

Federal State Unitary Enterprise  
Production Amalgamation  
"Novosibirsk Instrument Making Plant"



# OBSERVATION BINOCULAR

## PNB-1

Service manual

AL3.803.101 TO

## **INSTRUCTION**

The present certificate is intended for study of the principle of operation, design and modes of operations of binocular observation device PNB-1. The certificate contains the descriptions of the designs and methods of operation of the device.

## **CONTENTS**

	Page
1 Application	3
2 Specification	3
3 Standard equipment	4
4 Design and operation of device	5
4.1 Basic optical Train	5
4.2 Design of device	5
5 General directions	6
6 Containers and packing	7
7 Preparation of device for operation	7
8 Order of operation	7
9 Derangement's and method of elimination	8
10 Acceptance certificate	8
Supplement 1: Restoration of absorbing capacity of silica gel	9
Supplement 2: Figures	11

## 1 APPLICATION

The binocular observation device PNB-1 is designed for observation of air and ground targets from stationary and emergency observation posts in the day - time and at night in the searching light.

Operating temperature range is from minus 50°C up to + 40°C with relative humidity of maximum 100% at the temperature +25°C.

## 2 SPECIFICATIONS

The main parameters and dimensions must be in compliance with those stated in table 1.

Table 1

Specifications	Value
Magnification	15x
Field of view in the space of objects, degree	6
Eye relief , mm	15
Diameter of the pupils, mm:	
of the entrance one	1.10
of the exit one	7.33
Resolution of each monocular in centre of field of view, ..."	4
Parallax between image of infinitely distant object and reticule, ...	1
Light transmission, %	50
Distance between centres of the right exit pupils and left tubes, mm	59-72
Convergence of the light beams behind the eyepieces, D	minus 3 to 12
Range of measuring the angles of elevation, degree	minus 35 to 60
Range of measuring the traversing angles, degree	unlimited
Reading of measuring the angles	0-05
Division value of limbs	0-10
Overall dimensions , mm:	
length (without blind)	400
width	580
height (without tripod)	342
Mass, kg, max:	
of the device	30
of the tripod	9

### 3 STANDARD EQUIPMENT

The composition of the device is given in the table 2.

Table 2

Designation	Name	Qty	Note
AL3.803.101	Device PNB-1	1	
	<b>SPARE PARTS</b>		
AL5.883.033	Desiccator	2	
AL5.183.003	Round level	1	
	<b>TOOLS</b>		
AL8.392.030	Wrench	1	
AL6.890.030-08	Screwdriver	1	
	<b>ACCESSORIES</b>		
AL6.430.256	Cap	2	
AL6.430.257	Cap	2	
	Art brush from squirrel hair	1	
AL8.890.001-01	Napkin	2	
AL5.940.187	Light filter	2	
AL5.940.187-01	Light filter	2	
AL6.454.018	Pipe connection	1	
AL6.832.138	Cover	1	
	<b>REMOVABLE PARTS</b>		
AL6.156.025	Tripod	1	
AL6.150.231	Stand	1	Delivered at special request
	<b>MARKET CONTAINERS</b>		
AL4.161.927	Case	1	
	<b>SERVICE DOCUMENTS</b>		
AL3.803.101TO	Technical description and service manual	1	

## **4 DESIGN AND OPERATION OF DEVICE**

### **4.1 Basic Optical Train**

The optical train of the device is a telescopic system which consists of two branches. Each branch has an objective composed of lenses 1, 2 (Fig. 1) and prism 3, 4, 14, an eyepiece composed of lenses 5, 6 and cemented lenses 7, 8, 9, changeable light filters 10, 11.

The light beams which come from the object to be viewed pass through the objective, and after collecting in its focal plane form an inverted image of the object.

There is a prismatic inversion system composed of prisms 3, 4, 14 in the focal plane of the eyepiece for obtaining an erect image. The prisms serve also for deviation of the sighting line by 30° upwards and for changing the distance between the exit pupils and between the entrance pupils.

