SLOVENSKI STANDARD
SIST EN 167:2002
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Nadomeščа:
SIST EN 167:1996

Osebno varovanje oči - Metode optičnih preskusov

Personal eye-protection - Optical test methods

Persönlicher Augenschutz - Optische Prüfverfahren

Protection individuelle de l'oeil - Méthodes d'essais optiques

Ta slovenski standard je istoveten z: EN 167:2001

ICS:

13.340.20 Varovalna oprema za glavo Head protective equipment

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EUROPEAN STANDARD

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EN 167

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English version

Personal eye-protection - Optical test methods

Protection individuelle de l'oeil - Méthodes d'essais optiques

Persönlicher Augenschutz - Optische Prüfverfahren

This European Standard was approved by CEN on 3 September 2001.

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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.

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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

Ref. No. EN 167:2001 E

Contents

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of an identical text or by endorsement, at the latest by May 2002, and conflicting national standards shall be withdrawn at the latest by May 2002.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 167:1995.

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.

Annex A is normative. The annexes 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.

1 Scope

This European Standard specifies optical test methods for eye-protectors, the requirements for which are contained in other ENs.

Alternative methods may be used if shown to be equivalent.

Non-optical test methods are given in EN 168.

Specifications are given in EN 166.

A definition of terms is given in EN 165.

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 166, *Personal eye-protection — Specifications.*

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

3 Test for spherical, astigmatic and prismatic refractive powers

NOTE The reference methods for assessment of refractive power are contained in 3.1 and 3.2.

If during measurement using the telescope a doubling or other aberration of the image is observed then the ocular may either be classified as a defective, or subjected to further examination using the method described in annex A.

3.1 Testing unmounted oculars covering one eye

3.1.1 Apparatus

3.1.1.1 Telescope

A telescope with an aperture of nominally 20 mm and a magnification between 10 and 30, fitted with an adjustable eyepiece incorporating a reticule.

3.1.1.2 Illuminated target

A target, consisting of a black plate incorporating the cut-out pattern shown in Figure 1, behind which is located a light source of adjustable luminance with a condenser, if necessary, to focus the magnified image of the light source on the telescope objective.

The large annulus of the target has an outer diameter of (23,0 ± 0,1) mm with an annular aperture of (0,6 ± 0,1) mm. The small annulus has an inner diameter of (11,0 ± 0,1) mm with an annular aperture of (0,6 ± 0,1) mm. The central aperture has a diameter of (0,6 ± 0,1) mm. The bars are nominally 20 mm long and 2 mm wide with a nominal 2 mm separation.

3.1.1.3 Filter

A filter with its maximum transmittance in the green part of the spectrum may be used to reduce chromatic aberrations.

3.1.1.4 Calibration lenses

Lenses with positive and negative spherical refractive powers of 0,06 m^{-1}, 0,12 m^{-1} and 0,25 m^{-1} (tolerance ± 0,01 m^{-1}).

3.1.2 Arrangement and calibration of apparatus

The telescope and illuminated target are placed on the same optical axis (4,60 ± 0,02) m apart.

The observer focuses the reticule and the target and aligns the telescope to obtain a clear image of the pattern. This setting is regarded as the zero point of the focusing scale of the telescope. The telescope shall be aligned so that the central aperture of the target is imaged on the centre of the cross-line graticule. This setting is regarded as the zero point of the prism scale.

The focusing adjustment of the telescope is calibrated with the calibration lenses (3.1.1.4) so that a power of 0,01 m^{-1} may be measured. Any other equivalent calibration method may be used.

3.1.3 Procedure

Position the ocular in front of the telescope in the as-worn position, or other position as specified by the manufacturer. If the as-worn position is unknown, or if no position is specified by the manufacturer then the ocular shall be positioned normal to the telescopic axis and the tests conducted at the geometric centre.

3.1.3.1 Spherical refractive power and astigmatic refractive power

3.1.3.1.1 Oculars without astigmatic refractive power

The telescope is adjusted until the image of the target is clearly focussed. The spherical power of the ocular is then read from the scale of the telescope.

