INTERNATIONAL STANDARD

ISO 8980-4

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Ophthalmic optics — Uncut finished spectacle lenses —

Part 4: Specifications and test methods for anti-reflective coatings

Optique ophtalmique — Verres de lunettes finis non détourés — Partie 4: Spécifications et méthodes d'essai relatives aux traitements antireflet

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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

Attention is drawn to the possibility that some of the elements of this part of ISO 8980 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8980-4 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 7, *Ophthalmic optics and instruments*.

ISO 8980 consists of the following parts, under the general title *Ophthalmic optics — Uncut finished spectacle lenses*:

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

— *Part 2: Specifications for progressive power lenses*

— *Part 3: Transmittance specifications and test methods*

— *Part 4: Specifications and test methods for anti-reflective coatings*

Annex A of this part of ISO 8980 is for information only.

Ophthalmic optics — Uncut finished spectacle lenses —

Part 4:
Specifications and test methods for anti-reflective coatings

1 Scope

This part of ISO 8980 specifies optical and non optical requirements and test methods for anti-reflective coatings on spectacle lenses.

This part of ISO 8980 does not deal with the following topics:

— transmittance and absorptance;

— the colour of the reflected light.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8980. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8980 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 8980-1:1996, *Ophthalmic optics — Uncut finished spectacle lenses — Part 1: Specifications for single-vision and multifocal lenses.*

ISO 8980-2:1996, *Ophthalmic optics — Uncut finished spectacle lenses — Part 2: Specifications for progressive power lenses.*

ISO 8980-3:1999, *Ophthalmic optics — Uncut finished spectacle lenses — Part 3: Transmittance specifications and test methods.*

ISO 13666:1998, *Ophthalmic optics — Spectacle lenses – Vocabulary*.

ISO 14889:1997, *Ophthalmic optics — Spectacle lenses — Fundamental requirements for uncut finished lenses.*

3 Terms and definitions

For the purposes of this part of ISO 8980, the terms and definitions given in ISO 13666:1998 and the following apply.

3.1
coated lens
anti-reflective coated spectacle lens

4 Requirements

4.1 General requirements

Anti-reflective coated lenses shall comply with the general requirements concerning the finished spectacle lens specifications in:

— ISO 8980-1:1996

— ISO 8980-2:1996

— ISO 8980-3:1999

— ISO 14889:1997

NOTE For further information on the properties of anti-reflective coatings, see informative annex A.

The reflectance characteristics of an anti-reflective coating should not significantly change due to deterioration of the coating in normal use. Durability tests are being developed and will be incorporated at a future date.

4.2 Luminous and mean reflectances

The luminous reflectance ρ_V and the mean reflectance ρ_M of an anti-reflective coated lens shall be determined by the method specified in 5.2.

If the manufacturer specifies values for luminous and mean reflectances, the measured values shall not exceed the specified values by more than 20 %.

When measured, the luminous reflectance ρ_V of any anti-reflective coated lens surface shall be less than 2,5 %.

4.3 Usable diameter of coated area

The usable diameter of the coated area for uncut finished spectacle lenses shall be $\geqslant (d_n - 4)$ mm, where d_n is the nominal diameter of the lens, in millimetres, indicated by the manufacturer.

5 Testing

5.1 General

This clause specifies type test methods for anti-reflective coatings on spectacle lenses. At least 24 h shall elapse after coating before any type test is carried out. Alternative test methods may be used if shown to be equivalent.

5.2 Method of determination of reflectance

5.2.1 Apparatus

Use any dual- or single-beam spectrophotometer with an incident angle not larger than 17° and with a measurement accuracy sufficient to give the value of the spectral reflectance at all wavelengths λ between 380 nm and 780 nm with an uncertainty of less than 0,1 % (for example, an anti-reflective coating quoted as having 0,5 % reflectance may be measured as having 0,4 % to 0,6 % reflectance). The wavelength increment of measurement shall not be more than 5 nm. The spectral bandwidth (full width at half maximum — FWHM) shall not exceed 5 nm.

The calibration specimen shall have a surface curvature within 0,50 dioptres of that of the spectacle lens to be tested. The back surface of this specimen shall be designed such that no reflection will interfere with the measurement (e.g. both frosted and painted matt black). The calibration specimen shall be of known refractive

index $n(\lambda)$ (uncertainty $\Delta n < 0{,}001$) and have no coating (which could affect its surface reflective properties). The surface shall be cleaned.

5.2.2 Spectacle lens preparation

The surface of the spectacle lens under test shall have a radius of curvature greater than 80 mm. The back surface of the lens shall be designed such that no reflection will interfere with the measurement (e.g. both frosted and painted matt black). The surface shall be cleaned.

5.2.3 Measurement

Insert the calibration specimen and calibrate the spectrophotometer to give a value of 100 %. Then insert the spectacle lens. The spectrophotometer will give the value of the spectacle lens to calibration specimen spectral reflectance ratio $R_T(\lambda)$ in %. By using this technique, any error due to surface curvature will be eliminated.

