GICHD

EXPLOSIVE ORDNANCE GUIDE FOR UKRAINE

FIRST EDITION

Cover: OF-25 projectile. Ukraine. April 2022. Image © Sean Moorhouse.

ACKNOWLEDGEMENTS

This guide was developed by Roly Evans and Bob Seddon with the support of Jovana Carapic and Tammy Hall.

GICHD would like to especially thank Sean Moorhouse for his advice during the development of this guide. Thanks also to John Montgomery, the Danish EOD and Search Center, the Dutch EOD Center and Kdo Kamir for their kind support to the CORD database and this guide.

EXPLOSIVE ORDNANCE GUIDE FOR UKRAINE

FIRST EDITION

TABLE OF CONTENTS

INTRODUCTION

The first edition of the GICHD Ukraine Ordnance Guide is intended to provide a basic explosive ordnance recognition guide for qualified EOD operators in Ukraine conducting mine action activities. It may also be used by trained survey staff. The guide was developed at speed in order to provide an imperfect resource sooner, rather than something more comprehensive later. The guide cannot be deemed complete, but it does cover a reasonable range of the explosive ordnance confirmed as seen in Ukraine.

The guide provides only basic information about explosive ordnance found in Ukraine. The guide provides no information on Render Safe Procedures.

As the current use of various models of explosive ordnance progressively becomes apparent, and as a wider range of explosive ordnance is used in Ukraine, the guide will inevitably become dated. It is the intention to update the guide in time.

This guide was developed using a range of data including the CORD data base. CORD can be accessed at https://ordata.info/

The guide has been written for use by humanitarian actors who are involved in mine action activities in Ukraine. The purpose of the guide is entirely humanitarian in nature.

ABBREVIATIONS OR DESIGNATIONS

APM	Anti-Personnel Mine
AVM	Anti-Vehicle Mine
AXO	Abandoned Explosive Ordnance
EFP	Explosively Formed Projectile
ERW	Explosive Remnants of War
HMX	Cyclotetramethylene-Tetranitramine
OF	Oskolocho-Fygasnaya
MANPAD	Man Portable Air Defence System
PETN	Pentaerythritol Tetranitrate
RBK	Razovaya Bombovaya Kasseta
RDX	Cyclotrimethylenetrinitramine
RGD	Ruchnaya Granata Distantsionnaya
RKG	Ruchnaya Kumulyativnaya Granata
RPG	Ruchnoy Protivotankovy Granatomyot
SAM	Surface to Air Missile
TNT	Trinitrotoluene
UXO	Unexploded Ordnance
UZRGM	Universal'nyi Zapal Ruchnaya Granata Modernizirovannyi

ANTI-PERSONNEL MINES

MON-50

Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Anti-Personnel Directional Fragmentation
EXPLOSIVE FILL (g)	700g PVV-5A
AUW (g)	2000g
DIMENSIONS (mm)	226x156x66
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	MUV/VPF/EPDr/NM with MD-5

MON stands for 'Mina Oskolochnaya Napravlennogo' and was developed as a Soviet version of the M18 Claymore. It is a directional fragmentation anti-personnel mine. It has a plastic casing, either green or brown in colour. On the concave side will be printed MON-50 with respective factory markings. For Russian version, on the other convex side the phrase "К ПРОТИВНИКУ" (k protivniku, "towards enemy") may be printed onto the plastic in black. The mine contains 700g of Plastichnym Vzryvchatym Veshchestvom - 5A (PVV-5A), an RDX based plastic explosive with 20% plasticiser.

The two detonator cavities enables two different means of initiation. For example the mine could be set for command initiation in one fuze well, and victim initiation by means of trip wire in another. For command initiation this mine is often used with the NM electrical initiator. For tripwire initiation, the MUV series of mechanical switches is most often used.

There have been recent reports that MON-50 and MON-90 AP mines have been found with anti-handling (tilt) devices in Ukraine or protected by 'keeper' anti-personnel blast mines. MON-50 mines in Ukraine have also been placed on top of ML-8 anti-lift initiators. Consideration should be given to pulling these devices using hook and line if boobytraps are suspected.

MON-90

Image © Fenix Insight

ORDNANCE SUB-CATEGORY	Anti-Personnel Directional Fragmentation
EXPLOSIVE FILL (g)	6200g PVV-5A
AUW (g)	12100g
DIMENSIONS (mm)	345x202x153
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	MUV/VPF/EPDr/NM with MD-5

This is a larger version of the MON-50, with a greater range. The MON-90 designation indicates an effective range of 90m.

Unlike the MON-50, the MON-90 is not equipped with scissor legs. It is only equipped with a tree spike mounting. The MON-90 comes with a distinctive case (the same size as an 82mm mortar case) with an aiming marker indentation on the lid that braces the mine. Sometimes the MON-90 can be found deployed on this storage box.

As with the MON-50 the mine has two fuze wells with M-10 threads enabling employment of two different fuze types. The mine's fragmentation consists of 2,000 pieces of chopped steel, each 7 mm long. For command initiation this mine is often used with the NM electrical initiator. For tripwire initiation, the MUV series of mechanical switches is most often used.

The mine is typically a green base colour with black, stencilled markings. MON-90 and the batch number is stencilled on the rear of the body.

MON-100

Left, INERT MON-100 with INERT MUV-1 fuze. Image © Kdo Kamir
Right, Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Anti-Personnel Directional Fragmentation
EXPLOSIVE FILL (g)	2000g TNT
AUW (g)	5000g
DIMENSIONS (mm)	236x83
COUNTRY OF ORIGIN	Russia
FUZE	MUV/VPF/EPDr/NM with MD-5

The MON-100 is the second-largest in the MON series, with the 100 designation indicating its intended lethal range of 100 metres. The MON-100 and the MON-200 are both large cylindrical directional fragmentation mines that are distinctly different from the smaller MON-50 and MON-90. The mine has a single fuze well in the centre of the concave face of the body. It can hold either electrical or non-electric detonators. It has a U-shaped, metal, frame, fitted with a spike for mounting. The metal frame has 2 pivots, which allow the mine to be aimed in a specific direction. The mine is also fitted with a canvas carrying handle on the side of the body. The mine's fragmentation consists of 400 pieces of chopped steel, each 10 mm long. The fragmentation is set into a resin matrix, immediately behind the convex side of the mine body. Owing to its size, the mine is typically command initiated, usually with an NM type initiator, but it could also be tripwire initiated, usually with an MUV-type mechanical switch.

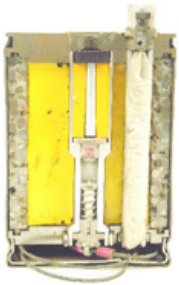
MON-200

Left, Image © Fenix. Right, Image © Robert Friedel

ORDNANCE SUB-CATEGORY	Anti-Personnel Directional Fragmentation
EXPLOSIVE FILL (g)	12000g TNT
AUW (g)	25000g
DIMENSIONS (mm)	434x130
COUNTRY OF ORIGIN	Russia
FUZE	MUV/VPF/EPDr/NM with MD-5

The MON-200 is one of, if not the, largest conventional anti-personnel mine, by NEQ and AUW, and is the largest mine in the MON series. The 12000g TNT explosive charge would be large for an anti-vehicle mine, let alone an anti-personnel mine. The 200 designation indicates that it has an intended lethal range of 200 metres. Its large size means that it can be effective against lightly armoured targets, in addition to personnel. Like the MON-100, the MON-200 has a single M10 threaded fuze well in the centre of the concave face of the body. It can hold either electrical or non-electric detonators. The mine is also fitted with a canvas carrying handle on the side of the body. The mine's fragmentation consists of 900 pieces of chopped steel rod. Each piece of rod has a diameter of 10 mm and a length of 12 mm. The fragmentation is set into a resin matrix, immediately behind the convex side of the mine body.

OZM-72



Images © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-Personnel Bounding
EXPLOSIVE FILL (g)	660g TNT
AUW (g)	5000g
DIMENSIONS (mm)	172x108
COUNTRY OF ORIGIN	Russia
FUZE	MUV/VPF/NM initiator

The OZM-72 (Осколочно-Заградиительная Мина 72) is a bounding fragmentation mine with a larger high explosive charge than its predecessors the OZM-3 and OZM-4.

The cast-iron inner mine body is contained within a sheet-steel outer body. The top of the mine has an offset, threaded, fuze well and a central detonator well, which is sealed with a steel plug. The fragmentation for this mine is made up of pre-formed fragments of chopped steel rod. The mine is typically tripwire initiated, most often with a mechanical, MUV-type fuze, but it can also be command initiated, usually with an NM type electrical initiator. The mine can also be initiated by an MVU-P fuze (associated with the seismically initiated VP 12/13 firing switch). The mine can also be fitted with the MVE-72 break-wire system. When the fuze is initiated, a black powder expulsion charge in the base forces the inner body into the air. When the mine reaches a height of 1 m, the tether wire becomes taut, which pulls the striker down, compressing its spring. The compression of the spring allows the retaining balls to escape and release the striker into the stab-sensitive detonator, thereby initiating the main charge. The OZM-72 is usually supplied in kits of 6 mines in a wooden box with Styrofoam packaging inserts that if discarded near where the mines are emplaced can be an indicator of their presence.

After initiation, the OZM-72 mine casing will very likely remain buried in the ground with the metal lanyard attached. While this might seem harmless any anti-lift device can remain under this casing. This mine has been known to be used with MS-3, ML-7 and ML-8 anti-lifting devices. Caution is advised.

PFM-1

Images © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-Personnel Blast Mine /SCATMIN
EXPLOSIVE FILL (g)	37g VS-6D
AUW (g)	75g
DIMENSIONS (mm)	120x61x20
COUNTRY OF ORIGIN	Russia
FUZE	VGM-6

The PFM-1 (ПФМ-1) is an anti-personnel mine, scattered by means of either artillery rocket carriers or dispensed from aircraft. It can also be emplaced by ground troops. It is a copy of the BLU-43 Dragon's Tooth mine. The mine contains a relatively small charge of 37g of a liquid explosive. The mine is known as 'Lepestock' (Лепесток) which literally translates to petal. Colloquially they have been termed "butterfly mines" over time although this is not an official designation. A (У) cyrillic stencilled into the wing designates a training version, U-PFM-1 (У-ПФМ-1). учебный, uchebnyy literally translates as "for training".

This mine may be scattered from a KMGU dispenser attached to an aircraft, or by ground troops using a hand emplaced PKM projection cannister. It may also be delivered by means of 122mm Grad 9M22K or 220mm Uragan 9M27K3 rockets. The KSF-1 canister holds 8 racks of 9 PFM-1s each. (Image top right). If practicable EOD operators should try to establish the means of delivery in order to estimate the likely size of minefield. The aluminium KSF-1 clips are sometimes a good visual indicator of the presence of PFM mines.

This mine is relatively easy to detect, since although the fuze is largely made of aluminium, there are ferrous components (springs, locking balls etc). As a form of SCATMIN the items area also usually found on the surface. The fuze utilizes the hydraulic pressure of the enclosed VS-6D liquid explosive. The fuze is designed to operate when approximately 5 - 25 kg is applied to the mine body.

The PFM is not designed to remain functional for many years due to the lightness of its casing which can be degraded by UV light. Due to the toxic contents, every effort should be made to avoid contact with the skin and ingestion of the fumes if the VS-6D explosive charge sack ruptures. A PFM-1S variant exists which incorporates a self-destruct mechanism. The self-destruct mechanism is not very reliable and may leave mines in a sensitive condition.

PMN

Image Left © Danish EOD and Search Center. Image Right © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-Personnel Blast
EXPLOSIVE FILL (g)	220-240g TNT Main Charge. 9g Tetryl booster.
AUW (g)	600g
DIMENSIONS (mm)	112x57
COUNTRY OF ORIGIN	Russia
FUZE	MD-9

The PMN (ПМН) is possibly the most common anti-personnel mine ever made. For an anti-personnel blast mine the charge is relatively large. The MD-9 fuze incorporates a cocked striker. A lead shear arming delay is initiated once the pin is removed. The typical arming delay is 12-15 minutes but this time can change with temperature extremes. Once a cutting wire shears through the lead retainer the striker assembly is only prevented from contact with the primer by the cylinder stop holding device. The cylinder stop is held in place by a vertical cylinder spring. This can weather and degrade over time reducing the support to the cylinder stop and making the mine more sensitive to handling. The fuze is designed to operate when approximately 8 - 25 kg is applied to the pressure plate.

If the metal collar for the cover is in place the mine should be readily detectable. Even without the collar there are enough metallic components to make this mine relatively easy to detect.

While most often found with a brown bakelite casing, other green plastic versions have been manufactured. The mine has been widely copied by numerous countries, sometimes with slight variations in design. The PMN mine is very similar in construction to the MS-3 anti-lift and great care should be taken not to mistakenly identify an MS-3 device as a PMN mine.

It is advised that these mines are considered no touch and destroyed in situ.

PMN-2

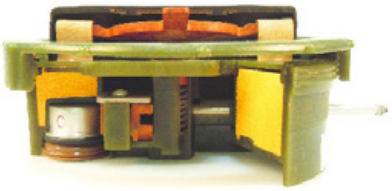


Image Left © Danish EOD and Search Center. Image Right Cutaway © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-Personnel Blast
EXPLOSIVE FILL (g)	100g TG-40 (RDX/TNT 60/40)
AUW (g)	420g
DIMENSIONS (mm)	120x53
COUNTRY OF ORIGIN	Russia

The PMN-2 (ПМН-2) is a blast anti-personnel mine. It has a distinct cruciform rubber pressure plate, designed to limit the susceptibility of the mine is to blast overpressure. The mine casing is made from injection moulded plastic and is usually green in colour. There is some anecdotal evidence that the plastic casing of this mine can lead to plastic fragmentation that is very difficult for surgeons to remove - often giving rise to infections and possible double lower limb amputations. The mine contains less than half of the explosive used in a PMN, albeit the more powerful RDX-based TG-40 explosive is employed.

Like the PMN, the PMN-2 uses a transverse fuzing system, although the actual fuzing system itself is noticeably different. The PMN-2 fuze contains a cocked-striker and an integral detonator. Unlike the relatively simple lead shear arming delay of the PMN, the PMN-2 has a much more complex arming mechanism. This involves pneumatic bellows and a spring-loaded detonator slide. To arm the mine, the T-shaped arming key in the side of the body is both rotated and pulled away from the body. When approximately 15 kg of weight is applied to the pressure plate, it depresses a central plunger, which allows the detonator to be pushed into line with the striker.

The mine is often stored in white Styrofoam packaging that if discarded near where the mines are emplaced can be an indicator of their presence. Discarded arming keys can also be a good visual indicator.

PMN-4

Images © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Anti-Personnel Blast
EXPLOSIVE FILL (g)	52-60g TNT/TG-40
AUW (g)	300g
DIMENSIONS (mm)	95x42
COUNTRY OF ORIGIN	Russia

The PMN-4 (ПМН-4) is a blast anti-personnel mine. The mine consists of a plastic casing with a neoprene cover over an alloy pressure plate. The fuze mechanism is enclosed in a cast aluminium housing within the body of mine and is surrounded by the main explosive charge. The mine is fitted with a steel safety clip which is attached to a wire which is in turn fixed to the fuze arming mechanism. Removal of the safety clip causes the attached wire to rotate the fuze arming mechanism. This in turn releases a spring-loaded arming plunger within a viscous gel. The arming delay is dependent on temperature and varies from approximately 1 to 40 minutes. Once fully armed, pressure applied to the pressure plate will lift a block and release a spring-loaded striker into the mine detonator. The fuze is designed to operate when approximately 5 - 10 kg is applied to the pressure plate.

The TNT explosive charge is relatively small compared with its antecedents at 60g. Some sources state that the fill is TG-40.

The PMN-4 is not a minimum metal mine and is relatively easy to detect.

This mine can be used with MS-3, ML-7 and ML-8 anti-lifting devices. Caution is advised.

POM-2

Images © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-Personnel Fragmentation (SCATMIN)
EXPLOSIVE FILL (g)	140g TNT
AUW (g)	1600g
DIMENSIONS (mm)	180x63
COUNTRY OF ORIGIN	Russia
FUZE	"Mechanical with tension-type target sensors."

POM-2 (ПОМ-2) is a scatterable, Anti-Personnel (AP), fragmentation mine, which can be delivered by a range of different methods, including by helicopter, fixed wing aircraft and multi-barrelled rocket launchers. The mine may also be delivered manually using a method similar to the PKM delivery system. The mine can come from a batch of 4 mines in one KPOM-2 canister. A 122mm GRAD 9M18 rocket can carry 5 mines. A 220mm URAGAN 9M59 rocket can carry nine POM-2 mines. A full salvo of 16 rockets from one URAGAN launcher could create a minefield of 144 mines. If one mine is found, assume others are present. A pursuit deterrent version of this mine, the POM-2R (ПОМ-2Р), which is used by special forces, can also be delivered manually. This variant of the mine has a pyrotechnic pull cord igniter.

The body is a cast-steel cylinder fitted with an alloy tripwire dispenser at the top. The tripwire dispenser contains 4 spring-loaded tripwires, each of which is 9.5 m long. The fuzing system is located in a vertical well that runs through the middle of the mine body. The upper part of the fuzing system contains a cocked striker with a detonator and booster assembly below it. Six, spring-loaded fins are fitted to the bottom of the mine.

The fuze is extremely sensitive and only requires approximately 300g of weight on one of the 4 tripwires to initiate it. The self-destruct mechanism is supposed to function between 4-100 hours after the fuze is armed. If the mine is found after this period has passed it can be in a delicate and dangerous condition. This mine can be neither neutralised nor disarmed.

POM-3

Images © Private

ORDNANCE SUB-CATEGORY	Anti-Personnel Fragmentation (SCATMIN)
EXPLOSIVE FILL (g)	100g A-IX-1
AUW (g)	1200g
DIMENSIONS (mm)	183x60
COUNTRY OF ORIGIN	Russia
FUZE	Electronic fuzing based on a microprocessor controlled seismic sensor

The POM-3 (ПОМ-3) is a new type of scatterable anti-personnel mine which has so far only been delivered operationally by the multi-launch rocket Zemledeliye mine delivery system. The mine is sometimes referred to as Medal'on (Медальон) meaning 'medallion'. It is considered likely that this mine is also capable of being delivered by helicopters or truck mounted KPOM type canister-based mine delivery systems. The mine is superficially similar to the POM-2S in that the main body is cylindrical and it has six spring-loaded supports. There are indications that the POM-3 contains some form of seismic sensor spike that implants in the ground beneath the upright mine. Unlike the POM-2S, the POM-3 is not fitted with tripwires. It is reported that the mine contains an electronic microprocessor based seismic detector which can differentiate between the amplitude of a typical human and other false positives such as a wild animal or vehicle.

