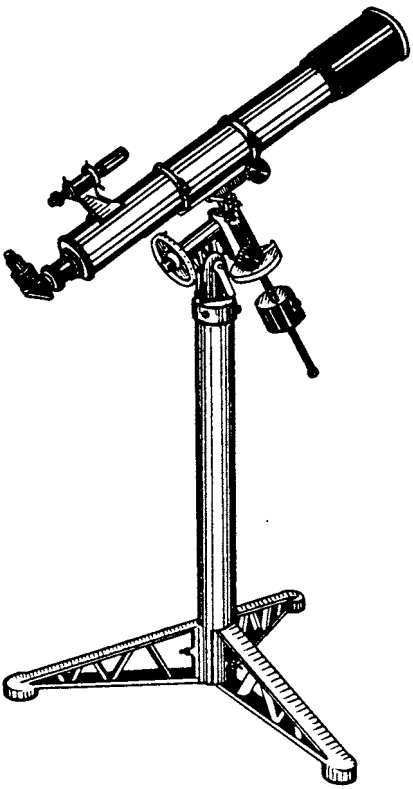
TELESCOPE TAL-100R (TAL-100RT)



Service manual

CONTENTS

The telescope is subject to continuous development and improvement, consequently it may incorporate minor changes in detail from the information contained herein.

1. GENERAL DIRECTIONS

ATTENTION!

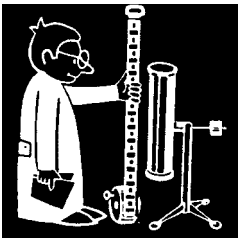
Never attempt to directly view the Sun with or any other telescope including finderscopes and binocolulars. Instant and permanent eye damage or blindness will result. Never allow children to use the telescope during daylight hours unless they are supervised by a responsible abult conversant with this real danger.

If you decide to make an observation of the Sun directly, It is necessary to reduce an aperture with the help of diaphragm and to use a black solar light filter.

The telescope can operate normally at the ambient temperature from 30°C to minus 30°C.

Telescope TAΛ-100R (hereinafter in the text referred to as «telescope») is a precise powerful amateur astronomer telescope. It demands a careful handling and certain knowledge in the field of astronomy. Only in this case user will be full satisfied.

When buying the telescope one should pay attention to the package safety ensured by the seal of the manufacturing plant. After unsealing the case one should check compliance of the complete set denoted in the list of enclosure. Prior to using the telescope one gets acquainted with its handling and order of operation.



2. SPECIFICATIONS

Diameter of objective lens	100 mm
Focal length,	1000 mm
Focal aperture	1:10
Magnifications and angle field of view (changeable):	
-with the eyepiece of f'=25 mm	40^{x} 1°
-with the eyepiece of f'=6.3 mm	155^{x} 0°15′
Resolution limit	1,4″
Limiting magnitude	12^{m}
Range of slow-motion control on the declination axes	±4°
Rotation of the telescope:	
In right ascension (hour-long angle)	360°(24h)
in declination	360°
Operation limit by latitude	0° - 70°
- with tripod	0° - 60°
Angular field of view of the finderscope	8°
Magnification of the finderscope	6^{x}
Overal dimensions:	
length tube	950 mm
height	1460 mm
Weight of the telescope	25 kg

3. STANDARD EQUIPMENT

Name	Qty
Telescope	1
Eyepiece of f'=25mm	1
Finderscope	1
Equatorial mounting	1
Hinged clips	2
Supports	3*
Tripod	1*
Pier	1*
Screw	6
Table	1
Accessories and Parts	
Eyepiece of f'=6.3 mm	1
Reticle	1
Blind	1
Adapter	1
Stopper	1
Bushing	1
Housing	1
Service manual	1

