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PROPOSED METHODS
For
demilitarization and/or destruction of cluster munitions

Sofia
2013

I. AIM.
Proposals on recommended methods for cluster munitions demilitarization and/or destruction.

II. BASIS FOR PREPARATION OF RECOMMENDED METHODS.
Minister of Defence order No. R-125/28.03.2013.

III. INTRODUCTION.
A Convention on Cluster Munitions was ratified by a law, approved by 41st National Assembly on 10 February 2011, and enters into force for the Republic of Bulgaria on 01.10.2011. Under the provisions of the Convention, the Republic of Bulgaria undertakes to destroy or ensure destruction of all cluster munitions referred in the Convention as soon as possible, but not later than eight years after its entry into force for the Republic of Bulgaria.
Cluster munitions have been removed from active service in the Bulgarian Army by the Minister of Defence order No. OH-177/07.03.2012, and were decommissioned by Chief of Defence order No. ZNO-86/20.03.2013.

IV. SPECIFICATION.
Bulgarian Armed Forces do not own a documentation concerning construction of cluster munitions set for demilitarization and/or destruction. The available documentation is only about exploitation matters and does not cover all kinds of cluster munitions. For that reason, Internet was used as an additional source of information when composition, tactical and technical data and exploitation analysis have been done for different kinds of cluster munitions.

1. Types of cluster munitions in the Bulgarian Army.

Air Bomb RBK 250-275 AO 1 SCH
Air Bomb RBK 250 ZAB 2,5 SM
Air Bomb RBK 250 PTAB 2,5 M
Air Bomb RBK 500 AO 2,5 RT Air
Bomb RBK 500 ZAB 2.5 SM Air
Bomb RBK 500 SHOAB 0,5 M Air
Bomb RBK 500 SHOAB 0,5 Air
Bomb RBK 500-255
Air Bomb BKF AO 2,5 RT
Air Bomb BKF AO 2,5 RTM
Air Bomb BKF PTM 3
Air Bomb BKF PTAB 2,5
Air Bomb RBS-100
Submunition ZAB 2,5
Submunition PTAB 2,5
Cluster RBK 250
Warhead 9N123K

2. Aviation bombs RBK 250-275 AO-1 СЧ and RBC 250-275 AO-2,5 СЧ.

2.1. Purpose of cluster aviation bombs RBK 250-275 AO-1 СЧ and RBK 250-275 AO-2,5СЧ is destruction of enemy vehicles, light armored vehicles and manpower by fragments.

2.2. Characteristics of aviation sub-munitions bomb presented at Table 1.

Table 1: Characteristics of RBK 250-275 AO- 1 СЧ, RBK 250-275 AO-2,5 СЧ.

Tactical and technical characteristics	РБК 250-275 АО-1 СЧ	РБК 250-275 АО-2,5 СЧ
Diameter	325 mm	mm
Length	2119÷2151 mm	
Weight	273 kg	365 kg
Number of sub-munitions in the set	150	
Weight of propellant powder	41 g	
Minimum permissible height of tape disclosure	400 m	
Length of АО-1 СЧ	153÷158 mm	373 – 378 mm
Diameter of АО-1 СЧ	49 mm	52 mm
Weight of АО-1 СЧ with fuse	1,2 kg	2,68 kg
Weight of explosives	0,038 kg	Смес К-2; 0,09 kg

2.3. Cluster aviation bomb RBK 250-275 AO- 1 СЧ consists of a thin metal frame with sub-caliber stabilizer (Fig. 1) and sub-munitions projectiles (aviation bomb АО-1 СЧ).

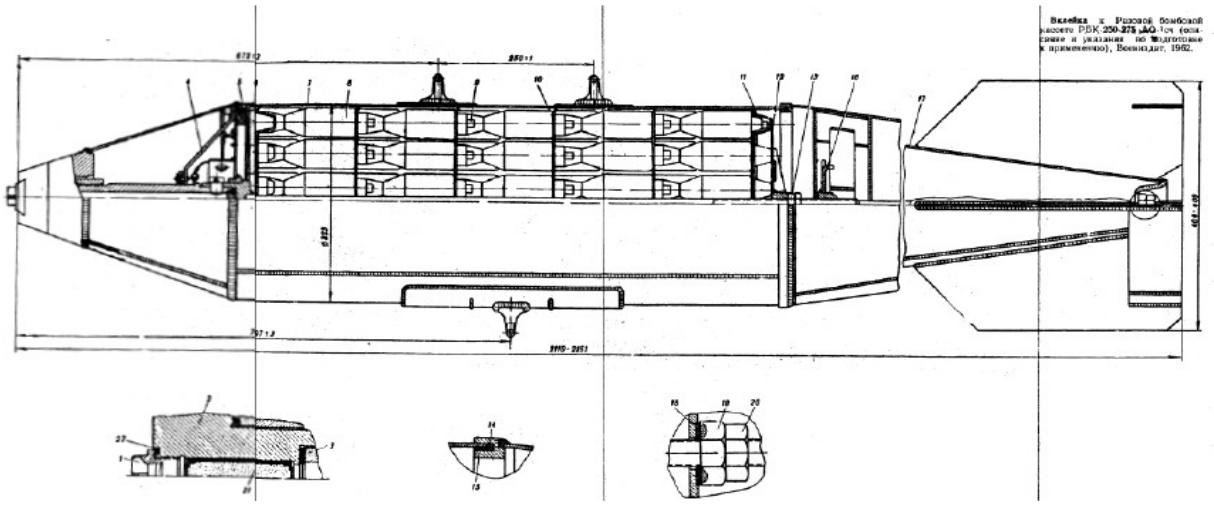

Fig. 1. RBK 250-275 AO-1 СЧ.

