Photo camera “Zakhod”

Technical and handling manual

BL3.821.097 TO

Approved
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1. INTRODUCTION

1.1. The technical and handling manual is intended for studying and mastering the skills, required to handle and maintain the “Zakhod” camera and keep it in constant readiness for work.

2. DESIGNATION

2.1. A subminiature automated camera “Zakhod” is designed to make photos at a distance of from 3 to 7 meters on 16-mm wide, non perforated film.

3. TECHNICAL DATA

3.1. Optical characteristics:

1) standard lens ZH 1/2.8
   focal length, in *mm*……23.96±0.48
   relative aperture……. 1:2.8
2) interchangeable lens ZH 1/11
   focal length, in *mm* ……...…21.24±0.42
   relative aperture……...1:11
3) range of brightness of an object to be photographed, measured per system TTL DM for the lens ZH 1/2.8 at film sensitivity, in *candelas per sq. m*
   $S_{0.2}$=500, 250, 180 units of GOST*2817-50 …… from 12 to 4000
   $S_{0.2}$= 800, 250, 180 units of GOST 2817-50…… from 8 to 4000
4) lens resolution on the film type ZP-80 TU6-17-1390-86 at fully opened relative aperture, in *mm,* not less than
   center……..….. 65
   edge…….. 35

3.2. Design characteristics:

1) film to be used, non perforated
   type ……..…….. ZP-80

width, in *mm* …….. 16
thickness, in *mm* .....…… 0.08-0.1

2) frame size, in *mm* …… . 14.8x21

*GOST – is an acronym for State All Union Standard

3) cassette capacity, *frames,* not less than ……. 30
maximum film length in a cassette, in *m*, ……1.1
4) time of one operation cycle, in *sec*, not more than…….. … 1.5
5) camera power supply from rechargeable batteries,
5D-0.26C in *V* …… 6
6) number of shooting cycles powered by one
rechargeable battery at a temperature
minus 20°C, in *cycles,* not less than……..……. 150
from +15 to +50°C, in *cycles,* not less than ……..… …210
7) shutter speed in manual mode setting, in *sec* ……..... 1/30
8) range of automatic shutter speeds, in *sec* ……..from1/60 to 1/1000
9) values of automatically changing relative
aperture of a standard lens
in automatic mode:
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(geometrical),
1:11
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11)summary automatic exposure error
at brightness of an object in a range
from 12 to 4000 candelas per sq. m
in *logarithmic units*, not more than……..... ±0.3
12)frame counter of the remaining frames
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13)overall dimensions
of the camera without a lens in *mm* ……. 23x65x96
14)overall dimensions
of the camera with lens, in *mm* …….....29x65x96
15)weight of the camera
with a lens and a cassette, in *kg*, not more than ……..... 0.230

3.3 Climatic conditions of camera operation:

1) range of operating temperatures, in °*C* ……. from minus 20 to +50
2) allowable air humidity
at the temperature (35± 2) ° C, in *%* …… 95±3

4. PACKAGED DELIVERY SET

4.1. The camera body is made in three modifications:

Modification #1 – BL3.821.097 has film sensitivity settings $S_{0.2}$=180, 250, 500 units of GOST.

Modification #2 – BL3.821.097-01 has film sensitivity settings $S_{0.2}$=180, 250, 800 units of GOST.

Modification #3 – BL3.821.097-02 is supplied with a lens ZH 1/11, without lens attachments.

4.2. Components of the delivery set are shown in the Table 4.1

Table 4.1.