When initiated, the mine acts in a manner similar to a bounding fragmentation mine with the warhead propelled to 1-1.5m above the ground before detonating. The POM-3 is believed to have a programmable self-destruct capability but the available time delays are not known. It is not known if this mine incorporates some form of anti-disturbance device and whether fuzing is dependent on the life of a battery or capacitor.

Given the human-targeted seismic based initiation system used with this type of mine, manual methods of neutralisation are not recommended. Remote employment of disposal charges, or the use of stand-off small arms, fired from a safe distance, may be appropriate. Extreme caution is advised when dealing with this mine.

ANTI-VEHICLE MINES

TM-62M

Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Anti-Vehicle Mine
EXPLOSIVE FILL (g)	7500g TNT
AUW (g)	9500g
DIMENSIONS (mm)	320x128
COUNTRY OF ORIGIN	Russia
FUZE	MVCh-62 / MVP-62

The TM-62M is a metal-bodied, AV, blast mine, which was developed from the earlier TM-57. The mine has a single, large, bakelite, central fuze well, with a metal-cased booster screwed onto the bottom of the fuze well. Like all other mines in the TM-62 series, the TM-62M will accept all fuzes that were developed for the TM-62 series, the TM-72 series and the TM-80 series of mines. Therefore, potentially this mine can be fitted with a range of magnetic influence fuzes. The TM-62M is typically fitted with the pressure-actuated, MVCh-62 pressure fuze, which contains a cocked-striker retained by ball bearings. It is armed by removing the safety clip from the arming button. This begins a clockwork arming delay where a spring-loaded striker moves from the horizontal to the vertical and in line with the detonator. Once armed a weight greater than 150 kg will initiate the fuze.

The image above shows the mine with an MVP minimum metal fuze. If deployed in the field in this way, it would be a waste of a fuze and would indicate a potential lack of training or lack of alternative fuzes for those who emplaced the mine.

The TM-62M is confirmed as being widely used in Ukraine since 2014. It is known to be used at roadblocks among other locations.

TM-62P3


Image Left © Danish EOD and Search Center. Image Right © Roly Evans

ORDNANCE SUB-CATEGORY	Anti-Vehicle Mine
EXPLOSIVE FILL (g)	6500g TNT
AUW (g)	8000g
DIMENSIONS (mm)	310x85
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	MVCh-62 (Above left) MVP-62 (minimum metal) (Above right)

The TM-62P3 is a large, plastic-bodied, AV, blast mine, which was developed from the earlier TM-62M. The mine has a single, large, central fuze well, with booster screwed into the base. The booster consists of 180 g of pressed TNT. The TM-62P3 has a distinctive canvas carrying sling that wraps around the body. (See image above right). Like all other mines in the TM-62 series, the TM-62P3 will accept all fuzes that were developed for this series, the TM-72 series and the TM-80 series of mines. Therefore, this mine may be fitted with a range of magnetic influence fuzes. The TM-62P3, when used with an MVP fuze, can be deemed a minimum metal mine. Opinions vary on how easy it can be to detect with an MVP fuze.

PTM-1

Image © Kdo Kamir

ORDNANCE SUB-CATEGORY	Anti-Vehicle Mine
EXPLOSIVE FILL (g)	1100g PVV-12S-1
AUW (g)	8000g
DIMENSIONS (mm)	310x85
COUNTRY OF ORIGIN	Russia
FUZE	MVDM-G

The PTM-1 (ПТМ-1) is a scatterable, AV mine, delivered normally by 122mm and 220mm multi-launch rocket systems. The PTM-1 is not designed to be emplaced by hand. The PTM-1 employs the MVDM fuze which contains a clockwork self-destruct mechanism and a pyrotechnic delay element. The MVDM fuze is designed to operate when approximately 150 - 400 kg is applied to the mine body. The PTM-1 arming sequence begins when the mine is ejected from its dispenser and the pyrotechnic delay element is ignited. The mine has an arming delay of 60-100 seconds. After this delay, a spring-loaded arming rod aligns the detonator with the striker and the hydraulic fuze with the igniter. Once the mine is armed and sufficient weight is applied to the body, the liquid explosive is forced through apertures in the fuze body. This lifts a diaphragm and the inner fuze components until 2 locking balls are displaced, thereby releasing the cocked striker onto the detonator and detonating the mine. The self-destruct mechanism consists of another cocked-striker and igniter and can be factory set to function after 6, 12 or 20 hours. These mines cannot be disarmed or neutralised by manual techniques. PTM-1 mines should not be approached within the self-destruct period. If these mines are found outside the rocket carrier they should be assumed to be armed. The PTM-1 was formerly known as the PGMDM, and PGMDM should no longer be used when referring to this model of mine.

PTM-3

Images © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-Vehicle Mine
EXPLOSIVE FILL (g)	1800 TG-40 (RDX/TNT 60/40)
AUW (g)	4900g
DIMENSIONS (mm)	330x84x84
COUNTRY OF ORIGIN	Russia
FUZE	BT-06 magnetic influence fuze

The PTM-3 (ПТМ-3) is a scatterable magnetic influence fuzed anti-vehicle mine. The mine is normally dispensed from the KPTM-3 canister (each containing two mines) which can be deployed in vehicles and helicopters. It can also be dispensed from 122mm GRAD (9M22K), BM-27 220mm URAGAN (9M59) and 300mm SMERCH (9M55K4) multi-launch rocket systems. It is also possible to manually emplace this mine using the PKM/KPTM canister launching system. The mine is designed to attack the belly armour of a tank. The mine utilises a shaped charge of 1800g of TG-40 (60/40 RDX/TNT). Whichever way the mine lands a shaped charge will be orientated upwards since a copper elongated concave liner is found on each side with the 1800g TG-40 charge applicable to each.

When the PTM-3 mine is ejected from its carrier a series of pyrotechnic charges ignite which arm the fuze in approximately 60 seconds. The PTM-3 incorporates a battery powered BT-06 magnetic influence fuze. If no target presents itself, the mine should in theory self-destruct 16-24 hours after deployment.

Due to its magnetic influence method of operation, any attempted movement of an armed mine is likely to result in detonation. As with all influence fuzed munitions, minimum metal precautions should be taken. PTM-3 mines should not be approached within the self-destruct period. Substantial donor charges should be used to destroy PTM-3 mines found in KPTM-3 canisters as inadequate charges may cause PTM-3 mines to become armed if ejected during demolition.

PTM-4

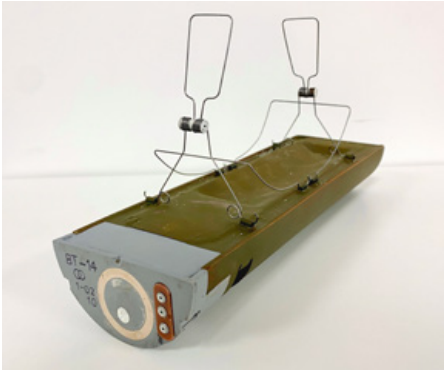


Image © Fenix

ORDNANCE SUB-CATEGORY	Anti-Vehicle Mine
EXPLOSIVE FILL (g)	1400g
AUW (g)	3250g
DIMENSIONS (mm)	350x110x55
COUNTRY OF ORIGIN	Russia
FUZE	VT-14 (BT-14) battery-powered magnetic influence (MI) fuze

The PTM-4 (ПТМ-4) is a scatterable magnetic influence fuzed anti-vehicle mine. The mine is normally dispensed from the KPTM-4 canister (each containing two mines) which can be deployed in vehicles and helicopters. It is assessed that this mine is also capable of deployment by larger (220mm and 300mm) multi-launch rocket systems. It is also possible to manually emplace this mine using the PKM/KPTM canister launching system. The PTM-4 is distinguishable by its fabric chute that opens by action of a spring on release from the canister. The image above shows the mines with the fabric chute partially removed, and the springs visible. The PTM-4 incorporates a battery powered VT-14 magnetic influence fuze. If no target presents itself, the mine will in theory self-destruct at the end of a programmed period of time. These are reported to be: 8, 12, 24 and 48 hours, or up to 120 days.

Relatively little is known about this mine, including the levels of magnetic influence that would initiate the fuzing system. Any movement of an armed mine is likely to result in detonation. As with all influence fuzed munitions, minimum metal precautions should be taken by personnel involved in search and clearance operations. PTM-4 mines should not be approached within the self-destruct period. Substantial donor charges should be used to destroy PTM-4 mines found in KPTM-4 canisters as inadequate charges may cause PTM-4 mines to become armed if ejected during demolition.

PARM 2 / DM-22

Image © Open Source

ORDNANCE SUB-CATEGORY	Anti-Vehicle Off Route Mine
EXPLOSIVE FILL (g)	Unknown. Estimated at 1900g.
AUW (g)	20000g
DIMENSIONS (mm)	
COUNTRY OF ORIGIN	Germany

Little is known about the DM-22. It is a development from the earlier DM-12. Its German designation translate as Mine, Panzerabwehr, DM22, Hohlladung, Richtmine. It is believed to incorporate a fin stabilized rocket with a shaped charge warhead.

The mine can use a SAPIR infra-red sensor and can be active up to 30 days after employment. After the programmed period the mine should self-neutralize. The mine can also be initiated by command.

PTKM-1R

Image © Private

ORDNANCE SUB-CATEGORY	Anti-Vehicle
EXPLOSIVE FILL (g)	N/K
AUW (g)	19900g
DIMENSIONS (mm)	510x220
COUNTRY OF ORIGIN	Russia
FUZE	N/K

This manually deployed anti-vehicle mine was only shown at arms fairs in 2021. Relatively little is known about this mine.

The mine has four acoustic sensors and two seismic sensors. The manufacturers claim the mine can classify and select targets, with a priority for armoured vehicles. On initiation a sensor-fuzed munition/submunition (SFM/SFS) is launched into the air in order to effect a top attack by means of an EFP. The EFP is directed by IR sensors that are projected into the air as part of the warhead. It is likely the mine will be employed near routes or likely trafficable areas.

The PTKM-1R is fitted with a self-destruct mechanism, the longest extent of which is 10 days. EOD operators should consider the development of standard soak period when dealing with this mine. It is not known whether the mine incorporates any anti-disturbance device.

EXPLOSIVE SUBMUNITIONS

3B30

Image © SESU

ORDNANCE SUB-CATEGORY	Submunition – DPICM (HEAT/Frag)
EXPLOSIVE FILL (g)	46g OMA (HMX based)
AUW (g)	240g
DIMENSIONS (mm)	128x43
COUNTRY OF ORIGIN	Russia
FUZE	Impact/inertia with self-destruct

The 3B30 is a modern Dual Purpose Improved Conventional Munition (DPICM) designed primarily for delivery by multi-launch rocket systems. The submunition has also been referred to as 'КОБЭ'. KOBE stands for Kumulyativno-Oskolochnymi Boyevymi Elementami (Кумулятивно-Осколочными Боевыми Элементами), which literally translates to "cumulative (i.e. shaped charge) fragmentation combat elements".

When contained in the carrier, the lower part of the 3B30 body fits around the upper part. On release, the lower part springs down to provide stand-off for the shaped charge. The base fuze is armed when a ribbon unscrews the arming mechanism during the descent. On impact, the detonator is driven into a stab-sensitive detonator, which causes the main charge to function. The fuze has a secondary self-destruct mode of operation of 130-260 seconds. The submunition is 62.5 mm long when in the carrier munition. Once deployed, it springs open to its operational length of 118 mm. The 3B30 uses the high-energy OMA HMX based explosive and has copper shaped charge liner with a cone diameter of approximately 40mm. The usual method of deployment is the 122mm Grad, with 9M218/9M541 rockets deploying 45 submunitions, or the 300mm Smerch, with the 9M55K rocket deploying 588 to 646 submunitions. A 152 mm (3-O-33) artillery projectile that delivers 42 submunitions has also been reported. Fully extended submunitions should be assumed to be armed and should be destroyed in situ.

9N210/9N235

Image © Roly Evans

ORDNANCE SUB-CATEGORY	Submunition – Blast/Frag
EXPLOSIVE FILL (g)	270 – 320g A-IX-10 or K-991 (RDX based)
AUW (g)	1850g
DIMENSIONS (mm)	265x65
COUNTRY OF ORIGIN	Russia
FUZE	Impact/inertia with self-destruct

The 9N210 and 9N235 are fin-stabilized high explosive fragmentation submunitions. The 9N210 is delivered by the 220mm 9M27K artillery rocket with 30 submunitions; the 9N235 is delivered by both 220mm 9M27K rocket, with 30 submunitions, or 300mm 9M55K rocket, with 72 submunitions.

9N210 and 9N235 differ slightly in the configuration of the warhead. The 9N210 utilizes A-IX-10 and the 9N235 utilizes K-991, both RDX based explosives. The 9N235 has two sizes of pre-formed fragmentation (0.5g and 4.5g), the 9N210 has only one size (2g). Varying figures for net explosive content have been given for both submunitions, ranging from 270 to 320 g.

Both the 9N210 and 9N235 employ a mechanical fuze where the firing pin acts as a holding device on a slider under lateral spring pressure. The submunitions contain an impact fuze that also incorporates a circular pyrotechnic delay self-destruct element of 110 seconds. Both the 9N210 and 9N235 have a high failure rate.

The fragmentation produced by these submunitions is distinctive. Usually in any strike the distinguishing black fins will be found. The tail unit of the carrier rocket will invariably fly further than the strike and embed with some force in the ground or building. It will easily puncture a road surface.

These items should be destroyed in situ and not moved.

9N24

Image © SESU

ORDNANCE SUB-CATEGORY	Submunition – Blast/Frag
EXPLOSIVE FILL (g)	1480g A-IX-2 (aluminised RDX)
AUW (g)	7450g
DIMENSIONS (mm)	373x88
COUNTRY OF ORIGIN	Russia
FUZE	9E237 impact/inertia with self-destruct

The 9N24 is a high explosive fragmentation submunition designed for delivery by guided missiles. The 9N24 has been employed in Ukraine by the 9M79 Tochka (NATO SS-21 Scarab) short range ballistic missile. The 9N24 uses a long white ribbon to stabilize itself in flight and to orientate the munition in its optimum position to enable the impact fuze to function. Each submunition fuze contains a self-destruct element, which is reported to operate 30 – 60 seconds after deployment.

The 9M79 Tochka missile can be fitted with a number of types of warhead, the most common submunition variant, the 9N123K, contains 50 x 9N24 submunitions. Missile strikes involving the 9N24 usually have 9N24 (9H24) marked metal end caps found short of the strike zone, 9N24 munitions within the strike zone, and the main motor and body section of the 9M79 missile beyond the strike zone. Analysis of the position of recovered items can also aid in determining the direction of the missile launch site.

The 9M714 Oka (NATO SS-23 Spider) also employs the 9N24 sub munition. There are reports that the 9N722K5 warhead associated with the Iskander-M (NATO SS-26 Stone) can deploy 54 large sub munitions similar in type to the 9N24.

9N24 submunitions which have deployed from their carrier missile should be assumed to be armed and destroyed in situ. The white ribbons are an important indicator that a cluster strike has taken place. Consistent strike marks, including on hard surfaces, should not necessarily be deemed sufficient proof of a strike without corroborating evidence of ribbons, associated fragmentation, and metal end caps.

PTAB-1M

Image © John Montgomery

ORDNANCE SUB-CATEGORY	Submunition – Blast/Frag
EXPLOSIVE FILL (g)	110g K991 (RDX based)
AUW (g)	934g
DIMENSIONS (mm)	260x42
COUNTRY OF ORIGIN	Russia
FUZE	Impact/inertia with self-destruct

The PTAB-1M is a fin stabilised HEAT submunition which can be delivered by an RBK-500 PTAB 1-M cluster bomb (263 submunitions) or by a KMGU dispenser using a BKF PTAB-1M (БКФ ПТАБ-1М). A base detonating impact fuze contains a pyrotechnic 20-40 second self-destruct element. Given how the submunitions are dispersed from the RBK it is assessed that this fuze arms, at least partially, by centrifugal force. There is some speculation that the fuze is point initiating base detonating (PIBD) and similar in design to a VP-7.

Within the RBK-500 there are three sections that contain 80 submunitions and a fourth at the rear that contains 28 submunitions. The RBK-500 carrier munition contains a central low-explosive bursting charge, which is initiated by a preconfigured mechanical time fuze. In the event of a failure in either the bomb fuze or the bursting charge, the bomb will impact the ground intact and may burst open on impact, scattering submunitions. PTAB literally translates Противотанковая Авиабомба, “Antitank Aviation Bomb”. This version was developed in the 1980s by Bazalt. An improved PTAB-1U (ПТАБ-1У) exists. It is not known what modifications these incorporate.

PTAB-1M submunitions which have deployed from their bomb carrier or dispenser should be assumed to be armed and destroyed in situ.

SPBE

Image Open Source

ORDNANCE SUB-CATEGORY	Sensor Fuzed Submunition – EFP
EXPLOSIVE FILL (g)	4500g
AUW (g)	15500g
DIMENSIONS (mm)	384x185
COUNTRY OF ORIGIN	Russia
FUZE	Infrared/millimetric wave sensing

The SPBE is a parachute retarded sensor-fuzed anti-vehicle submunition. The SPBE is most commonly associated with the RBK-500 aircraft delivered carrier munition although multi-launch rocket system variants may also exist. SPBE (samopritselivayushchiysya boyevoy СамоПрицеливающийся Боевой Элемент) literally translates to self-guided submunition.

