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Eye and face protection — Test methods —

Part 1: Geometrical optical properties

Protection des yeux et du visage — Méthodes d'essai —

Partie 1: Propriétés optiques géométriques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 6, *Eye and face protection*.

This first edition of ISO 18526-1, together with ISO 18526-2, cancels and replaces ISO 4854:1981 which has been technically revised.

A list of all parts in the ISO 18526 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The family of documents comprised of the ISO 16321 series, the ISO 18526 series and the ISO 18527 series was developed in response to the worldwide stakeholders' demand for minimum requirements and test methods for eye and face protectors traded internationally. ISO 4007 gives the terms and definitions for all the various product types. The test methods are given in the ISO 18526 series, while the requirements for occupational eye and face protectors are given in the ISO 16321 series. Eye protectors for specific sports are mostly dealt with by the ISO 18527 series. A guidance document, ISO 19734, for the selection, use and maintenance of eye and face protectors is under preparation.

Eye and face protection — Test methods —

Part 1: Geometrical optical properties

1 Scope

This document specifies the reference test methods for determining the spherical, cylindrical, and prismatic refractive power properties of unmounted and mounted plano lenses (non-corrective lenses) for eye and face protectors.

This document does not apply to any eye and face protection product requirement standards for which other test methods are specified.

Other test methods can be used provided they have been shown to be equivalent and include uncertainties of measurement no greater than those required by the reference method.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 4007, *Personal protective equipment — Eye and face protection — Vocabulary*

ISO 18526-4:2020, *Eye and face protection — Test methods — Part 4: Headforms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4007 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Preparatory information

Before testing, refer to the appropriate product's requirements standard for the information needed to apply the tests in this document, for example:

— the number of test samples[1)];

— preparation of test samples;

— the selection of test samples (if included in this document);

1) For the purpose of this document, “test sample” is taken to be the object under test, e.g. “lens”, “filter” or “complete protector” as specified in the requirement standards.

— any prior conditioning or testing;

— test method (if more than one are included in this document);

— any deviations from the method(s);

— characteristics to be assessed subjectively (if appropriate);

— pass/fail criteria.

5 General test requirements

Unless otherwise specified, the values stated in this document are expressed as nominal values. Except for temperature limits, values that are not stated as maxima or minima shall be subject to a tolerance of ± 5 %.

Unless otherwise specified, the ambient temperature for testing should be between 16 °C and 32 °C but if any temperature limits are specified, these should be subject to an accuracy of ± 2 °C. Relative humidity should be maintained at (50 ± 20) %.

Unless otherwise specified, the test samples shall be tested at the reference points (for testing) as defined in ISO 4007.

The tests shall be done by trained observers.

For each of the required measurements performed in accordance with this document, a corresponding estimate of the uncertainty of measurement shall be evaluated according to Annex A.

6 Geometrical optical test methods

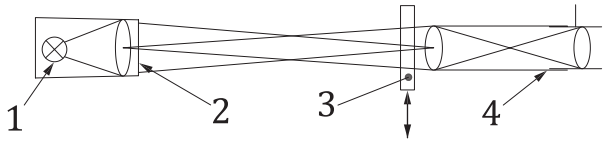
6.1 Test method for refractive power and prismatic power for plano lenses

6.1.1 Principle

This test is intended to measure the refractive power and prismatic power for nominally plano lenses and is called the telescope method.

6.1.2 Apparatus

A schematic drawing of a possible telescope set-up is given in Figure 1. Alternatively, an externally illuminated telescope target may be used.



Key

1 light source
2 telescope target
3 test sample
4 telescope

Figure 1 — Schematics of telescope set-up

6.1.2.1 Telescope, with a nominal aperture of 20 mm and a magnification between ×10 and ×30, fitted with an adjustable eyepiece incorporating a reticule. The focusing adjustment shall have a scale of refractive power such that the telescope can be calibrated with a maximum uncertainty of measurement of 0,01 D[2)] using the test method described in 6.1.2.4.

