BDPA-07

DETECTING UNIT OF ALPHA RADIATION

Operating manual
BICT.418251.003-02 РЭ

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This operating manual (the OM) is intended to inform the user about principles of operation, rules of application, maintenance, storage and shipping of the BDPA-07 detecting unit of alpha radiation.

The OM contains the following abbreviations:
A –a numeric value of measured surface alpha-particles flux density 1/(cm^2×min)
DLCD – digital liquid crystal display.

1 DESCRIPTION AND OPERATION

1.1 Purpose of use of the BDPA-07 detecting unit

The BDPA-07 detecting unit of alpha radiation (hereinafter called the detecting unit) is designed to search for alpha radiation sources and measure surface alpha-particles flux density.

The detecting unit is used with the MKS-07 "POSHUK" search dosimeter-radiometer ТУ У 22362867.003-99. The detecting unit can also be used as a part of computer-aided systems of radiation control.

1.2 Technical specifications

1.2.1 Key specifications are presented in the Table 1.1.

Table 1.1 - Key specifications of the detecting unit

Name	Unit of measurement	Standardized value according to the specifications
1 Measurement range of surface alpha-particles flux density	1/(cm^2×min)	$1 – 10^5$
2 Basic relative permissible error limit of surface alpha-particles flux density measurement at ^{239}Pu calibration with confidence probability of 0.95	%	15+10/A , where A is a numeric value of measured surface flux density, 1/(cm^2×min)
3 Maximum gamma radiation exposure dose rate that does not introduce complementary error in measurement of surface alpha-particles flux density, not more than	mR/hour	10^4
4 Operating supply voltage of the detecting unit from the external regulated power supply	V	3.30±0.05
5 Useful current of the detecting unit for overall measurement range of surface alpha-particles flux density, not more than	mA	50
6 Setup time of operating mode of the detecting unit, not more than	min	1
7 Unstable readings of the detecting unit during 6-hour continuous operation, not more than	%	7
8 Energy range of surface alpha-particles flux density	MeV	4 - 8

Table 1.1 (continued)

Name	Unit of measurement	Standardized value according to the specifications
9 Complementary permissible error limit of measurement, caused by ambient temperature change from – 25 °C to 55 °C	%	5 per each 10 °C deviation from 20 °C
10 Dimensions of the detecting unit, not more than	cm	Ø10.4 x 5.0
11 Total area of entrance window (three holes), not less than	cm^2	21.0
12 Weight of the detecting unit Note – Weight is stated without the telescopic bar holder (0.036 kg) and the protective cover for storage and shipping (weight 0.080 kg)	kg	0.4

1.2.2 Use environment.

1.2.2.1 Concerning the resistance to climatic and other environmental factors, the detecting unit meets the requirements outlined below.

1.2.2.2 The detecting unit is resistant to the influence of the following climatic factors:

- air temperature from – 25 °C to 55 °C;
- relative humidity up to 100 % at 30 °C temperature, non-condensing;
- atmospheric pressure from 84 kPa to 106.7 kPa.

No requirements to other climatic factors.

1.2.2.3 The detecting unit is resistant to sinusoidal vibrations.

1.2.2.4 The detecting unit is resistant to shocks with the following parameters:

- shock pulse duration – from 5 ms to 10 ms;
- number of shocks - 1000±10;
- maximum shock acceleration – 100 m/s^2.

1.2.2.5 The detecting unit in shipping container is resistant to the influence of:

- ambient air temperature from - 40 °C to 60 °C;
- relative humidity up to (95 ± 3) % at 35 °C temperature;
- shocks with acceleration of 98 m/s^2, shock pulse duration of 16 ms, and number of shocks – 1000±10.

1.2.2.6 The detecting unit is resistant to the influence of magnetostatic fields or alternating magnetic fields (50 Hz ±1 Hz) with 400 A/m voltage.

1.2.2.7 The detecting unit is resistant to the influence of gamma radiation with exposure dose rate up to 1.0 Sv/hour during 5 min.

1.3 Delivery kit of the detecting unit

The delivery kit of the detecting unit consists of units and maintenance documentation, given below.

