
Ophthalmic optics — Mounted spectacle lenses

Optique ophtalmique — Verres ophtalmiques montés

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 7, *Ophthalmic optics and instruments*.

This second edition cancels and replaces the first edition (ISO 21987:2009), which has been technically revised.

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Ophthalmic optics — Mounted spectacle lenses

1 Scope

This document specifies requirements and test methods for mounted spectacle lenses relative to the prescription order.

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 7944, *Optics and optical instruments — Reference wavelengths*

ISO 8429, *Optics and optical instruments — Ophthalmology — Graduated dial scale*

ISO 8598-1, *Optics and optical instruments — Focimeters — Part 1: General purpose instruments*

ISO 8624, *Ophthalmic optics — Spectacle frames — Measuring system and terminology*

ISO 8980-1, *Ophthalmic optics — Uncut finished spectacle lenses — Part 1: Specifications for single-vision and multifocal lenses*

ISO 8980-2, *Ophthalmic optics — Uncut finished spectacle lenses — Part 2: Specifications for power-variation lenses*

ISO 13666, *Ophthalmic optics — Spectacle lenses — Vocabulary*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13666 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

power-variation lens

spectacle lens with a smooth variation of focal power over part or all of its area, without discontinuity, designed to provide more than one focal power

Note 1 to entry: These are usually designed to provide increasing or decreasing spherical power, typically in a vertical meridian, so as to provide correction for different object distances.

Note 2 to entry: Examples of *power-variation lenses* are, but not limited to, *progressive-power lenses* (3.2) and *degressive-power lenses* (3.3).

3.2

progressive-power lens

PPL

progressive-addition lens

PAL

varifocal lens

power-variation lens (3.1) with two reference points for focal power, generally designed to provide correction for presbyopia and clear vision from distance to near

Note 1 to entry: *Progressive-power lenses* have a *primary reference point* (3.5) that is the distance reference point and a *secondary reference point* (3.6) that is the near reference point.

3.3

degressive-power lens

power-variation lens (3.1) with a *primary reference point* (3.5) for near vision, generally designed to provide clear vision from near to further distances

3.4

position-specific single-vision lens

single-vision lens, generally with complex surface geometry, that needs to be positioned accurately according to the ordered specification and bears permanent alignment reference markings

Note 1 to entry: An example for *position-specific single-vision lenses* are those single-vision lenses calculated to take into account the as-worn position and therefore requiring accurate mounting in front of the wearer's eye.

3.5

primary reference point

point on the front surface of a *power-variation lens* (3.1) at which the *verification power* (3.8) for the designed primary use of the lens 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* (3.2) is the distance reference point and for a *degressive-power lens* (3.3) is the near reference point.

3.6

secondary reference point

point on the front surface of a *power-variation lens* (3.1) at which the *verification power* (3.8) for the designed secondary use of the lens applies

Note 1 to entry: Some *power-variation lenses* can have a *secondary reference point* (3.6) that is used for the determination of the addition power or *variation power* (3.7).

Note 2 to entry: For example, the *secondary reference point* for a *progressive-power lens* (3.2) is the near reference point.

3.7

variation power

<for a *power-variation lens*> difference between the vertex powers at the *primary* (3.5) and *secondary reference points* (3.6)

Note 1 to entry: For example, for a *progressive-power lens* (3.2), this is the addition power, while for some *degressive-power lenses* (3.3), it is the degression power.

Note 2 to entry: *Variation power* is defined for *power-variation lenses* (3.1) only if they have both a *primary* and a *secondary reference point*.

3.8

verification power

dioptric power of the lens, specifically calculated and provided by the manufacturer as the reference for focimeter verification

Note 1 to entry: This is the power that is expected to be found as the measured power using the specified method, and to which the tolerances apply.

Note 2 to entry: The *verification power* can differ from the ordered power, for example, because the ray path through the lens when being measured on a focimeter can be different from that in the as-worn position, and because of (ocular) physiological effects.

Note 3 to entry: If only one power is stated by manufacturer with the finished uncut or mounted lenses, then this will be the ordered power and is to be used for verification.

4 Classification

Finished, mounted lenses are classified as follows:

- a) single-vision finished lenses;
- b) multifocal finished lenses;
- c) power-variation finished lenses.

5 Requirements

5.1 Reference temperature

The tolerances shall apply at a temperature of $23\text{ °C} \pm 5\text{ °C}$.

5.2 Lenses used in manufacturing complete spectacles

Uncut finished lenses used in manufacturing complete spectacles shall meet the requirements of ISO 14889.

Lenses in mounted spectacles shall also comply with those other requirements of the prescription order not included in this document.

5.3 Optical requirements

5.3.1 General

The optical characteristics shall be verified using a focimeter conforming to the requirements of ISO 8598-1.

