GICHD

EXPLOSIVE ORDNANCE GUIDE FOR UKRAINE

THIRD EDITION

Cover: A Ukrainian EOD operator rendering safe the warhead of a Russian Kh-101 missile. Image © SESU

ACKNOWLEDGEMENTS

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Explosive Ordnance Guide for Ukraine, GICHD, 2025

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INTRODUCTION

The third edition of the GICHD Explosive Ordnance Guide for Ukraine is intended as a basic reference for qualified EOD operators conducting explosive ordnance risk reduction activities in Ukraine and may also be used by trained survey staff. It provides guidance on explosive ordnance recognition but does not include render safe procedures. Special safety warnings are included for explosive ordnance containing substances particularly hazardous to human health, such as liquid propellants.

With the addition of over 60 new entries, this third edition covers a reasonable range of explosive ordnance confirmed or likely to be encountered in Ukraine. However, it should not be considered exhaustive.

The guide draws on information from a variety of sources, including open-source intelligence, news reports, and the CORD database (accessible at https://ordata.info/). It also includes details about explosive ordnance reportedly intended for delivery to Ukraine, based on open-source and news information, which may not have been confirmed on the ground at the time of publication. However, the guide remains subject to the limitations of the available data.

As new information on explosive ordnance models in Ukraine emerges, this guide will inevitably become dated. Periodic updates are planned to ensure its relevance.

This guide has been developed solely for humanitarian purposes and is designed to support humanitarian actors involved in explosive ordnance risk reduction in Ukraine. Feedback to improve the guide is welcomed and can be sent to cord@gichd.org.

ABBREVIATIONS OR DESIGNATIONS

ADAM	area denial artillery munition
AFV	armoured fighting vehicle
ALCM	air-launched cruise missile
AP	anti-personnel
APFSDS	armour-piercing fin-stabilized discarding sabot
AP-T	armour-piercing–tracer
AT	anti-tank
ATGW	anti-tank guided weapon
AUW	all-up weight
AVM	anti-vehicle mine
AXO	abandoned explosive ordnance
BCU	battery coolant unit
CLU	container launch unit
DPICM	dual-purpose improved conventional munition
DSMAC	digital scene matching and area correlation
EFI	exploding foil initiator
EFP	explosively formed projectile
EOD	explosive ordnance disposal
ERA	explosive reactive armour
ERW	explosive remnants of war
ESAF	electronic safe arm and firing
FRAG	fragmentation
GNSS	global navigation satellite system
GP	general purpose
GPS	global positioning system
HE	high-explosive
HEAT	high-explosive anti-tank
HE-I	high-explosive–incendiary
HERA	high-explosive rocket-assisted
HESH	high-explosive squash head
HMX	cyclotetramethylene-tetranitramine
ICM	improved conventional munition
JDAM	joint direct attack munition
JSOW	joint standoff weapon
NEQ	net explosive quantity
MANPAD	man-portable air defence system
PBX	polymer-bonded explosives
PETN	pentaerythritol tetranitrate
PIBD	point-initiating base-detonating
RAAM	remote anti-armour mine
RCU	remote control unit
RDX	cyclotrimethylenetrinitramine
SACLOS	semi-automatic command to line of sight
SAM	surface-to-air missile
TNT	trinitrotoluene
UAV	unmanned air vehicle
UCAV	unmanned combat air vehicle
UXO	unexploded ordnance

ANTI-PERSONNEL MINES

MON-50

© Danish EOD and Search Center

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

MON (mina oskolochnaya napravlennogo) was developed as a Soviet version of the M18 Claymore. It is a directional fragmentation anti-personnel mine with a plastic casing, either green or brown. The inscription MON-50 is printed on the concave side, along with respective factory markings. For the Russian version, the phrase " " (k protivniku, towards enemy) may be printed on the convex side on the plastic, in black. The mine contains 700g of plastichnym vzryvchatym veshchestvom – 5A (PVV-5A), an RDX-based plastic explosive with 20% plasticizer.

The two detonator cavities enable two different means of initiation. For example, the mine may be set for command initiation in one fuze well, and victim initiation in another by means of trip wire. 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 anti-personnel mines have been found with anti-handling (tilt) devices 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. If booby traps are suspected, these devices should be pulled using a hook and a line.

MON-90

© Fenix Insight

ORDNANCE SUB-CATEGORY	Anti-personnel directional fragmentation
EXPLOSIVE FILL (g)	6,200 (PVV-5A)
AUW (g)	12,100
DIMENSIONS (mm)	345×202×153
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	MUV/VPF/EPDr/NM with MD-5

The MON-90 is a larger version of the MON-50 with a greater effective range of 90m, as indicated by its name.

Unlike the MON-50, the MON-90 is not equipped with scissor legs. It may use a tree spike mounting. The MON-90 comes with a distinctive case (the same size as an 82mm mortar case) which has 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 M-90 has two fuze wells with M-10 threads, enabling the use of two different fuze types. The mine's fragmentation consists of 2,000 pieces of chopped steel, each 7mm long. For command initiation, the M-90 is often used with the NM electrical initiator. For tripwire initiation, the MUV series of mechanical switches is most often used.

The MON-90 typically has a green base colour with black, stencilled markings. The inscription “MON-90” and the batch number are stencilled on the rear of the body.

MON-100

Left: INERT MON-100 with INERT MUV-1 fuze. © Swiss EOD Center.
Right: © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Anti-personnel directional fragmentation
EXPLOSIVE FILL (g)	2,000 (TNT)
AUW (g)	5,000
DIMENSIONS (mm)	236×83
COUNTRY OF ORIGIN	Russian Federation
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 MON-100 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 two pivots, which allow the mine to be aimed in a specific direction. The mine is also fitted with a canvas carrying a handle on the side of the body.

The fragmentation of the MON-100 consists of 400 pieces of chopped steel, each 10mm 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 may also be tripwire-initiated, usually with an MUV-type mechanical switch.

MON-200

Left, © Fenix. Right, © Robert Friedel

ORDNANCE SUB-CATEGORY	Anti-personnel directional fragmentation
EXPLOSIVE FILL (g)	12,000 (TNT)
AUW (g)	25,000
DIMENSIONS (mm)	434×130
COUNTRY OF ORIGIN	Russian Federation
FUZE	MUV/VPF/EPDr/NM with MD-5

The MON-200 is one of the largest (if not the largest) conventional anti-personnel mine by NEQ and AUW, and is the largest mine in the MON series, with an intended lethal range of 200 metres, as indicated by its name. The 12,000g TNT explosive charge would be large for an anti-vehicle mine, so it is huge for an anti-personnel mine. 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. It is also fitted with a canvas carrying a handle on the side of the body.

The fragmentation of the MON-200 consists of 900 pieces of chopped steel rod. Each piece of rod has a diameter of 10mm and a length of 12mm. The fragmentation is set into a resin matrix, immediately behind the convex side of the mine body.

OZM-72

© Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-personnel bounding
EXPLOSIVE FILL (g)	660 (TNT)
AUW (g)	5,000
DIMENSIONS (mm)	172×108
COUNTRY OF ORIGIN	Russian Federation
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 (OZM-3 and OZM-4).

The 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 of the OZM-72 is made up of preformed fragments of chopped steel rod. The OZM-72 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). It can also be initiated by an MVU-P fuze (associated with the seismically-initiated VP 12/13 firing switch).

The OZM-72 can also be fitted with the MVE-72 breakwire 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 1m, 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 six mines in a wooden box with styrofoam packaging inserts, which can indicate their presence if pieces are discarded near where the mines are emplaced.

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

PMN

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

ORDNANCE SUB-CATEGORY	Anti-personnel blast
EXPLOSIVE FILL (g)	220–240 (TNT main charge), 9 (tetryl booster)
AUW (g)	600
DIMENSIONS (mm)	112×57
COUNTRY OF ORIGIN	Russian Federation
FUZE	MD-9

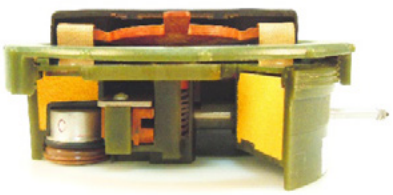
The PMN (ПМН) is possibly the most common anti-personnel mine ever made. For an anti-personnel blast mine, the charge is relatively large. The MD-9 fuze incorporates a cocked striker. A lead shear arming delay is initiated once the pin is removed. The typical arming delay is 12–15 minutes but can change with extreme temperatures. Once 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, which can deteriorate and degrade over time, reducing support to the cylinder stop and making the mine more sensitive to handling. The fuze is designed to operate when approximately 8–25kg 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, the PMN contains enough metallic components to make it 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 PMN mines are considered no touch and destroyed in situ.

PMN-2



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

ORDNANCE SUB-CATEGORY	Anti-personnel blast
EXPLOSIVE FILL (g)	100 (TG-40 – RDX/TNT 60/40)
AUW (g)	420
DIMENSIONS (mm)	120×53
COUNTRY OF ORIGIN	Russian Federation

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 to blast over pressure. The mine casing is made from injection-moulded plastic and is usually green. 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, but the more powerful RDX-based TG-40 explosive.

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 15kg 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, which can indicate their presence if pieces are discarded near where the mines are emplaced. Discarded arming keys can also be a good visual indicator.

PMN-4

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Anti-personnel blast
EXPLOSIVE FILL (g)	52–60 (TNT/TG-40)
AUW (g)	300
DIMENSIONS (mm)	95×42
COUNTRY OF ORIGIN	Russian Federation

The PMN-4 (ПМН-4) is a blast anti-personnel mine. It 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 attached to a wire, which is fixed to the fuze arming mechanism. Removal of the safety clip causes the attached wire to rotate the fuze arming mechanism. This 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 5–10kg is applied to the pressure plate.

The TNT explosive charge is relatively small compared with its predecessors 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.

M18A1 CLAYMORE

© Dutch EOD Center

ORDNANCE SUB-CATEGORY	Anti-personnel directional fragmentation
EXPLOSIVE FILL (g)	680 (C4)
AUW (g)	1,590
DIMENSIONS (mm)	216×172×35
COUNTRY OF ORIGIN	United States
FUZE	M57 firing device and M4 blasting cap

The M18A1 Claymore was the first conventionally manufactured directional fragmentation mine. It has been supplied for initiation by command. The M18A1 has a curved, rectangular, olive drab, moulded case of fibreglass-filled plastic. The front face is lined with steel spheres embedded in a plastic matrix. The back portion of the case, behind the matrix, contains C4 explosive. The fragmentation face is convex horizontally (to direct the fragments in a 60-degree arc), and concave vertically (to control the vertical dispersion of the fragments). A built-in sight and two pairs of scissors-type folding legs allow aiming of the mine.

Two detonator wells located in the top of the mine enable it to be fired from two locations. The wells are sealed by the plug ends of the shipping plug priming adapters. The adapter is reversed when the mine is to be armed and the slotted end of the adapter is used to hold the mine detonator. Similar directional fragmentation mines have been known to be booby trapped or protected by concealed anti-personnel blast mines. Caution is advised.

ANTI-VEHICLE MINES

TM-62M

© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	7,500 (TNT)
AUW (g)	9,500
DIMENSIONS (mm)	320×128
COUNTRY OF ORIGIN	Russian Federation
FUZE	MVCh-62/MVP-62

The TM-62M is a metal-bodied anti-vehicle 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 into the bottom of the fuze well. Like all other mines in the TM-62 series, the TM-62M accepts all fuzes that were developed for the TM-62, TM-72 and TM-80 series of mines. Therefore, this mine can potentially 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 150kg will initiate the fuze.

The image above shows the mine with an MVP minimum metal fuze. If deployed in the field like this, the fuze would be wasted, indicating a potential lack of training or of alternative fuzes from 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.

UDSH SMOKE POT

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Smoke pot
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	13,500
DIMENSIONS (mm)	318×139
COUNTRY OF ORIGIN	Russian Federation

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 differences on the body of the device.

The marking "UDSh" (*unifitsirovannaya dymovaya shashka*, unified smoke block) is usually stencilled in black on the side. Some sources state that these devices are largely used by nuclear, biological and chemical (NBC) defence troops.

TM-62P3

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

ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	6,500 (TNT)
AUW (g)	8,000
DIMENSIONS (mm)	310×85
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	MVCh-62 (image on left) MVP-62 (minimum metal) (image on right)

The TM-62P3 is a large plastic-bodied anti-vehicle 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 180g of pressed TNT. The TM-62P3 has a distinctive canvas carrying sling that wraps around the body (see image on the right).

Like all other mines in the TM-62 series, the TM-62P3 accepts 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.

PTKM-1R

© Private

ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	Unknown
AUW (g)	19,900
DIMENSIONS (mm)	510×220
COUNTRY OF ORIGIN	Russian Federation
FUZE	Unknown

The PTKM-1R is a manually deployed anti-vehicle mine that was only shown at arms fairs in 2021. Little is known about it.

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 infrared sensors that are projected into the air as part of the warhead. The PTKM-1R is likely to be employed near routes or trafficable areas.

The PTKM-1R is fitted with a self-destruct mechanism, the longest extent of which is ten 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.

TM-83

© Armed Forces Ukraine

ORDNANCE SUB-CATEGORY	Off-route mine
EXPLOSIVE FILL (g)	9,600 (TG-40 – RDX/TNT 60/40)
AUW (g)	20,400
DIMENSIONS (mm)	250 (diameter), 440 (height, on stand)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Various including: command, seismic, break wire, and infrared

The TM-83 is an off-route mine fitted with a large-diameter Misznay-Schardin EFP warhead. It employs a 9.6kg main charge with an EFP liner made of copper with a mass of 4kg. The mine produces an EFP slug which can penetrate the side armour of an armoured fighting vehicle at a range of 50 metres. The overall body colour of this mine is yellow/green and it has black stencilled markings. The mine is distinctive in configuration due to the infrared sensor and illuminator mounted on the top edge of the mine.

The TM-83 is usually initiated by a VT-01 infrared sensor or a VT-02 seismic sensor. Once armed, the system has an operational battery life of 30 days. The mine may also be configured easily for electric command initiation or pull-wire initiation using a MUV-type initiator.

Great caution should be exercised when dealing with the TM-83 and a manual approach should be avoided until the target area has been identified and the actual means of initiation confirmed. The potential use of seismic sensors suggests the use of a remote means of render safe. It is not advisable to approach this mine from its front. Consideration should also be given to the considerable downrange hazard posed by the EFP slug if this mine is destroyed in situ.

TMRP-6

© MilitaryNewsUA

ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	5,000 (TNT with 25g black powder clearing charge)
AUW (g)	7,800
DIMENSIONS (mm)	290 (diameter), 140 (height, fuze fitted – additional 600 with tilt rod)
COUNTRY OF ORIGIN	Former Republic of Yugoslavia/Serbia
FUZE	UTMRP-6 single-impulse pressure and tilt rod, 350kg activating pressure (without tilt rod)

The TMRP-6 is a single-impulse, pressure-operated, anti-vehicle mine, which may be fitted with a tilt rod to provide full-width attack on AFVs. The principal components are contained within a light green plastic body. The mine is fitted with a fold-away plastic carrying handle.

The TMRP-6 uses a Misznay-Schardin warhead to penetrate the belly armour of AFVs. The EFP plate is made of copper. The UTMRP-6 fuze is of a mechanical type and uses a key-operated clockwork mechanism to provide a delay to arm. Once armed, a single-impulse pressure on the fuze of 350kg will cause the mine to function. With the tilt rod fitted, in full-width attack mode, pressure on the tilt rod of less than 2kg will cause the mine to function. A clearing charge consisting of black powder is fired immediately prior to the main charge.

The base of the mine has a screw-threaded aperture for emplacement of a detonator for a secondary firing system (anti-lift). There is also space above the EFP plate for the addition of other anti-handling mechanisms. Once armed, especially if the tilt rod is fitted, the UTMRP-6 fuze is extremely sensitive and hand removal is not recommended. If the clearing charge has functioned and the main charge has not, the mine may still be in a hazardous condition. Consideration should be given to the hazard posed by the EFP slug if this mine is destroyed in situ.

PARM 2 / DM-22

© Open Source

ORDNANCE SUB-CATEGORY	Anti-vehicle off-route mine
EXPLOSIVE FILL (g)	Unknown, estimated 1,900
AUW (kg)	20
DIMENSIONS (mm)	300-700, diameter: 110
COUNTRY OF ORIGIN	Germany

The PARM-2/DM-22 (Panzerabwehr-Richtmine-2) is a development of the PARM-1 off route mine. It incorporates several improvements over the PARM-1, such as increased range and an improved target acquisition sensor.

The mine can use a Sensor Active Passive Infrared (SAPIR) 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.

DM-31

© Swiss EOD Center

ORDNANCE SUB-CATEGORY	Anti-vehicle mine – EFP
EXPLOSIVE FILL (g)	3,900–4,000 (TNT/RDX)
AUW (g)	8,400
DIMENSIONS (mm)	254×134
COUNTRY OF ORIGIN	Sweden/Germany

The DM-31 (Panzerabwehrverlegemine DM31) is a full-width-attack, influence-initiated anti-vehicle mine that dates from the 1970s. It is the German version of the Swedish FFV 028. The DM-31 employs the Misznay-Schardin effect to create an explosively formed projectile in order to attack the underside of an armoured vehicle. The fuze is initiated by magnetic influence and has an arming delay of 60 minutes.

Given the method of operation of the fuze, this mine is susceptible to premature initiation if approached by hand-held or vehicle-mounted detectors. Given the nature of the fuzing employed, this item should be considered high risk for EOD and demining personnel. If there is evidence that such items are buried in an area, survey and clearance methods that will not cause the fuzing to initiate, should be considered.

HPD-2A2

© Swiss EOD Center

ORDNANCE SUB-CATEGORY	Anti-vehicle mine – EFP
EXPLOSIVE FILL (g)	2,800 (composition B: RDX/TNT)
AUW (g)	7,000
DIMENSIONS (mm)	278×189×104
COUNTRY OF ORIGIN	France

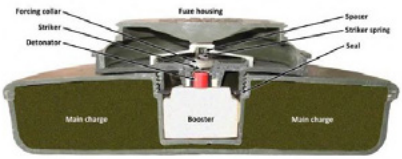
The HPD-2 is a full-width-attack, influence-initiated anti-vehicle mine. It employs a Misznay-Schardin form of shaped charge. The full French designation is "MI AC HPD F2" (for "mine antichar à haut pouvoir de destruction modèle F2"). The mine functions by means of a mutual-inductance sensor.

The HPD-2 mine consists of two main subassemblies. The first one is the electronic fuze unit containing the sensor, the mission management electronics, the safety and arming unit, and the power source. The second one is the mine warhead containing the explosive charge.

The HPD-2 incorporates a selectable anti-handling switch and may be programmed to self-destruct or self-neutralize after a predetermined period. It has an active period of up to 90 days once set.

Due to the method of operation of the fuze, it is susceptible to premature initiation if approached by hand-held or vehicle-mounted detectors. Given the nature of fuzing employed, this item should be considered high risk for EOD and demining personnel. If there is evidence that such items are buried in an area, survey and clearance methods that will not cause the fuzing to initiate, should be considered.

C-3-B HE



ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	5,000 (TNT/RDX/aluminium 50/30/20)
AUW (g)	5,700
DIMENSIONS (mm)	290 (diameter), 109 (height, fuze fitted)
COUNTRY OF ORIGIN	Spain
FUZE	Single-impulse pressure 275kg

The C-3-B anti-vehicle mine is a single-impulse, pressure-operated, blast anti-vehicle mine. The principal components are contained within a solvent-bonded olive green polystyrene plastic body. The mine is fitted with a fabric carrying strap and there are no additional fuze holes for secondary firing systems.

The C-3-B mine has an extremely low metal content, with only the fuze striker spring being made of steel. This makes the mine very difficult to reliably detect using conventional metal detectors, particularly in ground where other metallic contamination is present.

M21 HE

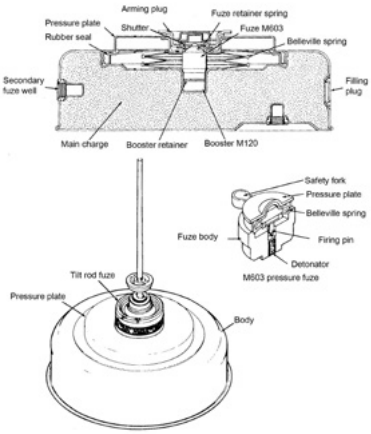
ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	4,900 (composition H6 – RDX/wax/aluminium)
AUW (g)	8,000
DIMENSIONS (mm)	230 (diameter), 210 (height, fuze fitted – additional 600 with tilt rod)
COUNTRY OF ORIGIN	United States
FUZE	M607 single-impulse pressure and tilt rod, 132kg activating pressure (without tilt rod)

The M21 anti-vehicle mine is a single-impulse, pressure-operated, anti-vehicle mine, which may be fitted with a tilt rod to provide full-width attack on AFVs. The principal components are contained within an olive green metal body. Markings may be stencilled in black or yellow. It is fitted with a fabric carrying handle.

The M21 uses a Misznay-Schardin EFP warhead to penetrate the belly armour of AFVs. The EFP plate is made of steel. The mine is fitted with the M607 fuze, which is of a mechanical type and is fitted with an M46 stab detonator. With the tilt rod fitted, in full-width-attack mode, pressure on the tilt rod of less than 2kg will cause the mine to function. A clearing charge consisting of approximately 50g of black powder is fired immediately prior to initiation of the main charge. The mine may also be positioned vertically and employed as an improvised off-route mine.

Great caution should be exercised with armed M21 mines with tilt rods fitted. Consideration should be given to the hazard posed by the EFP slug if this mine is destroyed in situ.

M15 HE



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ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	10,000 (composition B – RDX/TNT)
AUW (g)	14,250
DIMENSIONS (mm)	330 (diameter), 200 (height, fuze fitted – additional 600 with tilt rod)
COUNTRY OF ORIGIN	United States
FUZE	M603 internal fuze or M624 external fuze

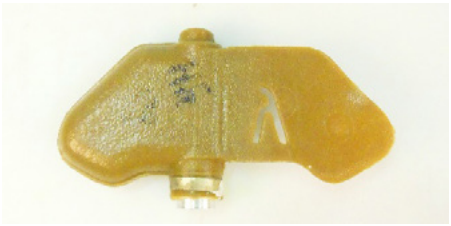
The M15 is a single-impulse, pressure-operated blast anti-vehicle mine, which may be fitted with a tilt rod to provide full-width attack on AFVs. The principal components are contained within an olive green metal body. It is fitted with a fabric carrying handle.

The M15, when fitted with the M603 internal fuze, requires an operating pressure of approximately 160kg to function. When the external M624 fuze is fitted with a tilt rod, less than 2kg of pressure is required for the fuze to function.

The M15 is fitted with secondary fuze wells in the side and base of the mine to allow other methods of initiation. Great caution should also be exercised with armed M15 mines fitted with tilt rods.

SCATTERABLE MINES

PFM-1



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ORDNANCE SUB-CATEGORY	Anti-personnel blast mine – SCATMIN
EXPLOSIVE FILL (g)	37 (VS-6D)
AUW (g)	75
DIMENSIONS (mm)	120×61×20
COUNTRY OF ORIGIN	Russian Federation
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 (for example, from a KMGU dispenser attached to an aircraft), or by ground troops using a hand-emplaced PKM projection canister. It may also be delivered by means of 122mm GRAD 9M22K or 220mm URAGAN 9M27K3 rockets.

The PFM-1 is a copy of the BLU-43 Dragon's Tooth mine. It contains a relatively small charge of 37g of a liquid explosive and is known as "Лепесток" (*lepestock*, petal). Colloquially, they have been termed "butterfly mines" over time although this is not an official designation. The cyrillic inscription "А (У)" stencilled into the wing designates a training version ("У-ПФМ-1" from "учебный", *uchebnyy*, for training).

The KSF-1 canister holds eight racks of nine PFM-1 mines each (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. The PFM-1 is relatively easy to detect, since it contains ferrous components (springs, locking balls, etc.) although the fuze is largely made of aluminium. As a form of SCATMIN, the mines are also usually found on the surface.

The fuze uses the hydraulic pressure of the enclosed VS-6D liquid explosive. The fuze is designed to operate when approximately 5–25kg is applied to the mine body, but not 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.

POM-2

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ORDNANCE SUB-CATEGORY	Anti-personnel fragmentation – SCATMIN
EXPLOSIVE FILL (g)	140 (TNT)
AUW (g)	1,600
DIMENSIONS (mm)	180×63
COUNTRY OF ORIGIN	Russian Federation
FUZE	Mechanical with tension-type target sensors

POM-2 (ПОМ-2) is a scatterable anti-personnel fragmentation mine, which can be delivered by a range of different methods, including by helicopter, fixed-wing aircraft and multi-barrelled rocket launchers. It may also be delivered manually using a method similar to the PKM delivery system.

The mine can come from a batch of four mines in one KPOM-2 canister. A 122mm GRAD 9M18 rocket can carry five mines. A 220mm URAGAN 9M59 rocket can carry nine POM-2 mines. A full salvo of 16 rockets from one URAGAN launcher may create a minefield of 144 mines. If one mine is found, assume others are present.

The POM-2R (ПОМ-2Р), a pursuit deterrent version of this mine used by special forces, can also be delivered manually. It 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 four spring-loaded tripwires, each of which is 9.5m 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 underneath. Six spring-loaded fins are fitted to the bottom of the mine.

The fuze is extremely sensitive and only about 300g of weight on one of the four tripwires is necessary 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 neutralized nor disarmed.

POM-3

© SESU

ORDNANCE SUB-CATEGORY	Anti-personnel fragmentation – SCATMIN
EXPLOSIVE FILL (g)	100 (A-IX-1)
AUW (g)	1,200
DIMENSIONS (mm)	183×60
COUNTRY OF ORIGIN	Russian Federation
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 "Медальон" (medal'on, 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 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, nor whether fuzing depends 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 neutralization are not recommended. Remote employment of disposal charges, or the use of standoff small arms fired from a safe distance may be appropriate. Extreme caution is advised when dealing with this mine.

PTM-1

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ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	1,100 (PVV-12S-1)
AUW (g)	8,000
DIMENSIONS (mm)	310×85
COUNTRY OF ORIGIN	Russian Federation
FUZE	MVDM-G

The PTM-1 (ПТМ-1) is a scatterable anti-vehicle mine, normally delivered 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 150–400kg 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 two 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 neutralized 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

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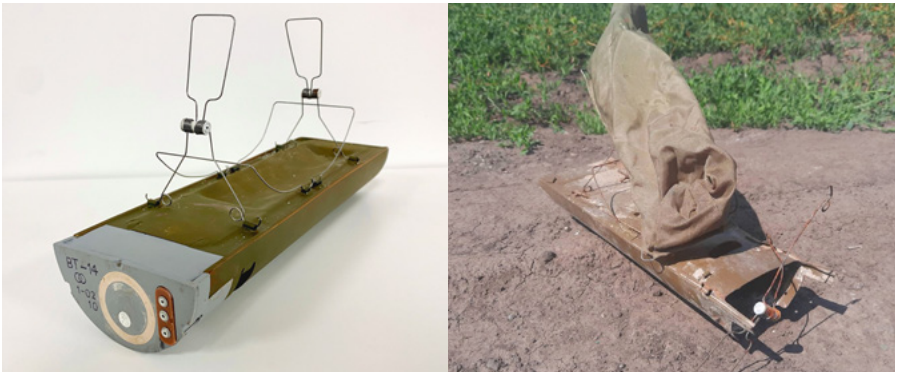
ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	1,800 (TG-40, RDX/TNT 60/40)
AUW (g)	4,900g
DIMENSIONS (mm)	330x84x84
COUNTRY OF ORIGIN	Russian Federation
FUZE	BT-06 magnetic influence fuze

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 the 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 uses a shaped charge of 1,800g of TG-40 (RDX/TNT 60/40). Whichever way the mine lands, a shaped charge will point upwards since a copper elongated concave liner is found on each side with the 1,800g TG-40 charge applicable to each. When the PTM-3 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. The PTM-3 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. A modified variant of the PTM-3, fitted with sensitive anti-movement and magnetic influence sensors, has been widely deployed by UAVs. Great caution should be taken when dealing with these.