1.3.1 BICT.418251.003-02 BDPA-07 detecting unit with protective cover..... 1 pc.

1.3.2 BICT.301524.001 Holder for fastening to the telescopic bar..... 1 pc.

1.3.3 BICT.418251.003-02 РЭ Operating manual..... 1 copy.

1.3.4 Packing (shared with the MKS-07 “POSHUK” dosimeter..... 1 pc.

1.4 Design and operation principle of the detecting unit

1.4.1 Design description.

1.4.1.1 The detecting unit is designed as a compact measuring instrument of cylindrical form. On the top surface of the device (1) (according to Figure 1) an output terminal with an access plug (2), a bushing with a central threaded hole (3) (used to join the holder to the telescopic bar) are located, labeling is inscribed. The bottom surface of the device is closed with a removable protective cover (4), which is demonstrated during use by releasing a spring (5) from a hook of the protective cover.

Figure 1

The bottom surface of the device (according to Figure 2) contains three round holes with gratings (6) that protect the alpha radiation detectors (7) from mechanical damage.

Figure 2

Caution.

The detecting unit uses the alpha radiation detectors (counters of СИ9АМ type) with thin (circa 10 μm) mica membranes, damage of which causes failure of the device. In light of the abovementioned, during use you should:

-be careful using the device;

-avoid examining long, thin and sharp objects that are smaller than windows of gratings;

-store and ship the device only with protective cover.

1.4.1.2 Holder for fastening the telescopic bar ensures comfortable handling of the unit in hard-to-reach places. According to Figure 3, the holder (8) is inserted in the central threaded hole of the bushing on the top surface of the detecting unit and is nutted up (9). The holder is fixed to the telescopic bar (10) with the help of the bayonet connection. Necessary position of the telescopic bar to the device (within the 180º angle) is fixed with the screw (11).