Denomination	Designation	Quantity in modifications			Note
		-	01	02	

1. Photo camera	BL3.821.098	1		1	
Camera body	BL3.821.098-01		1		
	BL3.821.100	1		1	
	BL3.821.100-01		1		
Cassette	BL3.930.529	1	1	1	
2. Technical and handling manual	BL3.821.097 TO	1	1	1	
3. Log book	BL3.821.097 FO	1	1	1	
4. External control unit with the remot control	BL3.624.088	1	1	1	
5. Spool	BL6.123.364	2	2	2	
6. Spare part set	BL4.071.064				
	BL4.071.064-01	1	1	1	
External control unit with a remote control	BL3.624.088	1	1	1	
Camera lens 3X 1/11	BL3.873.490			1	
Cassette	BL3.930.259	2	2	2	

Continuation of Table 4.1

Denomination	Designation	Quantity in modifications			Note
		-	01	02	

Can	BL4.186.018			1	
Cable	BL4.863.940	1	1	1	
Cable	BL4.640.137	1	1	1	
Cable	BL6.640.144	1	1	1	For connection to a charger-discharger unit
Attachment	BL5.927.013	2	2		Without a latch
Attachment	BL5.927.013-01	1	1	1	With a latch
Release button	BL6.356.099	2	2	2	
Link	BL6.461.055	2	2	2	
7. Set of tools and accessories	BL4.078.190	1	1	1	
-Power control unit	BL5.170.022	1	1	1	
- Absorbent tissue	BL8.849.005	1	1	1	
- Round painting art brush	TU17-15-07-89	1	1	1	
-Round painting art brush #6 made of squirrel hair					
8. Wooden packing box	BL4.164.082	1	1	1	For a camera
Casing	BL4.164.079	1	1	1	For a cassette
Cardboard box	BL4.180.690	2	2	2	
Wooden packing box	BL4.162.554-14	0.5	0.5	0.5	

Continuation of Table 4.1.

Denomination	Designation	Quantity in modifications	Note

		-	01	02	
Note: 1) Overhaul set of spare parts, tool and instruments for 50 cameras 2) Group set of spare parts, tool and instruments for 3 cameras 3) Group set of spare parts, tool and instruments for 5 cameras 4) Group set of spare parts, tool and instruments for 8 cameras 5) Group set of spare parts, tool and instruments for 10 cameras	BL4.060.367 BL4.060.368 BL4.060.369 BL4.060.370 BL4.060.371				supplied per a separate order supplied per a separate order supplied per a separate order supplied per a separate order supplied per a separate order

Note: Camera is delivered in modification requested by customer.

5. DESIGN OF THE CAMERA SET

5.1. **Camera set**

5.1.1. Camera set “Zakhod” (pic.1) consists of the following main units: photo camera (**2**), interchangeable lens ZH 1/11 (**8**), external control unit with a remote control (**4**)**,** power supply control unit (Pic.6), shutter release button (**5**)**,** cable (**6**), cable (**7**)**,** link (**3**)**.**

5.2. Photo camera

5.2.1. The photo camera (Pic.2) is a complex optical-electronic device with automatic shutter cocking, aperture drive mechanism cocking and film winding, with execution of shutter exposure time in automatic and manual modes.

Photo camera consists of the following main parts: camera body (**2**) with a standard lens ZH 1/2.8 (**3**) and a cassette (**6**).

The camera body consists of four parts: casing (**5**), two covers (**4**), (**14**) and front panel (**8**). In the camera casing, the following units are positioned: drive mechanism and an electronic circuit. On the left side of the camera body is a film sensitivity switch (**1**) with settings 180, 250, 500, or 180, 250, 800 if the camera is of second modification.
On the left side of the camera, there is a cassette lock button (**9**). On the front panel there is an opening with a thread M13X0.5 for lens attachment, which, in its turn, is fixed with a screw (**16**).

On the left cover of the casing, there is a groove (**10**) of a dovetail shape designed for installation of the attachment to be used with the lens ZH 1/2.8. For fixing the attachment, there is a lock (**15**) on the camera front panel rigidly connected with a lever (**11**). When the lever (**11**) is pressed, its deflected part and the lock (**15**) fall back into the attachment slots, thus fixing it.

A frame counter is positioned in the left part of the camera casing. A scale (**12**) shows the number of exposed pictures on the frame counter, visible through an opening in the camera cover. A lever (**13**), positioned in the lower part of the camera, is used for setting the frame counter for 30 frames.