Container contains 150 sub-munitions bombs (aviation bomb АО-1 СЧ) in five rings; each ring includes 30 sub-munitions bombs. Bombs are fixed in the cartridge by system “obturating ring-pressure plate”. Container destruction and munitions disperse performed by primers set out in the cup of obturating ring. The powder charge is ignited by the remote lighter АТ ЭВ which is located in the container front side.

2.4. Sub-munitions design.
Fragmented aviation bomb АО-1 СЧ consists of (Fig. 2) bomb case (iron) – 2, stabilizer block 6 and 7, detonator АМ-А – 1 (can be used also АМ- А b/c) and explosive – 4.

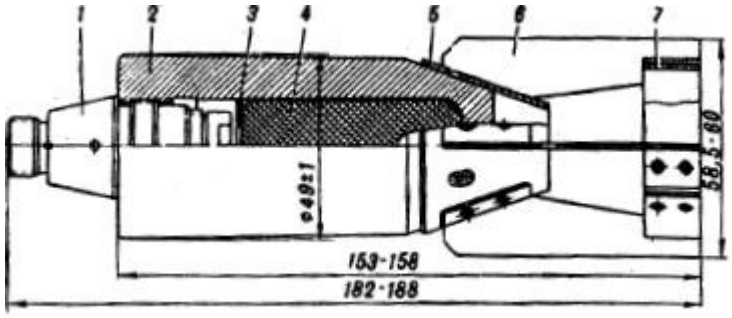

Fig. 2. Fragmented aviation bomb АО-1 СЧ.

Aviation bomb АО-2,5 СЧ (Fig. 3) consists of: case 7, stabilizer 8 and arming.

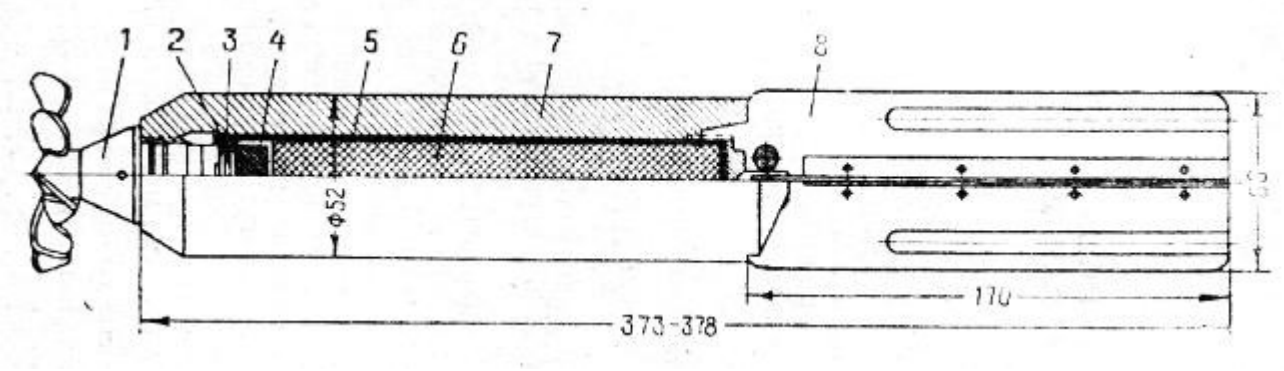

Fig. 3. Fragmentary aviation bomb АО-2,5 СЧ.

3. Aviation bomb RBK 500 AO-2,5 СЧ.

3.1. Cluster aviation bomb purpose is destruction of enemy vehicles, light armored vehicles and manpower by fragments.

3.2. Characteristics of aviation sub-munitions bombs presented at Table 2.

Table 2.

Tactical and technical characteristics	РБК 500 АО-2,5 РТ
Diameter	450 mm
Length	
- with fairing	1950 mm
- without fairing	1500 mm
Weight	
- with fairing and mechanism for disclosure;	325 kg
- with fairing and mechanism for disclosure	315 kg
Number of sub-munitions in the set	60
Detonator type	АТК-ЭБ/ТМ-24Б с МДВ-4
Length of АО-2,5РТ	150 mm
Diameter of АО-2,5РТ	90 mm
Weight of АО-2,5РТ with fuse И-352В	2,8 kg
Weight of explosive ТГ-40	0,55 kg

3.4. Sub-munitions design.
АО-2,5РТ consists of two sub-munitions, fixed to one another (Fig. 3): composite case – 1, adapter tube – 2, stabilizers – 3, 4 and explosive ТГ-40-5. Stabilizer (3) provides stability during flight and arm the detonator (4).