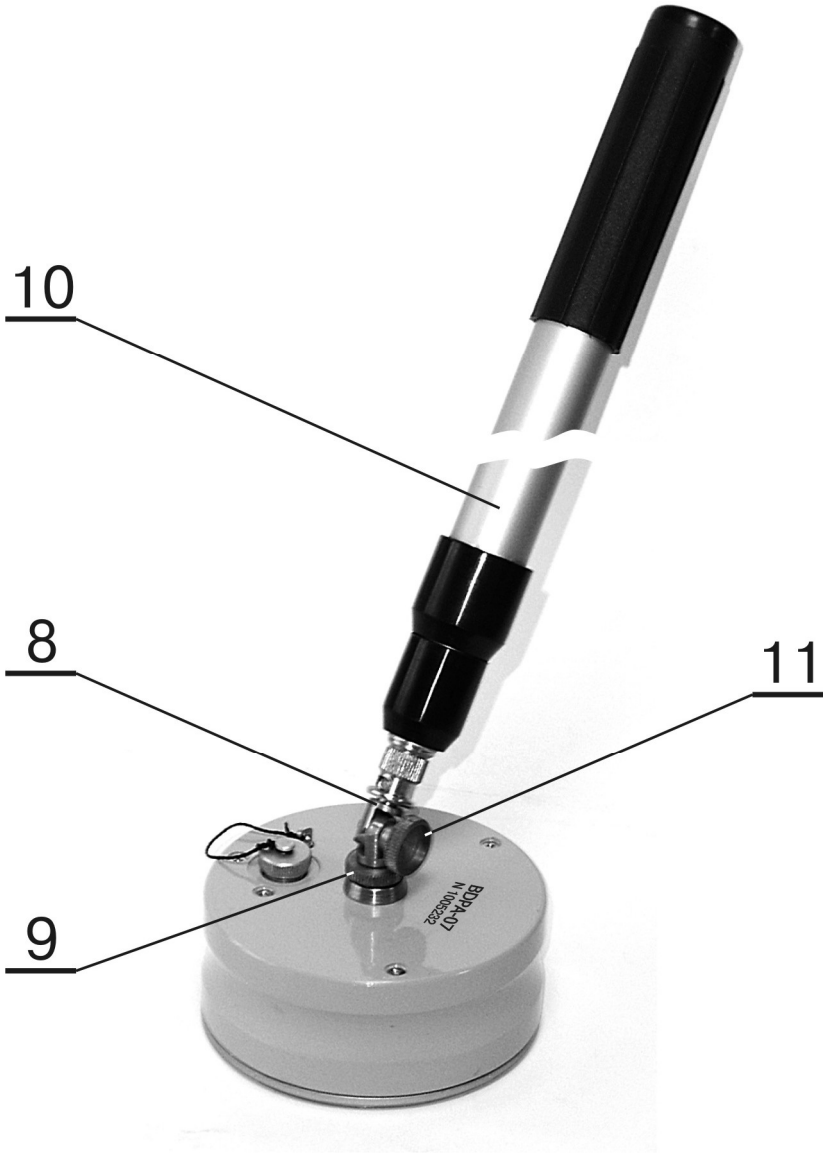

Figure 3

1.4.2 Operation principle of the detecting unit.

Operation of the detecting unit is based on the method of alpha radiation transformation into the voltage pulse train on the detector's outlet.

Three counters of СИ9АМ type that work in the corona discharge mode are used as the detector in the detecting unit.

For corona discharge ignition, high voltage of 500 V is applied to the counters. Voltage is formed with the scheme based on the multivibrator with diode-capacitive voltage multiplier.

Pulses from alpha-particles on the counters outlets are separated from noise. They are formed according to the amplitude and sent to the detecting unit outlet.

1.5 Measuring instruments, tools and equipment

1.5.1 The list of measuring instruments, tools and equipment necessary for control, setting and current repair of the detecting unit is presented in the Table 1.2.

Table 1.2 - List of measuring instruments, tools and equipment

Name	Standardized document or main technical requirements
1 MKS-07 "POSHUK" search dosimeter-radiometer	ТУ У 22362867.003-99
2 В7-21А Digital voltmeter	Measurement range of direct current intensity from 10^{-7} A to 1 A
3 ИПУ-12У2 DC power source	Output voltage - from 0 V to 30 V. Output current - from 0 A to 2.5 A
4 Standard plane sources of alpha radiation of 5П9 type containing ^{239}Pu isotope	Surface alpha-particles flux density range from 1 to 50000 1/(cm^2×min)
Note - Other measuring instruments that satisfy the specified accuracy are permitted	

1.6 Labeling and sealing

1.6.1 The case of the detecting unit is marked with engraving according to the design document of the producer enterprise. Labeling contains:

- trademark of the producer enterprise;
- design letter and type of the detecting unit;
- serial number according to the numbering system of the manufacturer;
- production date.

Note – Trademark of the producer enterprise and production date can be printed on the individual packing of the detecting unit.

1.6.2 Sealing of the detecting unit is performed by the producer enterprise.

1.6.3 Removal of seals and repeated sealing is performed by the organization in charge of repair of the units.

1.7 Packing

1.7.1 The maintenance documentation is placed in a plastic sachet which is welded after packing performed. The detecting unit and the maintenance documentation are packed in a specially provided place in the packing bag of the MKS-07 "POSHUK" dosimeter.

1.7.2 During transportation of the detecting units the rules applied to all other component parts of the MKS-07 "POSHUK" dosimeter should be followed.

2 PROPER USE

2.1 Operating limitations

2.1.1 The detecting unit is a complex electronic-physical device that should be competently serviced.

2.1.2 Study this document before you start using the detecting unit. All requirements stated in the technical documents for the detecting unit should be precisely met.

2.1.3 The detecting unit should operate under conditions that do not fall outside the use requirements outlined in section 1.2.2.

2.2 Preparation of the detecting unit for operation

2.2.1 Safety measures.

2.2.1.1 The detecting unit contains no external parts exposed to voltages hazardous for life.

2.2.1.2 During calibration and testing of the detecting units, if operating with ionizing radiation sources, the radiation safety requirements stated in valid regulatory documents should be met.

2.2.2 Volume and order of external examination.

Before using the detecting unit, unpack it and check if the delivery kit is complete. Examine for mechanical damage.