*** Telescope can be completed with a metal pier (ТАЛ-100R) or tripod (ТАЛ-100RT) with table**

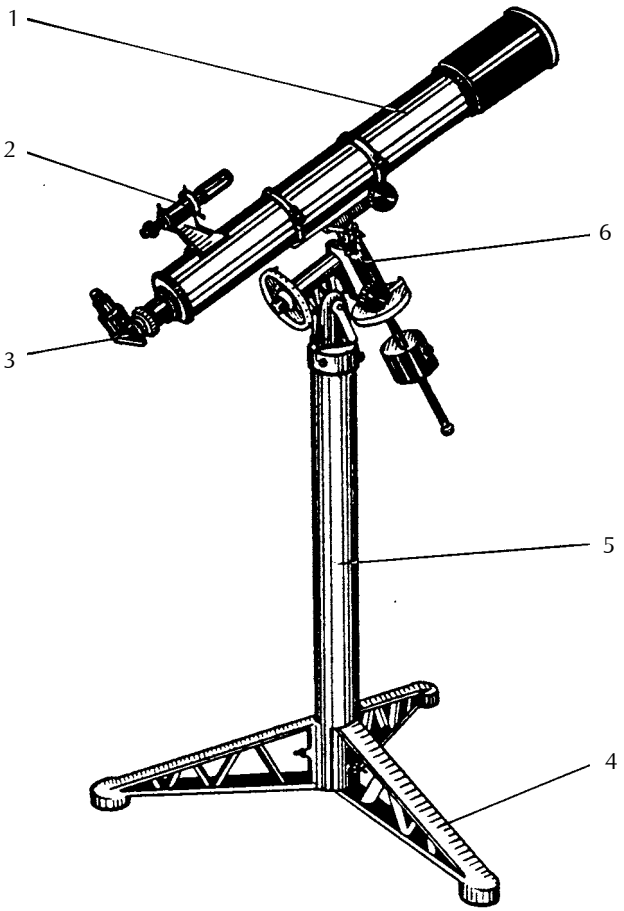


Fig. 1. **General view**

1 - telescope tube; 2 - optical findescope;
3 - eyepiece set; 4 - supports; 5 - pier; 6 - equatorial mounting

