Irish Standard
I.S. EN ISO 13694:2018

Optics and photonics - Lasers and laser-related equipment - Test methods for laser beam power (energy) density distribution (ISO 13694:2018)

I.S. EN ISO 13694:2018

Incorporating amendments/corrigenda/National Annexes issued since publication:

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National Foreword

I.S. EN ISO 13694:2018 is the adopted Irish version of the European Document EN ISO 13694:2018, Optics and photonics - Lasers and laser-related equipment - Test methods for laser beam power (energy) density distribution (ISO 13694:2018)

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 13694

December 2018

ICS 31.260

Supersedes EN ISO 13694:2015

English Version

Optics and photonics - Lasers and laser-related equipment - Test methods for laser beam power (energy) density distribution (ISO 13694:2018)

Optique et photonique - Lasers et équipements associés aux lasers - Méthodes d'essai de distribution de la densité de puissance (d'énergie) du faisceau laser (ISO 13694:2018)

Optik und Photonik - Laser und Laseranlagen - Prüfverfahren für die Leistungs-(Energie-)dichteverteilung von Laserstrahlen (ISO 13694:2018)

This European Standard was approved by CEN on 23 September 2018.

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Contents

Page

European foreword **3**

European foreword

This document (EN ISO 13694:2018) 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of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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.

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Endorsement notice

The text of ISO 13694:2018 has been approved by CEN as EN ISO 13694:2018 without any modification.

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I.S. EN ISO 13694:2018

INTERNATIONAL STANDARD

ISO 13694

Third edition
2018-11

Optics and photonics — Lasers and laser-related equipment — Test methods for laser beam power (energy) density distribution

Optique et photonique — Lasers et équipements associés aux lasers — Méthodes d'essai de distribution de la densité de puissance (d'énergie) du faisceau laser

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Contents

Page

Foreword ..... **iv**

Introduction ..... **v**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **1**
3.1 Measured quantities 1
3.2 Characterizing parameters 3

4 Coordinate system **7**

5 Characterizing parameters derived from the measured spatial distribution **7**

6 Test principle **7**

7 Measurement arrangement and test equipment **8**
7.1 General 8
7.2 Preparation 8
7.3 Control of environment 8
7.4 Detector system 8
7.5 Beam-forming optics, optical attenuators, and beam splitters 9

8 Test procedure **9**
8.1 Equipment preparation 9
8.2 Detector calibration procedure 10
8.2.1 Spatial calibration 10
8.2.2 Power (energy) calibration 10
8.3 Data recording and noise correction 10
8.3.1 General 10
8.3.2 Correction by background-map subtraction 11
8.3.3 Correction by average background subtraction 11

9 Evaluation **12**

10 Test report **12**

Annex A (informative) **Test report** **13**

Bibliography **16**

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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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 www.iso.org/iso/foreword.html.

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

This third edition cancels and replaces the second edition (ISO 13694:2015), which has been technically revised. The main changes compared to the previous edition are as follows:

a) the definition of beam ellipticity has been harmonized with ISO 11145 and ISO 11146-1;

b) the term “second linear moments” has been replaced by “second moments”;

c) the term “field of view” has been replaced by “aperture”;

d) Clause 9 was rewritten; the paragraphs on clip-levels were corrected to reflect that they are no longer intended for noise cancelation;

e) the entries “Fitted distribution type”, “Roughness of fit R”, and “Goodness of fit G” have been removed from the Test Report;

f) the term “aspect ratio” has been removed from the test report.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Many applications of lasers involve using the near-field as well as the far-field power (energy) density distribution of the beam. The power (energy) density distribution of a laser beam is characterized by the spatial distribution of irradiant power (energy) density with lateral displacement in a particular plane perpendicular to the direction of propagation. In general, the power (energy) density distribution of the beam changes along the direction of propagation. Depending on the power (energy), size, wavelength, polarization, and coherence of the beam, different methods of measurement are applicable in different situations. Five methods are commonly used: camera arrays (1D and 2D), apertures, pinholes, slits, and knife edges.

According to ISO 11145, it is possible to use two different definitions for describing and measuring the laser beam diameter. One definition is based on the measurement of the encircled power (energy); the other is based on determining the spatial moments of the power (energy) density distribution of the laser beam.

The use of spatial moments is necessary for calculating the beam propagation factor, K, and the beam propagation ratio, M^2, from measurements of the beam widths at different distances along the propagation axis. ISO 11146-1 describes this measurement procedure. For other applications, other definitions for the beam diameter can be used. For some quantities used in this document the first definition (encircled power (energy)) is more appropriate and easier to use.

Optics and photonics — Lasers and laser-related equipment — Test methods for laser beam power (energy) density distribution

1 Scope

This document specifies methods by which the measurement of power (energy) density distribution is made and defines parameters for the characterization of the spatial properties of laser power (energy) density distribution functions at a given plane.

The methods given in this document are intended to be used for the testing and characterization of both continuous wave (cw) and pulsed laser beams used in optics and optical instruments.

This document provides definitions of terms and symbols to be used in referring to power density distribution, as well as requirements for its measurement. For pulsed lasers, the distribution of time-integrated power density (i.e. energy density) is the quantity most often measured.

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 — Laser and laser-related equipment — Vocabulary and symbols*

ISO 11146-1, *Lasers and laser-related equipment — Test methods for laser beam widths, divergence angles and beam propagation ratios — Part 1: Stigmatic and simple astigmatic beams*

ISO 11554, *Optics and photonics — Lasers and laser-related equipment — Test methods for laser beam power, energy and temporal characteristics*

IEC 61040, *Power and energy measuring detectors, instruments and equipment for laser radiation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11145 and IEC 61040 and the following apply.

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

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

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

3.1 Measured quantities

3.1.1
power density distribution
$E(x, y, z)$
set of all power densities at location z of a certain cw beam with non-negative values for all transverse coordinates (x, y)