Reticle 13 which is a plane - parallel plate is positioned in the focal plane of the right objective. The plate is engraved with three scales: vertical, horizontal and angle - measuring one. The field of view is shown in Fig. 7.

The vertical and horizontal scales are intended for measuring the angular dimensions of the objects. The division value is 0.05. The total range of the vertical scale is 0-30 and horizontal one is  $\pm 0-30$ . The central sign (cross-hairs) indicates a centre of the field of view. Light filters 9, 10 (Fig.8) facilitate the condition observation.

### **4.2 Design of Device**

The device consists of two telescopes, casings 2 and 4 (fig. 2) which are connected below by means of a mechanism of the eye distance with handwheel 5 (Fig.5).

Each telescope consists of a casing, objective 3 (Fig. 4), block of prisms 9, eyepiece, desiccator 10, nipple 12 and blind.

The eyepieces are set for the image sharpness of the target by an observer's eye by rotation of scales 1 (Fig.3). The value of the diopter setting of the eyepieces (in the range from minus 3 to 5 diopters) is determined by scale 1 (Fig. 3) and indices on casings 2 and 6. In operation with the device, if it is necessary, changeable light filters 9, 10 (Fig. 8) of a required colour from the single STA kit are put on.

Headrest 8 (Fig. 4) is inserted in bracket 6 fastened on casing 2 (Fig. 2). The headrest serves as a support for the head and ensures a convenient operation. It can be moved and to be fixed with the use of handle 7 (Fig.4).

Desiccators 10 (Fig.4) to be filled with silicagel are fastened on casings 2 and 4 (Fig. 2) and serve for constant desiccation of the device inner cavity.

Blinds 3 and 5 (Fig. 2) are put on casings 2 and 4 on the side of the objectives, protect them against lighting by the sunrays and serve for decreasing detrimental (diffused) light which penetrates in the device.

The tripod (Fig.6) is designed for mounting the device on this ground or any immovable base.

The mechanism of the vertical laying consists of outer bracket, its box embodies gearing train, gears and limb with the scale of angles of elevation. The mechanism of horizontal laying performs horizontal laying of the device with the help of handles which are also used for vertical laying.

The round spherical level 6 (Fig. 2) serves for levelling the device. It consists of vial and casing. The vial is filled with ethyl alcohol. Three concentric circumferences are marked on its outer surface; they are used for determination of the device levelling accuracy. The level division value is 0-02.

## **5 GENERAL DIRECTIONS**

For faultless operation of the device it is necessary to keep to the following:

- protect the device against impacts and damages;
- avoid touching the optical surfaces with hands and oiled cleaning cloth;
- remove systematically dust, dirt and moisture from the optical surfaces with the use of clean napkin or brush from the single STA kit;
- replace the desiccators in due time;
- avoid exerting excessive effort in rotation of the handwheels and handles.

In operation with the device in the fields one should use cover 14 (Fig. 8).

Depending on the concrete conditions of operation one uses for mounting the device the following supports:

- the stand;
- the tripod (Fig. 6).

## **6 CONTAINERS AND PACKING**

Housing is designed for carrying and transportation of the device and single STA kit.

Prior to packing the device one obtains the minimal interpupillary distance between the eyepieces by using handwheel 5 (Fig.5).

Remove the device from the tripod or stand depending on the kind of mounting.

Put the device in the housing on the blocks and press it with a cleat.

The parts of the single STA kit are put at the place in compliance with list of enclosure available on the inner side of the housing cover.

## **7 PREPARATION OF DEVICE FOR OPERATION**

Prepare the device for operation in the following order:

- remove the protective caps from the objective and eyepieces and wipe the device with some cleaning cloth and the outer optical surfaces with a napkin, if it is necessary;

- obtain a sharp image of both tubes of the device in turn for each eye by rotating scale 1 (Fig. 3) ( in doing so in turn close the eyes or darken the inlet posts of the device);

- set the eyepieces at the distance equal to the interpupillary distance of the observer. To perform this one obtains a clear visibility of the full field of view of the reticle (the field of view is shown in Fig.5) and viewing through the device with both eyes. The device field of view must be visible in the shape of one whole circle without cutting the edges.