The SPBE submunition has a warhead design based on an explosively formed projectile (EFP) and this gives the munition the ability to penetrate armoured targets at considerable standoff (70mm of armour from up to a 100m standoff). The submunition employs a detector based on infrared or millimetric wave sensing. This is reported to provide the submunition with the capability to act as an anti-vehicle mine if no target is detected during its descent. The dual-mode infrared/millimetric sensor is fitted to the side of the large EFP warhead and is used to detect large metal objects such as armoured vehicles. The SBPE descent is retarded by three small parachutes making strikes involving the SPBE readily identifiable. The SPBE submunition is usually delivered by aerial bomb and the RBK-500 SPBE cluster bomb contains 15 submunitions. The RBK-500 carrier munition contains a central low-explosive bursting charge, which is initiated by a preconfigured mechanical time fuze. It is believed modified versions SPBE-D and SPBE-K exist although it is not clear what modifications these incorporate. It is strongly recommended that a suitable soak period be applied before suspected SPBE strike locations are approached. Once identified, SPBE submunitions should not be approached from the direction of the sensor and, ideally, remote means of neutralisation should be employed.

AERIAL BOMBS

RBK-250-275

Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Aerial Bomb - Carrier
EXPLOSIVE FILL (g)	N/A
AUW (g)	250000-275000g
DIMENSIONS (mm)	2150x325
COUNTRY OF ORIGIN	Russia
FUZE	ATK-ET

The RBK-250/275 is a carrier that is often employed as a cluster bomb, dependent on the submunitions carried. Razovaya Bombovaya Kasseta' (Разовая Бомбовая Кассета) literally translates as 'Single-Use Bomb Dispenser'. When the cargo is explosive submunitions the RBK can be deemed a cluster bomb under Article 2 of the Convention on Cluster Munitions. The numbers 250 or 275 refer to the weight of the munition (approximate). There are a range of configurations for the RBK-250 and the RBK250/275. Regardless of the cargo the RBK series typically use an ATK-EB electro-mechanical time fuze. EOD operators are reminded that an intact RBK includes not only the fuze and cargo but also a low explosive expulsion charge. Explosive submunitions that can be employed by this carrier munition include the AO-1, the PTAB-2.5, the PTAB-2.5M, and the AO-2.5RT.

The RBK-250/275 can also carry the ZAB-2.5 incendiary submunition. While such cargo is certainly a significant hazard, in such circumstances the RBK-250-275 does not satisfy the legal definition of a cluster munition.

The casing, a combination of steel and aluminium, is sometimes badly damaged on impact to the extent that it can be difficult to discern the black markings stencilled. The tail unit is more robust. For a typical strike, and assuming the munition functioned as intended, the tail unit will land first along the flight path, the cargo second and the nose unit furthest. All components are key evidence whose position should be strictly recorded in order to better map and then efficiently clear the strike.

RBK-500

Image © Vitaly V. Kuzmin

ORDNANCE SUB-CATEGORY	Aerial Bomb - Carrier
EXPLOSIVE FILL (g)	N/A
AUW (g)	500000g
DIMENSIONS (mm)	1955x450
COUNTRY OF ORIGIN	Russia
FUZE	ATK-ET

The RBK-500 is a carrier that is often employed as a cluster bomb, dependent on the submunitions carried. Razovaya Bombovaya Kasseta' (Разовая Бомбовая Кассета) literally translates as 'Single-Use Bomb Dispenser'. When the cargo is explosive submunitions the RBK can be deemed a cluster bomb under Article 2 of the Convention on Cluster Munitions. The number 500 refers to the weight of the carrier munition (approximate). There are a range of configurations for the RBK-500. Regardless of the cargo the RBK series typically use an ATK-EB electro-mechanical time fuze. Operators are reminded that an intact RBK-500 includes not only the fuze and cargo but also a low explosive expulsion charge.

Explosive submunitions that can be employed by this carrier munition include the PTAB-1M (above) and the SPBE. The RBK-500 SPBE and RBK- PTAB-1M has a distinct shape with a pointed nose cone and an enclosed fin configuration. There are over fifteen RBK-500 versions.

The casing, a combination of steel and aluminium, is often badly damaged on impact to the extent that it can be difficult to discern the black markings stencilled. The tail unit is more robust. For a typical strike, and assuming the munition functioned as intended, the tail unit will land first along the flight path, the cargo second and the nose unit furthest. All components are key evidence whose position should be strictly recorded in order to better map and more then efficiently clear the strike.

FAB-500 M62

Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Aerial Bomb
EXPLOSIVE FILL (g)	209000 TNT
AUW (g)	497000g
DIMENSIONS (mm)	2470x400
COUNTRY OF ORIGIN	Russia
FUZE	AVU-ET

The FAB-M62 is a common high explosive aerial bomb. It is typically fuzed with an electro-mechanical impact fuze such as an AVU-ET. There are fuze wells in the nose and in the rear underneath the tail assembly. The fuze in the nose will often be fitted with a fuze adaptor. The casing around the nose is reinforced to assist penetration.

The body is more streamlined than earlier FAB-500 models.

While many versions use TNT as the main explosive fill, later versions might use TGAF (59% TNT, RDX 19%, Aluminium 17%, 5% wax).

OFZAB-500

Image © Vitaly V. Kuzmin

ORDNANCE SUB-CATEGORY	Aerial Bomb
EXPLOSIVE FILL (g)	37500 EXPL -250000 OM-100MI-3L
AUW (g)	500000g
DIMENSIONS (mm)	2500x450
COUNTRY OF ORIGIN	Russia
FUZE	AVU-ET

The OFZAB-500 combines both incendiary and high explosive fragmentation roles. Oskolochno-Fugasnaya Zazhigatelnaya Bviatsionnaya Bomba literally translates as Fragmentation High Explosive Incendiary Bomb. Arguably it could be classified as a form of thermobaric bomb. The OFZAB-500 is typically fuzed with an electro-mechanical impact fuze such as an AVU-ET. It can only be fuzed in the nose.

It is not confirmed what high explosive is used with the OFZAB. The incendiary/ thermobaric composition is OM-100MI-3L.

The bomb is normally marked with black stencils near the lugs.

FUZES

MVCH-62

Image © Kdo Kamir

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	15 g PETN booster plus mine detonator
AUW (g)	No data
DIMENSIONS (mm)	144
COUNTRY OF ORIGIN	Russia/Bulgaria/Romania

The MVCh-62M is the most common minimum metal fuze threaded at 85mm for the TM-62, TM-72 and TM-80 series of mines. The casing is made of bakelite/plastic. The fuze contains a clockwork arming mechanism. Removal of the safety clip and depression of the green arming button initiates the arming delay. The clockwork mechanism retards the detonator from aligning with the striker. The fuze is designed to operate when approximately 200 kg is applied to the pressure plate.

While originally claimed to be minimum metal, the MVCh-62 is relatively easy to detect, even though parts of the clockwork mechanism are plastic. The safety clip is slightly different from that found on the MVP.

Th “y” prefix on the item above indicates this was a training version.

MVP-62M

Image © Roly Evans

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	No data
AUW (g)	No data
DIMENSIONS (mm)	122x80
COUNTRY OF ORIGIN	Russia/Bulgaria

The MVP -62M is a minimum metal fuze threaded at 85mm for the TM-62, TM-72 and TM-80 series of mines. The fuze body is made out of bakelite. The fuze is armed by removal of the metal clip and then depressing the prominent arming button on the upper surface. The fuze has a bellows system that retards the movement in line of the detonator by up to 300 seconds. The fuze is designed to operate when approximately 120 kg is applied to the pressure plate.While "minimum metal", the striker, the striker spring, larger side spring and detonator capsule make this mine detectable with most modern electro-magnetic induction detectors. The safety clip for the mine is subtlety different from that of the MVCh-62 with a round contour to hold the arming button. Discarded clips can be a good indicator as to the presence of AV mines.

Bulgarian versions usually have the 46 Dunarit marking in the distinct double circle. The Russian versions are either made in factory 583 or Russian state factories, symbolised by two semi circles or overlapping circles as per the image above.

M-6

Image © Roly Evans

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	6-10g Tetryl.
AUW (g)	168g
DIMENSIONS (mm)	51x83x40
COUNTRY OF ORIGIN	Russia / Bulgaria

The M6 is a point detonating impact fuze that incorporates a long standing Soviet fuze design. It has no setting bolt and will only function in Superquick mode. The internal workings incorporate a number of holding devices including a creep spring, set back sleeve, and locking balls. The firing pin acts as a holding device on the slider until arming. The fuze is armed by setback. There is some speculation that the fuze cap is left on in order to try to artificially create a delay function although this is unconfirmed.

The fuze is usually found in hermetically sealed round tins stored in a side compartment of a box of ten 82mm mortars. Most Russian or Bulgarian versions of this fuze utilise aluminium for the windshield. Chinese versions utilise a distinct brown bakelite. Unfired mortar bombs fitted with this fuze and ejected from the seat of an explosion (such as in a vehicle or explosive store house) may become armed and should be treated accordingly.

M-12

Image © Roly Evans

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	23g Tetryl
AUW (g)	535g
DIMENSIONS (mm)	117x40mm
COUNTRY OF ORIGIN	Russia/China

The M-12 is the standard impact fuze for 120mm high explosive mortar rounds. It dates from the later 1950s. Versions seen in Ukraine tend to be largely coloured black. A modified version designated the 3V35 that is almost identical is known to be in circulation.

The fuze utilizes the standard set back armed mechanical fuze design that incorporates holding devices including a creep spring, set back sleeve, locking balls. The firing pin acts as a holding device on the slider until arming. The basic fuze mechanism differs from the M-6 mortar fuze used on smaller calibres in that a setting bolt is incorporated that enables selection of superquick or delay. This is done by placing the respective flash channel with pyrotechnic delay in line. The booster incorporates a tetryl charge of just under 23g. Tetryl is no longer used as a booster charge by a number of nations. Tetryl exposure to the skin is not advised. If destroying these items in bulk consideration should be given as to the potential environmental impact.

Unfired mortar bombs fitted with this fuze and ejected from the seat of an explosion (such as in a vehicle or explosive store house) may become armed and should be treated accordingly.

RGM-2/V-429 PROJECTILE FUZE

Image © Roly Evans

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	12.5g Tetryl
AUW (g)	438g
DIMENSIONS (mm)	106x40
COUNTRY OF ORIGIN	Russia

The RGM-2 is a Russian percussion or point detonating artillery fuze. The setting bolt changes the pyrotechnic delay to give options of superquick and delay. The mechanism employed is the same as many old soviet mechanical point-detonating fuzes, and incorporates a setback sleeve, creep spring and locking ball assembly. The RGM-2 are routinely used with common 122mm HE-FRAG artillery ammunition such as the OF-462 of 3OF56. The V-429, whilst almost externally identical, tends to be used with smoothbore tank ammunition such as the OF-19 or OF-26.

Like many fuzes, the RGM-2 is manufactured at Russian Factory 50.

GPV-3

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	
AUW (g)	
DIMENSIONS (mm)	125x40
COUNTRY OF ORIGIN	Russia

The GPV-3 is used with 152mm HEAT ammunition. In this role the D-20 howitzer, or equivalent, fires the munitions in a direct fire role. This electromechanical fuze is setback armed, even though the rifled 152mm barrel will impact significant centrifugal force to the projectile. The fuze contains a rotor masking device. The fuze does not include any sort of pyrotechnic time delayed self-destruct mechanism. On impact the crushing of the piezo initiatites the main shaped charge in the warhead by means of spitback.

It is believed that GPV stands for Golovnoy Pyezoelektricheskiy Vzryvatel which can be translated as 'head piezo-electric fuze'. As with many Russian projectile fuzes, the thread is 36mm.

AR-5

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	Tetryl
AUW (g)	500g
DIMENSIONS (mm)	130x44
COUNTRY OF ORIGIN	Russia

The AR-5 is a standard proximity fuze used with 122mm and 152mm artillery projectiles. It can be referred to using the name "Signal". It dates from the late 1970s. It arms by setback and centrifugal force.

The plastic windshield of the fuze is usually green in colour. A setting ring with red lettering is found at the base of the green windshield. As with many Russian projectile fuzes, the thread is 36mm.

There is some evidence that this fuze is in short supply, with most fire missions against entrenched positions utilizing sub-optimal mechanical impact fuzing.

As with all proximity fuzing, EOD operators should be cautious approaching a fuze where there is a realistic chance of a residual charge in the capacitor.

T-7

Image © US DoD

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	7g
AUW (g)	626g
DIMENSIONS (mm)	157x64
COUNTRY OF ORIGIN	Russia

The T-7 is a Powder Train Time Fuze (PTTF) with a super quick impact function. It is used with carrier projectiles such as the 122mm S-463 illumination round. It can also be used with old means of delivering leaflets such as the A1 122mm base ejection projectile, which has been seen in Ukraine.

MRV/MRV-U ROCKET FUZE

Left, MRV fuze. Right, MRU-U fuze cutaway. Image © Dutch EOD Center.

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	29g Tetryl or PETN
AUW (g)	746g
DIMENSIONS (mm)	195x64
COUNTRY OF ORIGIN	Russia

The MRV-U is the standard point-detonating impact fuze used with high explosive 122mm 9M22U rockets. It dates from the early 1970s. The key recognition difference from the earlier MRV the shape of the nose cap. The basic fuze design is similar in principle to the M-12 mortar fuze. The basic set-back sleeve configuration is supplemented by a setting bolt controlling a slider masking device. The setting bolt has Delay and Superquick options. The fuze arms by setback. MRV fuzes are normally packaged in hermetically sealed metal boxes. The fuze is widely made, not just by former Soviet countries but also in the Balkans, Iran and India. While dated, this fuze is still in production and widely operational. The fuze has other designations dependent on country of manufacture, such as MJ-4 (China).

Unfired rockets fitted with this fuze and projected from the seat of an explosion (such as in a vehicle or explosive store house) may become armed and should be treated accordingly. The booster may be tetryl for older MRV versions, or PETN for newer MRV-U versions.

TM-120 ROCKET FUZE

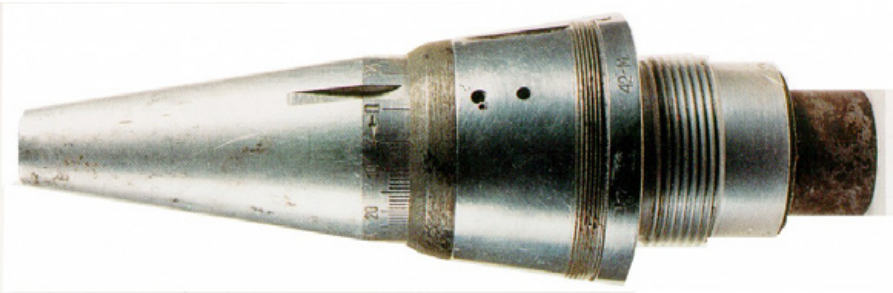


Image © US DoD

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	N/K quantity of black powder/pyrotechnic composition
AUW (g)	694g
DIMENSIONS (mm)	196 x 64
COUNTRY OF ORIGIN	Russia

The TM-120 is the standard mechanical time fuze used for 122mm Grad 9M22 carrier rockets. The fuze can also be used with the 220mm 9M27K Uragan carrier rockets.

The fuze is armed by setback and contains a clockwork mechanism

The fuze body is marked with TM-120 and 42.M just above the fuze thread. the functioning time is selected by rotating the gradations on the windshield. Functioning delay can range from 4 to 120 seconds.

If this fuze is used in error with rockets containing a unitary high explosive warhead it will fail to initiate the warhead.

ATK MT SERIES

Image © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	100g pyrotechnic composition
AUW (g)	N/K
DIMENSIONS (mm)	64 x 86
COUNTRY OF ORIGIN	Russia

The ATK Mechanical time (MT) series of fuzes are routinely used with non-explosive Russian aircraft bombs such as the RBK carrier units for cluster munitions, the SAB parachute flare series and the Photab photoflash bomb. The fuze is often referred to as electro-mechanical in nature since it is armed by initiation of an electrical squib which in turn initiates a pyrotechnic pellets that serves as a holding device on the mechanical clockwork mechanism. ATK fuzes can be found in either the nose or the tail fuze pockets of a carrier bomb. There are no external indications as to whether the fuze has been armed. If found on dropped aerial ordnance the fuze should be considered as armed. Usually the ATK is emplaced with a lockring. There three versions: ATK-EB, ATK-EA and ATK-B. The ATK-EB is the version more commonly found. The 'E' (Э) refers to the electro pyrotechnic nature of the army process.

The fuze contains a spring-loaded firing pin and fuzes on dropped bombs should not be jarred or moved.

AVU SERIES

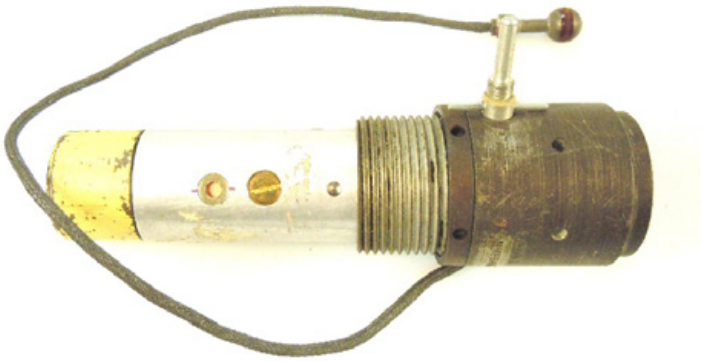


Image © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	60g booster plus other pyrotechnic charges
AUW (g)	1970g
DIMENSIONS (mm)	658 x 598 x 191
COUNTRY OF ORIGIN	Russia/Bulgaria

The AVU is a common Russian bomb fuze. It can be found in the nose or tail of the bomb. As with the ATK the fuze is armed by means of an electrical squib initiating a pyrotechnic holding device. The fuze is an impact inertia all-way. Impact from any angle should initiate a functioning fuze. The fuze has a selectable arming function (instantaneous, short delay, and long delay).

A safety screw/pin assembly is found opposite the coaxial cable. This is inverted prior to flight, and the red safety flag removed. Some believe that the presence of the screw indicates that the fuze is unarmed. This is incorrect. If the longer safety pin is visible rather than the screw the fuze should be considered as armed. The electro-pyrotechnic initiating cable protruding from a tail assembly is a tell-tale that an electro-pyrotechnic fuze of some description is present.

This fuze is commonly associated with the FAB, OFAB, BETAB-500, KhAB, OFZAB and ZAB series of aircraft bombs.

