INTERNATIONAL STANDARD

ISO 12864

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Ophthalmic optics — Contact lenses — Determination of scattered light

Optique ophtalmique — Lentilles de contact — Détermination de la lumière diffusée

ISO 12864:1997(E)

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.

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.

International Standard ISO 12864 was prepared by ISO/TC 172 *Optics and optical instruments*, Subcommittee SC 7 *Ophthalmic optics and instruments.*

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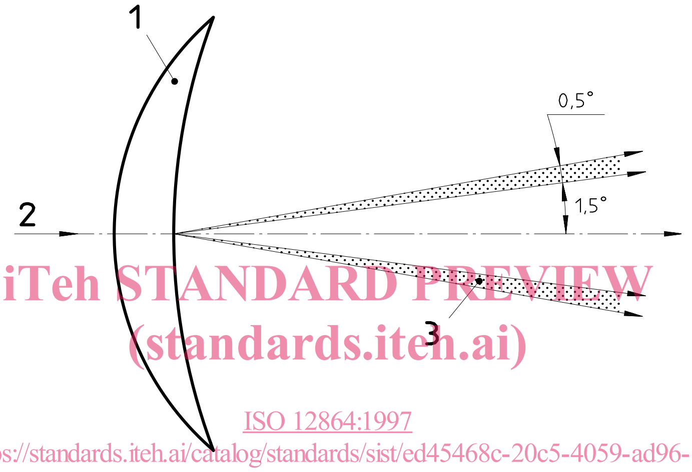
Introduction

If light is scattered significantly when passing through a contact lens (CL), contrast is reduced and the visual performance of the wearer is impaired. In this case, the light which is scattered at a large angle to the direction of radiation is generally less disturbing than light which is scattered at small angles. In particular, light scattered at small angles may cause problems for drivers when the sun is low in the sky, when it reflects off wet roads and at night with oncoming traffic. Therefore it is desirable to minimize the small-angle scattering of contact lenses (see figure 1).



1 CL
2 Optical axis
3 Scattered light

Figure 1 — Small-angle scattering of a contact lens

Ophthalmic optics — Contact lenses — Determination of scattered light

1 Scope

This International Standard describes a method for the determination of the scattering of light by contact lenses. The test method described is given as a reference method.

The existence of this International Standard does not imply in any way that the testing of contact lenses for light scatter is a requirement.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8320:1986, *Optics and optical instruments - Contact lenses - Vocabulary and symbols*

ISO 10344:1996, *Optics and optical instruments - Contact lenses - Saline solution for contact lens testing*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 8320 apply, together with the following.

3.1 luminance factor, l

<at a surface element of a non-self-radiating medium, in a given direction under specified conditions of illumination> Ratio of the luminance of the surface element in the given direction (the scattered light, L_S) to that of a perfect reflecting or transmitting diffuser identically illuminated (here taken to be the illuminance, E).

NOTE The luminance factor is expressed using equation (1):

$$l = \frac{L_S}{E} \quad \text{in} \quad \frac{\text{cd}/\text{m}^2}{\text{lx}} \qquad (1)$$

3.2 reduced luminance factor, l^*

Ratio of the luminance factor, l, to the transmittance, τ.

NOTE The reduced luminance factor, which is the luminance factor expressed so as not to depend on the transmittance of the contact lens, is obtained using equation (2):

$$l^* = \frac{l}{\tau} = \frac{L_S}{E \cdot \tau} \quad \text{in} \quad \frac{\text{cd}/\text{m}^2}{\text{lx}} \qquad (2)$$

4 Principle

The beam from a He-Ne laser is diverged (using the two lenses L_1 and L_2) onto the centre of the contact lens. The beam is deflected according to any inherent prismatic effect at this point. A cone of scattered light is formed around the deflected beam. The sensor S is conjugate with the centre of the lens. S, L_3 and D_1 / D_2 lie along the deflected beam. Apertures D_1, D_2 are subsequently used to assess the scattered light of the cuvette with and without the contact lens.

5 Apparatus

The test arrangement is shown in figure 2.

Using two lenses L_1 and L_2, the beam from a He-Ne laser is extended onto the centre of the contact lens, these two lenses constituting an afocal system. The contact lens is mounted so that it can be rotated around the optical axis of the laser beam and so that the centre of the contact lens lies on the axis of rotation. The part of the test assembly consisting of the diaphragms D_1 or D_2, the lens L_3 and the sensor S is constructed so that it can pivot. The axis of pivoting passes through the centre of the contact lens.

This ensures that, whatever the prismatic effect of the contact lens at the point of measurement, the deflected central beam always runs parallel to the optical axis of the assembly, within the pivoting range. Since the contact lens itself is mounted so that it can be rotated around the optical axis, the prismatic deflection can always be arranged so that it lies within the plane of the pivoting movement.

NOTE The capacity to rotate the contact lens and to pivot the sensor arm is generally not necessary for testing a contact lens of nominal plano power.