## **8 ORDER OF OPERATION**

Operation with the device in the following way:

- put one of light filters from the single STA kit in the device. If it is necessary (fit the light filter mount at the places of its cutting for its reliable fastening on the eyepieces);

- move out the blinds;

- reliable the brake of laying for direction by rotation of handwheel and carry out an observations.

## 9 DERANGEMENTS AND METHODS OF ELIMINATION

Table 3

Derangement, outer display and additional signs	Probable cause	Method of elimination
The terrain image is visible weakly through the device	Dust and dirt on the outer surfaces of the optical pieces Sweating of the optical pieces	Wipe the outer optical pieces by using the single STA kit
Silicagel in the desiccators becomes pink	Silicage is saturated with moisture	Replace the desiccator by a new one from the single STA kit
The level dubble is not visible or it is increased and exceeds the bounds of the middle lines of the vial	The level out of order	Replace it by a new one from the single STA

## 10 ACCEPTANCE CERTIFICATE

Observation binocular device PNB-1, serial No \_\_\_\_\_ meet the specifications and state standards and is accepted for service.

Date of issue \_\_\_\_\_

Signatures \_\_\_\_\_  
(stamp)

Federation State Unitary Enterprise  
Production Amalgamation "Novosibirsk Instrument-Making Plant"  
179/2, D.Kovalchuk,  
Novosibirsk, 630049  
Russian



## **RESTORATION OF ABSORBING CAPACITY OF SILICA GEL**

For restoration of absorbing capacity of silicagel unscrew a cap from the desiccator, pour silica gel in a clean metal vessel which is put on the heat source (an electric stove and so on).

The direct contact of silica gel with the flame is not permitted.

Restoration is carried out at a temperature of 150-170°C for four hours, t.i. until silica gel changes its colour for an intensive blue one.

Cool the restored silica gel in the closed vessel and pour it in the dehydrator plug, screw in the cap, screw the desiccator in the container.

It is forbidden to calcinate the desiccator. A spare dehydrator plug without the protective container and the restored silica gel must not be exposed to the open air for more than two minutes to avoid saturation of silica gel with moisture from the surrounding.

Silica gel can be restored unlimited, in doing so its absorbing capacity is preserved.

However, the silica gel service life is decreased in case of its contamination. Therefore in assembling and dismantling the desiccator and in restoration of silica gel one should treat it carefully, avoid touching silica gel directly with hands and calcinating it in dusty premises.



**FIGURES**



# Basic Optical Train

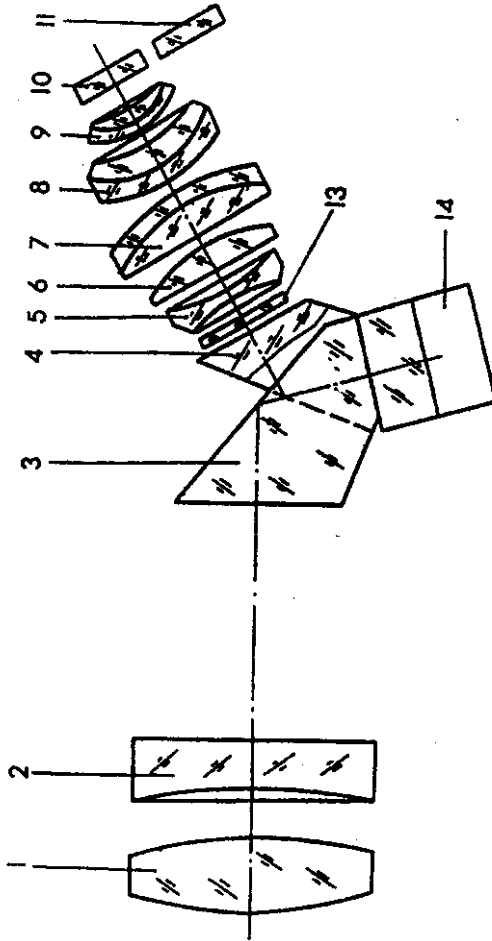


Fig. 1

1,2 - lenses; 3,4 - prisms; 5-9 lenses; 10 - neutral light filter; 11 - orange light filter;  
13 - reticle; 14 - prism

