



Personal eye-protectors — Optical test methods

Protecteurs individuels de l'œil — Méthodes d'essai optiques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4854 was developed by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, and was circulated to the member bodies in July 1978.

It has been approved by the member bodies of the following countries :

Australia	Iran	Poland
Austria	Ireland	Romania
Belgium	Israel	South Africa, Rep. of
Czechoslovakia	Italy	Spain
Denmark	Mexico	Switzerland
France	Netherlands	USA
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The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

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Personal eye-protectors — Optical test methods

1 Scope and field of application

This International Standard specifies the optical test methods for eye-protectors the requirements for which are given in ISO 4849 to ISO 4853.¹⁾

The test methods other than optical test methods are given in ISO 4855.

2 References

ISO 4849, *Personal eye-protectors — Specifications.*

ISO 4850, *Personal eye-protectors for welding and related techniques — Filters — Utilisation and transmittance requirements.*

ISO 4851, *Personal eye-protectors — Ultraviolet filters — Utilisation and transmittance requirements.*

ISO 4852, *Personal eye-protectors — Infrared filters — Utilisation and transmittance requirements.*

3 Test for refractive, astigmatic and prismatic powers

Any method of examining the required area with an accuracy of $\pm 0,015 \text{ m}^{-1}$ may be used. However, the methods described below are given as reference methods for use in cases of dispute.

3.1 Testing unmounted oculars

3.1.1 Apparatus

3.1.1.1 Telescope, with a magnification of between 7,5 and 20 (recommended magnification 15) with an aperture of 15 to 20 mm and an adjustable eye-piece fitted with a graticule, for example a theodolite which is adjustable both vertically and laterally.

In the event that the telescope, a large-aperture instrument, shows a doubling of the image or other aberration, the ocular to be tested shall be examined with a 5 mm aperture instrument to locate and quantify the area or areas of aberration in the total area of 20 mm diameter. A focometer may be used for this operation.

3.1.1.2 Adjustable light source, with condenser.

3.1.1.3 Target, consisting of a black plate with the cut-out pattern shown in figure 1. The bars are 2,0 mm wide. The larger annulus depicted inside the bars has a diameter of 23 mm with an annular aperture of 0,6 mm, and the smaller has a diameter of 11 mm. The diameter of the central aperture is 0,6 mm. The target is mounted on a glass plate.

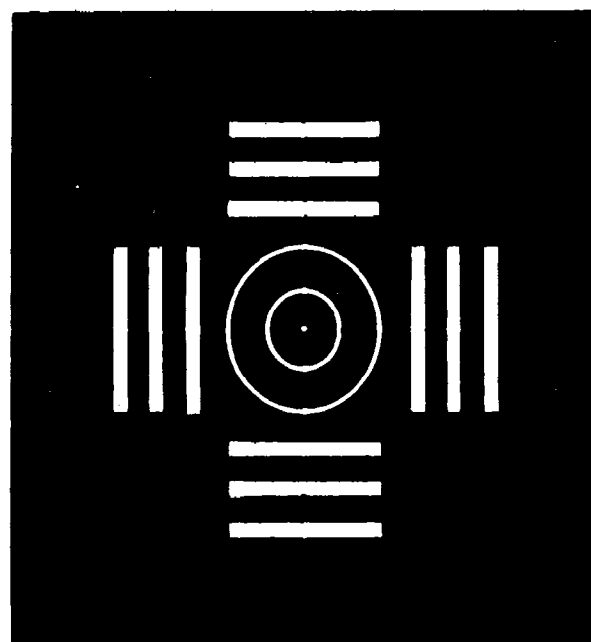


Figure 1 — Target

3.1.1.4 Interference filter, with $\lambda \text{ max.} = 555 \pm 10 \text{ nm}$ and a half-band width of approximately 50 nm.

1) In preparation : ISO 4853, *Personal eye-protectors — Daylight filters, utilisation and transmittance requirements.*

3.1.1.5 Standard lenses, with refractive powers of $\pm 0,06 \text{ m}^{-1}$, $\pm 0,12 \text{ m}^{-1}$ and $\pm 0,25 \text{ m}^{-1}$ (tolerance $\pm 0,01 \text{ m}^{-1}$). Any other method of calibration may be used.

