भारतीय मानक

Indian Standard

IS 5920 (Part 11) : 2024
IS0 10110-17 : 2004

प्रकाशिकी और फोटोनिक्स — प्रकाशीय तत्वों और प्रणालियों के लिए आरेखण तैयार करना

भाग 11 लेजर विकिरण क्षति सीमा

Optics and Photonics — Preparation of Drawings for Optical Elements and Systems

Part 11 Laser Irradiation Damage Threshold

ICS 01.100.20; 37.020; 31.260

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

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Optics and Photonics Sectional Committee, PGD 39

NATIONAL FOREWORD

This Indian Standard (Part 11) which is identical to ISO 10110-17 : 2004 ‘Optics and photonics — Preparation of drawings for optical elements and systems — Part 17: Laser Irradiation Damage Threshold ’ issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Optics and Photonics Sectional Committee and approval of the Production and General Engineering Division Council.

This standard specifies the presentation of design and functional requirements for optical elements in technical drawings used for manufacturing and inspection. It also specifies rules for the indication of the damage threshold from laser irradiation up to which optical surfaces shall not exhibit any damage as defined in ISO 11254-1.

IS 5920 (Part 1) supersedes the first published Indian Standard IS 5920 : 1970 ‘Recommendation for the preparation of drawing for optical elements and system’.

This standard has been published in thirteen parts. The other parts in this series are:

Part 1	General
Part 2	Surface form tolerances
Part 3	Centering tolerances
Part 4	Surface imperfections
Part 5	Surface texture
Part 6	Surface treatment and coating
Part 7	Non-tolerance data
Part 8	Aspheric surfaces
Part 9	Wave front deformation tolerance
Part 10	Diffractive surfaces
Part 12	Stress birefringence, bubbles and inclusions, homogeneity, and striae
Part 13	General description of surfaces and components

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are however not identical to those used in Indian Standards. Attention is particularly drawn to the following

a) Wherever the words ‘International Standard’ appear referring to this standard, they should be read as ‘Indian Standard’; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

(*Continued on third cover*)

Indian Standard

OPTICS AND PHOTONICS — PREPARATION OF DRAWINGS FOR OPTICAL ELEMENTS AND SYSTEMS

PART 11 LASER IRRADIATION DAMAGE THRESHOLD

1 Scope

ISO 10110 specifies the presentation of design and functional requirements for optical elements in technical drawings used for manufacturing and inspection.

This part of ISO 10110 specifies rules for the indication of the damage threshold from laser irradiation up to which optical surfaces shall not exhibit any damage as defined in ISO 11254-1.

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 10110-5, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 5: Surface form tolerances*

ISO 10110-6, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 6: Centring tolerances*

ISO 10110-7, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 7: Surface imperfection tolerances*

ISO 10110-10:2003, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 10: Table representing data of optical elements and cemented assemblies*

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

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 11254-2, *Lasers and laser-related equipment — Determination of laser-induced damage threshold of optical surfaces — Part 2: S-on-1 test*

3 Terms and definitions

For the purposes of this document the terms and definitions given in ISO 11145, ISO 11254-1 and the following apply.

3.1
wavelength
λ
wavelength of the laser radiation

3.2
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 in energy density H_{max} or power density E_{max}.

[ISO 11254-1:2000]

3.3
effective pulse duration
τ_{eff}
⟨laser pulse⟩ ratio of the total pulse energy to maximum pulse power

[ISO 11254-1:2000]

3.4
threshold energy density
H_{th}
⟨pulsed laser irradiation⟩ energy density threshold, expressed in joules per square centimetre, above which damage may occur

3.5
threshold power density
E_{th}
⟨pulsed laser irradiation⟩ power density threshold, expressed in watts per square centimetre, above which damage may occur

3.6
threshold linear power density
F_{th}
⟨continuous wave and long pulse laser irradiation⟩ linear power density threshold, expressed in watts per centimetre, above which damage may occur

NOTE For laser damage considerations a long pulse is when the thermal transit distance, $(2\ D\ \tau_{eff})^{1/2}$, where D is the thermal diffusivity, is in the order of the size of the test spot $d_{T,eff}$.

4 Other test parameters

Any other test parameters shall be in accordance with the relevant parts of ISO 11254. For certain optical elements it may be necessary to specify the state and plane of polarization as well as the angle of incidence.

