ANSI/OEOSC OP1.002-2009
(Revision of ANSI/OEOSC OP1.002-2006)

American National Standard

For Optics and Electro-Optical Instruments – Optical Elements and Assemblies – Appearance Imperfections

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Secretariat
Optics and Electro-Optics Standards Council

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American National Standard

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Foreword to the second edition

(This Foreword does not contain requirements necessary for conformance to this standard.)

The second edition of OP1.002 for Appearance Imperfections includes updates to allow for the specification and inspection of surface imperfections in applications where the physical dimensions, and not the visibility, are important. This is achieved by adopting a second notation based upon MIL-C-48497A and MIL-F-48616 to differentiate from the application of scratch and dig specifications for visibility.

Suggestions for improvement of this standard are welcome. They should be sent to the Optics and Electro-Optics Standards Council, P.O. Box 25705, Rochester, NY 14625-0705.

Steve VanKerkhove, Chairperson
Gene Kohlenberg, Secretary
Gordon Boultbee, Task Force Leader

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

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†SPIE Standards Committee	Lincoln Endelman

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Foreword to the first edition (This Foreword does not contain requirements necessary for conformance to this standard.)

This standard establishes uniform practices for stating, interpreting, and inspecting appearance imperfections for transmissive and reflective optical elements and assemblies. It does this by presenting the nomenclature and inspection methods of MIL-O-13830 as a national standard. This standard maintains methods for evaluating the appearance of these imperfections using guidelines and scales that have been used in the US and other countries for more than half a century, while attempting to eliminate much of the ambiguity and obsolete nomenclature of the MIL-O-13830 standard and its successor documents. The US Army Comparison Standard required to evaluate optical samples according to this national standard is referenced in clause 3.4.1 and its footnote.

This standard is to be followed by an additional standard covering the functional effects of these imperfections and the methods of specifying and evaluating them.

Robin Pruss, Northrop Grumman Corporation created the images that appear in the Annex.

Suggestions for improvement of this standard are welcome. They should be sent to the Optics and Electro-Optics Standards Council, P.O. Box 25705, Rochester, NY 14625-0705.

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Zygo Corporation	David Aikens

American National Standard for – Optics and Electro-Optics Instruments – Optical Elements and Assemblies – Appearance Imperfections

1 Scope

1.1 General

This standard establishes uniform practices for stating, interpreting, and inspecting surface imperfections for transmissive and reflective optical elements and assemblies. This standard provides two alternative notations for specifying surface imperfections. A numerical notation indicates the allowable *visibility* of surface imperfections under specific viewing conditions. An alphabetic notation indicates the allowable *size* of surface imperfections. It is the responsibility of the optical engineer to choose which notation to use. This standard does not address the impact of imperfections on element or system performance.

1.2 Reference to this Standard

Drawings based on this Standard shall note this fact on the drawing or in a document referenced on the drawing.

1.3 Application Caution

This Standard does not address the legal, safety, or health issues associated with its use. It is the responsibility of the users of this Standard to establish appropriate health and safety practices, and to determine the applicability of regulatory limitations. Nothing in this Standard shall be construed to exempt the user from or supersede applicable laws or government regulations.

2 Terms and Definitions

2.1 Appearance Imperfections

An appearance imperfection is an anomaly that appears on or in optical elements and assemblies. The four classes of appearance imperfections are area, long, round, and edge imperfections. The following list defines appearance imperfections pertinent to this specification:

2.1.1 Chips: Typically localized rough and irregular areas or relatively smooth conchoidal fractures (curved concavities resembling a clam shell) where the material has flaked or broken away from the surface, edge, or bevel of an optical element.

2.1.2 Coating spatter: Deposits or droplets of partially vaporized coating material that adhere to the optical surface during the coating operation.

2.1.3 Digs: Round (regular) and sometimes irregular shaped holes or voids (pinholes), including grinding pits and opened entrapped bubbles, in the polished or molded optical surface that may be filled with a residue, e.g., dried grinding or polishing slurry.

2.1.4 Fracture: An obvious crack or split in an optical element that is visible because there is an air spaced separation along the fracture or a barely visible hairline fracture that is almost imperceptible because the material has not yet separated and the two sides remain almost perfectly contacted along the crack.

2.1.5 Gray: An area of the optical surface that appears somewhat gray compared to the rest of the surface. Under magnification, the area will have multiple fine pits and scratches.

2.1.6 Scratch: A marking or tearing of the optical surface that usually has a v-groove contour that is significantly longer in dimension than it is wide. A scratch is sometimes referred to as a long imperfection. Scratches that are shorter than the allowable dig diameter are considered digs.

2.1.7 Stain: A patchy, localized, or overall discoloration of the surface caused by a foreign substance or a chemical reaction.