## Outer Appearance of PNB-1

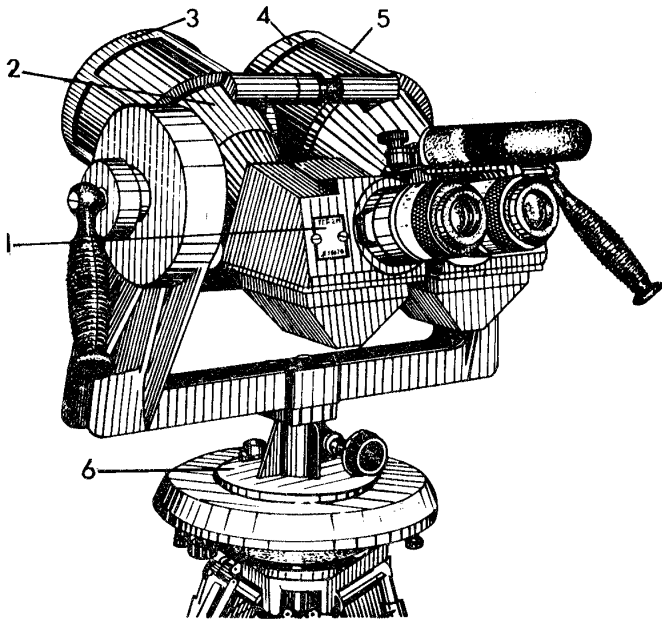


Fig. 2

1 - label; 2 - casing; 3 - blind; 4 - casing; 5 - blind;  
6 - round spherical level

# Eyeieces

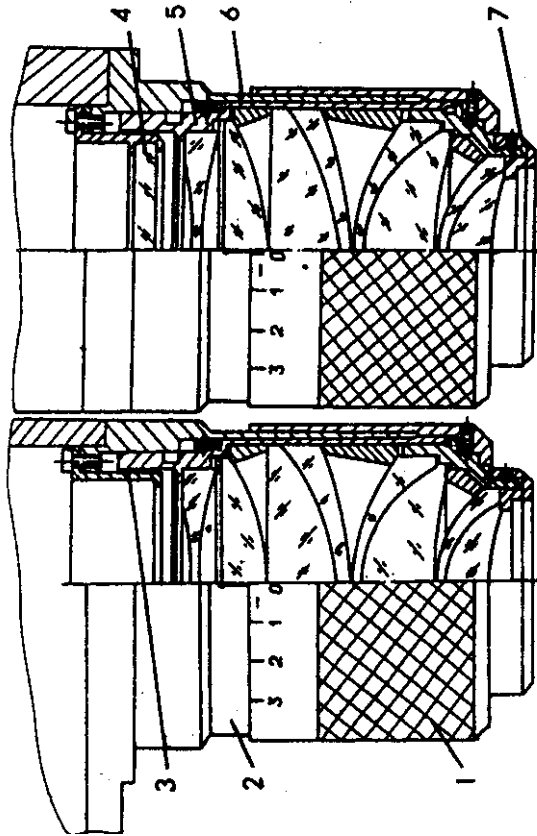


Fig. 3

1 - scale; 2 - casing; 3 - diaphragm; 4 - reticle; 5 - mounting;  
6 - casing; 7 - ring