PTM-4



Left © Fenix. Right © SESU

ORDNANCE SUB-CATEGORY	Anti-vehicle mine
EXPLOSIVE FILL (g)	1,400
AUW (g)	3,250
DIMENSIONS (mm)	350×110×55
COUNTRY OF ORIGIN	Russian Federation
FUZE	VT-14 (BT-14) battery-powered magnetic influence 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 can also be deployed by larger (220mm and 300mm) multi-launch rocket systems or emplaced manually 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 or 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 PTM-4 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. The PTM-4 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.

155MM M692 AND M731 ADAM

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ORDNANCE SUB-CATEGORY	Artillery projectile with scatterable anti-personnel mines
EXPLOSIVE FILL (g)	51 (M10 propellant expulsion charge) 36×ADAM AP mines each containing 21g of RDX
AUW (g)	46,500 (without fuze)
DIMENSIONS (mm)	804 (length, unfuzed), 899 (length, fuzed), 155 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Mechanical or electronic time fuze for carrier projectile

The 155mm M692 and M731 carrier projectiles contain 36 area denial artillery munition (ADAM) anti-personnel mines. They may be fired by any NATO-standard 155mm howitzer. The overall body colour of the projectiles is olive drab with yellow stencilling. Yellow triangular markings around the circumference of the projectile ogive indicate the scatterable anti-personnel mine payload. The letter "L" inside the triangle indicates that the shell contains the ADAM AP mine with long duration self-destruct (M692 – 72 hours). The letter "S" indicates it contains a mine with the short duration self-destruct (M731 – 4 hours) (see separate entry).

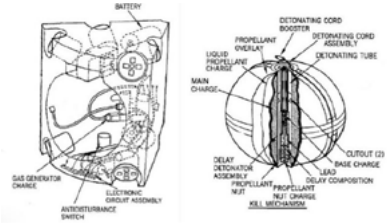
Projectiles may be fitted with either a mechanical or electronic time fuze, which initiates a 50g M10 propellant expelling charge. This acts on a piston and pusher plate which ejects the ADAM AP mines using the base eject principle.

The M692 and M731 carrier projectiles are of similar size and configuration to the M718 and M741 155mm projectiles associated with the M70 RAAM system and the M483 dual-purpose improved conventional munition (DPICM). Great care should be taken to correctly identify intact projectiles which have failed to dispense their payload and where markings have been obliterated.

Care should be taken with any fuzed projectile which has failed to function, as jarring or impact on the fuze may cause it to function and initiate the expulsion charge. Each ADAM AP mine employs an epoxy containing a small amount (0.1g) of uranyl acetylacetonate. This heavy metal hazard should be considered in areas where logistic disposal of munitions is considered.

Projectiles which have been fired and have failed to function may contain mines that have armed and have running self-destruct timers. A minimum safe waiting period of 4 days is recommended before projectiles containing ADAM mines are approached. Given the relatively small explosive content and the design of the ADAM mine, substantial donor charges are recommended. Attempts to manually dismantle this type of fired projectile are most likely to result in death.

M67 AND M72 ADAM



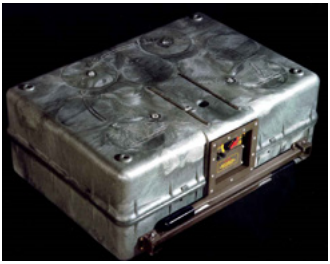
ORDNANCE SUB-CATEGORY	Artillery-delivered scatterable anti-personnel mine
EXPLOSIVE FILL (g)	Kill mechanism main explosive charge: 21 (RDX) Ejection charge: 50 (liquid M10 propellant)
AUW (g)	540
DIMENSIONS (mm)	57 (width), 82 (height)
COUNTRY OF ORIGIN	United States
FUZE	Setback-initiated electronic arming with tripwire and anti-disturbance firing system

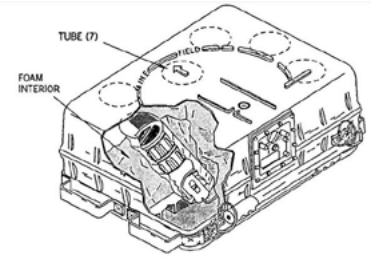
The area denial artillery munition (ADAM) anti-personnel mine is a non-persistent bounding scatterable mine delivered by 155mm M692 and M731 carrier projectiles, each of which contains 36 anti-personnel mines. Two variants of the ADAM mine exist. The M692 has a self-destruct time of 72 hours and contains the M67 ADAM variant. The M731 has a self-destruct time of just 4 hours and contains the M72 ADAM variant (see separate entry). The mine has a triangular wedge shape and its overall body colour is olive drab with black stencilled markings.

The action of setback on projectile firing causes a slider to unlock the mines and centripetal force locks this bar in place. A liquid electrolyte is released from a glass reservoir, which is broken by the pressure generated by the projectile expulsion charge. This also causes the mines to be radially ejected from the projectile. On impact with the ground, a gas generator within the mine ejects three long tripwires. A force of 200 to 700g acting on the tripwire is sufficient to cause the kill mechanism (a 40mm diameter spherical ball-shaped warhead) to be ejected, which then detonates in mid-air at a height of 1 to 2m. Any movement of the mine will cause the anti-disturbance switch to close, also initiating the mine. If not initiated, the mine self-destructs at the end of its designed elapsed time, 4 or 72 hours.

Each ADAM AP mine employs an epoxy containing a small amount (0.1g) of uranyl acetylacetonate. This heavy metal hazard should be considered when conducting UXO clearance operations. Projectiles which have been fired and have failed to function may contain mines that have armed and have running self-destruct timers. A minimum safe waiting period of 4 days is recommended before approaching deployed ADAM mines. Attempts to manually dismantle this mine are most likely to result in death.

M131 MOPMS MINE-DISPENSING SYSTEM





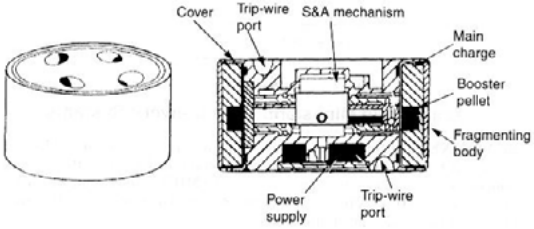
ORDNANCE SUB-CATEGORY	Scatterable mine system
EXPLOSIVE FILL (g)	Each of the 4 AP mines: 335 (composition B – RDX/TNT) 17×AT mine: 610 (PBX – RDX/estane)
AUW (g)	Loaded MOPMS dispenser (21×AP/AT mines): 73,500
DIMENSIONS (mm)	818 (length), 576 (width), 345 (height)
COUNTRY OF ORIGIN	United States
FUZE	Electronic fuze with selectable self-destruct for AP and AV mines

The M131 modular pack mine (MOPMS) provides a non-persistent scatterable mine capability for the rapid creation of small tactical protective minefields. Its overall body colour is olive drab with markings stencilled in white. Mines are held ready within the modular dispenser pack and are launched on command (hard-wired or radio controlled). Each MOPMS module contains anti-personnel (AP) and anti-tank (AT) mines which may be remotely armed, reset or command-detonated using the M71 remote control unit (RCU) (see separate entries). The MOPMS dispenser is a one-shot device and is not reloadable once mines have been launched.

The MOPMS dispenser module contains seven tubes, each of which contains three mines and a small propellant ejection charge. The standard configuration of the MOPMS dispenser has 17 AT mines and 4 AP mines. The MOPMS dispenser has a master safe arm contained within the side-mounted module control unit. Each mine contains a battery which is activated immediately prior to launch from the MOPMS dispenser.

Both AP and AT MOPMS mine types incorporate a bore-riding pin which is released when the mine is removed or launched from its canister. The MOPMS AP mine employs fine 12m-long tripwires and the AT mine uses a magnetic influence fuze-based initiation system. Appropriate precautions should be taken when dealing with deployed mines. Attempts to remove mines from canisters may cause them to arm with obvious negative consequences.

M131 MOPMS AP MINE



ORDNANCE SUB-CATEGORY	Scatterable AP mine
EXPLOSIVE FILL (g)	335 (composition B4 – RDX/TNT)
AUW (g)	1,600
DIMENSIONS (mm)	66 (height), 121 (diameter, not including spring fingers on later mine variants)
COUNTRY OF ORIGIN	United States
FUZE	Electronic fuze with re-programmable 4-hour self-destruct time. Tripwire primary means of initiation.

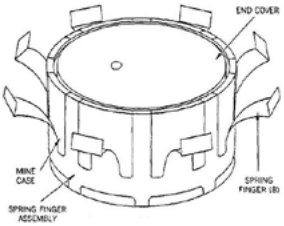
The M131 modular pack mine system (MOPMS) AP mine is a non-persistent scatterable mine launched from the M131 MOPMS mine dispenser (see separate entry). The M131 MOPMS AP mine is superficially similar to the M139 Volcano AP mines in its cylindrical configuration, side-mounted spring fingers and 12m-long tripwires. The overall body colour of the mine is forest green. It has a programmed timed self-destruct of 4 hours, which may be reset up to three times using the M71 RCU.

The mine-arming process starts as the mine is ejected from its canister and the bore-riding pin on the mine is released. Arming is completed several minutes after the mine lands on the ground and after seven 12-m-long tripwires are deployed (four from the top of the mine, three from the bottom). Only 100 to 200g of force on any of the deployed tripwires will cause the mine to function. The mine is powered by a lithium battery.

A minimum safe waiting period of 12 hours is recommended after any attempt has been made to reset, disarm or initiate self-destruction of the mine using the M71 RCU. Appropriate magnetic precautions should be taken as MOPMS AP mines are always used in conjunction with magnetic influence-fuzed MOPMS AT mines.

Given the difficulty of seeing the fine tripwires, remote observation and render safe procedures should be considered and no attempt should be made to move a deployed mine. Attempts to manually dismantle this mine are most likely to result in death.

M131 MOPMS AT MINE



ORDNANCE SUB-CATEGORY	Scatterable AT mine
EXPLOSIVE FILL (g)	610 (PBX – RDX/estane)
AUW (g)	1,900
DIMENSIONS (mm)	66 (height), 121 (diameter, not including spring fingers on later mine variants)
COUNTRY OF ORIGIN	United States
FUZE	Electronic fuze with re-programmable 4-hour self-destruct time. Magnetic influence initiation.

The M131 modular pack mine system (MOPMS) AT mine is a non-persistent scatterable mine launched from the M131 MOPMS mine dispenser (see separate entry). The mine warhead incorporates a double Miznay-Schardin plate which creates an explosively formed projectile (EFP) on firing. The mine has a small gunpowder clearance charge on its outer surface to clear debris before the main warhead initiates. The mine has a programmed timed self-destruct of four hours, which may be reset up to three times using the M71 RCU.

The mine has a cylindrical configuration and its overall body colour is forest green. The mine-arming process commences as the mine is ejected from its canister and is completed several minutes after the mine lands on the ground. The mine employs a magnetic influence sensor to detect the presence of a target. The mine is powered by a lithium battery. The mine sensor is sufficiently sensitive that changing the orientation of the mine in the earth's magnetic field may cause the mine to function.

A minimum safe waiting period of 12 hours is recommended after any attempt has been made to reset, disarm or initiate self-destruction of the mine using the M71 RCU. The tripwire hazard posed by the likely presence of M131 MOPMS AP mines should also be considered. Given the sensitivity of the mine's influence sensor, suitable magnetic precautions should be taken, and no attempt should be made to move a deployed mine. The potential down range hazard posed by the EFP warhead should be considered if unexploded mines are to be destroyed by demolition. Attempts to manually dismantle this mine are most likely to result in death.

M139 VOLCANO MINE-DISPENSING SYSTEM

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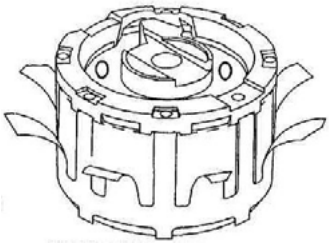
ORDNANCE SUB-CATEGORY	Scatterable mine system
EXPLOSIVE FILL (g)	Each M87 canister: 5 (M1 propellant expulsion charge) Each AP mine: 420 (composition B – RDX/TNT) Each AT mine: 605 (RDX)
AUW (g)	Each M87 canister: 13,600 AP mine: 1,600 AV mine: 1,600
DIMENSIONS (mm)	Canister; 620 (length), 127 (diameter), 899 (length, fuzed)
COUNTRY OF ORIGIN	United States
FUZE	Electronic fuze with selectable self-destruct for AP and AV mines

The M139 Volcano mine dispenser provides a scatterable mine capability for use with helicopters and ground vehicles and can rapidly create a minefield 110m long and 120m wide. The dispenser racks accept and launch mines from M87 mine canisters. The overall colour of mine canisters is olive drab and they have a circumferential band of yellow and black triangles near the breech, indicating a scatterable mine payload.

The Volcano dispenser contains a combination of 960 AT and AP mines. All mines have a timed self-destruct capability of 4 hours, 48 hours or 15 days, selectable prior to delivery. The M87 mine canister contains five AT mines and a single AP mine. The M87A1 mine canister contains six AT mines (see separate entries).

The Volcano AT mine variant is an influence-fuzed mine and appropriate magnetic precautions should be taken. The AP mine variant employs very fine 12m-long tripwires which are difficult to see. Both mine types incorporate a bore-riding pin/timer which is released when the mine is removed or launched from its canister. Attempts to manually remove mines from canisters may cause them to arm with obvious negative consequences.

M139 VOLCANO AP MINE



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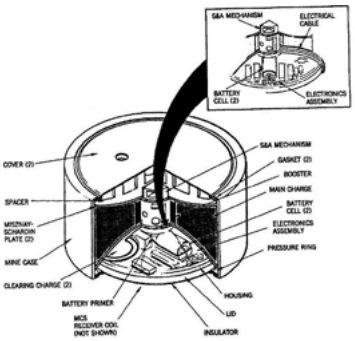
ORDNANCE SUB-CATEGORY	Scatterable AP mine
EXPLOSIVE FILL (g)	420 (composition B – RDX/TNT)
AUW (g)	1,600
DIMENSIONS (mm)	66 (height), 121 (diameter, not including spring fingers on later mine variants)
COUNTRY OF ORIGIN	United States
FUZE	Electronic fuze with selectable self-destruct time. Tripwire primary with anti-disturbance secondary

The M139 Volcano AP mine is a scatterable mine launched from the M139 Volcano mine dispenser (see separate entry). All mines have a timed self-destruct capability of 4 hours, 48 hours or 15 days, selectable prior to delivery. The M139 Volcano AP mine is incorporated into the M87A1 mine canister and is used to protect the five other AT mines deployed at the same time.

The mine has a cylindrical configuration and its overall body colour is olive drab. The mine-arming process starts as the mine is ejected from its canister and is completed several minutes after the mine lands on the ground. Arming is complete after four 12m-long tripwires are deployed. A share of Volcano AP mines are equipped with an anti-disturbance switch, which will operate if the mine is moved. Only 100 to 200g of force on any of the deployed tripwires will cause the mine to function.

A minimum safe waiting period of 4 weeks is recommended before Volcano AP mines are approached. Given the difficulty of seeing the fine tripwires, remote observation and render safe procedures should be considered and no attempt should be made to move a deployed mine. Attempts to manually dismantle this mine are most likely to result in death.

M139 VOLCANO AT MINE



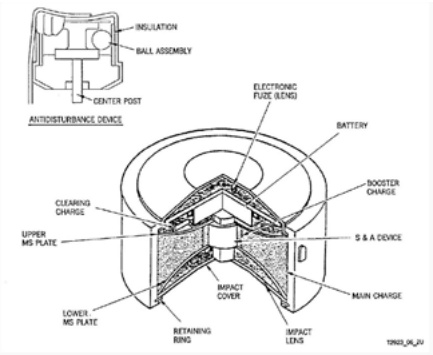
ORDNANCE SUB-CATEGORY	Scatterable AT mine
EXPLOSIVE FILL (g)	605 (RDX)
AUW (g)	1,600
DIMENSIONS (mm)	66 (height), 121 (diameter, not including spring fingers on later mine variants)
COUNTRY OF ORIGIN	United states
FUZE	Electronic fuze with selectable self-destruct time. Magnetic influence initiation.

The M139 Volcano AT mine is a scatterable mine launched from the M139 Volcano mine dispenser (see separate entry). All mines have a timed self-destruct capability of 4 hours, 48 hours or 15 days, selectable prior to delivery. The M139 Volcano AT mine is incorporated into the M87 and M87A1 mine canisters.

The mine has a cylindrical configuration and its overall body colour is olive drab. The mine-arming process starts as the mine is ejected from its canister and is completed several minutes after the mine lands on the ground. The mine employs a magnetic influence sensor to detect the presence of a target. This sensor is sufficiently sensitive that changing the orientation of the mine in the earth's magnetic field may cause the mine to function. The mine warhead incorporates a double Miznay-Schardin plate which creates an EFP on firing.

A minimum safe waiting period of 4 weeks is employed before approaching Volcano AT mines. The tripwire hazard posed by the likely presence of M139 Volcano AP mines should also be considered. Given the sensitivity of the mine's influence sensor, suitable magnetic precautions should be taken and no attempt should be made to move a deployed mine. The potential down range hazard posed by the EFP warhead should be considered if unexploded mines are to be destroyed by demolition. Attempts to manually dismantle this mine are most likely to result in death.

M70 RAAM



Left: © GICHD CORD. Right: © US DoD

ORDNANCE SUB-CATEGORY	Scatterable anti-vehicle mine
EXPLOSIVE FILL (g)	570 (PBX 0280 – RDX/estane 95/5)
AUW (g)	2,800
DIMENSIONS (mm)	127 (diameter), 60 (height)
COUNTRY OF ORIGIN	United States
FUZE	Magnetic influence fuze armed on impact or after 1 minute

The M70 remote anti-armour mine (RAAM) is a scatterable anti-vehicle mine, which is delivered by the M718/M741 155mm carrier projectiles (see separate entries). Its overall body colour is green and no external indication of its arming status.

The M70 is ejected from its parent carrier shell at a time determined by the projectile fuze. Having been subject to setback and centripetal forces within the shell on firing, the mine is armed either immediately on landing or after a delay of 1 minute. The mine contains a magnetic influence fuze which detects the presence of armoured vehicles. The warhead is a double explosively formed penetrator type and has a small gunpowder clearance charge on its outer surface, to clear debris before the main warhead initiates. If the mine is not activated by a target, it is preprogrammed to self-destruct after either 4 or 48 hours. Some mines within each carrier projectile are fitted with anti-handling devices to inhibit minefield clearance. The mine is fitted with a battery with a designed maximum operational life of 14 days.

If possible, a safe waiting period of 72 hours is recommended before clearing minefields known to contain M70 RAAM. Given the influence fuze, minimum metal precautions should be taken before approaching this mine.

GRENADES

F-1

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

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	60 (TNT)
AUW (g)	600
DIMENSIONS (mm)	130×55
COUNTRY OF ORIGIN	Russian Federation/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 of relatively low quality and rarely fragments evenly. The fragmentation is claimed to be lethal up to 200m, although 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 to 4.2 seconds after the fly-off lever is released. Theoretically, any firing device with an M-10 thread may 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 booby traps 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 in the ground adjacent to an omni-directional mine stake or adjacent to a buried bounding fragmentation mine).

RGD-5

© Danish EOD and Search Center

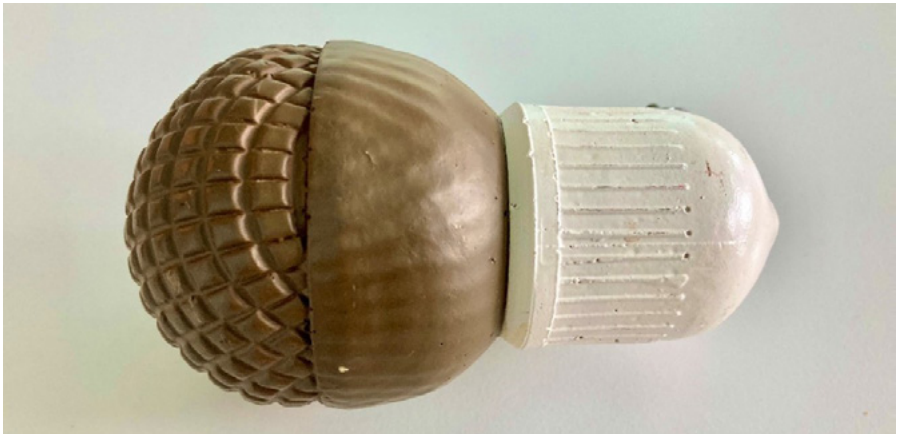
ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	110 (TNT)
AUW (g)	310
DIMENSIONS (mm)	114×58
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	UZRGM-2

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

The RGD-5 can 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.

RGO/RGN



© Roly Evans

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	90–110 (A-IX-1), estimated
AUW (g)	530
DIMENSIONS (mm)	114×60
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	UDZ

The RGO (*ruchnaya granata oboronitel'naya*) is a defensive high-explosive, fragmentation 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 high-explosive hand grenade. The self-destruct mechanism is timed to function after 3.2 to 4.2 seconds, similar to the delay for a UZRGM-2.

The RGN is almost identical to the RGO, the main difference being that the RGN has an aluminium alloy body while the RGO has a steel body. Some publications state that the RGN has a 110g main charge whereas the RGO's is 90g, However, the accuracy of this statement is not clear.

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

© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade – HEAT
EXPLOSIVE FILL (g)	350 (TG-50)
AUW (g)	1,070
DIMENSIONS (mm)	362×72
COUNTRY OF ORIGIN	Russian Federation/Bulgaria/East Germany
FUZE	Impact inertia/cocked striker

The RKG-3 (for "Ручная Кумулятивная Граната", *ruchnaya kumulyativnaya granata,* hand cumulative grenade) is a HEAT hand grenade designed to be used in urban combat, where it can be deployed from buildings. 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 proceed with extreme caution.

There are indications that the RKG-3 has been adapted for use as a small aerial HEAT bomb labelled RKG-1600, to be deployed by unmanned air vehicle (UAV). In this configuration, the fuzing in the handle is replaced by what is assumed to be an in-line impact inertia fuze.

VOG-17/VOG-17M

VOG-17M. © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	34 (A-IX-1)
AUW (g)	350
DIMENSIONS (mm)	132×30
COUNTRY OF ORIGIN	Russian Federation/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 fuze 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 in-line primer; it is therefore not bore-safe. VOG-17 mines with VMG fuzes, even when found as AXO, should be handled accordingly.

The VOG-17 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 in the case of VOG-17M) overcomes a relatively weak creep spring to initiate the explosive train.

The VOG-17 and VOG-17M look virtually identical. Markings are the easiest way to differentiate them. The explosive fill is marked on the black body of the grenade with the inscription “A-IX-1”.

VOG-17 IMPROVED

© Private

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	34 (A-IX-1), estimated
AUW (g)	300, estimated
DIMENSIONS (mm)	Unknown
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	VMG/VMG-M

The VOG-17 improvised grenade has been seen in Chechnya, the Syrian Arab Republic and Ukraine. It is sometimes referred to as "хаттабка" (*khattabka*), a term also used for 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 main difference is the fuzing as the DVM fuze looks clearly different from a UZRGM-2 fuze.

VOG-25

© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	48 (A-IX-1)
AUW (g)	250
DIMENSIONS (mm)	102×40
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	VMG-K

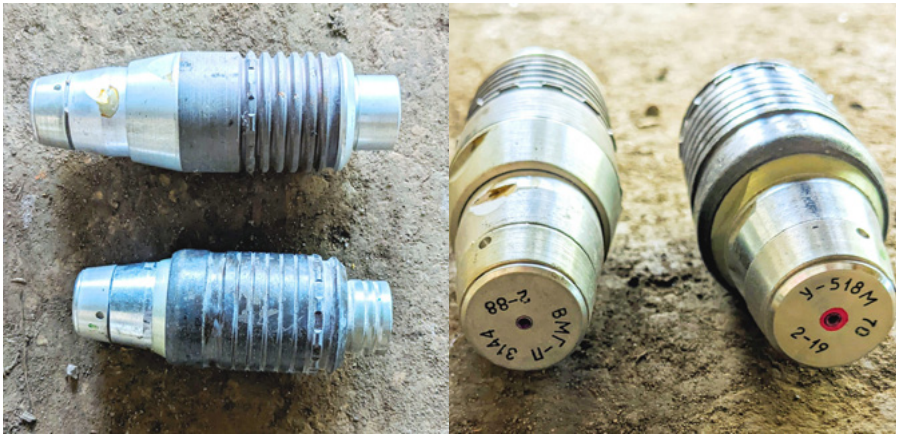
The VOG-25 is a projected HE-Frag grenade largely used with the GP-25 under-barrel grenade launcher Often used as an indirect fire weapon, it is claimed to have an effective range of up to 400m. As with other projected grenades, the muzzle velocity is relatively low (77m/s). The forces required to arm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

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

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

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

VOG-25M



© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	70 (A-IX-1)
AUW (g)	278
DIMENSIONS (mm)	107×40
COUNTRY OF ORIGIN	Russian Federation/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 fragmentation 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 that one is a training version.

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

VOG-25M IMPROVISED

© Private

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	50 (A-IX-1), estimated
AUW (g)	Unknown
DIMENSIONS (mm)	Unknown
COUNTRY OF ORIGIN	Chechnya/Syria/Ukraine
FUZE	UZRGM-2

This grenade has also been labelled "хаттабка" (*khattabka*). The fuze body is drilled and a thread tapped to accept a UZRGM-2 10mm fuze. It is unclear whether the propellant charge is removed.

It is possible that 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 that of a VOG-25M in order to allow space for the detonator attached to the UZRGM-2 fuze.

DM-51

© SESU and Manniman2

ORDNANCE SUB-CATEGORY	Grenade – HE-Frag
EXPLOSIVE FILL (g)	60 (PETN-based composition)
AUW (g)	450
DIMENSIONS (mm)	112×40
COUNTRY OF ORIGIN	Germany

The DM-51 is a German universal-type hand grenade that can be adapted to both offensive and defensive roles. The use of the fragmentation sleeve (as per the image above) makes the grenade "defensive". The yellow (HE) stencilled marking "HGR DM51 Splitter" is visible on the sleeve.

The sleeve contains 6,500 2–2.5mm steel balls.

The grenade is conventional in operation and uses a fly-off lever with shrouded mousetrap-type percussion fuze with a delay-stemmed detonator. The grenade fuze has a nominal delay of 3 to 5 seconds and has a lethal radius of 10m (defensive role with fragmentation jacket fitted).

M430A1

© Dutch EOD Center and Private

ORDNANCE SUB-CATEGORY	Grenade – improvised aerial bomb
EXPLOSIVE FILL (g)	45 (composition A5)
AUW (g)	340
DIMENSIONS (mm)	112×40
COUNTRY OF ORIGIN	United States
FUZE	Adapted M550

The M430 is a common 40mm projected grenade that has been repurposed for use as a small aerial bomb to be deployed by UAV. The high-explosive dual-purpose round includes a small copper-lined shaped charge that the manufacturer claims can penetrate 76mm of rolled homogenous armour. It is not known how the munition is modified for use as an aerial bomb.

The propellant cartridge is removed in order to incorporate a fin assembly. It is not confirmed if any additional plastic explosive is added to enhance the main charge, although this is feasible. The fuzing would require modification and it is unclear exactly how this is done. It is likely that the setback pin will be withdrawn, and the rotor and gear assembly manipulated in order to align an M55 stab detonator with the striker.

On impact, three hammer weights drive the aligned striker into the detonator and the shaped charge will function by means of spitback. Items attached to UAVs are very likely to be armed and should be treated with extreme caution.