UZRGM-2

INERT version. Image © Kdo Kamir

ORDNANCE SUB-CATEGORY	Grenade Fuze
DIMENSIONS (mm)	104 (39mm prominent from grenade body).
COUNTRY OF ORIGIN	Russia/Bulgaria

The UZRGM and UZRGM-2 are probably the most common mechanical grenade fuzes in existence. Useable in any grenade that has a M-10 (10mm) thread, they are routinely found in common grenades such as the F-1 and RGD-5.

UZRGM stands for Universal'nyi Zapal, Ruchnaya Granata, Modernizirovannyi, which translates to Universal Igniter Hand Grenade Improved.

The fuze operates in a standard manner for simple mechanical grenade fuze. Once the pin is pulled and the hand grip released from the fly off lever there is nothing to hold the cocked striker from driving the striker into the primer to initiate the pyrotechnic delay and subsequently the detonator.

The primer is lead azide based. The fuze body is made of aluminium. The pyrotechnic delay in grenade fuzes is stated as being 3.2-4.0 seconds. An instantaneous variant of the UZRGM fuze has been encountered and has been designed for use in booby traps. Grenades with UZRGM fuzes found as Abandoned Explosive Ordnance (AXO) should therefore be treated with caution.

GRENADES

F-1

Bulgarian F1 and UZRGM-2 fuze. Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	60g TNT
AUW (g)	600g
DIMENSIONS (mm)	130x55
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	UZRGM-2

Despite its age the F-1 remains one of the most common high explosive fragmentation grenades. The UZRGM-2 fuze is a simple cocked striker. The fly off lever which retains the cocked striker is held by a standard pin as a holding device.

The pre-scored fragmentation is relatively low quality and rarely fragments evenly. The fragmentation is claimed to be lethal up to 200m although lethal fragmentation within 30m is more likely.

UZRGM-2 fuzes, made in a range of countries, can be used with this grenade. The fuze will typically initiate 3.2-4.2 seconds after the fly off lever is released. Theoretically any firing device with an M-10 thread could be used with the F-1 grenade. For example a simple MUV fuze with an MD-5 detonator can easily be attached as a firing device. These grenades are often employed as crude boobytraps in Ukraine, typically using some sort of pull mechanism such as a trip wire. The grenades can also be used as anti-lift devices when placed with the pin removed under an object, or as an anti-tamper device when placed adjacent in the ground to an omni-directional mine stake or adjacent to a buried bounding fragmentation mine.

RGD-5

Images © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	110g TNT
AUW (g)	310g
DIMENSIONS (mm)	114x58
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	UZRGM-2

In use since the 1950s, the RGD-5 is a common offensive grenade. The reduced fragmentation means a reduce effective range of 15-20m. The M-10 fuze thread accepts the standard UZRGM-2 fuze, can an also accept compatible switches such as a MUV series fuze with an MD-5 detonator. As with other grenades the UZRGM-2 has a 3.2-4.2 second delay.

This item can still be readily used as a booby trap,

The grenade is usually marked with a black capital T to indicate a TNT fill. The markings differ depending on where the grenade was manufactured. Markings will also be found on the fly off lever of the UZRGM-2 fuze.

VOG-17/VOG-17M

VOG-17M. Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	34g A-IX-1
AUW (g)	350g
DIMENSIONS (mm)	132x30
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VMG/VMG-M

The VOG-17 is a projected HE/FRAG grenade. It is typically fired by AGS-17 grenade launcher and can be used as a form of light local indirect fire support. The VMG is a point detonating and graze fuze that arms by setback and centrifugal force. A VMG-M version, used on the VOG-17M, includes a pyrotechnic delay self-destruct feature that is initiated by setback on launch. It should be noted that the VMG-M contains a small rotor that maintains the primer out of line until the holding devices are removed during the arming sequence. The VMG has no such rotor and thus contains an inline primer, and therefore is not bore safe. VOG-17s with VMG fuzes, even when found as AXO, should be handled accordingly. The grenade is projected by means of a single based nitrocellulose propellant charge initiated on indentation of the primer by a firing pin in the AGS-17.

On impact the striker, now in line with the primer if a VOG-17M, overcomes a relatively weak creep spring to initiate the explosive train.

The VOG-17 and VOG-17M are externally virtually identical. Markings are the easiest way to tell the difference. The explosive fill, A-IX-1 is marked on the black body of the grenade.

VOG-17 IMPROVED HAND GRENADE

Image © Private

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	34g A-IX-1 estimated
AUW (g)	300g estimated
DIMENSIONS (mm)	N/K
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VMG/VMG-M

The VOG-17 improvised grenade has been seen in Chechnya, Syria and Ukraine. It is sometimes referred to as "Khattabka" (хаттабка). Khattabka can also be used to refer to other improvised or adapted grenades, such as those adapted from a VOG-25. The UZRGM-2 fuze works as it would for any other HE/GRAG grenade.

The grenade should not be confused with the conventionally manufactured AR-ROG grenade made in Bulgaria. The different fuzing is the easiest way to tell the difference, the DVM fuze being clearly different from a UZRGM-2.

VOG-25

Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	48g A-IX-1
AUW (g)	250g
DIMENSIONS (mm)	102x40
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VMG-K

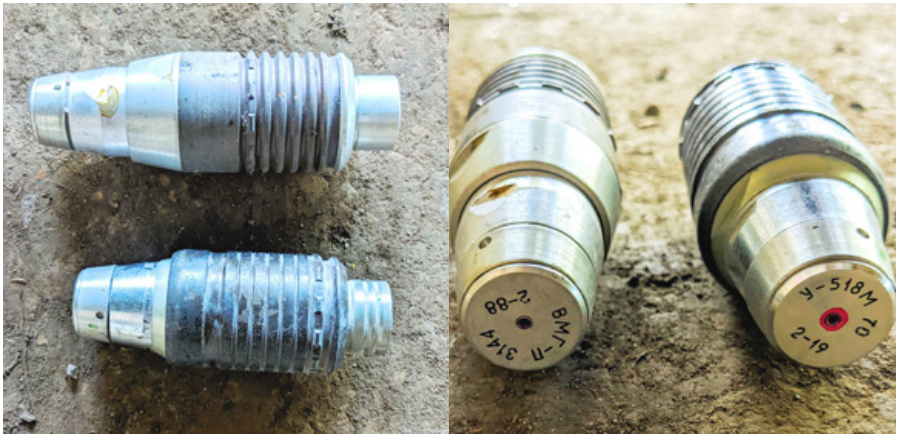
The VOG-25 is a projected HE/FRAG grenade largely used with the GP-25 UGL. Often used as an indirect fire weapon, it is claimed to have an effective range up to 400m. As with other projected grenades the muzzle velocity is relatively low (77m/s). The forces required to arm the fuze are relatively low.

The VMG-K (ВМГ-К) is a point initiating fuze with a pyro technic self-destruct initiated on setback.

Factory markings are usually visible on the nose of the VMG-K fuze.

The windshield of the grenade will typically show indentations on impact. Such impact damage and an indentation on the primer, along with propellant scorch marks, and the easiest way to identify a blind.

VOG-25M



Images © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	70g A-IX-1
AUW (g)	278g
DIMENSIONS (mm)	107x40
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VMG-K

The VOG-25M is a 40mm projected grenade. The VMG-K fuze is armed by setback and centrifugal force. A VOG-25PM version with a bounding frag role looks very similar to the VOG-25M. The 68-70g A-IX-1 charge is more than that used with other VOG grenades.

Two versions of the VOG-25M have been seen in Ukraine. It is possible one is a training version.

The Bulgarian version grenade is marketed as the ARFG-25B.

VOG-25M IMPROVISED

Image © Private

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	50g A-IX-1 estimated.
AUW (g)	N/K
DIMENSIONS (mm)	N/K
COUNTRY OF ORIGIN	Chechnya/Syria/Ukraine
FUZE	UZRGM-2

This grenade has also been labelled Hattabka. The fuze body is drilled and a thread tapped to accept a UZRGM-2 10mm fuze. It is unclear if the propellant charge is removed.

It is possible the different fuze mechanism changes the NEQ although the HE/FRAG effect remains in any case. It is also likely that the explosive charge is less than a VOG-25M in order to allow space for the detonator attached to the UZRGM-2 fuze.

RGO/RGN

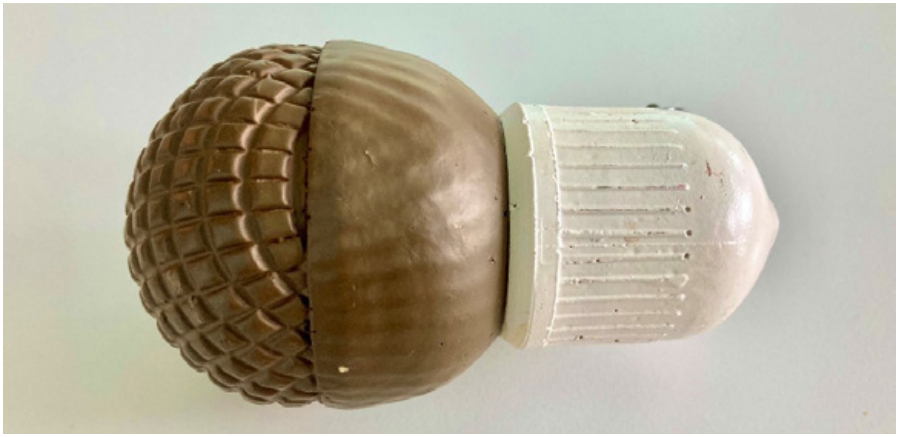


Image © Roly Evans

ORDNANCE SUB-CATEGORY	Grenade - HE/FRAG
EXPLOSIVE FILL (g)	90g-110g A-IX-1 estimated.
AUW (g)	530g
DIMENSIONS (mm)	114x60
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	UDZ

The Ruchnaya Granata Oboronitel'naya (RGO) RGO is a defensive HE-FRAG grenade. It has a UDZ all-ways fuze with two pyrotechnic self-destruct elements. On impact a circular inertia weight, armed after a pyrotechnic delay of 1-2 seconds, pushes a primer onto a striker. In this respect the UDZ is a relatively uncommon fuze for a HE hand grenade. The SD is timed to function after 3.2-4.2 seconds, similar for the delay for a UZRGM-2 in any case.

The RGN is almost identical to the RGO – the main difference being the RGN has an aluminium alloy body where the RGO body is made from steel. Some publications state that the RGN has a 110g main charge vs 90g for an RGO although it is not clear how accurate this is.

While A-IX-1 is the most common modern filling, TG-30 and TG-40 have also been used.

The UDZ all-ways fuze is known to be highly dangerous. EOD operators are advised to be extremely cautious.

RKG-3

Image © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade - HEAT
EXPLOSIVE FILL (g)	350 TG-50
AUW (g)	1070g
DIMENSIONS (mm)	362x72
COUNTRY OF ORIGIN	Russia/Bulgaria/East Germany
FUZE	Impact Inertia/Cocked Striker

The RKG-3 is HEAT hand grenade, designed to be used in urban combat where it can be deployed from buildings. Ruchnaya Kumulyativnaya Granata (Ручная Кумулятивная Граната) translates to 'Hand Cumulative Grenade'. An RKG-3 M version also exists, that employs a copper rather than steel shaped charge liner. A longer RKG-3EM version with an enhanced standoff configuration is also in circulation.

The easiest way to tell if the item has been armed is the deployment of a small white drogue chute.

Like the RGO/RGN the RKG-3 has an impact fuze. The cocked striker may function when an impact force moves the last holding devices (sleeve and locking balls). The cocked striker fuze is known to be highly dangerous. EOD operators are advised to be highly cautious.

There are indications this item has been adapted for use as a small aerial HEAT bomb labelled the RKG-1600 to be deployed by UAV. In this configuration the fuzing in the handle is replaced by what is assumed to be an in-line impact inertia fuze.

MORTAR ROUNDS

82MM 0-832

Images © Roly Evans

ORDNANCE SUB-CATEGORY	Mortar Round
EXPLOSIVE FILL (g)	440 TNT
AUW (g)	3230g
DIMENSIONS (mm)	329 x82
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	M-6

The O-832 is a common high explosive 82mm mortar round. O stands for Oskolocho which translates as 'fragmentation'. These rounds are invariably fuzed with relatively simple M-6 mechanical impact fuzes. These fuzes employ the standard Soviet mechanism of setback sleeve spring. When not fuzed to come with a black plastic transit plug. Mortars usually come ten rounds per box with a side compartment for the fuzes in hermetically sealed tins.

The images above show a slightly improved 53-O-832DU (53-O-832ДУ) version.

120MM 0F-843

Images © Roly Evans

ORDNANCE SUB-CATEGORY	Mortar Round
EXPLOSIVE FILL (g)	1400 TNT or TD-50
AUW (g)	16000g
DIMENSIONS (mm)	674x120
COUNTRY OF ORIGIN	Russia
FUZE	M-12

The OF-843 is a smoothbore high explosive mortar. Typically it is impact fuzed. The M-12 fuze incorporates not only the usual set back sleeve design but also a slider, and a selector for delay and/or Superquick functions. When not fuzed the mortar comes with a black plastic transit plug.

OF stands for Oskolocho-Fygasnaya which translates as Fragmentation Explosive.

Usually 120mm high explosive mortars come two per storage box. Fuzes are found in hermetically sealed tins in a compartment at the side of the box. There are a range of OF-843 high explosive mortars with suffixes such as A and B to denote minor differences. Note that bagged supplementary propelling charges associated with this type of mortar ammunition are very easily damaged and care should be taken not to spill propellant during handling.

120MM OF-49

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Mortar Round
EXPLOSIVE FILL (g)	4900 A-IX-2
AUW (g)	17200g
DIMENSIONS (mm)	590x120
COUNTRY OF ORIGIN	Russia
FUZE	M-12

This 120mm high explosive mortar is different from many others in Russian service in that it is not smoothbore but has pre-cut rifling. It is commonly associated with the 2S9 Anona (anemone) 120mm self-propelled mortar.

While more centrifugal force is imparted to the mortar than a standard model, the round is fuzed with an M-12 armed by setback. Ammunition which has been the subject of vehicle fires should be assumed to be armed and handled with caution.

240MM F-864

Image © SESU

ORDNANCE SUB-CATEGORY	Mortar Round
EXPLOSIVE FILL (g)	31900 TNT
AUW (g)	130700g
DIMENSIONS (mm)	1541x240
COUNTRY OF ORIGIN	Russia
FUZE	M-16

The 240mm F-864 mortar is most commonly associated with the Russian 2S4 Tyulpan (tulip) self-propelled mortar.

The F-864 is often fuzed with mechanical impact fuzes, most likely the M-16. When not fuzed the rounds are shipped with a grey transit plug as seen above. Each fuze well typically has some form of fuze adaptor. The mortar uses a primary cartridge which is fixed to the tail. The bagged supplementary propelling charges associated with this type of mortar ammunition are very easily damaged and care should be taken not to spill propellant during handling.

PROJECTILES

OF-17

Image © Private

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	1690g A-IX-2
AUW (g)	18100g
DIMENSIONS (mm)	100x611
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	V-429

The OF-17 is a 100mm unitary high explosive fragmentation round used by the 2A70 tank gun found on BMD-4 armoured vehicles. OF stands for Oskolocho-Fygasnaya which translates as Fragmentation Explosive. This round has been found as kick out around destroyed BMD-4 armoured vehicles. It has also been found as unfuzed AXO. The round is similar to the OF32, albeit slightly heavier.

The round is typically fuzed with a V-429 mechanical impact fuze. The V-429 series are relatively basic mechanical impact fuzes that are armed by setback. The muzzle velocity of the round is 850m/s. The V-429 fuze looks very similar to the RGM-2 fuzes used on artillery projectiles. Another fuze may be used, the V-35. This looks very similar to an M-12 mortar fuze.

OF-19

Image © Arcon Partners Ltd

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	3150g TNT
AUW (g)	23219g
DIMENSIONS (mm)	125x670
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	V-429

The OF-19 is a spin stabilized 125mm high explosive tank round. It has largely been replaced in inventories by the OF-26. Both rounds use the V429 series of fuzes that are armed by set-back. Both have four fins to provide slow spin stabilized in flight. The main difference is the explosive charge employed, with theOF-19 using TNT rather than A-IX-2. When combined with a 4Z40/4Zh52 propellant charge assembly the whole round is designated the 3VOF22 (3ВОФ22).

The OF-19 look very similar to its successor round the 3OF-26. Markings are the easiest way of telling the difference. If markings are not visible a fuzed OF-19 is 5mm shorter than an OF-26. The V-429 fuze looks very similar to the RGM-2 fuzes used on artillery projectiles.

OF-26

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	3340g A-IX-2
AUW (g)	23200g
DIMENSIONS (mm)	125x675
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	V-429

The OF-26 is the standard Russian 125mm HE projectile. Its full GRAU index code is 3OF-26. If found as Abandoned Explosive Ordnance (AXO) the round will come with a separate 4Z40/4Zh52 propellant charge assembly which uses a single based propellant. The complete assembly of 3OF-26 and propellant charge is designated the 3vOF36. The round is fired from smoothbore tank guns and is fin stabilised. The 4 fins provide a slow rate of spin that is not employed in fuze arming. The V-429 series are relatively basic mechanical impact fuzes that are armed by setback. The muzzle velocity of the round is 850m/s.

Identification should be confirmed by markings on the munition – this round is easy to confuse with the OF-19. Usually ОФ-26 and A-IX-2 are marked in black on one side of the munition. Rounds are packaged one round and separate propellant charge per box. The munitions come both fuzed and unfuzed within the packaging. A large number of OF-26 rounds have been found with heat damage around destroyed AFVs. The V-429 fuze looks very similar to the RGM-2 fuzes used on artillery projectiles.

OF-32

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	1700g A-IX-2
AUW (g)	15660g
DIMENSIONS (mm)	100x490
COUNTRY OF ORIGIN	Russia
FUZE	V-429

The OF-32 is a 100mm unitary high explosive fragmentation round used by the 2A70 tank gun found on BMD-4 armoured vehicles. OF stands for Oskolocho-Fygasnaya which translates as Fragmentation Explosive. This round has been found as kick out around destroyed BMD-4 armoured vehicles. It has also been found as unfuzed Abandoned Explosive Ordnance (AXO). The round is similar to the OF17, albeit slightly lighter.

The round is typically fuzed with a V-429 mechanical impact fuze. The V-429 series are relatively basic mechanical impact fuzes that are armed by setback. The muzzle velocity of the round is 850m/s. The V-429 fuze looks very similar to the RGM-2 fuzes used on artillery projectiles. Another fuze may be used, the V35. This looks very similar to an M-12 mortar fuze.