2.2.2.2 Before using the detecting unit that was on temporary closing-down, re-activate it and check its operability.

2.2.2.3 Register the re-activation and putting the detecting unit in operation in the corresponding sections of the OM.

2.2.3 Guidelines on switching on and testing the detecting unit with description of testing procedure of the detecting unit in operation.

2.2.3.1 Prepare for operation the MKS-07 “POSHUK” search dosimeter-radiometer (hereinafter the dosimeter). Do the following:

- take the control panel of the dosimeter out of the packing case;
- connect the connecting cable (included in the dosimeter’s kit) to the corresponding inlet of the control panel of the dosimeter.

2.2.3.2 Prepare the detecting unit for operation. Do the following:

- unpack the detecting unit;
- remove the protective cover from the detecting unit by releasing the spring from the hook of the protective cover according to Figure 1;
- remove the plug from the output terminal of the detecting unit;
- connect the detecting unit to the cable, which has already been connected with one end to the control panel of the dosimeter.

2.2.3.3 Switch the control panel of the dosimeter on and observe the “α” symbol and “10^3/(cm^2×min)” dimension of quantity on the liquid crystal display of the control panel (hereinafter the LCD) if the value of measured surface alpha-particles flux density equals to or is more than a thousand partic./(cm^2×min). No dimension of quantity will be displayed in case the values are less than a thousand part./(cm^2×min).

2.2.3.4 To examine the objects in hard-to-reach places connect the telescopic bar according to Figure 3.

2.2.4 List of possible troubles and troubleshooting.

2.2.4.1 The list of possible troubles and troubleshooting is presented in the Table 2.1.

Table 2.1 - List of possible troubles and troubleshooting

Trouble	Probable cause	Troubleshooting
1 The control panel of the dosimeter does not identify the detecting unit	The cable between the detecting unit and the control panel of the dosimeter is damaged	Repair the cable
2 The control panel of the dosimeter identifies the detecting unit, but at presence of alpha radiation source, no measurement results are displayed	The cable between the detecting unit and the control panel of the dosimeter is damaged	Repair the cable
3 The control panel of the dosimeter identifies the detecting unit, but at presence of alpha radiation source, no measurement results are displayed	The mica membranes of alpha radiation detectors are damaged	Replace damaged detectors

2.2.4.2 Troubles during use are registered in Appendix D of this operating manual.

2.2.4.3 At failure to eliminate the troubles presented in the Table 2.1, or at detection of more complicated faults, the detecting unit should be sent for repair to the repair services or to the producer enterprise.

2.3 Use of the detecting unit

2.3.1 Safety measures during use of the detecting unit.

2.3.1.1 Safety measures during use of the detecting unit fully comply with the requirements presented in section 2.2.1 of the OM.

2.3.1.2 Direct use of the detecting unit is not dangerous for the maintenance personnel and is environmentally friendly.

2.3.2 Operation procedure of the detecting unit.

The detecting unit can be used in two operating modes:

- search for alpha radiation sources;
- measurement of surface alpha-particles flux density.

2.3.2.1 To search for alpha radiation sources do the following:

- unpack the detecting unit;
- remove the protective cover from the detecting unit;
- remove the plug from the output terminal of the detecting unit;
- connect the detecting unit to the control panel of the dosimeter with the help of the connecting cable;
- attach the telescopic bar to the detecting unit with the help of the bayonet connection;
- set the detecting unit in operating position on the telescopic bar and fix it with threaded clamps;
- set the audio alarm threshold at the level of not more than 1.0 part./(cm^2×min);
- place the detecting unit at the minimum distance from the surface of the object to be examined;
- search for alpha radiation sources using audio alarm of the dosimeter, flashing of segments of the analog intensity indicator and readings increment on the LCD.

2.3.2.2 To measure surface alpha-particles flux density, do the following:

- unpack the detecting unit;
- remove the protective cover from the detecting unit;
- remove the plug from the output terminal of the detecting unit;
- connect the detecting unit to the control panel of the dosimeter with the help of the connecting cable;
- attach the telescopic bar to the detecting unit with the help of the bayonet connection;
- set the detecting unit in operating position on the telescopic bar and fix it with threaded clamps;
- place the detecting unit at the minimum distance from the surface of the object to be examined;
- read the measurement results from the LCD on the control panel of the dosimeter. If required to get accurate results, or in case the levels of alpha-contamination are low, measurement should be carried out in the "Start-Stop" or "Precisely" modes when using the MKS-07 "POSHUK" dosimeter-radiometer.