MORTAR ROUNDS

82MM O-832

© Roly Evans

ORDNANCE SUB-CATEGORY	Mortar round
EXPLOSIVE FILL (g)	440 (TNT/TG-42)
AUW (g)	3,230
DIMENSIONS (mm)	329×82
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	M-6

The O-832 (for *oskolocho*, fragmentation) is a common high-explosive 82mm mortar round. 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, they come with a black plastic transit plug. Usually, there are ten mortars per box, with a side compartment for the fuzes in hermetically sealed tins.

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

120MM 0F-843

© Roly Evans

ORDNANCE SUB-CATEGORY	Mortar round
EXPLOSIVE FILL (g)	1,400 (TNT or TD-50)
AUW (g)	16,000
DIMENSIONS (mm)	674×120
COUNTRY OF ORIGIN	Russian Federation
FUZE	M-12

The OF-843 (for *oskolocho-fygasnaya*, high-explosive fragmentation) is a smoothbore high-explosive mortar. Typically, it is impact-fuzed. The M-12 fuze incorporates not only the usual setback 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.

Usually, there are two 120mm high-explosive mortars per storage box. Fuzes are found in hermetically sealed tins in a compartment at the side of the box. A range of OF-843 high-explosive mortars exist, with suffixes such as A and B to denote minor differences. Note that 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.

120MM OF-49

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Mortar round
EXPLOSIVE FILL (g)	4,900 (A-IX-2)
AUW (g)	17,200
DIMENSIONS (mm)	590×120
COUNTRY OF ORIGIN	Russian Federation
FUZE	M-12

This 120mm high-explosive mortar is different from many others in Russian service in that it is not smoothbore but has precut 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, this brings no advantage, and the round is typically fuzed with the M-12 setback-armed fuze.

120MM 3VZ4

© SESU

ORDNANCE SUB-CATEGORY	Mortar round – incendiary
EXPLOSIVE FILL (g)	Unknown incendiary composition
AUW (g)	16,900
DIMENSIONS (mm)	612×120
COUNTRY OF ORIGIN	Russian Federation
FUZE	M-12

The 3VZ4 is an incendiary mortar. It is initiated by a T1 powder train time fuze, which is a pyrotechnic time fuze with an optional impact setting. The required time delay is set on the T1 mortar fuze prior to launch and, when the fuze functions, an expelling charge is ignited.

The expelling charge ignites the incendiary pellets and exerts pressure inside the mortar bomb body such that the bomb body separates at a joint between the tail and bourrelet. The burning incendiary pellets are then scattered. The incendiary pellets burn for approximately 1 minute. The type of incendiary composition employed is believed to be a thermite composition. The 3VZ4 120mm incendiary mortar has a distinctive red circumferential marking just below the bourrelet.

240MM F-864

© SESU

ORDNANCE SUB-CATEGORY	Mortar round
EXPLOSIVE FILL (g)	31,900 (TNT)
AUW (g)	130,700
DIMENSIONS (mm)	1,541×240
COUNTRY OF ORIGIN	Russian Federation
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 within 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.

240MM 3-O-8

© Open Source

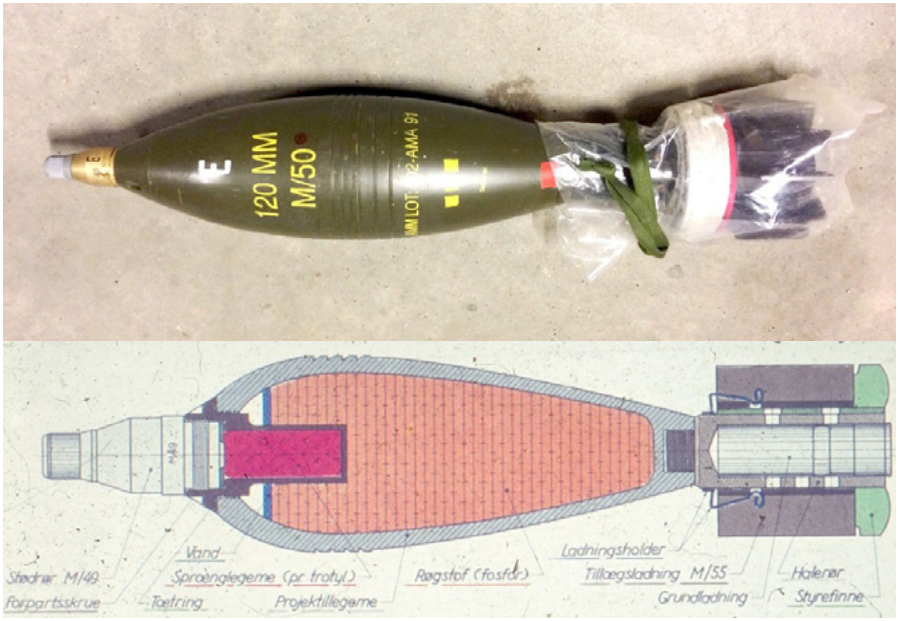
ORDNANCE SUB-CATEGORY	Mortar carrier – cluster munition
EXPLOSIVE FILL (g)	14 × 3-O-10 submunitions
AUW (kg)	230
DIMENSIONS (mm)	240
COUNTRY OF ORIGIN	Russian Federation

The 240mm 3-O-8 is a fin-stabilized rocket-assisted carrier mortar bomb. 240mm mortar bombs are typically fired from the Russian 2S4 Tyulpan self-propelled mortar. This is the largest calibre mortar system in modern use. The 3-O-8 designation refers to the entire mortar round including the rocket motor.

The cargo warhead contains 14 3-O-10 submunitions (see separate entry for technical details). The round is fitted with the 3M15 rocket motor, which is also associated with several other rocket-assisted mortar rounds. The 3-O-8 round may also be fitted with the 3Ch20 braking ring, which is used when the mortar is required to engage targets at short range.

The small parachutes that stabilize the 3-O-10 submunition are good visual indicators that this cluster munition has been employed. Each submunition will also make a distinctive fragmentation pattern on a hard surface, indicating the flight of the submunitions and the parent mortar cluster munition. These indicators can help when surveying the extent of a cluster strike.

M/50 120MM MORTAR



ORDNANCE SUB-CATEGORY	Mortar round – HE
EXPLOSIVE FILL (g)	2,325 (TNT)
AUW (g)	13,800
DIMENSIONS (mm)	590×120
COUNTRY OF ORIGIN	Sweden

The M/50 120mm mortar has been supplied with M/49 impact fuzes. The mortar has a TNT charge with a plasticized RDX-based booster. Any low-order attempts should be mindful of the position of the booster charge. The mortar is typically supplied with augmenting charges sealed with plastic attached to the tail.

PROJECTILES

100MM OF-17 HE

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	1,690 (A-IX-2)
AUW (g)	18,100
DIMENSIONS (mm)	100×611
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	V-429

The OF-17 (for *oskolocho-fygasnaya*, high-explosive fragmentation) is a 100mm unitary high-explosive fragmentation round used by the 2A70 tank gun found on BMD-4 armoured vehicles. 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, although slightly heavier.

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

100MM OF-32 HE

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	1,700 (A-IX-2)
AUW (g)	15,660
DIMENSIONS (mm)	100×490
COUNTRY OF ORIGIN	Russian Federation
FUZE	V-429

The OF-32 (for *oskolocho-fygasnaya*, high-explosive fragmentation) is a 100mm unitary high-explosive fragmentation round used by the 2A70 tank gun found on BMD-4 armoured vehicles. 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 OF17, although slightly lighter.

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

122MM OF-462 HE

ORDNANCE SUB-CATEGORY	Projectile – HE-Frag
EXPLOSIVE FILL (g)	3,460 (TNT)
AUW (g)	21,760
DIMENSIONS (mm)	122×645
COUNTRY OF ORIGIN	Russian Federation/Ukraine/Bulgaria/Romania
FUZE	RGM-2

The OF-462 is a common 122mm high-explosive fragmentation artillery projectile. The body is made of steel. Fired projectiles will show scoring on the copper driving band. While spin-stabilized, the typical RGM-2 impact fuze arms by setback. While compatible proximity fuzes with a 36mm thread exist, 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.

122MM BK-13M HEAT

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – HEAT
EXPLOSIVE FILL (g)	1,800 (A-IX-1)
AUW (g)	18,200
DIMENSIONS (mm)	122×637 (projectile only)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Unknown

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 standoff 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.

122MM S-463 ILLUM

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – Illum
EXPLOSIVE FILL (g)	20 (expulsion charge)
AUW (g)	21,960
DIMENSIONS (mm)	122×551
COUNTRY OF ORIGIN	Russian Federation
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 determined by a T-7 powder train time fuze. 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.

122MM 3SH1 FLECHETTE

© Roly Evans

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	Small black powder charge
AUW (g)	22,340
DIMENSIONS (mm)	122×480 (without fuze)
COUNTRY OF ORIGIN	Russian Federation
FUZE	DTM-75

The 3Sh1 (3Ш1) is a 122mm carrier projectile with a flechette payload that dates from the 1970s. Each flechette is made of steel. The projectile body and packaging are often simply marked "Sh1".

The projectile is designed to function in the air at a time determined by the setting of the DTM-75 time fuze. The flame produced by the functioning of the nose fuze is transmitted via a central tube to a black powder charge in the base of the shell. This charge operates against a pusher plate and the weak joint at the front of the shell. Flechettes are ejected at high velocity.

Typically, the 3Sh1 is employed by D-30 122mm howitzers but can also be used by other 122mm artillery, such as the 2S1 Gvozdika self-propelled gun. Ideally, these items should not be destroyed using high-order detonation techniques. If found as UXO, fuze removal prior to transportation and specialized disposal is recommended.

125MM OF-19 HE

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	3,150 (TNT)
AUW (g)	23,219
DIMENSIONS (mm)	125×670
COUNTRY OF ORIGIN	Russian Federation/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 setback. Both have four fins to provide slow spin-stabilization in flight. The main difference is the explosive charge employed, with the OF-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 similar to its successor round, the 3OF-26. Markings are the easiest way of differentiating them. If markings are not visible, a fuzed OF-19 is 5mm shorter than an OF-26. The V-429 fuze looks similar to the RGM-2 fuzes used on artillery projectiles.

125MM OF-26 HE

© SESU

ORDNANCE SUB-CATEGORY	Projectile (tank gun)
EXPLOSIVE FILL (g)	3,340 (A-IX-2)
AUW (g)	23,200
DIMENSIONS (mm)	125×675
COUNTRY OF ORIGIN	Russian Federation/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 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 3VOF36.

The round is fired from smoothbore tank guns and is fin-stabilized. The four fins provide a slow rate of spin that is not employed in fuze arming. Fuzes in 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, the marking "ОФ-26" and "A-IX-2" appear in black on one side of the munition. There is 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 armoured fighting vehicles. The V-429 fuze looks similar to the RGM-2 fuzes used on artillery projectiles.

125MM BM-26 APFSDS

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – APFSDS
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	4,800 (projectile), 7,050 (complete round)
DIMENSIONS (mm)	125×395 (projectile only)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Not applicable

The BM-26 is a common 125mm APFSDS round used with Russian smoothbore tank guns. The core of the round is made from a tungsten–nickel–iron alloy, a heavy metal tungsten alloy. The round comes as a two-piece construction with the dual propellant cartridges.

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

These rounds should not be destroyed by explosive means due to potential sinter. They should be removed for specialized industrial processing.

125MM BM-32 APFSDS-DU

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ORDNANCE SUB-CATEGORY	Projectile – APFSDS
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	7,050
DIMENSIONS (mm)	125×585 (projectile only)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Not applicable

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 potential sinter. They should be removed for specialized industrial processing.

125MM BK-14 HEAT

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ORDNANCE SUB-CATEGORY	Projectile – HEAT
EXPLOSIVE FILL (g)	1,850 (OKFOL)
AUW (g)	19,020
DIMENSIONS (mm)	125×677 (projectile only)
COUNTRY OF ORIGIN	Russian Federation
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 (3ВБК10М). 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 differentiate them is a subtle difference in the shape of the probe end.

125MM BK-18 HEAT

© SESU

ORDNANCE SUB-CATEGORY	Projectile– HEAT
EXPLOSIVE FILL (g)	1,760 (A-IX-1)
AUW (g)	19,000
DIMENSIONS (mm)	680×125
COUNTRY OF ORIGIN	Russian Federation

The 125mm 3-BK-18M HEAT projectile (designated 3-VBK-16 when combined with the propellant charge and stub case) is the principal fin-stabilized HEAT projectile fired by main battle tanks with a 125mm gun (T-64, T-72, T-80 and T-90). The round is loaded in combination with a semi-combustible propellant case designated Zh52. The propellant is single-based with a TNT additive. The round uses a VU-729 piezo-based spitback fuze.

The marking "BK18M" is stencilled in black on the projectile body. EOD operators should apply standard precautions for destroying HEAT ammunition with this item and should be mindful of the considerable down range hazard posed by the shaped charge jet. Typically, fired and armed BK-18 projectiles will have some form of impact damage on the probe.

152MM OF-25 HE

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ORDNANCE SUB-CATEGORY	Projectile – HE-Frag
EXPLOSIVE FILL (g)	6,800 (A-IX-2)
AUW (g)	43,560 (unfuzed)
DIMENSIONS (mm)	152×646
COUNTRY OF ORIGIN	Russian Federation
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-stabilized, the typical RGM-2 impact fuze arms by setback. While compatible proximity fuzes with a 36mm thread exist, 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 markings “OF-25” (designation) and “A-IX-2” (explosive fill) appear on one side of the munition. The factory number, lot number and year of manufacture are marked on the other.

152MM OF-29 HE

© US DoD

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	6,420 (A-IX-2)
AUW (g)	46,000
DIMENSIONS (mm)	725×152
COUNTRY OF ORIGIN	Russian Federation
FUZE	RGM-2

TThe OF-29 is a common Russian 152mm HE-Fragmentation artillery projectile and may be fired by all Russian in service 152mm howitzers, including the D-1 and D-20 towed howitzers, and the 2S3 Akatsiya and 2S19 Msta self-propelled howitzers.

The shell body is made of steel and is conventional in design. The shell is typically fitted with RGM-2 or RGM-2M point-detonating fuzes. This shell may optionally be fitted with the V-90 or AR-5 proximity fuzes.

The markings “OF-29” (designation) and “A-IX-2” (explosive fill) appear on one side of the munition. The factory number, lot number and year of manufacture are marked on the other. Typically, “A-IX-2” is marked on the ogive rather than next to the model designation. Distinctive recognition features are the double driving band, the double bourrelets and the fuze adaptor with two tooling holes.

152MM OF-45 HE

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Projectile – HE-Frag
EXPLOSIVE FILL (g)	7,650 (A-IX-2)
AUW (g)	43,560 (unfuzed)
DIMENSIONS (mm)	152×864
COUNTRY OF ORIGIN	Russian Federation
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-stabilized, the typical RGM-2 impact fuze arms by setback. While compatible proximity fuzes with a 36mm thread exist, 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 markings “OF-25” (designation) and “A-IX-2” (explosive fill) appear on one side of the munition. The factory number, lot number and year of manufacture are marked on the other.

152MM BP-540 HEAT

© Sean Moorhouse

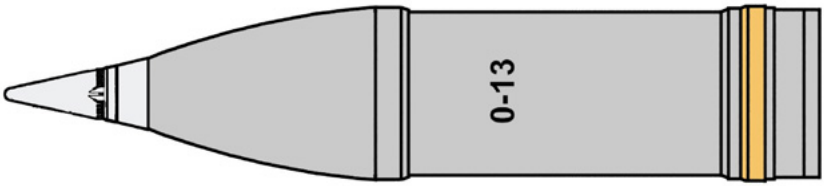
ORDNANCE SUB-CATEGORY	Projectile – HEAT
EXPLOSIVE FILL (g)	3,920 (A-IX-2)
AUW (g)	27,400
DIMENSIONS (mm)	152×531
COUNTRY OF ORIGIN	Russian Federation
FUZE	GPV-3

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 armed by setback. The fuze is point-initiating base-detonating, piezoelectric spitback, without any form of self-destruct. The round has a tracer element.

The factory, lot, year of manufacture and calibre are usually marked on one side of the munition, 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.

152MM 3-O-13 ICM



ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	1,840 (A-IX-2) – 8 × 3-O-16 submunitions
AUW (g)	41,400
DIMENSIONS (mm)	664x152
COUNTRY OF ORIGIN	Russian Federation
FUZE	Mechanical time

The 3-O-13 is a Russian 152mm improved conventional munition (ICM). The 3-O-13 is usually filled with eight 3-O-16 high-explosive fragmentation submunitions (see separate entry on the 3-O-16). The projectile, which is of grey-painted steel, has a single driving band and bourrelet, and is usually fitted with a mechanical time fuze which ignites a low-explosive expulsion charge at the required point in the shell's trajectory. Submunitions are ejected through the base of the projectile.

The markings “3-O-13” (designation) and “A-IX-2” (explosive fill of the submunitions) appear on one side of the munition. The factory number, lot number and year of manufacture are marked on the other.

Use of the 3-O-13 was confirmed in the Kharkhiv area in April 2022. The 3-O-13 meets the definition of a cluster munition under Article 2 of the Convention on Cluster Munitions.

If found complete after firing (that is, with an engraved driving band), EOD operators should use a substantial donor charge to destroy the complete projectile and submunition contents. Use of an insufficient donor charge may result in armed submunitions being ejected from the demolition with obvious hazardous results.

152MM 3OF39 KRASNOPOL

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ORDNANCE SUB-CATEGORY	Guided artillery projectile
EXPLOSIVE FILL (g)	6,400 (A-IX-2)
AUW (g)	58,000
DIMENSIONS (mm)	1,305×152
COUNTRY OF ORIGIN	Russian Federation

The 3OF39 is a 152mm laser guided artillery projectile that dates from the late 1980s. When combined with 54-ZhN-546, the whole round is designated the 3OF64. The actual projectile has the designation 3OF39.

The projectile is fitted with a nose-mounted mechanical time fuze, which allows the aerodynamic shroud protecting the laser seeker to be ejected at an appropriate point in the shell's trajectory. The projectile employs a laser seeker, which detects the reflected laser energy from a target illuminated by an appropriately coded laser target designator. The projectile's guidance control unit generates corrective commands to the battery-operated fins, which are located just forward of the warhead section. The tail fins provide stability for the projectile in flight. Power for all onboard electrical systems is provided by a thermal battery.

The HE-Frag warhead is relatively large for a 152mm projectile, weighing 20.5kg, of which 6,400g is A-IX-2. One recognition feature is the thin copper driving bank found behind the fins which deploy one fired from the barrel. The driving band will be scored on firing. Black markings are stencilled onto the olive green body.

This round is also produced in a 155mm version, the Krasnopol-M. It has a slightly reduced NEQ of 6,200g of A-IX-2.

203 MM OF-43

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ORDNANCE SUB-CATEGORY	Projectile – HE-Frag
EXPLOSIVE FILL (g)	17,800 (A-IX-2)
AUW (g)	110,000
DIMENSIONS (mm)	203
COUNTRY OF ORIGIN	Russian Federation
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 960m/s. The V-491 has a selector bolt for delay and super quick functions.

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

105MM M1 HE

© Private

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	2,300 (TNT or composition B)
AUW (kg)	13,600 (projectile)
DIMENSIONS (mm)	552×105
COUNTRY OF ORIGIN	United States/Bulgaria/Italy

The 105mm M1 projectile consists of a hollow steel forging with a boat tail base, a streamlined ogive and gilding metal driving band. A base cover is welded to the base of the projectile. The high-explosive filler within the projectile may be either cast TNT or Composition B.

A fuze cavity is formed in the filler at the nose end of the projectile. A cavity liner – to preclude dusting of HE during transportation and handling – is seated in the cavity and expanded into the lower projectile fuze threads. The cartridge case contains a percussion primer assembly and seven individually bagged and numbered propelling charge increments. The base of the cartridge case is drilled and the primer assembly is pressed into the base. The percussion primer assembly consists of a percussion ignition element and a perforated flash tube containing black powder.

If found as AXO, the round will be integrated with a brass cartridge case containing 1,400g of propellant. L119 howitzers can also fire 105mm projectiles with separate charge propellant. The M1 rounds have been used with M739A1 fuzes when used for point-detonating or delay functions.

155MM DM121 HE

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	1,100 (COMP B/PBX RH26)
AUW (g)	43,500
DIMENSIONS (mm)	841×155
COUNTRY OF ORIGIN	Germany

The DM121 is the standard German 155mm high-explosive artillery projectile. While supplied for use with the PzH 2000 self-propelled howitzer, it can be used with both NATO-standard 155mm/39 calibre and 155mm/52 calibre ordnance.

It has a hollow base. The round may employ a base bleed unit containing low explosive for extended range.

The 2-inch fuze thread can accept a range of NATO-compliant fuzes.

155MM OE 155 F1

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	8,800 (composition B or TNT)
AUW (g)	42,200
DIMENSIONS (mm)	841×155
COUNTRY OF ORIGIN	France

The OE 155 F1 is a standard 155mm high-explosive artillery projectile. It can be used with both NATO-standard 155mm/39 calibre and 155mm/52 calibre ordnance. It has been supplied for use by the CEASAR 155mm/52-calibre self-propelled howitzer.

The round may employ a base bleed unit containing low explosive for extended range or a hollow base.

The 2-inch fuze thread can accept a range of NATO-compliant fuzes. With the fuze attached, the round is 841mm long; without it, it is 768mm long.

155MM LU 211 HE INSENSITIVE MUNITION (IM)

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ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	8,800 (EIDS XF 13 333)
AUW (g)	43,250
DIMENSIONS (mm)	940×155
COUNTRY OF ORIGIN	France

The LU 211 is a 155mm high-explosive artillery projectile. It can be used with both NATO-standard 155mm/39 calibre and 155mm/52 calibre ordnance. It has been supplied for use by the CAESAR 155mm/52 calibre self-propelled howitzer.

The shell may employ a base bleed unit containing low explosive for extended range (LU 211-IM-BB) or a hollow base (LU 211-IM-HB). The fuze thread of LU 211 is 2" and can accept a range of NATO-compliant fuzes. With the fuze attached, the round is 940mm long; without it, it is 867mm long.

The LU 211 may be filled with TNT or Composition B, although insensitive munition (IM) versions containing XF 13 333 have been identified on the ground. These will be marked "MURAT" (for "munition à risques atténués"). XF® 13 333 (31% TNT, 48% NTO, 13.5% aluminium powder and 7.5% wax) is melt-castable.

LU 211s found as UXO often have the olive drab paint stripped and may show the steel underneath. With time, they will show signs of weathering. The model designation and the date of manufacture is typically stencilled just above the double copper driving band.

155MM OFD MKM HE

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	10,000 (TNT)
AUW (g)	43,550
DIMENSIONS (mm)	829×155
COUNTRY OF ORIGIN	Slovakia

The OFd MKM is a 155mm high-explosive artillery projectile. It can be used with both NATO-standard 155mm/39 calibre and 155mm/52 calibre ordnance. The projectile has a boat tail base bleed unit containing low explosive for extended range or a hollow base. Typically, the round is supplied with KZ984 point-detonating fuzes.

The 2-inch fuze thread can accept a range of NATO-compliant fuzes.

155MM M107 HE

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	5,950 (COMP B/TNT)
AUW (g)	42,600
DIMENSIONS (mm)	858×155
COUNTRY OF ORIGIN	Slovakia
FUZE	KZ-984

The 155mm M107 high-explosive projectile is an old US design that has been copied by a Slovakian supplier. Of limited range, with a smaller main charge than some other 155mm HE ammunition, the M107 is nevertheless compliant with NATO Standardization Agreements and can be fired from NATO 155mm artillery pieces.

The M107 tends to be fuzed with a Slovakian KZ-984 point-detonating fuze. Slovak markings conform to NATO colour codes. The copper driving band swages on firing.

While the 2-inch fuze thread can accept a range of NATO-compliant fuzes, it is most often fitted with a mechanical direct action and graze fuze.

Each pallet will contain eight or twenty M107 projectiles. The M107 is the most prolific NATO-standard 155mm artillery projectile ever produced.

155MM M795 HE

© US DoD

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	10,940 (composition B or IMX-101)
AUW (g)	47,060
DIMENSIONS (mm)	748×155
COUNTRY OF ORIGIN	United States

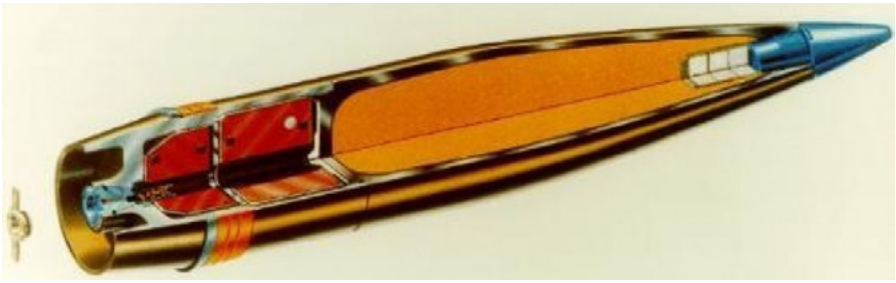
The 155mm M795 high explosive is the projectile that replaced the M107 in US service from the 1990s. The gilding metal (copper/zinc) driving band enables the use of improved propelling charges compared to the M107 and, consequently, an enhanced range.

Older versions of the M795 use a TNT filling but versions manufactured in the last decade tend to employ an IMX-101. To date, TNT versions have been identified in Ukraine.

The M795 is typically employed with M777 howitzers, although it is compatible with NATO 155mm artillery in accordance with STANAG-4425. It is typically employed with M739A1 point-detonating fuzes or M782 multi-option fuzes.

If versions with the IMX-101 filling are found unfired or unfuzed, EOD operators are advised to place donor charges in fuze wells. If found as UXO, a large donor charge is advised.

155MM M549 HERA



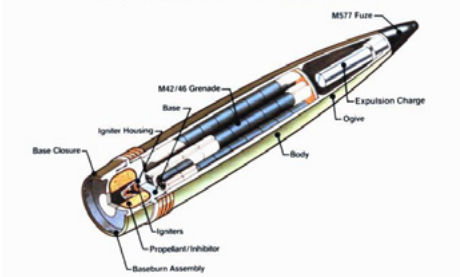
ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	10,650 (composition B or TNT)
AUW (g)	42,600
DIMENSIONS (mm)	858×155
COUNTRY OF ORIGIN	United States

The 155mm M549 high-explosive rocket-assisted (HERA) projectile incorporates a solid propellant rocket motor that enables engagement of target at enhanced ranges up to 30km.

The warhead joint with the rocket motor section is visible forward of the driving band. These projectiles may be used with M777 howitzers, M109 self-propelled howitzers and other NATO-compliant 155mm ordnance. The 2-inch fuze thread can accept a range of NATO-compliant fuzes such as the M557 and M739. The M549 can also be fuzed with precision-guided munition kits.

While this item of explosive ordnance is technically a projectile fired from a gun barrel, some may designate it a form of rocket due to the integral propulsion.

155MM M483 AND M864 DPICM



ORDNANCE SUB-CATEGORY	Artillery projectile with submunitions
EXPLOSIVE FILL (g)	30 (composition A-5) per M42 or M46 submunition with 58g expulsion charge)
AUW (g)	46,000
DIMENSIONS (mm)	M483: 940 (length, fuzed), 155 (diameter) M864: 900 (length, fuzed), 155 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Mechanical or electronic time fuze for carrier projectile

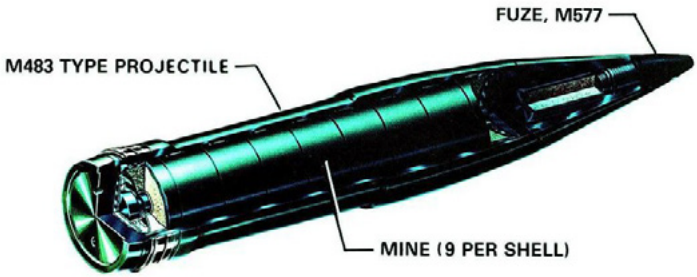
The 155mm M483 and M864 are carrier projectiles which employ the M42 and M46 DPICMs. They may be fired by any NATO-standard 155mm howitzer. The overall body colour of the projectiles is olive green with yellow stencilling. Yellow diamond markings around the circumference of the projectile ogive indicate the submunition payload (see separate entries).