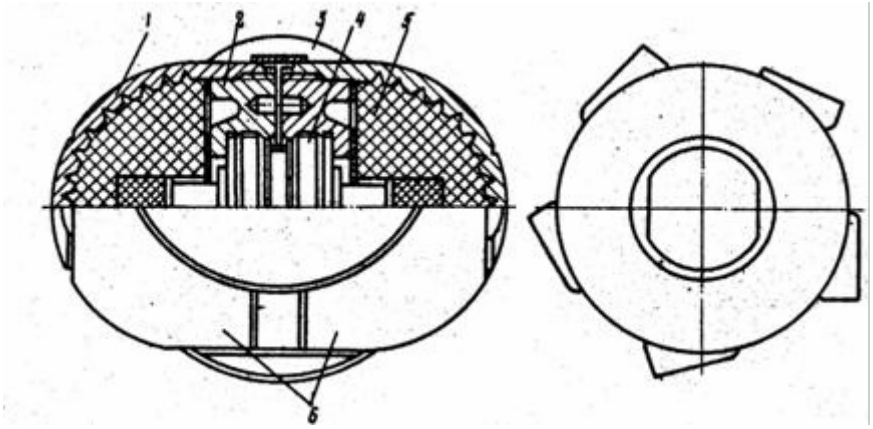

Fig. 4. АО-2,5 РТ

Detonator main data:
Detonator is designed for setting off the rotating aviation bomb and serves to separate them when meeting with an obstacle into two pieces and the explosion of these elements over the barrier. It consists of fuse and hammer mechanism, gunpowder detonator and detonating device with pyrotechnic bombs.

4. Aviation bomb RBK PTAB 250-2,5 M.

4.1. Cluster aviation bomb is designed for destruction of armored targets.

4.2. Cluster aviation bomb consist of thin metal frame, sub-caliber stabilizers and projectile bombs PTAB-2,5 M.

4.3. Basic data of unfuzed aviation bomb (without propellant and fuze):

- Length:	2276-2300 mm
- Diameter:	325 mm
- Stabilizer span:	410 mm
- Weight:	248 kg
- Sub-munitions PTAB-2,5M quantity:	42
- Primer quantity:	2

4.4. Basic data about the sub-munitions PTAB-2,5M:

- Weight:	2.8 kg
- Length (without fuse):	332 to 339 mm
- Diameter:	68 mm
- Mass of explosive	0,45 kg

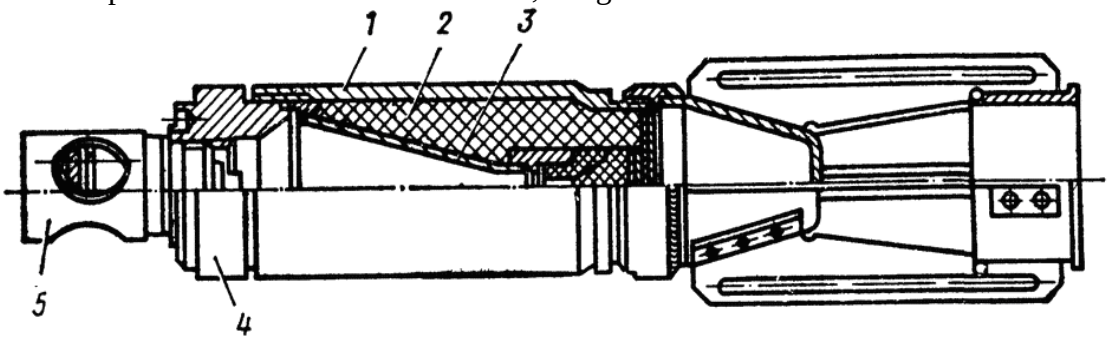

Fig.5. Scheme of PTAB-2,5 M

1 – case, 2 – explosive, 3 – lining the cumulative cavity; 4 – fuse-protection mechanism, 5 – exploder.

5. Aviation bombs RBK 250 ZAB-2.5 CM and RBK 500 ZAB-2.5 CM.

5.1. Cluster aviation bomb purpose is destruction by ignition of trains, storages of material resources, motorized equipment, etc.

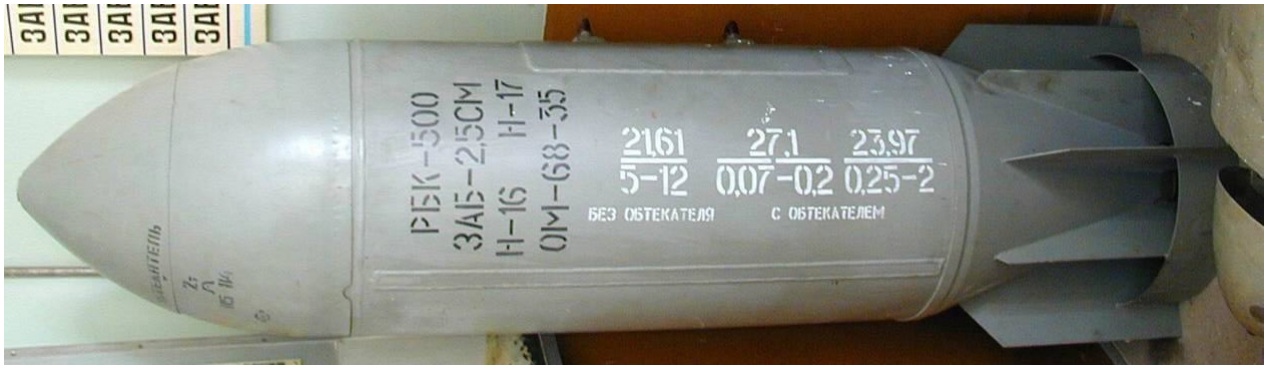

Fig. 6. RBK 500 ZAB 2,5 CM.