It is worth considering, that if measured values of flux density are within the range from 0.1 to 999.9 part./(cm^2×min), measurement results of surface alpha-particles flux density on the LCD will be indicated without dimension of quantity symbol „10^3/(cm^2×min)" and will be presented on the LCD in the form of XXX.X, where X is decimal digits on the LCD. Their value from right to left will constitute one-tenth of the particles, unities, the tens, the hundreds of particles correspondingly. In the event the measured value of surface alpha-particles flux density exceeds 999.9 part./(cm^2×min), the LCD will switch to the mode of indication with dimension of quantity symbol „10^3/(cm^2×min)", and the result will be presented in the form of X.XXX or XX.XX, where X is decimal digits on the LCD. In such a case the significancy of digits to the left from point will constitute the thousands and tens of thousands of part./(cm^2×min).

3 MAINTENANCE

3.1 Technical maintenance of the detecting unit

3.1.1 General instructions.

The list of operations during technical maintenance (hereinafter the TM) of the detecting unit, order and peculiarities of operational phases are given in the Table 3.1

Table 3.1 - List of operations during maintenance

List of operations	Maintenance type			OM item No.
	during		during long-term storage	
	everyday use	periodical use (annually)		
External examination	-	+	+	3.1.3.1
Delivery kit completeness check	-	-	+	3.1.3.2
Operability check	+	+	+	3.1.3.3
Damaged covering repair	-	+	+	3.1.3.4
Verification	-	+	+	3.2
Registration of operations in the performance records table	-	+	-	3.1.3.5
Note – "+" symbol means the operation is applicable during this maintenance type, "-" symbol means the operation is not applicable.				

3.1.2 Safety measures.

Safety measures during maintenance fully comply with safety measures presented in section 2.2.1 of the OM.

3.1.3 Maintenance procedure of the detecting unit.

3.1.3.1 External examination.

3.1.3.1.1 External examination of the detecting unit should be performed in the following order:

а) check the technical condition of the detecting unit surface, integrity of seals, absence of scratches, traces of corrosion, and surface damage;

б) check the condition of the connector in the cable connection point.

Clean the metal parts of the detecting unit with the oiled cloth after operation in the rain or after special treatment (deactivation).

3.1.3.1.2 Deactivation of the case surface and component parts of the detecting unit is performed if required.

Deactivate the surface of the component parts of the detecting unit by cleaning it with decontamination solution and by airing the detector's surfaces under protective gratings with the stream of compressed air.

Boric acid (H_3BO_3 12÷16 g/l) is recommended to be used as the decontamination solution. The following decontamination solutions are also permitted:

- 5 % solution of citric acid in ethyl alcohol C_2H_5OH (96 % concentration);
- boric acid – 16 g/l, $Na_2S_2O_3 \cdot 5H_2O$ – 1 % solution;
- standard synthetic detergents.

Expenditure rate of the decontamination solution during deactivation of the detecting unit surface is 0.2 l. Use cotton gloves, surgical gloves and sheeting during deactivation.

To deactivate, wipe thoroughly the contaminated areas of the detecting unit surface with a cloth moistened with decontamination solution, then with a cloth moistened with warm water and wipe dry.

Notes

1 Before deactivating the detecting unit, put on cotton gloves and rubber (surgical) gloves, observing safety requirements for operation with chemical solutions.

2 Deactivation of the detecting unit can be done according to the procedure established at the object of use for ionizing radiation measuring instruments.

3 During deactivation protect mica membranes from mechanical damage.

3.1.3.2 Delivery kit completeness check.

Check if the delivery kit of the detecting unit is complete according to section 1.3. Check the technical condition, the placement of the component parts of the detecting unit, and the presence of the maintenance documentation.