3.1.3.1.2 Oculars with astigmatic refractive power

The target, or the ocular, is rotated in order to align the principal meridians of the ocular with the bars of the target. The telescope is focused firstly on one set of bars (measurement D_1) and then on the perpendicular bars (measurement D_2). The spherical power is the mean, $\frac{D_1 + D_2}{2}$ the astigmatic refractive power is the absolute difference, $|D_1 - D_2|$, of the two measurements.

NOTE During this process the best focus shall be used across the whole target for each meridian.

3.1.3.2 Prismatic refractive power

The ocular to be tested is placed in front of the telescope, and, if the point of intersection of the lines of the reticule falls outside the image of the large circle, the prismatic power exceeds 0,25 cm/m. If the point of intersection of the lines of the reticule falls inside the image of the small circle of the target, the prismatic power is less than 0,12 cm/m.

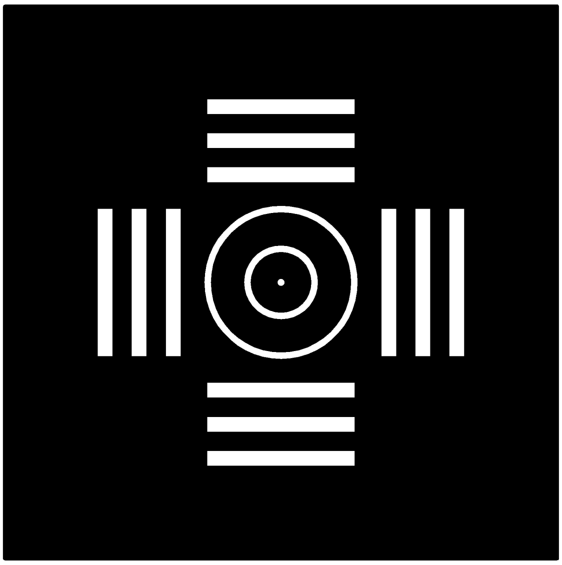


Figure 1 — Telescope target (dimensions are given in 3.1.1.2)

3.2 Testing unmounted oculars covering both eyes and mounted oculars (spectacles, goggles and face-shields)

3.2.1 Determination of the spherical and astigmatic refractive power

Position the ocular such that it is in an “as-worn” orientation in front of the telescope.

Measurements of spherical and astigmatic powers shall be taken based on the visual centre of the ocular using the procedures specified in 3.1.3.1.

3.2.2 Determination of the difference in prismatic refractive power

3.2.2.1 Apparatus

The arrangement of the reference method is shown in Figure 2.