The optical tolerances shall apply at the reference point(s) of the lenses at one of the reference wavelengths specified in ISO 7944.

If the manufacturer states a verification power, then the ranges and tolerances in [Table 1](#), [Table 2](#), [Table 3](#), and [Table 4](#) shall be chosen according to and applied to the verification power. In this case, the verification power may be stated by the manufacturer in an accompanying document.

5.3.2 Back vertex power

When verified according to 5.3.1, spectacle lenses shall comply with the tolerances on the power of each principal meridian (see Table 1, second column), and with the tolerances on the cylindrical power (see Table 1, third to sixth column), using the method specified in 6.2:

- the back vertex power at the reference point of all single-vision lenses and the distance reference point of multifocal lenses, including those with aspherical or atoroidal surfaces, shall comply with the tolerances in Table 1;
- the back vertex power at the primary reference point of power-variation lenses shall comply with the tolerances in Table 2.

Table 1 — Tolerances on the back vertex power of single-vision and multifocal lenses

Values in dioptres (D)

Power of principal meridian with higher absolute back vertex power	Tolerance on the back vertex power of each principal meridian	Tolerance on the absolute cylindrical power			
		$\geq 0,00$ and $\leq 0,75$	$> 0,75$ and $\leq 4,00$	$> 4,00$ and $\leq 6,00$	$> 6,00$
$\geq 0,00$ and $\leq 3,00$	$\pm 0,12$	$\pm 0,09$	$\pm 0,12$	$\pm 0,18$	—
$> 3,00$ and $\leq 6,00$	$\pm 0,12$	$\pm 0,12$	$\pm 0,12$	$\pm 0,18$	$\pm 0,25$
$> 6,00$ and $\leq 9,00$	$\pm 0,12$	$\pm 0,12$	$\pm 0,18$	$\pm 0,18$	$\pm 0,25$
$> 9,00$ and $\leq 12,00$	$\pm 0,18$	$\pm 0,12$	$\pm 0,18$	$\pm 0,25$	$\pm 0,25$
$> 12,00$ and $\leq 20,00$	$\pm 0,25$	$\pm 0,18$	$\pm 0,25$	$\pm 0,25$	$\pm 0,25$
$> 20,00$	$\pm 0,37$	$\pm 0,25$	$\pm 0,25$	$\pm 0,37$	$\pm 0,37$

Table 2 — Tolerances on the back vertex power at the primary reference point of power-variation lenses

Values in dioptres (D)

Power of principal meridian with higher absolute back vertex power	Tolerance on the back vertex power of each principal meridian	Tolerance on the absolute cylindrical power			
		$\geq 0,00$ and $\leq 0,75$	$> 0,75$ and $\leq 4,00$	$> 4,00$ and $\leq 6,00$	$> 6,00$
$\geq 0,00$ and $\leq 6,00$	$\pm 0,12$	$\pm 0,12$	$\pm 0,18$	$\pm 0,18$	$\pm 0,25$
$> 6,00$ and $\leq 9,00$	$\pm 0,18$	$\pm 0,18$	$\pm 0,18$	$\pm 0,18$	$\pm 0,25$
$> 9,00$ and $\leq 12,00$	$\pm 0,18$	$\pm 0,18$	$\pm 0,18$	$\pm 0,25$	$\pm 0,25$
$> 12,00$ and $\leq 20,00$	$\pm 0,25$	$\pm 0,18$	$\pm 0,25$	$\pm 0,25$	$\pm 0,25$
$> 20,00$	$\pm 0,37$	$\pm 0,25$	$\pm 0,25$	$\pm 0,37$	$\pm 0,37$

5.3.3 Direction of the cylinder axis

When verified according to 5.3.1 and using the method specified in 6.3, the direction of the cylinder axis shall comply with the tolerances specified in Table 3. The cylinder axis shall be specified in accordance with ISO 8429.

NOTE 1 To allow for some tolerance in mounting, the tolerances on the direction of cylinder axis have generally been increased over the tolerances found in ISO 8980-1 and ISO 8980-2.

NOTE 2 There are no requirements for the axis direction for cylindrical powers of less than 0,12 D.

Table 3 — Tolerances on the direction of the cylinder axis

Absolute cylindrical power dioptres (D)	<0,12	≥0,12 and ≤0,25	>0,25 and ≤0,50	>0,50 and ≤0,75	>0,75 and ≤1,50	>1,50 and ≤2,50	>2,50
Tolerance on the direction of the cylinder axis degrees (°)	No requirement	±16	±9	±6	±4	±3	±2

5.3.4 Addition power or variation power

For multifocal lenses and those power-variation lenses with primary and secondary reference points, the following shall apply. When verified according to 5.3.1 and using the method specified in 6.4, the addition or variation power shall comply with the tolerances specified in Table 4.