5.3. Drive mechanism

5.3.1. The camera drive is actuated by a miniature electric motor E83K (**37**) (Pic.3) rotating with a speed of 2200 rpm. During motor operation, rotation is transferred via gear wheels of a reduction gear (**11**) to a bevel gear (**40**), which makes one revolution per operating cycle.

When the shutter (**26**) is wound, the gear quadrant (**28**), fixed on the shaft of a cam unit, initiates engagement with the gear quadrant (**27**) and the lever (**21**) that is a leading link of the blade unit. The remaining blades (**22**), (**23**), (**24**) are attached to the axle (**20**) by means of a swivel joint. Parallel motion of the blades is ensured by a groove sliding along the immovable axle and fixed to the casing. When the shutter winds, the lens exposure aperture opens by means of a turning flap (**47**) activated by a cam (**48**).

When lever (**21**) turns from 0° position to 62°, the blades of the first unit will open and will be fixed in that position by the ratchet trigger (**35**). Then gear quadrants (**27**) and (**28**) disengage, and the curtain drive* is turned off. Movement of the lever (**21**) of the first blade unit is transferred onto the lever (**10**) of the second blade unit by means of a rod (**19**). The blades fold and are fixed in this position by the lever (**6**), which, in its turn, is held by an electric magnet (**3**).

* i.e. “shutter blade drive”

During rotation of the cam (**29**) the inertia mass arm (**38**) snaps into action. The arm (**38**), during its movement, will disengage by means of the pin (**32**) the timing contacts (**34**), and then disengage the locking device (**35**), holding in a fixed position the gear quadrant (**27**).

Under action of the winding spring (**9**) the first blade unit opens the frame window, and the sector (**27**) is returned into the initial position.

The electronic circuit will de-energize the electric magnet (**3**) after laps of a time interval, the duration of which depends on illumination of the object being photographed. Under action of the winding spring (**5**) of the second blade unit, the armature (**4**) is moved away from the electromagnet, and the blade unit closes the frame window. After the shutter operation is finalized, the ratchet trigger (**15**) mounted on the flange (**13**), under action of a spring, engages with the ratchet wheel (**14**) and the rotation movement is transferred from the reduction gear (**11**) via the bevel gearing (**12**) to the take-up spool (**17**) of the cassette. The film (**25**) is wound for one frame, and after this procedure, the ratchet trigger (**15**), sliding with its arm on a lobe of the cam (**16**), disengages from the ratchet wheel (**14**), and thus the film winding cycle ends.

During rotation of the cam (**31**) which is attached to the shaft of the bevel wheel (**40**), the movement is transferred via the lever (**7**) fixed on the shutter section, onto the ratchet wheel (**2**), turning it for one tooth, thus turning the frame counter dial (**1**) one gradation.

During rotation of the cam (**45**), the levers (**44**) and (**43)** start to turn and set the aperture diaphragm (**46**), retained by the electromagnet (**42**). The electronic circuit de-energizes the electromagnet (**42**), depending on the illumination of the object being photographed, and the lever (**43**), under action of a spring, releases the aperture diaphragm (**46**).

In case illumination of the object is insufficient, the cam (**30**) will short the contact (**33**) after of 1/60 of a second, the magnet will be de-energized and the blade unit will close the frame window.

4. Cassette

5.4.1. The cassette (Pic.4) is intended for storage and transport of the film having a length up to 1.2 m (not less than 30 frames).

The cassette consists of three separable units: body (**3**), cover (**1**) and take-up spool (**5**). The gear wheel of the camera rotates the take-up spool.

The moving film rotates the shaft (**4**) and is used for a visual control of film winding.

Film flattening in the image plane area is done by the pressure plate (**2**), providing a constant gap in the camera film gate.

5. Lens ZH 1/2.8

5.5.1. The photo lens ZH 1/2.8 (**1**) (Pic.1) is intended for taking pictures on a film with a size of a frame 14.8x21 mm from a distance of 3 m.