6 Procedure

6.1 Calibration of the apparatus

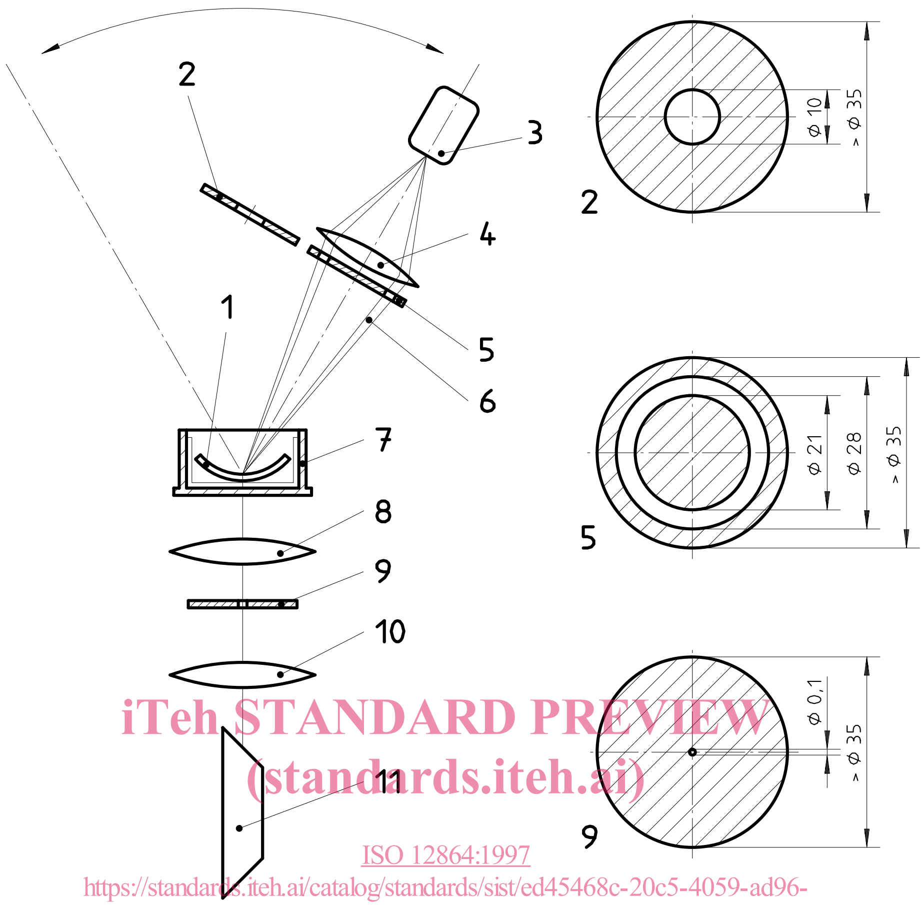
Set up the apparatus, the essential features of which are shown in figure 2, with the cuvette filled with saline solution conforming to ISO 10344 but with the contact lens absent. Arrange the sensor S, lens L_3 and the diaphragm D_1 so that they all move in the same plane and are positioned to record the maximum intensity (that is, all lie on the axis of the laser beam).

Measure the flux Φ_{1CU} falling onto the sensor S, corresponding to the light passing directly through the cuvette filled with saline solution. Replace the circular diaphragm D_1 by the annular diaphragm D_2. Measure the flux Φ_{2CU} falling onto the sensor S, corresponding to the scattered transmitted light. Calculate ω, the solid angle defined by the annular diaphragm.

Obtain the reduced luminance factor l^*_{CU} for the apparatus and the cuvette filled with saline solution for the solid angle ω using equation (3):

$$l^*_{CU} = \frac{\Phi_{2CU}}{\omega \cdot \Phi_{1CU}} \qquad (3)$$

Dimensions in millimetres



1	CL:	Contact lens
2, 5	D_1, D_2	Diaphragms as specified in the drawings, located 400 mm from the centre of the contact lens.
3	S :	Radiation sensor
4	L_3 :	Lens of approximately 5 D, diameter approximately 30 mm
6		Scattered light
7	CU:	Cuvette for holding the contact lens
8	L_2 :	Lens of 30 D
9	D_3:	Diaphragm with a circular hole approximately 0,1 mm in diameter.
10	L_1 :	Lens of 100 D
11	Laser:	He-Ne laser (cw; 632,8 nm; ≤ 1 mW)

NOTE 1 The vertex powers of the lenses are only given as indications. They can be selected differently, if for instance greater beam spread is desired or a reduced image of the test piece is to be shown on the radiation sensor.

NOTE 2 A class 2 laser (see IEC 60825-1[1)]) with a beam diameter between 0,6 mm and 1 mm is recommended.

Figure 2 — Arrangement of apparatus for measurement of scattered light

1) IEC 60825-1:1993, *Safety of laser products - Part 1: Equipment classification, requirements and user's guide.*

6.2 Testing a contact lens

Fill the cuvette with saline solution conforming to ISO 10344 and mount the contact lens under test in the cuvette. Rotate the cuvette with the contact lens so that the deflected beam is in a known plane. Arrange the sensor S, lens L_3 and the diaphragm D_1 so that they all move in the same plane and are positioned to record the maximum intensity (that is, all lie on the axis of the deflected beams).

Measure the flux Φ_{1CL} falling onto the sensor S, corresponding to the light passing directly through the contact lens in the cuvette filled with saline solution. Replace the circular diaphragm D_1 by the annular diaphragm D_2. Measure the flux Φ_{2CL} falling onto the sensor S, corresponding to the scattered transmitted light for the solid angle ω defined by the annular diaphragm.

Obtain the reduced luminance factor l^*_{tot} for the apparatus and the contact lens in the cuvette filled with saline solution for the solid angle ω using equation (4):

$$l^*_{tot} = \frac{\Phi_{2CL}}{\omega \cdot \Phi_{1CL}} \qquad (4)$$

6.3 Calculation of result

Calculate the reduced luminance coefficient of the contact lens using equation (5):

$$l^*_{CL} = l^*_{tot} - l^*_{CU} \qquad (5)$$

7 Test report

The test report shall contain at least the following information:

a) a reference to this International Standard, i.e. ISO 12864;

b) the identification of the contact lens tested;

c) the reduced luminance coefficient of the contact lens l^*_{CL};

d) the date of examination.