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Ophthalmic optics — Spectacle lenses — Vocabulary

Optique ophtalmique — Verres de lunettes — Vocabulaire

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Foreword

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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).

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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 172 *Optics and photonics*, Subcommittee 7, *Ophthalmic optics and instruments.*

This third edition cancels and replaces the second edition (ISO 13666:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Since the document is for spectacle lens terminology, the single word “lens” rather than “spectacle lens” is used throughout the document.

— This revision has resulted in a few terms that were no longer used in lens standards or in communications between participants in the lens manufacturing and dispensing chain being deleted. The terms that were in clause 17 have been either moved or incorporated into earlier terms.

— Over 50 % of terms and definitions have been revised. In some cases, this is as little as changing the order of synonyms for the term, to significant changes in the wording of definitions or notes to entry, but without change of meaning.

— The meaning of vertex distance has been altered so that it now refers to the horizontal distance between the back surface of the lens and the apex of the cornea, measured with the eyes in the primary position. The plane of the lens shape is now defined as being the plane containing the vertical centreline parallel to the horizontal centreline of the individual lens based on the apex of the groove instead of being based on the plane tangential to the demonstration lens. The design reference points are where the manufacturer's specifications apply, while the reference points are where the lenses are to be verified. For single-vision and most multifocal lenses, these are the same. The previous distinction for a multifocal lens, where the distance design reference point was usually the centre of the semi-finished lens blank (now called simply "blank") while the distance reference point was usually the intended position of the optical centre of the distance portion after surfacing, has been removed — they are the design reference point or simply the reference points of the blank and the finished lens.

— The term "*as-worn" corrected dioptric power* has been replaced by the term *verification power* — this word explains its purpose better, and is clarified by a new definition. Shape magnification has been replaced by the more general *spectacle magnification.*

— The following additional terms have been added:

  — as-worn pantoscopic angle;

  — centration point position;

  — darkened state;

  — degressive-power blank;

  — distance power;

  — faded state;

  — fused multifocal lens;

  — infrared transmittance;

  — lens shape;

  — mean sphere;

  — near power;

  — near reference point;

  — ordered distance prismatic effect;

  — ordered near prismatic effect;

  — ordered power;

  — ordered prismatic effect;

  — position-specific single-vision lens;

  — power-variation blank;

  — power-variation lens;

  — power-variation surface;

  — presbyopia;

  — prescribed power;

  — primary reference point;

  — reference point;

  — secondary reference point;

  — segment bottom;

  — segment top;

  — solar blue-light transmittance;

  — spectacle magnification;

  — spherical equivalent power;

— traffic signal light;

— ultraviolet transmittance;

— variation power;

— verification power.

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

This new edition of ISO 13666 has been prepared in line with the new provisions of ISO/IEC Directives, Part 2. This led to a renumbering of all terms. All the terms are now in Clause 3, “Terms and definitions”, so the previous subsections have been made into full subclauses to simplify the numbering. "Notes" have been replaced by "notes to entry" — these can be normative, as opposed to notes in specification standards which are informative.

General considerations in the interpretation of this vocabulary document are:

— since this document relates to spectacle lenses, the simple word 'lens' or 'lenses' is generally used throughout (except where definitions have been quoted from other standards) instead of 'spectacle lens' or 'spectacle lenses'. The term "spectacle lens" is defined in 3.5.2. When “lens” means a lens in general, including but not restricted to spectacle lenses, it is not italicized in the text. When “lens” means a spectacle lens, the word “lens” is put in italics.

— the unit of focusing power, expressed in reciprocal metres (m^{-1}), of a lens or surface is the dioptre. See 3.10.1 for a complete definition;

— the unit of prismatic power is the prism dioptre (Δ), expressed in centimetres per metre (cm/m). See 3.11.11 for a complete definition;

— to simplify definitions and the understanding of the optics of ophthalmic lenses, aberrations of lenses and prisms are ignored in definitions except when specifically mentioned;

— definitions are classified according to subject;

— deprecated: Some obsolete terms are listed for convenience, but are indicated as "DEPRECATED" and should not be used;

— in this document, the word "normal" (to a surface) means a line that is at 90° to the plane that is tangential to the surface at the point of interest, i.e. is perdendicular to the surface at that point.