5.2 . Characteristics are presented in table 3.

Table 3

Tactical and technical characteristics	RBK 250-275 ZAB 2,5 CM	RBK 500 ZAB 2,5 CM
Diameter	325 mm	450 mm
Length		
- with fairing		1954 mm
- without fairing	1492 mm	1500 mm
Weight	194 kg	499 kg
Number of sub-munitions in the set	48	297
Destruction area	3900÷28400 m^2	20000÷80000 m^2

5.3. Sub-munitions.
Cassette can contain three types of sub-elements (Fig. 7): ZAB-2,5M1, ZAB-2,5M1 and ZAB-2,5C.

Fig. 7. Sub-elements ZAB-2,5M1, ZAB-2,5M2 and ZAB-2,5C.

ZAB-2,5M1 and M2 are projectiles with solid spark up H-16 (ZAB-2,5M1) and H-17 (ZAB-2,5M2) that ensure burn-action elements. In comparison with previous compositions, they have better ignition characteristics. Charges, projectiles with a composition H-16, burns steel with thickness up to 3 mm, and those with a composition H-17 – up to 5 mm. Sub-element ZAB-2,5C contains thermobaric composition OM-68-35.

5.4. There are three types of sub-munitions ZAB-2,5:

Type 1. A container that consists of tube with welded cover and 6 gas conducting holes. Container contains incendiary, transitional and primary incendiary compositions.
Type 2. Differs from the first type by existence of bursting charge.
Type 3. The main composition is pressed at one-quarter of the container length. Rift charge is embedded in the tube by pressing. The balloon with burning-composition and sticky thread are located at the rest of the space.

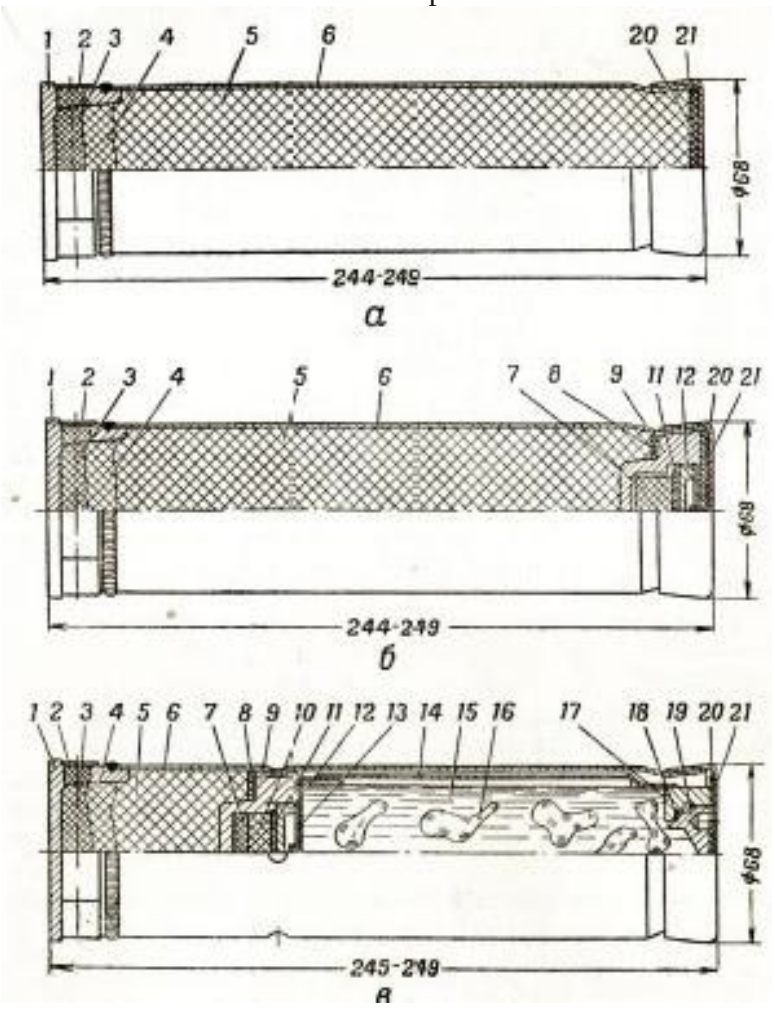

Fig. 8: Incendiary sub-munitions ZAB-2,5 (Types 1-3).

ZAB 2.5 Type	Weight (kg)	Combustion Time (min)
1	2.3	2.4 - 3
2	2.4	2-3
3	2.2	5-9

6. Aviation bombs RBK 500 SHOAB-0,5M and RBK 500 SHOAB-0.5.

6.1. Cluster aviation bombs RB -500 with SHOAB 0,5 and SHOAB 0,5M are designed for destruction of enemy manpower and vehicles.