3.1.3.3 Operability check of the detecting unit.

3.1.3.3.1 Operability check of the detecting unit in the process of its use is performed according to 2.2.4.

3.1.3.3.2 The procedure of pre-repair fault detection and rejection.

Use the following criteria to evaluate the necessity of sending the detecting unit for repair and type of repair:

- for mid-life repair:

a) deviation of parameters from control values during periodical verification of the detecting unit;

b) minor defects of the connector that do not affect its hermiticity and correct readings of measurement results;

- for major repair:

a) non-operating measuring channel;

б) mechanical damages that affected the detecting unit case or the connector, and damages that affected the integrity of membranes of alpha radiation detectors.

3.1.3.4 Damaged covering repair.

Repair damaged covering of the detecting unit case with the help of the НЦ-1125 enamel. Choose carefully the proper tint to try to match the color of the lacquered covering. Clean the area that should be enameled. Brush on a level layer of paint on the surface.

3.1.3.5 Registration of operations in the performance records table.

Register actual operation hours of the detecting unit in Appendix A of the OM.

3.2 Verification of the detecting unit

The detecting units should be verified after manufacture, repair and during use (periodical testing at least once a year).

3.2.1 Testing operations.

During testing, the operations presented in the Table 3.2 should be performed.

Table 3.2 - Verification operations

Operation name	Verification procedure No.
1 External examination	3.2. 4.1
2 Testing	3.2. 4.2
3 Calculation of basic relative permissible error limit at measurement of surface alpha-particles flux density	3.2.4.3

3.2.2 Verification facilities.

The following measuring instruments and equipment should be used during testing:

- ТУ У 22362867.003-99 MKS-07 "POSHUK" search dosimeter-radiometer;
- alpha radiation standard plane sources of 5П9 type, containing ^{239}Pu isotope;
- MB-4M aspirated psychrometer;
- M-67 control aneroid barometer.

Usage of other measurement equipment that meets the specified accuracy is allowed.

3.2.3 Verification conditions.

Verification should be carried out in compliance with the following conditions:

- ambient air temperature in the range of (20±5) ^{o}C;
- relative air humidity in the range of (65±15) %;
- atmospheric pressure from 84 kPa to 106.7 kPa;
- natural background level of gamma radiation, not more than 0.25 μSv/h.

3.2.4 Verification procedure.

3.2.4.1 External examination.

During external examination the detecting unit should meet the following requirements:

- the delivery kit should be completed as described in section 1.3 of the OM;
- labeling should be accurate;
- QCD seals should not be violated;
- the detecting unit should be free from mechanical damage that may affect its performance.

Note – The delivery kit completeness is checked only at manufacture.

3.2.4.2 Testing.

The detecting unit should be tested according to section 2.2.3 of the operating manual.

3.2.4.3 Calculation of basic relative error at measurement of surface alpha-particles flux density.

3.2.4.3.1 Prepare the detecting unit for operation according to section 2.2.3.2 of the operating manual and measure personal background of the detecting unit in the "Precisely" mode with the attached protection cap during measurement time not less than 5 min.

3.2.4.3.1.1 For automatic compensation of personal background of the detecting unit press and hold the DOSE button until the flashing "γ" symbol appears.

3.2.4.3.2 Place the detecting unit with the removed protection cap at the minimum distance over the surface of the standard plane source of alpha radiation of 5П9 type, which creates surface alpha-particles flux density with the value in the range from 1.0 part./(cm^2×min) to 50 part./(cm^2×min).

3.2.4.3.3 Measure surface alpha-particles flux density in the "Precisely" mode during the averaging time not less than 5 min with the help of the MKS-07 "POSHUK" dosimeter in compliance with the technical specification and its operating manual.

Calculate the average arithmetical value of five observations at measurements of surface alpha-particles flux density. Register the received readings in the protocol.

Calculate the basic relative error at measurement of surface alpha-particles flux density.

3.2.4.3.4 Repeat the operations according to 3.2.4.3.3 by placing the detecting unit over the surface of the standard plane source of alpha radiation of 5П9 type, which creates surface alpha-particles flux density with the value in the range from 500 part./(cm^2×min) to 1000 part./(cm^2×min) during the averaging time of 1 min.

