

Optics and optical instruments — Test methods for radiation scattered by optical components

The European Standard EN ISO 13696:2002 has the status of a British Standard

ICS 37.020

National foreword

This British Standard is the official English language version of EN ISO 13696:2002. It is identical with ISO 13696:2002.

The UK participation in its preparation was entrusted to Technical Committee CPW/172, Optics and optical instruments, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 30 August 2002

Summary of pages

This document comprises a front cover, an inside front cover, the EN ISO title page, the EN ISO foreword page, the ISO title page, pages ii to v, a blank page, pages 1 to 26, the Annex ZA page and a back cover.

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Optique et instruments d'optique - Méthodes d'essai du
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13696:2002)

Optik und optische Instrumente - Bestimmung von
Streustrahlung hervorgerufen durch optische Komponenten
(ISO 13696:2002)

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CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (ISO 13696:2002) has been prepared by Technical Committee ISO/TC 172 "Optics and optical instruments" in collaboration with Technical Committee CEN/TC 123 "Lasers and laser-related equipment", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2003, and conflicting national standards shall be withdrawn at the latest by January 2003.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 13696:2002 has been approved by CEN as EN ISO 13696:2002 without any modifications.

NOTE Normative references to International Standards are listed in Annex ZA (normative).

INTERNATIONAL STANDARD

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Optics and optical instruments — Test methods for radiation scattered by optical components

*Optique et instruments d'optique — Méthodes d'essai du rayonnement
diffusé par les composants optiques*



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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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13696 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 9, *Electro-optical systems*.

Annexes A to D of this International Standard are for information only.

Introduction

In most applications, scattering in optical components reduces the efficiency and deteriorates the image-forming quality of optical systems. Scattering is predominantly produced by imperfections of the coatings and the optical surfaces of the components. Common surface features which contribute to optical scattering are imperfections of substrates, thin films and interfaces, surface and interface roughness, or contamination and scratches. These imperfections deflect a fraction of the incident radiation from the specular path. The spatial distribution of this scattered radiation is dependent on the wavelength of the incident radiation and on the individual optical properties of the component. For most applications in laser technology and optics, the amount of total loss produced by scattering is a useful quality criterion of an optical component.

This International Standard describes a testing procedure for the corresponding quantity, the total scattering (TS) value, which is defined by the measured values of backward scattering and forward scattering. The measurement principle described in this International Standard is based on an Ulbricht sphere as the integrating element for scattered radiation. An alternative apparatus with a Coblentz hemisphere, which is also frequently employed for collecting scattered light, is described in annex A. Currently, advanced studies on the comparability and the limitations of both light collecting elements are being performed (e.g. round robin tests, EUREKA-project EUROLASER: CHOCLAB).

Optics and optical instruments — Test methods for radiation scattered by optical components

1 Scope

This International Standard specifies procedures for the determination of the total scattering by coated and uncoated optical surfaces. Procedures are given for measuring the contributions of the forward scattering and backward scattering to the total scattering of an optical component.

This International Standard applies to coated and uncoated optical components with optical surfaces that have a radius of curvature of more than 10 m. The wavelength range includes the ultraviolet, the visible and the infrared spectral regions.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 11145, *Optics and optical instruments — Lasers and laser-related equipment — Vocabulary and symbols*

ISO 14644-1:1999, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 11145 and the following apply.

3.1.1

scattered radiation

fraction of the incident radiation that is deflected from the specular optical path

3.1.2

front surface

optical surface that interacts first with the incident radiation

3.1.3

rear surface

surface that interacts last with the transmitted radiation

3.1.4

backward scattering

fraction of radiation scattered by the optical component into the backward halfspace

NOTE Backward halfspace is defined by the halfspace that contains the incident beam impinging upon the component and that is limited by a plane containing the front surface of the optical component.

3.1.5

forward scattering

fraction of radiation scattered by the optical component into the forward halfspace

NOTE Forward halfspace is defined by the halfspace that contains the beam transmitted by the component and that is limited by a plane containing the rear surface of the optical component.

3.1.6

total scattering

ratio of the total power generated by all contributions of scattered radiation into the forward or the backward halfspace or both to the power of the incident radiation

NOTE The halfspace in which the scattering is measured should be clearly stated.

3.1.7

diffuse reflectance standard

diffuse reflector with known total reflectance

NOTE Commonly used diffuse reflectance standards are fabricated from barium sulfate or polytetrafluoroethylene powders (see Table 2). The total reflectance of reflectors freshly prepared from these materials is typically greater than 0,98 in the spectral range given in Table 2, and it can be considered as a 100 % reflectance standard. For increasing the accuracy, diffuse reflectance standards with lower reflectance values can be realized by mixtures of polytetrafluoroethylene powder and powders of absorbing materials. (See reference [5] in the Bibliography.)

3.1.8

range of acceptance angle

range from the minimum to the maximum angle with respect to the reflected or transmitted beam that can be collected by the integrating element

3.1.9

angle of polarization

γ

angle between the major axis of the instantaneous ellipse of the incident radiation and the plane of incidence

NOTE 1 For non-normal incidence, the plane of incidence is defined by the plane which contains the direction of propagation of the incident radiation and the normal at the point of incidence.

NOTE 2 The angle of polarization, γ , is identical to the azimuth, ϕ (according to ISO 12005), if the reference axis is located in the plane of incidence.