The M483 contains 64 M42 and 24 M46 submunitions. The base of the carrier shell is hollow and is not fitted with a base bleed unit. The M864 is a longer-range derivative of the M483 and contains 48 M42 and 24 M46 submunitions. The base of the M864 projectile is fitted with a base bleed unit containing a composite propellant based on ammonium perchlorate and HTPB.

The M483 carrier projectile has a similar size and configuration to the M718 and M741 155mm projectiles associated with the M70 RAAM system. Great care must be taken to correctly identify intact projectiles which have failed to dispense their payload and where markings have been obliterated.

Care should be taken with any fuzed projectile which has failed to function, as jarring or impact on the fuze may cause it to function and initiate the submunition expulsion charge. The efflux produced by the base bleed unit on the M864 projectile is toxic and appropriate PPE should be worn when handling fired base units.

155MM M718 AND M741 RAAM



ORDNANCE SUB-CATEGORY	Artillery projectile with scatterable mines
EXPLOSIVE FILL (g)	570 (PBX 0280 – RDX/estane 95/5) per M70 mine
AUW (g)	46,700
DIMENSIONS (mm)	860
COUNTRY OF ORIGIN	United States
FUZE	Mechanical or electronic time fuze for carrier projectile

The 155mm M718 and M741 are the carrier projectiles associated with the M70 RAAM (see separate entry).

The 155mm M718 and M741 projectiles are similar in construction to the M483 carrier projectile used with the M42 and M46 dual-purpose improved conventional submunition. The shell body is painted olive drab and has yellow circumferential triangular markings around the ogive of the shell. Each shell is fitted with nine M70 mines, two of which (randomly positioned in the shell) are fitted with anti-handling features. The carrier shell is fitted with either a mechanical time or an electronic time fuze, which initiates an expulsion charge at the required point in the projectile's trajectory. The mines are deployed via the base eject principle from the carrier shell. The M718 has a preset self-destruct time for its mines of 48 hours and the M741 of 4 hours.

The M70 RAAM is a magnetic influence mine and suitable precautions should be taken before approaching areas where this mine has been deployed. The M70 mine also employs a self-destruct mechanism and a share of mines are equipped with anti-handling devices. Note that the arming of this mine begins immediately after firing, while the mines are in the carrier projectile. It should not be assumed that mines found within fired projectiles are unarmed and are safe to move.

155MM SMOKE DM105

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	8,150 (GP ejection charge and 4 HCE smoke pots)
AUW (g)	42,500
DIMENSIONS (mm)	Shell body: 780 (length), 155 (diameter)
COUNTRY OF ORIGIN	Germany
FUZE	Electronic or mechanical time fuze

The 155mm Smoke DM105 is a non-white phosphorous screening smoke shell in use with the Ukrainian armed forces. The shell may be fired by any NATO-compliant 155mm self-propelled or towed howitzer system.

The DM105 shell is of conventional design and of steel construction, and fitted with a combined copper driving band with a polymeric obturating band. The centre portion of the shell is fitted with a cylindrical aluminium liner which holds four DM1216 smoke canisters. The nose of the shell is screw-threaded for a standard 2-inch electronic or mechanical time fuze. Immediately below the fuze is a GP booster charge and an ejection charge. The shell operates on the base eject principle. Each DM1216 smoke canister is cylindrical, approximately 12cm in diameter and 12cm high. The case is manufactured from aluminium and fitted with an igniter cartridge. Each canister contains approximately 2kg of hexachloroethane (HCE) smoke composition.

HCE is moderately toxic, and appropriate PPE should be worn by personnel handling both smoke canisters which have functioned and those which have failed to ignite. HCE is not a substance subject to the controls of the Chemical Weapons Convention.

155MM ILLUMINATING DM106

© Rheinmetall

ORDNANCE SUB-CATEGORY	Artillery projectile
EXPLOSIVE FILL (g)	8,150 (GP ejection charge and 4 HCE smoke pots)
AUW (g)	42,500
DIMENSIONS (mm)	Shell body: 780 (length), 155 (diameter)
COUNTRY OF ORIGIN	Germany
FUZE	Electronic or mechanical time fuze

The 155mm Illum DM106 is a parachute-type illuminating shell in service with the Ukrainian armed forces. The shell may be fired by any NATO-compliant 155mm self-propelled or towed howitzer system.

The DM106 shell is of similar construction to the 155mm DM105 smoke shell. It is of conventional design and of steel construction, and fitted with a combined copper driving band with polymeric obturating band. The centre portion of the shell is fitted with a flare and parachute unit. The nose of the shell is screw-threaded for a standard 2-inch electronic or mechanical time fuze. Immediately below the fuze are GP booster charges and an ejection charge. The shell operates on the base eject principle. The flare unit is approximately 12.5cm in diameter and 27cm long. The flare unit contains approximately 3.5kg of a magnesium-based flare composition.

155MM BONUS SFM

© BAE Systems

ORDNANCE SUB-CATEGORY	Artillery projectile with sensor-fuzed submunitions
EXPLOSIVE FILL (g)	approximately 2,500 (HMX-based composition per SFM)
AUW (g)	Each SFM: 6,500
DIMENSIONS (mm)	130 (SFM EFP diameter)
COUNTRY OF ORIGIN	Sweden/France
FUZE	Electronic safe arm fuze with EFI

The 155mm BONUS sensor-fuzed munition (SFM) is the product of a Swedish/French collaborative project. The shell may be fired by any NATO-compliant 155mm self-propelled or towed howitzer system.

The shell requires no special programming prior to firing other than the setting on the shell's electronic or mechanical time fuze, which determines the point in the parent shell's trajectory where the SFMs are ejected, using a low-explosive charge and a base eject method.

Each BONUS SFM consists of a 130mm diameter EFP held in a steel body and employs a main charge based on HMX. The initiation system is assessed to be electronic and uses a thermal battery initiated on firing with a charged capacitor circuit and an exploding foil initiator (EFI). After ejection from the carrier shell, each SFM deploys titanium wings which delay the spin of the munition and orientate the projectile so that the sensors point downwards. Each SFM employs a combination of imaging infrared and light detection and ranging (LiDAR) technology to compare acquired targets against a stored threat database. A laser range finder is used to determine the optimum height of detonation for the EFP warhead.

A safe waiting period is recommended before approaching a BONUS SFM to allow firing capacitors to discharge. The EFP cone and sensors should not be approached head on.

120MM TANK (LEOPARD 2 – M1 ABRAMS)

© Rheinmetall/GD OTS and Nammo

ORDNANCE SUB-CATEGORY	Tank ammunition – 120mm smooth bore
EXPLOSIVE FILL (g)	M830: 2,000 (composition A3 – RDX/wax)
AUW (g)	M830: 13,500 (projectile)
DIMENSIONS (mm)	M830: 850 (projectile length), 120 (diameter)
COUNTRY OF ORIGIN	United States/Germany
FUZE	Various base fuzes in HE projectiles

This section gives an overview of the main types of high-explosive 120mm tank ammunition used by the Ukrainian armed forces in its Leopard and M1 Abrams tanks. 120mm tank ammunition designed for use in the rifled barrel of the British 120mm Challenger is not interoperable with ammunition designed for the 120mm smoothbore barrel fitted to the M1 Abrams and Leopard tanks. 120mm tank ammunition designed for Leopard and M1 Abrams tanks also uses a fixed cartridge as opposed to a separate bag charge on the British 120mm tank ammunition.

Cartridge 120mm HEAT M830/DM12A1. This is functionally almost identical to the German DM12A1 projectile: it is fin-stabilized and has a standard off probe to facilitate optimum standoff for the HEAT warhead. The overall body colour is black, indicating its primary anti-armour role. It is fitted with a crush switch mounted on the probe and a base fuze at the rear of the warhead body.

Cartridge 120mm HE DM11. This is a modern HE-Fragmentation munition produced by Rheinmetall. The overall body colour of the projectile is green and it is fitted with a base fuze. It contains approximately 2kg of an insensitive high explosive.

Cartridge 120mm IM HE-T. This is the latest general purpose HE-Fragmentation ammunition produced by General Dynamics and Nammo. The overall body colour of the projectile is olive drab and it is fitted with a point-detonating nose fuze. It has a 3.2kg insensitive high-explosive filling.

A minimum safe waiting period of 60 minutes is recommended before approaching any 120mm HE/HEAT projectiles which have been fired and failed to function.

120MM TANK (CHALLENGER 2)

ORDNANCE SUB-CATEGORY	Tank ammunition – separate projectile and charge
EXPLOSIVE FILL (g)	120mm HESH: 4,100 120mm Smoke (WP): 100 + 4,100 (WP)
AUW (g)	Various
DIMENSIONS (mm)	HESH: 440 Smoke (WP): 430
COUNTRY OF ORIGIN	United Kingdom
FUZE	Fuze percussion base L56 (HESH and Smoke variants)

The UK Challenger 2 MBT is fitted with the L30 120mm rifled tank gun and can fire a variety of ammunition types.

Shell 120mm Tank HESH L31. The HESH shell is approximately 44cm long and is fitted with the L56 base fuze. The main charge consists of 4.1kg of an RDX/wax composition. The base of the shell is fitted with four tracers. The overall body colour of the shell is black with a yellow nose.

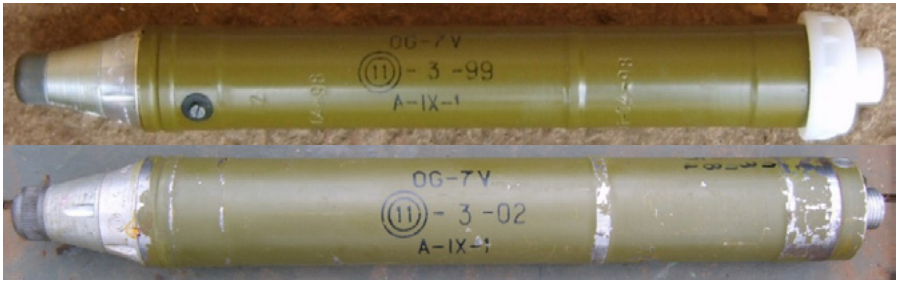
Shell 120mm Tank Smoke Bursting L34. The Smoke shell is approximately 43 cm long and is also fitted with the L56 base fuze. The main charge consists of a central bursting charge of approximately 110g of CE (tetryl) and a main filling of approximately 4.1kg of white phosphorus. The base of the shell is not fitted with tracers and the overall body colour is light green.

Shot 120mm Tank APFSDS L23. The L23 is a variant of the 120mm APFSDS shot with a penetrator core based on a heavy metal tungsten alloy. The long rod penetrator is inert.

Shot 120mm Tank APFSDS-DU L27. The L27 is a variant of the 120mm APFSDS shot with a penetrator core based on depleted uranium. The long rod penetrator is inert.

ROCKETS AND RECOILLESS AMMUNITION

OG-7V HE-FRAG



Bulgarian OG-7. © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless – blast/FRAG
EXPLOSIVE FILL (g)	210 (A-IX-1)
AUW (g)	1,760
DIMENSIONS (mm)	593×40
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	O-4M

The OG-7 (for *oskolochnymi*, indicating the use of fragmentation around the warhead) is a blast fragmentation rocket-propelled grenade fired from the RPG-7 range of 40mm calibre launchers. 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 with other RPG AT 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 1,000m.

The 04-M fuze uses 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 AXO. An expulsion charge bare of any propellant does not necessarily mean an armed item, since abandoned OG-7s that have been prepared for firing will still see the rapid weathering of the expulsion charge cardboard casing and propellant.

PG-7L HEAT

© SESU

ORDNANCE SUB-CATEGORY	Rocket – recoilless
EXPLOSIVE FILL (g)	890 (OKFOL), 420 (propellant)
AUW (g)	1,500
DIMENSIONS (mm)	680×93
COUNTRY OF ORIGIN	Russian Federation

The PG-7L is a Russian recoilless rocket/projectile that dates from the late 1970s. The larger shaped charge contains 890g of OKFOL, a phlegmatized version of HMX.

The round represents a significant upgrade in penetration capability from its predecessor the PG-7M. The weight of explosive charge is roughly double that of the PG-7M and the explosive used is more powerful in that it creates a higher detonation pressure.

The VP-22 fuze also represents an upgrade from the VP-7M. The PG-7L was quickly superseded by the PG-7VL (1,030g OKFOL) and then progressively by tandem shaped charge warheads. Nevertheless, the PG-7L is still in widespread use in Ukraine. As with other VP fuzes, the absence of the VP-16GCh piezo nose fuze element does not mean it is acceptable to move the item. Like the VP-7M, the VP-22 has a self-destruct element.

The PG-7L (ПГ-7Л) is marked with black stencilling on the motor section and fuze body. The factory code, lot number and year of manufacture are also marked as per the Russian standard.

PG-7M HEAT

Bulgarian PG-7M. © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	320 (A-IX-1), 420 (propellant)
AUW (g)	1,500
DIMENSIONS (mm)	675×71
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	VP-7M

The PG-7M is a HEAT rocket-propelled grenade 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 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-stabilized and the fins are surrounded by the expulsion charge propellant, which is protected by a waxed cardboard tube. The warhead is fitted with a PIBD fuze, which also contains a pyrotechnic based self-destruct mechanism that causes the warhead to function at a maximum range of approximately 950m.

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 minimize 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 warhead diameter of 72mm and different markings: "ПГ-7ВС" (PG-7VS). 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 HEAT

Bulgarian PG-7V. © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	390 (A-IX-1), 420 (propellant)
AUW (g)	1,750
DIMENSIONS (mm)	646×85
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	VP-7M

The PG-7V (for "Противтанковая Граната", *protivtankovya granata*, AT grenade) is a HEAT rocket-propelled grenade fired from the RPG-7 range of 40mm calibre launchers. It is probably the most common PG-7 variant. The round is propelled from the launcher by an expulsion charge 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-stabilized and the fins are surrounded by the expulsion charge propellant, which is protected by a waxed cardboard tube. The round is fitted with a PIBD VP-7 fuze. The shaped charge has a copper liner. There is also a pyrotechnic delay self-destruct detonator initiated by a setback 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 are usually found with the expended expulsion charge aluminium tail 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 HEAT

Russian PG-7VL. © Roly Evans

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	1,030 (OKFOL), 420 (propellant)
AUW (g)	2,600
DIMENSIONS (mm)	93×40
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	VP-22

The PG-7VL is a HEAT rocket-propelled grenade 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. It is propelled from the launcher by an expulsion charge 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-stabilized and the fins are surrounded by the expulsion charge propellant, which is protected by a waxed cardboard tube. The round is fitted with a 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 damaged. The expulsion charge will be burnt out, leaving only an aluminium frame. There will be an indention on the primer. The venturi 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 standoff 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 HEAT TANDEM

© Sean Moorhouse.

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	1,590 (OKFOL), 420 (propellant)
AUW (g)	3,630
DIMENSIONS (mm)	1,230×105 (with expulsion charge)
COUNTRY OF ORIGIN	Russian Federation
FUZE	V-728 base fuze/K-728 precursor fuze

The PG-7R ("R" for *rezyume*, summary) is a HEAT rocket-propelled grenade which is fired from the RPG-7 range of 40mm calibre launchers.

The warhead contains a tandem shaped charge 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 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-stabilized 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 and has the same diameter warhead (105mm) but contains a larger 1,740g 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.

TBG-7L THERMOBARIC

© Sean Moorhouse.

ORDNANCE SUB-CATEGORY	Recoilless – thermobaric
EXPLOSIVE FILL (g)	Unknown
AUW (g)	Unknown
DIMENSIONS (mm)	93 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Unknown

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.

OG-9V HEAT

© VMZ Sopot

ORDNANCE SUB-CATEGORY	Recoilless projectile
EXPLOSIVE FILL (g)	655-750 (TNT derivative, usually TD-50)
AUW (g)	3,700
DIMENSIONS (mm)	774×73
COUNTRY OF ORIGIN	Russian Federation/Bulgaria/Hungary

The OG-9V is a recoilless high-explosive fragmentation projectile fired from the 73mm SPG-9 Kopye recoilless gun which dates from the early 1960s. However, the accuracy of the SPG-9 recoilless rifle out to 600m has led to the weapon still being used in certain circumstances. The round is essentially the same as that used with an OG-15V, and is interchangeable by selecting the extra, longer propellant attachment. The warhead is manufactured from cast iron and has two bourrelets. The tail unit is made of extruded aluminium and provides basic stability for the projectile in flight.

The projectile is fitted with either the GO-2 or O-4M nose-mounted point-detonating fuze. The GO-2 fuze is based on the standard Russian setback sleeve and locking ball configuration. However, the primer is always in line with the firing pin. There is no slider. When unfired, the firing pin should be held in a position where it cannot puncture the stab detonator, although caution is still advised.

If fired and found as UXO, only a creep spring separates the firing pin from the primer. The Bulgarian version of the GO-2 is designated AF71. Fuzed OG-9 projectiles which have been involved in fires and have been ejected from the seat of an explosion (for example, an armoured fighting vehicle or ammunition dump) should be assumed to be armed and treated with caution.

PG-9V HEAT

© VMZ Sopot

ORDNANCE SUB-CATEGORY	Recoilless projectile
EXPLOSIVE FILL (g)	330 (A-IX-1)
AUW (g)	2,530
DIMENSIONS (mm)	774×73
COUNTRY OF ORIGIN	Russian Federation/Bulgaria/Hungary

The PG-9V is a recoilless HEAT projectile fired from the 73mm SPG-9 Kopye recoilless gun which dates from the early 1960s. Its tactical AT role has now been rendered obsolete by the introduction of lightweight disposable rocket launchers and AT guided missiles. The round is essentially the same as that used with a PG-15, and is interchangeable by means of selection of the extra, longer propellant charge assembly. The PG-9V has a bourrelet at its midpoint and there is a rear bourrelet between the rocket motor and fin assembly. The round has six fold-out hinged fins located in front of the propellant charge assembly.

The PG-9V is fitted with the VP-9 point-initiating base-detonating fuze, which is similar to the VP-7. Recent production versions use an updated fuze. Some variants may have fuzing equivalent to a VP-22.

An improved version from Bulgaria (PG-9VN) is in circulation. It is marked "PG-9VN" on the warhead. A PG-9S version is also in circulation, which has a warhead containing 330g of HMX. The long propellant attachment will also be marked, although this marking will only be visible on unfired AXO.

If found as AXO, the propellant of the round will very probably have weathered significantly. Propellant attachments usually come in a distinct hard green plastic sleeve.

The PG-9V is packaged in a similar way to the PG-15 round. It usually comes sealed in a transparent plastic sleeve in a wooden case containing six units.

OG-15 HE

Top: © VMZ Sopot. Bottom: © Dutch EOD Center

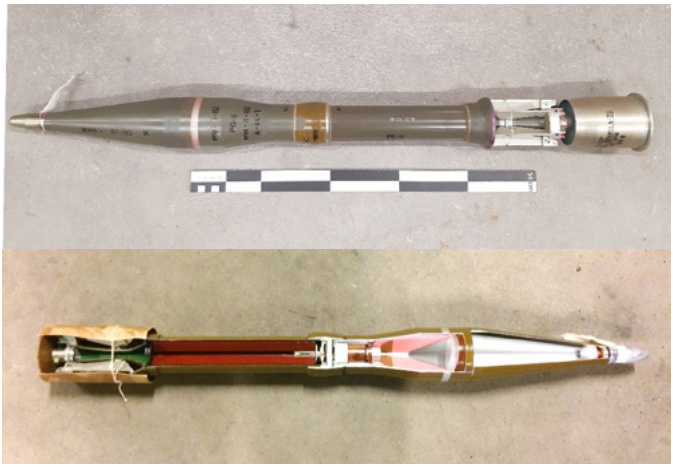
ORDNANCE SUB-CATEGORY	Recoilless – blast/FRAG
EXPLOSIVE FILL (g)	660 (TD-50)
AUW (g)	4,600
DIMENSIONS (mm)	828×82
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	GO-2 or O-4M

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 element to differentiate them 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 (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. OG-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-15 HEAT



Top: © Swiss EOD Center. Bottom: © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	320 (A-IX-1)
AUW (g)	3,470
DIMENSIONS (mm)	878×82
COUNTRY OF ORIGIN	Russian Federation/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 element to differentiate them is the size of the expulsion cartridge. The metal encased cartridge for the PG-15 is smaller. The marking on the warhead will often be "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. Versions 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.

PG-18 HEAT

© Swiss EOD Center

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	400 (OKFOL)
AUW (g)	2,600 (launcher), 1,400 (rocket)
DIMENSIONS (mm)	705×64
COUNTRY OF ORIGIN	Russian Federation/Bulgaria/East Germany
FUZE	VP-18

The RPG-18 is a single-shot disposable rocket launcher, 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 piezoelectric 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. Its nickname is “Myxa” (mukha, 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 HEAT

© Dutch EOD Center

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	450 (OKFOL)
AUW (g)	2,700 (launcher), 1,480 (rocket)
DIMENSIONS (mm)	755×72.5
COUNTRY OF ORIGIN	Russian Federation/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 Russian Federation 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 PIBD with a self-destruct mechanism. A distinct bulge on the motor section is one way to differentiate it from the PG-26 warhead. Another is the 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 HEAT

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	570 (OKFOL)
AUW (g)	2,900 (launcher), 1,480 (rocket)
DIMENSIONS (mm)	770×72.5
COUNTRY OF ORIGIN	Russian Federation/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 HEAT TANDEM

© Private

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	1,790 (HMX)
AUW (g)	8,300
DIMENSIONS (mm)	1,135×105
COUNTRY OF ORIGIN	Russian Federation
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 designed to defeat explosive reactive armour. The PG-27 has a significantly larger warhead than its predecessor, the PG-26. (1,790g of OKFOL compared to 570g for the PG-26).

A variant with a thermobaric warhead has been developed. The RShG-1 (for "Реактивная Штурмовая Граната", *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 HEAT

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ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	2,330 (HMX)
AUW (g)	6,700
DIMENSIONS (mm)	1,097×105
COUNTRY OF ORIGIN	Russian Federation
FUZE	V-728 base fuze/K-728 precursor fuze

The PG-29 is a reloadable recoilless AT 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 and a separate K-728 fuze is used for the precursor charge. Both fuzes arm by setback.

The PG-29V may be identified by its GRAU index code "7P29 (7П29)". The PG-29 is sometimes referred to as a Vampire (Вампир) launcher. The PG-29 round outside of the launcher is easy to mistake for the PG-7VR since they have the same warhead design. However, the motor section is different and this is the easiest way of differentiating them. 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-30 HEAT TANDEM

© SESU

ORDNANCE SUB-CATEGORY	Recoilless projectile
EXPLOSIVE FILL (g)	1,830 (OKFOL)
AUW (g)	10,300
DIMENSIONS (mm)	1,135×105
COUNTRY OF ORIGIN	Russian Federation
FUZE	K-728 (precursor), V-728 (main charge)

The RPG-30 is an improved tandem warhead recoilless AT launcher. It entered service in 2011 and remains in production. It is easily recognizable by the separate precursor decoy round launch tube, the purpose of which is to defeat active protection systems on modern armoured fighting vehicles.

It has the GRAU index code "7P53". The codename Kryuk (hook or crook) is sometimes used.

It is claimed that the main warhead can defeat 600mm of rolled homogenous armour.

The PG-30 recoilless projectile is almost identical in appearance to the PG-29, with the same fuzing employed. The main charge is HMX-based OKFOL.

RPO-A THERMOBARIC

ORDNANCE SUB-CATEGORY	Recoilless – Thermobaric
EXPLOSIVE FILL (g)	2,100 (thermobaric filler)
AUW (g)	22,000
DIMENSIONS (mm)	920×93
COUNTRY OF ORIGIN	Russian Federation
FUZE	Unknown

The RPO-A (for *reaktivnyy pekhotnyy ognemet*, reactive infantry flamethrower) is a shoulder-launched thermobaric rocket designed for use against combatants in enclosed spaces. It is sometimes categorized 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" although this 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.

122MM 9M22 GRAD ROCKET

© SESU

ORDNANCE SUB-CATEGORY	HE-Frag
EXPLOSIVE FILL (g)	6,400 (A-IX-2)
AUW (g)	66,000
DIMENSIONS (mm)	2,729×122
COUNTRY OF ORIGIN	Russian Federation/Bulgaria/Poland/ Romania/Serbia
FUZE	MRV

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 (U stands for "У" for "Улучшенный", *uluchshennyy*, improved) is an improved version.

A typical BM-21 launcher contains 40 rockets in four rows of ten. However, not every salvo will use all 40 launch tubes. 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

© SESU

ORDNANCE SUB-CATEGORY	Payload-dependent
EXPLOSIVE FILL (g)	Payload-dependent (51,900 HE unitary)
AUW (g)	2,800 (9M27F)
DIMENSIONS (mm)	4,833×220
COUNTRY OF ORIGIN	Russian Federation
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 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 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 submunitions. 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.

The fuzing in the 9M27 series often replicates that used for the 122mm GRAD rockets. Point-impact MRV fuzes can be used for HE-Frag warheads (for example, 9M27F). For carrier versions, simple mechanical time fuzes such as the TM-120 are sometimes used. When used with carrier munition warheads (for submunitions or scatterable mines), the expulsion charge 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 to corroborate evidence to try to discern the 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 ROCKET

© Private

ORDNANCE SUB-CATEGORY	Payload-dependent
EXPLOSIVE FILL (g)	Payload-dependent (70,000 HE unitary warhead)
AUW (g)	800,000
DIMENSIONS (mm)	7,600×300
COUNTRY OF ORIGIN	Russian Federation
FUZE	Payload-dependent

The 9M55 rocket series is launched by the 300mm 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-stabilized 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 9N235 submunitions. The 9M55K4 carries 25 PTM-3 AV mines. 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 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. EOD operators should actively seek to corroborate evidence to confirm the warhead type and state prior to any remote movement of buried motor sections.

TG-73 HEAT TANDEM

© Sean Moorhouse.

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

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-stabilized and has a tandem warhead. The precursor charge employs 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.

BULLSPIKE PG-22

© VMZ Sopot

ORDNANCE SUB-CATEGORY	Recoilless projectile
EXPLOSIVE FILL (g)	450 (OKFOL)
AUW (g)	3,480 (PG-22)
DIMENSIONS (mm)	774×73
COUNTRY OF ORIGIN	Bulgaria

The Bullspike is an updated version of the RPG-22 disposable rocket launcher. The major difference is that once the launch tube is extended and made ready for use, it can be collapsed again. This is not possible with the original RPG-22.

The launch tube for the Bullspike is easily identifiable and distinguishable from standard RPG-22 launch tubes. The rocket projectile is a PG-22 with a HEAT warhead and has VMZ Sopot markings. The launcher is delivered in boxes of five, with each rocket launcher hermetically sealed in transparent plastic.

RPG-75

Top: © Megan Lynn. Bottom: © Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Recoilless projectile
EXPLOSIVE FILL (g)	320 (A-IX-1)
AUW (g)	800
DIMENSIONS (mm)	630×68
COUNTRY OF ORIGIN	Czechia

The RPG-75 (for *reaktivního protitankového granátu vzor* 75, reactive AT grenade model 75) is a lightweight disposable AT system. The projectile has no motor section and is thus sometimes classified as a projected grenade.

The launch tube is 633mm long when in storage configuration but extends to 890mm when prepared for firing. The HEAT warhead is relatively small and is only effective against lightly armoured vehicles.

A thermobaric warhead, developed in the 2000s, may also be employed. Circumferential coloured hazard bands on the standoff probe are the easiest way to differentiate between the warheads. Twin black and yellow bands indicate HEAT as per many NATO munitions. Twin yellow and red bands indicate a thermobaric warhead. These colour markings are replicated on the outside of the launch tube, just behind the muzzle.