Ophthalmic optics — Spectacle lenses — Vocabulary

1 Scope

This document defines terms relating to ophthalmic optics, specifically to blanks, finished spectacle lenses and fitting purposes.

Terms relating to processes and material for fabrication and surface treatment (other than some specific terms relating to coatings), and terms relating to defects in materials and after optical processing are given in ISO 9802.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/

NOTE CIE International Lighting Vocabulary CIE S 017: 2011 is available at http://eilv.cie.co.at/.

3.1 Basic optics

3.1.1
optical radiation
electromagnetic radiation at wavelengths between the region of transition to X-rays ($\lambda \approx 1$ nm) and the region of transition to radio waves ($\lambda \approx 1$ mm)

[SOURCE: CIE S 017:2011, 17-848]

3.1.2
visible radiation
light
any *optical radiation* (3.1.1) capable of causing a visual sensation directly

Note 1 to entry: The limits of photo-detection depend upon the amount of radiant power reaching the retina and the responsivity of the observer.

Note 2 to entry: ISO 20473 specifies the spectral range of *visible radiation* to have a lower limit of 380 nm and an upper limit of 780 nm for application to Optics and Photonics standards. These limits apply to *spectacle lens* (3.5.2) standards.

[SOURCE: CIE S 017:2011, 17-1402, modified — the note has been deleted, while notes 1 and 2 to entry have been added.]

3.1.3
ultraviolet radiation
DEPRECATED: ultraviolet
optical radiation (3.1.1) for which the wavelengths are shorter than those for *visible radiation* (3.1.2)

Note 1 to entry: ISO 20473 specifies the spectral range of *ultraviolet radiation* for the application to Optics and Photonics standards and subdivides the UV range into:

— UV-A: 315 nm to 380 nm;

— UV-B: 280 nm to 315 nm;

— UV-C: 100 nm to 280 nm.

Other health and safety disciplines define UV-A as 315 nm to 400 nm.

[SOURCE: CIE S 017:2011, 17-1367, modified —The notes have been deleted while note 1 to entry has been added.]

3.1.4
infrared radiation
DEPRECATED: infrared
optical radiation (3.1.1) for which the wavelengths are longer than those for *visible radiation* (3.1.2), from 780 nm to 1 mm

Note 1 to entry: For *infrared radiation*, the range between 780 nm and 1 mm is commonly subdivided into:

— IR-A: 780 nm to 1 400 nm;

— IR-B: 1,4 µm to 3 µm;

— IR-C: 3 µm to 1 mm.

Note 2 to entry: These limits are also specified in ISO 20473.

Note 3 to entry: The solar *infrared radiation* spectrum at sea level extends to about 2 000 nm.

Note 4 to entry: The range of *infrared radiation* emitted by the source and reaching the *lens* shall be considered in the design of an *infrared radiation*-absorbing material.

[SOURCE: CIE S 017:2011, 17-580, modified — Notes 2, 3 and 4 to entry have been added.]

3.1.5
refractive index
$n(\lambda)$
ratio of the velocity of propagation of monochromatic radiation of the wavelength (λ) in vacuum to its velocity of propagation in the medium

Note 1 to entry: For technical applications, the *refractive index* is given against air instead of against vacuum.

Note 2 to entry: The wavelengths to be used for the characterization of *optical materials* (3.3.1), all kinds of optical systems and instruments, and *spectacle lenses* (3.5.2), are specified in ISO 7944.