Table 4 — Tolerances on the addition power or variation power

Values in dioptres (D)

Value of the addition power or variation power	≤4,00	>4,00
Tolerance	±0,12	±0,18

5.3.5 Prism imbalance (relative prism error) for mounted single-vision lenses (excluding position-specific single-vision lenses) and multifocal lenses

When verified according to 5.3.1 and using the method specified in 6.6, the prism imbalance (relative prism error), after neutralizing or allowing for any prescribed prism, for single-vision (excluding position-specific single-vision) lenses and multifocal lenses shall comply with the tolerances in Table 5. Lenses with no ordered prism are also included.

To determine the prism imbalance tolerances:

- 1) if ordered as an oblique prism, resolve any ordered prism into its horizontal and vertical components;
- 2) determine the higher of the ordered horizontal component values and the higher of the ordered vertical component values;
- 3) find the four principal powers (two in each lens);
- 4) identify the highest absolute power from the four principal powers;
- 5) horizontal: if the absolute value of the power found in 4) is ≤3,37 D, use the tolerance values in the second column of Table 5. The row is determined using the higher of the ordered horizontal component values. If the absolute value of the power is >3,37 D, use the tolerance values in the third column;

NOTE Figure 1 can be used to determine the horizontal prism imbalance tolerance rather than using Table 5. Find the horizontal prism imbalance tolerance on the y-axis using the power from 4) above on the x-axis, and the curve representing the relevant prism range, i.e. that containing the higher ordered horizontal prism component value.

- 6) vertical: if the absolute value of the power found in 4) is ≤5,00 D, use the tolerance values in the fourth column of Table 5. The row is determined using the higher of the ordered vertical component values. If the absolute value of the power is >5,00 D, use the tolerance values in the fifth column.

NOTE [Figure 2](#) can be used to determine the vertical prism imbalance tolerances rather than using [Table 5](#). Find the vertical prism imbalance tolerance on the y-axis using the power from 4) above on the x-axis, and the curve representing the relevant prism range, i.e. that containing the higher ordered vertical prism component value.

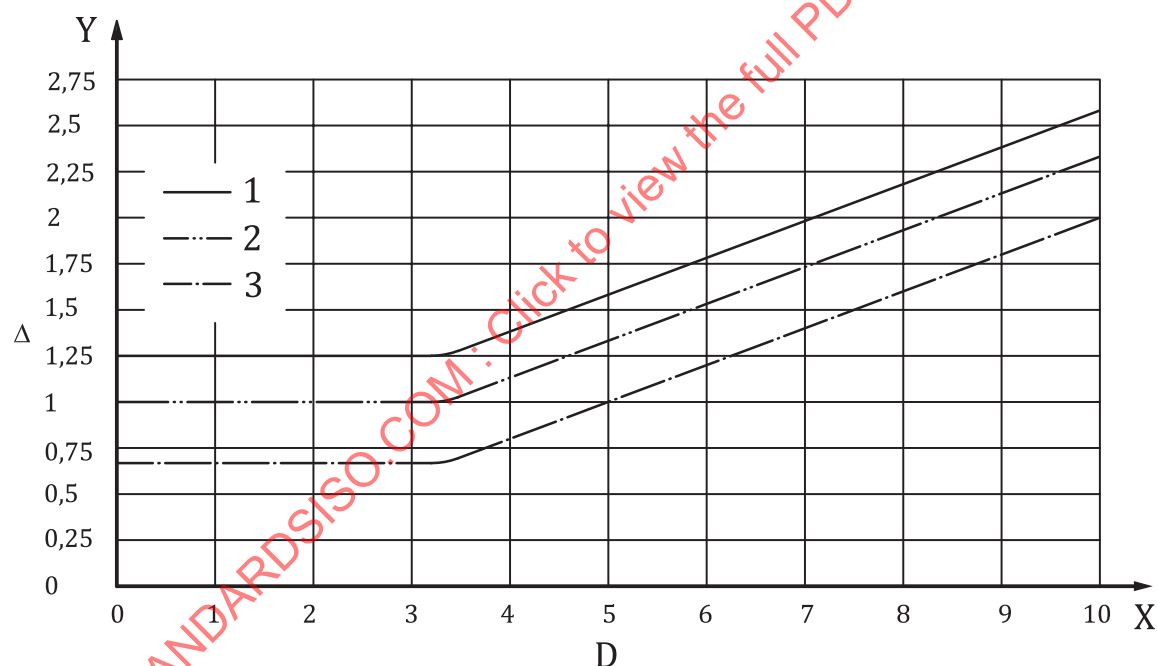
Table 5 — Prism imbalance (relative prism error) tolerances for single-vision lenses (excluding position-specific single-vision lenses) and multifocal lenses

Values in prism dioptres (Δ)