BM-26

Images © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile - APFSDS
EXPLOSIVE FILL (g)	N/A
AUW (g)	4800g projectile. 7050g complete round
DIMENSIONS (mm)	125x395 (projectile only)
COUNTRY OF ORIGIN	Russia
FUZE	N/A

The BM-26 is a common 125mm APFSDS round used with Russian smoothbore tank guns. The core of the round is made from tungsten-nickel-iron alloy, a HMTA (Heavy Metal Tungsten Alloy). The rounds comes as a two-piece construction with the dual propellant cartridges.

The unitary round with the 4Zh63 propelling charge might be referred to as the 3VBM11/3BM26/27. The actual round itself is the BM-26.

These rounds should not be destroyed by explosive means due to the sinters that can result. These rounds should be removed for specialised industrial processing.

BM-32

Image © Open source

ORDNANCE SUB-CATEGORY	Projectile - APFSDS
EXPLOSIVE FILL (g)	N/A
AUW (g)	7050g
DIMENSIONS (mm)	125x585 (projectile only)
COUNTRY OF ORIGIN	Russia
FUZE	N/A

The BM-32 projectile is a common 125mm APFSDS round used with Russian smoothbore tank guns. The core of the round is made from Depleted Uranium. When used with dual propellant cartridges the round is designated 3VBM-13. Dating from the 1980s this was the first Soviet DU APFSDS round. It can be referred to as Vant (Вант) after the research project that developed it.

It is important these rounds are correctly identified and not mistaken for other APFSDS models. These rounds should not be destroyed by explosive means due to the sinters that can result. These rounds should be removed for specialised industrial processing.

BK-13M

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile - HEAT
EXPLOSIVE FILL (g)	1800 A-IX-1
AUW (g)	18200g
DIMENSIONS (mm)	122x637 (projectile only)
COUNTRY OF ORIGIN	Russia
FUZE	N/K

The BK-13 is a 122mm HEAT-FS-T round. It is employed by a D-30 howitzer in direct fire mode. When combined with a propellant charge in a 122mm metallic casing the round may be referred to as 3VBK9M (3ВБК9М). The probe is sometimes referred to as a stand-off spike. there is no tandem charge in the probe. the only shaped charge is in the main warhead. The driving band is typically not painted. The stabilizer is made up of six fins.

The easiest way of telling if the round has been fired is impact damage around the probe/spike.

BK-14

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile - HEAT
EXPLOSIVE FILL (g)	1850 OKFOL
AUW (g)	19020g
DIMENSIONS (mm)	125x677 (projectile only)
COUNTRY OF ORIGIN	Russia
FUZE	V-15

The BK-14 is a 125mm HEAT-FS-T round fired by smoothbore tank guns. It has a single shaped charge in the main warhead. The V-15 fuze is point initiating base detonating. There is no tandem charge in the probe. This HEAT projectile is commonly fired by the T-72 and T-80 main battle tanks.

Usually the identity of the round is stencilled in black markings, but unpainted and unmarked rounds have been observed.

When used with a 4Zh40/4Zh52 propellant charge the complete round is designated a 3VBK10M (3BBK10M). These are the same propellant charges used with other 125mm smoothbore Russian tank rounds.

The BK-14 may be confused with the BK-29. The easiest way to tell between the two is a subtle difference in the shape of the probe end.

OF-462

Image © Roly Evans

ORDNANCE SUB-CATEGORY	Projectile – HE/FRAG
EXPLOSIVE FILL (g)	3460 TNT
AUW (g)	21760g
DIMENSIONS (mm)	122x645
COUNTRY OF ORIGIN	Russia/Ukraine/Bulgaria/Romania
FUZE	RGM-2

The OF-462 is a common 122mm HE FRAG artillery projectile. The body is made of steel. Fired projectiles will show scoring on the copper driving band. While spin stabilised, the typical RGM-2 impact fuze arms by setback. While there are proximity fuzes with a 36mm thread that are compatible with this projectile, most fuzing seen to date has been relatively simple point-detonating mechanical fuzes.

These rounds are used with D-30 howitzers and can be found as AXO around abandoned or destroyed D-30 positions. It can also be expected in abandoned or destroyed self-propelled 122mm artillery such as the 2S1 (2C1) self-propelled howitzer.

The OF-462 designation, and the TNT explosive fill are marked on one side (usually designated by the letter T), the factory number, lot number and year of manufacture are marked on the other.

S-463

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – ILLUM
EXPLOSIVE FILL (g)	20g expulsion charge
AUW (g)	21960g
DIMENSIONS (mm)	122x551
COUNTRY OF ORIGIN	Russia
FUZE	T-7

The S-463 is the standard 122mm ILLUM round for D-30 howitzers and self-propelled 122mm artillery such as the 2S1. The copper driving band may be visible or painted over. As with many ILLUM rounds a candle is expelled from the main body of the carrier projectile by a small 20g black powder low explosive expulsion charge. The timing of the deployment is typically governed by a T-7 Powder Train Time Fuze (PTTF). Once deployed the candle is maintained in the air by a white chute. Candles that have landed are usually visible by means of the chute and scorch marks on the ground.

OF-25

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – HE/FRAG
EXPLOSIVE FILL (g)	6800g A-IX-2
AUW (g)	43560g (unfuzed)
DIMENSIONS (mm)	152x646
COUNTRY OF ORIGIN	Russia
FUZE	RGM-2

The OF-25 is a common 152mm HE FRAG artillery projectile. The body is made of steel. Fired projectiles will show scoring on the copper driving band, which is painted the same grey colour as the rest of the projectile. While spin stabilised, the typical RGM-2 impact fuze arms by setback. While there are proximity fuzes with a 36mm thread that are compatible with this projectile, most fuzing seen to date has been relatively simple point-detonating mechanical in nature.

These rounds are used with D-20 howitzers and can be found as AXO around abandoned or destroyed D-20 positions. It can also be expected in abandoned or destroyed self-propelled 152mm artillery such as the 2S3 (2C3) Akatsiya (Акация).

The OF-25 designation, and the A-IX-2 explosive fill are marked on one side, the factory number, lot number and year of manufacture are marked on the other.

OF-45

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – HE/FRAG
EXPLOSIVE FILL (g)	7650g A-IX-2
AUW (g)	43560g (unfuzed)
DIMENSIONS (mm)	152x864
COUNTRY OF ORIGIN	Russia
FUZE	RGM-2

The OF-45 is a common 152mm HE FRAG artillery projectile that dates from the 1980s. It is noticeably longer than other 152mm HE artillery rounds. The body is made of steel. Fired projectiles will show scoring on the copper driving band, which is painted the same grey colour as the rest of the projectile. The base unit is hollow, the join to which is visible beneath the driving band. While spin stabilised, the typical RGM-2 impact fuze arms by setback. While there are proximity fuzes with a 36mm thread that are compatible with this projectile, most fuzing seen to date has been relatively simple point-detonating mechanical in nature.

These rounds are used with D-20 howitzers and can be found as AXO around abandoned or destroyed D-20 positions. It can also be expected in abandoned or destroyed self-propelled 152mm artillery such as the 2S3 (2C3) Akatsiya (Акация).

The OF-25 designation, and the A-IX-2 explosive fill are marked on one side, the factory number, lot number and year of manufacture are marked on the other.

BP-540

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – HEAT
EXPLOSIVE FILL (g)	3920g A-IX-2
AUW (g)	27400g
DIMENSIONS (mm)	152x531
COUNTRY OF ORIGIN	Russia
FUZE	GPV-3

The BP-540 is a 152mm HEAT projectile for use in a direct fire role by D-20 howitzers. The body is made of steel. Fired projectiles will show scoring on the copper driving band, which is painted the same grey colour as the rest of the projectile. There are two distinct spanner holes at the base of the ogive. Although the BP-540 is a spin stabilized round, the GPV-3 fuze that it is commonly used with is setback armed. The fuze is point initiating base detonating, piezoelectric spit-back, without any form of self-destruct. The round has a tracer element.

The factory, lot, year of manufacture and calibre is usually marked on one side, the explosive fill on the other.

As well as being used by the D-20 howitzer, the round can be employed by self-propelled artillery such as the 2S3, 2S19, and 2A65.

OF-43

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – HE/FRAG
EXPLOSIVE FILL (g)	17800g A-IX-2
AUW (g)	110000g
DIMENSIONS (mm)	203
COUNTRY OF ORIGIN	Russia
FUZE	V-491

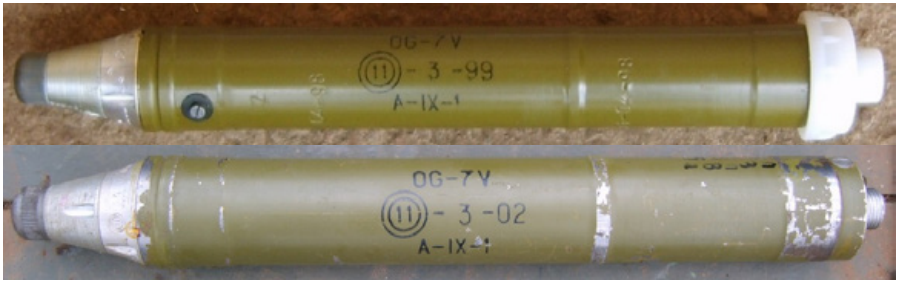
The OF-43 is a 203mm HE projectile employed by 2S7 Pion and 2S7M Malka self-propelled howitzers. The projectiles are used with two bag charges.

The V-491 mechanical impact fuze arms by setback. The muzzle velocity on firing is 960 m/s. The V-491 has a selector bolt for delay and super quick functions.

These items are packaged in similar wooden rack system used for Soviet aerial bombs.

ROCKETS AND RECOILLESS AMMUNITION

OG-7V



Bulgarian OG-7. Images © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless Blast FRAG
EXPLOSIVE FILL (g)	210g A-IX-1
AUW (g)	1760g
DIMENSIONS (mm)	593x40
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	O-4M

The OG-7 is a blast fragmentation rocket propelled grenade which is fired from the RPG-7 range of 40mm calibre launchers. O stands for Oskolochnymi and indicates the use of fragmentation around the warhead. Its only form of propulsion is the standard expulsion charge used with the range of RPG ammunition. There is no sustain rocket motor section as is found with other RPG anti-tank ammunition thus the muzzle velocity is only that imparted by the expulsion charge, and hence is lower than other RPG rounds. The effective range is also less (280m), although some claim a range out to 1000m.

The 04-M fuze utilizes a simplified version of the standard Soviet setback sleeve design. It is important to note that there is no masking device such as a shutter in the fuze. The primer is in line with the striker, no bore safety is present.

A black metal cap is removed from the fuze before firing. The absence of this cap and any impact damage, along with a burnt-out expulsion charge, are the likely indicators of an armed item. Items found with a white or black plastic transit cap over the flash channel to the expulsion charge are likely to be abandoned explosive ordnance (AXO). An expulsion charge bare of any propellant does not necessarily mean an armed item, since abandoned OG-7s that have nevertheless been prepared for firing will still see the rapid weathering of the expulsion charge cardboard casing and propellant.

PG-7M

Bulgarian PG-7M. Image © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	320g A-IX-1 / 420g propellant
AUW (g)	1500g
DIMENSIONS (mm)	675x71
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VP-7M

The PG-7M is a HEAT rocket propelled grenade which is fired from the RPG-7 range of 40mm calibre launchers. The PG-7M functions in a similar way as other PG-7 type rounds. The round is propelled from the launcher by an expulsion charge which is screwed onto the rear of the sustain rocket motor. The sustain motor ignites a safe distance in front of the firer and provides the thrust to take the warhead to its maximum range. The round is fin stabilised and the fins are surrounded by the expulsion charge propellant, which is protected by a waxed cardboard tube. The warhead is fitted with a point-initiating base detonating (PIBD) fuze which also contains a pyrotechnic based self-destruct mechanism which causes to warhead to function at a maximum range of approximately 950 metres.

The PG-7M differs from the PG-7V not only in shape but also in the plastic liner used in the windshield of the warhead in order to minimise short circuit blinds due to the round glancing off an object before the piezo fuze can impact the target.

The PG-7M is still in production. It can easily be mistaken for the PG-7VS, which looks externally almost identical but has a 72mm warhead diameter and different markings: PG-7VS (ПГ-7ВС). Notably the PG-7VS uses OKFOL rather than A-IX-1. Some sources suggest that more recent versions use a VP-22 fuze.

Indicators of a potentially armed fuze include the seals covering the sustain motor venturis being blown, and an indentation on the percussion primer at the motor end of the device. Fired PG-7M rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by the shaped charge warhead.

PG-7V

Bulgarian PG-7V. Images © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	390g A-IX-1 / 420g propellant
AUW (g)	1750g
DIMENSIONS (mm)	646x85
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VP-7M

The PG-7V is a HEAT rocket propelled grenade which is fired from the RPG-7 range of 40mm calibre launchers. It is probably the most common PG-7 variant. Protivtankovya' (Противтанковая) literally translates as anti-tank, Granata (Граната) translates as grenade. The round is propelled from the launcher by an expulsion charge which is screwed onto the rear of the sustain rocket motor. The sustain motor ignites a safe distance in front of the firer and provides the thrust to take the warhead to its maximum range. The round is fin stabilised and the fins are surrounded by the expulsion charge propellant, which is protected by a waxed cardboard tube. The round is fitted with a point initiating base detonating (PIBD) VP-7 fuze. The shaped charge has a copper liner. There is also pyrotechnic delay self-destruct detonator initiated by a set-back igniter within the VP-7. This should function after 4.8 to 5 seconds (approximately 950m of flight) although failure is common.

The flash channel from the primer to the expulsion charge should also be void, although sometimes this cannot be seen if the expulsion charge aluminium frame is still attached. Blind rounds Fired grenades are usually found with the expended expulsion charge attached and will usually have impact damage on the external surfaces of the warhead body. Such damage can lead to a short circuit between the piezo and the VP-7 fuze at the base of the shaped charge. Indicators of a potentially armed fuze include the seals covering the sustain motor venturis being blown, and an indentation on the percussion primer at the motor end of the device. Fired PG-7V rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by the shaped charge warhead.

PG-7VL

Russian PG-7VL. Images © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	1030g OKFOL / 420g propellant
AUW (g)	2600g
DIMENSIONS (mm)	93x40
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VP-22

The PG-7VL is a HEAT rocket propelled grenade which is fired from the RPG-7 range of 40mm calibre launchers. This is an improved HEAT grenade/rocket that saw service from the late 1970s onwards. The fuzing system is the same as other PG-7 rounds, however the shaped charge is noticeably bigger (93mm diameter). The large (HMX-based) 1kg Okfol shaped charge gives superior armour penetrating performance than earlier PG-7 designs. L stands for Luch, a codename for the development project of this enhanced round. Due to the round being almost 1kg heavier than many other PG-7 rounds, the unchanged motor section consequently produces a lower muzzle velocity. the effective range of this round is only 300m. The round is propelled from the launcher by an expulsion charge which is screwed onto the rear of the sustain rocket motor. The sustain motor ignites a safe distance in front of the firer and provides the thrust to take the warhead to its maximum range. The round is fin stabilised and the fins are surrounded by the expulsion charge propellant, which is protected by a waxed cardboard tube. The round is fitted with a point initiating base detonating (PIBD) VP-7 fuze. Some sources suggest that more recent versions use a VP-22 fuze.

The indicators for a fired and potentially armed device are the same as with other PG-7 designs. The windshield will most likely be the damaged. The expulsion charge will be burnt out leave only an aluminium frame. There will be an indention on the primer. The venturis seals will not be present and there will be indications of combustion. Like the PG-7M, the PG-7VL has a line in the nose to reduce the potential for short circuit if the round grazes an object. The VP-22 fuzing is very similar to other standard PG-7 rounds and incorporates a Vp-7 type fuze armed by setback that incorporates a timed pyrotechnic self-destruct mechanism. A piezo fuze in the nose enables impact initiation with stand-off if the item is undamaged.

Fired PG-7VL rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by the shaped charge warhead.

PG-7R

Image © Sean Moorhouse.

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	1590g OKFOL / 420g propellant
AUW (g)	3630g
DIMENSIONS (mm)	1230x105 (with expulsion charge)
COUNTRY OF ORIGIN	Russia
FUZE	V-728 base fuze/ K-728 precursor fuze

The PG-7R is a HEAT rocket propelled grenade which is fired from the RPG-7 range of 40mm calibre launchers. The R suffix in PG-7R stands for Rezyume which literally translates as 'Summary'.

The warhead contains a tandem shaped charge which is designed to defeat explosive reactive armour. The PG-7R is essentially the same warhead employed with the PG-27 and PG-29, but adapted for the RPG-7 40mm calibre launcher. The round is propelled from the launcher by an expulsion charge which is screwed onto the rear of the sustain rocket motor. The sustain motor ignites a safe distance in front of the firer and provides the thrust to take the warhead to its maximum range. The round is fin stabilised and the fins are surrounded by the expulsion charge propellant, which is protected by a waxed cardboard tube. The precursor (front) charge is fitted with the K-728 fuze and the main (rear) charge is fitted with the V-728 fuze. Both fuzes arm by setback on firing.

A very similar PG-7VR version exists which is 30mm longer, has the same diameter warhead (105mm) although contains a larger 1740g OKFOL explosive charge.

Fired PG-7R rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by the shaped charge warheads. The precursor charge may break off during impact with hard targets and may need to be disposed of separately.

TG-73

Image © Sean Moorhouse.

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	A-IX-1
AUW (g)	NK
DIMENSIONS (mm)	73mm
COUNTRY OF ORIGIN	Bulgaria
FUZE	NK

The TG-73 is a round launched by the disposable DRTG-73 launcher. Its components are made by VMZ Sopot and Arsenal in Bulgaria.

Little is known about the round. It is fin stabilised. It does have a tandem warhead. The precursor charge employ A-IX-1. It is not known whether the main charge uses an RDX or HMX based explosive

As with most Bulgarian munitions factory markings are clearly stencilled in black on both the rocket and the launch tube.

Rounds identified in Ukraine often show manufacturing markings from 2012 and 2014.

TBG-7L

Image © Sean Moorhouse.

