INTERNATIONAL STANDARD

ISO 11884-2

Second edition
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Optics and photonics — Minimum requirements for stereomicroscopes —

Part 2: High performance microscopes

Optique et photonique — Exigences minimales pour les stéréomicroscopes —

Partie 2: Microscopes à hautes performances

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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.

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 11884-2 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 11884-2:1997), which has been technically revised.

ISO 11884 consists of the following parts, under the general title *Optics and photonics — Minimum requirements for stereomicroscopes*:

— *Part 1: Stereomicroscopes for general use*

— *Part 2: High performance microscopes*

Optics and photonics — Minimum requirements for stereomicroscopes —

Part 2: High performance microscopes

1 Scope

This part of ISO 11884 specifies minimum requirements for high performance stereomicroscopes. It is not applicable to operation microscopes.

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 7944, *Optics and optical instruments — Reference wavelengths*

ISO 9022-2, *Optics and optical instruments — Environmental test methods — Part 2: Cold, heat and humidity*

ISO 9022-3, *Optics and optical instruments — Environmental test methods — Part 3: Mechanical stress*

ISO 11883, *Optics and optical instruments — Microscopes — Marking of stereomicroscopes*

ISO 10934-1, *Optics and optical instruments — Vocabulary for microscopy — Part 1: Light microscopy*

ISO 15227, *Optics and optical instruments — Microscopes — Testing of stereomicroscopes*

IEC 61010-1:2001, *Safety requirements for electrical equipment for measurement, control and laboratory use — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10934-1 apply.

4 Requirements

All the indications given below are minimum requirements. They apply to the reference wavelength in accordance with ISO 7944.

4.1 Optical and mechanical specifications

The specifications given in Table 1 shall apply.

Testing shall be done in accordance with 5.1.

Table 1 — Requirements for optical and mechanical specifications

Criterion			Requirements
Tolerance of total magnification			± 7,5 %
Difference in magnification between left and right optical systems			⩽ 1,5 %
Difference in axis between left and right optical systems[a]	vertical		⩽ 15'
	horizontal[b]	convergence	⩽ 45'
		divergence	⩽ 10'
Horizontal difference in the centre of the primary image between left and right optical systems[c]			⩽ 0,33 mm
Difference in centres of eyepiece diaphragm between left and right optical systems	vertical		⩽ 0,2 mm[d]
	horizontal[e]	divergence	⩽ 0,4 mm[d]
		convergence	⩽ 0,4 mm[d]
Shift of focussing planes		axial object plane	$S_o \leqslant 3 \times D_F$ [f g]
by magnification change		lateral image plane[h]	⩽ 0,4 mm diameter
Focus difference between both optical systems			$D_{L/R} < 1{,}5 \times D_F$ [f]
The resolution in the centre of the field shall be a minimum of			2 500 × NA line pairs/mm
Difference in imaging rotation between right and left image			⩽ 2°
Eyepiece	Difference in exit pupil height between left and right optical systems		⩽ 1,5 mm at 0 *D* on the dioptre scale
	Calibration error if a dioptre scale is used		± 0,25 *D* at 0 *D* on the dioptre scale
	Minimum range for interpupillary distance		55 mm to 75 mm
	Minimum adjustment range		+ 5 *D* to – 5 *D*

a Including a 10× eyepiece and 0 *D* adjustment.

b This requirement does not apply to those stereomicroscopes where the mechanical axes of the eyepieces are not parallel to each other due to the design.

c This requirement is only valid if the horizontal difference in axis does not apply.

d To be measured on the image plane of the stereomicroscope to be tested.

e This requirement applies to those stereomicroscopes where the mechanical axes of the eyepieces are not parallel due to the design.

f Depth of field, in millimetres (in object space)

$$D_F = \frac{\lambda}{2\mathrm{NA}^2} + \frac{1}{7 \times M_{\mathrm{TOT\ VIS}} \times \mathrm{NA}}$$

where:

λ is the wavelength, in millimetres;

NA is the numerical aperture;

$M_{\mathrm{TOT\ VIS}}$ is the total visual magnification.

g S_o is the shift of object plane.

h The displacement of a centred structure shall be inside a centred circle of 0,4 mm diameter in the primary image plane.

4.2 Environmental conditions

Testing shall be done in accordance with 5.2.

4.2.1 Conditions of use

The functioning of stereomicroscopes, given in the relevant instrument specifications, shall be ensured under the environmental conditions given in Table 2. Under these conditions, all optical and mechanical requirements, in particular the accuracy requirements, apply, if necessary, with the inclusion of correction tables.