RGW 90 HH

RGW 90 HH: © Dynamit Nobel Defence GmbH. Right: © Belgian EOD

ORDNANCE SUB-CATEGORY	Recoilless – HEAT/HESH
EXPLOSIVE FILL (g)	Unknown
AUW (g)	8,900
DIMENSIONS (mm)	1,000×90
COUNTRY OF ORIGIN	Germany/Israel/Singapore
FUZE	Unknown

The RGW 90 (for "Rückstoßfreie Granatwaffe 90", recoilless grenade launcher 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 countermass 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. Versions made under license in Israel and Singapore are sometimes referred to as the MATADOR.

PANZERFAUST 3

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

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 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.

RPG-76 KOMAR HEAT

© Defence Express

ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	320 (A-IX-1)
AUW (g)	2,100
DIMENSIONS (mm)	1,190×68 (extended)
COUNTRY OF ORIGIN	Poland
FUZE	Unknown

The RPG-76 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 grenade". Although it is 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 translates as "mosquito".

64MM M80 ZOLJA HEAT

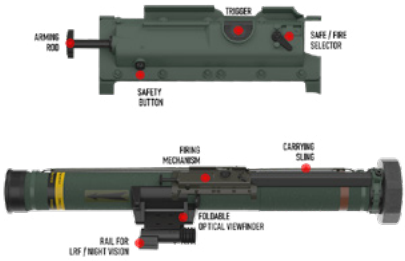
© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Recoilless projectile
EXPLOSIVE FILL (g)	300
AUW (g)	3,000
DIMENSIONS (mm)	800×64 (1,200×64 extended)
COUNTRY OF ORIGIN	Former Yugoslavia

The M-80 is a lightweight disposable recoilless HEAT rocket launcher. It has similarities to RPG-18.

The UT PE M80 SP fuze is based on a piezoelectric crystal but also has a powder time self-destruct function.

C90-CR-AM (M3)



© Instalaza

ORDNANCE SUB-CATEGORY	Recoilless projectile
EXPLOSIVE FILL (g)	Warhead-dependent
AUW (g)	5,200
DIMENSIONS (mm)	774×90
COUNTRY OF ORIGIN	Spain

The C-90 is a lightweight disposable rocket launcher that dates from the early 1980s. A range of versions with different warheads are produced. These include anti-armour (C90-CR-RB), dual-purpose HEAT and AP (C90-CR-AM), smoke and incendiary (C90-CR-FIM) and anti-fortification (C90-CR-BK).

The C90-CR-AM (M3) is a dual-purpose warhead, with not only a shaped charge to penetrate armour (or concrete) but a fragmentation jacket to target personnel.

The dual-purpose anti-armour and fragmentation warhead is designated by the twin yellow and black circumferential hazard bands marked near the muzzle of the launcher. The rear of the launcher is marked with a brown circumferential hazard band indicating low-explosive propellant.

AT-4 HEAT/HESH

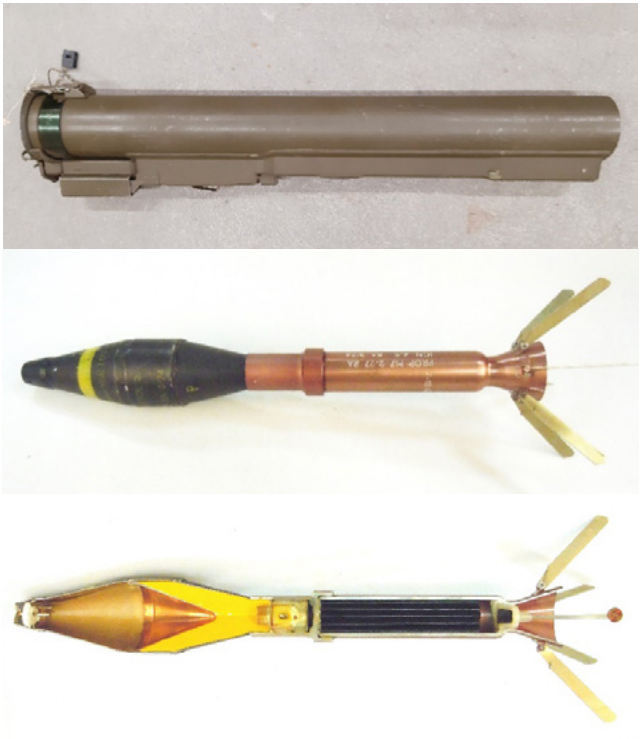
© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Recoilless – HEAT/HESH
EXPLOSIVE FILL (g)	830 (HMX or TNT)
AUW (g)	6,800
DIMENSIONS (mm)	1,016×84
COUNTRY OF ORIGIN	Sweden
FUZE	Unknown

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 rear 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. An AT4 CS (for "confined space") version for fighting from enclosed positions. It uses an aerosol of salt water instead of plastic shreds for the countermass.

M72 LAW HEAT



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ORDNANCE SUB-CATEGORY	Recoilless – HEAT
EXPLOSIVE FILL (g)	315 (OCTOL)
AUW (g)	3,450
DIMENSIONS (mm)	981×66 (extended)
COUNTRY OF ORIGIN	United States
FUZE	M412A1

The M72 LAW comes in a series of versions. It is believed that only later versions with larger rocket motors and eight fins have been supplied to Ukraine. The explosive fill is OCTOL (HMX 70%, TNT 30%) and the motor sections uses double-base propellant. A rotor provides 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.

CANNON AMMUNITION

30×165MM AP-T 3UBR6

© SESU

ORDNANCE SUB-CATEGORY	Cannon projectile – AP-T
EXPLOSIVE FILL (g)	123 (propellant)
AUW (g)	853
DIMENSIONS (mm)	30×292 (complete round) 30×165 (projectile)
COUNTRY OF ORIGIN	Russian Federation/Bulgaria

The 30×165mm armour-piercing–tracer (AP-T) is a common Russian cannon round employed by 2A38, 2A42 and 2A72 automatic cannons used on the BMP-2 and BMP-3 and some BTR-80 variants. The ammunition can also be fired by the 30mm NR-30 aircraft cannon and the GSh-30-2 cannon fitted to the Su-25 ground attack aircraft. The complete round in Russian land service has the GRAU designation 3UBR6.

The fired projectile is solid steel shot with a zinc ballistic cap. The projectile has a copper driving band that is scored if fired. The tracer pocket should be inspected to confirm no pyrotechnic composition remains.

If found as AXO, the propellant in the cartridge (typically more than 100g) should be disposed of. It is not advised that these items be disposed of by means of explosive demolition.

A 30mm cannon ammunition is easy to mistake for the 23mm cannon rounds used on ZSU-23-series anti-aircraft guns. The distinct dual crimping around the cannelures is one of the easier ways to differentiate them.

30 X 165 MM HE-I 3UOF8

© SESU

ORDNANCE SUB-CATEGORY	Cannon projectile – HE-I
EXPLOSIVE FILL (g)	49 (A-IX-2) and 123 (propellant)
AUW (g)	837
DIMENSIONS (mm)	30×292 (complete round) 30×165 (projectile)
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	A-670M

The 30×165mm high-explosive–incendiary (HE-I) is a common Russian cannon round employed by 2A38, 2A42 and 2A72 automatic cannons used on the BMP-2 and BMP-3 and some BTR-80 variants. The ammunition can also be fired by the 30mm NR-30 aircraft cannon and the GSh-30-2 cannon fitted to the Su-25 ground attack aircraft. The complete round in Russian land service has the GRAU designation 3UOF8. If just the black oxide coloured 30mm projectile is found, it is designated OFZ 30.

The point-detonating A-670M fuze arms by setback and centrifugal force. The fuze has a self-destruct version that is based on a circular powder train time element. The self-destruct functions after 7.5 to 14.5 seconds. Typically, this would equate to a 3,900–5,300m flight distance.

The item can be easily mistaken for an OFZ 25 30mm round. In any case, the fuze is the same A-670M. Bulgarian versions of the 3UOF8 are designated AR-302 and have the distinctive Bulgarian factory markings.

Cannon rounds should be treated with caution. Fired HE-I rounds should be destroyed in situ.

25×137MM BUSHMASTER

© US DoD

ORDNANCE SUB-CATEGORY	Cannon ammunition
EXPLOSIVE FILL (g)	Variable 30 (RDX-based composition for M792 HEI-T projectile)
AUW (g)	Variable
DIMENSIONS (mm)	137 (case length), 223 (round overall length)
COUNTRY OF ORIGIN	United States
FUZE	Point-detonating M758 fuze for M792 HEI-T projectile

The 25×137mm cannon ammunition is used in a variety of armoured fighting vehicles. In Ukraine, it is fired from the M242 cannon fitted to the Bradley infantry fighting vehicle. Ammunition is manufactured by a wide variety of western manufacturers and is usually marked and qualified according to NATO standards.

The cartridge case is of lacquered steel and is of bottleneck configuration.

M791 APDS-T: The M791 uses a heavy metal tungsten alloy penetrator fitted within a plastic discarding sabot. The base of the shot is fitted with a tracer.

M792 HEI-T/SD: The M792 has a thin steel wall and a net explosive content of approximately 30g of HE. It is fitted with the PD M758 fuze, which also has a self-destruct function. The base of the shell is fitted with a tracer.

PGU-25 HEI: The PGU-25 is a high-explosive variant optimized for use in aircraft-mounted cannon.

PGU-47 armour-piercing with explosive (APEX): This round is manufactured by Nammo AS and uses a hardened steel body with a heavy metal tungsten alloy penetrator with an explosive and incendiary filling. The energetic materials are initiated by an FMU-171 fuze located centrally in the projectile. This round is also optimized for use in aircraft-mounted cannon.

35×228MM GEPARD

© Nammo and Rheinmetall

ORDNANCE SUB-CATEGORY	Cannon ammunition
EXPLOSIVE FILL (g)	85–98 (RDX/aluminium)
AUW (g)	1,500 (complete round), 550 (projectile)
DIMENSIONS (mm)	228 (case length), 387 (round overall length)
COUNTRY OF ORIGIN	Germany/Various
FUZE	Various types of PD or BD with self-destruct

The 35×228mm cannon ammunition is most widely associated in Ukraine with the Flakpanzer Gepard self-propelled anti-aircraft gun (SPAAG). The Gepard mounts two Oerlikon KD cannons and has a cyclic rate of fire of 550 rounds per minute. Most cartridge cases are of drawn lacquered steel and the case is of bottleneck configuration.

35×228mm HEI/SD: This variant has a high-explosive incendiary projectile, with self-destruct, and has an all-up mass of 0.55kg. It is fitted with a base-detonating fuze.

35×228mm HEI-T/SD: This high-explosive incendiary projectile, with self-destruct, has an all-up mass of 0.55kg and is fitted with a point-detonating fuze and has a tracer burn time of 4s. This is the most common ammunition associated with the 35mm cannon and is produced by a variety of manufacturers (see left image above).

35×228mm APDS-T: The armour-piercing discarding sabot projectile uses a subcalibre penetrator which is manufactured from a heavy metal tungsten alloy and is fitted with a tracer. The sabot is manufactured from plastic and the overall body colour of the projectile is black (see right image above).

Most projectiles with a high-explosive filling have a yellow overall body colour.

30MM RARDEN

ORDNANCE SUB-CATEGORY	Cannon ammunition
EXPLOSIVE FILL (g)	22 (torpex – TNT/aluminium)
AUW (g)	Variable
DIMENSIONS (mm)	30×170 (cart case)
COUNTRY OF ORIGIN	United Kingdom
FUZE	Fuze nose percussion direct action L86 (for HE variant)

The L21 30mm RARDEN cannon is fitted to several armoured fighting vehicles operated by the Ukrainian armed forces. All ammunition types use the same fixed cartridge case, which is 170mm long and has a base diameter of 43mm. The cartridge case is fitted with either a screw-threaded or push fit percussion primer.

Round 30mm AFV HE L13: The L13 30mm HE projectile has a yellow overall body colour and is fitted with the L86 nose percussion fuze. The shell body is filled with a pressed torpex high explosive, and the rear of the shell is fitted with a tracer.

Round 30mm AFV APSE L5: The L5 30mm armour-piercing secondary effect (APSE) projectile is a purpose-made armour penetrating round with a filling of oiled amorphous phosphorous to give the projectile an improved behind armour effect. The projectile is fitted with a tracer but does not contain any fuze.

Round 30mm AFV APDS L14: The L14 30mm armour-piercing discarding sabot (APDS) projectile comprises a penetrator which is fitted with a tracer and sabot manufactured from a reinforced plastic composition.

EXPLOSIVE SUBMUNITIONS

3B30

© SESU

ORDNANCE SUB-CATEGORY	Submunition – DPICM (HEAT/FRAG)
EXPLOSIVE FILL (g)	46 (OMA, HMX-based)
AUW (g)	240
DIMENSIONS (mm)	128×43
COUNTRY OF ORIGIN	Russian Federation
FUZE	Impact/inertia with self-destruct

The 3B30 is a modern DPICM designed primarily for delivery by multi-launch rocket systems.

The submunition has also been referred to as КОБЭ/KOBE (for "Кумулятивно-Осколочными Боевыми Элементами", *kumulyativno-oskolochnymi boyevymi elementami*, cumulative (that is, 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 standoff 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 62.5mm long when in the carrier munition. Once deployed, it springs open to its operational length of 118mm. 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 152mm (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.

9N24

© SESU

ORDNANCE SUB-CATEGORY	Submunition – blast/FRAG
EXPLOSIVE FILL (g)	1,480 (A-IX-2, aluminized RDX)
AUW (g)	7,450
DIMENSIONS (mm)	373×88
COUNTRY OF ORIGIN	Russian Federation
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 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 submunition. There are reports that the 9N722K5 warhead associated with the Iskander-M (NATO SS-26 Stone) can deploy 54 large submunitions similar in type to the 9N24.

It should be assumed that 9N24 submunitions which have deployed from their carrier missile are armed and they should be 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

© John Montgomery

ORDNANCE SUB-CATEGORY	Submunition – HEAT
EXPLOSIVE FILL (g)	110 (K991, RDX-based)
AUW (g)	934
DIMENSIONS (mm)	260×42
COUNTRY OF ORIGIN	Russian Federation
FUZE	Impact/inertia with self-destruct

The PTAB-1M (for "Противотанковая Авиабомба", AT aviation bomb) is a fin-stabilized 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-to-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 are three sections that contain 80 submunitions and a fourth one 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.

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

© Open Source

ORDNANCE SUB-CATEGORY	Sensor-fuzed submunition – EFP
EXPLOSIVE FILL (g)	4,500
AUW (g)	15,500
DIMENSIONS (mm)	384×185
COUNTRY OF ORIGIN	Russian Federation
FUZE	Infrared/millimetric wave sensing

The SPBE (for "Самоприцеливающийся Боевой Элемент", *samopritselivayushchiysya boyevoy* element, self-guided submunition) 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.

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. A suitable soak period is recommended 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 neutralization should be employed.

9N210

© SESU

ORDNANCE SUB-CATEGORY	Submunition – blast/FRAG
EXPLOSIVE FILL (g)	270 (A-IX-10)
AUW (g)	1,850
DIMENSIONS (mm)	265×65
COUNTRY OF ORIGIN	Russian Federation
FUZE	9E246/9E246M

The 9N210 is a fin-stabilized high-explosive fragmentation submunition. The 9N210 is delivered by the 220mm 9M27K artillery rocket with 30 submunitions. The 9N210 uses 270g of A-IX-10 an RDX-based explosive. The 9N210 has only one size of preformed fragmentation (2g).

Two fuzes may be employed with this submunition, the 9E246 and the improved 9E246M. The 9E246 has no pyrotechnic time self-destruct element. The exact fuze designation is normally stencilled into the metal body of the fuze just above the main body of the submunition. The submunition model is normally marked with black stencilling on the warhead body. The fragmentation produced by both the 9N210 and 9N235 is distinctive.

Usually, in any strike, the distinguishing black fins will be found. These items should be destroyed in situ and not moved. The 9N210 is known to have a high failure rate.

9N235

© Roly Evans

ORDNANCE SUB-CATEGORY	Submunition – blast/FRAG
EXPLOSIVE FILL (g)	310 (K-991)
AUW (g)	1,850
DIMENSIONS (mm)	265×65
COUNTRY OF ORIGIN	Russian Federation
FUZE	9E272

The 9N235 is a fin-stabilized high-explosive fragmentation submunition. It can be delivered by the 220mm 9M27K1 rocket, with 30 submunitions, or the 300mm 9M55K rocket, with 72 submunitions. The 9N235 employs 310g of K-991 rather than 270g of A-IX-10 used in the 9N210. The 9N235 has two sizes of preformed fragmentation (0.5g and 4.5g).

The 9N235 employs a mechanical fuze where the firing pin acts as a holding device on a slider under lateral spring pressure. The submunition has a 9E272 (9Э 272) impact fuze that incorporates a circular pyrotechnic delay self-destruct element of 110 seconds. This is different from the fuze employed with the 9N210. The fuze designation is stencilled into the base of the visible fuze. Like the 9N210, the 9N235 has a high failure rate. The submunition model is marked with black stencilling on the warhead body.

These submunitions have been widely encountered by EOD teams during the conflict to date. Some of the fragmentation produced by the 9N235 (and 9N210) 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. These items should be destroyed in situ and not moved.

3-O-10

© SESU

ORDNANCE SUB-CATEGORY	Submunition – HE-Frag
EXPLOSIVE FILL (g)	640 (A-IX-2)
AUW (g)	3,900
DIMENSIONS (mm)	300×65
COUNTRY OF ORIGIN	Russian Federation

The 3-O-10 is a high-explosive, fragmentation submunition associated with ammunition fired by the Russian 2S4 Tyulpan self-propelled mortar. It is delivered by the 240mm 3-O-8 rocket-assisted mortar cluster carrier munition, which contains 14 3-O-10 submunitions. Each 3-O-10 submunition is stabilized by a PS-69 series white parachute, which is this submunition's distinctive signature. EOD operators will probably notice the munition parachutes prior to seeing the actual submunition.

The 3-O-10 may be mistaken for the 3-O-16, a similar submunition, which, apart from the overall length, differs only in its markings. The 3-O-10 is longer than the 3-O-16 by over 100mm. The 3-O-16 also uses a ribbon stabilizer instead of a parachute.

3-O-16

© Roly Evans

ORDNANCE SUB-CATEGORY	Submunition – HE-Frag
EXPLOSIVE FILL (g)	230 (A-IX-2)
AUW (g)	1,375
DIMENSIONS (mm)	193×52
COUNTRY OF ORIGIN	Russian Federation
FUZE	9E246M1

The 3-O-16 is a high-explosive, fragmentation submunition and is delivered by either the 3-O-13 improved conventional munition (ICM) 152mm artillery projectile, which contains eight submunitions; or the 3-O-14 ICM 203mm projectile, which contains 24 submunitions. The 3-O-13 152mm projectile may be fired by all Russian 152mm howitzers, the 3-O-14 203mm projectile is associated solely with the 2S7 Pion self-propelled howitzer. Use of the 3-O-13 was confirmed in the Kharkhiv area in April 2022.

Each 3-O-16 submunition is stabilized by four ribbons. EOD operators will probably see these white ribbons prior to seeing the actual submunition. The 9E246M1 fuze has a self-destruct mechanism based on a pyrotechnic delay. However, there are indications that this is unreliable.

Fuzes breaking off on impact have been observed. The setback on expulsion from the carrier projectile is the main means of arming the 9E246M1 fuze. The 3-O-16 is easy to mistake for the 3-O-10, a similar submunition. The 3-O-16 is approximately 100mm shorter, with ribbons as a stabilizer rather than a parachute. The presence of ribbons could also be an indicator of use of the 9N24 submunition, that also are ribbon stabilized. If markings are obscured, the submunition length, fuze shape and fragmentation jacket perforations are the easiest way to correctly identify this submunition.

KH-101

© X (author unknown)

ORDNANCE SUB-CATEGORY	Submunition
EXPLOSIVE FILL (g)	400, estimated (unknown explosive)
AUW (g)	Approximately 4,000
DIMENSIONS (mm)	Sphere: approximately 150 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	136B3 pyrotechnically-armed inertia fuze

This submunition variant is the third type of the conventional warhead associated with the Russian Kh-101 air-launched cruise missile (ALCM). Detailed information is scarce, and the information presented here may change as further technical details are released.

The submunition is spherical in shape and consists of two aluminium hemispheres, which wrap around a matrix of 6mm diameter steel spheres (projectiles). The core of the submunition contains a spherical explosive charge. The submunition has prominent ridges which surround the circumference and may assist in fixing the munition within the missile carriage and dispensing system. Each submunition is fitted with a screw-threaded centrally located recess, approximately 2cm in diameter, which contains the 136B3 pyrotechnically armed fuze. The fuze appears similar to that associated with the slightly smaller spherical submunition used with the Kh-59M (AS-18 Kazoo) ALCM.

The 136B3 fuze uses a small pyrotechnic block to keep the inertia block striker, detonator and primer out of line whilst it is in the safe position. Unarmed 136B3 fuzes may be indicated by intact silver foil being present over the flash receptacle of the fuze. The stab detonator is initiated by a firing pin operating within a sliding inertia block. As this fuze operates on the inertia principle and has an all-ways action, great care should be taken when handling this submunition. If movement is considered essential, then the munition should be held such that the fuze is horizontal and at right angles to the direction of movement. Under no circumstances should armed submunitions be rotated so that the fuze is uppermost, as such an action may cause the fuze firing pin to further impinge of the stab sensitive detonator and cause the submunition to function.

Submunitions contained within Kh-101 missiles that have crashed or have been shot down, particularly those which have been involved in a fire, may have become armed and appropriate care should be taken. Disposal in situ should be considered.

M74

© X (author unknown)

ORDNANCE SUB-CATEGORY	Submunition
EXPLOSIVE FILL (g)	130 (composition B – RDX/TNT)
AUW (g)	Approximately 600
DIMENSIONS (mm)	Rough sphere: approximately 70 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	M219 centripetal arming

The M74 submunition forms the principal payload of the MGM-140 ATACMS missile. The munition body is manufactured from steel and has external flutes. An inner pre-notched fragmentation shell is formed from tungsten alloy. The overall body colour is green.

The M219 fuze is armed after ejection from the parent missile through the application of centripetal force on the fuze mechanism caused by rotation of the munition in the air stream, which is enabled by the external flutes. Once armed, the munition functions on impact.

All M74 submunitions which have been ejected from the parent ATACMS missile should be considered armed and may be in an extremely sensitive condition. Disposal by demolition in situ should be considered.

M42/M46/M77 DUAL PURPOSE IMPROVED CONVENTIONAL MUNITION

© Telegram (author unknown)

ORDNANCE SUB-CATEGORY	Submunition
EXPLOSIVE FILL (g)	30 (composition A-5 – pressed RDX/stearic acid)
AUW (g)	215
DIMENSIONS (mm)	81 (length), 38 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Inertia (impact) fuze with M55 stab detonator

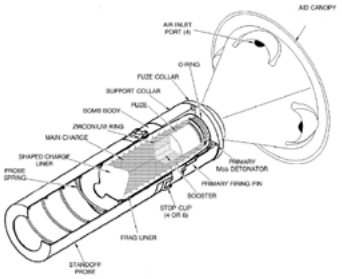
The M42, M46 and M77 are all DPICMs. The M42 and M46 are associated with the M483 and M864 155mm carrier projectiles and the M77 is associated with the M26 variant of the MLRS family of rockets (launched from M270 tracked MLRS or M142 HIMARS wheeled launchers).

Each submunition is fitted with a slider which holds an out of line M55 stab-sensitive detonator. When ejected from its parent carrier, a ribbon unfurls and the action of the munition rotating in the airstream causes the firing pin to unscrew from the slider. Centripetal force causes the slider to move outwards, bringing the detonator in line with the firing pin. On impact with a hard surface, the firing pin is forced into the detonator initiating the main charge. Each DPICM incorporates a shaped charge in the forward end and the body of the munition causes fragmentation. Submunitions falling on soft ground such as snow, sand or mud may fail to detonate and may be in an extremely sensitive condition.

Great care should be taken when approaching targets which have been attacked with DPICM-type submunitions. Zero movement of UXO and destruction in situ are strongly recommended. Care should also be taken when approaching DPICM-type munitions in high winds as this may cause movement of arming ribbons and allow submunitions to arm.

Under no circumstances should any attempt be made to move the slider from the armed to the unarmed position.

BLU-97



Left: © US DoD. Right: © Bob Seddon

ORDNANCE SUB-CATEGORY	Air-delivered submunition
EXPLOSIVE FILL (g)	290 (cyclotol – RDX/TNT) 280 (PBXN-107 – RDX-based PBX)
AUW (g)	1,500
DIMENSIONS (mm)	168 (length, probe not deployed); 64 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Firing pin initiation of M55 stab detonator which compresses a piezoelectric crystal, which initiates an Mk-96 electric detonator

The BLU-97 submunition is a combined effect munition with HEAT and fragmentation effects and forms the principal payload of the AGM-154A joint standoff weapon (see separate entry). The submunition body has a yellow overall body colour and has black stencilled markings.

The BLU-97 submunition is armed by the airstream effect on the munition after it is ejected from the AGM-154A dispenser. The standoff probe is deployed using spring power and the air canopy at the rear of the munition orientates the munition for downwards impact. Probe deployment brings the primary firing pin into the armed position. The primary means of initiation is direct action. The BLU-97 submunition is fitted with a secondary (graze) initiation system, which provides an "all ways" action.

All BLU-97 submunitions which have been ejected from the parent AGM-154A JSOW dispenser should be considered armed and may be in an extremely sensitive condition. Care should be taken when approaching targets attacked with BLU-97 submunitions in high wind conditions, as wind action on the canopy may move the munition and cause it to function. Disposal by demolition in situ is invariably the best option. Attempts to dismantle armed BLU-97 submunitions will most likely result in death.

AIR-DROPPED WEAPONS

RBK-250/275

© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Aerial bomb – carrier
EXPLOSIVE FILL (kg)	Not applicable
AUW (kg)	250–275
DIMENSIONS (m)	2.15×0.325
COUNTRY OF ORIGIN	Russian Federation
FUZE	ATK-ET

The RBK-250/275 (for "Разовая Бомбовая Кассета", *razovaya bombovaya kasseta*, single-use bomb dispenser) is a carrier that is often employed as a cluster bomb, dependent on the submunitions carried. 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 RBK-250/275. Regardless of the cargo, the RBK series typically uses an ATK-EB electromechanical 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

© Vitaly V. Kuzmin

ORDNANCE SUB-CATEGORY	Aerial bomb – carrier
EXPLOSIVE FILL (kg)	Not applicable
AUW (kg)	500
DIMENSIONS (m)	1.955×0.45
COUNTRY OF ORIGIN	Russian Federation
FUZE	ATK-ET

The RBK-500 (for "Разовая Бомбовая Кассета", *razovaya bombovaya kasseta*, single-use bomb dispenser) is a carrier that is often employed as a cluster bomb, dependent on the submunitions carried. 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 uses an ATK-EB electromechanical 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 15 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

© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Aerial bomb
EXPLOSIVE FILL (kg)	209 (TNT)
AUW (kg)	497
DIMENSIONS (m)	2.47×0.4
COUNTRY OF ORIGIN	Russian Federation
FUZE	AVU-ET

The FAB-M62 is a common high-explosive aerial bomb. It is typically fuzed with an electromechanical 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, 19% RDX, 17% aluminium, 5% wax).

OFZAB-500

© Vitaly V. Kuzmin

ORDNANCE SUB-CATEGORY	Aerial bomb
EXPLOSIVE FILL (kg)	37.5 (EXPL), 250 (OM-100MI-3L)
AUW (kg)	500
DIMENSIONS (m)	2.5×0.45
COUNTRY OF ORIGIN	Russian Federation
FUZE	AVU-ET

The OFZAB-500 (for *oskolochno-fugasnaya zazhigatelnaya aviatsionnaya bomba*, fragmentation high-explosive incendiary bomb) combines both incendiary and high-explosive fragmentation roles. It could arguably be classified as a form of thermobaric bomb.

The OFZAB-500 is typically fuzed with an electromechanical impact fuze such as an AVU-ET. It can only be fuzed in the nose.

