INTERNATIONAL STANDARD

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Optics and optical instruments — Specifications for binoculars, monoculars and spotting scopes —

Part 2: High performance instruments

Optique et instruments d'optique — Spécifications pour jumelles, monoculaires et lunettes —

Partie 2: Instruments haute performance

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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 14133-2 was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 4, *Telescopic systems*.

ISO 14133 consists of the following parts, under the general title *Optics and optical instruments — Specifications for binoculars, monoculars and spotting scopes*:

— *Part 1: General purpose instruments*

— *Part 2: High performance instruments*

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Optics and optical instruments — Specifications for binoculars, monoculars and spotting scopes —

Part 2:
High performance instruments

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1 Scope

This part of ISO 14133 is applicable to high performance binoculars, monoculars and spotting scopes. It is not applicable to general purpose binoculars, monoculars and spotting scopes which are specified in ISO 14133-1.

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 10109-4, *Optics and optical instruments — Environmental requirements — Part 4: Test requirements for telescopic systems*

ISO 14132-1, *Optics and optical instruments — Vocabulary for telescopic systems — Part 1: General terms and alphabetical indexes of terms in ISO 14132*

ISO 14132-2, *Optics and optical instruments — Vocabulary for telescopic systems — Part 2: Terms for binoculars, monoculars and spotting scopes*

ISO 14490-1, *Optics and optical instruments — Test methods for telescopic systems — Part 1: Test methods for basic characteristics*

ISO 14490-2, *Optics and optical instruments — Test methods for telescopic systems — Part 2: Test methods for binocular systems*

ISO 14490-7, *Optics and optical instruments — Test methods for telescopic systems — Part 7: Test methods for limit of resolution*

3 Terms and definitions

For the purposes of this document, the general terms, definitions and symbols given in ISO 14132-1 apply and particular terms and definitions for binoculars, monoculars and spotting scopes given in ISO 14132-2 apply.

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4 Specifications

Fundamental requirements are defined by minimum values or tolerances for important characteristics of binoculars, monoculars and spotting scopes.

Tolerances specify maximum deviations between measured and nominal values. Nominal values shall be laid down by the manufacturing or trading company.

Wherever relevant, all tolerances and values refer to measurements made on axis.

Binoculars, monoculars and spotting scopes shall comply with the environmental requirements relative to the respective instrument type, as appropriate. These environmental requirements are specified in ISO 10109-4.

Compliance of the binoculars, monoculars and spotting scopes with the requirements given in Tables 1 and 2 shall be tested in accordance with the test methods specified in ISO 14490-1, ISO 14490-2 and ISO 14490-7, respectively.

Table 1 — Acceptable deviations of optical characteristics

Characteristics	Values of tolerances		
Magnification [a], Γ	± 4 %		
Field of view in object space [a, b]	± 3 %		
Entrance pupil diameter [c]	± 2 %		
Exit pupil diameter	± 6 %		
Eye relief (mm)	$^{+5}_{-0,5}$		
Zero-setting error of dioptre scale (m^{-1})	± 0,5		
Image rotation (degrees)	± 1,0		
Disparity of image rotations [d] (minutes of arc)	30		
Relative difference in magnification [d]	1,5 %		
Focusing difference of telescopes of binoculars when focused by means of the centre focusing mechanism within the focusing range (m^{-1})	0,5		
Non-parallelism of axes of beams emergent from the eyepieces of binoculars over the interpupillary distance range (minutes of arc):	$\Gamma \leqslant 20\times$	$20\times < \Gamma \leqslant 30\times$	$\Gamma > 30\times$
— dipvergence in the vertical plane	20	$1\times\Gamma$	30
— divergence in the horizontal plane	60	$3\times\Gamma$	90
— convergence in the horizontal plane	20	$1\times\Gamma$	30

[a] For zoom instruments relates to the minimum and the maximum values.

[b] For instruments referred to as “wide angle” the minimum field of view in the image space shall be 60°.

[c] Measured at maximum magnification for zoom systems.

[d] Does not apply to monoculars.

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Table 2 — Minimum requirements of optical characteristics

Characteristics	Value
Limit of resolution [a] in object space (seconds of arc):	
— with exit pupil diameter $\leqslant$ 4,5 mm	$\varepsilon \leqslant \left(\frac{240}{D}\right)$
— with exit pupil diameter $>$ 4,5 mm	$\varepsilon \leqslant \left(\frac{60}{\Gamma}\right)$
Dioptre adjustment range for spotting scopes and monoculars (total range) (m^{-1})	9 (including the range of –3 to +3)
Limits of interpupillary distance adjustment (mm)	56 to 72
Dioptre adjustment range for binoculars with centre focusing mechanism (m^{-1}):	
— when focused by means of centre focusing mechanism	9 (including the range of –3 to +3)
— dioptre compensation for right and left eyes	± 3
Dioptre adjustment range for binoculars with individual focusing (m^{-1})	± 5
[a] When testing zoom binoculars the exit pupil diameter at highest magnification shall be used.	

5 Consumer information

5.1 Designation and marking

For identification and operation, binoculars, monoculars and spotting scopes shall have the designation and markings as specified in Table 3.

Table 3 — Designation and marking

Characteristics	Designation and marking	
	required	recommended
Magnification or range of magnifications [a]	X	
Entrance pupil diameter [a] (mm)	X	
Field of view		X
Name of the manufacturer or registered trade mark or trade name	X	
Product name or identification		X
Country of origin		X
Position for zero dioptre		X
Serial number		X
[a] Basic designation is given by the combination of magnification and diameter of entrance pupil e.g.: 8×42.		

5.2 Information of the product

Product catalogues, user manuals and other technical information brochures for binoculars, monoculars and spotting scopes shall provide complete information at least on technical characteristics enlisted in Table 4.

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Table 4 — Information of the product

Characteristics	Designation and marking	
	required	recommended
Magnification or range of magnifications	X	
Entrance pupil diameter (mm)	X	
Name of the manufacturer or registered trade mark or trade name	X	
Product name or identification	X	
Country of origin		X
Field of view in the object space (metre per 1 000 metres distance, or degree)	X	
Field of view in the image space (degree)		X
Field of view for eyeglass wearers (metre per 1 000 metres distance, or degree)		X
Exit pupil diameter (mm)	X	
Eye relief (mm)	X	
Dioptre adjustment range (m^{-1})	X	
Range of interpupillary distance adjustment (mm)	X	
Close distance (m)		X
Resolution or MTF		X
Light transmission		X
Type of coating		X
Twilight number		X
Mechanical dimensions (mm)	X	
Mass or weight (g)	X	
Operational temperature range		X
Storage temperature range		X
Water tightness	X	

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5.3 Compliance

Products complying with the requirements given in this part of ISO 14133 may be designated as high performance instruments in accordance with this part of ISO 14133, i.e. ISO 14133-2.

NOTE Products complying with the requirements given in ISO 14133-1 are designated as general purpose instruments in accordance with ISO 14133-1.

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