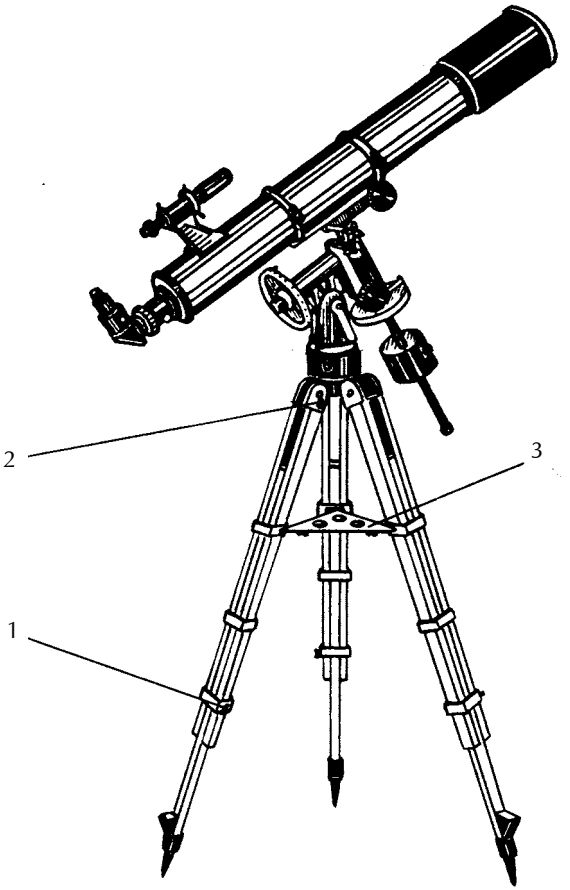


Fig. 2. **General view of telescope mounted on tripod**

1,2 - stoppers; 3 - table

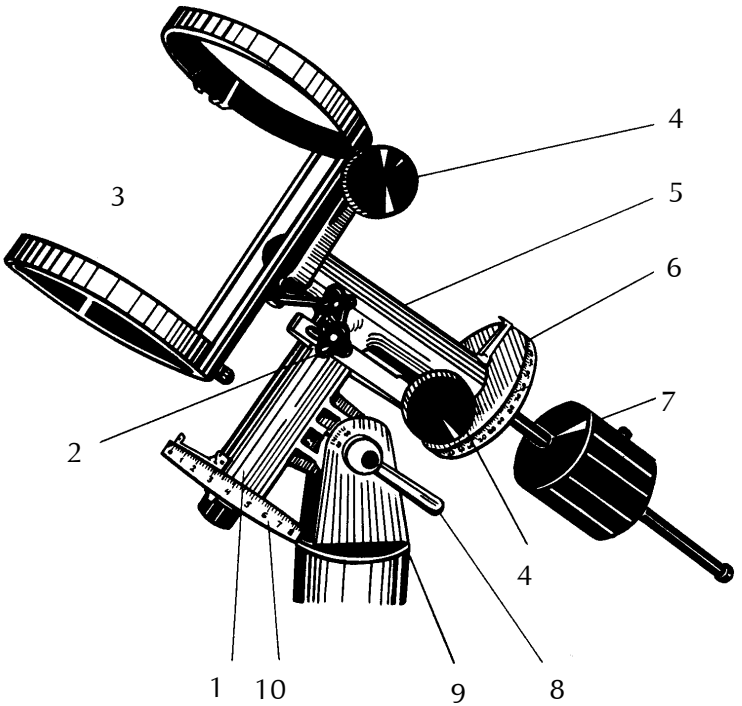
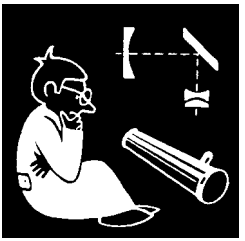


Fig. 3. **Equatorial Mounting**

1 - polar axis; 2 - screw of axis brake; 3 - folding clips; 4 - handwheel of micrometer screw of polar axis; 5 - declination axis; 6 - circle of declination; 7 - counterweights; 8 - hendle; 9 - bracket with scale of latitudes; 10 - circle of hour angles



4. DESIGN AND PRINCIPLE OF OPERATION OF TELESCOPE

The telescope (fig.1,2) consists of three basic units: the telescope tube, equatorial mounting, and pier with supports or tripod.

The tube 1 is the basic part of the telescope, which embodies the optical units: objective lens, eyepieces, and finderscope.

Eyepiece parts 3 consist of the following units: focusing mechanism, diagonal mirror, set of symmetrical eyepiece f'=25 and 6.3mm mounted with the fitting place of 31.8 mm (1.25″).

Finderscope 2 is a scope with 6^{x} magnification and field of view of 8°. It is completed with blind (fig.1) which is mounted on objective lens.

The equatorial mounting (fig. 3) consists of polar axes 1 and declination axis 5 perpendicular to the polar axis.

Fastened on one end of the declination axis is the saddle with hinged clips 3 in which the telescope tube is mounted; fastened on the other end of the axis is the counterweights 7 which can move along the axis for balancing the telescope tube. Solar-screen 1 (fig. 8) can be fastened on the same axis as well.

The casing of the polar axis is fastened on the bracket 9 provided with a scale of latitudes by which the polar axis is set to the latitude of the observer's site. Position of polar axis can be fixed with the help of handle 9. Setting circle 6 on the declination axis, which shows the object declination, is figured from 0 to 90° with a division value of 2°. Circle 10 positioned on the polar axis (the circle of hour angles) is figured from 0 to 24 hours with a division value of 10 minutes.

The declination axis has braking screw and mechanism of slow motion, which moves the tube in the range of ±4°. By using this mechanism it is possible to correct the position of the object in the field of view.

Pier 5 (fig. 1) consists of a pipe with three supports 4.

The tripod (fig. 2) allows to adjust a height of telescope and to fix each leg of tripod with the help of stops 1 and 2. Also it is completed with table 3.

5. OPTICAL TRAIN

The telescope tube (fig.4) is a refractor with achromatic objective lens 1. It provides a high quality of image with a resolution limit of diffraction level.

Telescope tube is completed with two symmetrical changeable eyepieces 4 f'=25mm and f'=6.3mm.

For easy observation of celestial objects near by zenith an eyepiece set of

telescope turned to optical axis by 90° with the help of plane diagonal mirror 2. If it is necessary one should use a finderscope consisted of objective lens 7, reticle with cross-hair 6 and eyepiece 5 that to allow locating an object in the centre of field of view.