3.1.2 Procedure

The target shall be trans-illuminated by means of a parallel beam of monochromatic light of adjustable intensity. The telescope and the optical system of the target shall be on the same axis.

The interference filter is used to reduce chromatic aberration.

The focusing adjustment of the telescope shall be calibrated so that a power of $0,01 \text{ m}^{-1}$ can be measured.

The distance between the telescope and the target shall be $4,6 \pm 0,1 \text{ m}$. Focus the graticule and the target and align the telescope to obtain a clear image of the target. This setting shall be regarded as the zero point of the scale of the telescope.

Calibrate the equipment using standard lenses of known refractive powers or any other equivalent method.

Position the ocular normal to the telescope axis. Make measurements at the test points defined in sub-clause 7.1.2.1.1 of ISO 4849.

To determine the refractive power, adjust the telescope until the image of the target is perfectly resolved. Then read the refractive power of the eye-protector from the scale of the telescope.

The astigmatism of the ocular is the maximum refractive power difference between two perpendicular meridians observed during rotation of the ocular axis. Record this maximum difference obtained in resolving the horizontal and vertical bars during rotation as the astigmatism.

To determine the prismatic power, position the ocular to be tested in front of the telescope and, if the point of intersection of the lines of the graticule falls outside the image of the bigger annulus, the prismatic power exceeds $0,25 \text{ cm/m}$. If the permitted limit is $0,12 \text{ cm/m}$, the point of intersection of the lines of the graticule shall fall inside the image of the smaller annulus of the target.

The values obtained for the refractive, astigmatic and prismatic powers shall be within the limits defined in table 2, sub-clause 7.1.2.1.1, of ISO 4849.

Oculars may be also tested with a device using a laser beam. This optional method, allowing the measurement of small refractive and astigmatic powers, is described in annex A.

3.2 Control methods for mounted oculars

3.2.1 Apparatus

3.2.1.1 Standard support for spectacles, constructed in metal or other rigid material according to figure 2, to reproduce

the position of the spectacles in front of the eyes of the wearer. Protectors without side pieces shall be positioned on the support as they are normally placed before the eyes when worn.

3.2.1.2 Two telescopes, similar to the one described in 3.1.1.1, fitted with 6 mm diameter circular diaphragms and fixed with 2 axes 66 mm apart and parallel to within $1'$.

A single telescope may also be used which can be displaced, its axis remaining parallel to within $1'$ of its original direction; alternatively, the protector may be displaced relative to the single telescope and target, these remaining fixed. The distance between ocular and telescope shall be reduced to a minimum.

In the event that the telescope, a large-aperture instrument, shows a doubling of the image or other aberration, the ocular to be tested shall be examined with a 5 mm aperture instrument to locate and quantify the area or areas of aberration in the total area of 20 mm diameter. A focometer may be used for this operation.

3.2.1.3 Double target, conforming to the design shown in figure 3, or **single target**, as the case may be, on which the reading is made. The target is brightly illuminated and placed $4,6 \pm 0,1 \text{ m}$ from the telescope(s).

3.2.2 Procedure

Place the protector to be tested on the support (3.2.1.1). Using both telescopes, one for each ocular in the case of spectacles (the arms of those must be horizontal) and two-piece goggles, or at each visual centre in the case of face-shields and one-piece goggles, measure the horizontal and vertical prismatic powers by counting the number of circles across which the vertical and horizontal cross-wires of the graticule are displaced and by interpolating between two circles if necessary. Since each circle represents $0,05 \text{ cm/m}$, the reading may be made to the nearest $\pm 0,025 \text{ cm/m}$.

Deviations measured for each ocular or each visual centre are added when they are in opposite directions and subtracted when they are in the same direction.

Measure the refractive power for each ocular or each visual centre by opening the telescope diaphragm to 20 mm. Determine the astigmatism by the difference of refractive powers measured by resolving 2 circular arcs on the target. Spherical effect is the average of refractive powers measured by resolving 2 circular arcs on the target.

