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

Part 18:  
**Stress birefringence, bubbles and  
inclusions, homogeneity, and striae**

*Optique et photonique — Indications sur les dessins pour éléments et  
systèmes optiques —*

*Partie 18: Biréfringence sous contrainte, bulles et inclusions,  
homogénéité, et stries*





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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](http://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](http://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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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

This first edition of ISO 10110-18 cancels and replaces ISO 10110-2:1996, ISO 10110-3:1996 and ISO 10110-4:1997 which have been merged into one document and technically revised.

The main changes compared to the previous editions are as follows:

- a) additional notation defined for the indication code to directly specify the raw material for a finished part,
- b) wavefront deviation method added for specifying limits to acceptable striae,
- c) bubble concentration rule adjusted to count only maximum size bubbles,
- d) multi-directional notation added to striae specification, and
- e) focus term notation added to homogeneity specification.

A list of all the parts in the ISO 10110 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The ISO 10110 series is composed of separate parts. It standardizes drawing indications for optical elements and systems. This document (Part 18) standardizes drawing indications for the tolerancing of material imperfections.

Material imperfections require tolerances because they can degrade the quality of an optical part. This document provides notations for material imperfections in optical elements. This includes the specification of a tolerance for stress birefringence, bubbles and inclusions, refractive index homogeneity, and striae. It includes the notations and grades formerly described in ISO 10110-2, ISO 10110-3, and ISO 10110-4, and provides complete backward compatibility to drawings developed using those standards.

A drawing notation standard, such as this document for specifying all optical material tolerances, should accommodate all common specification methods to allow broad adoption and application. In some cases, material tolerances are specified on the final part, and in other cases material tolerances are specified on the raw material or blank used to make the final part.

Even on a single part, different tolerances may be specified and controlled in different ways. For example, it might be desirable to specify the bubbles and inclusions of a finished doublet assembly in addition to a specification on the individual elements. Additionally, for that same doublet, it might be prudent to specify raw material tolerances and accept the manufacturer's material quality certifications for stress birefringence, refractive index homogeneity and striae, which are much more difficult to validate on a finished part or assembly.

In this document, every effort has been made to provide flexibility in the notation to allow the materials to be specified in the most sensible means for the given application. In each case the user is allowed to either specify the material imperfection tolerance for the finished part, using the "0/", "1/", and "2/" notations, or to specify the quality of the material blank used in the manufacture of the part, using the "00/", "01/" and "02/" notations. If the specification is intended to apply to the finished assembly, the notations "10/", "11/", and "12/" are used.

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

## Part 18: Stress birefringence, bubbles and inclusions, homogeneity, and striae

### 1 Scope

This document specifies the indication of tolerances for four categories of imperfections within optical materials — stress birefringence, bubbles and inclusions, homogeneity, and striae — in the ISO 10110 series, which standardizes drawing indications for optical elements and systems.

Tolerances are applied either to a finished optical part, a finished system of optical parts, or to the raw material used to manufacture an optical part.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 9802, *Raw optical glass — Vocabulary*

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

ISO 10110-11, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 11: Non-toleranced data*

ISO 12123, *Optics and photonics — Specification of raw optical glass*

ISO 14999-4:2015, *Optics and photonics — Interferometric measurement of optical elements and optical systems — Part 4: Interpretation and evaluation of tolerances specified in ISO 10110*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions of ISO 9802 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

#### 3.1 Terms for stress birefringence

##### 3.1.1

##### **birefringence**

variation of the refractive index with the orientation of polarization inside optical materials