Irish Standard
I.S. EN ISO 11551:2019

Optics and photonics - Lasers and laser-related equipment - Test method for absorptance of optical laser components (ISO 11551:2019)

I.S. EN ISO 11551:2019

Incorporating amendments/corrigenda/National Annexes issued since publication:

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National Foreword

I.S. EN ISO 11551:2019 is the adopted Irish version of the European Document EN ISO 11551:2019, Optics and photonics - Lasers and laser-related equipment - Test method for absorptance of optical laser components (ISO 11551:2019)

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 11551

November 2019

ICS 31.260

Supersedes EN ISO 11551:2003

English Version

Optics and photonics - Lasers and laser-related equipment - Test method for absorptance of optical laser components (ISO 11551:2019)

Optique et photonique - Lasers et équipements associés aux lasers - Méthode d'essai du facteur d'absorption des composants optiques pour lasers (ISO 11551:2019)

Optik und Photonik - Laser und Laseranlagen - Prüfverfahren für den Absorptionsgrad von optischen Laserkomponenten (ISO 11551:2019)

This European Standard was approved by CEN on 21 October 2019.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN ISO 11551:2019) has been prepared by Technical Committee ISO/TC 172 "Optics and photonics" in collaboration with Technical Committee CEN/TC 123 “Lasers and photonics” 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of an identical text or by endorsement, at the latest by May 2020, and conflicting national standards shall be withdrawn at the latest by May 2020.

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

This document supersedes EN ISO 11551:2003.

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Endorsement notice

The text of ISO 11551:2019 has been approved by CEN as EN ISO 11551:2019 without any modification.

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I.S. EN ISO 11551:2019

INTERNATIONAL STANDARD

ISO 11551

Third edition
2019-10

Optics and photonics — Lasers and laser-related equipment — Test method for absorptance of optical laser components

Optique et photonique — Lasers et équipements associés aux lasers — Méthode d'essai du facteur d'absorption des composants optiques pour lasers

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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.

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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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee 9, *Laser and electro-optical systems*.

This third edition cancels and replaces the second edition ISO 11551:2003 which has been technically revised.

The main changes compared to the previous edition are as follows:

a) Introduction: The assumptions were revised in the second paragraph. Minor wording and example adjustment in third paragraph.

b) Clause 4: Table for symbols and units was corrected.

c) Clause 5: More detailed specification of environmental conditions for UV- and IR applications are provided in the second paragraph. ISO 7 specification was deleted.

   In the fourth paragraph, Annex A is explicitly mentioned for the dependence of absorption on other test parameters.

   In the fifth paragraph, Annex B is explicitly mentioned to account for the critical issue of finite heat conductivity.

d) In 7.2.3: In the first paragraph, the calibration procedure is specified in more detail, including the consideration of the heating scheme for thick samples.

   Note 1 is complemented by the restriction for thin samples.

   Note 2 is complemented with the consideration of heating scheme for finite heat conduction.

e) In 7.3: In the first paragraph the specifications for the ambient temperature drift were clarified.

   The requirements to the total temperature rise during heating were generalized.

In the third paragraph the terminology “pre-irradiation” was replaced by “drift record”. The description of the duration of the cooling period was complemented.

f) In 8.1: In the first paragraph “heat capacity” was replaced by “specific heat capacity”.

g) In A.1: “irradiation dose” added as influencing parameter.

h) In A.3: Generalization of nonlinear absorption dependencies.

i) In B.3: More detailed comments on the convergence of the temperature curves in Figure B.1. Correction of Formulae (B.2) and (B.3). An additional paragraph with explanations for thick test samples, including two references.

Introduction

To characterize an optical component, it is important to know its absorptance. When radiation impinges upon a component, a part of that radiation is absorbed, increasing the temperature of the component. In this document only the part of the absorbed power/energy, that is converted into heat, is measured. If enough energy is absorbed, the optical properties of the component can change, and the component can even be destroyed. Absorptance is the ratio of the radiant flux absorbed to the radiant flux of the incident radiation.

In the procedures described in this document, the absorptance is determined calorimetrically as the ratio of power or energy absorbed by the component to the total power or energy, respectively, impinging upon the component. The assumption is made that the absorptance of the test sample is constant within the temperature fluctuations experienced by the component during the measurement.

For most optical bulk materials, the absorptance depends on the position of the irradiating beam on the sample surface. Several infrared materials exhibit a strong dependence of absorptance on temperature, especially at high temperatures.

Optics and photonics — Lasers and laser-related equipment — Test method for absorptance of optical laser components

1 Scope

This document specifies procedures and techniques for obtaining comparable values for the absorptance of optical laser components.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 11145, *Optics and photonics — Lasers and laser-related equipment — Vocabulary and symbols*

ISO 14644-1:2015, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration*

ISO 80000-7, *Quantities and units — Part 7: Light and radiation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11145 and ISO 80000-7 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
absorptance
a
ratio of the radiant flux absorbed to the radiant flux of the incident radiation

Note 1 to entry: The definition of absorptance used for this document is limited to absorptance processes which convert the absorbed energy into heat. For certain types of optics and radiation, additional non-thermal processes can result in absorption losses which will not be detected by the test procedure described here (see Annex A).

4 Symbols and units of measure

Symbol	Term	Unit
C_{eff}	Thermal capacity of test sample, holder, etc.	J/K
c_{p}	Specific heat capacity of test sample	J/(kg·K)
$d_{\sigma x}$, $d_{\sigma y}$	Beam width on test sample	mm
m_{i}	Mass of test sample, holder, etc.	kg
P	cw power	W