

American National Standard

for Optics and Electro-Optical Instruments –
Preparation of drawings for optical elements and systems–
Part 8: Surface texture; roughness and waviness

Secretariat
Optics and Electro-Optics Standards Council

Approved 2014
American National Standards Institute, Inc.



ANSI/OEOSC OP1.0110-8:2014 [ISO 10110-8:2010(E) MOD]

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

The Optics and Electro-Optics Standards Council
P.O. Box 24773
Rochester, NY 14624

Copyright © 2014 by the Optics and Electro-Optics Standards Council
Copyright © 2010 by the Organization for International Standardization

All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Printed in the United States of America

Foreword to the American National Standard edition

This national standard establishes uniform practices for indications on drawings of as related to surface texture; roughness and waviness. It is based entirely on the international standard, ISO 10110-8:2010.

In its implementation as a national standard, there are no accommodations necessary for standard practice in the United States.

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 10110-8 has not been modified.

ANSI/OEOSC OP1.0110-8:2014 [ISO 10110-8:2010(E) MOD]

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:

Hal Johnson, Chairperson
 David Aikens, Secretary & Editor
 David Aikens, Task Force Leader

Organization Represented

Name of Representative

†4D Technology Corp	Stephen Martinek
†APOMA	Walter Czajkowski
Brookhaven National Lab.....	Peter Takacs
Corning Tropel (Observer)	Paul Dewa
Davidson Optronics, Inc.....	Don Pearson II
E. R. Precision Optical.....	Brian Weinberg Jason Hess
†Edmund Optics	Walt Czajkowski, acting
Engineering Synthesis Design, Inc.(observer)	Piotr Szwaykowski
Exotic Electro-Optics.....	Melissa Stout Douglas Hibbard, Alternate
Fairfield Crystal Technology	Andy Timmerman
FLIR Precision Optics	Robert Bush
Gage-Line Technology, Inc	Frank Dombrowski
†Harold Johnson Optical Lab	Hal Johnson
†IEEE/LEOS	Marla Dowell Rich Linke, alternate
†Individual.....	Charles Gaugh
†Individual.....	Gordon Boulton
†Individual.....	William Royall
Jenoptik Optical Systems (Observer)	none
Lacroix Optical Co. (Observer)	Raymond A. LaCroix, Jr.
Lattice Materials, LLC	Peter Brown
Lawrence Berkeley National Lab	Wayne McKinney Valeriy V. Yashchuk, Alternate
Lighthouse Imaging, LLC	Dennis Leiner
Lockheed Martin Missiles and Fire Control.....	Gary Wiese Daniel Palmari, Alternate
M ³ Measurement Solutions, Inc.	Erik Stover
†National Institute of Standards and Technology	Marla Dowell

ANSI/OEOSC OP1.0110-8:2014 [ISO 10110-8:2010(E) MOD]

<u>Organization Represented</u>	<u>Name of Representative</u>
Nikon Research Corporation of America	Brian Stamper
†Northrop Grumman Electronic Systems	Donna Howland Christopher Svec, Alternate
Ophir-Photon, LLC (Observer).....	Jeffrey Guttman
Ophir-Sphiricon, LLC.	Jed Simmons
Optical Perspectives Group, LLC (Observer)	Robert Parks
Optical Imaging Association (Observer)	Clark Mulligan
Optical Society of America (Observer).....	David Jenkins
†Optimax Systems, Inc.....	Mike Mandina, Alternate Rick Plympton Jessica DeGroot Nelson, Alternate Joe Tipps, Alternate
OptiPro Systems (Observer).....	none
Opto-Alignment Technology, Inc.	Sasha Pearlman
QED Technologies	Paul Murphy Greg Forbes, Alternate Chris Supranowitz, Alternate
R.A.Smythe, LLC	Robert Smythe
†Ray Williamson Consulting	Ray Williamson
†Reichert Technologies	Doug Hoover
Research Electro-Optics, Inc.	Trey Turner
†Riyo LLC	Richard N. Youngworth
†Rochester Precision Optics, LLC.....	Sharon Bedard Nicholas Smith, Alternate
†Savvy Optics Corp.	David Aikens
Science Applications International Corporation	Adam Phenis
SPIE	Ron Scotti Peter Hallett, Alternate
†Triptar Lens Co., Inc.	Allen Krisiloff
University of Central Florida, CREOL (Observer).....	Kathleen Richardson
Zygo Corp	Chris Evans

This page intentionally left blank

AMERICAN
NATIONAL
STANDARD

ANSI/OEOSC
OP1.0110-8
[ISO 10110-8(E) MOD]

ISO Second edition
2010-10-01

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

Part 8:

Surface texture; roughness and waviness



Reference number
ISO 10110-8:2010(E)

© ISO 2010

ANSI/OEOSC OP1.0110-8:2014 [ISO 10110-8:2010(E) MOD]

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.



COPYRIGHT PROTECTED DOCUMENT

© ISO 2010

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office

Case postale 56 • CH-1211 Geneva 20

Tel. + 41 22 749 01 11

Fax + 41 22 749 09 47

E-mail copyright@iso.org

Web www.iso.org

Published in Switzerland

Contents

Foreword to the ISO Edition.....	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Description of surface texture	4
4.1 General	4
4.2 Description of matt surfaces	5
4.3 Description of optically smooth surfaces.....	5
4.3.1 Description methods.....	5
4.3.2 Rms roughness and rms waviness	6
4.3.3 Quantification of microdefects	6
4.3.4 Power spectral density (PSD) function.....	6
4.3.5 Rms slope	7
5 Indication in drawings	7
5.1 General	7
5.2 Indication for matt surface texture.....	7
5.3 Indication for optically smooth surface texture	8
5.3.1 Optically smooth surface without quantitative modification	8
5.3.2 Indication of polishing grade in terms of microdefects.....	8
5.3.3 Indication of rms roughness and rms waviness	9
5.3.4 Indication of PSD function specification	10
5.3.5 Indication of rms slope specification	10
5.3.6 Indication of lay	10
5.4 Location.....	11
Annex A (informative) Specification of texture for optically smooth surfaces in terms of microdefects.	12
Annex B (informative) Relationship between surface texture and scattering characteristic of textured surfaces.....	13
Annex C (informative) Examples of indication of surface texture requirements	15
Bibliography.....	19

ANSI/OEOSC OP1.0110-8:2014 [ISO 10110-8:2010(E) MOD]

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 10110-8 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 10110-8:1997) which has been technically revised.

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*

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

Part 8: Surface texture; roughness and waviness

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 surface texture of optical elements. Surface texture is the characteristic of a surface that can be effectively described with statistical methods. Typically, surface texture is associated with high spatial frequency errors (roughness) and mid-spatial frequency errors (waviness).

This part of ISO 10110 is primarily intended for the specification of polished optics.

This part of ISO 10110 describes a method for characterizing the residual surface that is left after detrending by subtracting the surface form. The control of the surface form is specified in ISO 10110-5 and ISO 10110-12, it is not specified in 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 1302:2002, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 4287:1997, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

3 Terms and definitions

For the purposes of this document, terms and definitions given in ISO 4287 and the following apply.

3.1

surface texture

characteristic relating to the profile of an optical surface that can be effectively described with statistical methods

NOTE Localized defects, known as surface imperfections, are specified in ISO 10110-7.

3.2

matt surface

optical surface for which the height variation of the surface texture is not considerably smaller than the wavelength of light