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Optics and optical instruments — Focimeters —

Part 1: General purpose instruments

Optique et instruments d'optique — Frontofocomètres —

Partie 1: Instruments pour cas généraux

Please see the administrative notes on page iii

Reference number
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ISO/CEN PARALLEL PROCESSING

This final draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO-lead** mode of collaboration as defined in the Vienna Agreement. The final draft was established on the basis of comments received during a parallel enquiry on the draft.

This final draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel two-month approval vote in ISO and formal vote in CEN.

Positive votes shall not be accompanied by comments.

Negative votes shall be accompanied by the relevant technical reasons.

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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8598-1 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 7, *Ophthalmics optics and instruments*.

This first edition of ISO 8598-1 cancels and replaces ISO 8598:1996, as well as ISO 8598:1996/Cor.1:1998, of which this constitutes a technical revision.

ISO 8598 consists of the following parts, under the general title *Optics and optical instruments — Focimeters*:

— *Part 1: General purpose instruments*

Introduction

General purpose focimeters are intended for measurement of contact lenses, single-vision, multifocal and progressive-power or degressive-power spectacle lenses, both uncut and mounted in spectacle frames, and for the orientation and marking of spectacle lenses.

Optics and optical instruments — Focimeters —

Part 1:
General purpose instruments

1 Scope

This part of ISO 8598 specifies requirements and test methods for general purpose focimeters designed for the measurement of vertex powers, cylinder axis, prismatic power and prism base setting within a restricted area at a specified location of a lens.

It is applicable to instruments typically intended for use by the ophthalmic community, with the capability to demonstrate conformity of lens products with the International Standards existing for these lenses.

NOTE This excludes instruments that can only measure the whole lens at once.

2 Normative references

The following referenced documents are indispensable for the application 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 9342-1[1)], *Optics and optical instruments — Test lenses for calibration of focimeters — Part 1: Test lenses for focimeters used for measuring spectacle lenses*

ISO 9342-2, *Optics and optical instruments — Test lenses for calibration of focimeters — Part 2: Test lenses for focimeters used for measuring contact lenses*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
adjusting rail
movable rail or bar used as the reference axis for spectacles during measurement and which is aligned perpendicularly to the optical axis of the focimeter and parallel to the axis direction 0° to 180°

NOTE This is also called the lens table or frame rest.

3.2
capability
ability of a system or process to determine whether a product meets the requirements for its intended use

3.3
general purpose focimeter
instrument that is used to measure vertex powers and prismatic effects of spectacle and contact lenses, to orientate and mark uncut lenses, and to verify the correct mounting of lenses in spectacle frames

1) ISO 9342-1 and ISO 9342-2 will, on the occasion of their next revision, be combined into one single standard and published as Part 2 to ISO 8598, i.e. ISO 8598-2.

3.3.1
manual focusing focimeter
instrument that allows the operator to view images formed by rays of light passing through a lens and, by manually focusing and adjusting, to measure the vertex power and identify the principal meridians

NOTE 1 For lenses with cylinder power, the cylinder axis is found using the method provided to locate the principal meridians of the lens in the area defined by the focimeter aperture. Prismatic power is measured separately for this type of focimeter.

NOTE 2 There are sub-classes of manual focusing focimeter. One type has an eyepiece whereas the other has a projection screen. With the eyepiece type, the measurement target is focused and viewed through an eyepiece.

3.3.2
automated focimeter
instrument that measures the vertex power of a lens, in the area defined by the focimeter aperture, in a single measurement without operator adjustment

3.3.3
continuously indicating focimeter
focimeter with a continuous scale

NOTE For the purposes of this part of ISO 8598, this includes both automated instruments when set to 0,06 D or 0,01 D steps and conventional manual focusing instruments.

3.3.4
digitally rounding focimeter
focimeter which displays measured values rounded to the nearest 0,25 D or 0,12(5) D incremental value

3.4
centration error of the instrument
residual prismatic error of the instrument with no lens in place

3.5
indication
⟨of a focimeter⟨ quantitative value provided as the output of the focimeter

3.6
indication error
difference between the value indicated by the focimeter and the true value of the reference lens

NOTE 1 Here the true value of the reference lens, the back vertex power, is calculated using the four known basic lens parameters: radii of curvature of the front and back surface (r_1 and r_2), the central thickness (t), and the refractive index (n) of optical glass, using the formulas listed in ISO 9342-1 and ISO 9342-2.