3.2.4.3.5 Repeat the operations according to 3.2.4.3.3 by placing the detecting unit over the surface of the standard plane source of alpha radiation of 5П9 type, which creates surface alpha-particles flux density with the value in the range from 10000 part./(cm^2×min) to 100000 part./(cm^2×min) during the averaging time of 1 min.

3.2.4.3.6 Calculate the basic relative error limits at measurement of surface alpha-particles flux density in the operative range according to the formula:

$$\delta_B = 1{,}1\sqrt{\theta_E^2 + \theta_X^2}\,, \qquad (1)$$

where:

Θ_E – is the error of alpha radiation standard plane sources calibration of 5П9 type relative to surface alpha-particles flux density;

Θ_X - is the basic relative error at measurement of surface alpha-particles flux density.

3.2.4.3.7 The detecting unit is acknowledged to have passed the testing, if the limits of basic relative error at measurement of each value of surface alpha-particles flux density do not exceed (15+10/A) %, where A is a numeric value of surface alpha-particles flux density.

3.2.4.4 Presentation of verification results.

3.2.4.4.1 Positive results of primary or periodic verification are presented as follows:

1) primary verification is registered in the "Certificate of acceptance" section;

2) periodic verification is registered in the issued certificate of the established form, or in the table of Appendix E of this OM.

The results of primary verification of the detecting unit are registered in the Table 3.3.

Table 3.3 – Primary verification of key specifications

Verified specification		Actual value
Name	Standardized value	
Basic relative permissible error limit at measurement of surface alpha-particles flux density at ^{239}Pu calibration with confidence probability of 0.95 % - in the range from 1 to 10 1/(cm^2×min) - in the range from 10 to 100 000 1/(cm^2×min)	15+10/A , where A is a numeric value of measured surface alpha-particles flux density, 1/(cm^2×min) 15	

3.2.4.4.2 The detecting units that do not meet the requirements of the verification procedure are not allowed for manufacture and use, and get the certificate of inadequacy.

4 CERTIFICATE OF ACCEPTANCE

The BDPA-07 detecting unit of alpha radiation with _____ serial number is tested and accepted for use.

Date of manufacture _____

Stamp here Quality Control Department: _____
(signature)

Verification mark here

State Verification Officer: _____
(signature)

5 PACKING CERTIFICATE

The BDPA-07 detecting unit of alpha radiation with _____ serial number is packed at the PE "SPPE "Sparing-Vist Center" enterprise in accordance with the requirements stated in section 1.7.

Date of packing _____

Stamp here Packed by: _____
(signature)

Packed product accepted by: _____
(signature)

6 WARRANTY

6.1 The manufacturer warrants that the detecting unit meets the technical requirements, provided that the user observes the operating, shipping and storage conditions described in the BICT.418251.003-02 РЭ operating manual.

6.2 The warranty period of the detecting unit shall terminate and be of no further effect in 24 months after the date of putting it into operation or after the warranty period of storage terminates.

6.3 The warranty period of storage of the detecting unit is 6 months after the manufacture date.

6.4 The warranty period is prolonged for the time when the detecting unit has been under warranty repair.

6.5 After the warranty period is terminated, the repair of the detecting unit is performed under separate contracts.

6.6 Warranty and post-warranty repair is done only by the manufacturer.

6.7 If the mechanical damage is detected or the seals are removed, the repair is done at the customer’s expense.

6.8 Failure of batteries after their warranty terminates is not the basis for claims.

7 REPAIR

7.1 In case of failure or troubles during the warranty period of the detecting unit, the user should draw up a statement about the necessity of repair and deliver the detecting unit to the manufacturer at the address:

PE "SPPE "Sparing-Vist Center"
33 Volodymyr Velyky Str.,
Lviv 79026, Ukraine
Tel.: (+38032) 242 15 15,
Fax: (+38032) 242 20 15.

7.2 All claims are registered in the Table 7.1.

Table 7.1

Date of failure	Claim summary	Action taken	Note

7.3 Information about repair of the detecting unit is registered in the table of the Appendix F of the operating manual.

8 STORAGE AND PUTTING IN PROLONGED STORAGE

8.1 Before putting in operation, the detecting unit should be stored in the packing of the producer enterprise in storehouses under special conditions. The storage period should not exceed one year. Shipping time is included in the storage period of the device.

