

INTERNATIONAL
STANDARD

ISO
9336-1

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**Optics and optical instruments — Optical
transfer function — Application —**

Part 1:

Interchangeable lenses for 35 mm still
(cameras)

ISO 9336-1:1994

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Optique et instruments d'optique — Fonction de transfert optique —
Application —

Partie 1: Objectifs interchangeables pour appareils photographiques de
35 mm



Reference number
ISO 9336-1:1994(E)

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.

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.

International Standard ISO 9336-1 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 19, *Fundamental standards*, in collaboration with Technical Committee ISO/TC 42, *Photography*.

ISO 9336 consists of the following parts, under the general title *Optics and optical instruments — Optical transfer function — Application*:

- Part 1: *Interchangeable lenses for 35 mm still cameras*
- Part 2: *Lenses for office copiers*
- Part 3: *Telescopes*

Optics and optical instruments — Optical transfer function — Application —

Part 1:

Interchangeable lenses for 35 mm still cameras

1 Scope

This part of ISO 9336 specifies a method of testing interchangeable lenses for 35 mm still cameras with a picture format of 24 mm × 36 mm in terms of imaging states aimed at making valid optical transfer function measurements.

Special lenses for macrophotography, i.e. those designed and manufactured exclusively for obtaining a magnified image are not covered by this part of ISO 9336.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9336. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9336 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 9334:—¹⁾, *Optics and optical instruments — Optical transfer function — Definitions and mathematical relationships*.

ISO 9335:—¹⁾, *Optics and optical instruments — Optical transfer function — Principles and procedures of measurement*.

3 Definitions

For the purposes of this part of ISO 9336, the definitions given in ISO 9334 apply.

4 General description of the lenses to be tested

The lenses are used in still cameras of 24 mm × 36 mm picture format. The typical object distance is up to several metres but sometimes more. Some lenses are capable of close focusing with a ratio of reproduction of up to 1:1.

5 Test conditions

In general, measurements shall be made with the infinite object/image conjugate and in accordance with the general principles and procedures given in ISO 9335. Measurements should be made at finite distances including the closest focusing distance.

When making measurements at a close distance, focusing shall be done by means of the lens focusing ring. Fine focusing may be done with a change in either the distance between the lens and the image analyser or that between the lens and the object, i.e. test pattern.

In order to determine the datum plane, focusing shall be done by adjusting the distance between the lens and the image analyser.

1) To be published.

6 Specification of the imaging state

6.1 Test specimen

Table 1 specifies an imaging state for the test specimen.

6.2 Measuring equipment

Table 2 specifies an imaging state for the measuring equipment.

6.3 Measurement

Table 3 specifies an imaging state for the measurement.

7 Presentation

Table 4 specifies an imaging state for the presentation.

8 Accuracy of equipment

Overall accuracy, repeatability within one laboratory and reproducibility between laboratories shall be assessed using known test lenses.

Table 1

| Parameter | Value/Setting | Notes |
|-------------------------|---|--|
| Aperture (f -number) | Maximum (full) and medium apertures essential Second maximum desirable | <p>"Medium" aperture shall be $f/5,6$, if the lens full aperture f-number is smaller than $f/4$. Otherwise, it shall be $f/8$.</p> <p>The second maximum aperture shall be the one that is one full stop smaller than the full aperture, i.e. 1,4 times greater f-number than the full aperture f-number; for example, if the full aperture f-number is $f/1,8$, the second maximum aperture is $f/2,5 (1,8 \times 1,4)$.</p> <p>If the second maximum aperture cannot be set for some reason, then the next possible f-number, which is more than half a stop greater than full aperture f-number, shall be used; in the case of the above example, $f/2,8$, instead of $f/2,5$.</p> |
| Reference mark | Index mark for distance scale | |