5 Specifications

5.1 General

Specifications of laser irradiation damage threshold apply to the finished surfaces, particularly surface treatments and coatings.

5.2 Damage threshold for pulsed laser irradiation

The specification of a laser irradiation damage threshold, H_{th} or E_{th}, for an optical surface shall include the laser wavelength, λ, and the effective pulse duration, τ_{eff}.

5.3 Damage threshold for long pulse and continuous wave (cw) laser irradiation

The specification of a laser irradiation damage threshold, F_{th}, for an optical surface shall include the laser wavelength, λ, and the effective pulse duration, τ_{eff}. In case of cw-irradiation specify the irradiation time.

NOTE In case of cw-lasers (i.e. irradiation time longer than 0,25 s according to ISO 11145) the effective pulse duration is not defined and the term “irradiation time” is used.

6 Indication

The laser irradiation damage threshold shall be indicated on the technical drawing by a code number and the parameters specified in Clause 5. Additional requirements shall be covered by notes.

The code number for the laser radiation threshold is **6**.

The indication shall have the following form:

a) for pulsed laser irradiation:

6/H_{th}; λ; τ_{eff} or **6**/E_{th}; λ; τ_{eff}

b) for long pulse and cw laser irradiation:

6/F_{th}; λ; τ_{eff}.

The units of H_{th}, E_{th}, F_{th}, λ and τ_{eff} shall be given in the indication.

7 Location

The indication on the technical drawing shall be shown in connection with a leader line to the surface to which it relates and will be associated with other surface codes (3/, 4/, 5/) as specified in ISO 10110-5, ISO 10110-6 and ISO 10110-7. An example of such an indication is shown in Figure A.1 of ISO 10110-1:1996.

Alternatively, the indication may be listed in a table according to Figure 3 of ISO 10110-10:2003.

8 Examples of indication

EXAMPLE 1: **6**/25 J·cm^{-2}; 1 064 nm; 20 ns

This means that the damage threshold is above an energy density of 25 J·cm^{-2}, for a laser wavelength of 1 064 nm (Nd:YAG) and an effective pulse duration of 20 ns.

EXAMPLE 2: **6**/10 kW·cm^{-1}; 10,6 μm; 1 s

This means that the damage threshold is above a linear power density of 10 kW·cm^{-1} for a cw laser emitting at 10,6 μm wavelength (CO_2) and an irradiation time of 1 s.

Bibliography

[1] ISO 10110-1:1996, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 1: General*

(Continued form second cover)

In this adopted standard, references appear to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degrees of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 10110-5 Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 5: Surface form tolerances	IS 5920 (Part 2) : 2024/ISO 10110-5 : 2015 Optics and photonics — Preparation of drawings for optical elements and systems: Part 2 Surface form tolerance	Identical
ISO 10110-6 Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 6: Centring tolerances	IS 5920 (Part 3) : 2024/ISO 10110-6 : 2015 Optics and photonics — Preparation of drawings for optical elements and systems: Part 3 Centring tolerances	Identical
ISO 10110-7 Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 7: Surface imperfection tolerances	IS 5920 (Part 4) : 2024/ISO 10110-7 : 2017 Optics and photonics — Preparation of drawings for optical elements and systems: Part 4 Surface imperfections	Identical
ISO 10110-10 Optics and photonics — Preparation of drawings for optical elements and systems — Part 10: Table representing data of optical elements and cemented assemblies	IS 5920 (Part 1) : 2024/ISO 10110-1 : 2019 — Optics and photonics — Preparation of drawings for optical elements and systems: Part 1 General (ISO 10110-10 has been amalgamated into ISO 10110-1)	Identical
ISO 11145 Optics and optical instruments — Lasers and laser-related equipment — Vocabulary and symbols	IS/ISO 11145 : 2018 Optics and optical instruments — Lasers and laser-related equipment —Vocabulary and symbols	Identical

The Committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
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 11254-2	Lasers and laser-related equipment — Determination of laser-induced damage threshold of optical surfaces — Part 2: S-on-1 test

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: 5th Floor/MTNL CETTM, Technology Street, Hiranandani Gardens, Powai Mumbai 400076	25700030 25702715

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