**Binocular**

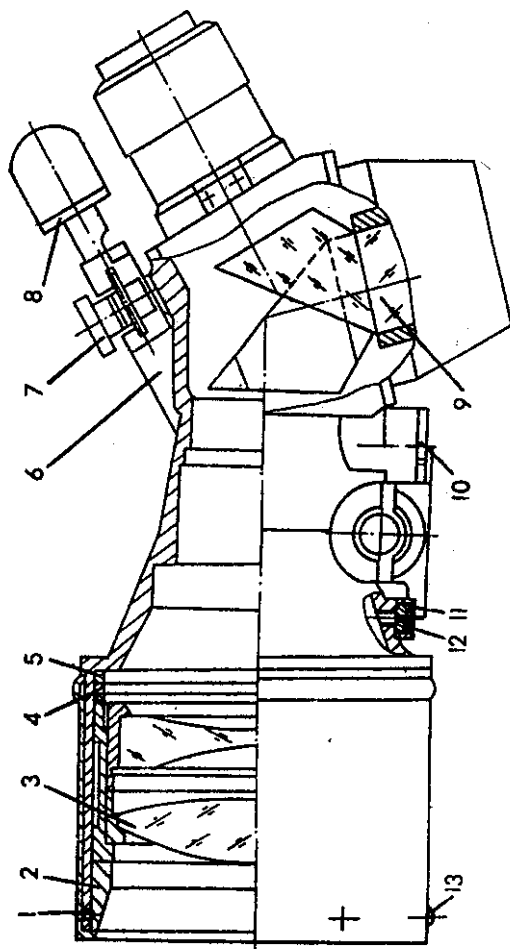


Fig. 4

1 - screw; 2 - ring; 3 - objective; 4, 5 - ring; 6 - bracket of headrest; 7 - handle; 8 - headrest; 9 - block of prisms; 10 - desiccator; 11 - cap; 12 - nipple; 13 - screw



Casing

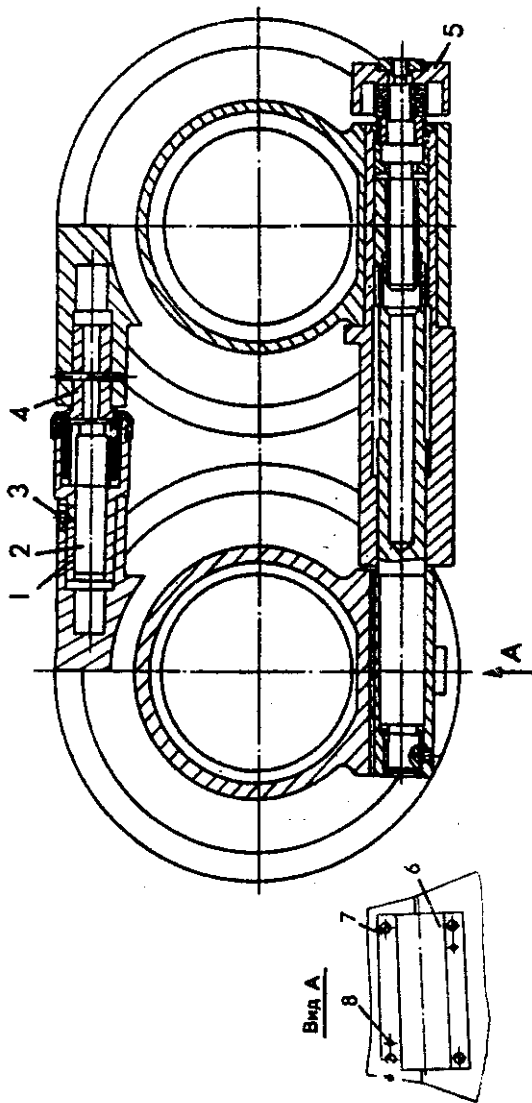


Fig. 5

1 - bush; 2 - shaft; 3 - screw; 4 - plug; 5 - handwheel;  
6 - bush; 7 - screw; 8 - spring