8.2 If necessary to prolong the storage period, or if the storage conditions are harsher than stated in section 8.1, the consumer should temporarily close the detecting unit down. Temporary closing-down according to the B3-10 protection option is recommended. Silicagel, used during temporary closing-down, is recommended to be placed into fabric bags or paper packages. It is allowed to perform not more than two temporary closing-downs. Before putting in prolonged storage or repeated use, silicagel should be dried. Total time of the detecting unit storage with the account of the repeated closing-down should not exceed 5 years.

8.3 Additional information on storage, check during storage and maintenance of the detecting unit is registered in Appendices B, C, G of the OM.

9 SHIPPING

9.1 The detecting units should be shipped under the conditions similar to those presented in 1.2.2.5.

9.2 The detecting units can be shipped by railway, motor, water and air transport. When shipped by railway transport, the detecting units should be placed in a box car. When carried by motor transport, they should be placed in a closed car or van, by water transport – in a ship's hold, and by air transport – in pressurized compartments.

9.3 During shipping of the detecting units, observe handling marks inscribed on the shipping containers.

9.4 Total shipping time of the detecting units in packing of the producer enterprise should not exceed one month.

9.5 Canting is forbidden.

10 DISPOSAL

Disposal of the detecting unit is performed as follows: metals are recycled or melted, and plastic parts are dumped.

Disposal of the detecting unit is not dangerous for the service personnel, and is environmentally friendly.

The detecting unit should be disassembled in accordance with the procedure established by the user enterprise.

APPENDIX A

OPERATION REGISTER

Date	Purpose for operation	Time of switching on	Time of switching off	Operation duration

APPENDIX B

PUTTING IN PROLONGED STORAGE AND REMOVAL FROM STORAGE

Date of putting in prolonged storage	Storage method	Date of removal from prolonged storage	Name of the enterprise in charge of putting in, or removing of the device from prolonged storage	Date, position and signature of the responsible official

APPENDIX C
STORAGE

Date		Storage conditions	Position, name and signature of the responsible official
of placing in storage	of removing from storage		

APPENDIX D

TROUBLE RECORD DURING USE

Date and time of trouble Operating mode	Type (external manifestation) of trouble	Cause of trouble, number of operation hours of the failed element	Action taken and claim note	Position, name and signature of the person responsible for solving the problem	Note

APPENDIX E
PERIODIC VERIFICATION OF KEY SPECIFICATIONS

Verified specification		Verification date					
Name	Value according to the technical requirements	20		20		20	
		Actual value	Measured by (position, signature)	Actual value	Measured by (position, signature)	Actual value	Measured by (position, signature)
Basic relative permissible error limit at measurement of surface alpha- particles flux density at ^{239}Pu calibration with confidence probability of 0.95 %	15+10/A , where A is a measured value of surface alpha-particles flux density, 1/(cm^2×min)						
- in the range from 1 to 10 1/(cm^2×min)							
- in the range from 10 to 100 000 1/(cm^2×min)	15						

Verified specification		Verification date					
Name	Value according to the technical requirements	20		20		20	
		Actual value	Measured by (position, signature)	Actual value	Measured by (position, signature)	Actual value	Measured by (position, signature)
Basic relative permissible error limit at measurement of surface alpha- particles flux density at ^{239}Pu calibration with confidence probability of 0.95 %	15+10/A , where A is a measured value of surface alpha-particles flux density, 1/(cm^2×min)						
- in the range from 1 to 10 1/(cm^2×min)							
- in the range from 10 to 100 000 1/(cm^2×min)	15						

APENDIX F
REPAIR

Name and type of the component part		
Reason for repair		
Date	of arriving for repair	
	of repair completion	
Name of the repair organization		
Number of hours worked before repair		
Type of repair		
Name of repair		
Position, name and signature of the responsible official	who performed the repair	
	who accepted after repair	

APPENDIX G
VERIFICATION AND INSPECTION RESULTS

Date	Type of verification or inspection	Result of verification or inspection	Position, name and signature of the person responsible for verification	Note