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## Microscopes — Graticules for eyepieces

*Microscopes — Réticules pour oculaires*

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Fax + 41 22 749 09 47  
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## Foreword

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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 9344 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 5, *Microscopes and endoscopes*.

This second edition cancels and replaces the first edition (ISO 9344:1996), which has been technically revised.

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# Microscopes — Graticules for eyepieces

## 1 Scope

This International Standard specifies dimensions and permissible material defects and processing faults for graticules with diameters of 19 mm, 21 mm and 26 mm to be used in microscope eyepieces for the purposes of measurement, assessment and comparison.

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

ISO 10110-3:1996, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 3: Material imperfections — Bubbles and inclusions*

ISO 10110-4:1997, *Optics and optical instruments — Preparation of drawings for optical elements and systems — Part 4: Material imperfections — Inhomogeneity and striae*

ISO 10110-5:2007, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 5: Surface form tolerances*

ISO 10110-7:2008, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 7: Surface imperfection tolerances*

ISO 10110-8:2010, *Optics and photonics — Preparation of drawings for optical elements and systems — Part 8: Surface texture; roughness and waviness*

## 3 Requirements

### 3.1 Dimensions

Table 1 specifies the dimensions for Type 1 and Type 2 graticules.

**Table 1 — Dimensions of graticules**

Dimensions in millimetres

| Parameter   | Type 1                          | Type 2                            |
|---|---------------------------------|-----------------------------------|
| Diameter <sup>a</sup> , <i>d</i>                  | 19 <sup>0</sup> <sub>-0,1</sub> | 19 <sup>0</sup> <sub>-0,033</sub> |
|   | 21 <sup>0</sup> <sub>-0,1</sub> | 21 <sup>0</sup> <sub>-0,033</sub> |
|   | 26 <sup>0</sup> <sub>-0,1</sub> | 26 <sup>0</sup> <sub>-0,033</sub> |
| Thickness   | 1,0                             | 1,0                               |
|   | 1,5                             | 1,5                               |
| Protective chamfer in accordance with ISO 10110-1 | 0,1 to 0,3                      | 0,1 to 0,3                        |

<sup>a</sup> Other diameters are also permitted if they comply with the specified thickness and the requirements listed in Table 2.

3.2 Permissible material defects and processing faults

Table 2 specifies the permissions for Type 1 and Type 2 graticules.

4 Marking

To differentiate the commonly used Type 1 graticule from the smaller tolerance Type 2 graticule, the marking “Type 2 conforming to ISO 9344” shall be placed on the graticule itself or on the graticule packaging.

Table 2 — Permissible material defects and processing faults

| Criterion                           | Reference for specification | Test region <sup>a</sup> | Minimum requirement  |
|-------------------------------------|-----------------------------|--------------------------|--|
| Bubbles                             | ISO 10110-3                 | 1                        | $1/2 \times 0,016^b$   |
|                                     |                             | 2                        | $1/2 \times 0,025^b$   |
| Striae                              | ISO 10110-4                 | —                        | 2/—; 3 <sup>c</sup>  |
| Surface form errors                 | ISO 10110-5                 | —                        | 3/6 (3) <sup>d</sup>   |
| Surface imperfections for each side | ISO 10110-7                 | 1                        | $5/2 \times 0,016^b$ ; L2 $\times 0,002 5^e$   |
|                                     |                             | 2                        | $5/2 \times 0,025^b$ ; L2 $\times 0,004^e$   |
| Surface quality                     | ISO 10110-8                 | —                        | f<br>P3<br> |
| Parallelism tolerance               | —                           | —                        | $\leq 10'$   |

<sup>a</sup> For an illustration of the test regions, see Figure 1.

<sup>b</sup> Code for defect/permissible number of defects multiplied by the square root of the maximum area of the largest defect, in mm<sup>2</sup>.

EXAMPLE  $1/2 \times 0,1$  indicates 2 bubble defects with a maximum area of 0,01 mm<sup>2</sup> per bubble.

<sup>c</sup> The dash following the defect code indicates that the inhomogeneities are unspecified; the digit 3 indicates the class of striae, which may have the following effective areas, in reference to the diameter of the graticule plate:

|                              |    |    |    |
|------------------------------|----|----|----|
| Diameter, mm                 | 19 | 21 | 26 |
| Striae class                 | 3  | 3  | 3  |
| Striae area, mm <sup>2</sup> | 5  | 6  | 10 |

<sup>d</sup> In accordance with ISO 10110-5, the first number after the defect code represents the number of interference fringes, whereas the number in brackets gives the permissible deviation from rotational symmetry (number of fringe spacings).

<sup>e</sup> Two long scratches (L) of unspecified length and maximum width of 0,002 5 (0,004) mm are permissible.

<sup>f</sup> Polished surface with less than 16 microdefects per 10 mm scan line.