AS/NZS ISO 13694:2004
ISO 13694:2000

Australian/New Zealand Standard™

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

STANDARDS AUSTRALIA

STANDARDS NEW ZEALAND
Paerewa Aotearoa

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee SF-019, Personal Protection Against Laser Radiation. It was approved on behalf of the Council of Standards Australia on 11 February 2004 and on behalf of the Council of Standards New Zealand on 16 February 2004. It was published on 16 April 2004.

The following are represented on Committee SF-019:

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Australian Radiation Laboratory
Department of Defence (Australia)
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Australian/New Zealand Standard™

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee SF-019, Personal Protection Against Laser Radiation.

The Standard is identical with and has been reproduced from ISO 13694:2000, *Optics and optical instruments—Lasers and laser-related equipment—Test methods for laser beam power (energy) density distribution*.

The objective of this Standard is to specify 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.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number appears on the cover and title page while the International Standard number appears only on the cover.

(b) In the source text, ‘this International Standard, should read ‘this Australian/New Zealand Standard’.

(c) A full point should be substituted for a comma when referring to a decimal marker.

None of the documents referred in this Standard have been adopted as Australian or Australian/New Zealand Standards.

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INTRODUCTION

Many applications of lasers involve using the near-field as well as the far-field power [energy] density distribution of the beam[1)]. 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.

This International Standard 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.

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 times-diffraction-limit factor M^2 from measurements of the beam widths at different distances along the propagation axis. ISO 11146 describes this measurement procedure. For other applications, other definitions for the beam diameter may be used. For some quantities used in this International Standard, the first definition (encircled power [energy]) is more appropriate and easier to use.

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1) For the purposes of this International Standard, "near-field" is defined as the radiation field of a laser at a distance z from the beam waist which is less than the Rayleigh-length z_R. "Far-field" is defined in ISO 11145.

AUSTRALIAN/NEW ZEALAND STANDARD

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

1 Scope

This International Standard 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 International Standard 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.

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 11145:1994, *Optics and optical instruments — Laser and laser-related equipment — Vocabulary and symbols.*

ISO 11146:1999, *Lasers and laser-related equipment — Test methods for laser beam parameters — Beam widths, divergence angle and beam propagation factor.*

ISO 11554:1998, *Optics and optical instruments — Lasers and laser-related equipment — Test methods for laser beam power, energy and temporal characteristics.*

IEC 61040:1990, *Power and energy measuring detectors — Instruments and equipment for laser radiation.*

3 Terms and definitions

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

3.1 Measured quantities

3.1.1
power density
$E(x,y,z)$
part of the beam power at location z which impinges on the area δA at the location (x,y) divided by the area δA