Lens focal distance 23.96 mm
Lens visual angle 54°
Aperture ratio 1:2.8
The first lens element maximum diameter 10.5 mm

The lens consists of four components: the first lens element– converging meniscus; the second – agglutinated converging meniscus; the third – biconcave lens; and the fourth – biconvex lens. Each component is fixed in its mounting.

All components are assembled using auto collimation.

5.6. Lens ZH 1/11

5.6.1. The photo lens ZH 1/11 (**8**) (Pic.1) is intended for taking pictures on 14.8x21 mm film from a distance of 3 m.

Lens focal distance 21.24 mm
Lens visual angle 65°
Aperture ratio 1:11

The antireflection coating 24I is applied on all optical surfaces of the lens elements.

The lens consists of four components:

The first – diverging meniscus, the second – semi-convex lens, the third – agglutinated biconvex component, and the fourth – biconcave lens. Each component is fixed in its mounting. All component mountings are assembled using auto collimation.

The 2 mm diameter entrance pupil is positioned in of 1 mm from the edge of the lens.

5.7. External control unit

5.7.1. The external control unit (Pic.5) controls the camera operation.

The control unit consists of the plastic casing (**7**) and the cover (**5**). Five screws (**6**) secure them.

In the casing of the control unit are found the electronic module and two rechargeable battery packs consisting of five batteries Д-0.02 and three batteries Д-0.09.

The cable (**1**) with the connection (**2**) is used to attach the control unit to the camera.

The switch (**8**) **ВКЛ – ВЫКЛ** (ON- OFF) is used for turning the power supply of the control unit on and off.

When connecting the control unit to a charger, the switch (**8**) should be in the position **ВЫКЛ** (off).

The switch (**3**) **1/30 - АВТ** (1/30 - automatic) is used to switch the exposure time setting to automatic mode – **АВТ**, and to the manual exposure time setting – **1/30** of a second.

Six openings (**4**) in the cover of the control unit are used to connect the power supply control unit (Pic.7).

The release button turns on the electronic circuit and starts the camera's electric motor.

5.8. External control unit with remote control

5.8.1. The external control unit with remote control (Pic.6) controls the camera operation. It is similar to the external control unit, shown in Pic.5. It also has the switch (**10**) **НПР – ОДН** (continuous-single) for choosing the mode of camera operation, i.e. mode **НПР** – continuous and mode **ОДН** – single. The connection (**1**) is intended for connection of the release button (**5**) (Pic.1) to the external control unit.

The switch **ВКЛ – ВЫКЛ** (**4**) is positioned on the side of the control unit. The switch (**4**) **1/30 - АВТ** consist of two keys working simultaneously.

The openings for connection of the power supply control unit are positioned on the cover in the same way as on the external control unit (Pic.5).

5.9. Power supply control unit

5.9.1. Power supply control unit (Pic.7) controls the voltage of the rechargeable batteries of the external control units of the camera.

The unit consists of the following main parts and sub units:

casing (**4**)
two covers (**3**), (**5**) made out of plastic
electronic unit

In the lower part of the unit are two three-pin male connectors (**1**) and (**2**), designed for connection with external control unit connectors via openings (**4**) (Pic.5).

There are two indicators (**6**) and (**7**) for 3V and 5V, positioned on the front cover. They indicate the status of the rechargeable batteries of the external control units.

5.10. Electrical schematic diagram of the camera and the external control unit with the remote control

5.10.1.The electrical schematic diagram of the camera (Pic.8) consists of :

light sensitive device (ФПУ) (**Д1**);

micro-assembly (**D2**), which includes the circuits that control the operation of the electromagnets of the shutter and diaphragm;

electromagnets (**Y1**) of the shutter and (**Y2**) of the diaphragm;

electric motor (**M1**);

film sensitivity switch (**S1**).