6.2. Cluster aviation bomb RBK - 500 SHOAB 0,5 consists of a thin metal frame, sub-caliber stabilizers (Fig. 9) and 565 projectiles with sub-munitions SHOAB-0, 5 in six compartments around the charge. Sub-munitions fix in the cartridge is guaranteed by the system “obturating ring-pressure plate”.

Fig.9. RBK-500 SHOAB 0,5.

6.3. Tactical and technical characteristics of aviation bombs.

Table 4.

Tactical and technical characteristics	RBK 500 SHOAB-0,5	RBK 500 SHOB-0,5M
Diameter	450 mm	
Length (with fairing)	1500 (1950) mm	
Weight (with destruction mechanism)	334 (344) kg	385 (395) kg
Number of sub-munitions in set	565	546±5

6.4. Sub-munitions are spherical in shape. The case 1 is made of aluminum alloy and steel contains GGE. Aslant fairings on the body 5 provides flight stabilization and impact orientation.

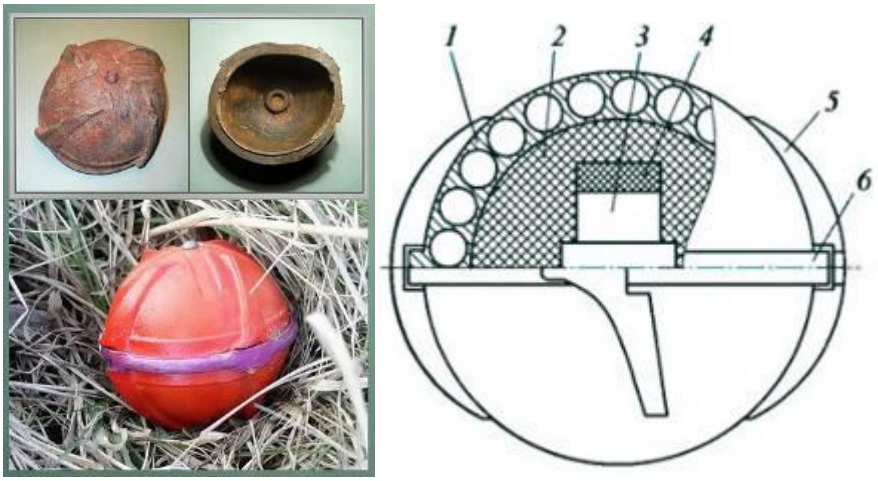

Fig.10. Sub-munitions SHOAB-0,5.

7. BKF AO-2,5 RT

7.1. Block BKF AO-2,5RT is designed for destroying convoys of infantry and marines, the concentration troop aria, as well as aircraft at flying line.

7.2. The block is used together with the containers KMGU or KMGU-2 and mounts to external load of the airplane. Block configuration:

Fully armed block
Metal box
Storage container for 2 blocks.

7.3. Tactical and technical characteristics of the BKF-AO-2,5RT.

Length, mm	346 max
Width, mm	256 max
Height, mm	373 max
Weight, kg	63 max
Metal box, kg	56,64 max
Weight of 2 blocks in storage container, kg	159 max
Quantity of aviation bomb AO-2,5RT in the block, items	12

7.4. Sub-munitions AO-2,5RT – see paragraph 3.4.

8. BKF with PTAB-2.5.

8.1. Block BKF PTAB-2,5 filled with aviation bombs PTAB-2,5KO is designed for destruction of tanks, self-propelled guns, light armored vehicles and manpower.

8.2. The block with triggering mechanism is used together with the containers KMGU or KMGU-2 and mounts to external load of the airplane. Block configuration:
Fully armed block;

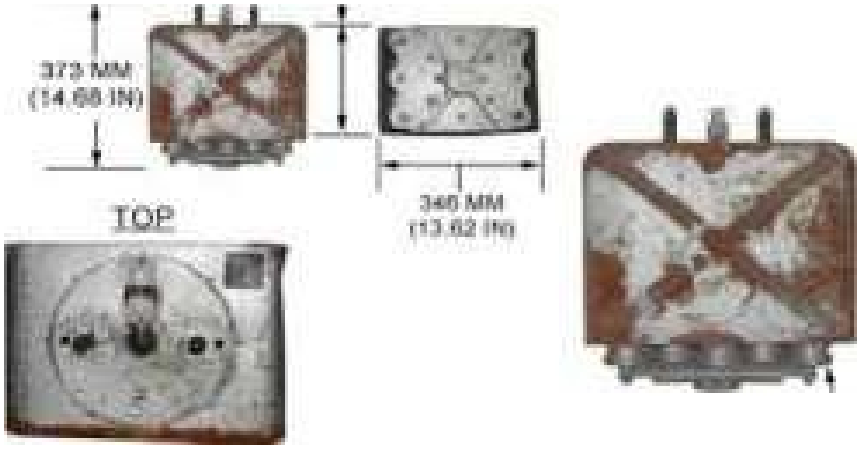

Fig.11. BKF

Metal box
Storage container for 2 blocks.

Fig.12. BKF PTAB - 2,5.