It is not confirmed which 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.

57MM S-5 KO ROCKET

© Dutch EOD Center

ORDNANCE SUB-CATEGORY	HE-Frag – HEAT
EXPLOSIVE FILL (g)	330 (A-IX-1)
AUW (g)	4,500
DIMENSIONS (mm)	1,004×57
COUNTRY OF ORIGIN	Russian Federation/Bulgaria
FUZE	V-5K

The 57mm diameter S-5 rocket is 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 commonly been seen 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 uses a relatively simple impact fuze based on the standard setback sleeve/creep spring configuration, designated 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. This means the detonator is in line at the point of launch and is therefore 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.

80MM S-8 KO ROCKET

© Roly Evans

ORDNANCE SUB-CATEGORY	HE-Frag – HEAT
EXPLOSIVE FILL (kg)	4.12 (A-IX-10)
AUW (kg)	11.3
DIMENSIONS (mm)	1,570×80
COUNTRY OF ORIGIN	Russian Federation/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 uses 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 three launchers. The B8V20 and the B8M pods both carry 20 rockets and the B8S7 only carries seven 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.

240MM S-24

© Bob Seddon

ORDNANCE SUB-CATEGORY	Air-to-surface rocket
EXPLOSIVE FILL (kg)	29 (TNT)
AUW (kg)	239
DIMENSIONS (mm)	2,120 x 240
COUNTRY OF ORIGIN	Russian Federation
FUZE	V24-A

The S-24 is an unguided air-to-surface rocket that dates from the 1960s. Two versions may be encountered, the S-24A and the S-24B. The difference is in the type of double-base propellant used for the motor: that used for the S-24B produces less smoke. Sometimes the rocket is referred to as *neupravlyayemaya aviatsionnaya raketa* (unguided aviation rocket). The S-24 rocket is most commonly associated with dedicated ground attack aircraft, such as the Su-24, Su-25 and Su-27. The S-24 rocket has been used extensively in Ukraine in seeming preference to guided missiles.

The S-24 warhead contains a 29kg TNT warhead with a 150g tetryl booster. The rocket motor (S-24B) contains 46kg of a double-base propellant and is fitted with a black powder igniter with twin electrical initiators. The initiators are at the forward end of the rocket motor, close to the warhead section. The rocket motor has six distinctive separate nozzles. The S-24 is typically used with a V-24A fuze electrotechnical fuze with impact and delay functions. The rocket may also be fuzed with the V-575 delayed impact fuze if hardened shelters, such as bunkers, are targeted. Fuzing with a S-24N proximity fuze is also possible.

S-25-O

© ruaviation.com

ORDNANCE SUB-CATEGORY	Air-to-surface rocket
EXPLOSIVE FILL (kg)	150 (TNT)
AUW (kg)	385
DIMENSIONS (m)	3.76×0.266
COUNTRY OF ORIGIN	Russian Federation
FUZE	Point-detonating or RV-25 proximity

The S-25-O is an unguided air-to-surface rocket. It has a large HE-Frag warhead (148kg TNT). The motor section, containing a double-base propellant, is also a significant hazard. The warhead has a distinctive bulged shape at its nose and is 420mm in diameter at its widest point and has a tough preformed fragmentation surface.

The S-25-O may be fitted with a point-detonating or RV-25 proximity fuze. If a proximity fuze is fitted, it is not known how long the firing capacitor in this fuze remains energized. Caution is advised.

UMPB D-30SN

© Boyko Nokolov

ORDNANCE SUB-CATEGORY	Precision-guided bomb
EXPLOSIVE FILL (kg)	100 (unknown explosive), reported
AUW (kg)	250, estimated
DIMENSIONS (m)	3 (length), 0.3 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Unknown

The UMPB D-30SN is a precision-guided glide bomb with similar characteristics to the US GBU-39 small-diameter bomb. The UMPB D-30SN, unlike the UMPK appliqué kit, is a purpose-built munition. The UMPB D-30SN guidance system has a navigation system which contains an electronic warfare–resistant Kometa global navigation satellite system (GNSS) and an inertial measuring unit. The bomb electronic systems are powered by a thermal battery. The rear fins are controlled by electrically powered actuators.

After dropping from the aircraft, the bomb automatically releases two spring-loaded folding wings and commences an aerodynamically controlled glide to the pre-recorded target. Control is affected by the four equally spaced fins at the rear of the bomb. The warhead is reported to be loosely based on the FAB-250 aircraft bomb, so the main explosive charge is likely to be a military explosive, probably based on RDX/TNT. No open-source details of the safety and arming and fuzing mechanism have been released. The bomb is most likely fitted with an impact fuze.

Caution should be exercised around crashed UMPB glide bombs where wings have failed to deploy.

UMPK GLIDE KIT

© Defense Express (UA)

ORDNANCE SUB-CATEGORY	Air-to-surface precision-guided bomb kit
EXPLOSIVE FILL (kg)	Munition-dependent
AUW (kg)	Munition-dependent
DIMENSIONS (m)	1.85 (length), 2.32 (wingspan)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Munition-dependent

UMPK (УМПК) is the name given to an appliqué precision guidance kit for Russian aircraft bombs. The UMPK kit has been used with a wide variety of conventional aircraft bombs of varying weights, including the FAB, OFAB and ODAB series of bombs. The kit has also been used to deploy carrier munitions, such as the RBK-500 cluster bomb. The UMPK is in some respects a rough Russian Federation copy of the US JDAM system.

The UMPK guidance kit consists of a navigation unit containing an improved electronic warfare–resistant Kometa global navigation satellite system (GNSS) and an inertial measuring unit, thermal batteries (used to power the electronic systems), servo motors (moving the rear control surfaces (ailerons)), and a small pyrotechnic mechanism (which initiates the deployment of the wings on release from the launch aircraft).

The UMPK kit is attached to the munition using three clamps. Wing deployment is enabled using powerful compressed springs. In more recent kits, the UMPK guidance system is updated from the target aircraft with position, attitude and velocity information immediately prior to dropping.

Caution should be exercised around crashed UMPK glide bombs where wings have failed to deploy.

KH-31 ANTI-RADIATION MISSILE (ARM) – AS-17 KRYPTON

© Russian Federation MoD

ORDNANCE SUB-CATEGORY	Air-to-surface anti-radiation missile
EXPLOSIVE FILL (kg)	Warhead: 68 (unknown explosive type)
AUW (kg)	Up to 650
DIMENSIONS (m)	up to 5.3 (length), 0.36 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Impact or proximity sensor with unknown safety and arming mechanism

The Kh-31 (NATO reporting name AS-17) is an air-launched anti-radiation missile (ARM) which is carried by Russian strike aircraft. The missile employs a two-stage propulsion system with hypergolic liquid fuels used to ignite the sustain ramjet.

The missile is structured in four parts: 1) the forward section contains the seeker head and guidance system; 2) the warhead, accessible via a door in the missile fuselage, 3) the sustain motor and 4) the rear section containing the boost motor and control fins. The control system operates using high-pressure nitrogen gas stored in three high-pressure vessels located in the rear third of the missile. Kh-31 missile variants may be fitted with blast/fragmentation (most common), semi-armour-piercing or submunition warheads.

The Kh-31 missile is fitted with a two-stage propulsion system. The first-stage motor has a 118kg solid composite propellant grain consisting of ammonium perchlorate and aluminium. The second-stage motor is a ramjet-type sustain motor which is ignited with toxic hypergolic liquids, the oxidizer being nitrogen tetroxide and the fuel unsymmetrical dimethylhydrazine. The sustain motor fuel tank contains approximately 55kg of JP-5 kerosene.

A safe waiting period is recommended before approaching a crashed missile and the approach should be from the rear of the missile. Appropriate PPE should be worn to mitigate the hazard posed by the toxic hypergolic igniter fuels used in the sustain motor. JP-5 fuel remaining in the sustain motor fuel tank may pose a residual fire hazard.

BRIMSTONE

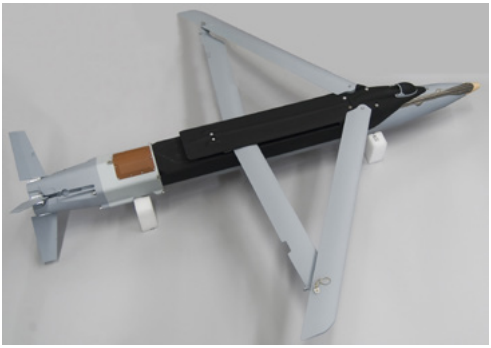
© UK MoD

ORDNANCE SUB-CATEGORY	Anti-tank guided weapon
EXPLOSIVE FILL (kg)	6.5 (LX-14 – HMX/estane)
AUW (kg)	Approximately 50
DIMENSIONS (m)	1.8 (length), 0.18 (diameter)
COUNTRY OF ORIGIN	United Kingdom
FUZE	Assessed to be a dual EFI (precursor and main charge)

Brimstone was originally developed as an autonomous air-launched precision-guided munition. It has been adapted for use in Ukraine for launch from ground-based platforms. It is optimized for use against armoured and high-value battlefield targets. It employs a millimetric wave (MMW) seeker head with lock on before launch (LOBL) or lock on after launch (LOAL) capabilities. Multiple missiles may be launched in a single salvo, thus enabling the launch aircraft/platform to engage multiple targets in a single engagement. When used in LOBL mode, missiles are assigned to different targets. When used in LOAL mode, the missile may be programmed to fly a predetermined range and commence searching for a target autonomously. The missile looks superficially like the US Hellfire missile but there are no component commonalities between the missile systems. Unlike the Hellfire missile, which uses a pneumatic, gas-driven control system, Brimstone employs a thermal battery-powered electrical control system. Missile yaw, pitch and roll control is achieved using a combination of four fins located around the centre section of the missile and four fins at the rear. It employs a two-stage warhead, which is designed to defeat explosive reactive armour and other active protection measures. The precursor shaped charge contains 300 g of explosive and the main explosive charge, which also employs the HEAT principle, has an explosive content of 6.2kg.

Brimstone missiles have an overall body colour of grey. Designation information is stencilled on the missile body using black paint. The centre of gravity of the missile and hoisting points are indicated by black painted symbols. The missile warhead section has a painted yellow circumferential band which indicates a high-explosive filling. Forward of this marking is a black circumferential band which indicates the primary anti-armour role of the missile. The rocket motor section has a brown circumferential band indicating the low-explosive hazard contained in this part of the missile. If a missile has been fired and has failed to function, a minimum safe waiting period of 30 minutes is recommended to allow thermal batteries and firing capacitors to discharge. Fired and crashed missiles should be approached from the rear.

GBU-39 SMALL-DIAMETER BOMB



© US National Air and Space Museum

ORDNANCE SUB-CATEGORY	Precision-guided bomb
EXPLOSIVE FILL (kg)	16.5 (AFX-757 PBX – RDX/Al/AP with HTPB)
AUW (kg)	130
DIMENSIONS (m)	1.8 (length), 0.19 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	ESAF device

The GBU-39 small-diameter bomb (SDB) is in service with the Ukrainian Air Force and is qualified for dropping from the MiG-29 Fulcrum and F-16 aircraft. The bomb uses a combination of inertial guidance with global positioning system (GPS) assistance. After release from the dropping aircraft, wings are released, which provide the bomb with aerodynamic stability and lift. Control is via four control fins fitted to the tail actuation system.

The bomb employs a blast/fragmentation warhead with a fuze fitted to the rear of the warhead. The main filling, AFX-757, is an RDX-based insensitive polymer-bonded explosive composition enhanced with ammonium perchlorate and aluminium, which was developed specifically for use in hard penetrator warheads. The bomb may be programmed for proximity mode with detonation above ground, or delay mode for detonation following target penetration. The bomb is capable of penetrating over 1m of reinforced concrete. Power for the ESAF is provided from a wind driven arming generator, which is mounted on the front of the wing assembly.

If an SDB has been dropped and has failed to function, a minimum safe waiting period of 60 minutes is recommended to allow firing capacitors to discharge. The fuze is held in place with a slotted screw-threaded retaining ring and may be difficult to remove if the bomb has deformed on impact after hitting a hard target.

MK-80 SERIES

Left: © Defence Industry Daily. Right: © Belgian EOD

ORDNANCE SUB-CATEGORY	General purpose low-drag aircraft bombs	
EXPLOSIVE FILL (kg)	Mk-81: 45 Mk-82: 87 Mk-83: 202 Mk-84: 429	(tritonal – TNT/aluminium, or H-6 explosive – RDX/TNT/aluminium)
AUW (lb)	Mk-81: 250 Mk-82: 500 Mk-83: 1,000 Mk-84: 2,000	
DIMENSIONS (m)	Length: Mk-81: 1.3 Mk-82: 1.7 Mk-83: 1.9 Mk-84: 2.6	Diameter: Mk-81: 0.23 Mk-82: 0.27 Mk-83: 0.36 Mk-84: 0.46
COUNTRY OF ORIGIN	United States	
FUZE	Various base fuzes and optional proximity nose fuze	

The Mk-80 series of aircraft bombs are general purpose low-drag bombs in use with the Ukrainian Air Force. Bombs may be encountered in "dumb" mode with no precision guidance kit fitted. The Mk-80 series of bombs are also used with the JDAM and JDAM-ER appliqué precision guidance kits (see separate entry on JDAM and JDAM-ER).

All Mk-80 series bombs may be fitted with various types of base fuzes. Bombs may also be fitted with the nose-mounted DSU-33 proximity fuze or the DSU-38 laser proximity fuze. Electrical power for the arming of the fuze and charging of fuze firing capacitors is provided by an FZU-48 or FZU-58 fuze initiator mounted in a recess between the bomb lugs.

JOINT DIRECT ATTACK MUNITION (JDAM)

© USAF

ORDNANCE SUB-CATEGORY	Air-to-surface precision-guided bomb
EXPLOSIVE FILL (kg)	430 (tritonal – GBU-31 with Mk-84 bomb)
AUW (kg)	940 (GBU-31 with Mk-84 bomb)
DIMENSIONS (m)	GBU-31 with Mk-84 GP bomb: 3.8 (length), 0.46 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Various tail fuzes and nose proximity fuze options available

The joint direct attack munition (JDAM) is the name given to a family of appliqué add-on precision guidance kits for a variety of aircraft bombs. The GBU-31 JDAM is the variant used with the 2,000lb Mk-84 GP bomb and the 2,000lb BLU-109 penetrator bomb. GBU-32 is the variant used with the Mk-83 1,000lb GP bomb, GBU-38 is the variant used with the Mk-84 500lb GP bomb.

JDAM uses a combination of inertial navigation and satellite-based GPS to steer the munition to a precise point in space. JDAMs are generally fitted with a base fuze. All base fuze variants may be used in conjunction with the nose-mounted DSU-33 proximity fuze. The bomb fuze receives power after dropping from the aircraft from the FZU-33 air-driven alternator, which is located between the suspension lugs.

The JDAM tail assembly consists of the tail fairing and structure, tail actuator subsystem (TAS), wire harness, guidance and control unit (GCU), GPS antenna, three movable control fins and one fixed control fin. The tail structure consists of a conical aluminium assembly that attaches to the bomb body with screws. The GCU is an integrated electronics assembly that includes the mission computer, inertial navigation system (INS), GPS receiver module and power conditioning module. The aerosurfaces (also known as strakes) consist of three formed steel panels that attach to and wrap around the bomb. The strakes produce aerodynamic lift and provide increased manoeuvrability. Depending on the configuration set, the bomb fuze may detonate on proximity (if the DSU-33 proximity sensor is fitted), on impact or after impact. An extended range variant (JDAM-ER), with differing wings and strakes has also been used.

AGM-88 HARM

© Ukraine MoD

ORDNANCE SUB-CATEGORY	Air-to-surface anti-radiation missile
EXPLOSIVE FILL (kg)	Warhead PBXN-107: approximately 20
AUW (kg)	Approximately 365
DIMENSIONS (m)	4.15 (length), 0.25 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	FMU-111 fuze with Mk-44 booster

The AGM-88 high-speed anti-radiation missile (HARM) is a supersonic, air-to-ground anti-radiation missile which is programmed to attack a variety of radar systems. The missile may be fired from a range of aircraft, including the F-16 and the Ukrainian MiG-29. The missile body consists of four sections: 1) the guidance section at the front containing the missile guidance electronics, 2) the section containing the missile warhead and bearing a yellow circumferential hazard band at its front; 3) the control section, which has movable guidance vanes at its rear and 4) the rear section containing the rocket motor and bearing a brown circumferential hazard band at its front.

The WDU-21 warhead has a shaped charge at its forward end and is lined with tungsten alloy cubes. The FMU-111 fuze is screwed to the rear part of the warhead and the Mk-44 booster is attached to the forward end of the fuze. The warhead contains PBXN-107, an RDX-based polymer-bonded explosive with a polyacrylate binder. The missile is equipped with an arming status indicator and a key-operated arming socket at the forward edge of the rocket motor.

The AGM-188 HARM employs a rocket motor which contains approximately 130kg of a composite propellant. The efflux produced by the motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. Appropriate PPE should be employed when handling fired rocket motors. If a missile has been fired and has failed to function, a minimum safe waiting period of 60 minutes is recommended to allow thermal batteries and firing capacitors to discharge. Fired and crashed missiles should be approached from the rear.

AGM-154 JSOW

© USMC

ORDNANCE SUB-CATEGORY	Precision-guided air-to-surface munition
EXPLOSIVE FILL (kg)	Variant-dependent
AUW (kg)	483
DIMENSIONS (m)	4.1 (length), 0.34 (width)
COUNTRY OF ORIGIN	United States
FUZE	Electronic safe and arm device (ESAD)

The AGM-154 joint standoff weapon (JSOW) is an air-to-surface glide munition with a variety of warhead options. It is an inertially-guided, GPS-assisted munition which requires no external intervention after launch. It is modular in design and all variants share the same basic airframe and precision guidance/navigation system.

AGM-154A is designed to carry 145 BLU-97 combined effects submunitions. AGM-154B is designed to carry six BLU-108/B dispensers, each containing four terminally guided Skeet anti-armour submunitions. AGM-154C is fitted with the BAE Systems two-stage BROACH warhead (the same type of warhead used on the Anglo-French Storm Shadow/SCALP missile) and is designed for the attack of hardened targets (see separate entries on BLU-97 and Storm Shadow).

The AGM-154 has an overall body colour of grey and a circumferential yellow hazard band is painted around the body of the dispenser in front of the forward suspension lug for dispensers containing high-explosive munitions. Textual information is stencilled on the dispenser in black. Missiles containing high-explosive components have a yellow hazard band painted around the missile body.

BLU-97 submunitions found close to or within a crashed AGM-154A dispenser could be armed and should be treated accordingly. If the dispenser wings have not deployed, then appropriate care should be taken. A safe waiting period of 3 hours is recommended before approaching a crashed AGM-154.

LOITERING MUNITIONS

LANCET

Left: © Vitaly Kuzmin. Right: © X (author unknown)

ORDNANCE SUB-CATEGORY	Unmanned combat air vehicle – loitering munition
EXPLOSIVE FILL (kg)	Lancet-3: 1.8 (TG-40 – TNT/RDX 40/60)
AUW (kg)	Lancet-3: 12
DIMENSIONS (m)	1.65 (length), 1 (width)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Impact fuze, details unknown

The ZALA Lancet is a catapult-launched, electric push-propeller driven unmanned combat air vehicle (UCAV) or loitering munition (also known as a kamikaze drone). It has a distinctive cruciform (X) wing configuration with control fins (ailerons) at the rear (see right image above).

The latest variant, Lancet-3, is reported to have a 40-minute mission time, with a 40km range and has an all-up mass of 12kg. It can carry a 3kg payload. The Lancet-3 employs a combination of simple inertial and coordinate based multi-band U-Blox global navigation satellite system (GNSS) with electro-optical command guidance, controlled by a human operator in the terminal attack phase.

The Lancet-3 is often fitted with a Russian KZ-6 demolition charge (see separate entry), which has a shaped charge and an all-up mass of 3kg. Other explosive charges may also be hidden within the airframe to deny exploitable components if the UCAV crashes or is shot down.

All crashed UCAVs must be reported to the Ukrainian authorities and **under no circumstances** shall they be moved or dismantled due to the high threat posed by anti-handling devices.

SHAHED-131/136

© Conflict Armament Research

ORDNANCE SUB-CATEGORY	UCAV – loitering munition
EXPLOSIVE FILL (kg)	NEC varies dependent on warhead type: 1.6 to 2
AUW (kg)	Approximately 200
DIMENSIONS (m)	3.5 (length), 2.5 (wingspan)
COUNTRY OF ORIGIN	Islamic Republic of Iran/Russian Federation
FUZE	Warhead fitted with single safety and arming and fuzing unit (SAFU) at the rear of the warhead

The Shahed-131 and 136 are long-range unmanned combat air vehicles (UCAV) which have been used extensively in Ukraine under the Geran 1/2 Russian names. The UCAV employs a combination of inertial navigation, using a tactical grade inertial measuring unit, and global navigation satellite system (GNSS). The UCAV is fitted with a pusher propeller at the rear of the bat-wing type airframe and is powered by a MADO MD-550 engine. The UCAV may be operated in one-way attack mode or may be fitted with other electronic systems to facilitate two-way communication and operation as a loitering munition.

The Shahed-131 and 136 may be configured with a variety of warhead types, including blast/fragmentation, a penetrating high-explosive warhead or a multi-purpose warhead (left image above). The maximum warhead mass is assessed as 50kg and the net explosive content of most warhead variants is assessed to be in the range of 16–20kg. The explosive type has not been identified but is probably a military explosive, such as RDX/TNT.

All crashed UCAVs must be reported to the Ukrainian authorities and **under no circumstances** shall they be moved or dismantled due to the high threat posed by anti-handling devices.

WARMATE

© WB Electronics

ORDNANCE SUB-CATEGORY	Loitering munition
EXPLOSIVE FILL (kg)	AV: 1 (TNT) TL: 1.4 (HEAT)
AUW (kg)	AV: 5.3
DIMENSIONS (m)	1.17 (length), 1.6 (wingspan)
COUNTRY OF ORIGIN	Poland
FUZE	Safety and arming mechanism of unknown type

The Warmate is a portable, fixed-wing loitering munition which delivers an explosive payload to a range of 20km. It is currently in service with the Ukrainian armed forces. The munition employs an electric motor-driven two-blade propeller, which is mounted at the rear of the munition and achieves launch speed through a catapult launch.

A variety of warhead types are available, including blast/fragmentation, HEAT and thermobaric (enhanced blast). The munition is fitted with a safety pin and lanyard fixed to the launcher. After the munition has left the launcher and is in flight, the safety pin is removed and part of the warhead arming sequence is complete.

The baseline Warmate variant is the AV. The Warmate TL is a tube-launched variant. Warmate 2 is a larger second-generation model and has an all-up weight on launch of 22kg and employs a 5kg warhead.

SWITCHBLADE


Left: © AeroVironment. Right: © USMC

ORDNANCE SUB-CATEGORY	Loitering munition
EXPLOSIVE FILL (kg)	600 variant: 2 (HMX PBX)
AUW (kg)	300 variant: 2.7 600 variant: 22.7
DIMENSIONS (m)	300 variant: 0.6 600 variant: 1.6
COUNTRY OF ORIGIN	United States
FUZE	Probably ESAF device with EFI

The Switchblade 300 is a lightweight loitering munition which delivers an explosive payload to a range of 30 km. It is currently in service with the Ukrainian armed forces. The Switchblade is entirely contained within its single-use launch tube and has spring-loaded wings which deploy on launch. The munition employs an electric motor-driven propeller which is mounted at the rear of the munition. The warhead is of a blast/fragmentation type with effects focused forwards.

Other variants of the system include the Switchblade 600, which has increased loitering time when compared with the 300 model and incorporates a larger shaped charge AT warhead. Switchblade 300 Block 20 is an updated variant of the 300 model. The Switchblade 600 is reported to employ a similar HEAT warhead to the multi-purpose warhead fitted to FGM-148 Javelin, which employs a warhead with a net explosive content of 2kg of an HMX-based PBX. The munition is thought to employ an ESAF device with an EFI-type initiator. The munition safety mechanisms are compliant with current US DoD munition safety standards.

A minimum safe waiting period of 30 minutes is recommended before approaching any crashed Switchblade munition, to enable on board firing capacitors to discharge.

ANTI-TANK GUIDED WEAPONS

9K111 FAGOT – AT-4 SPIGOT

© VMZ Sopot

ORDNANCE SUB-CATEGORY	Anti-tank guided weapon
EXPLOSIVE FILL (kg)	1.8 (OKFOL)
AUW (kg)	13
DIMENSIONS (mm)	Missile: 875 (length), 120 (diameter)
COUNTRY OF ORIGIN	Russian Federation, Bulgaria
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 40cm 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 AT 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

Top: © Sean Moorhouse. Bottom: © Thomas T.

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	1.8 (OKFOL)
AUW (kg)	14.5
DIMENSIONS (mm)	Missile: 955 (length), 120 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Electrical contact

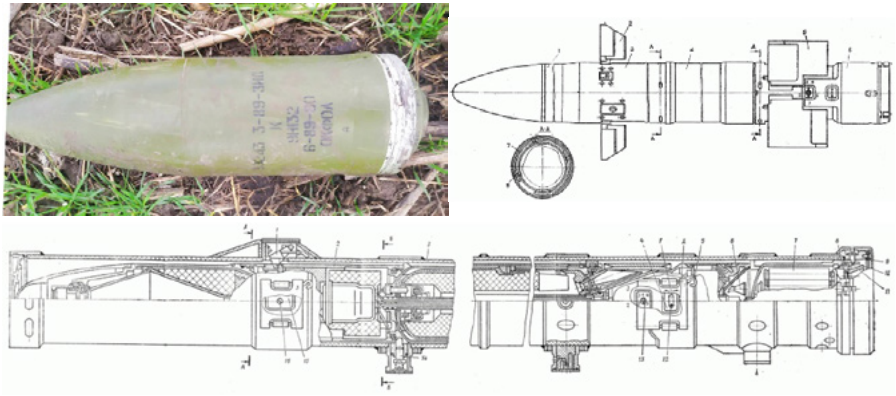
The 9M113 is a wire-guided SACLOS ATGW that dates from the mid-1970s. The 9M113 missile may be fired from the same launcher (9P135) associated with the 9K111 Fagot system but it is also mounted on infantry fighting vehicles, with the 9P148 launcher, such as the BMP-2, BMD-2 and BRDM-2. The NATO reporting 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 60cm 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.

9M114 KOKON – AT-6 SPIRAL



© SESU

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	2.2 (OKFOL)
AUW (kg)	35
DIMENSIONS (mm)	130×2,300 (missile probe extended)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Electrical contact

The 9M114 Shturm is a VHF radio guided, SACLOS ATGW system that dates from the mid-1970s. The system comprises the 9M114 missile and the 9P135 launcher. The NATO reporting name for the 9M114 is AT-6 Spiral.

The missile is transported within an environmentally sealed fibreglass tubular launch container. The missile is used both on Mi-24 Hind D attack helicopters and MTLB armoured vehicles (9P149). This missile has largely superseded by the AT-9 Spiral (9M120 Ataka). It has been used extensively in Ukraine. The missile is controlled by two pop-out fins in the forward section of the missile and it is fitted with four wrap-around fins at the rear to provide stability in flight.

The missile uses an ejection motor which contains 1.1kg of double-base propellant to eject the missile from the launch tube. The sustain motor contains a single propellant grain of 10kg (AT-6B) to 15kg (AT-6C) of double-base propellant.

The warhead is marked with the GRAU code 9H132 at the front of the missile, ahead of the forward fins. It contains a 2,200g OKFOL shaped charge. A small booster charge launches the missile from the tube. At about 20 m a sustainer solid fuel motor section takes over. Once launched, an operator controls the flight of the missile to the target. The motor section should be identified and destroyed during a demolition – if initiated the missile can travel at 345m/s. A thermobaric warhead variant (9M114F) also exists.