5.10.2.The electrical schematic diagram of the external control unit with remote control (Pic.9) consists of:

rechargeable batteries
release device assembled on transistors (**V1 – V5)**
switches (**S1**), (**S2**) of the automatic and manual mode of operation
power switch (**S3**)
switch (**S4**) for single and continuous shooting
release button (**S5**).

5.10.3. Charging of batteries of the external control unit is done via the contacts (**12**), (**3**) (battery GB1), (**7**), and (**6**) (battery GB2) of the connection **X2**.

5.10.4. Before starting operation of the electronic circuits (Pic.8, 9) in automatic mode, switches **S1**, **S2** of the external control unit must be set in the position **A.** Switch **S1** of the camera must be set in the position corresponding to the film sensitivity. Switch **S4** of the external control unit sets the required mode of camera operation (single or continuous).

When the button **S5 ПУСК** (start), is depressed, the release device snaps into action, and +5V and +3V voltage is supplied to the camera circuit. The release device ensures supply of electric power for 0.2-0.3 sec. (to charge the capacitor **C1**). For repeated use of the release device (in single mode photography), it is necessary to release the button **ПУСК** (start), at that moment the capacitor **C1** will discharge along the circuit **V5**, **R12**).Then the button must be depressed again.

When the electric motor of the camera starts to rotate, the contact group **S3** of the camera will close, thus blocking the release device of the external control unit. Electromagnets **Y1** of the shutter and **Y2** of the diaphragm are energized at that moment.

In case illumination of the object to be photographed exceeds the allowable value, then the control circuit of the diaphragm electromagnet de-energizes it and the diaphragm is set in the position 1:11.

Simultaneous with diaphragm motion, the shutter winds. Before the shutter begins to open, the contact group **S2** (contacts **2**, **3**) of the camera opens and the capacitor **C1** starts charging. Duration of charging depends on illumination of the object being photographed. When the capacitor is charged, the control circuit of the shutter electromagnet snaps into action. The electromagnet **Y1** is de-energized and the shutter closes.

To limit duration of maximum shutter-exposure time during low illumination of the object being photographed, two contacts in the circuit limit exposure time. After laps of 1/60 of a second from the moment of shutter opening, the contact (**1**) of the camera contact group **S2** closes. The control circuit de-energizes the electromagnet **Y1** and the shutter closes.

When film winding has ended, the camera contact group **S3** opens and the electric motor **M1** stops. The operation cycle of the camera ends.

5.11.Electric schematic diagram of the external control unit

1. The electric schematic diagram of the external control unit (Pic.10) consists of:

rechargeable batteries
release device, assembled on the transistors **V1**, **V2**
switches **S1**, **S2** of the automatic and manual modes of operation
button **S3 ПУСК** (start)
power off switch **S4**

The release device provides a power supply during all periods when the button **ПУСК** (start) is depressed.

5.12. Electrical Schematic Diagram of the Power Supply Control Unit

5.12.1. The electrical schematic diagram of the power supply control unit (pic.11) consists of two threshold devices on microchips **D1**, **D2** and the load resistors **R11**, **R12**. The load resistors create the necessary current usage, equivalent to the camera consumption current, i.e. checking of battery voltage control is done at a normal load.

When voltage drops to the value (5.1 ± 0.1)V in the 5V circuit and to the value (3.2 ±0.1)V in the 3V circuit, the light diodes **V3** and **V4** became dim, thus signaling battery discharge.

6. MARKING OF A SERIAL NUMBER

6.1.The camera casing and its wooden box should be marked with five digit numbers: first two digits designate the year of manufacture, the last three, the serial number.

7. PACKAGING

7.1 Packaging ensures the safety of the camera set while it is being transported and stored.

7.2. The camera should be packed in a box together with supplied cases, as per the packing inventory, affixed to the lid of the box.

7.3. The camera and cassettes should be put in their cases.

7.4. Before packing, the camera set should be cleaned of dust and adipose stains.

8. GENERAL HANDLING INSTRUCTIONS

8.1. The “Zakhod” camera is a complex optical-electronic instrument and needs to be handled with care and knowledge of its design and operating rules.

