
**Lasers and laser-related equipment —
Standard optical components —**

**Part 2:
Components for the infrared spectral
range**

iTeh STANDARD PREVIEW
*Lasers et équipements associés aux lasers — Composants optiques
standards —
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Partie 2: Composants pour la plage spectrale infrarouge*

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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.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword — Supplementary information](#).

The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

This second edition cancels and replaces the first edition (ISO 11151-2:2000), which has been technically revised with the following changes:

- [Clause 1](#), note was revised;
- new normative references in [Clause 2](#) were added;
- [Clause 4](#) was revised;
- footnotes were added in [Tables 5](#) and [6](#);
- Bibliography was revised;
- [Figure 1](#) was revised.

ISO 11151 consists of the following parts, under the general title *Lasers and laser-related equipment — Standard optical components*:

- *Part 1: Components for the UV, visible and near-infrared spectral ranges*
- *Part 2: Components for the infrared spectral range*

[Annex A](#) of this part of ISO 11151 is for information only.

Introduction

Lasers are used in a wide variety of applications, including medicine, materials processing, information technology, and metrology. Most lasers contain optical windows and mirrors (intracavity) and most laser systems use a variety of windows, beam splitters, deflectors, mirrors, and lenses. Those components used in high-power laser applications must withstand high-peak power and/or energy densities to avoid laser-induced damage, thus their component specifications are more demanding than those used in low-power applications.

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Lasers and laser-related equipment — Standard optical components —

Part 2: Components for the infrared spectral range

1 Scope

This part of ISO 11151 specifies requirements for laser components used from near-infrared to mid-infrared, from wavelengths 2,1 μm to 15,0 μm , and facilitates the supply of spare parts

- by specifying preferred dimensions and tolerances, thereby reducing the variety of types,
- by standardizing the specifications and removing barriers to trade, and
- by establishing an agreed designation for item orders.

This part of ISO 11151 covers planar, plano-spherical, and spherical substrates, lenses, and optical components that are designed specifically as standardized optical components normally offered through a catalogue from suppliers and intended for use with lasers.

This part of ISO 11151 includes component descriptions, materials employed, physical dimensions, and manufacturing tolerances (including surface finish, figure, and parallelism). Although most, but not all of these components will be coated (fully reflecting, partially reflecting, or anti-reflecting) before incorporation into the laser system, this part of ISO 11151 does not include recommendations for the specification of coatings.

NOTE The optical components used in the ultraviolet, visible, and near infrared spectral ranges (170 nm to 2 100 nm) is referred to ISO 11151-1. The specification and testing of optical coatings is referred to ISO 9211 (all parts).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9211-1, *Optics and photonics — Optical coatings — Part 1: Definitions*

ISO 9211-2, *Optics and photonics — Optical coatings — Part 2: Optical properties*

ISO 10110-1:2006, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 1: General*

ISO 10110-2, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 2: Material imperfections — Stress birefringence*

ISO 10110-3, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 3: Material imperfections — Bubbles and inclusions*

ISO 10110-4, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 4: Material imperfections — Inhomogeneity and striae*

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ISO 10110-5¹⁾, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 5: Surface form tolerances*

ISO 10110-6¹⁾, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 6: Centring tolerances*

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

3 Code for components covered

[Table 1](#) specifies codes for the components to which this part of ISO 11151 is applicable.

Table 1 — Component codes

Component form	Code
Optical flats	IOF
Circular windows — flat	IWC
Elliptical windows — flat	IWE
Rectangular windows — flat	IWR
Output couplers — flat	IOC
Mirrors — flat	IMF
Mirrors — convex	IMX
Mirrors — concave	IMV
Plano-convex lenses	IPX
Plano-concave lenses	IPV
Symmetric biconvex lenses	IBX
Symmetric biconcave lenses	IBV

4 Materials

This part of ISO 11151 covers components employed in the infrared wavelength region from 2,1 μm to 15 μm . A wide range of materials may be used, such as

- zinc selenide, ZnSe,
- potassium chloride, KCl,
- germanium, Ge,
- calcium fluoride, CaF₂,
- silicon, Si,
- copper, Cu, and
- Sapphire, Al₂O₃.

In view of the wide variety of materials available, the use of specific code numbers for each material has not been formalized. Manufacturers and designers shall therefore specify the exact materials used/required. The material specification shall be given as stated in ISO 10110-1:2006, 4.7. If birefringent materials are used/specified, the orientation of the optical axis relative to the geometric axes of the components shall be stated.

1) Currently under revision.

5 Requirements for quality

Preferred specifications and classes for material and surface quality are set out in [Tables 2 to 6](#), using terminology in accordance with ISO 10110-1 to ISO 10110-7. The same quality standards apply to all components of a given diameter, except that the material tolerances are inapplicable in the case of total reflector substrates.

The requirement of quality for components to be used with infrared lasers is in general high; therefore this part of ISO 11151 only promulgates one class of quality.

NOTE The quoted grade values assume that most of the incident radiation is scattered out of the beam by the imperfection. This is the case where the radiometric obscuration equals the area obscuration. If the imperfection is partially transmitting, its actual area could be larger than is suggested by these values. A method for measuring the surface imperfections is described in ISO 14997.

For this reason, there is no difference between a flat circular window, IWC, specification and an output coupler, IOC, specification in this waveband. It should be noted that the surface dig and pit critical dimensions for laser-induced damage are $\lambda/10$ to 10λ , where λ is the wavelength of operation of the laser.

Table 2 — Material and surface fabrication tolerances for lenses, windows and beamsplitters

Diameter mm	Stress birefringence 0/...	Bubbles and inclusions 1/...	Inhomogeneity and striae 2/...	Surface form 3/...	Centring 4/...	Surface imperfection 5/...
5 to 15	15	$3 \times 0,063$	0;2	-(0,4/0,4)	3'	$2 \times 0,025$
>15 to 30	15	$4 \times 0,063$	0;2	-(0,6/0,6)	3'	$3 \times 0,040$
>30 to 51	15	$4 \times 0,100$	0;2	-(1,0/1,0)	3'	$4 \times 0,063$
>51 to 102	15	$5 \times 0,100$	0;2	-(1,0/1,0)	3'	$5 \times 0,100$

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Table 3 — Material and surface fabrication tolerances for total reflector substrates

Diameter mm	Stress birefringence 0/...	Bubbles and inclusions 1/...	Inhomogeneity and striae 2/...	Surface form 3/...	Centring 4/...	Surface imperfection 5/...
5 to 15	NA	NA	NA	-(0,4/0,4)	5'	$2 \times 0,025$
>15 to 30	NA	NA	NA	-(0,6/0,6)	5'	$3 \times 0,040$
>30 to 51	NA	NA	NA	-(1,0/1,0)	5'	$4 \times 0,063$
>51 to 102	NA	NA	NA	-(1,0/1,0)	5'	$5 \times 0,100$

NOTE NA: not applicable.