

American National Standard

for Optics and Electro-Optical Instruments –
Preparation of drawings for optical elements and systems–
Part 5: Surface form tolerances

Secretariat
Optics and Electro-Optics Standards Council

Approved 2015
American National Standards Institute, Inc.



ANSI/OEOSC OP1.0110-5:2015 (ISO 10110-5:2007 MOD)

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Foreword to the American National Standard edition

This national standard establishes uniform practices for indications on drawings of as related to surface form tolerances. It is based entirely on the international standard, ISO 10110-5:2007.

In its implementation as a national standard, there are no accommodations necessary for standard practice in the United States. It has therefore been adopted without modification. There are five points that should be considered.

1. The default wavelength in the United States is the red HeNe line, 632.8 nm. The normative reference for ISO 7944 should be considered informative. A note should be included on the drawing indicating the wavelength, for example "Reference wavelength $\lambda = 632.8 \text{ nm}$."
2. The decimal point may be used instead of the decimal comma. These two notations should not be mixed on a single drawing.
3. References to ISO-14999-4:2007 should be disregarded. Readers are directed to refer to OP1.004:20XX instead.
4. No provision is given for the specification of a Peak to Valley (P-V) tolerance for the total surface deviation. If such a specification is necessary, this information shall be given in a note on the drawing (e.g. "Surfaces to be $\lambda/10$ Peak to Valley").
5. Total peak to valley, such as in the above case, is the peak to valley value computed as defined in section 3.4 of OP1.004:20XX of the shape deformation function defined in section 3.13.7 of OP1.004:20XX.

As with other parts of ISO 10110, there are several references to other parts of ISO 10110 for which there is an analogous American National Standard. The following table shows the OP equivalent standards for the parts of ISO 10110. Where possible, it is recommended that the OP standards be used. As of this writing, not all of the OP standards are available, and suitable equivalent ISO standards should be employed.

ISO Standard	OP Equivalent	Subject
ISO 10110-1	OP 1.0110-1	Drawing notation, general
ISO 10110-2 thru 4	OP 3.001	Glass tolerances
ISO 10110-5 and ISO10110-14	OP 1.0110-5 OP 1.0110-14	Surface wavefront, transmitted wavefront
ISO 10110-6	OP 1.0110-6	Centering
ISO 10110-7	OP 1.002	Surface imperfections
ISO 10110-8	OP 1.0110-8	Surface texture
ISO 10110-9	OP 1.0110-9	Coatings
ISO 10110-10	OP 1.0110-10	Tabular notation
ISO 10110-11	OP 1.0110-11	Non-toleranced Data
ISO 10110-12	OP 1.0110-12	Aspheric surfaces
ISO 10110-17	Under review	Laser Damage

In the interests of facilitating the use of this standard, the original text of ISO 10110-5 has not been modified. Instead, the changes which differentiate the American National Standard version from the ISO version have been

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identified with a note following each section requiring modification. These notes are marked "ANS Note" so that they are not confused with the notes in the original document.

This standard was processed and approved for submittal to ANSI by the OEOSC Committee on Optics and Electro-Optical Instruments, ASC OP. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the OP Committee had the following members:

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 David Aikens, Task Force Leader

† A member of the Task Force that prepared this standard

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Name of Representative

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**AMERICAN
NATIONAL
STANDARD**

**ANSI/OEOSC
OP1.0110-5
(ISO 10110-5 MOD)**

ISO Second edition
2007-08-01

**Optics and photonics — Preparation of
drawings for optical elements and
systems —**

**Part 5:
Surface form tolerances**



Reference number

ISO 10110-5:2007

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Foreword to the ISO Edition

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.

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.

ISO 10110-5 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 1, *Fundamental standards*.

This second edition cancels and replaces the first edition (ISO 10110-5:1997) which has been technically revised. It also incorporates the Technical Corrigendum ISO 10110-5:1996/Cor.1:1996.

ISO 10110 consists of the following parts, under the general title *Optics and photonics — Preparation of drawings for optical elements and systems*:

- *Part 1: General*
- *Part 2: Material imperfections — Stress birefringence*
- *Part 3: Material imperfections — Bubbles and inclusions*
- *Part 4: Material imperfections — Inhomogeneity and striae*
- *Part 5: Surface form tolerances*
- *Part 6: Centring tolerances*
- *Part 7: Surface imperfection tolerances*
- *Part 8: Surface texture*
- *Part 9: Surface treatment and coating*
- *Part 10: Table representing data of optical elements and cemented assemblies*
- *Part 11: Non-toleranced data*
- *Part 12: Aspheric surfaces*
- *Part 14: Wavefront deformation tolerance*
- *Part 17: Laser irradiation damage threshold*

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Introduction

This part of ISO 10110 refers to deformation in the form (shape) of an optical surface and provides a means of specifying tolerances for certain types of surface deformation in terms of “fringe spacings”.

Because it is common practice to measure the surface form deviation interferometrically as the wavefront deformation caused by a single reflection from the optical surface at normal (90° to surface) incidence, it is possible to describe a single definition of interferometric data reduction that can be used in both cases, i.e. in surface form deviation as well as wavefront deformation. One “fringe spacing” is equal to a surface deformation that causes a deformation of the reflected wavefront of one wavelength.

The surface under test together with the test glass is, for example, such an interferometer. The surface form deviation is represented by the wavefront deviation which is the difference between the wavefront reflected by the actual surface and that reflected by the test glass surface.

Because of the potential for confusion and misinterpretation, nanometers rather than fringe spacings should be used where possible. Where fringe spacings are used as units, the wavelength should also be specified. A value expressed in nanometers is (e.g. in the case of test glass testing) a converted value of one which is expressed in fringe spacings.

Optics and photonics — Preparation of drawings for optical elements and systems —

Part 5: Surface form tolerances

1 Scope

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

This part of ISO 10110 specifies rules for indicating the tolerance for surface form.

NOTE 1 The terminology of interferometry is used for the specification of tolerances and, in particular, for the units in which the tolerances are to be specified; however, this does not stipulate that only interferometric methods may be used for the actual testing of optical parts. Other non-interferometric methods may be used if the results are converted to the units specified here.

This part of ISO 10110 applies to surfaces of both spherical and aspheric form.

NOTE 2 ISO 10110-12 allows the surface form tolerance for aspheric surfaces to be specified without reference to this part of ISO 10110.

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 7944:1998, *Optics and optical instruments — Reference wavelengths*

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

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*

ISO 14999-4:2007, *Optics and photonics — Interferometric measurement of optical elements and optical systems — Part 4: Interpretation and evaluation of tolerances specified in ISO 10110.*

ANS Note 1: ISO 7944 is considered informative, not normative.

ANS Note 2: ISO 14999-4:2007 shall not be used as a reference.

ANS Note 3: The American National Standard OP1.004:20XX shall be used as a normative reference in place of ISO 14999:2007.

ANS Note 4: If available, ANS versions of all other parts of ISO 10110 should be substituted as normative references.