8.2. Before starting to work with the camera, it is necessary to get acquainted thoroughly with the technical and handling manual of the camera.

8.3. The camera set should be kept clean and should be safeguarded from sharp impacts; and penetration of dust, moisture and solar radiation. When it is not used at work, it should be kept in cases and they in their turn stored in a packing box.

8.4. When bringing the camera from a cold environment into a warm room, the camera optics can mist over; it is not advisable to clean them at that time. Misting will disappear by itself in 5-6 hours, and, when the camera is kept in its box, in 10-12 hours.

8.5. Operating conditions of the rechargeable batteries **D-0.09**, installed in the external control units, do not correspond to the requirements of ТУ (technical conditions) for their applications in the part concerning the discharge currents.

Application of the batteries in these modes of operation is authorized by the Military Detachment 68240*

8.6. After 5 years of operation (including a storage period of 3 years), it is necessary to change the electric motor E-83K.

* Military acceptance or so called “Representatives of a customer”

GETTING THE CAMERA READY FOR OPERATION

9.1. Cassette loading

9.1.1. Load the cassette (Pic.1) with film in the following mode:

1) remove the cover (**1**) from the cassette; take out the spool (**5**)

2) cut 1.2 m of film in the dark. Wind the film on a roll (with an emulsion layer inside), with a starting diameter of 5 mm. Tuck in the film's free end under the bush sleeve (**6**), with the emulsion layer inside

3) install the take-up spool and the film roll in the cassette casing (**3**). The film in the cassette should be positioned with the emulsion layer facing the frame window

4) feed the film to the side of the take-up spool for one or two frames by pressing on the film in the area of a frame window.

9.2. Getting the camera ready for operation

9.2.1. In case of the need to change the standard lens ZH 1/2.8 to the interchangeable lens ZH 1/11, unscrew the fixing screw (**16**) (Pic.2) and turn the lens counterclockwise, unscrew it and install the other one.

When working with a lens attachment, insert it in the slot (**10**) all the way to the stop at the extended position of the lever (**11**). Fix the attachment by pressing upon the lever to the complete stop.

A t t e n t i o n. When working with the camera without the attachment, the lever should be in the retracted position.

Install the loaded cassette in the camera, moving the lock button (**9**) into the position **O** (open). Push the cassette to a stop and release the button, which will move under spring action into position **3** (closed).

Set the film sensitivity switch (**1**) into the required position 180, 250, 500 (800), corresponding to the sensitivity of the film.

Set the frame counter dial to 30 using (**13**).

9.3. Getting the external control unit ready for operation.

9.3.1. Connect the power supply control unit (Pic.7) to openings (**4**) on the cover of the external control unit (Pic.5).

If both indicators (**6**) and (**7**) for 3V and 5V of the power supply control unit illuminate, the rechargeable batteries of the control unit are in operational condition.

If there is no illumination of the indicators, change the batteries and recharge them. In order to charge the batteries, connect the cable from the spare part set to the cable (**1**) of the control unit. Connect the cable connection to the charging unit, ensuring charging of the batteries 5D-0.02 and 3Д-0.09 in accordance with the requirements of technical conditions for rechargeable batteries.

A t t e n t i o n. When connecting the external control unit to the charging unit, the switch (**8**) (Pic.5) or the switch (**4**) (Pic.6) should be in the position **ВЫКЛ** (off).

When batteries are charged, check them again for efficiency, using the power supply control unit.

Connect the external control unit to the camera using the connector (**2**) (Pic.5), positioned on the flexible cable (**1**) of the control unit. In case of necessity it is possible to connect the external control unit to the camera via a cable (**7**) (Pic.1) taken from the spare part set.

Set the exposure time switch (**3**) to **АВТ** or **1/30**. Set the exposure to 1/30 of a second in manual mode in cases where illumination of the subject is not sufficient or when shooting against the light.