Higher ordered prism component value	Tolerance			
	(measured in prism dioptres at the centration points, i.e. the ordered positions)			
	Horizontal component		Vertical component	
	For powers $\geq 0,00$ to $\leq 3,37$ D	For powers $> 3,37$ D	For powers $\geq 0,00$ to $\leq 5,00$ D	For powers $> 5,00$ D
$\geq 0,00$ to $\leq 2,00$	$\pm 0,67$	$\pm (0,2 \times S)$	$\pm 0,50$	$\pm (0,1 \times S)$
$> 2,00$ to $\leq 10,00$	$\pm 1,00$	$\pm [0,33 + (0,2 \times S)]$	$\pm 0,75$	$\pm [0,25 + (0,1 \times S)]$
$> 10,00$	$\pm 1,25$	$\pm [0,58 + (0,2 \times S)]$	$\pm 1,00$	$\pm [0,50 + (0,1 \times S)]$

NOTE 1 These tolerances are determined by the highest absolute principal power, S , in dioptres, of the pair of lenses.

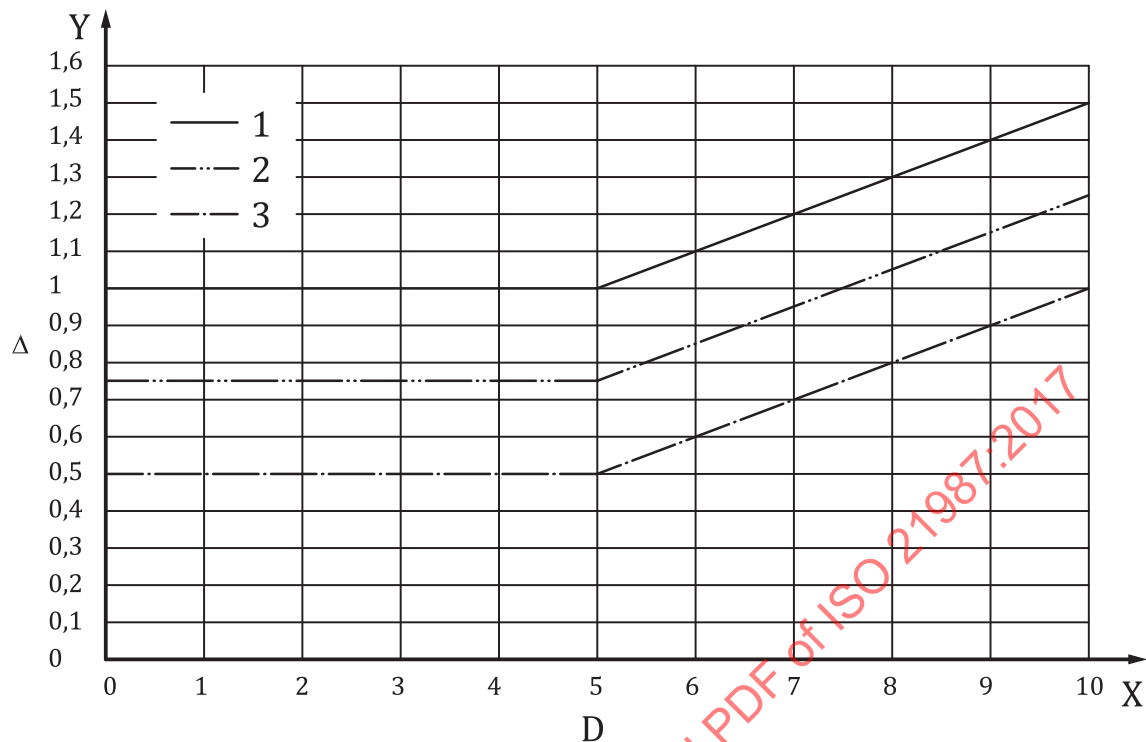
NOTE 2 $(0,2 \times S)$ corresponds to the prismatic effect of 0,2 cm (2 mm) displacement, while $(0,1 \times S)$ corresponds to the prismatic effect of 0,1 cm (1 mm) displacement.



Key

- X highest absolute principal power, D
- Y prism imbalance tolerance, Δ
- 1 higher ordered horizontal prism component $> 10,00 \Delta$
- 2 higher ordered horizontal prism component $> 2,00 \Delta$ to $\leq 10,00 \Delta$
- 3 higher ordered horizontal prism component $\geq 0,00 \Delta$ to $\leq 2,00 \Delta$

Figure 1 — Horizontal prism imbalance (relative prism error) tolerances

**Key**

- X highest absolute principal power, D
 Y prism imbalance tolerance, Δ
 1 higher ordered vertical prism component $>10,00 \Delta$
 2 higher ordered vertical prism component $>2,00 \Delta$ to $\leq 10,00 \Delta$
 3 higher ordered vertical prism component $\geq 0,00 \Delta$ to $\leq 2,00 \Delta$

Figure 2 — Vertical prism imbalance (relative prism error) tolerances

5.3.6 Prism imbalance (relative prism error) for position-specific single-vision lenses and power-variation lenses

Position-specific single-vision lenses and power-variation lenses shall be positioned according to [5.5.2](#).