3.1.6
chromatic dispersion
change in the *refractive index* (3.1.5) of monochromatic radiation in a medium as a function of the frequency of the radiation

Note 1 to entry: The *chromatic dispersion* gives rise to chromatic aberration in a lens made from dispersive materials.

3.1.7
Abbe number
v_d, v_e
DEPRECATED: constringence
DEPRECATED: V-value
indicator of the *chromatic dispersion* (3.1.6) of an *optical material* (3.3.1) or component

Note 1 to entry: The *Abbe number* can be calculated as either:

$$v_d = \frac{n_d - 1}{n_F - n_C}$$

where

n_d is the *refractive index* of the yellow helium d-line (wavelength: 587,56 nm);

n_F is the *refractive index* of the blue hydrogen F-line (wavelength: 486,13 nm); and

n_C is the *refractive index* of the red hydrogen C-line (wavelength: 656,27 nm);

or

$$v_e = \frac{n_e - 1}{n_{F'} - n_{C'}}$$

where

n_e is the *refractive index* of the green mercury e-line (wavelength: 546,07 nm);

$n_{F'}$ is the *refractive index* of the blue cadmium F′-line (wavelength: 479,99 nm); and

$n_{C'}$ is the *refractive index* of the red cadmium C′-line (wavelength: 643,85 nm).

Note 2 to entry: These reference wavelengths are given in ISO 7944:1998.

3.1.8
optical axis
straight line joining the centres of curvature of both surfaces of a *lens* (3.5.2)

Note 1 to entry: This line is normal to both optical surfaces so light can pass along it undeviated.

Note 2 to entry: For *lenses* (3.5.2) with strong *prismatic power* (3.11.10), the *optical axis* can lie outside the area of the *lens*.

Note 3 to entry: *Power-variation lenses* (3.7.7) do not have a true *optical axis*.

3.1.9
vertex
point of intersection of the *optical axis* (3.1.8) with a surface of a *lens* (3.5.2)

3.1.10
power
capacity of a *lens* (3.5.2) or optical surface to change the curvature or direction of incident wavefronts by refraction

3.1.11
focal point
image point conjugate to an infinitely distant object point on the *optical axis* (3.1.8)

3.1.12
bioactinic
exhibiting or referring to *bioactinism* (3.1.13)

3.1.13
bioactinism
property of *optical radiation* (3.1.1) that enables it to cause chemical changes to biological tissues

3.1.14
presbyopia
reduction in the ability to accommodate through normal ageing, resulting in the inability to focus at usual near distances with any ametropia corrected

3.2 Lenses and their dispensing

3.2.1
boxed lens system
boxing system
system of measurement and definitions based on the rectangle formed by the horizontal and vertical tangents to the extremities of the *lens shape* (3.2.2)

Note 1 to entry: Because the horizontal and vertical tangents might not be in the same plane, for a *lens* (3.5.2) this can be thought of as an orthogonal projection onto a plane parallel to the *front surface* (3.2.13) at its *boxed centre* (3.2.5).

3.2.2
lens shape
outline of the *edged lens* (3.8.9) periphery in its intended orientation

Note 1 to entry: The nasal side should be indicated.

Note 2 to entry: *Lens shape* refers to the shape of *lenses* (3.5.2) that fit the frame with:

— for a *lens* having a bevelled edge, the outermost edge of the *lens*, the *lens* having a bevel which includes a symmetrical angle of 120° and a bevel width greater than the width of the groove in the front;

— for a *lens* having a flat or grooved edge, the outermost edge of the *lens*.

3.2.3
horizontal centreline
horizontal straight line located at an equal distance from the two horizontal tangents of the *boxed lens system* (3.2.1)

[SOURCE: ISO 8624:2011, A.1, modified — The words "horizontal straight" have been added and the word "(boxing)" has been deleted.]

3.2.4
vertical centreline
vertical straight line located at an equal distance from the vertical sides of the rectangular box that circumscribes the *lens shape* (3.2.2)

[SOURCE: ISO 8624:2011, A.2, modified — The words "vertical straight" have been added and the word "which" has been changed to "that".]