Getting ready for operation of the external control unit with remote control possibilities (ДУ) (Pic.6) is done in similar manner.

To obtain a remote control of the camera, connect the release button (**5**) (Pic.1) to the external control unit via the connector (**1**) (Pic.6).

Set the operation mode switch (**10**) to the necessary mode position - **НПР** or **ОДН** (continuous or single). During continuous mode of operation, the picture taking cycles will function automatically when the release button is constantly depressed. During single mode of operation the picture taking cycle will function during each subsequent depression of the release button.

10. PROCEDURES OF WORKING WITH THE CAMERA

When the preliminary procedures for getting the camera ready for photographing are done, set the switch (**8**) (Pic.5) on the external control unit to the position **ВКЛ** (on). By depressing the release button **ПУСК** (start), make three exposures for winding the light-stricken part of the film during the cassette loading. Make sure the film is winding into the cassette by rotation of the shaft (**4**) (Pic.4).

Point the camera on the subject to be photographed. Make the necessary number of photographing cycles by depressing the release button **ПУСК** (start) of the external control unit or depressing the release button (**5**) (Pic.1).

In order to prevent the last picture from being light-stricken, make at least two more cycles.

Duration of a cycle is not more than 1.5 seconds.

When working with the external control unit (Pic.5), the mode of operation depends on the time of the release button depression. When a depression time is more than 1.5 seconds, the camera will make a series of cycles, the number of which depends on the time of the release button depression. When the depression time is less 1.5 seconds, the camera will make one cycle.

It is necessary to keep the external control unit in normal climatic conditions and to connect it to the camera just before photographing procedure.

When photographing is finished, set the switch (**8**) (Pic.5) on the external control unit into the position **ВЫКЛ** (off).

11. POSSIBLE MALFUNCTIONS AND METHODS OF THEIR ELIMINATION

11.1. In case defects are not possible to correct without special equipment and without a skilled technician, the camera should be sent to a special repair shop or to the manufacturer.

The list of possible malfunctions is given in the Table 11.1.

Table 11.1.

Malfunction name	Possible cause	Method of elimination	Note

1. Blurred image on the film	Outer surfaces of the lens are dirty	Clean the soiled spots with a cotton swabs moistened in ethyl alcohol.	0.005L
2. The shutter does not open, the film is not winding	1. Batteries of the external control unit are discharged	Change the batteries.	
	2. Faulty cable of the external control unit	Check the cable using a multimeter and correct the cause.	
	3. The lens attachment is not properly installed	Install the lens attachment properly	

Malfunction name	Possible cause	Method of elimination	Note

3. The shutter does not open, the film is winding	The time setting contacts in the camera are dirty	Wipe the contacts with ethyl alcohol	0.003L
4. During depression of the release button **ПУСК** (start) the motor starts to rotate momentarily with a subsequent stop	The cycle contacts are dirty or oxidized	Wipe the contacts with ethyl alcohol	0.003L
5. The camera shutter is operating at exposure time “B” only regardless of the exposure switch setting	The power supply of 5V is not fed into the electric circuit.	Check condition of the cable of the camera and the external control unit. Using the power supply control unit, check the condition of the rechargeable batteries 5D-O.02 and charge them or change them if necessary	
6. Duration of automatic shutter exposure time has changed	Wear of shutter blade grooves	Change the blades of the shutter or of the drive mechanism	

21.1. To ensure a continuous operational life of the camera, it is necessary to know its design, to fix its malfunctions in proper time and to observe its handling rules.

It is necessary to perform a maintenance inspection of the camera and all its accessories once in 1.5-2 months. Duration of an inspection is not more than 10 minutes.

A maintenance inspection consists of checking the external condition and fixing small defects without disassembling the camera such as:

1) inspection of the camera and cleaning of the film track and cassettes

2) wiping and cleaning of the external optical surfaces

3) checking that the cassettes are fault-free

4) checking that the removable back cover can be fixed reliably to the camera and the lock operation is fault free.