8.3. Tactical and technical characteristics of BKF PTAB-2,5.

Length, mm	346 max
Width, mm,	256 max
Height, mm,	373 max
Weight, kg,	41 max
Weight in Metal box, kg,	56,64 max
Weight of two blocks in storage container, kg,	146,78 max
Quantity of aviation bombs PTAB-2,5KO in block, items,	12

8.4. Data of aviation bomb PTAB-2,5KO.

Weight, kg	1.85 max
Length, mm	308 max
Diameter, mm	34 max
Wight of explosives, kg	0,180 max
Burst radius, m	200 max

Fuse technical data:

Weight, kg,	0,2 max
Height, mm,	68.2 max
Diameter, mm,	34 max
Actuation time, sec,	0.7 - 1.7

Type of detonator – base inertial detonating fuse with remote switching control and self-destruction (in previous versions without self-destruction) .

9. BKF with PTM -3

9.1. Block BKF PTM-3 with landmines PTM-3 is designed for destruction of enemy track machines and wheel vehicles..

9.2. The block is used together with the containers KMGU or KMGU-2 and mounts to external load of the airplane. Block configuration:

Fully armed block;
Metal box;
Storage container for 2 blocks.

9.3. Tactical and technical characteristics of BKF PTM-3.

Length, mm	346 max
Width, mm	256 max
Height, mm	373 max
Number of PTM-3 in block, items	12

9.4. Basic tactical and technical characteristics of antitank mine PTM-3.

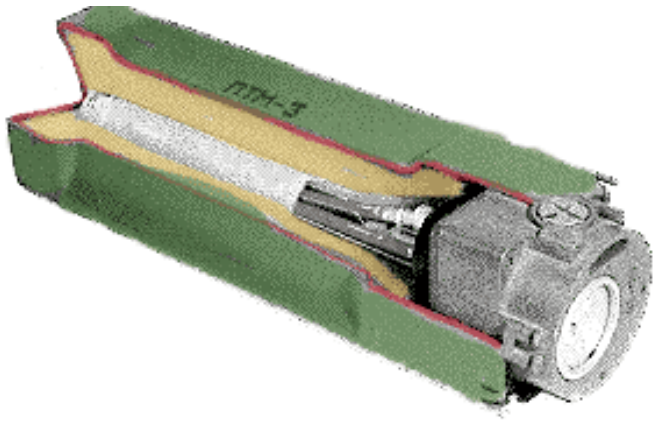

Fig.13. Sub-munitions PTM-3.

Weight, kg	4.9 max
Length, mm	330 max
Width, mm	88 max
Height, mm	88 max
Mass of explosives, kg	1.8 max
Self-destruction time, hours	8-24
Arming time after block discharge	60-100 sec

9.5. Main tactical technical characteristics of a fuse.

The base fuse magnetically intercommunicates with the magnetic field of the machine; it is a part of the mine structure; can be activated from influence of the metal or by operator. The additional fuse, which is also a part of mine structure, is the element for anti-extraction and deactivating prevention. Sensitive to mine move or its inclination.

10. RBC – 100.

10.1. The individual bombing sheaf allows to connect some fragmentation or fragmentation and demolition aviation bombs in calibre/weight / 25-50 kg connected to the help of a sheaf in one block. The sheaf represents a pipe which is coming to an end with various shafts, fastenings of bombs, fastening systems to the plane and a remote fuse. Aviation bombs with calibre 33кг have own fuse.

10.2. The RBS device – 100.
In a forward part of a pipe the powder charge providing dehiscence sheaves at the moment of operation of a remote fuse is placed. After separation of RBS from the holder during set time, the remote fuse becomes more active and the powder charge ignites. Powder gases break off a sheaf, and aviation bombs pass to free flight during which their fuse are cocked.

