INTERNATIONAL STANDARD

ISO 10322-1

Fourth edition
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Ophthalmic optics — Semi-finished spectacle lens blanks —

Part 1: Specifications for single-vision and multifocal lens blanks

Optique ophtalmique — Verres de lunettes semi-finis —

Partie 1: Spécifications pour les verres unifocaux et multifocaux

Reference number
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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 7, *Ophthalmic optics and instruments*.

This fourth edition cancels and replaces the third edition (ISO 10322-1:2006), which has been technically revised.

ISO 10322 consists of the following parts, under the general title *Ophthalmic optics — Semi-finished spectacle lens blanks*:

— *Part 1: Specifications for single-vision and multifocal lens blanks*

— *Part 2: Specifications for progressive-power and degressive-power lens blanks*

Introduction

Compared with previous editions, this part of ISO 10322 now applies to all types of semi-finished single-vision and multifocal lens blanks.

Ophthalmic optics — Semi-finished spectacle lens blanks —

Part 1: Specifications for single-vision and multifocal lens blanks

1 Scope

This part of ISO 10322 specifies requirements for the optical and geometrical properties of all semi-finished single-vision and multifocal spectacle lens blanks.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 8598-1, *Optics and optical instruments — Focimeters — Part 1: General purpose instruments*

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

3 Terms and definitions

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

4 Classification

Semi-finished lens blanks (shortened to lens blanks in the remainder of this part of ISO 10322 for easier reading) are classified according to the finished surface as follows:

a) single-vision lens blanks;

b) multifocal lens blanks;

c) progressive-power and degressive-power lens blanks.

5 Requirements

5.1 General

The tolerances shall apply at a temperature of 23 °C ± 5 °C.

5.2 Optical requirements for the finished surface

5.2.1 General

The optical tolerances shall apply to the manufacturer's stated values at the reference points of the lens blank at one of the reference wavelengths specified in ISO 7944.

The reference point should be specified by the manufacturer. If no reference point is specified, the blank's geometric centre may be assumed to be the reference point.

The optical tolerances in Tables 1, 2 and 3 are expressed as surface power values, in dioptres, in the refractive index of the material of the lens blank being measured.

5.2.2 Tolerances on the surface power of single-vision and multifocal lens blanks

The tolerances on the surface power as specified in Table 1 shall apply at the reference point and shall be measured using the method described in 6.2.

Table 1 — Tolerances on the surface power

Values in dioptres (D)

Surface power	Tolerance on surface power[a] $\frac{F_1 + F_2}{2}$	Tolerance on surface cylindrical power[b] $\lvert F_1 - F_2 \rvert$
≥0,00 and ≤2,00	±0,09	0,06
>2,00 and ≤10,00	±0,06	0,06
>10,00 and ≤15,00	±0,09	0,06
>15,00 and ≤20,00	±0,12	0,08
>20,00	±0,25	0,08

F_1 and F_2 are the maximum and minimum values of the surface power expressed in the refractive index of the material.

[a] These tolerances apply to those lens blanks that are intended to have either no surface cylindrical power or a surface cylindrical power <0,25 D.

[b] Relative to zero, or to any intended surface cylindrical power of the lens blank's design, where this is <0,25 D.

5.2.3 Uniformity of the surface power of lens blanks with nominally spherical surfaces

Over a zone of 40 mm diameter centred around the reference point, the surface power shall not deviate by more than 0,06 D from the surface power measured at the reference point.

The uniformity shall be determined using a suitable instrument and the method described in 6.2.

5.2.4 Tolerances on the intended surface cylindrical power

The tolerances on the intended surface cylindrical power as specified in Table 2 shall apply at the reference point and shall be measured using the method described in 6.2.

Table 2 — Tolerances on the intended surface cylindrical power

Values in dioptres (D)

Intended cylindrical power	Tolerance
≥0,25 and ≤4,00	±0,06
>4,00 and ≤6,00	±0,09
>6,00	±0,12

5.2.5 Tolerances on the surface addition power for multifocal lens blanks

The tolerances on the addition power as specified in Table 3 shall apply at the reference points and shall be measured using the method described in 6.3.

Table 3 — Tolerances on the surface addition power

Values in dioptres (D)

Surface addition power	Tolerance
≤4,00	±0,12
>4,00	±0,18

5.3 Geometrical tolerances

5.3.1 Tolerances on the size

The sizes are classified as follows:

a) nominal size (d_n): dimension(s), in millimetres, indicated by the manufacturer;

b) effective size (d_e): actual dimension(s), in millimetres;

c) usable size (d_u): dimension(s), in millimetres, of the area that is optically usable;

1) effective size, d_e:

$$d_n - 1 \text{ mm} \leq d_e \leq d_n + 2 \text{ mm};$$

2) usable size, d_u:

$$d_u \geq d_n - 1 \text{ mm for } d_n \leq 65 \text{ mm};$$

$$d_u \geq d_n - 2 \text{ mm for } d_n > 65 \text{ mm}.$$

The tolerance on usable size does not apply to lens blanks for lenses with a carrier curve, such as lenticulars.