NOTE 2 When using a measuring instrument, the influence of the uncertainty and indication error of the device should be considered.

3.7
lens support
mechanical interface of the instrument against which the spectacle lens or the contact lens is placed for measurement

NOTE The focimeter measures the vertex power related to the surface placed against the lens support.

3.8
near portion power
vertex power measured at the near reference point, as specified by the manufacturer, of a multifocal, progressive-power or degressive-power lens

3.9
non-symmetric error for cylindrical power and cylinder axis
residual error in the indicated cylindrical power and/or the indicated cylinder axis of a spherocylindrical lens for an automated focimeter after calibration

3.10
non-symmetric prism error of a focimeter
difference in the prismatic power readings when a plano-prism is measured first with its base setting in one direction and then in the opposite direction, for example, base settings of 180° and 360°, or 90° and 270°

3.11 Vertex power

3.11.1
back vertex power
reciprocal of the paraxial value of the back vertex focal length measured in metres

3.11.2
front vertex power
reciprocal of the paraxial value of the front vertex focal length measured in metres

NOTE 1 Conventionally, the back vertex power, in dioptres, is specified as the "power" of a spectacle lens or a contact lens, although the front vertex power is required for certain purposes, for example in the measurement of some multifocal lenses or progressive-power lenses.

NOTE 2 The unit for expressing vertex power is the reciprocal metre (m^{-1}). The name for this unit is the "dioptre", for which the symbol is "D".

4 Technical requirements for general purpose focimeters

4.1 The measuring range shall include vertex powers with a range from at least −20 D to +20 D and prismatic powers from 0 Δ to at least 5 Δ.

The instrument shall be capable of measuring the axis direction (see ISO 8429) of cylindrical lenses between 0° and 180°. For prisms, it shall be possible to determine the direction of the base setting between 0° and 360°.

4.2 For manual focusing focimeters with non-digital display, the dioptric power scale shall have an interval not greater than 0,25 D and shall be clear enough for interpolations to be made to the nearest 0,12 D or less.

For axis directions (see ISO 8429) the scale interval shall not exceed 5° and shall be clear enough for interpolations to be made to the nearest degree.

For prismatic power readings, the scale interval shall not exceed 1 Δ and shall be clear enough for interpolations to be made to the nearest 0,50 Δ.

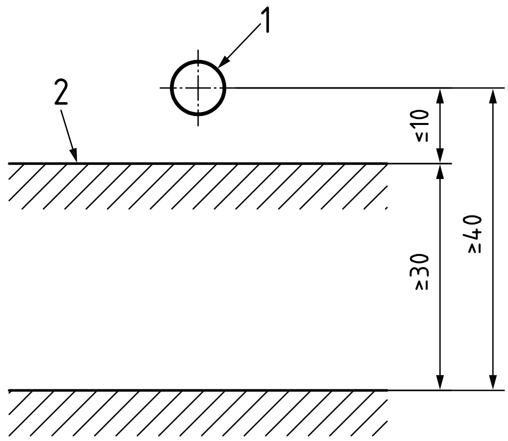
4.3 For focimeters with digital display in the range from +20 D to −20 D, the minimum step of the display shall be equal to or lower than 0,06 D. The display shall show at least two decimal digits.

For axis directions, the increment of the digital display shall be 1°.

For prismatic power readings, the minimum step of the digital display shall be equal to or lower than 0,06 Δ.

4.4 The instrument designed to measure spectacle lenses shall be able to measure lenses with a diameter of at least 80 mm and a thickness of at least 20 mm. Translational movements of the lenses on the lens support of not less than 30 mm in a direction perpendicular to the optical axis and to the adjusting rail shall be possible, starting from no more than 10 mm below, in front of, or behind, the optical axis of the instrument, as applicable. The adjusting rail shall also be capable of movement of not less than 30 mm in a direction perpendicular to its length and the optical axis of the instrument. See Figure 1.

