

**Lasers and laser-related equipment - Test methods
for laser beam widths, divergence angles and beam
propagation ratios - Part 2: General astigmatic
beams (ISO 11146-2:2005)**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN ISO 11146-2:2005 sisaldab Euroopa standardi EN ISO 11146-2:2005 ingliskeelset teksti.</p> <p>Standard on kinnitatud Eesti Standardikeskuse 28.04.2005 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 15.02.2005.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN ISO 11146-2:2005 consists of the English text of the European standard EN ISO 11146-2:2005.</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 28.04.2005 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>Date of Availability of the European standard text 15.02.2005.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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English version

**Lasers and laser-related equipment - Test methods for laser
beam widths, divergence angles and beam propagation ratios -
Part 2: General astigmatic beams (ISO 11146-2:2005)**

Lasers et équipements associés aux lasers - Méthodes
d'essai des largeurs du faisceau, angles de divergence et
facteurs de limite de diffraction - Partie 2: Faisceaux
astigmatiques généraux (ISO 11146-2:2005)

Laser und Laseranlagen - Prüfverfahren für
Laserstrahlmessungen, Divergenzwinkel und
Beugungsmaßzahlen - Teil 2: Allgemein astigmatische
Strahlen (ISO 11146-2:2005)

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Foreword

This document (EN ISO 11146-2:2005) 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of an identical text or by endorsement, at the latest by August 2005, and conflicting national standards shall be withdrawn at the latest by August 2005.

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Endorsement notice

The text of ISO 11146-2:2005 has been approved by CEN as EN ISO 11146-2:2005 without any modifications.

**Lasers and laser-related equipment —
Test methods for laser beam widths,
divergence angles and beam propagation
ratios —**

**Part 2:
General astigmatic beams**

*Lasers et équipements associés aux lasers — Méthodes d'essai des
largeurs du faisceau, angles de divergence et des facteurs de limite de
diffraction —*

Partie 2: Faisceaux astigmatiques généraux



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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 2.

The main task of technical committees is to prepare International Standards. 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.

ISO 11146-2 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

ISO 11146 consists of the following parts, under the general title *Lasers and laser-related equipment — Test methods for laser beam widths, divergence angles and beam propagation ratios*:

- *Part 1: Stigmatic and simple astigmatic beams*
- *Part 2: General astigmatic beams*
- *Part 3: Intrinsic and geometrical laser beam classification, propagation, and details of test methods* (Technical Report)

Introduction

The propagation properties of laser beams can be characterized by ten independent parameters when applying the method of second order moments (see ISO/TR 11146-3). Most laser beams need few parameters for a complete description due to their higher symmetry. Lasers emit beams which are stigmatic or simple astigmatic due to their resonator design.

Part 1 of ISO 11146 describes the measurement methods for stigmatic and simple astigmatic beams while this part of ISO 11146 deals with the measurement procedures for general astigmatic beams. This part of ISO 11146 is applicable to beams of unknown type. Beam characterization, based on the method of second order moments as described in Part 1 and this part of ISO 11146, is only valid within the paraxial approximation.

The theoretical description of beam characterization and propagation as well as the classification of laser beams is given in ISO/TR 11146-3, which is an informative Technical Report. The procedures for background subtraction and offset correction are also given in ISO/TR 11146-3.

In ISO 11146, the second order moments of the power (energy) density distribution function are used for the determination of beam widths. If problems are experienced in the direct measurements of these quantities, other indirect methods of measurement of second order moments may be used as long as comparable results are achievable.

In ISO/TR 11146-3, three alternative methods for beam width measurement and their correlation with the method used in this part of ISO 11146 are described. These methods are:

- variable aperture method;
- moving knife-edge method;
- moving slit method.

The problem of the dependence of the measuring result on the truncation limits of the integration area was investigated and evaluated by an international interlaboratory experiment carried out in 1997. The results of this interlaboratory testing were taken into consideration in this document.

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning the determination of beam characteristics by measuring along the beam caustic of the transformed beam produced by a lens as described in 5.3 and 5.4.

ISO takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right (U.S. No. 5,267,012) has assured ISO that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with the ISO. Information may be obtained from:

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

Lasers and laser-related equipment — Test methods for laser beam widths, divergence angles and beam propagation ratios —

Part 2: General astigmatic beams

1 Scope

This part of ISO 11146 specifies methods for measuring beam widths (diameter), divergence angles and beam propagation ratios of laser beams. This part of ISO 11146 is applicable to general astigmatic beams or unknown types of beams. For stigmatic and simple astigmatic beams, ISO 11146-1 is applicable.

Within this part of ISO 11146, the description of laser beams is accomplished by means of the second order moments of the Wigner distribution rather than physical quantities such as beam widths and divergence angles. However these physical quantities are closely related to the second order moments of the Wigner distribution. In ISO/TR 11146-3, formulae are given to calculate all relevant physical quantities from the measured second order moments.

2 Normative references

The following referenced documents are indispensable for the application 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 optical instruments — Lasers and laser-related equipment — Vocabulary and symbols*

ISO 11146-1:2005, *Lasers and laser-related equipment — Test methods for laser beam widths, divergence angles and beam propagation ratios — Part 1: Stigmatic and simple astigmatic beams*

IEC 61040:1990, *Power and energy measuring detectors, instruments and equipment for laser radiation*