ORDNANCE SUB-CATEGORY	Recoilless THERMOBARIC
EXPLOSIVE FILL (g)	NK
AUW (g)	NK
DIMENSIONS (mm)	93 diameter
COUNTRY OF ORIGIN	Russia
FUZE	NK

The TBG-7L is a thermobaric rocket propelled grenade which is fired from the RPG-7 range of 40mm calibre launchers. It is designed to target individuals in enclosed spaces.

PG-15

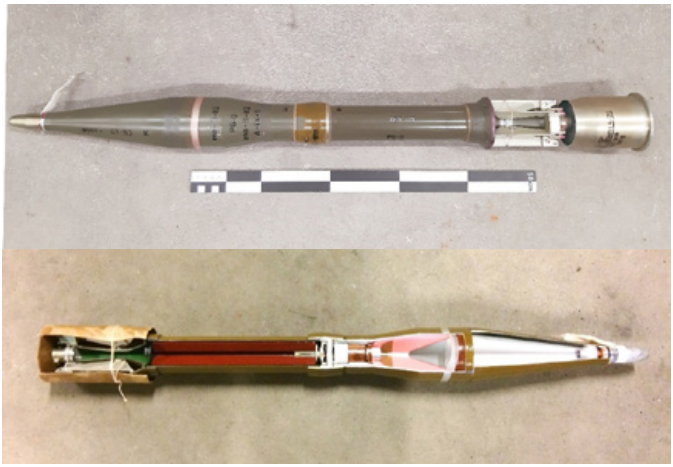


Image Top © Kdo Kamir. Image Bottom © Danish EOD and Search Center.

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	320g A-IX-1
AUW (g)	3470g
DIMENSIONS (mm)	878x82
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VP-15

The PG-15 is used in the 73mm 2A28 Grom smoothbore gun found on BMP-1 and BMD-1 armoured vehicles. The PG-15 is similar to the PG-9 but with a different expulsion charge attachment. The easiest way of distinguishing between the two is the size of the expulsion cartridge. The metal encased cartridge for the PG-15 is smaller. The marking on the warhead will often read PG-9 in any case.

The essential functioning of the PG-15 is very similar to that of a PG-7V. The VP-9 fuze is almost identical to a VP-7. Version with an N suffix tend to use OKFOL rather than A-IX-1.

Fired PG-15 rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by the shaped charge warheads. PG-15 rounds which have been involved in vehicle or ammunition store fires and explosions may become armed during projection and should be destroyed in situ.

OG-15

Image © VMZ Sopot. Image © Dutch EOD Center.

ORDNANCE SUB-CATEGORY	Recoilless Blast Frag
EXPLOSIVE FILL (g)	660g TD-50
AUW (g)	4600g
DIMENSIONS (mm)	828x82
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	GO-2 or O-4M

The OG-15 is used in the 73mm 2A28 Grom smoothbore gun found on BMP-1 and BMD-1 armoured vehicles. The OG-15 is similar to the OG-9 but with a modified expulsion charge attachment. The easiest way of distinguishing between the two is the size of the expulsion cartridge. The metal encased cartridge for the OG-15 is smaller. The explosive used is of a lower quality than that employed in its sister shaped charge munition. Older versions might use TNT, newer versions might use TD-50 which is a 50/50 mix of TNT and RDX. These rounds are fuzed with either a GO-2 or 0-4M. Both types of fuze have in line detonators and cannot be deemed bore safe.

Fired OG-15 rounds which have failed to function should be destroyed in situ.15 rounds which have been involved in vehicle or ammunition store fires and explosions may become armed during projection and should be destroyed in situ.

PG-18

Image © Kdo Kamir

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	400g OKFOL
AUW (g)	2600g (launcher) 1400g (rocket)
DIMENSIONS (mm)	705x64
COUNTRY OF ORIGIN	Russia/Bulgaria/East Germany
FUZE	VP-18

The RPG-18 is a single-shot disposable rocket launcher and is similar to the US 66mm M72 LAW. The actual PG-18 round, outside of the launch tube, looks similar to a PG-9/PG-15, but is over 100mm shorter in length, with a smaller calibre warhead (64mm). It dates from the early 1970s. The lightweight single shot launcher is different from earlier RPG versions that were designed for a reusable launcher. The weapon is intended for use at short range (up to 200m). The VP-18 fuze works broadly in a similar way to the earlier VP fuzes, with a piezo electric point initiating base detonating (PIBD) fuze that incorporates a self-destruct mechanism. The 400g HMX-based OKFOL shaped charge warhead is relatively small compared with more modern single shot rocket launchers. The PG-18 was surpassed by the PG-22 and PG-26 by the 1980s. Old East German versions of the PG-18 have been supplied to Ukraine. The Mukha (myxa) designation translates as 'fly'. While PG-18s in an un-extended launcher may be deemed unarmed, caution is advised given potential booby trapping of these items. Fired PG-18 rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by the shaped charge warhead.

PG-22

Images © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	450g OKFOL
AUW (g)	2700g (launcher) 1480g (rocket)
DIMENSIONS (mm)	755x72.5
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VP-22

The PG-22 is a second-generation single-shot disposable anti-armour rocket. It contains a slightly larger HMX based shaped charge (450g OKFOL) than its predecessor, the PG-18. It was manufactured until the early 1990s in Russia and is still produced in Bulgaria.

The PG-22 has a truncated motor section compared with its predecessor and consistent with this has a relatively short range (150m). The VP-22 fuze is point initiating base detonating (PIBD) with a self-destruct mechanism. A distinct bulge on the motor section is one way to tell the difference with the PG-26 warhead, another is subtle differences in the shape of the warhead itself. Even on fired rounds markings are usually discernible for identification. If found in the launcher, the PG-22 has an extendable launch tube, the PG-26 does not.

PG-26

Images © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	570g OKFOL
AUW (g)	2900g (launcher) 1480g (rocket)
DIMENSIONS (mm)	770x72.5
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	VP-26

The PG-26 is a second-generation single-shot disposable anti-armour rocket. It has a rigid non-telescoping launch tube and contains a larger shaped charge (570g OKFOL) than its predecessor, the PG-22. The maximum effective range of the rocket is 250m. The round is sometimes referred to as "Aglen". A variant with a thermobaric warhead, the RShG-2, is in circulation. The RShG-2 has a cylindrical warhead configuration.

PG-27

Images © Private

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	1790g HMX
AUW (g)	8300g
DIMENSIONS (mm)	1135x105
COUNTRY OF ORIGIN	Russia
FUZE	V-728 base fuze/ K-728 precursor fuze

The PG-27 is a second-generation single-shot disposable anti-armour rocket and is sometimes referred to as Tavolga ('meadow grass'). It has an effective range of 200m. The warhead contains a tandem shaped charge which is designed to defeat explosive reactive armour. The PG-27 has a significantly larger warhead than its predecessor the PG-26. (1790g of OKFOL vs 570g).

A variant with a thermobaric warhead, the RShG-1, been developed. The RShG-1 (Реактивная ШтурмоваяГраната, Reaktivnaya Shturmovaya Granata), has a single bulbous thermobaric warhead. Another variant, the RMG, has a tandem warhead which employs a HEAT precursor charge and a thermobaric main charge.

Fired PG-27 rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by any shaped charge warheads. For variants with tandem warheads, precursor charges may need to be disposed of separately.

PG-29

Image Public Domain US Government. Image © Private.

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	2330g HMX
AUW (g)	6700g
DIMENSIONS (mm)	1097x105
COUNTRY OF ORIGIN	Russia
FUZE	V-728 base fuze/ K-728 precursor fuze

The PG-29 is a reloadable recoilless anti-tank rocket system and has an effective range of 500m. The warhead contains a tandem shaped charge which is designed to defeat explosive reactive armour. The V-728 base fuze is used for initiation of the main charge, a separate K-728 fuze is used for the precursor charge. Both fuzes arm by setback. PG-29V may be identified by its GRAU index code - 7P29 (7П29). The PG-29 is sometimes referred to as a Vampir (Вампир) launcher. The PG-29 round outside of the launcher is easy to mistake for the PG-7VR since they effectively have the same warhead design. The motor section is different however and is the easiest way of telling the difference. The launch tube is made from reinforced fibreglass. Fired PG-7R rounds which have failed to function should be destroyed in situ and consideration should be given to reducing the hazard posed by the shaped charge warheads. The precursor charge may break off during impact with hard targets and may need to be disposed of separately.

RPG-76 KOMAR

Image © Defence Express

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	320g A-IX-1
AUW (g)	2100g
DIMENSIONS (mm)	1190x68 (extended)
COUNTRY OF origin	Poland
FUZE	NK

The RPG-78 is a lightweight disposable HEAT rocket that dates from the 1980s. It is not compatible with 40mm RPG launchers. It has also been termed a "rocket assisted rifle brigade". While a HEAT round it is only effective against lightly armoured vehicles or as a means of targeting bunkers.

The fuzing is different from that employed with other PG-7 variants. The base detonating fuze arms by setback. There is no piezo employed. It is assumed that the fuze contains a slider type masking device that is released by burning a pyrotechnic pellet. it is also assumed that once the slider moves the primer in line the fuze functions by an impact inertia mechanism.

Komar literally translates as 'mosquito'.

RPO-A

Image © NAVEODTECHDIV

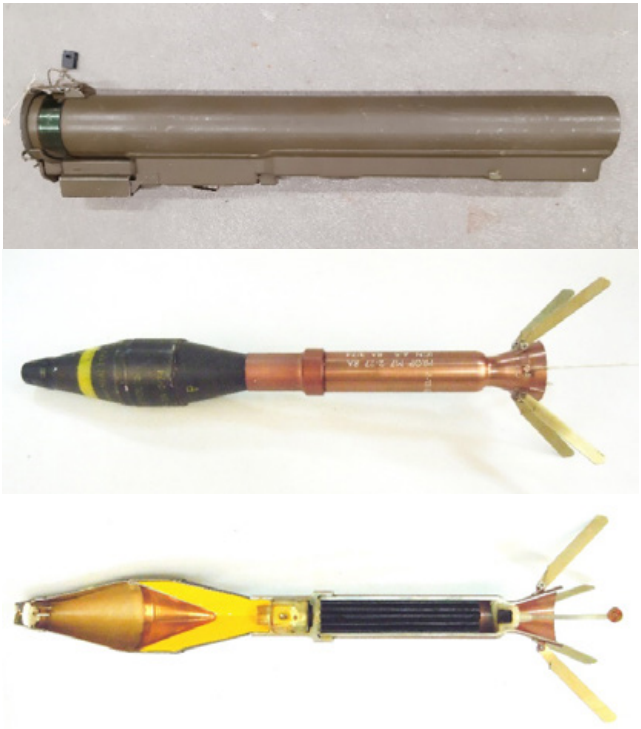
ORDNANCE SUB-CATEGORY	Recoilless Thermobaric
EXPLOSIVE FILL (g)	2100g thermobaric filler
AUW (g)	22000g
DIMENSIONS (mm)	920 x93
COUNTRY OF ORIGIN	Russia
FUZE	NK

The RPO-A (Reaktivnyy Pekhotnyy Ognemet) a shoulder launched thermobaric rocket, designed for use against combatants in enclosed spaces. Reaktivnyy Pekhotnyy Ognemet literally translates as Reactive Infantry Flamethrower and for this reason the weapon is sometimes categorised as a flamethrower rather than a rocket or recoilless projectile. As with PG-7 rounds the rocket has a two-stage propulsion system. An expulsion charge enables the firer to be separated from the efflux of the sustainer rocket motor. The metal expulsion charge is often found at a firing point. The RPO-A has an effective range of up to 200m.

The launch tube is made from reinforced fibreglass. The warhead contains a low explosive burster charger. The thermobaric charge uses atmospheric oxygen to create a high-impulse blast wave which is particularly effective in urban areas. The round itself is metallic silver and is unpainted, unlike the expulsion charge which is painted green with black stripes.

The RPO-A is often referred to as the 'Shmel' but more accurately Shmel refers to a wider family of recoilless shoulder launched weapons. A Ukrainian version of the RPO-A called the RPV-16 has been in production since 2016.

M72 LAW



Images © Danish EOD and Search Center. Dutch EOD Center.

ORDNANCE SUB-CATEGORY	Recoilless HEAT
EXPLOSIVE FILL (g)	315g OCTOL
AUW (g)	3450g
DIMENSIONS (mm)	981x66 (extended)
COUNTRY OF ORIGIN	USA
FUZE	M412A1

The M72 LAW comes in a series of versions. It is believed only later versions with larger rocket motors and eight fins have been supplied to Ukraine. The explosive fill is OCTOL (HMX 70%/ TNT 30%), the motor sections uses double based propellant. A rotor provide bore safety for up to 20m after launch. The M412A1 fuze is Impact and graze base detonating. It arms by setback. the M72 launch tube can be mistaken for an RPG-18 or RPG-22. M72A5 versions have been seen in Ukraine.

RGW 90 HH

RGW 90 HH. Images © Dynamit Nobel Defence GmbH. Image Right © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Recoilless HEAT/HESH
EXPLOSIVE FILL (g)	NK
AUW (g)	8900g
DIMENSIONS (mm)	1000x90
COUNTRY OF ORIGIN	Germany/Israel/Singapore
FUZE	NK

RGW stands for Rückstoßfreie Granatwaffe 90 which literally translates as 'recoilless grenade launcher 90 HEAT/HESH'. The RGW 90 allows selection of both HEAT and HESH warhead effects. When in HEAT mode the munition has a distinctive standoff probe protruding from the front. The probe is retracted when in HESH mode. This weapon is preferred for use in built up areas since its Davis counter-mass systems enables firing from within enclosed spaces. This system expels shredded plastic from the rear of the weapon. This shredded plastic can be evidence for survey and EOR personnel that this weapon system has been used. The RGW 90 has also been marketed as the Panzerfaust-90. Version made under license in Israel and Singapore are sometimes referred to as the MATADOR.

PANZERFAUST 3

Images © Dutch EOD Center

ORDNANCE SUB-CATEGORY	Recoilless HEAT/HESH
EXPLOSIVE FILL (g)	RDX or HMX
AUW (g)	NK
DIMENSIONS (mm)	NK
COUNTRY OF ORIGIN	Germany
FUZE	NK

The Panzerfaust 3 is a man portable recoilless rocket system that dates from the 1980s. The basic rocket motor design has remained broadly similar consistent since then, although new warheads have been developed. The launcher can fire a variety of rocket types with a 60mm diameter motor. Like the RGW 90 HH, the DM-12, DM-32 and DM-72 have a retractable standoff probes. When the probe is not extended all three variations act in a HESH role. The DM-72 has a tandem warhead with a small precursor charge in the extended probe – EOD operators should be careful to destroy this as well as the main warhead. The DM-12 has an RDX based charge whereas the DM-32 and DM-72 use a form of desensitized HMX. These rockets are HCC 1.1E in storage.

AT-4

Images © US DoD

ORDNANCE SUB-CATEGORY	Recoilless HEAT/HESH
EXPLOSIVE FILL (g)	830g HMX/TNT
AUW (g)	6800g
DIMENSIONS (mm)	1016x84
COUNTRY OF ORIGIN	Sweden
FUZE	NK

The AT-4 is a disposable recoilless anti-tank rocket. In flight the rocket is fin stabilized. The launch tube is made from reinforced fibreglass. A safety pin is removed by the firer prior to launch. The safety pin is found near the rea of the launch tube. It acts as a holding device on the spring-loaded firing rod that runs down the exterior of the main tube. The safety pin is usually marked with clear white letters. It is possible to see from one end to another in a discarded launcher.

Depending on categorization preference the item can be deemed a recoilless projectile or rocket. There exists a AT4 CS (Confined Space) version for fighting from enclosed positions. Instead of plastic shreds for the countermass, in this version an effective aerosol of salt water is used.

S-5 KO ROCKET

Images © Dutch EOD Center

ORDNANCE SUB-CATEGORY	HE/FRAG - HEAT
EXPLOSIVE FILL (g)	330g A-IX-1
AUW (g)	4500g
DIMENSIONS (mm)	1004x57
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	V-5K

The 57mm diameter S-5 rockets are designed to be fired from a wide variety of rocket pods from Russian fixed wing ground attack aircraft and armed helicopters. In Ukraine the S-5 has been seen commonly on Su-25 Frogfoot ground attack aircraft, Mil-Mi-24/35 attack helicopters, and the Ka-52 attack helicopter. The S-5 KO is a surface to ground HEAT rocket with a dual-purpose fragmentation jacket visible in the texture of the casing. The warhead utilizes a relatively simple impact fuze based on the standard setback sleeve/ creep spring configuration, designated a V-5K. The design is very similar to the GK-1 fuze used on recoilless ammunition. The fuze arms by setback. As with the 04-M the fuze does not contain a slider means the detonator is in line at the point of launch and is thus not "bore-safe". EOD staff are advised to take extra precautions even for items that are assessed as AXO. If found in a rocket pod such as the UB-16-57U (УБ-16-57) earthing procedures should be observed. KO stands for Kumulyativno-Oskolochnymi - Kumulyativno (cumulative) indicates the presence of a shaped charge in Russian munitions. Oskolochnymi indicates the use of fragmentation around the warhead. For this reason KO is a designation of a dual purpose warhead. Given the sensitivity and limited safety features of the V-5K rocket fuze, S-5 rockets found in rocket pods attached to downed aircraft should be assumed to be armed and handled carefully.

S-8 KO ROCKET

Image © Roly Evans

ORDNANCE SUB-CATEGORY	HE/FRAG - HEAT
EXPLOSIVE FILL (g)	4120g A-IX-10
AUW (g)	11300g
DIMENSIONS (mm)	1570x80
COUNTRY OF ORIGIN	Russia/Bulgaria
FUZE	V-5KP1

The 80mm diameter S-8 rockets are designed to be fired from a wide variety of rocket pods from Russian fixed wing ground attack aircraft and armed helicopters. This tactic is also likely to increase significantly the spread of rockets within the target area.

The S-8 KO is a surface to ground HEAT rocket with a dual-purpose fragmentation jacket visible in the texture of the casing. The warhead utilizes a V-5KP1 fuze that is similar in function to VP-7 type fuzes used on RPG rounds. Piezo precautions should be observed.

The S-8 KO can be carried in 3 launchers. The B8V20 and the B8M pods both carry 20 rockets and the B8S7 only carries 7 rockets.