5.3.2 Tolerances on thickness

5.3.2.1 Centre thickness

The centre thickness, when measured at the geometric centre (unless otherwise stated by the manufacturer), shall be neither less than the minimum thickness stated by the manufacturer nor exceed this minimum thickness by more than 3 mm.

5.3.2.2 Edge thickness

When measured at the point stated by the manufacturer, the edge thickness shall be neither less than the minimum thickness stated by the manufacturer nor exceed this minimum thickness by more than 3 mm.

5.3.3 Segment tolerances for multifocal lens blanks

5.3.3.1 Dimensions

When using one of the methods described in 6.3, each of the segment dimensions (width, depth and intermediate depth) shall not deviate from its nominal value by more than ±0,5 mm.

If sold as a matched pair, each of the segment dimensions shall not differ between the left and right lens blanks by more than 0,7 mm.

5.3.3.2 Position

The segment position shall be measured from the distance reference point using the measurement method described in 6.4. If no reference point is specified, the blank's geometric centre may be assumed

to be the distance reference point. The horizontal position (horizontal displacement of segment) shall be the distance, in millimetres, from the distance reference point to the segment extreme point. The vertical position (vertical segment displacement) shall be the distance, in millimetres, from the distance reference point to the segment's dividing line (or highest point of the segment for segments with curved tops and round segments).

Neither the horizontal nor the vertical position shall deviate from the nominal value by more than ±1,0 mm.

Segment size and position tolerances are applicable only if the segment boundaries are clearly delineated.

6 Test methods

6.1 General

Alternative measurement methods are acceptable if shown to perform equivalently to the reference test methods in 6.2 to 6.5.

6.2 Determination of surface power

Surface power at the reference point shall be determined using a suitable instrument capable of measuring surface power, by reflection, with an accuracy that is appropriate to the tolerances listed in Tables 1 and 2. If a segment dividing line (edge) interferes with the measurement centred at the reference point, the measurement shall be taken at the closest point where interference from the segment dividing line does not occur.

The optical tolerances in Table 1 are expressed as surface power values, in dioptres, in the refractive index of the material of the lens blank being measured.

NOTE 1 Some surface power instruments allow setting of the reference refractive index to match that of the actual lens blank being measured. Conversion might be required to establish the tolerance values if the blank is measured with equipment calibrated for a different reference refractive index (see Annex B).

NOTE 2 It might be necessary to use a device that limits the aperture of measurement. The recommended range for the measurement aperture is 4 mm to 8 mm.

Uniformity of surface power of lens blanks with nominally spherical surfaces over the area specified in 5.2.3 shall be determined using a suitable instrument capable of measuring surface power, by reflection, with an accuracy that is also appropriate to the tolerances listed in Table 1. The lens blank may need to be supported on a device allowing the instrument to be positioned normally to the surface despite its curvature.

6.3 Addition power measurement

6.3.1 General

For lens blanks where the addition power is created by a change in curvature of the surface, the addition power shall be measured using a suitable instrument capable of measuring surface power, by reflection, with an accuracy that is appropriate to the tolerances listed in Table 3. Measure the powers at the distance reference point and at the near reference point.

NOTE The test method for determining addition power requires the measurement of surface addition power.

For fused multifocal lens blanks, or when no surface measurement capability exists, an alternative method for addition power measurement using a focimeter is provided in Annex C.

6.3.2 Measurement

Measurements shall be made at points N and D (see Figure 1), unless the use of points N and B is stated by the manufacturer.

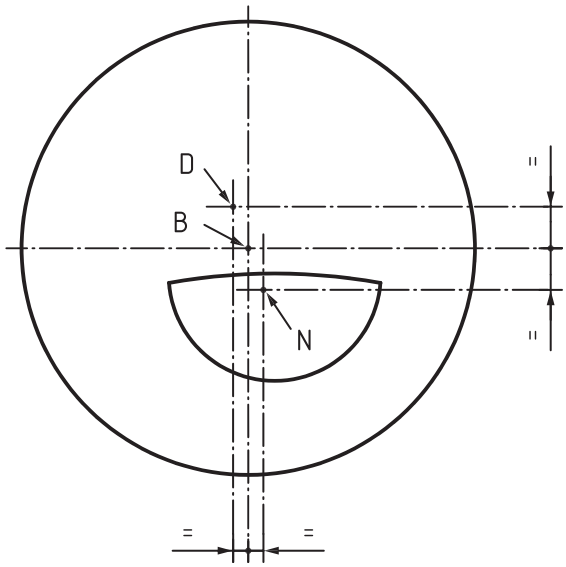
— Establish point N as the specified near reference point. If the position of the near reference point is not specified, point N is the point 5 mm below the segment extreme point.