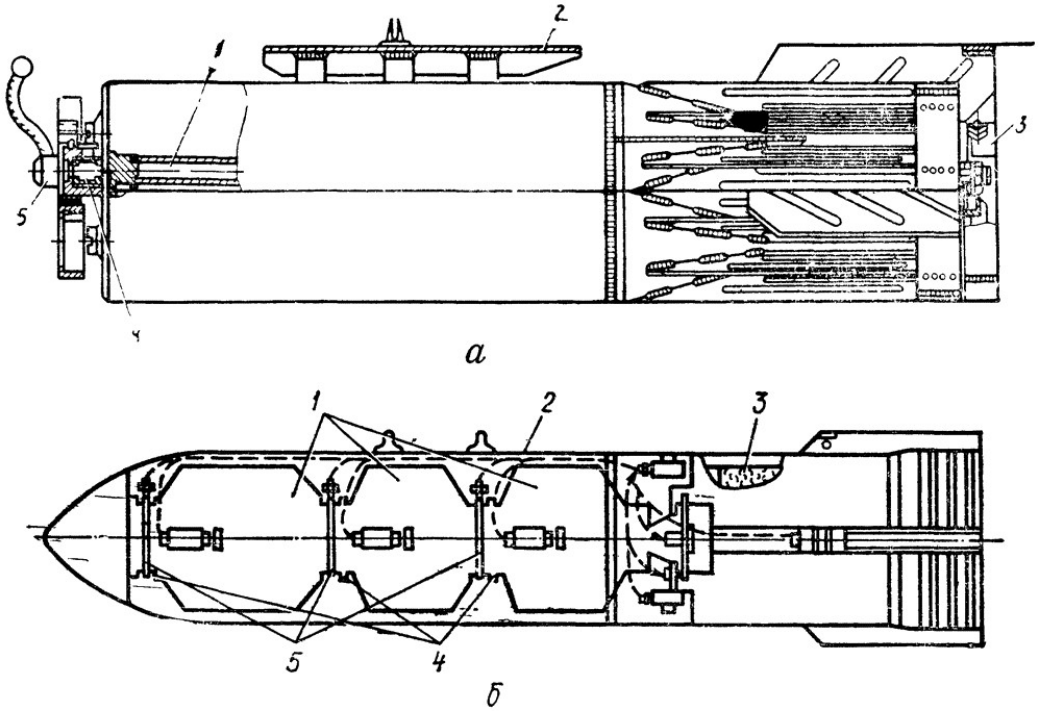

Fig. 14. RBS-100

11. Warhead 9H123K.

11.1. The warhead 9H123K is designed for liquidation of the enemy's light armored vehicles and manpower long-range.

11.2. Fragmentation - cluster warhead 9H123K (fig. 15) consists of the case 9H311 (4), 50 pieces of fragmentation fighting elements 9H24 (3), the central explosive charge 9X34 (5), the radio sensor 9Э326 and two contact sensor 9Э128 (1) and the sensor of pressure (PIM) 9Э117 (6).

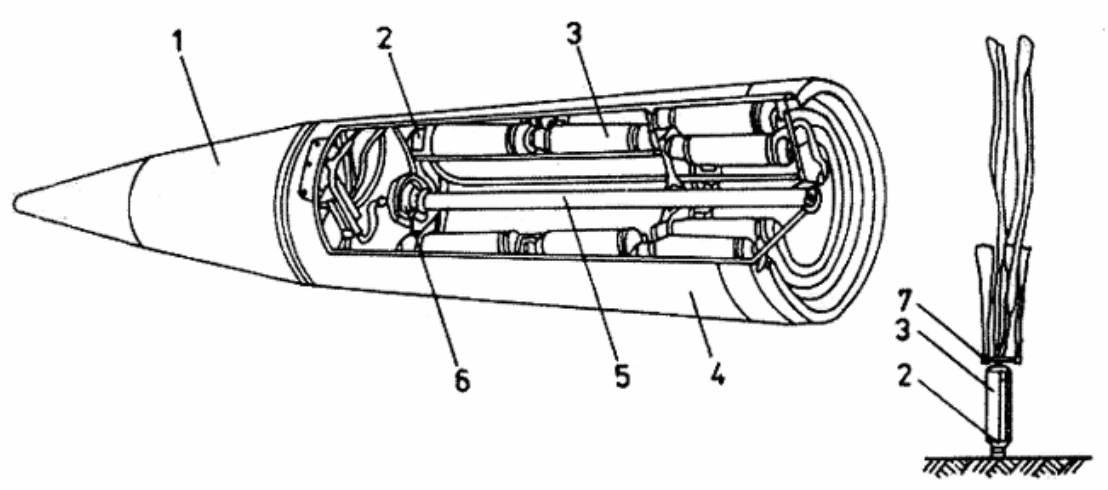

Fig. 15

1-the radio sensor 9Э326 and two contact sensor 9Э128, 2 – front fuse cluster elements 9Э237, 3 - fragmentation fighting elements 9H24, 4-case 9H311, 5 - the central explosive charge 9X34, 6 – the sensor of pressure (PIM) 9Э117, 7 - the stabilizer of tape type.

Fig. 16

The case 9H311 (4) is divided into three parts: a conic fairing in which two compartments, are separated by a partition between them; a forward part of the case with the radio sensor; an average part with the fragmentation elements located in it and a back part on the case with fixed connecting cable ШI45 on which the warhead is connected with a rocket part and a control system.

In an average part of the case 50 pieces of fragmentation fighting elements 9Н24 in two consecutive ranks on 12 elements (fig. 16) and in two parallel ranks on 13 elements (fig. 17) are located.