3.2.2.2 Procedure

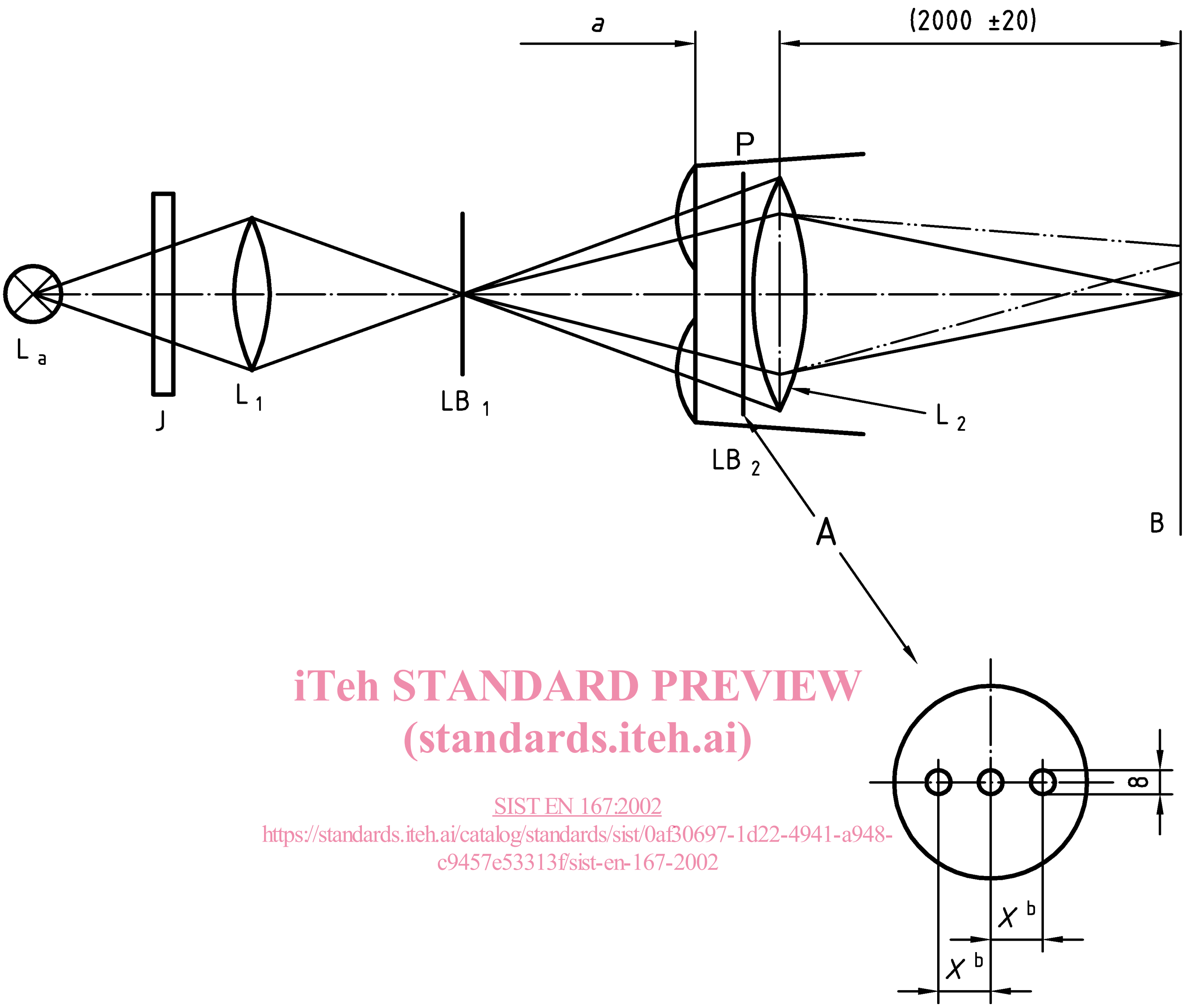
The diaphragm LB_1, illuminated by the light source, is adjusted in such a way that it produces an image on the plane B when the eye-protector (P) is not in position. The eye-protector is placed in front of the lens L_2 in the as-worn position so that the axis of the eye-protector is parallel to the optical axis of the test assembly. Adjustable tilt eye-protectors are positioned with their oculars normal to the optical axis of the test equipment.

Measure the vertical and horizontal distances between the two displaced images arising from the two ocular regions of the eye-protector.

These distances in centimetres are divided by two to give the horizontal and vertical prismatic differences in centimetres per metre.

If the light paths which correspond to the two eye regions cross, the prismatic refractive power is `base in' and if the light paths do not cross, it is `base out'.

Dimensions in millimetres (nominal unless toleranced)



Key

L_a Light source, for example, small filament lamp, laser with wavelength of (600 ± 70) nm, etc.

J Interference filter with peak transmittance in the green part of the spectrum (required only if a filament lamp is used as the light source)

L_1 Achromatic lens, focal length between 20 mm and 50 mm

LB_1 Diaphragm, diameter of aperture 1 mm nominal

P Eye-protector

LB_2 Diaphragm as shown in detail A

L_2 Achromatic lens, 1 000 mm nominal focal length and 75 mm nominal diameter

B Image plane

[a] As close as possible.

[b] X = (32,0 ± 0,2) mm or (27,0 ± 0,2) mm depending on the size of the head-form specified in EN 168.

