
**Optics and optical instruments —
Specifications for astronomical
telescopes**

*Optique et instruments d'optique — Spécifications pour télescopes
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.

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.

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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 amateur astronomical telescopes, which should be distinguished from hand-held or mounted general purpose monocular telescopes.

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 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 10109-4:2001, *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 14132-4, *Optics and optical instruments — Vocabulary for telescopic systems — Part 4: Terms for astronomical telescopes*

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

3 Terms and definitions

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

4 Specifications

4.1 Optical characteristics: values and tolerances

The values and tolerances for optical characteristics of astronomical telescopes are specified in Table 1.

The characteristics specified in Table 1 shall be measured in accordance with ISO 14490-4.

Table 1 — Optical characteristics: values and tolerances

Telescope	Item		Characteristic's value or tolerance	
Main	Clear aperture of objective (mm)	Refractive	±1,0	
		Reflective	±2,0	
	Focal length of objective (mm)	Refractive	±2 %	
		Reflective	±3 %	
	Focal length of eyepiece (mm)		±5 %	
	Angular resolution in object space and on the optical axis (arc second)		general purpose	high performance
$\frac{140}{D}$			$\frac{120}{D}$	
Finder	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 on the optical axis (arc second)		$\frac{100}{\Gamma}$	
NOTE 1 The resolution on the optical axis is used as a criterion for image quality.				
NOTE 2 D = clear aperture of the objective in millimetres.				
NOTE 3 Γ = magnification of the finder.				

Tolerances for clear aperture and focal length of the objective lens (primary mirror); focal length of the eyepiece; clear aperture, magnification and angular field of view in objective space of the finder telescope shall be obtained by taking nominal values as reference.

The magnification Γ and field of view in the object space of a finder telescope provided with a dioptr adjustment mechanism shall be assessed at 0-setting of the dioptr scale. Wherever no dioptr adjustment mechanism is provided, the magnification of the finder shall be checked when the finder is focused to infinity.

4.2 Mechanical requirements

4.2.1 The moving parts shall operate smoothly and reliably. Excessive oiling shall not be used, and parts 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 provided with a finder telescope shall have an adjustment device in order to bring the optical axis of the finder within $1/2$ of the real visual angle of the main telescope when the main telescope is set to maximum magnification.

NOTE Maximum magnification is defined as the value obtained when the exit pupil diameter is 1 mm.

4.2.4 The eyepiece of a finder telescope with a dioptr adjustment mechanism shall be capable of adjusting in the range of $+2 m^{-1}$ to $-4 m^{-1}$ or higher.

For finders without a dioptr adjustment mechanism, the eyepiece shall be fixed to $-1 m^{-1}$.

4.2.5 A mounting that supports an astronomical telescope shall always be made robust and stable. For an equatorial-type mounting the polar axis and the declination axis shall be at right angles to each other. When any kind of accessory is attached to the lens-barrel or eyepiece side, the point of intersection of the axes shall stay in balance, or be capable of being rebalanced in a simple manner.

In an alt-azimuth telescope-type mounting, the plane including the altitude axis and the horizontal plane against the azimuth axis shall be mutually perpendicular. When any kind of accessory is attached to the lens-barrel or eyepiece side, the altitude axis shall keep the balance.

4.2.6 All rotary axes of the mounting which 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 efficient in operation of the telescope and in observation.

4.2.9 Driving mechanisms of the polar and declination axes (in the equatorial telescope) and of the altitude and azimuth axes (in the alt-azimuth telescope) which use electric motor drives shall be smooth and precise in operation.

4.3 Interfaces for accessories

4.3.1 General

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

4.3.2 Sleeve-fitting type interface

Eyepieces of the sleeve-fitting type shall have one of the following outer barrel diameters and tolerances (in mm):

24,5 _{-0,1} ⁰	31,75 _{-0,1} ⁰	50,8 _{-0,1} ⁰
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The sleeve-fitting type interface shall be provided with a clamp or a friction drop-preventing device.

4.3.3 Screw-in type interface

A screw-in type interface shall be provided with the external screw M42 × 0,75 in accordance with ISO 68-1 for a camera body.

4.4 Optical requirements

4.4.1 For the purpose of solar observation, in order to prevent eye injury, a safety device such as a solar projection plate, a solar objective filter, or a Herschel wedge shall be available. Solar eyepiece filters shall not be provided with the telescope or supplied as accessories.

4.4.2 Measures shall be taken to minimize the intensity of internal reflections and flares in the telescope tube, eyepiece tube and eyepiece subsidiary tube.

4.4.3 The optical components shall exhibit no mechanical damage (scratches, chips), contamination, stain or inhomogeneity.

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

4.4.4 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 10109-4:2001.

5 Consumer information

5.1 Designation and marking

An astronomical telescope and its components or accessories shall have the designations and markings listed in Table 2.

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.

5.2 Product information

Product catalogues, user manuals and other technical information brochures for astronomical telescopes shall provide complete information on at least the technical characteristics listed in Table 3.

Table 3 — Product information

Part	Characteristics	Designation and markings	
		required	recommended
Main telescope	Focal length (mm)	×	
	Clear aperture of objective (mm)	×	
	Obscuration ratio of reflective telescopes ^a (%)		×
	Brand name		×
	Product name		×
	Country of origin		×
Finder telescope	Magnification	×	
	Entrance pupil diameter (mm)	×	
	Field of view (degrees)	×	
Eyepiece	Type	×	
	Focal length (mm)	×	
Each component	Interface mechanical dimension		×
	Mass or weight (kg)		×
	Brand name or sign		×

^a Ratio of the diameter of the central obscuration to the diameter of the primary mirror.