Table 2 — Conditions of use

Criterion	Environmental condition
Temperature	+ 10 °C to + 40 °C
Relative humidity	⩽ 85 %
Atmospheric pressure	700 hPa to 1 060 hPa
Shock	10 *g* duration 6 ms

4.2.2 Storage conditions

After being exposed to the conditions given in Table 3, stereomicroscopes have to meet the instrument specification under the conditions of use according to 4.2.1.

Table 3 — Storage conditions

Criterion	Environmental condition
Temperature	– 10 °C to + 55 °C
Relative humidity	⩽ 95 %
Atmospheric pressure	700 hPa to 1 060 hPa

4.2.3 Transport conditions

The transport clause is recommended for all packing requirements, but the following conditions shall apply when the use of this part of ISO 11884 is claimed by the manufacturer.

After exposure of the stereomicroscopes in their original packing to the conditions given in Table 4, the stereomicroscopes shall meet the instrument specifications under the conditions of use according to 4.2.1.

Table 4 — Transport conditions

Criterion	Environmental condition
Temperature	– 40 °C to + 70 °C
Relative humidity	⩽ 100 %
Atmospheric pressure	500 hPa to 1060 hPa
Sinusoidal vibration	10 Hz to 500 Hz: 0,5 *g*
Shock	30 *g* duration 6 ms
Bump	10 *g* duration 6 ms

4.3 Safety

Testing shall be done in accordance with 5.3. IEC 61010-1 shall apply.

5 Test methods

All tests specified in this part of ISO 11884 are type tests. Compliance with the requirements in accordance with 4.1 shall be tested in accordance with ISO 15227.

5.1 Testing of optical and mechanical specifications

Compliance with the requirements in accordance with 4.1 are checked with measuring devices whose measuring error shall be smaller than 10 % of the value to be determined.

Measurements shall be carried out according to general rules of statistical evaluation.

5.2 Testing of environmental conditions

The requirements of 4.2 shall be tested in accordance with the test methods of the relevant part of ISO 9022 given in Table 5.

5.3 Testing of safety

Tests in accordance with IEC 61010-1 shall apply.

6 Accompanying documents

The stereomicroscope shall be accompanied by documents containing instructions for use, cleaning and maintenance.

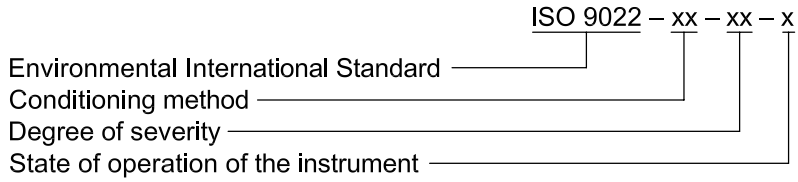
7 Marking

Marking shall be in accordance with ISO 11883.

Table 5 — Environmental tests

Conditions	Test code	Reference according to ISO 9022 Part	Remarks
Environmental conditions of use	ISO 9022-11-01-2 (10 ± 2) °C / 16 h	2	dry heat
	ISO 9022-11-01-2 (40 ± 2) °C / 16 h		
	ISO 9022-12-01-2 (40 ± 2) °C / 90 % to 95 % RH / 24 h		damp heat
Storage conditions	ISO 9022-10-01-1 (– 10 ± 3) °C / 16 h	2	cold
	ISO 9022-11-02-1 (+ 55 ± 2) °C / 16 h		dry heat
	ISO 9022-12-01-1 (+ 40 ± 2) °C / 90 % to 95 % RH / 16 h		damp heat
Transport conditions	ISO 9022-10-05-0 (– 40 ± 3) °C / 16 h	2	cold
	ISO 9022-11-04-0 (+ 70 ± 2) °C /16 h		dry heat
	ISO 9022-16-01-0 + 23 °C / 80 % to 85 % RH / + 40 °C / 90 % to 95 % RH / 5×		damp heat, cyclic
	ISO 9022-30-03-0 30 *g* / 6 ms	3	shock
	ISO 9022-31-01-0 Bump 10 *g* / 6 ms / 1 000×		bump
	ISO 9022-36-02-0 1 *g* / 10 Hz to 2 000 Hz / 2×		sinusoidal vibration

NOTE 1 The environmental test-code designation reads as follows:



NOTE 2 The numbers used in the test code to represent conditioning methods have the following meaning:

10: cold
11: dry heat
12: damp heat
13: condensed water
14: slow temperature change
16: damp heat, cyclic
30: mechanical stress – shock
31: mechanical stress – bump
36: mechanical stress – sinusoidal vibration

NOTE 3 Severity grades are given in the relevant part of ISO 9022.

NOTE 4 The figures of the state of operation mean:

0: Specimen in its normal transport and/or storage container as provided by the manufacturer.

1: Specimen unprotected, ready for operation, power supply not connected.

2: Specimen in operation during the test, as specified in the relevant specification.