KO stands for Kumulyativno-Oskolochnymi - Kumulyativno (cumulative) indicates the presence of a shaped charge in Russian munitions. Oskolochnymi indicates the use of fragmentation around the warhead. For this reason KO is a designation of a dual-purpose warhead.

Given the sensitivity and limited safety features of the V-5K rocket fuze, S-8 rockets found in rocket pods attached to downed aircraft should be assumed to be armed and handled carefully.

122MM 9M22 GRAD ROCKET

Image © VMZ Sopot

ORDNANCE SUB-CATEGORY	HE/FRAG
EXPLOSIVE FILL (g)	6400g A-IX-2
AUW (g)	66000g
DIMENSIONS (mm)	2729x122
COUNTRY OF ORIGIN	Russia/Bulgaria/Poland/Romania/Serbia
FUZE	V-5KP1

The 9M22 series of rockets is perhaps one of the most common artillery rockets in history. Grad refers to the 122mm rocket launcher but has become a label for the rockets themselves.

The warhead is initiated by a simple MRV impact fuze. This fuze is widely copied by a number of countries. The fuze makes use of the standard setback sleeve and creep spring layout, with a slider acting as a masking device.

The 9M22U (У) is an improved version - 'Uluchshennyy' (Улучшенный).

A typical BM-21 launcher contains 40 rockets in four rows of ten. Not every salvo will use all 40 launch tubes however. The launcher can direct fire at targets 5-20km away. These rockets are rarely launched singularly. The reliability of the MRV fuze is not high and unexploded ordnance is common.

220MM 9M27 URAGAN ROCKETS

Image © SESU

ORDNANCE SUB-CATEGORY	Payload dependent
EXPLOSIVE FILL (g)	Payload dependent (51.9kg HE unitary)
AUW (g)	2800g (9M27F)
DIMENSIONS (mm)	4833x220
COUNTRY OF ORIGIN	Russia
FUZE	Payload dependent

The 9M27 rocket series is launched by the 9K57 Uragan MLRS. The system is also referred to as the BM-27. The 9M27 series of rockets is used in a variety of roles. Uragan literally translates as "hurricane" and the rocket is sometimes referred to as hurricane by the media.

When used as a carrier the 9M27 can be designated as a cluster munition. The 9M27K1 with a 9N128K warhead can carry 30 9N210 or 9N235? explosive submunitions. The rocket can also be used to deliver scatterable mines and sensor fuzed sub munitions. The 9M27K2 carries 24 PTM-1 AV mines, the 9M27K3 carries 312 AP mines and the 9M59 carries 9 PTM-3 AV mines. HE/FRAG warheads have a typical NEQ of 51.7kg (9M27F), a large HE charge for any sort of artillery munition. Fuzing the 9M27 series often replicates that used for the 122mm GRAD rockets. Point impact MRV fuzes can be used for HE/FRAG warheads (e.g. 9M27F). For carrier versions sometimes simple mechanical time fuzes such as the TM-120 are used.

When used with carrier munition warheads (for submunitions or scatterable mines) the warhead is initiated at a specific point in the rocket's trajectory to scatter the munitions over the required target area. The rear rocket motor section will continue on a ballistic trajectory and is often embedded in the ground beyond the strike location. First responders and EOD teams may not be able to identify the precise payload until

the remnants of the rocket have been extracted from the ground. EOD Operators should actively seek corroborating evidence to try to discern he nature of the warhead; for example submunition fragmentation. The tail sections of the 220mm 9M27 and 300mm 9M55 rocket series are similar in configuration, the key distinction is the diameter and rear fin slot shape.

300MM 9M55 SMERCH ROCKETS

Images © Private

ORDNANCE SUB-CATEGORY	Payload dependent
EXPLOSIVE FILL (g)	Payload dependent (70kg HE unitary warhead)
AUW (g)	800 kg
DIMENSIONS (mm)	7600 long x 300 diameter
COUNTRY OF ORIGIN	Russia
FUZE	Payload dependent

The 9M55 rocket series is launched by the 300 mm 9K58 Smerch MLRS. The launch platform is also sometimes referred to as the BM-30. The 9M55 series of rockets is used in a variety of roles. SMERCH literally translates as "tornado" or "whirlwind" and the rocket is sometimes referred to as such in the media. A Smerch MLRS contains 12 rockets. There are 25 known models with different warheads, of which 19 are believed to be carrier munitions of some sort. All rocket types are fin-stabilised and employ a solid propellant rocket motor. The other warheads are either HE/FRAG or thermobaric in nature. Particular warheads of note include the 9M55K that carries 72 x 9N235 submunitions. The 9M55K4 carries 25 s PTM-3 AV mines. There are three different rocket motor sizes that enable different maximum ranges (70, 90 and 120km).

There are different views as to whether the 9M55 series can be described as missiles or guided weapons although since there is no specific guidance section incorporated within the munition

The tail sections of the 9M27 and 9M55 rocket series look similar , the key distinction is the diameter and the rear fin slot size. The tail sections will often impact with a high degree of force and can easily penetrate road surfaces or buildings. Corroborating evidence to try to confirm the warhead identity and state should be sought prior to any remote movement of buried motor sections.

ANTI-TANK GUIDED WEAPONS

9K111 FAGOT AT-4 SPIGOT

Image © VMZ Sopot

ORDNANCE SUB-CATEGORY	Anti-Tank Guided Weapon
EXPLOSIVE FILL (g)	1800g OKFOL
AUW (g)	13000g
DIMENSIONS (mm)	Missile 875 mm long 120 mm diameter
COUNTRY OF ORIGIN	Russia
FUZE	Electrical contact

The 9K111 Fagot is a wire guided semi-automatic command to line-of-sight (SACLOS) anti-tank guided weapon (ATGW) system that dates from the early 1970s. The system comprises the 9M111 missile and the 9P135 launcher. The NATO reporting name for the 9K111 is AT-4 Spigot. The missile is transported within an environmentally sealed fibreglass tubular launch container. On launch, the 9Kh147 launch motor ejects the missile from the launch tube and the 9Kh145 sustain motor then ignites approximately 10 metres in front of the launcher. The 9M111 missile employs a single 9N122 HEAT warhead which contains approximately 1.8kg of HMX-based explosive with a copper shaped charge liner and is capable of penetrating 40 cm of rolled homogenous armour. The operator tracks the target throughout flight and the launcher automatically transmits guidance corrections to the missile via a fine wire which is paid out from the rear of the missile. Infrared flares on the rear of the missile aid tracking. A tandem warhead variant of the 9M111 exists and is designated the 9M111M. An anti-tank guided missile team will typically consist of three people, with one carrying the tripod/launch post and two others carrying two missiles each. If supported by an infantry fighting vehicle (BTR/BMP), a further eight missiles are normally available. There are superficial similarities between the 9M111 Fagot (AT-4 Spigot) and the 9M113 Konkurs (AT-5 Spandrel).

9K113 KONKURS AT-5 SPANDREL

Image Top © Sean Moorhouse. Image Base © Thomas T.

ORDNANCE SUB-CATEGORY	Anti-Tank Guided Weapon
EXPLOSIVE FILL (g)	1800g OKFOL
AUW (g)	14500g
DIMENSIONS (mm)	Missile 955 mm long 120 mm diameter
COUNTRY OF ORIGIN	Russia
FUZE	Electrical contact

The 9M113 is a wire guided semi-automatic command to line-of-sight (SACLOS) ATGW that dates from the mid-1970s. The 9M113 missile may be fired from the same launcher (9P135) associated with the 9K111 Fagot system but it is also mounted on infantry fighting vehicles, with the 9P148 launcher, such as the BMP-2, BMD-2 and BRDM-2. The NATO reporting name for the 9M113 is AT-5 Spandrel.

The missile is transported within an environmentally sealed fibreglass tubular launch container. The 9M113 missile employs a single 9N131 HEAT warhead which contains approximately 1.8kg of HMX-based explosive with a copper shaped charge liner and is capable of penetrating 60 cm of rolled homogenous armour.

The 9M113M version has a distinct probe compared with the 9M113. Both versions have a tandem warhead to overcome ERA. EOD operators are advised to ensure destruction of each warhead and any residual solid motor propellant.

9M119 SVIR AT-11 SNIPER

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Gun fired anti-tank missile
EXPLOSIVE FILL (g)	Precursor 800g Primary 2250g OKFOL
AUW (g)	17200g
DIMENSIONS (mm)	695 mm long 125 mm diameter
COUNTRY OF ORIGIN	Russia
FUZE	Nose crush switch with pyro delay arming

The 9M119 is a fin stabilized 125mm smoothbore gun-launched anti-tank guided missile. The missile employs laser beam riding guidance where the gunner in the launching tank continuously illuminates the target and the missile automatically guides itself to the designated target. The 9M119 employs a tandem shaped charge warhead and is thus capable of defeating explosive reactive armour.

The 9M119 missile has an unconventional configuration in that the primary warhead is located behind the sustain rocket motor section. EOD operators should note that the main warhead is behind the forward nozzles and in front of the missile fins. The 9M119 has a range of up to 4km.

The missile is designated Svir or REFLEXS by the Russians, and AT11AA SNIPER by NATO. 9M119F and 9M119F1 versions have enhanced warheads although it is not clear what design features this entails. SVIR and REFLEXS are not identical, there are minor differences in design. A 9M119M INVAR version dates from the early 1990s.

If the missile has been fired, it should be considered to be armed. The missile contains a pyrotechnic based self-destruct mechanism which may operate between 25 and 45 seconds after firing.

9K127 VIKHR AT-16 SCALLION

AT-16 missile warhead and guidance section. Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Air Launched Anti-Armour Missile
EXPLOSIVE FILL (g)	4300g OKFOL
AUW (g)	47000g
DIMENSIONS (mm)	2750x130
COUNTRY OF ORIGIN	Russia
FUZE	

The 9K127 Vikhr missile system is a tube-launched fin stabilized laser beam riding air to surface anti-tank missile based around the 9M127 Vikhr missile. It is commonly used by the Ka-52 attack helicopter. It dates from the early 1990s. The laser guidance system is very similar to that used by the 9M119 Svir missile/projectile. The missile is steered via four nose mounted canards and stabilised with four fins at the rear.

The missile employs a two-stage solid propellant rocket motor and is fitted with a tandem warhead which provides both shaped charge and fragmentation effects. The missile has both impact and proximity fuze with a self-destruct element armed by set-back. The missile has a maximum speed of 600m/second, three times that of the equivalent portable ATGW. The missile is carried in groups of 6 launch tubes under each helicopter pylon. The launch tubes have hinged caps at the front that open prior to launch

The 9K121 Vikhr can be fitted to the Ka-50 and Ka-52 attack helicopters and the Su-25T and Su-25TM/Su-39 fixed wing attack aircraft. The 9M127 Vikhr/AT-16 Scallion missile has been widely encountered in Ukraine on downed Ka-52 attack helicopters.

9K133 KORNET AT-14 SPRIGGAN

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Anti-Tank Guided Weapon
EXPLOSIVE FILL (g)	HEAT variant 4300g OKFOL
AUW (g)	27000g
DIMENSIONS (mm)	1250 mm long x 152 mm diameter
COUNTRY OF ORIGIN	Russia
FUZE	Electrical crush fuze

The 9K133 Kornet missile system is a tube-launched fin stabilized laser beam riding anti-tank missile based around the 9M133 Kornet missile. The NATO designation is AT-14 Spriggan. The Kornet is often deployed with BMP-3 fighting vehicles or may be employed from a crew portable tripod. The missile is fitted with either a tandem charge HEAT warhead (9M133), which is optimised for anti-armour applications or an enhanced blast (thermobaric) warhead (9M133F) which is optimised for operations in built up areas. The 9M133 variant employs an HMX-based explosive, the 9M133F contains a mixture of RDX, aluminium and isopropyl nitrate. The 9M133 Kornet missile employs a boost motor which contains approximately 850 g of propellant and a sustain rocket motor comprising of a single solid grain of double base propellant. The latter gives the missile a low visibility signature in flight. Missile guidance is achieved in flight through the use of canards mounted towards the front of the missile. Stability is provided my fins at the rear of the missile.

The tandem warhead is separated to a greater degree than with earlier Soviet ATGW. A small, shaped charge is found in the nose, the main warhead is just forward of the rear fins. The two warheads are separated by the main solid fuel motor section positioned in the centre of the missile. Another solid fuel expulsion charge is found at the rear. The venturis are found at the next to the smaller forward fins. Heat discolouration here, at the rear expulsion charge, along with impact damage, along with the appearance of the missile outside of its launch tube are good indicators of a potentially armed item.

SKIF/STUGNA-P

Images © Aramco and Tim Fish

ORDNANCE SUB-CATEGORY	Anti-Tank Guided Weapon
EXPLOSIVE FILL (g)	NK
AUW (g)	37000g
DIMENSIONS (mm)	1435x130-152
COUNTRY OF ORIGIN	Ukraine
FUZE	Not known probable electrical crush sensor

The SKIF/Stugna-P is a Ukrainian designed and manufactured anti-tank guided missile which utilizes laser beam riding guidance. The missile itself has a distinct shape with a bulge near the front of the missile indicating the location of one of the two shaped charges and fragmentation warheads.

When vehicle based the weapons systems might be designated Amulet, when portable it can be designated Stugna-P. It also appears that export versions of this system are designated SKIF whilst versions in use by the Ukrainian armed forces are designated Stugna-P. The Ukrainian designation code is RK-2M-OF. For the Stugna-P there are both 130mm and 152mm missile options.

The main warhead combines an explosively formed projectile (EFP) with a fragmentation jacket. The explosive fill is unknown although is believed to be HMX based.

NLAW

Image Left © UK MoD. Image Right © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Anti-Tank Guided Weapon
EXPLOSIVE FILL (g)	850g of Insensitive PBX
AUW (g)	12500g
DIMENSIONS (mm)	1000 mm long 310 mm diameter
COUNTRY OF ORIGIN	UK/Sweden
FUZE	Proximity fuze

The Round Guided Missile NLAW HE Anti-Tank K170A2 was first introduced into UK service in 2009, is widely favoured for short range anti-tank engagements in Ukraine. A disposable one-shot launcher, theoretically the weapon can engage targets as close as 20m, but as far out as 800m. Once the missile leaves the launcher it is not externally guided but employs a Predicted Line of Sight (PLOS) inertial based guidance system. This requires the firer to track the target for 3-6 seconds before launching. If the target is moving the flight path of the missile is predicted. Two attack modes can be selected, Overfly Top Attack and Direct Attack. The NLAW has a countermass system enabling launch from within enclosed space.

The launch motor comprises of approximately 120 g of a double base propellant and is separated from the missile after firing. The sustain motor contains approximately 750 g of a double base propellant and ignites a safe distance in front of the firer.

The NLAW warhead uses an insensitive PBX based explosive material with an overall net explosive content of less than 1 kg. EOD operators are advised to consider using a sufficiently large donor charge if disposing of NLAW blinds. EOD operators are advised to employ a safe waiting period of 30 minutes before approaching a crashed NLAW missile. Ideally the missile should be approached from the rear and the hazard posed by the HEAT warhead and laser proximity fuze should be considered.

The Swedish name for NLAW is Rb 57 (Robot 57), the Finnish name is 102 RSLPSTOHJ NLAW. In its packaging the Javelin is HCC 1.2E.

FGM-148 JAVELIN

Image Left © Lockhead Martin. Image Right © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Anti-Tank Guided Weapon
EXPLOSIVE FILL (g)	HMX based PBX 220g precursor 2000g primary
AUW (g)	16 kg (missile only not including CLU)
DIMENSIONS (mm)	1200 mm long 127 mm diameter
COUNTRY OF ORIGIN	USA
FUZE	

The FGM-148 is a man portable Anti-Tank Guided Missile with a range out to 4km. It is effective against all modern main battle tanks. The Javelin incorporates a tandem warhead found in front of the front stabilizer fins. The main components from the nose are the sensor system, precursor charge, main shaped charge, and solid fuel flight motor and a soft launch motor. The soft launch motor enables firing from enclosed spaces.

The nose contains an IR seeker. The warhead usually employs overhead top attack.

The energetic used for the precursor and main charge is an insensitive PBX explosive. EOD operators are advised to plan demolition methods accordingly. EOD operators are advised to employ a safe waiting period of 30 minutes before approaching a crashed Javelin missile. Ideally the missile should be approached from the rear and the hazard posed by the HEAT warhead should be considered.

There are a number of iterations of the Javelin – the latest is the FGM-148G. In its packaging the Javelin is HCC 1.2E.

MANPADS

9M32M STRELA 2 / SA-7B GRAIL

Image © Fenix Insight

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	370g A-IX-1
AUW (g)	9150g
DIMENSIONS (mm)	1440x72
COUNTRY OF ORIGIN	Russia

The 9M32M is the missile component of the 9K32 Strela-2 MANPAD. The NATO reporting name is SA-7b GRAIL. Dating from the early 1970s this was the first Soviet developed MANPAD. It is now obsolescent and is defeated easily by modern active countermeasures. However it remains effective against unprotected aircraft. The principal components of the system are the 9P54M (9П54M) launch tube which contains the 9M32M missile, the 9B17 (9Б17) thermal battery, and the 9P58 (9П58) gripstock. The SA-7b is noticeably shorter than the SA-16 and has no aerospike over the infra-red seeker dome on the nose of the missile.

The easiest way to identify the launch tube is the distinct shape of the 9B17 thermal battery. Black identification markings should be found on the upper body of the tube between the gripstock and the battery. It should be noted that this missile system uses an uncooled infra-red seeker and, unlike later Russian MANPADS, does not require the use of a battery coolant unit (BCU). The thermal battery is operated by the front mounted twist switch and the battery itself becomes hot when operated. Scorched paint is an indicator of an expended battery. The thermal battery is removed from the missile launch tube by a lever on the missile body. The gripstock is fitted to the missile launch tube with a hinged clip.

Despite its age and relatively poor performance by modern standards, substantial numbers of SA-7b systems are still in circulation and have been employed in Ukraine.