The individual prism errors of each lens, measured at the reference point or prism reference point, shall not exceed the tolerances given in ISO 8980-1 or ISO 8980-2.

5.4 Requirements for thickness

The thickness of the lens may be specified by the manufacturer or be agreed between the orderer and the supplier.

The thickness shall be verified at the reference point of the front surface and normal to this surface. It shall not deviate from the ordered or agreed value by more than $\pm 0,3$ mm.

5.5 Requirements for positioning

5.5.1 Multifocal lenses

5.5.1.1 Vertical positions (or heights) of the segments

The segment top positions (s in Figure 3) [or segment heights (h in Figure 3)] shall be within $\pm 1,0$ mm of that ordered. In addition, the difference between segment heights for the mounted pair shall not exceed 1,0 mm relative to any difference ordered. Measurement shall be made using one of the methods specified in 6.5.

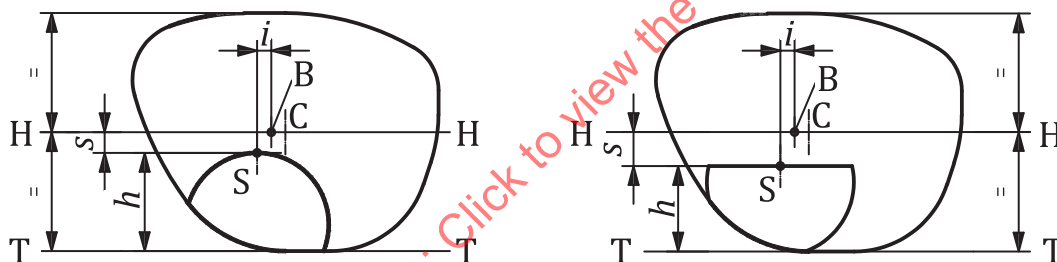
NOTE The measurement point for an E-style multifocal segment is the point on the dividing line at which the height of the ledge between the distance and near portions is a minimum.

5.5.1.2 Horizontal position of the segments

The horizontal position of the segment top S shall be $i \pm 1,0$ mm from the ordered monocular centration point B where i is the geometrical inset (see Figure 3). Measurement shall be made using the method specified in 6.5.

The horizontal position of both segments shall appear symmetrical and balanced unless unequal monocular centration distances or geometrical insets are ordered.

NOTE The measurement point for an E-style multifocal segment is the point on the dividing line at which the height of the ledge between the distance and near portions is a minimum.



Key

- C boxed centre of the edged lens shape
- HH horizontal centreline
- B distance centration point
- S segment top
- TT horizontal tangent to the peak of the bevel (if any) of the edge of the lens at its lowest point
- h segment height
- i geometrical inset
- s segment top position

Figure 3 — Positions of centration points and segment tops in multifocal lenses

5.5.1.3 Segment tilt for straight-top, curved-top and E-style segments

The orientation of the dividing line shall not be tilted more than 2° from the horizontal when measured using one of the methods specified in 6.5.

5.5.2 Position-specific single-vision lenses and power-variation lenses

5.5.2.1 Vertical position (or height) of the fitting point

The vertical position of the fitting point or the fitting point height shall be within $\pm 1,0$ mm of that ordered. In addition, the difference between fitting point heights for the mounted pair shall not exceed 1,0 mm relative to any difference specified. Measurement shall be made using one of the methods specified in [6.5](#).

5.5.2.2 Horizontal position of the fitting point

The horizontal fitting point position shall be within $\pm 1,0$ mm of the ordered monocular centration distance for that lens. Measurement shall be made using one of the methods specified in [6.5](#).

5.5.2.3 Alignment marking tilt

The line joining the permanent alignment reference markings shall not be tilted more than 2° from the horizontal when measured using one of the methods specified in [6.5](#).

5.6 Orientation requirement for polarizing lenses

Lenses mounted in spectacles that are claimed to be polarizing for sun glare attenuation and have no other orientation requirements, when mounted in spectacle frames, shall be fitted so that their planes of transmission do not deviate from the vertical by more than $\pm 5^\circ$ when tested according to the method in [6.7](#).

6 Verification methods

6.1 General

Alternative verification methods are acceptable if shown to perform equivalently to the reference test methods shown in Clause 6.

NOTE Verification of the powers of spectacle lenses is dependent upon various parameters including those relating to the design of the focimeter, focusing errors and, particularly, lens positioning on the instrument. These apply especially for determining the near addition. For details, see ISO/TR 28980.