3.2.5
boxed centre
C
intersection of the *horizontal centreline* (3.2.3) and the *vertical centreline* (3.2.4) of the rectangular box that circumscribes the *lens shape* (3.2.2)

Note 1 to entry: This term is applied to spectacle frames and to the *edged lens* (3.8.9).

[SOURCE: ISO 8624:2011, 2.1, modified — The word "which" has been replaced by "that" and note 1 to entry has been added.]

3.2.6
geometrical centre
geometric centre
intersection of the *horizontal centreline* (3.2.3) and *vertical centreline* (3.2.4) of the rectangular box that circumscribes the shape of the *blank* (3.8.1) or *uncut lens* (3.8.8)

3.2.7
nominal size
d_n
dimension indicated by the manufacturer

Note 1 to entry: For round *blanks* (3.8.1) or *lenses* (3.5.2), the size is given as the diameter. Otherwise, the horizontal and vertical dimensions are given.

3.2.8
effective size
d_e
actual physical dimension

Note 1 to entry: For round *blanks* (3.8.1) or *lenses* (3.5.2), the size is given as the diameter. Otherwise, the horizontal and vertical dimensions are given.

3.2.9
usable size
d_u
dimension of the area that is optically usable

Note 1 to entry: For round *blanks* (3.8.1) or *lenses* (3.5.2), the size is given as the diameter. Otherwise, the horizontal and vertical dimensions are given.

3.2.10
horizontal axis
zero direction through a *reference point* (3.2.19) on the *lens* (3.5.2) for the specification of *cylinder axes* (3.13.8) and *prism base settings* (3.11.7) as defined in ISO 8429

3.2.11
meridian
<surface> each plane that contains the centre(s) of curvature of the surface

Note 1 to entry: See also *principal meridians* (3.4.5).

3.2.12
meridian
<*lens*> each plane that contains the *optical axis* (3.1.8) of the *lens* (3.5.2)

3.2.13
front surface
surface of the *lens* (3.5.2) intended to be fitted away from the eye

3.2.14
back surface
surface of the *lens* (3.5.2) intended to be fitted nearer to the eye

3.2.15
optical centre
intersection of the *optical axis* (3.1.8) with the *front surface* (3.2.13) of a *lens* (3.5.2)

3.2.16
design reference point
point, stipulated by the manufacturer, on the finished surface of a *blank* (3.8.1) or on the *front surface* (3.2.13) of the *finished lens* (3.8.7) at which the design specifications apply

EXAMPLE *Distance design reference point* and *near design reference point*.

3.2.17
distance design reference point
point, stipulated by the manufacturer, on the *front surface* (3.2.13) of a *finished lens* (3.8.7) or on the finished surface of a *blank* (3.8.1) at which the design specifications for the *distance portion* (3.15.1) apply

3.2.18
near design reference point
point, stipulated by the manufacturer, on the *front surface* (3.2.13) of a *finished lens* (3.8.7) or on the finished surface of a *blank* (3.8.1) at which the design specifications for the *near portion* (3.15.3) apply

3.2.19
reference point
point, stipulated by the manufacturer, on the *front surface* (3.2.13) of a *finished lens* (3.8.7) or on the finished surface of a *blank* (3.8.1) at which the *verification power* (3.10.15) of a specific portion applies

Note 1 to entry: Unless a *verification power* (3.10.15) is stated, the power is the nominal or *ordered power* (3.10.14). See note 3 to entry to *verification power*.

Note 2 to entry: This point can, in some circumstances, differ from the respective *design reference point* (3.2.16).

Note 3 to entry: For *power-variation lenses* (3.7.7), *focal power* (3.10.2) and *prismatic power* (3.11.10) are measured at different *reference points*.

EXAMPLE *Distance reference point* and *near reference point*.