9M36 STRELA 3 / SA-14 GREMLIN

Image © war-time.ru

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	370g OKFOL
AUW (g)	10300g
DIMENSIONS (mm)	1470x72
COUNTRY OF ORIGIN	Russia

The 9K34 Strela-3 is the third iteration of the Russian Strela range of shoulder-fired air defence systems developed by the Russian KBM Design Bureau. The Strela-3 addresses some of the technical deficiencies associated with the 9K32M Strela-2 (NATO SA-7b Grail) system through the introduction of an improved cooled missile seeker head. The system uses a combined thermal battery and gas reservoir known as a battery coolant unit (BCU). The BCU designated for use with the 9M36 missile is the 9P51 (9П51). The system employs a grip stock which is superficially similar to that associated with the 9K32M Strela-2 system, but the grip stocks ARE NOT interchangeable. The grip stock used with the 9K34 Strela-3 is the 9P58M (9П58M). The missile launch tube associated with the system is the 9P59 (9П59). The warhead associated with the 9M36 missile is designated the 9N129 and contains an HMX based explosive within a pre-formed cylindrical fragmentation jacket.

The BCU contains a pressurized nitrogen bottle. EOD operators should be aware of the potential compressed gas hazard. The BCU is removed from the launch tube by pressing the release catch and sliding the unit forward. If the arming lever is rotated whilst the BCU is fitted it will be initiated. Black identification markings should be found on the upper body of the tube between the gripstock and the BCU. Otherwise the slight increase in length (30mm) is one way to tell the difference with the 9M32.

9M313 IGLA-1 / SA-16

Image © Fenix Insight

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	400g OKFAL
AUW (g)	10800g
DIMENSIONS (mm)	1673x72
COUNTRY OF ORIGIN	Russia

The 9K310 Igla-1 is a second-generation development of the Russian Strela range of shoulder-fired air defence systems developed by the Russian KBM Design Bureau. The 9M313 missile associated with Igla-1 system has a much greater degree of resistance to countermeasures and has a more powerful sustainer rocket motor, which together with the guidance and control system enhancements, give it a significantly improved kinematic performance compared to the Strela (NATO SA-7b Grail and SA-14 Gremlin) missiles.

The 9M313 rocket motor composition uses a high energy composite propellant based on ammonium perchlorate, aluminium and a polymeric binder and an RDX-based nitramine composition is also believed to have been added to improve thrust. The added high explosive also enables a supplementary charge in the warhead to detonate unconsumed propellant on warhead functioning. The BCU designated for use with the 9M313 missile is the 9B238 (9Б238). The grip stock used with the 9K310 Igla is the 9P519 (9П519). The BCU orientation on the Igla launch tube is angled downwards, rather than parallel to the launch tube as on the Strela-3/SA-14.

The SA-16 has a distinct aerospike on a wire tripod sitting above the domed seeker window. Markings should be evident to assist identification but if not, this missile is over 20cm longer than its SA-7b equivalent. OKFAL is a plasticised HMX based explosive and differs from OKFOL by the addition of aluminium to increase the heat of explosion. The BCU contains a pressurized nitrogen bottle.

EOD operators should be aware of the potential hazard. The BCU is removed from the launch tube by pressing the release catch and sliding the unit forward. If the arming lever is rotated whilst the BCU is fitted it will be initiated. SA-16 is typically packed two per wooden storage case. At the place of firing the launch tube may be abandoned. Other tell tales include presence of the ejection charge, tube end cap and BCU. The SA-16 has been produced under licence in a number of countries including Bulgaria, China, North Korea and Ukraine. A naval variant of this MANPAD designated SA-N-10 Grouse may also be encountered.

9M39 IGLA-2 / SA-18

Image © Fenix Insight

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	400g OKFAL
AUW (g)	10600g
DIMENSIONS (mm)	1639x72.2
COUNTRY OF ORIGIN	Russia

The 9K38 Igla-2 is a third-generation development of the Russian Strela range of shoulder-fired air defence systems developed by the Russian KBM Design Bureau. The BCU designated for use with the 9M39 missile is the 9B238 (9Б238). The grip stock used with the 9K38 Igla-2 is the 9P516 (9П516). The BCU orientation on the Igla-S launch tube is angled downwards like the Igla/SA-16.

The fuze, warhead (400g OKFAL) are similar to those used in the SA-16. The markings are stencilled in black on the 9M39 missile and on the 9K38 launcher are stencilled in black. The aerospike design is a key recognition difference. The 9K38 launcher has a distinct flared nose cap. The horseshoe shroud that encloses the end of the BCU is often an easy recognition feature, although this design has been seen on some versions of the SA-16. The 9B238 Battery Cooling Unit (BCU) is the same as that used on the SA-16. It should have designation markings stencilled in black at the end of the cylinder. A naval variant is in circulation. It has the NATO reporting name SA-N-10 GROUSE.

Substantial quantities of Igla-2/SA-18 are still in service. This missile system has been used widely in Ukraine.

9M342 IGLA S / SA-24

Image © V.Kuzmin

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	OKFAL
AUW (g)	11300g
DIMENSIONS (mm)	1690x72.2
COUNTRY OF ORIGIN	Russia

The 9M342 is the missile component of the 9K338 Igla-S MANPAD that dates from the early 2000s. The US DoD designation is SA-24. The NATO reporting name is GRINCH. The warhead utilizes an OKFAL charge although the exact amount is not confirmed. The BCU designated for use with the 9M342 missile is the 9B238 (9Б238). The grip stock used with the 9K338 Igla-S is the 9P522 (9П522). The BCU orientation on the Igla-S launch tube is angled downwards like the Igla-1/SA-16 and the Igla-2/SA-18.

The nose cap of the 9K338 launcher is distinct from its SA-18 predecessor. The same 9B238 BSU is used however. The aerospike on the 9M342 missile is also the same as used on the 9M39 missile. Apart from the stencilled markings, one way of telling the difference is that the 9M342 missile is 41mm longer.

PPZR PIORUN

Image © Mesko S. A.

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	N/K
AUW (g)	10250g
DIMENSIONS (mm)	1596x72
COUNTRY OF ORIGIN	Poland

The PIORUN is an improved model of the GROM, which itself is a Polish version of the 9K38 SA-18 GROUSE. Piorun translates as 'thunderbolt'. It came into service in 2020. It incorporates improved seeker, and an improved proximity fuze. The absence of ribs on the nose cap is way of telling the difference with an SA-18.

STARSTREAK (HIGH VELOCITY MISSILE)

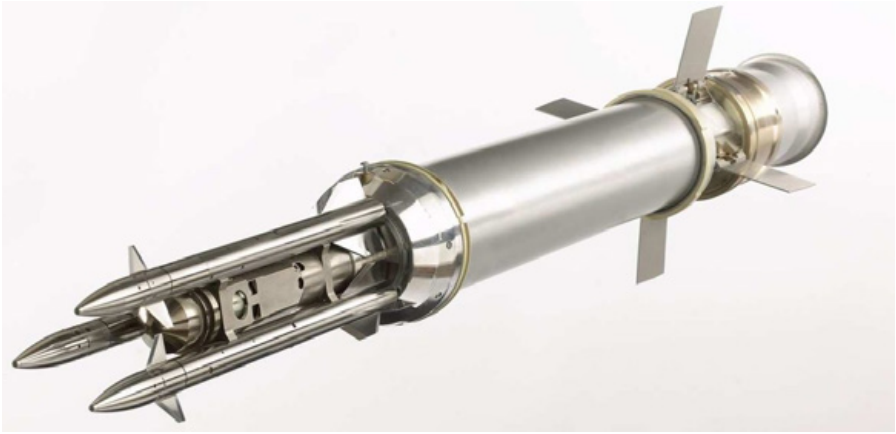


Image © Thales

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	NK
AUW (g)	14000g
DIMENSIONS (mm)	1400x130
COUNTRY OF ORIGIN	United Kingdom

The K130 Starstreak, or High Velocity Missile (HVM) is a surface-to-air missile system designed specifically for use against low-level attacking aircraft. It has an all-aspect attack profile and may be fired from an armoured vehicle (Stormer), the lightweight multiple launcher (LML), or from the shoulder. The missile contains three submunitions which are carried initially on a rocket propelled launch vehicle. Unlike many other MANPAD SAMs, Starstreak using laser beam riding guidance rather than infra-red homing, due to the prevalence of infrared countermeasures. The missile employs a first stage all-burnt on launch Brambling rocket motor, which propels the missile a safe distance from the launcher before the second stage sustain motor ignites. Each of the three dart-type submunitions contains a small RDX based main charge.

The system is also marketed by Thales as ForceSHIELD.

SAMS

9M37K BUK - SA-11 GADFLY /SA-17 GRIZZLY

Images © John Montgomery

ORDNANCE SUB-CATEGORY	Surface to Air Missile
EXPLOSIVE FILL (g)	21000g
AUW (g)	690000g
DIMENSIONS (mm)	5500x400
COUNTRY OF ORIGIN	Russia

The Buk (literal translation 'beech') is a medium to long range surface to air missile system that originally dates from the early 1970s. It was the first Russian radar guided air defence system to have all missile system components contained within a single transporter, erector, launcher and radar (TELAR) platform. The Buk missile incorporates a dual stage solid rocket motor and is rail launched from a tracked armoured vehicle. The missile employs semi-active radar homing and has a seeker head mounted in the front section of the missile. Later variants of the Buk system employ a tube launched missile. The earlier versions of the Buk missile are designated the SA-11 by the US DOD and GADFLY by NATO. The later Buk-M1-2 and Buk-M2 have the DoD designation of SA-17 and the NATO designation of GRIZZLY. The BUK M3 has the DoD designation SA-27. Later versions tend to have a slightly extended range – up to 45km. Earlier missiles for the SA-11 have a 9M38 or 9M38M1 GRAU code. Later versions associated with the SA-17 GRIZZLY have the 9M317 GRAU code. All missiles use a semi-active homing radar. Missiles are fuzed with proximity, impact and self-destruct fuzing. Different warheads can be fitted to the 9M38/9M38M1 and 9M317missiles. The most commonly encountered warhead, the 9N314M, has a distinctive bow tie shaped preformed fragmentation. Missiles usually have an overall body colour of green and the radome (nose) is normally painted white. The missile designation is stencilled in black between the set of fins found just forward of the motor section, approximately halfway along the body of the missile. If the warhead has functioned then the rear section of the expended rocket motor will normally be encountered on the ground. The spherical compressed air reservoir for the missile guidance system and the cylindrical gas cylinders for fin control may also be encountered intact. Missiles which have missed their designated targets and have failed to self-destruct may be encountered with complete warheads and attached safety and arming units. The warhead weight is often given as 50-70kg, although the NEQ is believed to be 21Kg.

BALLISTIC MISSILES

OTR-21 9K79/9M79 TOCHKA SS-21 SCARAB

Images © SESU

ORDNANCE SUB-CATEGORY	Short Range Ballistic Missile
EXPLOSIVE FILL (g)	Various
AUW (g)	2000000g
DIMENSIONS (mm)	6400x650
COUNTRY OF ORIGIN	Russia

The OTR-21 TOCHKA is a short range ballistic missile (SRBM) capable of carrying a range of warheads that dates from the 1970s. Its NATO reporting name is SCARAB. The US DoD designation is SS-21. OTR stands for Operativno-Takticheskiy Raketnyy which translates as Operational Tactical Missile. The missile utilizes a single-stage solid propellant motor, with fin stabilisation and lattice type aerodynamic control surfaces. The GRAU code for the missile is 9M79. The missile uses an inertial guidance system. The 9M79 missile may be fitted with a variety of unitary or sub-munition warheads. The unitary warhead (9N123F) employs a primary laser fuzing system with a secondary impact fuze. The sub munition warhead (9N123K) employs a radar altimeter fuze which is programmed to release sub-munitions at the optimum height based on the sub munition footprint required.

The image above right shows a crashed Tochka with a 9N123K warhead. This warhead carries 50 9N24 explosive submunitions. When fitted with the 9N123K warhead the TOCHKA can be termed a cluster munition under Article 2 of the Convention on Cluster Munitions. The 9N123F unitary high explosive fragmentation warhead contains 162kg of TG-20 explosive (20%TNT/80%RDX). The single-stage rocket motor consists of approximately 900 kg of composite (ammonium perchlorate, aluminium and binder) propellant. Propellant efflux when mixed with water is toxic and acidic. Care should be taken when recovering rocket motor sections associated with 9M79 Tochka missile strikes.

Further versions of the TOCHKA may be referred to as with combination of the NATO and US DoD designations, for example SS-21a SCARAB A. Nuclear and chemical filled variants of the Tochka missile were developed. The nuclear variant is thought to have had two yield options. The chemical filled variant is believed to contain approximately 250 kg of persistent nerve agent, probably VX.

9K715/9K720/9K728/ ISKANDER SS-26 STONE

Image © TASS

ORDNANCE SUB-CATEGORY	Short Range Ballistic Missile
EXPLOSIVE FILL (g)	Various
AUW (g)	
DIMENSIONS (mm)	7.2 metres long 920 mm diameter
COUNTRY OF ORIGIN	Russia

The code name Iskander covers a family of short-range ballistic missiles (SRBM) and cruise missiles which are launched from a common transporter erector and launcher (TEL) platform (9P78-1). The family name used by the US DoD and NATO is SS-26 Stone. The maximum stated range of the Iskander/SS-26 Stone is 500 km, though it may have the capability to operate at significantly longer ranges. The base model of the Iskander family, known as the 9K720 or Iskander-M is due to replace the 9M79/SS-21 Scarab in Russian service.

The missile employs a two-stage solid propellant motor, with fin stabilisation and thrust vector control. The missile uses a combination of inertial guidance, GLONASS satellite guidance, and terminal guidance based on digital scene matching and area correlation. The Iskander missiles may be fitted with a variety of unitary or sub-munition warheads. The 9M723 missile has a non-detaching warhead section and has two known variants; the 9N722K1 is thought to be the unitary warhead and the 9N722K5 the sub-munition warhead. Both warheads are thought to operate in conjunction with the 9E156 radar proximity fuze. A variable yield nuclear armed variant of the Iskander is thought to exist but no technical details are known.

The 9M728 Iskander variant is a ground launched cruise missile and is based on the maritime 3M14 Kalibr cruise missile. The 9M728 missile employs a solid fuel boost motor to eject the missile from its transport container and then makes use of an air-breathing turbofan for flight. Lift is provided by pop out wings on the missile. A 'hypersonic' air-launched variant of the Iskander, sometimes referred to as the Kinzhal or Kh-47M2, which is capable of being launched from Tu-22 backfire strategic bombers and MiG-31 aircraft.

Some variants of the Iskander missile are equipped with deployable electronic countermeasure systems (also known as penetration aids) which are deployed during the terminal phases of the missile trajectory.

MISCELLANEOUS

9B899 (9Б899) DECOY

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Decoy
EXPLOSIVE FILL (g)	N/A
AUW (g)	
DIMENSIONS (mm)	
COUNTRY OF ORIGIN	Russia
FUZE	

The 9B899 is an electronic countermeasure device deployed from the base of the 9M723-Iskander (SS-26 Stone) missile. The device appears to be a programmable multi-channel inhibitor powered by a thermal battery which is mounted in the rear section of the device. Programming and pre-deployment control of the device is achieved using a seven pin data port just forward of the fins. The exact method of operation of the device is unclear but it appears to be of a four channel, dual redundant design and contains a well-engineered redundant power amplifier system. The device antennae appear to be built into the external cylinders surrounding the electronic systems. The device is most likely configured to act as a penetration aid and is ejected by the Iskander missile in the mid to terminal stage of its trajectory. The device is probably configured to inhibit the communication links between ground based radars and surface to air missile systems. The 9M723 missile has six cylindrical ports in its base which are designed to house the 9B899 devices during transit, launch and flight. 9B899 devices which have failed to function may still contain live thermal batteries and should be handled accordingly. A lack of scorching present on the fins may indicate that the thermal battery has failed to function.

OFS AERIAL BOMB

Images © Private

ORDNANCE SUB-CATEGORY	Aerial Bomb
EXPLOSIVE FILL (g)	N/A
AUW (g)	
DIMENSIONS (mm)	200x40
COUNTRY OF ORIGIN	Russia
FUZE	

This item was named locally as an OFS. The fragmentation jacket has a 40mm diameter.

The fuze is not identified but appears to be a simple mechanical impact inertia fuze that should be assumed to be in line and armed. The explosive fill is estimated to be 100-150g of HE.

RKG-1600 AERIAL BOMB

Images © Open Source

ORDNANCE SUB-CATEGORY	Aerial Bomb
EXPLOSIVE FILL (g)	440g TG-50
AUW (g)	1115g
DIMENSIONS (mm)	387x76
COUNTRY OF ORIGIN	Russia
FUZE	

This appears to be a repurposed RKG-EM grenade – deployed by an UAV. Some sources state that this device was developed by a conventional manufacturer in Ukraine and is designated the RKG-1600. The warhead targets the thinner armour on top of an armoured vehicle.

The fuze is inevitably different from the standard RKG-EM. It is possible there are limited safety features with the fuze and that any item found should be considered in line and armed.

UDSH SMOKE POT

Images © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Smoke Pot
EXPLOSIVE FILL (g)	N/A
AUW (g)	13500g
DIMENSIONS (mm)	318x139
COUNTRY OF ORIGIN	Russia
FUZE	

The UDSh smoke generator/pot can easily be mistaken for a TM-62M anti-vehicle mine. The key distinguishing features are the prominent fuze, and the green plastic fuze cap. There are also subtle difference on the body of the device. UDSh is usually stencilled in black on the side. UDSh 'Unifitsirovannaya Dymovaya Shashka' literally translates as 'Unified Smoke Block'. Some sources state that these devices are largely used by NBC defence troops.

DM-11 SMOKE POT

Images © John Montgomery

ORDNANCE SUB-CATEGORY	Smoke Pot
EXPLOSIVE FILL (g)	N/A
AUW (g)	3100g
DIMENSIONS (mm)	159x106
COUNTRY OF ORIGIN	Russia
FUZE	

The DM-11 is a smoke generating device, sometimes referred to as a smoke pot. Beneath a lid with a thin handle ten vent holes are sealed with foil. It is believed the composition used is hexachloroethane

The DM-11 looks very similar to the later NDSh and ShD-MM smoke pot models. EOD Operators are advised to confirm the model by the black stencilled markings on the side. Some sources state that these devices are largely used by NBC defence troops.

INDEX

Geneva International Centre for Humanitarian Demining (GICHD)
Maison de la paix, Tower 3, Chemin Eugène-Rigot 2C
PO Box 1300, CH – 1211 Geneva 1, Switzerland
info@gichd.org
gichd.org