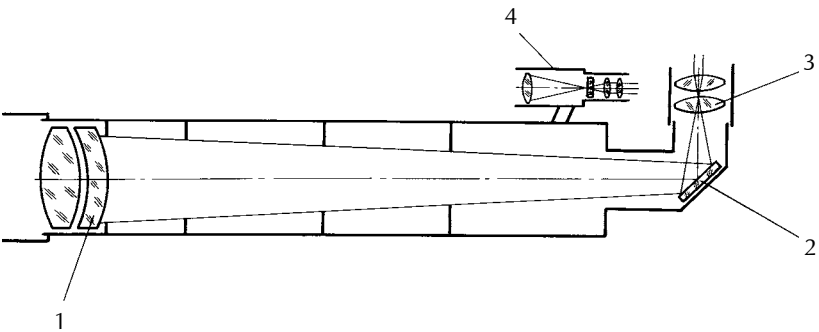
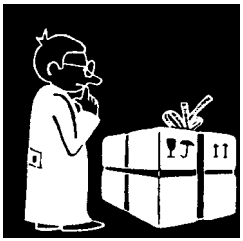


Fig. 4. **Optical train**

1 - achromatic objective lens; 2 - diagonal mirror;
3 - eyepiece; 4 - finderscope



6 . PREPARATION FOR OPERATION

6.1. Telescope assembling

For convenience of transportation and storage the telescope is supplied in disassembled condition. An assembling of telescope is fulfilled before observation.

Prior to assembling the units and parts should be cleaned from slushing compound of plant.

Tripod is located on the place of observation. One should fix a table 3 (fig. 1) using for changeable parts.

The equatorial mounting is set on mounting of tripod and fixed from below by means of clip.

One should set an axis with counterweights 7 (fig. 3) by thread on declination axis 5 and fix by means of nut.

Folding clips are fixed on the mounting's bracket 3 which are used for fixation of telescope's tube I (fig. 1).

The finderscope is fixed on the tube with six set screws.

If the telescope is completed with pier, three supports provided captive screws are fixed to the lower end of the pier through holes. The equatorial mounting is set on the upper end of the pier.

6.2. Telescope balancing

For smooth motion of the telescope and reliable operation of the slow motion knob it is important to balance its movable parts on the axes of the equatorial mounting.

For this purpose one should set the telescope tube in the horizontal position, unscrew the bolt of brake 2 (fig. 3) of the declination axis and holding slightly the tube by hand see to it whether it remains in the indifferent equilibrium. If the tube is not in balance, undo the screws of the clips, which fix the tube and move the tube along its axis until it will be in balance. After that one screws in the screws of the clips.

For balancing the telescope relative to the polar axis it is necessary to set the declination axis in the horizontal position. Then it is necessary to screw up the bolt of brake 2 (fig. 3) of the declination axis. Holding the axis by hand see to it whether the telescope is in balance about the polar axis. If the telescope is not in balance, move counterweight 7(fig.3) along the declination axis. When mounting the various devices on the telescope, for example, a camera, it is required to balance the telescope additionally.

7. ORDER OF OPERATION

7.1. Operation with telescope

Before mounting the telescope it is required to choose the place and prepare the site. It must be even and solid. Mount the telescope on the site and check it for tenable stability.

After mounting the telescope it is required to set parallelism of the optical axes of the telescope tube and finderscope. For this purpose one should insert a reticle 7 (fig.5) into eyepiece f'=25mm and to insert the eyepiece together reticle into eyepiece set. Then the telescope is pointed to the remote object. The position of the telescope is fixed by means of the screws of the brakes of the axes.

Then, by operating with the setting screws of the rings of fiderscope, one brings the chosen remote object to the centre of the findelscope view field. This operation is performed only once. In the future before observation only the parallelism of the optical axes of the telescope and finderscope is checked.

The celestial sphere together with astronomical objects performs the visible motion about the celestial axis. Therefor the telescope is provided with equatorial mounting. Being set correctly, this mounting makes it possible to perform to the celestial object tracking. After pointing the telescope to the object the observer can keep the object in the view field center for a half a haul by rotating slowly the micrometer screw of the polar axis.

In order to avoid guiding collection in declination, the polar axis of the telescope should be set parallel to celestial axis. In this case the north (upper) end of the polar axis faces the celestial pole positioned near Polaris (α Ursae Minoris). For visual observations it is enough to incline the polar axis at an angle equal to the latitude of the observing site and direct it approximately along the line the South - North. With such setting of the telescope the object will 'deviate' step by step in declination (it is lifted or lowered in the view field). This error is corrected occasionally by means of the micrometer screw of the declination axis.

For photographic operations and in the cases when the telescope can be set stationary, the polar axis of the telescope should be set precisely. For this purpose one observers any blight star in the East, then in the South and makes notice of the direction of the star displacement.