3.2.20
distance reference point
major reference point
point on the *front surface* (3.2.13) of the *lens* (3.5.2) at which the *verification power* (3.10.15) for the *distance portion* (3.15.1) applies

Note 1 to entry: This point can, in some circumstances, be different from the *distance design reference point* (3.2.17).

Note 2 to entry: Unless a *verification power* (3.10.15) is stated, the power is the nominal or *ordered power* (3.10.14). See note 3 to entry to *verification power*.

3.2.21
near reference point
point on the *front surface* (3.2.13) of the *lens* (3.5.2) at which the *verification power* (3.10.15) for the *near portion* (3.15.3) applies

Note 1 to entry: This point can, in some circumstances, be different from the *near design reference point* (3.2.18).

Note 2 to entry: Unless a *verification power* (3.10.15) is stated, the power is the nominal or *ordered power* (3.10.14). See note 3 to entry to *verification power*.

3.2.22
primary reference point
point on the *front surface* (3.2.13) of a *power-variation lens* (3.7.7) at which the *verification power* (3.10.15) for the designed primary use of the *lens* (3.5.2) applies

Note 1 to entry: All *power-variation lenses* have a *primary reference point*.

Note 2 to entry: For example, the *primary reference point* for a *progressive-power lens* (3.7.8) is the *distance reference point* (3.2.20) and for a *degressive-power lens* (3.7.9) is the *near reference point* (3.2.21).

[SOURCE: ISO 21987:2017, 3.5]

3.2.23
secondary reference point
point on the *front surface* (3.2.13) of a *power-variation lens* (3.7.7) at which the *verification power* (3.10.15) for the designed secondary use of the *lens* (3.5.2) applies

Note 1 to entry: Some *power-variation lenses* (3.7.7) can have a *secondary reference point* that is used for the determination of the *addition power* (3.16.3) or *variation power* (3.16.4).

Note 2 to entry: For example, the *secondary reference point* for a *progressive-power lens* (3.7.8) is the *near reference point* (3.2.21).

[SOURCE: ISO 21987:2017, 3.6]

3.2.24
line of sight en: US
visual axis en: GB
ray path from the point of interest (i.e. point of fixation) in object space to the centre of the entrance pupil of the eye and its continuation in image space from the centre of the exit pupil to the retinal point of fixation (generally the foveola)

Note 1 to entry: These two parts of the ray path are distinct and separate segments.

3.2.25
primary direction
direction of the *line of sight* (3.2.24), usually taken to be the horizontal, to an object at an infinite distance measured with habitual head and body posture when looking straight ahead in unaided vision

3.2.26
primary position
position of the eye when looking in the *primary direction* (3.2.25)

3.2.27
visual point
point of intersection of the *line of sight* (3.2.24) with the *back surface* (3.2.14) of a *lens* (3.5.2)

3.2.28
interpupillary distance
PD
distance between the centres of the pupils when the eyes are in the *primary position* (3.2.26)

3.2.29
monocular pupillary distance
distance between the centre of the pupil and the mid-line of the bridge of the nose or the spectacle frame when the eye is in the *primary position* (3.2.26)

3.2.30
centration point
CP
point with respect to the frame at which the *optical centre* (3.2.15), *distance reference point* (3.2.20) or *fitting point* (3.2.34) is to be located in the absence of any *ordered prismatic effect* (3.11.14) and any *prism thinning* (3.16.9), or after any such *prismatic effect* (3.11.9) has been neutralized

Note 1 to entry: Which of these is relevant depends upon the type of *lens* (3.5.2), for example, the *optical centre* (3.2.15) usually applies to a *single-vision lens* (3.7.1), *distance reference point* (3.2.20) usually to an *aspheric lens* (3.6.8) or *multifocal lens* (3.7.3) and *fitting point* (3.2.34) usually to a *position-specific single-vision lens* (3.7.2) or a *power-variation lens* (3.7.7).