Figure 2 — Arrangement of apparatus for measurement of prismatic difference

4 Light diffusion test

4.1 Principle

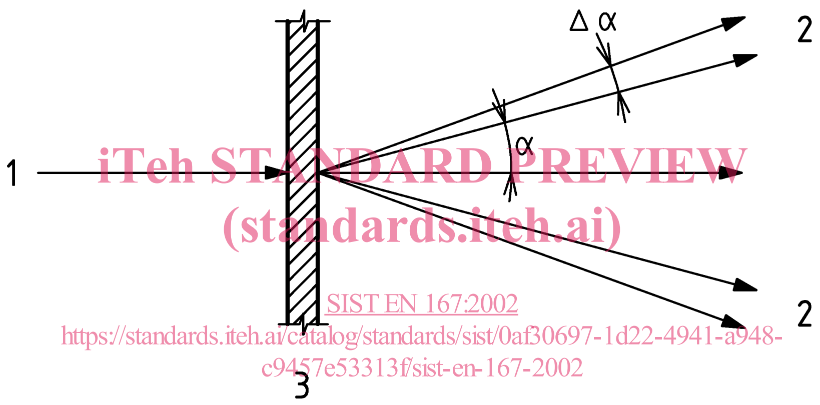
The luminance (L_S) of an illuminated ocular is a measure of its light diffusion and is proportional to the illuminance (E). The proportionality factor is the luminance factor $l = L_S/E$, which is expressed in candelas per square metre per lux $\frac{(cd/m^2)}{lx}$.

To obtain a factor l^* which is independent of the transmittance of the ocular, the luminance factor is divided by the transmittance τ.

$$l^* = \frac{L_s}{\tau E}$$

This quantity is known as the reduced luminance factor and is expressed in the same units as the luminance factor.

NOTE Most oculars have diffusion properties which are symmetrical about the optical axis. For these oculars, the mean value of the reduced luminance factor is measured within an angle limited by the two cones shown in Figure 3. This mean value depends upon values α and $\Delta\alpha$.



Key

1 Incident light on optical axis

2 Diffused light

3 Ocular

Figure 3 — Diffusion angles

4.2 Test methods

Two test methods are specified which use the same measurement principle. The `basic method' detailed in 4.2.1 may be used for oculars without corrective effect and for all shade numbers. The `simplified method' detailed in 4.2.2 has to be used for oculars with corrective effect.

The results obtained with the two methods may be considered to be equivalent; whichever method is used the relative measurement uncertainty for the reduced luminance factor shall not be greater than 25 %.

Measurements of light diffusion shall be taken at the visual centre of the ocular. If the visual centre is not known then the geometric centre shall be used.

NOTE Visual centre is as defined in EN 166.

4.2.1 Basic method

4.2.1.1 Apparatus

The arrangement is shown in Figure 4.

The spherical concave mirror H_1 forms an image of light L of identical dimensions at diaphragm LB. The spherical concave mirror H_3 forms an image of diaphragm LB in the plane of diaphragms B_L and B_R. The achromatic lens A is positioned immediately behind the diaphragm so that a reduced image of the test sample in position P appears on diffusing screen MS. The image of iris diaphragm IB_1 is formed at the same time as IB_2.

The arrangement collects all the light originating from the filter between angles $\alpha = 1{,}5°$ and $\alpha + \Delta\alpha = 2°$ in relation to the optical axis.

4.2.1.2 Procedure

The ocular is placed in the parallel beam at position P, then diaphragm B_L is put in place. The flux Φ_{1L} falling onto the photodetector corresponds to the undiffused light transmitted by the sample. Diaphragm B_L is then replaced by annular diaphragm B_R; flux Φ_{1R} falling onto the photodetector corresponds to the total diffused light originating from the filter and from the apparatus. The test sample is then placed at position P′. The flux Φ_{2R} which then falls onto the photodetector corresponds to the diffused light coming from the apparatus only.

The difference Φ_{1R} - Φ_{2R} corresponds to the light diffused by the filter. The mean reduced luminance factor l^* for the solid angle ω is calculated from the preceding fluxes by means of the formula:

$$l^* = \frac{l}{\omega} \cdot \frac{\Phi_{1R} - \Phi_{2R}}{\Phi_{1L}}$$

where

Φ_{1R}, Φ_{2R} are the luminance fluxes with the annular diaphragm;

Φ_{1L} is the luminous flux with the circular diaphragm;

ω is the solid angle defined by the annular diaphragm.