SLOVENSKI STANDARD
SIST EN ISO 11254-1:2000

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Laserji in laserska oprema - Ugotavljanje praga poġkodbe na optiļ ni povrġini, povzroļ ene z laserjem - 1. del: Preskus 1 na 1 (ISO 11254-1:2000)

Lasers and laser-related equipment - Determination of laser-induced damage threshold of optical surfaces - Part 1: 1 on 1 test (ISO 11254-1:2000)

Laser und Laseranlagen - Bestimmung der laserinduzierten Zerstörschwelle optischer Oberflächen - Teil 1: 1-auf-1-Prüfung (ISO 11254-1:2000)

Lasers et équipements associés aux lasers - Détermination du seuil d'endommagement provoqué par laser sur les surfaces optiques - Partie 1: Essai 1 sur 1 (ISO 11254-1:2000)

Ta slovenski standard je istoveten z: **EN ISO 11254-1:2000**

ICS:

31.260	Optoelektronika, laserska oprema	Optoelectronics. Laser equipment

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EUROPEAN STANDARD

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EN ISO 11254-1

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ICS

English version

Lasers and laser-related equipment - Determination of laser-induced damage threshold of optical surfaces - Part 1: 1 on 1 test (ISO 11254-1:2000)

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Laser und Laseranlagen - Bestimmung der laserinduzierten Zerstörschwelle optischer Oberflächen - Teil 1: 1 auf 1 Prüfung (ISO 11254-1:2000)

This European Standard was approved by CEN on 1 June 2000.

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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 Central Secretariat 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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

The text of the International Standard ISO 11254-1:2000 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 December 2000, and conflicting national standards shall be withdrawn at the latest by December 2000.

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 11254-1:2000 was approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

ISO 11254-1

First edition
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Laser and laser-related equipment — Determination of laser-induced damage threshold of optical surfaces —

Part 1: 1-on-1 test

Lasers et équipements associés aux lasers — Détermination du seuil d'endommagement provoqué par laser sur les surfaces optiques — Partie 1: Essai 1 sur 1

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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 part of ISO 11254 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 11254-1 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 9, *Electro-optical systems*.

ISO 11254 consists of the following parts, under the general title *Laser and laser-related equipment — Determination of laser-induced damage threshold of optical surfaces*:

— *Part 1: 1-on-1 test*

— *Part 2: S-on-1 test*

Annexes A, B and C of this part of ISO 11254 are for information only.

Introduction

Optical components can be damaged by laser irradiation of sufficiently high energy or power. At any specified laser irradiation level, the probability for laser damage is usually higher for the surface of a component than for the bulk. Thus the limiting value of an optical component is usually given by the damage threshold of its surface.

This part of ISO 11254 describes a standard procedure for determining the laser-induced damage threshold (LIDT) of optical surfaces, both coated and uncoated. The procedure has been promulgated in order to provide a method for obtaining consistent measurement results, which may be rapidly and accurately compared among different testing laboratories. In order to simplify the comparison of laser-damage measurement facilities, laser groups are defined in this part of ISO 11254.

This part of ISO 11254 is applicable to single-shot testing only (1-on-1 tests). For multi-shot testing (S-on-1) refer to ISO 11254-2.

Laser and laser-related equipment — Determination of laser-induced damage threshold of optical surfaces —

Part 1: 1-on-1 test

1 Scope

This part of ISO 11254 specifies a test method for determining the single-shot laser radiation-induced damage threshold (LIDT) of optical surfaces.

This test procedure is applicable to all combinations of different laser wavelengths and pulse lengths. However comparison of laser damage threshold data may be misleading unless the measurements have been carried out at identical wavelengths, pulse lengths and beam diameters.

Application of this part of ISO 11254 is provisionally restricted to irreversible damage of optical surfaces.

NOTE Examples of units and scaling of laser-induced damage thresholds are given in annex C.

WARNING — The extrapolation of damage data can lead to inaccurate or wrong calculated results and to an overestimation of the LIDT. In the case of toxic materials (e.g. ZnSe, GaAs, CdTe, ThF_4, chalcogenides, Be, Cr, Ni) this could lead to severe health hazards.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 11254. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 11254 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 10110-7:1996, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 7: Surface imperfection tolerances*.

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

3 Terms and definitions

For the purposes of this part of ISO 11254, the terms and definitions given in ISO 11145 and the following apply.

3.1
surface damage
any permanent laser radiation-induced change of the surface characteristics of the specimen which can be observed by an inspection technique described within this part of ISO 11254

3.2
1-on-1 test
test programme that uses one shot of laser radiation on each unexposed site on the specimen surface

3.3
threshold
highest quantity of laser radiation incident upon the optical surface for which the extrapolated probability of damage is zero

NOTE The quantity of laser radiation may be expressed as energy density H_{max} or power density E_{max} (see annex C).

3.4
target plane
plane tangential to the surface of the specimen at the point of intersection of the test laser beam axis with the surface of the specimen

3.5
effective area
$A_{T,eff}$
ratio of power [pulse energy] to maximum power [energy] density

NOTE 1 For spatial beam profiling perpendicular to the direction of beam propagation and angles of incidence differing from 0 rad, the cosine of the angle of incidence is included in the calculation of the effective area. In this case, the effective area may be approximated by the following formulae:

$$A_{T,eff} = \frac{Q}{H_{max}\cos(\alpha)} \tag{1}$$

$$A_{T,eff} = \frac{P}{E_{max}\cos(\alpha)} \tag{2}$$

NOTE 2 For the special case of a circular flat-top beam profile with diameter d_{100}, the effective area is given by:

$$A_{T,eff} = \frac{Q}{H_{max}} = \frac{H_{max}\pi d_{100}^2}{4H_{max}} = \frac{1}{4}\pi d_{100}^2 \tag{3}$$

For a focused Gaussian beam (circular beam) with a beam diameter $d_{86,5}$, the effective area is given by:

$$A_{T,eff} = \frac{Q}{H_{max}} = \frac{H_{max}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-8\frac{x^2+y^2}{d_{86,5}^2}}\,dx\,dy}{H_{max}} = 2\pi\int_0^{\infty} e^{-\frac{8r^2}{d_{86,5}^2}} r\,dr = \frac{1}{8}\pi d_{86,5}^2 \tag{4}$$

With the definition of the second moment of the energy density distribution function $H(x,y,z)$ at the location z,

$$\sigma^2(z) = \frac{\int_0^{\infty}\int_0^{2\pi} r^2 H(r,\varphi) r\,dr\,d\varphi}{\int_0^{\infty}\int_0^{2\pi} H(r,\varphi) r\,dr\,d\varphi} \tag{5}$$

and the definition of the beam diameter d_σ as a function of the second moment

$$d_\sigma(z) = 2\sqrt{2}\sigma(z) \tag{6}$$