If in the observation of the star In the East it is disposed in the telescope view field so that in Its tracking the upper end of the telescope tube sinks slowly, the north end of the three polar axis should be somewhat lifted.

If the upper end of the tube Is lifted step by step, the north (upper end of the polar axis should be lowered.

For precise setting of the axis by azimuth one observes the star near the meridian circle (above the South point) in the same way. If in the star tracking one has to lower slowly the upper end of the telescope tube, the north end of the polar axis should be displace to the West.

If In the process of the star tracking the upper end of the telescope tube I lifted, the north end of the polar axis should be displaced to the East.

In 20-30 minutes of such observations one can set the polar axis so that the star will remain on the cross-hairs for 10-15 minutes without correction in declination.

After precise setting of the polar axis one can set the declination and haul elides which must help to search the objects invisible with a naked eye or even through the findelscope.

First of all one should set the hour elide which is fixed on the polar axis. After fine setting of the polar axis set the declination axis horizontally. The horizontal setting should be checked with the aid of a level. After setting the axis one sets the haul elide so that «0» is found against the index. Fix the circle by means of brake.

For setting the declination circle fixed on the declination axis one should find the declination of two-three bright stars in the star catalogue or make use of the declinations of the planets. With the help of the findelscope one brings the star or the planet to the center of the field of view of the telescope at maximum magnification. After that one sets the declination of the required star against the index. The circle is to be fastened with a screw. Then one makes attempt to find the second star by its declination. For this purpose one slackens the screws of the axis brake and adjusts the telescope so that the declination of the star to be sought is set on the declination circle. Fix the declination axis by rotating the telescope tube slowly clockwise hound the polar; bring the star to the center of the telescope field of view. After checking of the circle setting one tightens it with a nut.

In order to avoid resetting of the polar axis and elides one should choose a solid horizontal site. Best of all it is made of some concrete of l.5xl.5 m size. The position of three supports of the telescope pier should be marked on the site. The telescope is mounted according to the marks on the concrete site.

7.2. Photographic observations

Photographing star fields is carried out with the use of the telescope in the main focus. To make it one should use a small size 35 mm camera or other devices having fitting thread of 42x1.0mm or 42x0.75mm. To mount a camera remove eyepiece from tube and to mount a bushing 9 (fig.5) with the thread of 42x1.0mm. If it is necessary one should mount an adapter 8 (fig.5) on the bushing when using the telescope with camera having a fitting place of 42x0.75. Mounted a camera one should make a focus it and to balance the telescope.

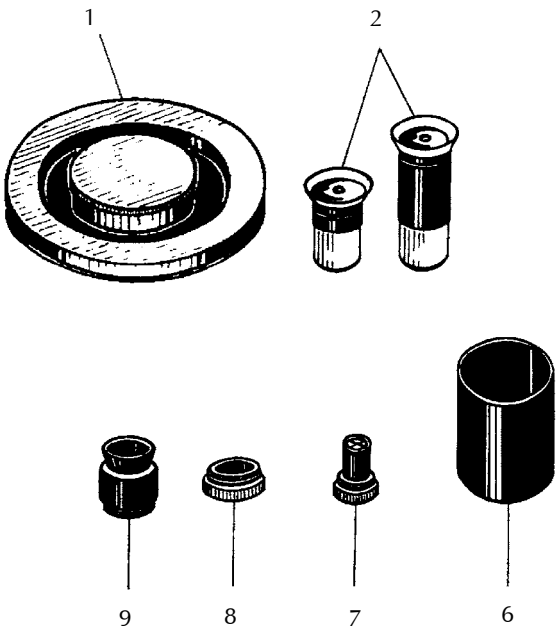


Fig. 5. **Accessories**

1 - cap; 2 - eyepiece; 6 - blind;
7 - reticle; 8 - adapter; 9 - bushing

The exposures, which are required for photographing the star fields, are tenths of minutes without interference of the street lighting. Therefore, for this period of time one should see to it that the camera follows the sky precisely in its diurnal rotation. Near the center of the field of view of the camera one chooses the bright star to which the telescope is pointed. To keep the star on the reticle cross hairs of the finderscope is the problem for an observer for the whole period of exposure. As the cross-hairs of the finderscope is not illuminated, the image of the guide stair should be slightly defocused in order to cross a light circle of the unsharp image of the star by the cross-hairs and to keep the star in this position for the period of exposure.

