INTERNATIONAL STANDARD

ISO 15253

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Ophthalmic optics and instruments — Optical devices for enhancing low vision

Optique et instruments ophtalmiques — Dispositifs optiques pour malvoyants

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15253 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 7, *Ophthalmic optics and instruments*.

Annexes A and B of this International Standard are for information only.

Ophthalmic optics and instruments — Optical devices for enhancing low vision

1 Scope

This International Standard applies to optical devices specified by the manufacturer for use by visually impaired persons as optical low-vision aids. It specifies the optical and mechanical requirements and test methods for such devices, including optical devices with electrical components such as illuminators.

It does not apply to electro-optical devices for enhancing low vision.

NOTE Requirements and test methods for electro-optical devices for enhancing low vision are specified in ISO 15254, *Ophthalmic optics and instruments — Electro-optical devices for low vision*.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 12870, *Ophthalmic optics — Spectacle frames — General requirements and test methods.*

ISO 14889, *Ophthalmic optics — Spectacle lenses — Fundamental requirements for uncut finished lenses.*

ISO 15004:1997, *Ophthalmic instruments — Fundamental requirements and test methods.*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply. The symbols for certain of these terms are language-dependent. Equivalent terms in other languages, and the corresponding symbols used in those languages as well as in English, are given in annex B.

3.1
astronomical telescope
Keplerian telescope
compound optical system, afocal in normal adjustment, consisting of a positive objective element or group and a positive ocular element or group forming a magnified, inverted image

3.2
binocular aid
optical device, usually consisting of two separate optical systems mounted in alignment, intended to be used with both eyes simultaneously

3.3
biocular aid
optical device in which both eyes view through a single optical system

3.4
distance cap
negative lens placed in front of a near-vision telescope/telemicroscope objective to adapt the device for viewing a distant object

3.5
equivalent power
reciprocal of the equivalent focal length in air measured in metres

NOTE Equivalent power is expressed in dioptres, or reciprocal metres.

3.6
eyepiece
ocular
optical element or group nearest to the eye in an optical imaging system, used for viewing the image formed by the objective

3.7
focal length
linear distance separating the principal focal point (or focus) of an optical system from a point of reference

See Figure 1.

NOTE The distance needs to be further specified in accordance with the point of reference chosen, e.g. vertex, principal point. See definitions 3.7.1 to 3.7.3.

3.7.1
back vertex focal length
distance in an optical system from the back surface to the back focal point, measured along the optical axis (axis of symmetry)

See Figure 1.

3.7.2
front vertex focal length
distance in an optical system from the front surface to the front focal point, measured along the optical axis (axis of symmetry)

See Figure 1.

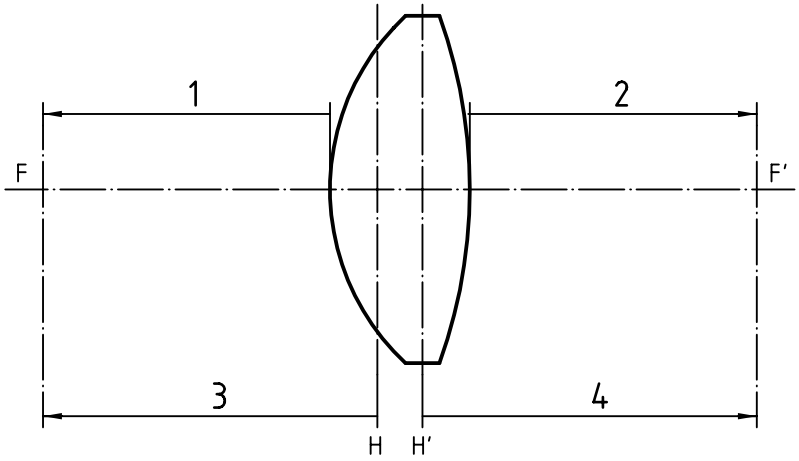
3.7.3
equivalent focal length
distance in an optical system from a focal point to the corresponding principal point, measured along the optical axis (axis of symmetry)

See Figure 1.