— Establish point D which is the symmetrical point of point N with respect to point B.

For non-spherical surfaces, other appropriate measurement methods and locations may be specified by the manufacturer.

The surface chosen for measurement shall be the segment side.

Measure the surface power at points N and D, and calculate the addition as the difference between the powers at points N and D. The powers at points N and D should be taken as the mean of the principal meridional surface powers.



Key

B distance reference point

D distance power measurement point

N near reference point

Figure 1 — Measurement of the addition power

6.4 Segment dimensions and position measurement method

Using a shadowgraph, an optical comparator fitted with the appropriate graticule or a precision millimetric measuring instrument, measure the segment dimensions (width, depth and intermediate depth) in the tangential plane to the centre of the segment and measure the position in a plan view.

6.5 Inspection method for material and surface quality

Material and surface quality can be assessed using the method in Annex A.

7 Marking and identification

7.1 Marking

a) For polarizing lens blanks

Polarizing lens blanks shall include permanent or non-permanent marking on the horizontal meridian to identify clearly the intended horizontal orientation. Alternatively, if manufacturers or suppliers chose to include marking on the vertical meridian of the lens blank to indicate the plane of transmission, this shall be clearly identified.

b) For lens blanks that have to be mounted with a specific orientation.

Lens blanks that have to be mounted with a specific orientation shall have their horizontal orientation indicated either with permanent or with non-permanent (ink) alignment reference markings.

For polarizing lens blanks intended for sun glare attenuation, the plane of transmission shall be aligned to the permanent or non-permanent alignment reference markings at 90 ° ± 3 °.

7.2 Identification required on the package

The lens blank shall be supplied in a package. This package shall be labelled with at least the following information (see also Clause 8).

a) for all lens blanks:

1) nominal surface power, in dioptres;

2) nominal surface cylindrical power, in dioptres, and orientation (if applicable);

3) nominal size, in millimetres;

4) colour (if not clear);

5) identification of any coating;

6) material of which the lens blank is made, its refractive index or the trade name indicating the material or equivalent;

7) trade name of the manufacturer or supplier;

b) and, in addition, for multifocal lens blanks:

1) addition power and intermediate power (where applicable), in dioptres;

2) style designation or trade name or trademark;

3) width, or segment dimension(s), in millimetres (if applicable);

4) an indicator stating right or left lens (if applicable).

7.3 Information to be made available

The following information shall be available on request:

a) the minimum centre thickness, in millimetres, and, if not measured at the geometric centre, where it is measured (see 5.3.2.1);

b) the minimum edge thickness, in millimetres, and identification of the measurement point (see 5.3.2.2);

c) the radius of curvature both of the finished surface (measured at the reference point) and of the unfinished surface, in millimetres;

d) the optical properties of the material ;

e) the method of measurement of addition power used by the manufacturer including reflection or transmission method, and if applicable, focimeter type;

f) for surfaces with intended surface cylindrical power, the magnitude and orientation of the intended cylindrical power and, if applicable, the tolerance on the axis;

8 Reference to this part of ISO 10322

If the manufacturer or supplier claims compliance with this part of ISO 10322, reference shall be made to ISO 10322-1 either on the package or in the available literature.

Annex A
(informative)

Material and surface quality

A.1 Assessment

A.1.1 Finished surface

The lens blank should not exhibit any defect either internally or on the finished surface which might impair vision. Small isolated material and/or surface defects not likely to impair vision may be acceptable.

A.1.2 Unfinished surface

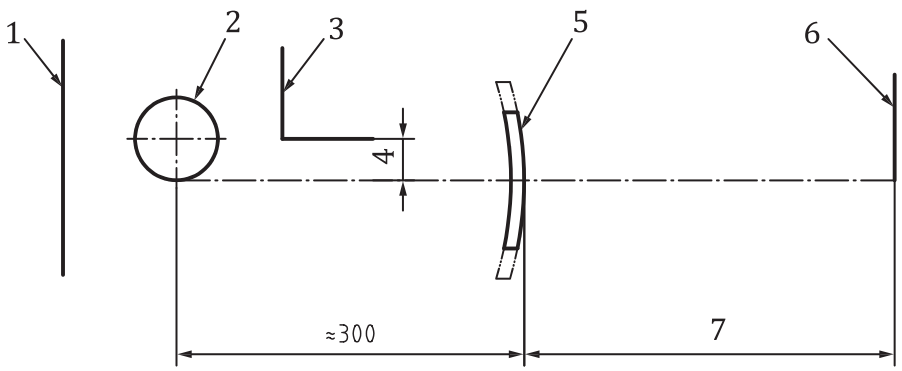
The surface quality of the unfinished surface should be sufficient to allow marking, inspection and measurement.