External optical surfaces of the lens should be kept clean. It is necessary to perform a regular inspection and cleaning of optical parts before starting to work with the camera. It is also necessary to be very cautious while removing dust from the lens element, because hard particles can scratch the glass surface. Dust should be removed with a squirrel hair brush.

Contamination of adipose matter, traces of moisture and so on should be removed with a soft cloth moistened with ethyl alcohol or petroleum ether in a quantity of 0.005 L. Cleaning is done by wiping the lens with a circular movement from the center to the periphery. The above mentioned work is done by a non-skilled specialist and does not require use of special tools.

It is recommended to inspect the camera with partial disassembly after completion of 10000 operating cycles. This work should be done in a special repair shop to check the camera's operational efficiency.

During partial disassembly of the camera, it is necessary to check the following:

1) condition of gear wheels
2) presence of dirt and corrosion
3) state of lubrication
4) condition of decorative trimming
5) tightening of attaching screws
6) condition of grooves and fixing of the shutter blades

This work is performed by a skilled specialist, having a professional skill of a metalworker in mechanical assembly of grade 3-5.

If corrosion is found on camera parts, as well as patina, spots and other defects, clean these defects and wipe them with a cotton swab moistened in oil 132-08 GOST 18375-73 or grease OKB-122-7 GOST 18179-72. In case of necessity before applying lubrication, wash the gear wheels in aviation gasoline of grade B-70 in a volume of 0.01L.

It is recommended to do a camera disassembly in a specialized repair shop after completion of 50000 cycles and to do a preventive repair with a change of worn-out parts and units. After the camera reassembly it is necessary to perform its set-up and adjustment according to the instruction BL3.821.097 I by a member of the Military Detachment 68240 or of the manufacturing plant post office box V-8450.

When a camera operates less than 50000 working cycles, it does not have any essential changes of its parameters.

In order to check the lens and its proper adjustment, make control exposures and check camera resolution. If adjustment equipment is not available, use the comparison method.

Check the exposure-control device in the following order:

1) check voltage of the rechargeable batteries of the external control unit (see Para 9.3.1)

2) get the camera ready for photographing

3) set the film sensitivity by moving the switch (**1**) (Pic.2) into the corresponding position

4) take a picture of an object having different brightness within the limit of the operational range of brightness

5) make an estimate of the operation of the exposure-control unit by examining the developed film.

When a camera is stored for a long period of time, it is necessary to turn on and test its operation regularly and not less than once a quarter.

13. TRANSPORTATION

1. It is permissible to transport the cameras, packed in wooden boxes, by any mode of transport:

1) by motor transport in covered trucks on unpaved and country roads for a distance up to 500 km at a speed not exceeding 40 km/hr.

The boxes should be rigidly attached to the truck body;

2) by motor transport in covered trucks on roads having smooth, hard surface for a distance up to 2000km at a speed not exceeding 80 km/hr. The boxes should be rigidly attached to the truck body;

3) by railroad in covered railroad cars, without any limitation as to a speed and distance. The boxes should be rigidly attached to the car floor;

4) by air, without limitation as to speed or a distance;

13.2. It is permissible to transport the cameras at the ambient air temperature from -40°C to +50°C.

15.3. If the cameras are taken from cold environmental conditions to a warm room, they should be unpacked not earlier than in 12 hours in order to prevent misting.

14. STORAGE RULES

14.1. The accepted* and sealed articles, packaged in cardboard boxes, should be stored indoors in a dry environment in cabinets or on racks away from heating systems or windows.

14.2. The air in a storage area should not be saturated with chemical mixtures, fumes, gases, alkalis, etc.

14.3. The temperature in a storage area should not be lower than +5°C or higher than +35°C. Air humidity should not exceed 80%.

14.4. It is necessary to pay attention to warnings attached to the wooden boxes during their installation on the racks.

*Note of a translator:
Inspection, acceptance and sealing was done by Military Acceptance (military representatives)