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Optics and optical instruments — Telescopic systems — Specifications for astronomical telescopes

Optique et instruments d'optique — Systèmes télescopiques — Spécifications pour lunettes astronomiques

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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.

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ISO 14134 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 4, *Telescopic systems*.

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Optics and optical instruments — Specifications for astronomical telescopes

1 Scope

This International Standard applies to astronomical telescopes, including finder telescopes, and to their functional specifications.

These specifications are restricted to the amateur astronomical telescopes, which should be distinguished from simple amusement telescopes, and give information about astronomical telescopes of commercial apertures.

2 Normative references

The following normative documents contain provisions which, through references in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1948:1987, *Photography — Front lens barrels up to 127 mm — Dimensions important to the connection of auxiliaries*

ISO 10109-4:2001, *Optics and optical instruments — Environmental requirements — Part 4: Test requirements for telescopic systems*

ISO 14132-1¹⁾, *Optics and optical instruments — Vocabulary for telescopic systems — Part 1: General terms and alphabetical indexes of terms in ISO 14132*

ISO 14132-4¹⁾, *Optics and optical instruments — Vocabulary for telescopic systems — Part 4: Terms for astronomical telescopes*

ISO 14490-4¹⁾, *Optics and optical instruments — Test methods for telescopic systems — Part 4: Astronomical telescopes*

3 Terms and definitions

For the purposes of this International Standard the terms and definitions given in ISO 14132-1 and ISO 14132-4 shall apply.

¹⁾ To be published.

4 Specifications

4.1 Optical characteristics, values and tolerances

The optical characteristics, values and tolerances of astronomical telescopes are listed in Table 1.

Table 1 — Optical characteristics, values and tolerances

Item			Characteristics / Value / Tolerance	
Main telescope	Clear aperture of objective [mm]	Refractive	± 1,0	
		Reflective	0 —2	
	Focal length of objective [mm]	Refractive	± 2 %	
		Reflective	± 3 %	
	Focal length of eyepiece [mm]		± 5 %	
	Angular resolution (arc second)	Centre	general purpose	high performance
$\frac{140}{D}$			$\frac{120}{D}$	
Finder telescope	Magnification		± 10 %	
	Clear aperture of objective [mm]		± 1,0	
	Field of view in the object space [degrees]		± 5 %	
	Reticle parallax (dioptr = m ⁻¹)		± 0,5	
	Angular resolution (arc second)	Centre	$\frac{100}{\Gamma}$	
NOTE 1 The resolution on the optical axis is used as a criterion for image quality. The resolution should be measured in accordance with ISO 14490-4.				
NOTE 2 Tolerances of the clear aperture and focal length of the objective lens (objective mirror), the focal length of eyepiece, the clear aperture, the magnification and the angular field of view in objective space of the finder telescope shall be obtained by taking nominal values as reference.				
NOTE 3 The magnification Γ and the values of field of view in the object space of a finder telescope shall be determined when the dioptr of the finder telescope has been set to 0 m ⁻¹ .				
NOTE 4 D = clear aperture of objective in millimetres.				
NOTE 5 Γ = magnification of the finder.				

4.2 Mechanical specifications

4.2.1 The moving parts shall operate smoothly and reliably. Further, excessive oil shall not be used, and other than moving parts shall not be contaminated with oil or grease.

4.2.2 An astronomical telescope shall not change collimation in any position.

4.2.3 An astronomical telescope with a finder telescope shall have an adjustable device so that the optical axis of the finder telescope lies within $\frac{1}{2}$ of the real visual angle in the main telescope's maximum magnification.

NOTE Maximum magnification is defined as the value at the exit pupil diameter of 1 mm.

4.2.4 For the eyepiece of a finder telescope having a dioptre adjustment mechanism, it shall be capable of adjusting in the range of $+2 \text{ m}^{-1}$ to -4 m^{-1} or higher.

NOTE For finders of a fixed dioptre type, it shall be fixed to -1 m^{-1} .

4.2.5 A mounting which supports an astronomical telescope shall always be made stable. For an equatorial-type mounting the polar axis and the declination axis shall be at right angles to each other and, in the case when any kind of accessory is attached, the point of intersection of the axes shall remain in balance.

In alt-azimuth telescope type mounting, when any kind of accessory has been attached on the lens-barrel or ocular-barrel, the altitude axis is also capable of keeping in balance. Further, the plane including the altitude axis and the horizontal plane against the azimuth axis are right-angled together.

4.2.6 All rotary axes of the mounting that support an astronomical telescope shall operate smoothly, in particular, the fine adjustment devices shall be free from squeak, play and unevenness.

4.2.7 All accessories shall be easily exchangeable.

4.2.8 The bases of a tripod or pillar type support, using suitable materials for strength, shall be robust and be efficient in operation of the telescope and observation.

4.2.9 Driving mechanisms of the polar and declination axes (in the equatorial telescope), as well as of the altitude and azimuth axes (in the alt-azimuth telescope) using electric motor drives shall be efficient in operation.

4.3 Interfaces for accessories

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Eyepieces and other accessories shall be interchangeable by means of suitable interfaces.

4.3.1 Sleeve fitting type interface

Eyepieces of the sleeve fitting type have the following outer barrel diameter and tolerance:

$\varnothing 24.5_{-0.1} \text{ mm}$

$\varnothing 31.75_{-0.1} \text{ mm}$

$\varnothing 50.8_{-0.1} \text{ mm}$

The sleeve fitting type shall be provided with a clamp or a friction drop-preventing device.

4.3.2 Screwed-in type interface

$\varnothing 42.0 \text{ mm}$ $p = 0.75 \text{ mm}$ (for camera adapter)

NOTE Metric Fine Screw Threads in accordance with ISO 1948:1987.

4.4 Optical specifications

4.4.1 The optical system shall be free from aberrations in practical use.

A diffraction disc should be apparent and approximately circular.

4.4.2 For the purpose of solar observation, in order to prevent eye injury, a safety device such as

- Solar projection plate
- Solar objective filter
- Hershel wedge

shall be provided.

4.4.3 Means should be taken to minimize the intensity of internal reflections and flares in the telescope tube, eyepiece tube or eyepiece subsidiary tube.

4.4.4 The optical components should not exhibit any mechanical damages (scratches, chips), contamination, stain or inhomogeneity.

A small quantity of small bubbles and striae are permissible, provided they do not impair functioning.

4.4.5 The scale lines of the reticle of the finder telescope shall be free from broken lines.

4.5 Environmental requirements

Astronomical telescopes shall withstand the test conditions prescribed for instruments type 06 or 07 in accordance with ISO 10109-4.

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5 Designation and marking and information of the product

5.1 Designation and marking

For identification and operation, an astronomical telescope shall have the following designation and markings:

Table 2 — Designation and marking

Part	Characteristics	Designation and markings	
		required	recommended
Main telescope	Focal length [mm]	×	
	Clear aperture of objective [mm]	×	
	Brand name		×
	Product name		×
	Country of origin		×
Finder telescope ^a	Magnification	×	
	Entrance pupil diameter [mm]	×	
	Field of view [degrees]	×	
Eyepiece	Type	×	
	Focal length [mm]	×	
Each component	Serial number		×
	Brand name or sign		×

^a Basic designation for the finder scope is given by the combination of magnification and diameter of entrance pupil e.g.: 6×20