## Tripod

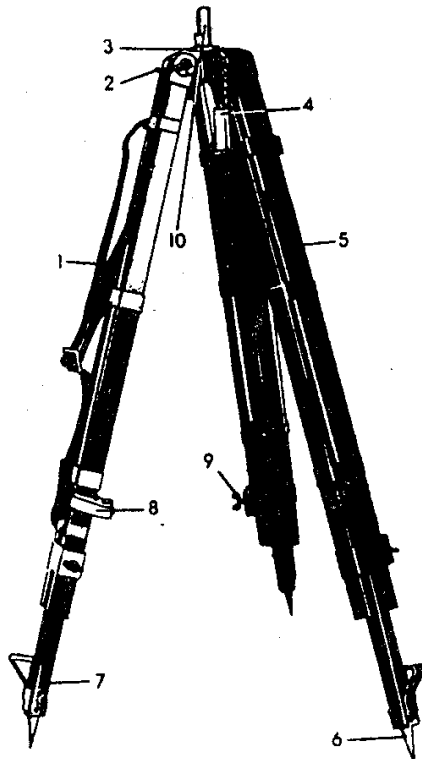


Fig. 6

1 - strap; 2 - treadle; 3 - head; 4 - cap; 5 - leg;  
6 - stop of leg; 7 - leg; 8 - strap; 9 - nut M6x1; 10 - pintle

# Viewfield

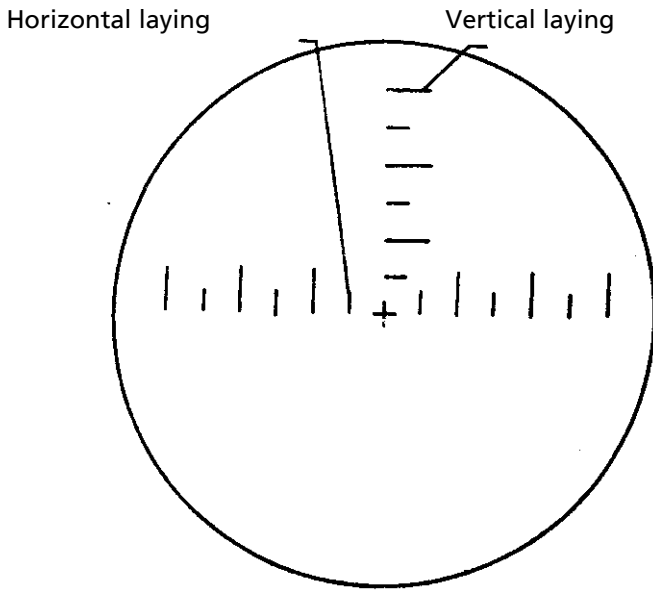


Fig. 7

## Singl STA

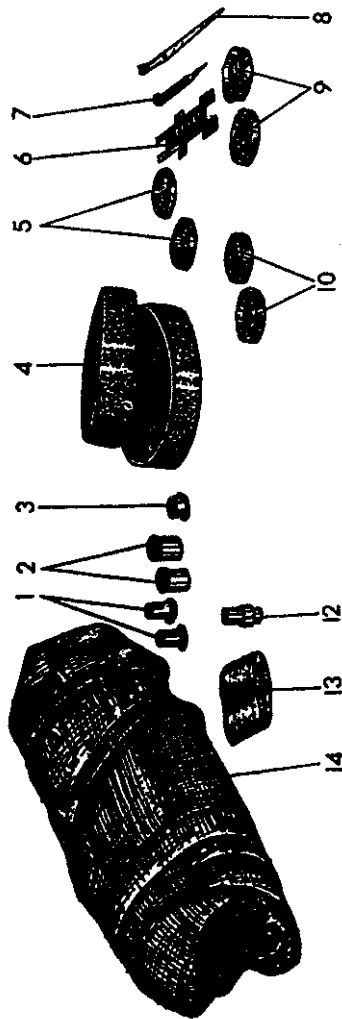


Fig. 8

1 - desiccator; 2 - container; 3 - round spherical level; 4, 5 - cap; 6 - wrench;  
7 - screwdriver; 8 - brush; 9, 10 - light filter; 12 - pipe connection; 13 - napkin; 14 - cover