9M116 METIS – AT-7 SAXHORN

Motor section of fired 9M116. © SESU

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	1 (OKFOL)
AUW (kg)	4.8
DIMENSIONS (mm)	733×93
COUNTRY OF ORIGIN	Russian Federation/Bulgaria

The 9M116 is the missile component of the 9K115 Metis ATGW system. Metis literally translates to "cross-breed". The system entered service in the late 1970s. The 9M116 Metis is a tube-launched, wire-guided, SACLOS ATGW system. It employs a pneumatically powered aerodynamic control system, using canards at the front of the missile. The missile is fitted with three large wrap-around fins to provide lift and stability in flight. It has a two-stage propulsion system, consisting of a 250g single base propellant ejection charge, which propels the missile a safe distance from the launch tube, before igniting a 1.2kg double-base propellant sustain motor. The GRAU index coding can be confusing, on the fibreglass CLU, the missile can be marked as 9M115. Incorporating only a single HEAT warhead, these missiles are now obsolete for the attack of main battle tanks with explosive reactive armour but can still be effective against lighter armoured vehicles. The body of the missile is typically painted black. The missile shape and dimensions are very similar to the 9M111/AT-4 Spigot. The two are easy to mistake for each other but the 9M116 only has three fins whereas the 9M111 has four. The motor section on the 9M116 is smaller than on the 9M111, and the missile is therefore lighter. The missile is fitted with a pyrotechnic self-destruct delay which initiates between 20 and 25 seconds after launch.

A 30-minute safe waiting period is recommended before approaching the missile. Given the sensitivity of the missile contact fuze, the missile should not be jolted or moved and should be destroyed in situ.

9M117 BASTION – AT-10 STABBER

© John Culp

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	1.35 (OKFOL 3.5)
AUW (kg)	18.8
DIMENSIONS (mm)	1,092×137 (with cartridge)
COUNTRY OF ORIGIN	Russian Federation

The 9M117 Bastion is a gun-launched, laser beam riding, optically tracked, high-explosive AT (HEAT) missile which dates from the early 1980s. Variants of the 9M117 missile may be fired from several 100mm and 115mm guns. The configuration of the propelling charge is dependent on the gun from which the missile is fitted, and the complete 9M117 Bastion round, when fitted inside its cartridge case, is similar in appearance to other large calibre fixed cartridge case rounds. The 9M117 missile employs laser beam riding guidance where the gunner in the launch platform continuously illuminates the target, and the missile automatically guides itself to that target. The control section is in front of a single HEAT warhead and is based on steerable canards. A BMP-3 infantry fighting vehicle typically carries up to eight 100mm 9M117s (GRAU code 3UBK10-3) to be launched from the 100mm 2A70 rifled gun.

There are seven other variants of the missile with different GRAU designations. The missile launch propelling charge is contained within a lattice body within the cartridge case. At a distance of approximately 200m, the main sustain rocket motor ignites. The sustain motor contains approximately 2kg of a double-base propellant. The missile's range is 4,000m and has a flight time of approximately 12 seconds. The tandem warhead variant (9M117M) contains two OKFOL based shaped charges with copper liners. The fuze incorporates a self-destruct element that functions 26–42 seconds after initial arming. A small window in the rear of the missile is used to detect the position of the missile in the guidance laser beam.

A safe waiting period of 30 minutes is recommended before approaching the missile. Given the sensitivity of the missile contact fuze, which is located adjacent to the control canards, the missile should not be jolted or moved and should be destroyed in situ.

9M120 ATAKA – SPIRAL-2/AT-9

© SESU

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	7.4 (OKFOL 3.5 tandem warhead)
AUW (kg)	48.3
DIMENSIONS (mm)	1,630×130
COUNTRY OF ORIGIN	Russian Federation

The 9M120 Ataka is the successor to the 9M114 (AT-6 Spiral) missile. It is the main ATGW on the Mi-28 Havoc attack helicopter and may also be launched from modern variants of the Mi-35 Hind E and Ka-52 Hokum attack helicopters. The 9M120 is compatible with the radio command guidance system of the Mi-24 Hind D.

The 9M120 has been used extensively in Ukraine. It is a dual-mode guidance system and may be guided by radio command or by laser beam riding with SACLOS. The system dates from the 1980s. The missile is controlled by two pop-out fins in its forward section and it is fitted with four wrap-around fins at the rear to provide stability in flight. It is usually deployed from attack helicopters although its fibreglass launch tube can also be mounted on armoured vehicles, such as the 9P149 version of the MTLB.

The NATO reporting name of this missile is Spiral-2 and the US DoD designation is AT-9. The AT variant employs a tandem HEAT warhead and has a spring-out nose-mounted probe which extends after launch. The missile has distinctive infrared lamp and reflector mounted in its tail. Adjacent to the silver reflector is a receiver horn for the radio command link and for more recent versions (9M120-1) a laser receiver as well. The 9M120-1 has a larger tandem shaped charge warhead. There are also variants of the missile fitted with a thermobaric warhead (9M120F) and an anti-aircraft variant using a continuous rod type fragmenting warhead.

9M119 SVIR AT-11 SNIPER

Image © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Gun-fired AT missile
EXPLOSIVE FILL (kg)	Precursor: 0.8, Primary: 2.25 (OKFOL)
AUW (kg)	17.2
DIMENSIONS (mm)	695 (length), 125 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Nose crush switch with pyro delay arming

The 9M119 is a fin-stabilized 125mm smoothbore gun-launched AT 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 Russian Federation, and AT11AA Sniper by NATO. The 9M119F and 9M119F1 versions have enhanced warheads although their distinctive design features are unclear. 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. © Sean Moorhouse

ORDNANCE SUB-CATEGORY	Air-launched anti-armour missile
EXPLOSIVE FILL (kg)	4.3 (OKFOL)
AUW (kg)	47
DIMENSIONS (mm)	2,750×130
COUNTRY OF ORIGIN	Russian Federation
FUZE	Contact and proximity (later variants)

The 9K127 Vikhr missile system is a tube-launched fin-stabilized laser beam riding air-to-surface AT 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 stabilized 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 an impact fuze and some later variants are also fitted with a proximity fuze. The missile is also fitted with a self-destruct element which is armed on launch by setback. The missile has a maximum speed of 600m/s, three times that of the equivalent portable ATGW. The missile is carried in groups of six 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.

9M131 METIS-M –AT-13 SAXHORN-2

© SESU

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	NK
AUW (kg)	4.8
DIMENSIONS (mm)	733x130
COUNTRY OF ORIGIN	Russia/Bulgaria

The 9M131 Metis-M is an improved variant of 9M115 (AT-7 Saxhorn). The 9M131 is the employed in the 9K-115-2 METIS-M and METIS-M1 systems. It is wire-guided SACLOS. Metis literally translates to "cross-breed". The difference between the two is an extended range (due to a different wire spool design) for the M1, along with an enhanced warhead, which incorporate a larger diameter (130mm) shaped charge.

The missiles are housed in fibreglass tubes, sometimes referred to a CLUs. The missile itself is coloured black with white stencilled markings. Unlike earlier versions of the METIS, "9M-131" is consistently marked on both the CLU and missile. The missile is usually fired from the 9P151 tripod ground launcher. The missile is 733mm in length, although the CLU is 980mm. The missile is fitted with a pyrotechnic self-destruct delay which initiates after launch.

A safe waiting period of 30 minutes is recommended before approaching the missile. Given the sensitivity of the missile contact fuze, the missile should not be jolted or moved and should be destroyed in situ.

It should be noted that the main warhead on this missile is situated towards the rear of the missile and is positioned between the wing and the sustain rocket motor venturi. The precursor warhead is in front of the forward control surfaces and may become separated from the main missile fuselage on missiles which have failed to explode.

9K133 KORNET – AT-14 SPRIGGAN

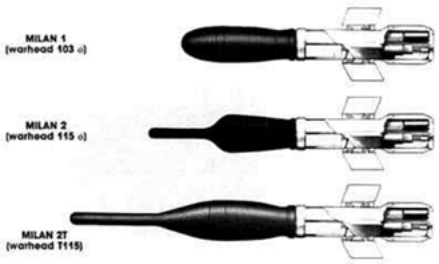
© Sean Moorhouse

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	HEAT variant: 4.3 (OKFOL)
AUW (kg)	27
DIMENSIONS (mm)	1,250 (length), 152 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Electrical crush fuze

The 9K133 Kornet missile system is a tube-launched fin-stabilized laser beam riding AT 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 launched from a crew portable tripod. The missile is fitted with either a tandem charge HEAT warhead (9M133) – which is optimized for anti-armour applications – or an enhanced blast (thermobaric) warhead (9M133F) – which is optimized 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 850g 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 by 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 next to the smaller forward fins. Heat discolouration here, at the rear expulsion charge, along with impact damage, and with the appearance of the missile outside of its launch tube are good indicators of a potentially armed item.

MILAN-2



Left: © Davric. Right: © Open source

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	1.85 (Octol – HMX/TNT)
AUW (kg)	6.73
DIMENSIONS (mm)	769×133
COUNTRY OF ORIGIN	France/Germany

The MILAN (for "missile d'infantrie léger antichar", infantry light AT missile) is a French/German AT missile. The missile is wire-guided and uses a SACLOS guidance. The first versions date from the 1970s. The system has been extensively developed since then, including the change to a tandem warhead to defeat explosive reactive armour (MILAN 2T).

The net explosive content of the missile depends on the version of missile employed. There are two single warhead variants, J103 and K105 and both use an OCTOL (HMX/TNT)-based composition in both the main charge and the booster. The J103 has the smaller warhead of 103mm diameter and a main charge of 1,450g of 75/25 OCTOL. The K115 has a 115mm warhead with a main charge of 1,850g, also of 75/25 OCTOL. Both warheads have a 78g of 85/15 OCTOL booster. The K115 also has a distinct standoff probe containing crush contacts. All variants of the missile use a propulsive gas generator which ejects the missile from the launch tube and a dual-grain boost and sustain rocket motor which contains approximately 1kg of double-base propellant.

The safe-to-arm mechanism works on gas pressure from the motor section. In simple terms, a shutter is unlocked and in moving un-shorts the firing circuit. The missile arms 20m from the firing post.

As all variants of the missile contain a sensitive nose-mounted crush sensor, missiles should absolutely not be jolted or moved and should be destroyed in situ. Operators are reminded of the need for radio frequency precautions when dealing with all guided weapon UXOs, and especially those with wire guidance.

SKIF/STUGNA-P

© SESU

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	Unknown
AUW (kg)	37
DIMENSIONS (mm)	1,435×130–152
COUNTRY OF ORIGIN	Ukraine
FUZE	Unknown, probable electrical crush sensor

The SKIF/Stugna-P is a Ukrainian designed and manufactured AT guided missile which uses 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, while 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 EFP with a fragmentation jacket. The explosive fill is unknown but believed to be HMX-based.

NLAW

Left: © UK MoD. Right: © Sean Moorhouse

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	0.85 (insensitive PBX)
AUW (kg)	12.5
DIMENSIONS (mm)	1,000 (length), 310 (diameter)
COUNTRY OF ORIGIN	UK/Sweden
FUZE	Proximity fuze

The round guided missile NLAW HE AT K170A2 was first introduced into service in the United Kingdom in 2009. It is widely favoured for short-range AT engagements in Ukraine. As a disposable one-shot launcher, theoretically, the weapon can engage targets as close as 20m and as far as 800m. Once the missile leaves the launcher, it is not externally guided but employs a predicted line of sight inertial-based guidance system. This requires the firer to track the target for 3 to 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 120g of a double-base propellant and is separated from the missile after firing. The sustain motor contains approximately 750g 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 1kg.

EOD operators are advised to use a sufficiently large donor charge if disposing of NLAW blinds. A safe waiting period of 30 minutes is recommended 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.

FGM-148 JAVELIN

Left: © Lockhead Martin. Right: © Sean Moorhouse

ORDNANCE SUB-CATEGORY	ATGW
EXPLOSIVE FILL (kg)	Precursor: 0.22, Primary: 2 (HMX-based PBX)
AUW (kg)	16 (missile only, not including CLU)
DIMENSIONS (mm)	1,200 (length), 127 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Electromechanical arming with impact and electro-optical sensors and high voltage exploding foil initiator (EFI)

The FGM-148 is a man-portable AT guided missile with a range of up 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, a solid fuel flight motor and a soft launch motor. The soft launch motor enables firing from enclosed spaces.

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

The energetic used for the precursor and main charge is an insensitive polymer bonded explosive (PBX) explosive.

EOD operators are advised to plan demolition methods accordingly. A safe waiting period of 30 minutes is recommended 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

© Fenix Insight

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	370 (A-IX-1)
AUW (kg)	9.15
DIMENSIONS (mm)	1,440×72
COUNTRY OF ORIGIN	Russian Federation

The 9M32M is the missile component of the 9K32 Strela-2 MANPADS. 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 main components of the system are the 9P54M (9П54M) launch tube which contains the 9M32M missile, the 9B17 (9Э 17) thermal battery, and the 9P58 (9П58) gripstock. The SA-7B is noticeably shorter than the SA-16 and has no aerospike over the infrared 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 infrared 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

© war-time.ru

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	370 (OKFOL)
AUW (kg)	10.3
DIMENSIONS (mm)	1,470×72
COUNTRY OF ORIGIN	Russian Federation

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 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 grip stocks are not interchangeable. The grip stock used with the 9K34 Strela-3 is the 9P58M (9Э 58Э). The missile launch tube associated with the system is the 9P59 (9Э 59). The warhead associated with the 9M36 missile is designated the 9N129 and contains an HMX-based explosive within a preformed 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 while 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 differentiate it from the 9M32.

9M313 IGLA-1 – SA-16 GIMLET

Image © Fenix Insight

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	400 (OKFAL)
AUW (kg)	10.8
DIMENSIONS (mm)	1,673×72
COUNTRY OF ORIGIN	Russian Federation

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. 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 (9Э 238). The grip stock used with the 9K310 Igla is the 9P519 (9Э 519). 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 plasticized 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 while the BCU is fitted, it will be initiated. There are typically two SA-16 per wooden storage case. At the place of firing, the launch tube may be abandoned. Other telltales 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, the Democratic People's Republic of Korea and Ukraine. A naval variant of this MANPAD designated SA-N-10 Grouse may also be encountered.

9M39 IGLA-2 – SA-18 GROUSE

© Fenix Insight

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	400 (OKFAL)
AUW (kg)	10.6
DIMENSIONS (mm)	1,639×72.2
COUNTRY OF ORIGIN	Russian Federation

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 (9Э 238). The grip stock used with the 9K38 Igla-2 is the 9P516 (9Э 516). 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. 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 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 GRINCH

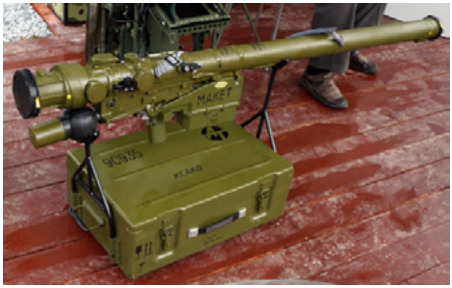
© V.Kuzmin

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	OKFAL
AUW (kg)	11.3
DIMENSIONS (mm)	1,690×72.2
COUNTRY OF ORIGIN	Russian Federation

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 uses an OKFAL charge although the exact amount is not confirmed. The BCU designated for use with the 9M342 missile is the 9B238 (9Э 238). 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. However, the same 9B238 BSU is used. The aerospike on the 9M342 missile is also the same as that used on the 9M39 missile. Apart from the stencilled markings, the 9M342 missile is 41mm longer than the 9M39.

9M336 VERBA – SA 25



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ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	400 (probably HMX composition)
AUW (kg)	17.25
DIMENSIONS (mm)	1,447×72
COUNTRY OF ORIGIN	Russian Federation

The 9M336 is the missile component of the 9K333 Verba ("willow"), and dates from the 2010s. The US DoD designation is SA-25. To date, no NATO designation has been assigned. The components that combine to make up the 9K333 system include the 9P333 (9Э 333) fibreglass launch tube, the 9B238 (9Б238) BCU, the 9P521 (9П521) gripstock and the 9M333 missile. The BCU contains compressed nitrogen for the purpose of cooling the thermal seeker in the nose of the missile. The BCU associated with the 9K333 Verba system is also compatible with the 9K310 (Igla-1/SA-16 Gimlet), the 9K38 (Igla/SA-18 Grouse), and the 9K338 (IGLA-s/SA-24 Grinch). The 9K333 Verba system may make optional use of the 1L229V (1Л229В) target cueing system and the 1PN97 (1ПН97) optical infrared sight.

The missile guidance system is an incremental improvement of that employed with the 9K338 and employs a multi-spectral sensor operating in the ultraviolet, near-infrared and mid-infrared bands. This reduces the effectiveness of aircraft infrared countermeasure systems. The missile employs four pop-out control canards, located in the forward section of the missile, and flight stability is provided by four wrap-around fins at the rear.

The kinematic performance of the missile is very similar to that of the 9K338 (IGLA-s/SA-24 Grinch). The SA-25 and SA-24 are very easily mistakable. Black stencilled marking on the motor section should be used to confirm identity. The BCU contains a pressurized nitrogen bottle. EOD operators should be aware of the potential hazard. Operators should also be aware that removing the BCU by pressing the release catch and sliding the unit forward will initiate the system if the arming lever is rotated. The arming lever must be checked before any positive action. Caution is advised.

PPZR PIORUN

© Mesko S. A.

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (g)	Unknown
AUW (kg)	10.25
DIMENSIONS (mm)	1,596×72
COUNTRY OF ORIGIN	Poland

The Piorun (“thunderbolt”) is an improved model of the Grom, which itself is a Polish version of the 9K38 SA-18 Grouse. 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.

AIR DEFENCE SYSTEMS

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

© John Montgomery

ORDNANCE SUB-CATEGORY	Surface-to-air missile
EXPLOSIVE FILL (kg)	21
AUW (kg)	690
DIMENSIONS (m)	5.5×0.4
COUNTRY OF ORIGIN	Russian Federation

The Buk ("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 platform.

The missile incorporates a dual-stage solid rocket motor and is rail-launched from a tracked armoured vehicle. It employs semi-active radar homing and has a seeker head mounted in its front section. Later variants of the Buk employ a tube-launched missile. Earlier versions are designated SA-11 by the US DoD and Gadfly by NATO. The later Buk-M1-2 and Buk-M2 have the DoD designation SA-17 and the NATO designation Grizzly. The Buk-M3 has the DoD designation SA-27. Later versions tend to have a slightly extended range, up to 45km. The GRAU codes of earlier missiles for the SA-11 are 9M38 or 9M38M1, while for later versions associated with the SA-17 Grizzly, it is 9M317.

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.

9M33 OSA – SA-8 GECKO

ORDNANCE SUB-CATEGORY	Short-range surface-to-air missile
EXPLOSIVE FILL (kg)	7 (RDX/TNT)
AUW (kg)	128
DIMENSIONS (m)	3.16 (length), 0.21 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Electromechanical safety and arming mechanism with proximity fuze

The 9M33 Osa (wasp) – (NATO reporting name SA-8 Gecko) is a short-range air-to-surface missile used by the armed forces of the Russian Federation and Ukraine. The missile is fired from a self-contained launch box mounted on a transporter erector launcher and radar (TELAR) vehicle.

The front of the missile contains the guidance electronics and control system. Next is the spherical pneumatic reservoir filled with high-pressure air which operates the canard type control surfaces. The 9N16 or 9N316 warhead has an all-up weight of approximately 15kg and employs an RDX/TNT explosive filling. The explosive charge is surrounded by a preformed matrix of steel fragments to provide the missile with the desired lethality characteristics.

The warhead is initiated by a proximity fuze and has a self-destruct function which causes the missile warhead to detonate after a predetermined delay should the missile miss the target. The rear of the missile is fitted with a single-stage rocket motor with a dual-thrust (boost and sustain) propellant grain, which contains 56kg of composite rocket propellant. The rear section also contains the rolling fins and guidance antennae.

The efflux produced by the rocket motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. Appropriate PPE should be worn when handling fired rocket motors.

S-300 – SA-10 GRUMBLE

Left: © SESU. Right: © Dr Carlo Kopp

ORDNANCE SUB-CATEGORY	Long-range surface-to-air missile
EXPLOSIVE FILL (kg)	65, estimated (RDX-based explosive composition)
AUW (kg)	5V55K: 1,665, 48N6: 1,800
DIMENSIONS (m)	5V55K: 7.25 (length), 0.514 (diameter) 48N6: 7.5 (length), 0.514 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Electromechanical safety and arming system with radar proximity and impact fuzes

The S-300 (NATO reporting name SA-10 Grumble) and its many variants and derivatives is in service with both the Ukrainian armed forces and the Russian Federation as a long-range air defence system. The S-300 missile is also used in the surface-to-surface mode by the Russian Federation. The earliest variants of missile were designated 5V55K, later variants included the 48N6 and 48N6E2.

The missile has four main sections: 1) the guidance section at the front, which contains the semi-active radar homing (SARH) seeker head and guidance electronics, 2) the warhead, 3) the single-stage rocket motor, which takes up most of the rear two thirds of the missile and 4) the control section at the rear, which consists of four equally spaced fins and a thrust vector control system.

The S-300 is transported and launched using a cold launch gas ejector from its transit tube. The missile has both inertial and command guidance and utilizes SARH guidance in its terminal phase. The S-300 is fitted with a 5Zh93 blast fragmentation warhead and has preformed metal fragments contained within a curved metal body (see left image). All variants of the S-300 missile are believed to employ a single-stage rocket motor with a composite propellant grain (48D6 rocket motor is used in the 5V55 series of missiles).

This type of propellant produces toxic efflux, and PPE should be worn when handling expended rocket motors. Crashed missiles should be approached from the rear to avoid ranging the radar proximity fuze, which is mounted in the front section of the missile.

9M330 TOR – SA-15 GAUNTLET

© RecoMonkey.com

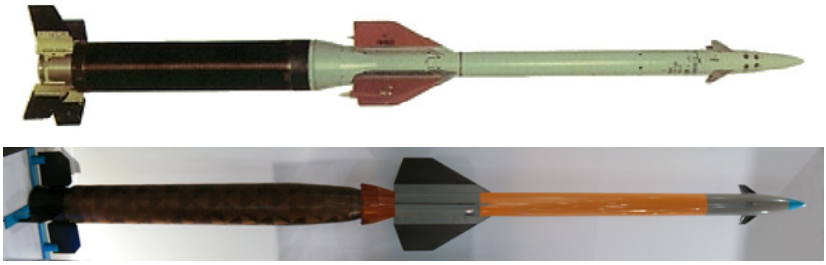
ORDNANCE SUB-CATEGORY	Short-range surface-to-air missile
EXPLOSIVE FILL (kg)	7 (probable RDX/TNT)
AUW (kg)	165
DIMENSIONS (m)	2.9 (length), 0.23 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Electromechanical safety and arming mechanism with contact and proximity fuzes

The 9M330 Tor (NATO reporting name SA-15 Gauntlet) is a short-range air-to-surface missile fired from a self-contained launch box mounted on a tracked transporter launcher and radar (TLAR) vehicle. The 9M330 Tor missile is superficially similar to the 9M33 Osa missile and operates on radio command guidance in automatic command line of sight (ACLOS) mode.

The front of the missile contains the guidance electronics and clipped delta wing control fins. The control surfaces are pneumatically operated by high-pressure air. The blast/fragmentation warhead has an all-up mass of 14.5kg and probably uses an RDX/TNT explosive filling. It is similar in configuration to the 9N316 warhead used on the 9M33 Osa missile. The safety and arming mechanism is mounted at the front of the warhead. The explosive charge is surrounded by a preformed matrix of steel fragments. The warhead is initiated by a contact or proximity fuze and has a self-destruct function, which causes the missile warhead to detonate after a predetermined delay should the missile miss the target. The rear of the missile is fitted with a single-stage composite rocket motor. The rear section also contains the rolling stabilizing fins.

The efflux produced by the rocket motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. Appropriate PPE should be worn when handling fired rocket motors. Crashed 9M330 Tor missiles should be approached from the rear to avoid ranging the nose-mounted radar proximity fuze. Note that the warhead on this missile is some distance from the nose and is positioned just in front of the rocket motor section.

9M335 – SA-22 GREYHOUND



Top: © 9M311 KBP. Bottom: © 57E6 Allocer

ORDNANCE SUB-CATEGORY	Short-range surface-to-air missile
EXPLOSIVE FILL (kg)	5 (probably RDX- or HMX-based)
AUW (kg)	75
DIMENSIONS (m)	3.2 (length), 0.21 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Electromechanical safety and arming mechanism with contact and proximity fuzes

The 9M335 (NATO reporting name SA-22 Greyhound) is a short-range air-to-surface missile used by the Pantsir self-propelled gun and anti-aircraft missile (SPAAGM) system. It is a derivative of the earlier 9M311 (SA-19 Grison) system. This system also incorporates a twin 30mm 2A38M cannon. The missile is cold-launched from a self-contained launch tube mounted on the turret of the transporter launcher and radar (TLAR) vehicle. It employs a first-stage boost motor which is discarded when all propellant is consumed, the second-stage section then coasts to the target under control. There are several missile variants in service, including the 57E6 (57Э 6) and the 9M335, which incorporates an improved continuous rod warhead. The 9M335 warhead has an all-up mass of 16kg.

The missile has a distinctive configuration with a thicker filament wound boost stage rocket motor and a thinner dart-like projectile for the second stage. The boost stage motor consists of a single propellant grain and employs a double-base composition. Note that there is no rocket motor in the second stage. The second stage is controlled by four equally spaced canards on the nose and stability in flight is provided by four fins at the rear. The boost motor is also fitted with four folding fins. Electrical power for the second stage is provided by a thermal battery and power for the control actuators is from a pyrotechnic gas generator.

An appropriate safe waiting period is recommended before approaching crashed missiles to allow firing capacitors to discharge. Missiles should be approached from the rear to avoid ranging the proximity fuze, which is mounted in the nose.

IRIS-T

© Diehl Defence

ORDNANCE SUB-CATEGORY	Medium-range air defence missile
EXPLOSIVE FILL (kg)	11.4 (type unknown)
AUW (kg)	87.4
DIMENSIONS (m)	2.94 (length), 0.127 (diameter), 0.447 (wingspan)
COUNTRY OF ORIGIN	Germany
FUZE	Radar proximity and contact fuze

The IRIS-T SL is a surface-launched variant of the IRIS-T air-to-air missile which is in service with the Ukrainian armed forces. The missile has four main sections: 1) the guidance section at the front, which has the antennae for the radar proximity fuze mounted on its outer surface, 2) the warhead, indicated by a yellow circumferential hazard band, 3) the propulsion system, a dual-thrust rocket motor, which takes up most of the rear half of the missile and is indicated by a brown circumferential hazard band and 4) the control section at the rear.

The missile is fitted with a blast/fragmentation warhead with an unknown filling. The missile rocket motor contains a composite rocket propellant based on ammonium perchlorate and aluminium with an HTPB polymeric binder.

The efflux produced by the rocket motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. Appropriate PPE should be employed when handling fired rocket motors.

A safe waiting period of 60 minutes is recommended before approaching a crashed IRIS-T missile. The missile should be approached from the rear to avoid ranging the radar proximity fuze.

NASAMS

© Raytheon

ORDNANCE SUB-CATEGORY	Medium-range air defence missile system
EXPLOSIVE FILL (kg)	6.7 (PBX (AF)-108 – RDX-based) or 7.2 (PBX-110 – HMX-based)
AUW (kg)	161
DIMENSIONS (m)	3.66 – 12 feet (length), 0.178 – 7 inches (diameter)
COUNTRY OF ORIGIN	Norway/United States
FUZE	FZU-49 safety, arming and fuzing (SAF) device with contact fuze and target detection device (proximity fuze)

The national advanced surface-to-air missile system (NASAMS) is a ground-launched variant of the AIM-120 advanced air-to-air missile (AMRAAM). The missile has four main sections: 1) the guidance section at the front, which contains the active radar seeker head, 2) the warhead, indicated by a yellow circumferential hazard band, immediately in front of the missile wing, 3) the propulsion system, which takes up most of the rear half and is indicated by a brown circumferential hazard band and 4) the control section at the rear. The missile has four longitudinal equally spaced target detection device (TDD) antennae located along the guidance section.