NOTE See **equivalent power** (3.5).

3.8
focusing telescopic device
device intended to be adjusted by the user for a range of object distances

3.9
free working distance
⟨optical low vision aid⟩ distance between the most anterior portion of a near-vision telescope/telemicroscope and the object



Key

1 Front vertex focal length
2 Back vertex focal length
3 Focal length
4 Equivalent focal length

Figure 1 — Illustration of focal lengths

3.10
Galilean telescope
compound optical system, afocal in normal adjustment, consisting of a positive objective element or group and a negative ocular element or group forming a magnified, erect image

3.11
hand magnifier
device intended to be positioned and supported by the user's hand and without artificial support

3.12
linear field of view
⟨of a low vision aid⟩ maximum observable extent of the object plane visible through the low vision aid under the conditions of use stated by the manufacturer

3.13
low vision aid
device used by visually impaired persons to enhance vision

3.14
low vision-aid telescope
optical system, Keplerian with inverted image or Galilean, that forms a magnified retinal image of an object

3.14.1
hand telescope
telescope designed to be hand-held

3.14.2
spectacle telescope
telescope mounted in or on a spectacle frame

3.15
magnification
ratio between any linear dimension of the retinal image when the magnifying device is in use and the corresponding dimension when the object is viewed without the magnifying device

3.15.1
angular magnification
ratio of the angle subtended by the image to that subtended by the object at a viewing point of reference such as the entrance pupil of the eye

3.15.2
nominal magnification
M
⟨for magnifiers⟩ magnification calculated from the product of the reference seeing distance (see 3.20), in metres, and the equivalent power F (see 3.5), in dioptres

EXAMPLE With a reference seeing distance of 0,25 m the nominal magnification is calculated from the formula $M = 0{,}25\ F$.

3.15.3
trade magnification (deprecated)
M_{trade}
⟨for magnifiers⟩ magnification calculated from the formula:

$$M_{\text{trade}} = M + 1$$

NOTE This definition is included since some text books on low vision refer to trade magnification. This term should not be used in future.

3.16
magnifier
low vision-aid microscope
lens system designed to produce an enlarged image

NOTE It may be a simple single element or a compound multiple-element system.

3.16.1
spectacle magnifier
spectacle microscope
magnifier in the form of spectacles and intended to be worn as spectacles, mounted or held close to the eye, which includes power in addition to a normal near correction

3.16.2
illuminated magnifier
magnifier incorporating illumination

3.17
monocular aid
optical device to be used before only one eye

3.18
optical dimensions
zone of optical dimensions
optical zone of magnifier
usable linear size of a magnifier when mounted

NOTE It is expressed in millimetres.

3.19
reading cap
positive lens placed in front of a telescopic objective to adapt the device for viewing a near object

3.20
reference seeing distance
least distance of distinct vision (deprecated)
agreed distance of 250 mm between the anterior corneal vertex of the eye and the object observed

NOTE The reference seeing distance is used, above all, as a reference parameter for calculating the magnification of optical instruments used for near vision.

3.21
relative distance magnification
change in the size of the retinal image that is obtained by changing the viewing distance

3.22
resolution
smallest separation between two details, expressed as a linear or angular measurement, at which a pair of points may be recognized as being separate under a given set of conditions

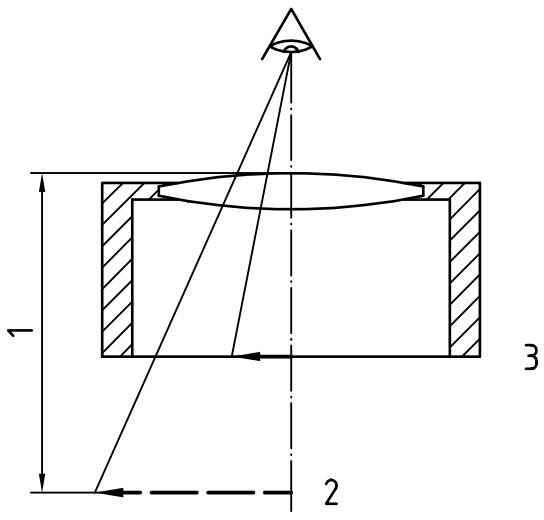
3.23
stand magnifier
magnifier in which the support is designed to position the optical system at a set or adjustable distance from the object to be viewed

3.23.1
vertex image distance
⟨for stand magnifiers⟩ distance from the magnifier surface nearest to the eye to the virtual image when the object is placed at the designated position

See Figure 2.

