9			4 – 9		
10			4 - 10		
11					
12					
13					
14					
15					
16					
<p>NOTE Code number key :</p> <ul style="list-style-type: none"> 2 Ultraviolet filter, colour recognition may be affected ; 3 Ultraviolet filter, good colour recognition ; 4 Infra-red filter ; 5 Sunglare filter without infrared specification ; 6 Sunglare filter with infrared specification. 					

6 Design and manufacturing requirements

6.1 General construction

Eye-protectors shall be free from projections, sharp edges or other defects which are likely to cause discomfort or injury during use.

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6.2 Materials

No parts of the eye-protector which are in contact with the wearer shall be made of materials which are known to cause any skin irritation.

6.3 Headbands

Headbands, when used as the principal means of retention, shall be at least 10 mm wide over any portion which may come into contact with the wearer's head. Headbands shall be adjustable or self-adjusting.

7 Basic, particular and optional requirements

All eye-protectors shall meet the basic requirements given in 7.1.

Furthermore, according to their intended use, eye-protectors shall, if appropriate, meet one or more of the particular requirements given in 7.2.

Optional requirements related to additional properties of eye-protectors are given in 7.3.

7.1 Basic requirements

7.1.1 Field of vision

The size of the field of vision is defined in conjunction with the appropriate head-form described in clause 17 of EN 168:2001.

Eye-protectors shall exhibit a minimum field of vision defined by the two ellipses in Figure 1 when placed and centered at a distance of 25 mm from the surface of the eyes of the appropriate head-form. The horizontal axis shall be parallel to and 0,7 mm below the height of the line connecting the centres of the two eyes.

The horizontal length of the ellipses shall be of 22,0 mm, the vertical width of the ellipses shall be 20,0 mm. The centre distance of the two ellipses shall be $d = c + 6$ mm, where c is the pupillary distance. The pupillary distance is 64 mm for the medium head-form and 54 mm for the small head-form, if not specified differently by the manufacture.

The test shall be carried out in accordance with clause 18 of EN 168:2001.

Dimensions in millimetres

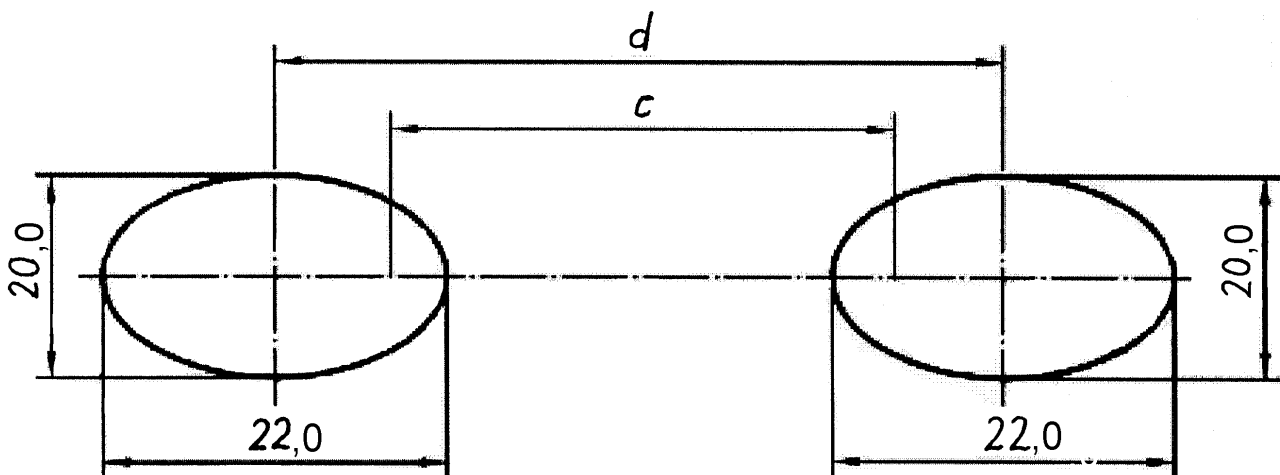


Figure 1 — Definition of the field of vision

7.1.2 Optical requirements

7.1.2.1 Spherical, astigmatic and prismatic refractive powers

The refractive powers of oculars shall be measured by the reference methods specified in clause 3 of EN 167:2001. This clause refers also to an optional method for use in specific circumstances; the details of this method are given in annex A of EN 167:2001.

7.1.2.1.1 Unmounted oculars covering one eye

The refractive power characteristics of unmounted oculars covering one eye shall be measured by the method specified in 3.1 of EN 167:2001 (non-corrective oculars), and by the methods specified in EN ISO 8980-3 (corrective oculars).

The permissible tolerances for oculars without corrective effect are given in Table 2.

The permissible deviations for the vertex powers of oculars with corrective effect are specified in EN ISO 8980-1 and EN ISO 8980-2. Oculars that comply with EN ISO 8980-1 and EN ISO 8980-2 shall be categorised as class 1. For class 2, the deviations in vertex refractions may be $0,06 \text{ m}^{-1}$ higher than for class 1.

Table 2 — Permissible tolerances for refractive powers of unmounted oculars without corrective effect covering one eye

Optical class	Spherical refractive power $(D_1 + D_2)/2$ m^{-1}	Astigmatic refractive power $ D_1 - D_2 $ m^{-1}	Prismatic refractive power cm/m
1	$\pm 0,06$	0,06	0,12
2	$\pm 0,12$	0,12	0,12
NOTE	D_1 and D_2 are the refractive powers in the two principal meridians.		

7.1.2.1.2 Mounted oculars and unmounted oculars covering both eyes

The refractive power characteristics of mounted oculars or unmounted oculars covering both eyes shall be measured by the method specified in 3.2 of EN 167:2001 at the visual centre of the ocular.

The permissible tolerances for oculars without corrective effect are given in Table 3.

The permissible deviations for vertex powers of oculars with corrective effect are as defined in 7.1.2.1.1. Deviations that would correspond to class 3 shall not be permitted.

NOTE The difference in prismatic refractive power specified for an eye-protector depends not only on the prismatic refractive power of each ocular, but also on the position of the optical axis of the ocular in relation to the axis of vision, and therefore the shape of the frame. It is therefore necessary to use replacement oculars for which the difference in prismatic power remains within the permissible tolerance limits for the frame in question.