In this way a value for the horizontal prismatic power and a value for the vertical prismatic power are obtained, as well as values for the spherical effect and astigmatism. These values shall be within the limits defined in table 3 of sub-clause 7.1.2.1.2 of ISO 4849.

Two other optional methods for prismatic power measurement are presented in annexes B and C.

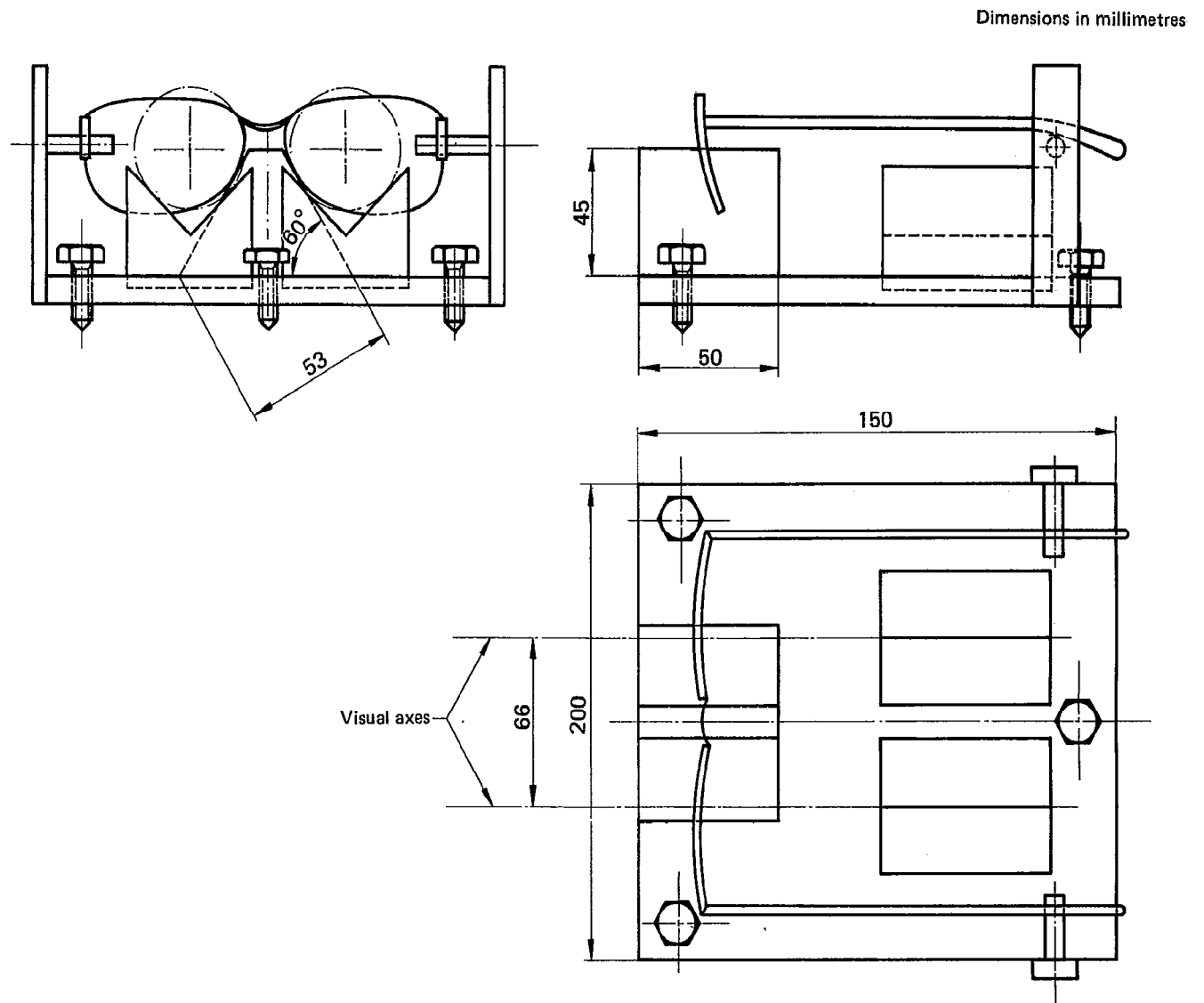


Figure 2 — Standard support for spectacles