6.2 Verification method for back vertex power

The back vertex power of single-vision lenses, of the distance portion of multifocal lenses and at the primary reference point for power-variation lenses shall be verified with the back surface of the lens against the focimeter's lens support. The lens shall be centred at the appropriate reference point. The back vertex power shall be verified according to [Table 1](#) or [Table 2](#), as appropriate.

6.3 Verification method for the direction of the cylinder axis

Verify the direction of the cylinder axis in relation to the horizontal centreline of the spectacle frame according to [Table 3](#) by placing the bottom edge of the frame on the focimeter rail and with the back surface of the lens against the focimeter's lens support. In cases where the positioning of the spectacle frame on the focimeter rail is not possible (e.g. frames with large face-form angle), alternative verification methods may be used.

6.4 Verification method for addition power or variation power

6.4.1 General

The addition power or variation power shall be verified according to [Table 4](#). The surface on which the segment or power-variation is located shall be chosen as the reference surface, in this subclause [6.4](#) only, for verification of the addition or variation power.

Alternatively, the manufacturer may nominate which surface of the lens shall be used as the reference surface.

NOTE Differences can occur between measurements made with different focimeters at points on a lens where prism is not zero. This is because of effects in the measurement, such as different focimeter designs, the nonlinearity error of focimeters, the positioning of the lens or the amount of tilt when the lens is placed on the support and the subjective focusing error.

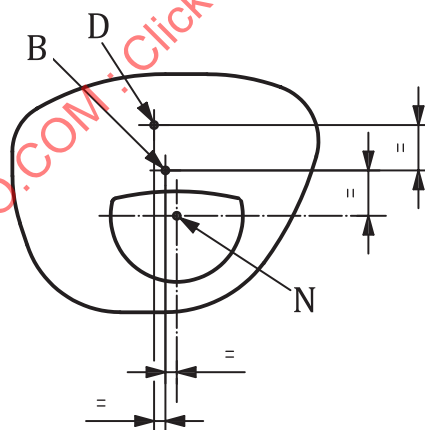
6.4.2 Method for verification of addition power for multifocal lenses

For each lens, establish point D, which is the symmetrical point of point N with respect to point B (see [Figure 4](#)). If the position of point N is not specified, choose a point 5 mm below the segment top as point N.

Place the lens so that the reference surface is against the focimeter's lens support; position the lens at point N, and measure the near power.

Keeping the reference surface against the focimeter's lens support, position the lens at point D unless point B is stated by the manufacturer and measure the distance power.

Calculate the addition power as the difference between the near power and the distance power. These powers may be either the power measured using the nearer-to-vertical lines of the target or the spherical equivalent power.



Key

- B distance reference point
- D verification point for distance power
- N verification point for near power

Figure 4 — Verification of addition power

6.4.3 Method for verification of variation power (including addition power) for power-variation lenses

For each lens, place the lens so that the reference surface is against the focimeter's lens support. Position the lens at the secondary reference point and measure the power at this point.

Keeping the reference surface against the focimeter's lens support, position the lens at the primary reference point and measure the power at this point.

Calculate the addition power or variation power as the difference between the power at the secondary reference point and the power at the primary reference point. These powers may be either the power measured using the nearer-to-vertical lines of the target or the spherical equivalent power.

6.5 Verification method for position and tilt

Segment location, fitting point position and tilt shall be measured in the plane view of the lens or spectacle front, as appropriate, and in accordance with the boxed lens system of measurement given in ISO 8624. Suitable methods utilize, among others, a shadowgraph, an optical comparator fitted with the appropriate reticule or a precision millimetric measuring instrument.

The positioning and tilt of a power-variation lens or a position-specific single-vision lens shall be verified by reference to the permanent alignment reference marking.

6.6 Verification method for prism imbalance (relative prism error) for mounted single-vision lenses (excluding position-specific single-vision lenses) and multifocal lenses

Proceed as follows.

- a) Prior to placing the spectacles on the focimeter, mark the ordered centration point on the right and left lenses.
- b) With the back surface of the lens against the focimeter's lens support, measure the horizontal and vertical prism values at the right ordered centration point and at the left ordered centration point and determine the horizontal and vertical prism difference (or imbalance) according to the following rules:
 - 1) for horizontal components (i.e. in or out), add together similar base directions and subtract opposite base directions to determine the horizontal prism imbalance;
 - 2) for vertical components (i.e. up or down), subtract similar base directions and add opposite base directions to determine the vertical prism imbalance.

NOTE An alternative verification method is given in [Annex C](#).

6.7 Verification method for planes of transmission of polarizing lenses

6.7.1 General

For the determination of the plane of transmission, a polarizer of known plane of transmission in the light path shall be used.

6.7.2 Apparatus

See [Figure 5](#).