Measure the spectacle lens to calibration specimen spectral reflectance ratio over the range 380 nm to 780 nm, at least every 5 nm.

5.3 Determination of spectral reflectance values

The value of the calibration specimen surface spectral reflectance $R_C(\lambda)$ is calculated theoretically from the refractive index:

$$R_C(\lambda) = \left(\frac{n(\lambda) - 1}{n(\lambda) + 1} \right)^2$$

The value of the spectacle lens surface spectral reflectance is calculated by multiplying the calibration specimen spectral reflectance value by the spectacle lens-to-calibration specimen spectral reflectance ratio:

$$\rho(\lambda) = R_C(\lambda) \times R_T(\lambda)$$

5.4 Determination of luminous reflectance

Using the spectral reflectance values $\rho(\lambda)$, calculate the luminous reflectance ρ_V using the equation given in ISO 13666:1998.

5.5 Determination of mean reflectance

Using the spectral reflectance values $\rho(\lambda)$, calculate the mean reflectance ρ_M using the equation given in ISO 13666:1998.

6 Information to be made available on request

The values of the luminous reflectance ρ_V and mean reflectance ρ_M and the spectral reflectance curve shall be made available on request for a typical surface with a radius of curvature greater than 80 mm.

7 Reference to this part of ISO 8980

If the manufacturer or supplier claims compliance with this part of ISO 8980, reference shall be made to this International Standard either on the package or in publicly available literature.

Annex A
(informative)

Significance of ρ_V and ρ_M in the description of anti-reflective coated lenses

The luminous reflectance ρ_V represents the ratio of the luminous flux reflected by the lens surface to the incident luminous flux. ρ_V emphasizes the spectral reflectance around the centre of the visible spectrum (around 550 nm) and reduces the importance of the blue and red ends of the spectrum.

Some types of anti-reflective coating, although having a very low spectral reflectance $\rho(\lambda)$ at the centre of the spectrum, show a marked increase in reflectance at the blue and red ends of the spectrum. Despite having a low luminous reflectance ρ_V, the pronounced coloration of the residual light reflected gives the subjective impression of an overall reflectance higher than suggested by ρ_V.

The mean reflectance ρ_M, which is not weighted by $V(\lambda)$, will, for such types of coating, have a relatively high or poor value. Although an anti-reflective coating having a similar spectral reflectance at the centre of the spectrum and a lower (better) reflectance in the blue and red regions will have a similar ρ_V, ρ_M will be lower than for other types of coating.

Hence, the mean reflectance ρ_M gives additional information describing the optical and cosmetic properties of an anti-reflective coating.

NOTE 1 Because types of coating with poor ρ_M show increased reflectance at the ends of the spectrum, glare may result from reflections off the back surface when driving at night. It is expected that additional physiological research will be carried out in this field.

NOTE 2 Typical examples: ρ_V = 0,70 % ρ_M = 0,68 %
ρ_V = 0,88 % ρ_M = 3,27 %

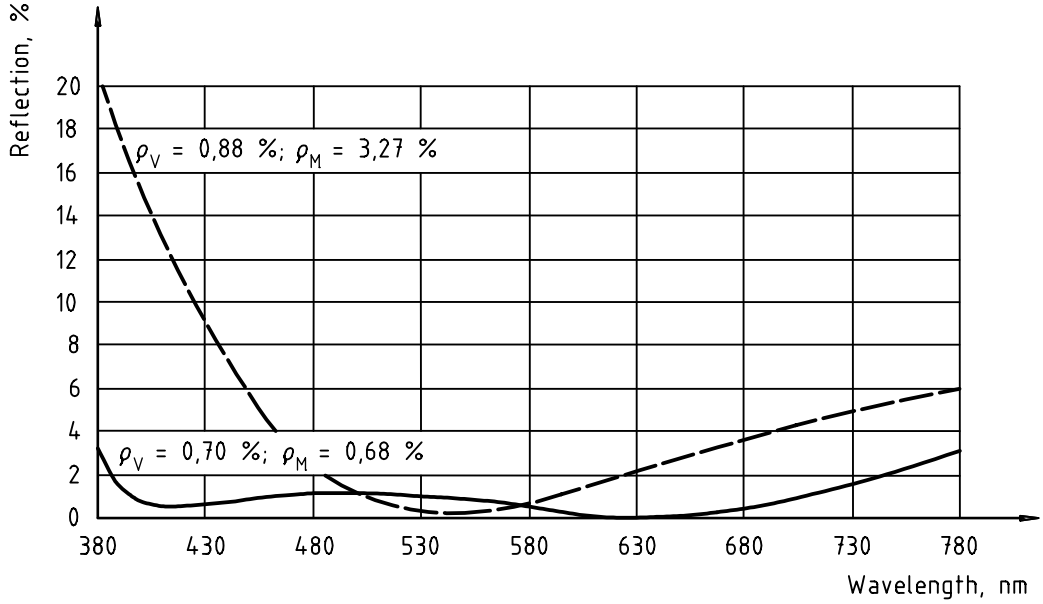

Figure A.1