One applies minor corrections for a clockwork drive with the help of handwheel 5 (fig. 3) keeping the star on the cross hairs for the whole period of exposure. One corrects the position of the guide star with the micrometer screw of the declination axis if necessary. To obtain the minimum corrections in

declination the polar axis should be set as precisely as possible to the celestial pole. One should remember that if the polar axis is set incorrectly, even in the case when the star image is kept on the cross-hairs, the images of the stars at the edges of the field of view appear as dashes.

7.3. Telescope and atmospheric conditions

At high magnifications together with the increase of the visible dimensions of the object the disturbances due to atmosphere are increased. They are expressed in great blurring of the images of the distant objects, in scintillation and blurring of the star images.

The observation in the cold seasons is possible when all telescope parts acquire the ambient temperature. For air circulation inside the telescope tube there is a hole plugged with a stopper in the cell of the primary mirror. In operation the stopper should be unscrewed from the cell.

But in observations outdoor the great disturbance of atmosphere may take place at nights, that lead to bad images of the celestial objects.

It is quite possible that at those nights the observations of the fine details of the planets and of the Moon are unsuccessful.

It is apparent that the observations with the aid of the telescope through the window are senseless as the rough surfaces of the window glasses distort the images.

In case of precipitation and stopping of operation the telescope together with supply unit must be covered.

8. MAINTENANCE

For faultless operation the telescope should be kept in cleanness and protected against mechanical damage. The metal surfaces are periodically dusted by using clean soft napkins, then wiped with a napkin impregnated with acidless vaseline, after that with a dry napkin.

The lenses of the eyepieces are wiped with a dry linen napkin. The fat spots are removed with a cotton wool piece impregnated with alcohol.

One should dismantle the optics only in case of necessity. In non-operating position the telescope tube must be constantly covered with a cap and the eyepiece one is to be plugged with a stopper.

9. RULES OF STORAGE

It is recommended practice to store the telescope in the heated room with the relative humidity of maximum 80% at the temperature from 5 to 40° C.

10. ACCEPTANCE CERTIFICATE

Telescope ТАЛ-100R (ТАЛ-100RT), serial N . . . . . is found fit for service.

Date ofmanufacture andslushing_____

Signatures _____

Table of close stellar pairs for testing image quality of the telescope

Name of star	Coordinates		Magnitude, m	Visible distance, ang. s.	Constellations
	h, m	ang. degrees, ang. min.			
αPsc	$1^h59.4^m$	+02°31′	4.3-5.3	1.9″	Pisces
γCet	$2^h40.7^m$	+03°02′	3.4-4.4	2.8″	Cetus
ξOri	$5^h38.2^m$	-01°58′	2.0-4.2	2.5″	Orion
αGem	$7^h31.4^m$	+32°00′	2.0-2.8	1.8″	Gemini
εHyd	$8^h44.1^m$	-06°36′	3.5-6.9	2.9″	Hydra
σ^2Uma	$9^h06.0^m$	+67°20′	4.9-8.2	2.7″	Ursa Major
38Lyn	$9^h15.8^m$	+37°07′	4.9-6.0	2.8″	Lynx
ξUma	$11^h15.6^m$	+31°49′	4.4-4.8	2.9″	Ursa Major
ξBoo	$14^h38.8^m$	+13°56′	4.6-4.6	1.2″	Bootes
εBoo	$14^h42.8^m$	+27°17′	2.7-5.1	3.0″	Bootes
μDra	$17^h04.3^m$	+54°32′	5.8-5.8	2.2″	Draco
τOph	$18^h00.4^m$	-08°11′	5.4-6.0	2.0″	Ophiucus
70 Oph	$18^h02.9^m$	+02°31′	4.0-6.0	2.4″	Ophiucus
ε^1Lyr	$18^h42.7^m$	+39°37′	5.1-6.2	2.7″	Lyra
ε^2Lyr	$18^h42.7^m$	+39°37′	5.1-5.4	2.2″	Lyra
δCyg	$19^h43.4^m$	+45°00′	3.0-6.5	2.2″	Cygnus
μCyg	$21^h41.9^m$	+28°30′	4.7-6.1	1.8″	Cygnus
ξAqr	$22^h26.3^m$	-00°17′	4.4-4.6	1.8″	Aquarius