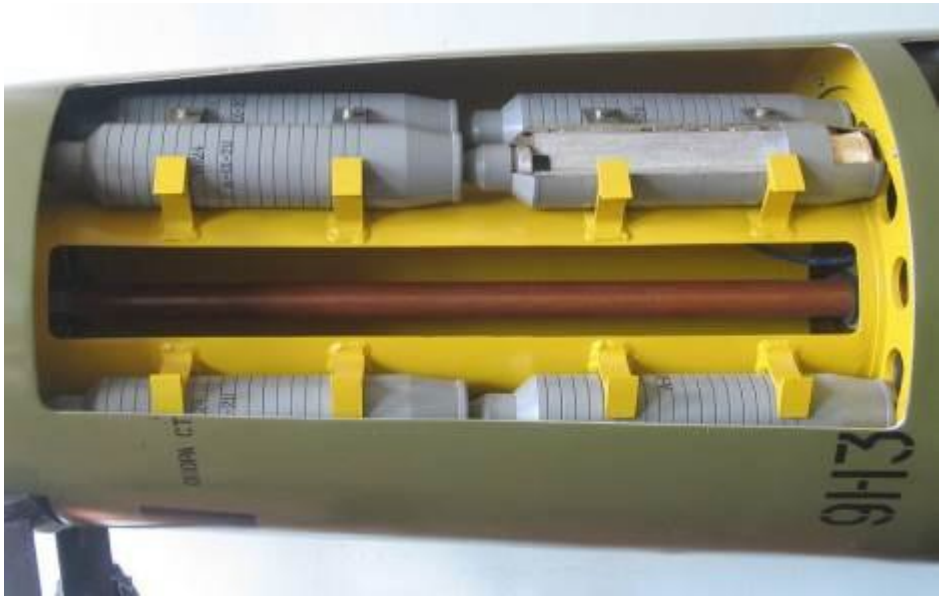

Fig. 17

Fig. 18

The fragmentation fighting element 9Н24 (fig. 18) consists of the case with 18 rings (factory manufacturing), А-IX-20 explosive, a front fuse contact type 9Э237 and the stabilizer (tape type).

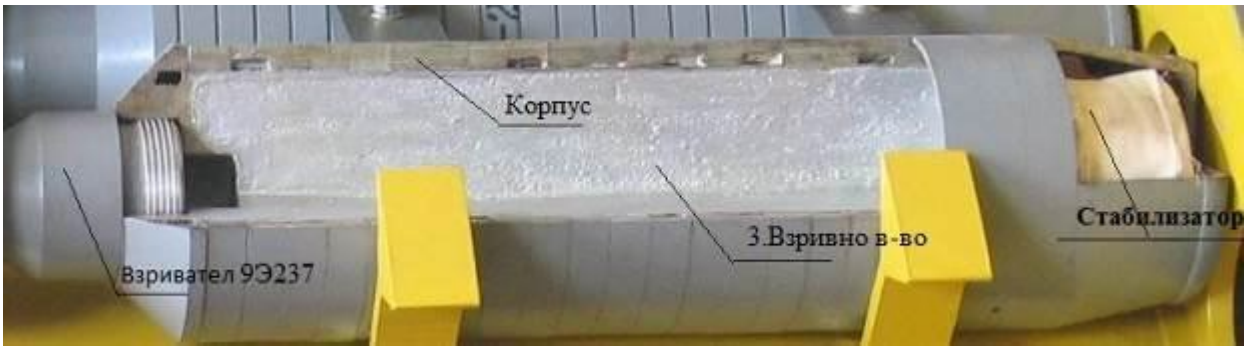

Fig. 19

Fuse 9Э237 contact type with the self-liquidator. The fuse to be cocked at explosion of the central explosive charge in a warhead works at a meeting with a barrier at an angle 25-90o. At not operation of a fuse the self-elimination knot will be involved. Time of self-elimination depends on temperature of pyrotechnic structure and makes 32-60 seconds after time of a rupture of a warhead.

The central explosive charge 9X34 serves for opening of the case of a warhead at height of 2250 meters. At the same time there is a distribution of cassette elements and the self-liquidator on a fuse 9Э237 will be involved. The central explosive charge 9X34 represents the cardboard cylinder filled with paraffin which placed 19 items with TNT detonator.

11.3. Warhead tactical technical characteristics.

weight, kg	482;
quantity of splinters in a warhead, items.	15800;
diameter, mm	650;
length, mm	2325;
quantity of cassette elements 9H24, items.	50;
mass of cassette elements 9H24, kg	7,45;
mass of explosive in cassette elements 9H24, kg	1,45;
quantity of splinters in a cassette element 9H24, items.	316;
mass of a splinter, gr.	7;

III. PREFERABLE METHOD OF DEMILITARIZATION AND/OR DESTRUCTIONS OF CLUSTER AMMUNITION

Having reviewed and analyzed the possible approaches, the following methods were definitely considered as demilitarization:

1. Destruction of products by a method of blasting or burning out.

2. Dismantling of the device and destruction of elements dangerous to the subsequent dismantling.

2.1. Dismantle of fuse and explosive charges;
2.2. Dismantling of a cassette part;
2.3. Dismantle and extraction of sub-elements;
2.4. Destruction of sub-elements;
2.5. Destruction of fuses and explosive charges;
2.6. Destruction of the elements containing explosives and gunpowder, by crushing, cutting, deformations and etc.

3. Demilitarization.

3.1. Dismantle of fuses and explosive charges
3.2. Dismantling of a cassette product;
3.3. Dismantle and extraction of sub-elements;
3.4. Dismantle of fuses of sub-elements;
3.5. Explosive extraction from sub-elements;
3.6. Destruction of fuses and explosive charges;
3.7. Destruction (finishing to worthlessness - scrap metal) the elements, containing explosives and gunpowder, by crushing, cutting, deformations and etc.

The working group, proceeding from ecological reasons and risks for staff while handling the products, considers that:

1. The method «Destruction of monolithic products by blasting or burning out» can be used in the Republic of Bulgaria territory only at impossibility of use of the other two ways, but in strict accordance with the Law on environmental protection.

2. Preliminary definition of a method - demilitarization and/or destruction of concrete type of ammunition in the technical specification of service is inexpedient in the absence of project documentation and continuous improvement of processing equipment for realization of individual methods and utilization approaches.