Table 2

| Parameter | Value/Setting | Notes |
|--------------------------|--|---|
| Bench configuration | 1) Object at infinity 2) Object and image at finite conjugate (up to 1:1) | |
| Spectral characteristics | 1) Spectral range: At least 380 nm to 670 nm 2) Light source: Tungsten halogen lamp operated at a correlated colour temperature of $(3\,200 \pm 200)$ K in combination with a blue filter which reduces the intensity of radiation over a wavelength range corresponding to the green to infrared region. The relative spectral transmittance of the filter ¹⁾ is shown in figure 1 3) Analyser: Photomultiplier with S-20 photocathode | Any light source/analyser combination may be used provided that the overall spectral characteristics are the same as that of 3 200 K/filter/S-20 combination. |

1) The Schott BG 38, 1 mm thick, is an example of a suitable product available commercially. This information is given for the convenience of users of this part of ISO 9336 and does not constitute an endorsement by ISO of this product.

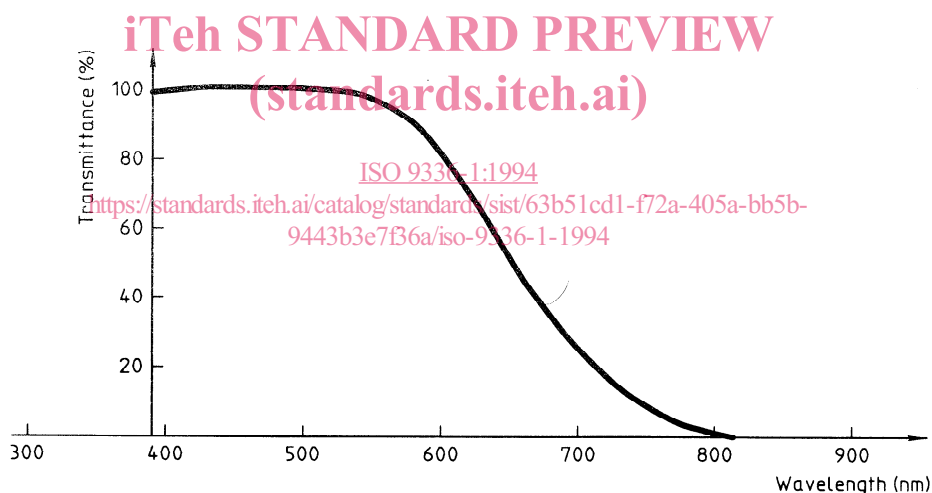


Figure 1 — Relative spectral transmittance of the filter

Table 3

| Parameter | Value/Setting | Notes |
|----------------------------|---|--|
| MTF/PTF | MTF essential PTF desirable | |
| Image scale | 1: ∞ essential Finite distances including the closest focusing distance desirable | |
| Focusing | 1) On-axis to maximum MTF at 20 mm^{-1} at full aperture recommended 2) 30 mm^{-1} recognized | |
| Image height (h') | 0 $0,3h'_{\text{max}}$ $0,5h'_{\text{max}}$ $0,7h'_{\text{max}}$ $0,85h'_{\text{max}}$ h'_{max} | h' : half diagonal of the image field (21,6 mm). This set of image heights should be used in intercomparisons of OTF results. However, a different set of image heights may be selected for special applications. |
| Reference angle (ϕ) | 1) 0° , 90° , 180° and 270° ; or alternatively 2) 56° , 124° , 236° and 304° | Two diagonal directions |
| Azimuth | Radial and tangential | |

Table 4

| Parameter | Value/Setting | Notes |
|---|--|---|
| Reference plane | Datum plane or mounting flange | |
| Upper spatial frequency | 50 mm^{-1} | Higher spatial frequencies may be chosen for special applications. |
| Selected spatial frequencies | 1) 10 mm^{-1} , 20 mm^{-1} and 40 mm^{-1} recommended 2) 10 mm^{-1} and 30 mm^{-1} recognized | To be used, for example, when the OTF is given as a function of the image height. |
| Frequencies for numerical presentations | 10 equidistant frequencies over the range 5 mm^{-1} to 50 mm^{-1} | Higher spatial frequencies may be chosen for special applications. |
| Parameter list | In addition to the standard parameter list given in ISO 9335:—, subclause 6.1, the following data should be listed: — position of the measurement plane relative to the datum plane; — the estimated uncertainty of the measurement. | |

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