A.2 Test method

Carry out the 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 blank within a room with ambient lighting of about 200 lx. Use a 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 method is subjective and requires some experience.

Dimensions in millimetres



Key

1 matt black background (150 × 360)
2 light source, ≥400 lm
3 diaphragm
4 adjustable opaque mask
5 movable lens blank
6 plane of the observer's eye
7 unobstructed vision

NOTE The diaphragm is adjusted to shield the eye from the light source and to allow the lens blank to be illuminated.

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

Annex B
(informative)

Conversion of surface power tolerances from the refractive index of the lens blank to that of an instrument's fixed reference

The surface power values and tolerances in this part of ISO 10322 are expressed as units of surface power in dioptres with respect to the refractive index of the material using Formula (B.1):

$$\text{Power}\left(\text{dioptres}\right) = \frac{\left(\text{Refractive index} - 1\right) \times 1\,000}{\text{Radius of curvature}\left(\text{mm}\right)} \tag{B.1}$$

Some surface power instruments allow setting of the refractive index to match that of the actual lens blank. If only a single reference index, n_R, (eg 1,530) is used by the instrument, it might be necessary to use a conversion table such as the one below to determine the appropriate tolerance value. For example, if a material has a refractive index, n_S, of 1,660 and the surface power tolerance is ±0,09 D, then the error in radius giving this power error will generate a smaller power error indication when measured with an instrument set to a refractive index of 1,530. The values for the tolerance to be applied as indicated by the instrument, in this case the reduced value of ±0,072 D shown in Table B.1, are obtained using Formula (B.2):

$$\text{Tolerance to be applied} = \text{tolerance expressed in refractive index of blank material} \times \frac{(n_R - 1)}{(n_S - 1)} \tag{B.2}$$

Table B.1 — Example of a table for tolerance value conversion for an instrument using a fixed reference index of 1,530

Values in dioptres (D)

Tolerance expressed in the refractive index of blank material	Tolerance to be applied when instrument reference refractive index (n_R) is 1,530				
	Examples for the refractive index of the lens blank (n_S)				
	1,499	1,586	1,600	1,660	1,740
0,04	0,042	0,036	0,035	0,032	0,029
0,05	0,053	0,045	0,044	0,040	0,036
0,06	0,064	0,054	0,053	0,048	0,043
0,07	0,074	0,063	0,062	0,056	0,050
0,08	0,085	0,072	0,071	0,064	0,057
0,09	0,096	0,081	0,080	0,072	0,064
0,10	0,106	0,090	0,088	0,080	0,072
0,11	0,117	0,099	0,097	0,088	0,079
0,12	0,127	0,109	0,106	0,096	0,086
0,15	0,159	0,136	0,133	0,120	0,107
0,18	0,191	0,163	0,159	0,145	0,129
0,25	0,266	0,226	0,221	0,201	0,179

Annex C
(normative)

Addition power measurement by transmission

C.1 General

This Annex is provided as an alternative addition power measurement method where a focimeter is used to determine addition power.

Addition power shall be measured using a focimeter meeting the requirements of ISO 8598-1.

The surface chosen for measurement shall be the segment side unless otherwise specified by the manufacturer, in which case that surface shall be placed against the focimeter's lens support.

NOTE 1 Differences can occur between measurements made with different focimeters at points on a lens blank where prism is not zero. This is because of effects in the measurement, such as different focimeter designs, the non-linearity error of focimeters, the positioning of the lens blank, and the amount of tilt when the lens blank is placed on the support and the subjective focusing error.

NOTE 2 It might be necessary to use a device that limits the aperture of measurement. The recommended range for the measurement aperture is 4 mm to 8 mm.

C.2 Method

Measurements shall be made at points N and D (see Figure 1), unless the use of points N and B is stated by the manufacturer.

— Establish point N as the specified near reference point. If the position of the near reference point is not specified, point N is the point 5 mm below the segment extreme point.

— Establish point D which is the symmetrical point of point N with respect to point B.

For non-spherical surfaces, other appropriate measurement methods and locations may be specified by the manufacturer.

Place the lens blank so that the chosen surface is against the focimeter's lens support, centralize the lens blank at point N and measure the near power at this point N.

Keeping the chosen surface against the focimeter support, centralize the lens blank at point D and measure the distance power at this point D.

Calculate the addition power as the difference between the powers at points N and D. These powers may be either the power measured using the nearer to vertical focal lines of the target or the spherical equivalent power.

The tolerances, as specified in Table 3, still apply to the transmitted addition power when using this method.

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