A pair of polarizers is cut to give planes of transmission at a $+3^\circ$ and a -3° angle from the horizontal. The top and bottom halves of the polarizers shall be then joined together and glass mounted, with the line of the joint horizontal to form a split-field polarizer. The split-field polarizer shall be capable of being rotated by means of a lever carrying a corresponding pointer. The pointer transverses a scale calibrated in degrees left or right of zero. The split fields shall be illuminated from behind by a diffused light source. Make sure that the top and bottom register bars are long enough to fix the complete frame parallel to the horizontal meridian for measurements of mounted lenses.

6.7.3 Procedure

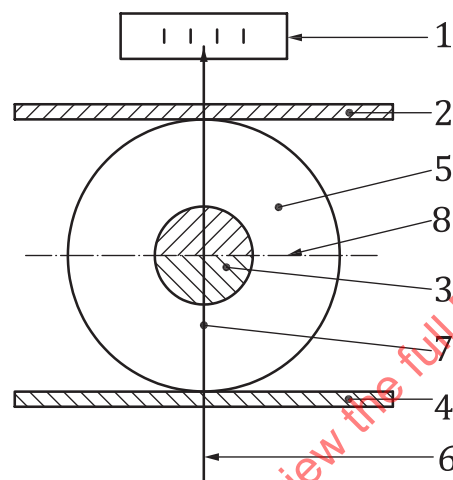
Mount the spectacles on the apparatus between the two register bars with the front surface of the lenses towards the split fields.

Ensure that the split field appears in the centre of the lens by means of vertical adjusters.

For the left lens, move the lever from side to side until the top and bottom halves of the illuminated split field appear of equal luminance when viewed through the lens.

Read off the pointer position to give the deviation in degrees (plus or minus) of the plane of transmission of the lens from the vertical.

Repeat the procedures for the right lens.



Key

- | | |
|-------------------------|---|
| 1 scales | 5 polarizing spectacle lens |
| 2 top register bar | 6 split fit rotation lever |
| 3 split field polarizer | 7 plane of transmission |
| 4 bottom register bar | 8 intended horizontal orientation of lens |

Figure 5 — Principle of an apparatus for the determination of the plane of transmission

6.8 Inspection method for material and surface quality

Material and surface quality can be assessed using the method in [Annex A](#).

7 Marking for position-specific single-vision lenses and power-variation lenses

7.1 Permanent marking

Each lens shall be permanently marked with at least the following:

- a) the alignment reference marking comprising two marks located nominally 34 mm apart, equidistant to a vertical plane through the fitting point or prism reference point;
- b) information as follows:
 - 1) for power-variation lenses with primary and secondary reference points, an indicator of the addition or variation power, in dioptres, under the temporal alignment reference marking;

- 2) degressive-power lenses and power-variation lenses without a secondary reference point may be excluded from this requirement, but if available in more than one variation or degression power, an appropriate indication shall be given;
- c) indicator of the manufacturer or supplier or tradename or trademark, but position-specific single-vision lenses may be excluded from this requirement.

NOTE There is a possibility that some of the permanent markings have been removed by edging.

7.2 Optional non-permanent marking

The following optional non-permanent markings, as applicable, are recommended:

- a) the alignment reference marking;
- b) the indicator of the primary reference point;
- c) the indicator of the secondary reference point;
- d) the indicator of the fitting point;
- e) the indicator of the prism reference point.

8 Recommendations on mounting

Recommendations on mounting are given in [Annex B](#).

9 Identification

The information to be stated by the manufacturer in an accompanying document shall comply with ISO 14889.

10 Reference to this document

If the manufacturer or supplier claims compliance with this document, reference shall be made to this document either on the package or in the available literature.

Annex A (informative)

Material and surface quality

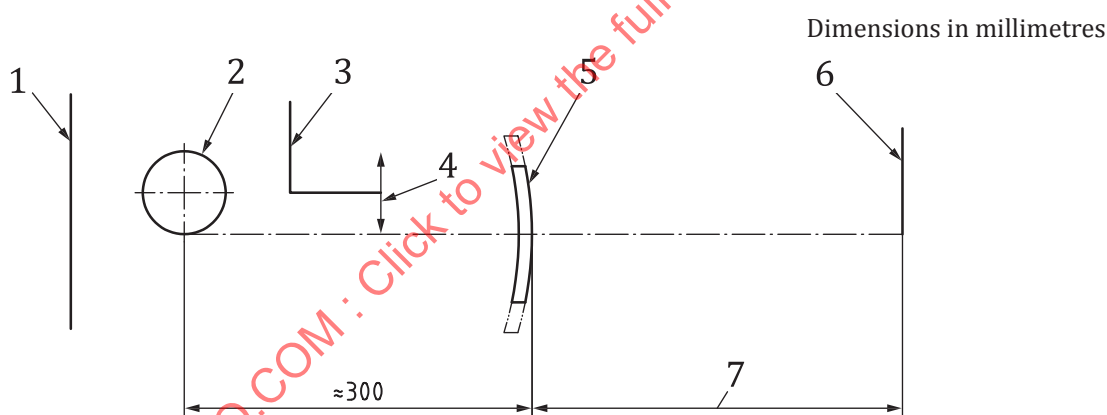
A.1 Assessment

Each lens should not exhibit any defect either internally or on the surfaces that may impair vision. Small isolated material and/or surface defects not likely to impair vision may be acceptable.