6.1.2.2 Illuminated target, consisting of a black plate incorporating the cut-out pattern shown in Figure 2, behind which is a light source of adjustable luminance. A condenser lens may be necessary to achieve sufficient luminance by focusing 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 (20,0 ± 0,1) mm long and (2,0 ± 0,1) mm wide with a (2,0 ± 0,1) mm separation. The distance from the outer circle to the inner bars shall be (2,0 ± 0,5) mm.

Figure 2 — Telescope target (dimensions are given in 6.1.2.2)

6.1.2.3 Filter (optional), with its maximum transmittance in the green part of the spectrum to reduce chromatic aberration. It is recommended that a filter with a spectral transmittance that is similar to the CIE 1931 standard colorimetric observer according to ISO/CIE 11664-1 be used.

6.1.3 Calibration of the apparatus

The apparatus shall be calibrated to achieve an uncertainty of measurement less than or equal to 0,01 D. This can be accomplished by using the method of adjusting the distance between the target and telescope according to Annex B or by using calibrated reference lenses e.g. these lenses shall have nominal positive and negative spherical powers of 0,06 D, 0,12 D and 0,25 D.

NOTE To achieve the 0,01 D uncertainty of measurement, the calibration of the reference calibration lenses needs to have an uncertainty of measurement less than ± 0,008 D.

6.1.4 Procedure

6.1.4.1 General

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

2) D is a commonly used symbol for the unit of focal power, the dioptre. This has dimensions of m^{-1} which is used in some countries as the official unit.

The test shall be carried out as follows.

— Focus the reticule and the target and align the telescope to obtain a clear image of the pattern. This setting is the zero point of the focusing scale of the telescope.

— Align the telescope so that the central aperture of the target is imaged on the centre of the cross-line reticule. This setting is the zero point of the prism scale position.

— Position the test sample in front of the telescope in the as-worn position. For unmounted lenses, position the lens into the appropriate frame provided by the manufacturer to determine the as-worn position with the specified headform.

Measurements of spherical and cylindrical power shall be taken using the procedures specified in 6.1.4.2.

If, during measurement using the telescope, a doubling or other aberration of the image is observed, then the test sample shall be subjected to further examination using the test method described in 6.3.

6.1.4.2 Spherical and cylindrical power

The test shall be carried out as follows.

— Rotate the target, or the test sample, in order to align the principal meridians of the test sample with the bars of the target.

— Focus the telescope firstly on one set of bars (measurement F_1) and then on the perpendicular bars (measurement F_2). The spherical power is the mean, $\frac{F_1+F_2}{2}$, the cylindrical power is the absolute difference, $|F_1-F_2|$, of the two measurements.

During this process, the best focus for each meridian across the whole target shall be used. An example for a lens with cylindrical power is given in Figure 3.

a) Focus on the vertical bars **b) Focus on the horizontal bars**

Figure 3 — Image of the target for a lens with cylindrical power

6.1.4.3 Prismatic power for unmounted lenses covering one eye

The test shall be carried out as follows.

— Place the test sample in front of the telescope in the as-worn position.

If the point of intersection of the lines of the reticule fall outside the image of the large circle, the prismatic power exceeds 0,25 Δ[3]. 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 Δ.

6.1.4.4 Test report

The measured values (spherical, cylindrical power and prismatic power) shall be reported.

6.2 Test method for the prism imbalance of complete eye protectors or lenses covering both eyes

6.2.1 Principle

This test method determines the prism imbalance (relative prism error) in the as-worn position at the two reference points of mounted lenses in complete eye protectors, or at the two reference points on the lens if it is designed to cover both eyes.

6.2.2 Apparatus

The arrangement of the test apparatus is shown in Figure 4. The uncertainty for the determination of the prism imbalance is equal to or less than 0,05 Δ.

NOTE If other light sources (e.g. laser sources) are used, the test apparatus needs to be adapted accordingly (e.g. expansion of the beam before LB_1 might be necessary).

3) Δ is a commonly used symbol for the unit of prismatic power, the prism dioptre. This has dimensions of cm/m, which is used in some countries as the official unit.