Dimensions in millimetres



Key

1 lens support

2 adjusting rail

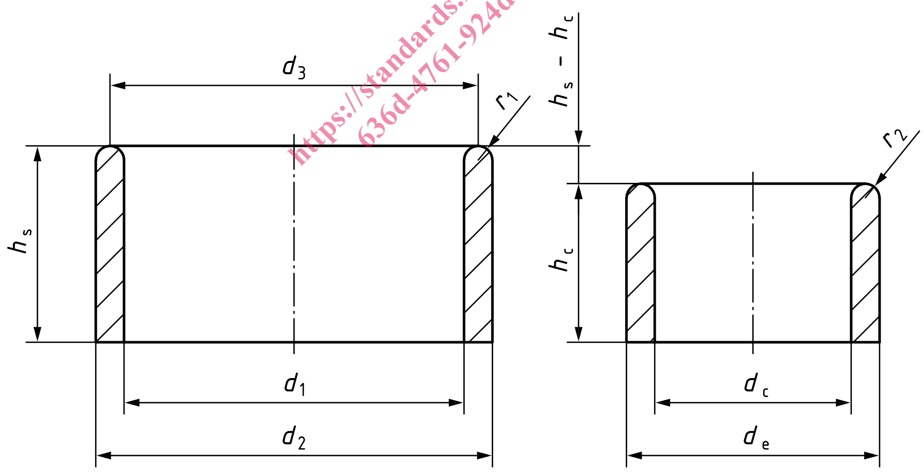
Figure 1 — Minimum required movement of the adjusting rail

4.5 The lens support should be designed so that it does not cause any damage to the lens under test when used in the manner recommended by the manufacturer.

It shall be designed and manufactured so that it will support a lens placed against it, holding the surface that is in contact with it perpendicular to the optical axis of the focimeter.

The lens support shall not adversely affect the accuracy of measurement by introducing sagittal error.

Examples of suitable lens supports are shown in Figure 2.



Key

d_1, d_c internal diameter of support

d_2, d_e external diameter of support

d_3 $= (d_1 + d_2)/2$

h_s, h_c height of support

r_1 $= (d_2 - d_1)/4$

r_2 $= (d_e - d_c)/4$

Figure 2 — Examples of lens supports for spectacle lenses (a) and contact lenses (b)

For spectacle lenses (a), d_1 should be in the range 5 mm to 8 mm while for contact lenses (b), d_c should be 4,5 mm ± 0,5 mm. Because of the increased sagittal depth of steeply-curved contact lenses, the contact lens support is usually smaller in diameter and slightly shorter. The height difference ($h_s - h_c$) should be 0,55 mm ± 0,02 mm.

NOTE The dimensions of the contact lens support are as specified in ISO 18369-3.

The internal diameter (d_1, d_c) of the lens support for focimeters used for spectacle lens measurement or for contact lens measurement shall be stated by the manufacturer.

4.6 The pin mark printed by the axis marker shall be small enough to enable the distance between a first and a second mark to be distinguished.

NOTE A diameter of 0,7 mm is recommended.

4.7 The instrument shall be designed so that it gives stable measured values in a normal environment (i.e. a temperature of 23 °C ± 5 °C, and a relative humidity of less than 85 %).

5 Metrological requirements

5.1 General

When tested with the reference lenses specified in ISO 9342-1 and/or ISO 9342-2, both manual focusing and automated focimeters shall give indication readings for vertex power and prismatic power over their entire claimed measuring range, and the indication error for the respective true value shall not exceed the limits given in Tables 1 and 2.

5.2 Reference wavelength

The instrument shall be manufactured to indicate dioptric powers with reference to the green mercury line λ_e = 546,07 nm or the yellow helium line λ_d = 587,56 nm, as given in ISO 7944 and the manufacturer shall indicate explicitly which wavelength has been selected.

NOTE If the light source used in the focimeter is not centred on the green mercury line λ_e = 546,07 nm or the yellow helium line λ_d = 587,56 nm, the user should be able either to set the instrument, or to apply corrections to the indicated values, for lenses made from materials other than the one that was used to calibrate the instrument.

5.3 Performance requirement

5.3.1 Indication error

When tested in accordance with 6.2.1, the instrument, when fitted with the spectacle lens support, shall not exceed the permissible indication errors given in Tables 1 and 2 when used with the spectacle form reference lenses specified in ISO 9342-1.

The instrument, if intended by the manufacturer solely for contact lens measurement, shall meet the requirements for permissible indication errors given in Table 1 when used with a support of the diameter specified in 4.5 by Figure 2 b) and, preferably, the contact lens form reference lenses specified in ISO 9342-2.

NOTE 1 The requirement mentioned above is for checking the indication error of focimeters when used for contact lens measurement, but not for the permissible error of commercial contact lenses.

NOTE 2 If the instrument is used for contact lens measurement but calibrated by the spectacle form reference lenses given in ISO 9342-1, this should be stated and the user should be aware that the calibration results may be significantly different from those obtained with the contact lens form reference lenses given in ISO 9342-2.