A.2 Test method

Carry out the lens inspection at a light/dark boundary and without the aid of magnifying optics. The recommended system is shown in [Figure A.1](#). Inspect the lens within a room with ambient lighting of about 200 lx. Use a light source of at least 400 lm as an inspection lamp, for example, a fluorescent tube of 15 W or a partly shaded 40 W incandescent clear lamp.

NOTE This observation is subjective and requires some experience.



Key

- | | | | |
|---|---|---|-----------------------------|
| 1 | matt black background (150 mm × 360 mm) | 5 | movable spectacle lens |
| 2 | light source, ≥ 400 lm | 6 | plane of the observer's eye |
| 3 | adjustable opaque shade or mask | 7 | unobstructed vision |
| 4 | range of adjustment | | |

NOTE The opaque shade or mask is adjusted to shield the eye from the light source and to allow the lens to be illuminated.

Figure A.1 — Recommended system for visually inspecting a lens for defects

Annex B

(informative)

Recommendations on mounting

B.1 Appearance of lens pairs

B.1.1 Geometrical dimensions

The two lenses of a pair should be reasonably matched in shape, size, form and mass and, except when necessary for matching purposes, should not be substantially thicker than is required to give mechanical stability.

NOTE In certain circumstances, a satisfactory match can require lenses to be specially worked.

B.1.2 Colour matching

The tint, including residual reflectance of anti-reflective coatings and reflectance of mirror coatings, of the two lenses of a pair, should not be obviously dissimilar.

B.2 Recommendations on mounting

B.2.1 Size and shape of lenses

The size and shape of a lens should be substantially the same as the size and shape of the corresponding aperture in the frame.

Care should be exercised to ensure that the dimensions of the spectacle front, after mounting, do not differ substantially from the corresponding dimensions before mounting. It should be borne in mind that significant alterations to rim shape, aperture size or bridge dimensions can considerably shorten the useful life of finished spectacles.

When mounting lenses into metal frames, care should be taken not to damage any protective coating on the metal.

B.2.2 Lenses with bevelled edges

The bevel should be smooth, regular, free from chips and starring, and reasonably free from facets, with a safety chamfer at the peak and at each edge where necessary.

B.2.3 Lenses for rimless and semi-rimless spectacle mounts

Flat-edged lenses should present a smooth finish with a neat safety chamfer at each edge where necessary.

Holes for rimless fittings should be drilled at the correct distance from the edge according to the type of mounting. Slots and grooves, when required, should be accurately positioned. Brow-bars of semi-rimless mounts should be carefully adjusted to follow the edge of the lens provided the frame model allows this. The ends of screws should be neatly finished.

B.2.4 Mounting

Lenses should be securely retained in the frame so that movement or rotation cannot occur under any normal condition of use. No gaps should be visible between the edge of the lens and the rim. The halves of closing block joints should close properly without undue force or without leaving a noticeable gap at the joint.

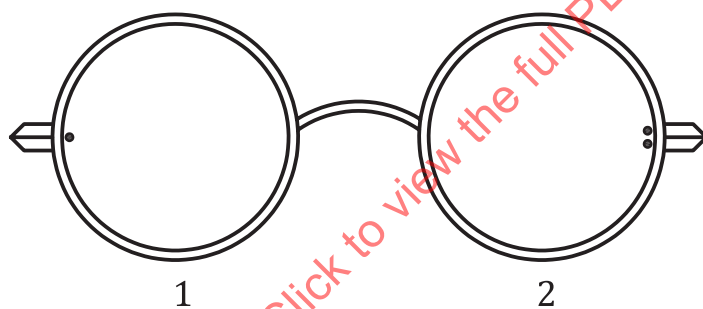
Lenses in rimless and semi-rimless mounts should be neatly and carefully fitted to ensure that they are securely held in position.

All mounted lenses should show no significant strain when examined in a polariscope or strainviewer.

B.2.5 Setting of round lenses

The setting position of round lenses (except those of thermally-toughened glass) should be indicated by means of a permanent mark placed next to the joint on the back lens surface as follows:

- a) on the right lens, one mark on the horizontal centreline at the temporal side;
- b) on the left lens, two marks placed symmetrically, one above and one below the horizontal centreline at the temporal side (see [Figure B.1](#)).



Key

- 1 right
- 2 left

Figure B.1 — Front view of round lenses illustrating marks (exaggerated) on back surfaces