3.23.2
exit image vergence
⟨for stand magnifiers⟩ reciprocal of the vertex image distance, expressed in metres

NOTE The unit of vergence is the dioptre.



Key
1 Vertex image distance
2 Image plane
3 Object plane

Figure 2 — Illustration of vertex image distance, object plane and image plane

3.24
telemicroscope
near-vision telescope
telescope adapted for viewing near objects

3.25
terrestrial telescope
astronomical telescope to which has been added an erecting system

4 Classification

4.1 Magnifiers

a) Hand-held

b) Stand

c) Head-mounted, including spectacles and spectacle-mounted

4.2 Telescopes — Distance vision

a) Hand-held

b) Head-mounted, including spectacles and spectacle-mounted

4.3 Telescopes — Near-vision/telemicroscopes

a) Hand-held

b) Head-mounted, including spectacles and spectacle-mounted

4.4 Telescopes — Adjustable

a) Hand-held

b) Head-mounted, including spectacles and spectacle-mounted

5 Requirements

5.1 Optical characteristics

5.1.1 Resolution

5.1.1.1 General

The resolution of the optical device shall be measured at an object contrast level of not less than 80 %.

5.1.1.2 Magnifiers and telemicroscopes/near vision telescopes

When tested in accordance with 7.4, the device shall resolve a target which consists of line pairs measuring not more than 0,233 mm per pair (0,116 mm per element) within the central 70 % of the linear field of view, for targets having white light meeting the specifications of CIE standard illuminant D65 within the illuminance range of 750 lx to 1000 lx with the device used as intended by the manufacturer.

5.1.1.3 Telescopes

When tested in accordance with 7.4, the device shall resolve targets consisting of line pairs subtending an angle of 2′ (or less) having elements subtending an angle of 1′ (or less) within the central 70 % of the linear field of view, or the central 10°, whichever is the smaller, unless these requirements exceed the diffraction limits of the device. In that case, the target when specified in cycles per degree shall not be less than 50 % of the diffraction limit for monochromatic light at 555 nm within the above specified area. The telescope shall meet these requirements at the limits of the claimed working range.

5.1.2 Equivalent power — Magnifiers

The equivalent power of the magnifier measured along the optical axis shall not deviate by more than 5 % of the value declared by the manufacturer. The difference in power between the two meridians shall not be more than 2,5 %.

For magnifiers designed with significantly different powers in the two meridians, the deviation of the equivalent power in the two principal meridians shall not total more than ± 2,5 % of the stronger power.

5.1.3 Angular magnification — Telescopes

The angular magnification of the telescope measured along the optical axis shall not deviate by more than 5 % of the value stated by the manufacturer.

5.1.4 Lateral variation of magnification — Magnifiers and telescopes

When the linear field of view of the device is examined as described in 7.5, the variation in magnification over the central 70 % of the linear field shall comply with Table 1 or Table 2.

The manufacturer shall state the method of testing.

Table 1 — Magnifiers/Near telescopes

Equivalent power dioptres	**Lateral variation of magnification** %
up to 12	5
over 12 to 20	10
over 20	15

Table 2 — Distance telescopes

Magnification	**Lateral variation of magnification** %
below 3 ×	2,5
3 × to 5 ×	5
over 5 ×	7,5

5.1.5 Transmittance

If claims about transmittance are made by a manufacturer, the measurements should comply with the relevant International Standard[1)] and the appropriate transmittance curves shall be made available on request.

1) ISO 14490-5, *Optics and optical instruments — Test methods for telescopic systems — Part 5: Test methods for transmittance,* is in course of preparation.