Two variants of a blast/fragmentation warhead may be fitted to the missile. The WDU-33 baseline model contains 6.7kg of PBX(AF)-108. The WDU-31 enhanced lethality warhead contains 7.2kg of PBXN-110. The missile rocket motor contains 45 to 52kg of a composite rocket propellant based on ammonium perchlorate with an HTPB polymeric binder.

The efflux produced by the rocket motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. Appropriate PPE should be employed when handling fired rocket motors. If a missile has been fired and has failed to function, a minimum safe waiting period of 90 minutes is recommended to allow thermal batteries and firing capacitors to discharge. Crashed missiles should be approached from the rear to avoid the detection area of the TDD.

K130 STARSTREAK

© Roly Evans

ORDNANCE SUB-CATEGORY	Missile
EXPLOSIVE FILL (kg)	Unknown
AUW (kg)	14
DIMENSIONS (m)	1.4×0.13
COUNTRY OF ORIGIN	United Kingdom

The K130 Starstreak or high-velocity missile 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 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 infrared 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.

MIM-23 HAWK

© Popular Mechanics/Ukraine MoD

ORDNANCE SUB-CATEGORY	Medium-range surface-to-air missile
EXPLOSIVE FILL (kg)	36 (H-6 – RDX/TNT/aluminium)
AUW (kg)	635
DIMENSIONS (m)	5 (length), 0.37 (diameter), 1.2 (wingspan)
COUNTRY OF ORIGIN	United States
FUZE	Electromechanical safety and arming mechanism

The MIM-23 Hawk (homing-all-the-way killer) surface-to-air missile is a guided missile which operates on the semi-active radar homing principle. It is currently in service with the Ukrainian armed forces.

The colour of the missile is olive drab. It has a yellow boxed circumferential marking around the warhead section and a brown boxed circumferential marking around the rocket motor section. The forward part of the missile contains the radar seeker head and guidance electronics. Immediately behind this section is the pneumatic accumulator, which contains high-pressure nitrogen gas that powers the hydraulicly operated control surfaces. The M155 blast/fragmentation warhead is in front of the wings and has an M100 safety and arming mechanism mounted on its front. The preformed metal fragments are contained within the warhead's polymeric casing. The M112 dual-thrust rocket motor contains 195kg of a composite rocket propellant (ammonium perchlorate, aluminium and a polyurethane binder).

Under no circumstances should any attempt be made to dismantle a crashed missile. Doing so will cause the missile warhead to detonate. The rocket motor efflux is toxic and when mixed with water, it produces hydrochloric acid. Appropriate PPE should be worn when handling fired missile fragments.

MIM-104 PATRIOT

ORDNANCE SUB-CATEGORY	Long-range air defence missile
EXPLOSIVE FILL (kg)	32 (composition B – RDX/TNT) for MIM-104A/B
AUW (kg)	910
DIMENSIONS (m)	5.3 (length), 0.4 (width – PAC-3: 250)
COUNTRY OF ORIGIN	United States
FUZE	M143 safety and arming mech with EFI

The MIM-104 Patriot missile is a single-stage missile with a proximity fuze-initiated blast/fragmentation warhead. It is in use with the Ukrainian armed forces. The MIM-104 early variants of the missile are structured in four sections: 1) the front section, which includes the radome and terminal guidance section, 2) the warhead section immediately behind the terminal guidance section, which is fitted with four longitudinal equally spaced fuze sensors, 3) the propulsion section, which takes up approximately the next two thirds of the missile and 4) the control section at the rear.

The control system is operated by a pneumatic reservoir which is charged with high-pressure gas. The PAC-3 Patriot variant (MIM-104E) has a smaller diameter (0.25 m) than earlier variants and is fitted with an attitude control system forward of the warhead.

The MIM-104A Patriot missile contains approximately 32kg of composition B-4 (RDX/TNT) and the warhead body is composed of preformed fragments secured within a thin metal skin. The rocket motor contains approximately 500kg of a solid propellant.

If a missile has been fired and has failed to function, a minimum safe waiting period of 90 minutes is recommended to allow thermal batteries and firing capacitors to discharge. Care should also be taken when operating in close proximity to control surfaces.

LONG-RANGE MISSILES

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

© SESU

ORDNANCE SUB-CATEGORY	Short-range ballistic missile
EXPLOSIVE FILL (kg)	Various
AUW (kg)	2,000
DIMENSIONS (m)	6.4×0.65
COUNTRY OF ORIGIN	Russian Federation

The OTR-21 (for *operativno-takticheskiy raketnyy*, operational tactical missile) Tochka is a short-range ballistic missile 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.

The missile uses a single-stage solid propellant motor, with fin stabilization 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 submunition warheads. The unitary warhead (9N123F) employs a primary laser fuzing system with a secondary impact fuze. The submunition warhead (9N123K) employs a radar altimeter fuze which is programmed to release submunitions at the optimum height based on the submunition 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 classified as 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 900kg 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 by 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 250kg of persistent nerve agent, probably VX.

ISKANDER – SS-26 STONE

© TASS

ORDNANCE SUB-CATEGORY	Short-range ballistic missile
EXPLOSIVE FILL (kg)	Various
AUW (kg)	3,800 at launch
DIMENSIONS (m)	7.2 (length), 0.92 (diameter)
COUNTRY OF ORIGIN	Russian Federation

The code name Iskander covers a family of short-range ballistic missiles and cruise missiles which are launched from a common transporter erector and launcher platform (9P78-1). The designation used by the US DoD and NATO is SS-26 Stone. The maximum stated range of the Iskander/SS-26 Stone is 500km, 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 has largely replaced the 9M79/SS-21 Scarab in Russian service.

The missile employs a two-stage solid propellant motor, with fin stabilization and thrust vector control. The missile uses a combination of inertial guidance, Glonass satellite guidance and terminal guidance based on digital scene matching with area correlation (DSMAC). The Iskander missiles may be fitted with a variety of unitary or submunition 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 submunition 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, can be launched from Tu-22 strategic bombers and MiG-31 aircraft (see separate entry for further details of this missile). 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 (see separate entry).

KH-22 BURYA – AS-4 KITCHEN

© Bob Seddon

ORDNANCE SUB-CATEGORY	Air-to-surface cruise missile
EXPLOSIVE FILL (kg)	580 (TGAG-5 – RDX/TNT/aluminium)
AUW (kg)	Approximately 5,400
DIMENSIONS (m)	11.7 (length), 0.9 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Unknown

The Kh-22 Burya (NATO reporting name AS-4 Kitchen) is a Russian long-range air-to-surface missile originally designed to attack NATO aircraft carriers and used in Ukraine in the land attack mode. The Kh-22 may be launched by the Tu-95 (Bear) or Tu-22M3 (Backfire) maritime strike aircraft. The missile employs toxic hypergolic liquid fuels and at launch contains approximately 720kg of TG-02 fuel (triethylamine/xylidine) and 2,300kg of AK-27P (inhibited red fuming nitric acid (IRFNA)/nitrogen tetroxide). Unusually for a missile of this size, the conventionally armed variant of this missile employs a shaped charge warhead.

The missile is structured in four parts: 1) the forward section, which contains the seeker head and guidance system, 2) the warhead, 3) the oxidizer and fuel tanks, which take up the middle half of the missile with the oxidizer tank in front of the fuel tank and 4) the rear section with the separate boost and sustain engines, and the control system. The control system operates using compressed gas stored in several high-pressure vessels located to the rear of the fuel tank.

The liquid propellants used in this missile will explode spontaneously when mixed and are **extremely toxic**. IRFNA is immediately dangerous to life at low concentrations and xylidine is a suspected human carcinogen. For first responders dealing with this missile, **PPE must be worn**, which provides full skin coverage and respiratory protection. Even after main engine cut-off, the missile tanks contain substantial (life-threatening) quantities of propellant. Great care should be taken ensuring that any material recovered from Kh-22 missile incidents is appropriately decontaminated.

KH-47 KINZHAL – AS-24 KILLJOY

Left: © SESU. Right: © www.kremlin.ru

ORDNANCE SUB-CATEGORY	Air-launched ballistic missile
EXPLOSIVE FILL (kg)	250, estimated (probably RDX-based composition)
AUW (kg)	Approximately 4,300
DIMENSIONS (m)	7.2 (length), 1.2 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Dual proximity, impact and delay variants

The Kh-47 Kinzhal (NATO reporting name AS-24 Killjoy) is a Russian long-range air-to-surface ballistic missile launched primarily from the MiG-31 aircraft. The missile is largely based on the 9M723-1F variant of the Iskander (SS-26 Stone) short-range ballistic missile. See separate entry on the Iskander for additional details. The missile has been used extensively by the Russian Air Force during the war in Ukraine.

The missile has been modified for air launch through the addition of a tail cone and four fins at the rear of the missile. The missile employs a combination of inertial guidance, Glonass and some form of precision guidance in the terminal phase, possibly either optical (digital scene matching with area correlation – DSMAC) or millimetric wave.

Due to its very high impact velocity, warheads which fail to function will usually bury themselves deeply and require considerable effort to reach. The warhead, as with most Russian large air-launched missiles, is fitted with two fuzes.

KH-59 OVOD – AS-13 KINGBOLT

© Global Defense News

ORDNANCE SUB-CATEGORY	Air-to-surface missile
EXPLOSIVE FILL (kg)	70 (explosive type unknown)
AUW (kg)	790
DIMENSIONS (m)	5.1 (length), 0.38 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Unknown

The Kh-59 Ovod (Gadfly) (NATO reporting name AS-13 Kingbolt) is a Russian tactical air-to-surface missile originally designed as the principal ground attack weapon for the Su-24 (Fencer) and MiG-27 (Flogger). It is often employed in suppression of enemy air defence (SEAD) roles with the Kh-31 (AS-17 Krypton) anti-radiation missile.

The missile is structured in four parts: 1) the forward section, which contains the electro-optical seeker head and the guidance electronics, 2) the warhead, 3) the sustain rocket motor and 4) the rear section, which contains the control system, control surfaces and the boost motor. Flight stability is provided by four equally spaced fixed fins mounted behind the seeker head.

The missile employs a combination of electro-optical (TV) command and inertial guidance. The missile is fitted with a blast/fragmentation warhead with an all-up mass of 148kg. The explosive weight is assessed to be 70kg of an unknown explosive type. The missile has a two-stage rocket motor which may be based on a composite propellant type. The booster motor is ejected after the missile reaches its cruising velocity.

KH-59M OVOD – AS-18 KAZOO

© Espreso Global

ORDNANCE SUB-CATEGORY	Air-to-surface missile
EXPLOSIVE FILL (kg)	Variable, up to 150 (explosive type unknown)
AUW (kg)	850
DIMENSIONS (m)	5.1 (length), 0.38 (diameter)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Unknown

The Kh-59M Ovod M (Gadfly) (NATO reporting name AS-18 Kazoo) is a development of the Kh-59 (AS-13 Kingbolt) with a significantly improved range and a larger payload. This missile has been launched from Russian tactical combat aircraft against largely static targets in Ukraine.

The missile is structured in four parts: 1) the forward section, which contains the electro-optical seeker head and the guidance electronics, 2) the warhead, 3) the kerosene fuel tank for the sustain engine and 4) the rear section, which contains the control system and solid fuel launch motor. The missile is powered in flight by a Saturn 36MT turbojet (the same model as the Kh-101 ALCM), which is permanently fixed below the mid-fuselage.

The missile employs a combination of inertial and electro-optical guidance. The missile may be fitted with three variants of warhead: an armour-piercing warhead with a mass of 315kg, a shaped charge warhead with a mass of 285kg, and a submunition warhead which employs spherical munitions, similar to those used on the Kh-101 missile (see separate entry).

Crashed Kh-59M missiles may pose a fire hazard due to unburnt kerosene propellant remaining in the sustain engine fuel tank.

KH-69 AIR-LAUNCHED CRUISE MISSILE

© SESU, Raduga Design Bureau

ORDNANCE SUB-CATEGORY	Air-to-surface missile
EXPLOSIVE FILL (kg)	Approximately 150 kg, explosive type not confirmed
AUW (kg)	Approximately 770 kg
DIMENSIONS (m)	6 (length), 0.42 (diameter), 1.5 (wingspan)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Warhead type dependent

The Kh-69 air-launched cruise missile is derived from the Kh-59MK2 (NATO reporting name AS-18 Kazoo) and is a Russian equivalent of the Anglo-French Storm Shadow/SCALP EG. It may be launched by a range of Russian modern tactical combat aircraft and is the principal long-range missile employed with the Su-57 Felon aircraft. Information on this missile is scarce, and details may change as more information is released.

The missile uses composite materials and has a box-shaped trapezoidal configuration with a low radar cross section. The missile is structured in four parts: the forward section contains the electro-optical seeker head and guidance electronics; next is the warhead; the next section contains the kerosene fuel tank for the sustain engine; and the rear section contains the sustain motor, the control system, which operates four equally spaced folding fins, and solid fuel launch motor. The blast-fragmentation warhead has an all-up mass of 310 kg, and the main charge is most likely a TN- or RDX-based military explosive. The sustain engine is a turbofan powered by kerosene. Unlike the pod-mounted turbofan associated with the Kh-101 (AS-23 Kodiak) and the Kh-59 (AS-18 Kazoo), the Kh-69 sustain engine, which is probably a derivative of the Saturn 36MT engine, is mounted conventionally within the rear missile fuselage.

The missile employs a combination of inertial navigation, global navigation satellite system (GNSS) mid-course correction, and electro-optical terminal guidance, the latter being a variant of digital scene matching with area correlation (DSMAC). The GNSS guidance

system is believed to be based on an electronic warfare-resistant multi-band Kometa-M design. So far, two warhead variants appear to have been fielded. One is a single high explosive unitary warhead and is fitted with two dual redundant fuzes. The other is a submunition warhead, similar to that used with the Kh-59MK2 (AS-18 Kazoo). The spherical submunition functions on impact and incorporates the 136B3 pyrotechnically armed inertia fuze. Crashed or shot down Kh-69 missiles may pose a fire hazard due to unburnt kerosene propellant remaining in the sustain engine fuel tank.

KH-101 – AS-23 KODIAK

Top: © SESU. Bottom: © Russian Federation MoD

ORDNANCE SUB-CATEGORY	Air-launched cruise missile
EXPLOSIVE FILL (kg)	Single unitary: 225 Tandem unitary: 400 (tandem submunition)
AUW (kg)	Approximately 2,300
DIMENSIONS (m)	7.4 (length), 0.51 (width)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Unitary warheads each fitted with dual electrical fuzes

The Kh-101 (NATO reporting name AS-23 Kodiak) is the principal Russian long-range air-to-surface cruise missile and is most often launched by the Tu-95 (Bear), Tu-22M3 (Backfire) or Tu-160 (Blackjack) aircraft. The missile is fitted with a kerosene-fuelled turbofan engine, which drops into its flight position after launch. The missile body is shaped to provide aerodynamic lift and a low radar signature. Two large composite wings are deployed automatically after launch.

The Kh-101 missile uses a combination of inertial navigation, terrain reference and global navigation satellite system (GNSS) with Glonass as the primary GNSS source. Terminal accuracy on some missiles is provided by an electro-optical seeker, which provides a variant of digital scene matching and area correlation (DSMAC). Some variants of the missile are fitted with an infrared flare countermeasure system, which ejects flares during the terminal phase of the missile's trajectory.

Three warhead variants have been encountered (not including the nuclear-armed Kh-102 variant). The single unitary warhead is fitted to the long-range missile. It has an all-up mass of 450kg and contains approximately 225kg of an unidentified high explosive. The dual unitary warhead variant is fitted to the shorter-range Kh-101 (through the replacement of fuel for warhead mass). Its combined all-up mass is 800kg with an assessed explosive content of 400kg. A tandem submunition warhead has also been fielded and each contains spherical submunitions (see separate entry).

STORM SHADOW – SCALP EG

Left and middle: © Paul Grimsley. Right: © MBDA UK Ltd

ORDNANCE SUB-CATEGORY	ALCM
EXPLOSIVE FILL (kg)	Precursor charge: 50 Follow-through bomb: 60
AUW (kg)	1,300 on launch
DIMENSIONS (m)	5.1 (length), 0.63 (width)
COUNTRY OF ORIGIN	United Kingdom/France
FUZE	Multi-application fuze initiation system (MAFIS)

The Storm Shadow Missile K230A1 (British designation) or SCALP EG (French designation) is an air-launched, long-range, air-to-surface cruise missile, which is designed for attacks against high-value fixed or stationary targets, such as hardened bunkers or key infrastructure. The missile has an all-weather, day and night capability and combines GPS, inertial navigation and terrain referencing precision navigation systems. After launch, the missile descends to a low-level flight profile to avoid detection. On approaching the target, the missile uses an infrared based digital scene matching and area correlation (DSMAC) sensor to ensure precision strike. Storm Shadow is qualified for operation from Tornado, Eurofighter Typhoon, Rafale, Mirage and Ukrainian Su-24 aircraft.

Storm Shadow is fitted with the two-stage BROACH warhead. On approaching the target, the missile nose-mounted sensor detects the target at a predetermined standoff and initiates the precursor charge. The precursor charge is a shaped charge and is designed to penetrate a variety of target materials, including reinforced concrete. The precursor charge jet creates a channel through which the follow-through bomb can penetrate and then detonate within the target structure. The precursor charge is a polymer-bonded explosive (PBX) based on cast HMX and the follow-through bomb is a PBX based on RDX.

Crashed missiles will normally have the warhead components separated from the fuselage with MAFIS fuzes remaining attached. Normal precautions for high-voltage initiation systems should be applied. Unburnt kerosene fuel may also pose a fire hazard.

GROUND-LAUNCHED SMALL-DIAMETER BOMB

© Saab

ORDNANCE SUB-CATEGORY	Ground-launched precision-guided munition
EXPLOSIVE FILL (kg)	16.5 (AFX-757 PBX – RDX/Al/AP with HTPB)
AUW (kg)	GBU-39 SDB only: 130
DIMENSIONS (m)	GBU-39 SDB only: 1.8 (length), 0.19 (diameter)
COUNTRY OF ORIGIN	Sweden/United States
FUZE	ESAF device

The ground-launched small-diameter bomb (GLSDB) is an amalgam of the rocket motor associated with the MLRS/HIMARS family of munitions and the GBU-39 SDB (see separate entries). The GBU-39 SDB has been integrated with the MLRS rocket motor to provide a standoff weapon system which is compatible with any launcher that can fire MLRS rocket pods, of which the M270 tracked MLRS and M142 HIMARS are both in service with the Ukrainian armed forces. The GBU-39 SDB is programmed with target and flight path data prior to launch. The missile is launched in a similar manner to the GMLRS missile and the GBU-39 SDB bomb is secured to the rocket motor via an adapter. At the high point on the rocket's trajectory, the bomb is released from the launch rocket motor and the bomb's diamond back wings are deployed, enabling the bomb to glide under control towards its target.

The GLSDB rocket motor contains approximately 118kg of Arcadene 361 composite propellant based on aluminium and ammonium perchlorate with a HTPB polymeric binder. The efflux produced by the motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. Appropriate PPE should be employed when handling fired rocket motors.

If a GLSDB has been fired and has failed to function, a minimum safe waiting period of 60 minutes is recommended to allow firing capacitors in the GBU-39 SDB bomb to discharge.

M31 GMLRS – HIMARS/M270 MLRS

© Lockheed Martin

ORDNANCE SUB-CATEGORY	Long-range guided missile
EXPLOSIVE FILL (kg)	24 (PBXN-109 – RDX/aluminium with HTPB binder)
AUW (kg)	Approximately 302
DIMENSIONS (m)	3.9 (length), 0.23 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Electronic Safe Arm Fuze (ESAF) with Low Energy Exploding Foil Initiator (LEEFI)

The M31 Guided MLRS is a single-stage long-range surface-to-surface guided missile which may be fired from the wheeled M142 HIMARS or tracked M270 MLRS launchers. This US-manufactured missile is in service with the Ukrainian armed forces.

The forward section of the missile contains the guidance system, the centre section contains the warhead, and the rear section contains the rocket motor and spinning tail fin assembly. The control canards are positioned at the front of the missile, just behind the nose. The ceramic nose houses the proximity sensor and the thermal battery. The principal method of guidance is through the inertial measuring unit with GPS assistance where appropriate. The missile employs a unitary warhead with an RDX polymer–bonded main charge contained with a warhead casing which is optimized for fragmentation. The ESAF is fitted inside the rear of the warhead and is initiated by a low energy exploding foil initiator (LEEFI).

The GMLRS missile system employs a rocket motor which contains approximately 118kg of Arcadene 361 composite propellant based on aluminium and ammonium perchlorate with a HTPB polymeric binder. The efflux produced by the motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. $Appropriate PPE should be employed when handling fired rocket motors.

If a missile has been fired and has failed to function, a minimum safe waiting period of 90 minutes is recommended to allow thermal batteries and firing capacitors to discharge. The missile should be approached from the rear, and the hazard posed by the proximity fuze and unprompted movement of the control actuators and canards should be considered.

MGM-140 ATACMS

© US DoD

ORDNANCE SUB-CATEGORY	Long-range guided missile
EXPLOSIVE FILL (kg)	See separate entry on the M74 submunition
AUW (kg)	Approximately 1,650
DIMENSIONS (m)	4 (length), 0.61 (diameter)
COUNTRY OF ORIGIN	United States
FUZE	Electronic Safe Arm Fuze (ESAF) with Low Energy Exploding Foil Initiator (LE EFI)

The MGM-140 ATACMS is a single-stage long-range surface-to-surface missile which may be fired from the wheeled M142 HIMARS or tracked M270 MLRS launchers. This US-manufactured missile is in service with the Ukrainian armed forces. The principal ATACMS variant in use in Ukraine is the M39 missile which delivers between 930 and 950 M74 submunitions. The M74 submunition is covered elsewhere in this guide. A warhead skin severance system, based on detonating cord, separates sections of the missile skin at the optimum time in flight and permits the dispersal of the M74 submunition payload.

The forward section of the missile contains the guidance system, the centre section contains the warhead, and the rear section contains the rocket motor. The control system and fins are located at the back of the missile and wrap around the rocket motor venturi. The control fins are operated electrically and the thermal batteries to power the guidance electronics and control system are located in the rear section.

All variants of the MGM-140 ATACMS missile employ a rocket motor which contains approximately 730kg of a composite propellant based on aluminium and ammonium perchlorate with a polymeric binder (HTPB). The efflux produced by the motor is toxic and when burnt propellant is mixed with water, hydrochloric acid is produced. Appropriate PPE should be employed when handling fired rocket motors.

If a missile has been fired and has failed to function, a minimum safe waiting period of 5 hours is recommended to allow thermal batteries and firing capacitors to discharge.

FUZES

MVCH-62

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	15 (PETN booster plus mine detonator)
AUW (g)	No data
DIMENSIONS (mm)	144
COUNTRY OF ORIGIN	Russian Federation/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 brings the detonator into line with the striker. The fuze is designed to operate when approximately 200kg 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.

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

MVP-62M

© Roly Evans

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	No data
AUW (g)	No data
DIMENSIONS (mm)	122×80
COUNTRY OF ORIGIN	Russian Federation/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 delays the movement in line of the detonator by up to 300 seconds. The fuze is designed to operate when approximately 120kg is applied to the pressure plate. While made out of "minimum metal", the striker, the striker spring, the larger side spring and the 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, symbolized by two semi-circles or overlapping circles as per the image above.

M-6

© Roly Evans

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	6–10 (tetryl)
AUW (g)	168
DIMENSIONS (mm)	51×83×40
COUNTRY OF ORIGIN	Russian Federation/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, setback 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 use aluminium for the windshield. Chinese versions use 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

© Roly Evans

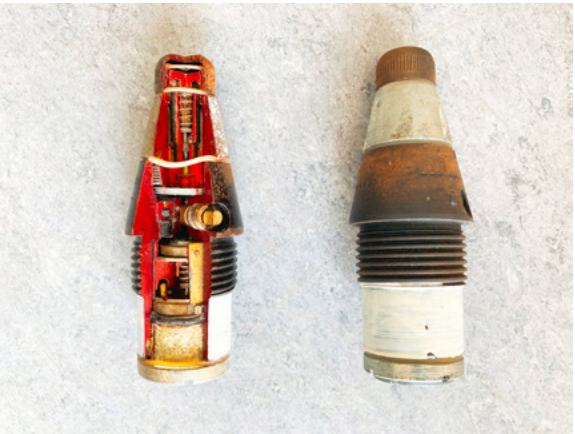
ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	23 (tetryl)
AUW (g)	535
DIMENSIONS (mm)	117×40
COUNTRY OF ORIGIN	Russian Federation/China

The M-12 is the standard impact fuze for 120mm high-explosive mortar rounds. It dates from the late 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 uses the standard setback-armed mechanical fuze design that incorporates holding devices including a creep spring, setback 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



© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	12.5 (tetryl)
AUW (g)	438
DIMENSIONS (mm)	106×40
COUNTRY OF ORIGIN	Russian Federation

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, while 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

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	Unknown
AUW (g)	Unknown
DIMENSIONS (mm)	125×40
COUNTRY OF ORIGIN	Russian Federation

The GPV-3 (supposedly for *golovnoy pyezoelektricheskiy vzryvatel*, head piezoelectric fuze) 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.

As with many Russian projectile fuzes, the thread is 36mm.

AR-5

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	Unknown (tetryl)
AUW (g)	500
DIMENSIONS (mm)	130×44
COUNTRY OF ORIGIN	Russian Federation

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 using suboptimal mechanical impact fuzing.

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

T-7

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ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	7
AUW (g)	626
DIMENSIONS (mm)	157×64
COUNTRY OF ORIGIN	Russian Federation

The T-7 is a powder train time fuze 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

Left: MRV fuze. Right: MRV fuze cutaway. © Dutch EOD Center

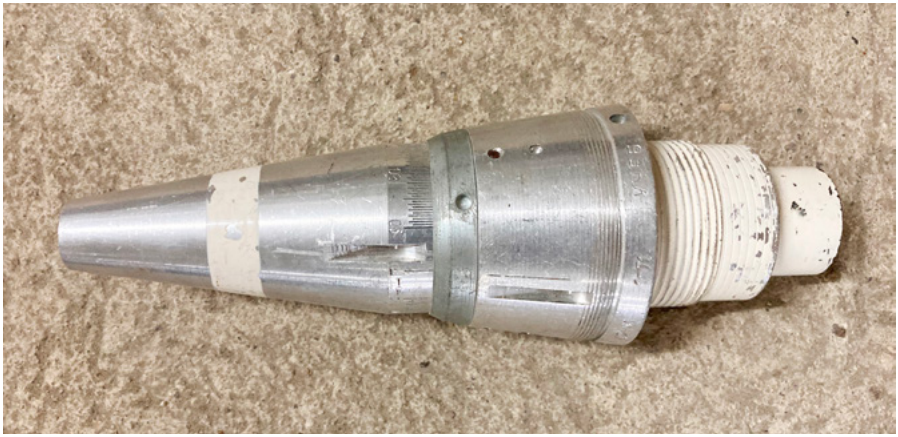
ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	29g Tetryl or PETN
AUW (g)	746g
DIMENSIONS (mm)	195x64
COUNTRY OF ORIGIN	Russia

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 is the shape of the nose cap. The basic fuze design is similar in principle to the M-12 mortar fuze.

The basic setback 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, India and the Islamic Republic of Iran. 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



© Danish EOD and Search Center

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	Unknown quantity of black powder or pyrotechnic composition
AUW (g)	694
DIMENSIONS (mm)	196×64
COUNTRY OF ORIGIN	Russian Federation

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

© Dutch EOD Center

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	100 (pyrotechnic composition)
AUW (g)	Unknown
DIMENSIONS (mm)	64×86
COUNTRY OF ORIGIN	Russian Federation

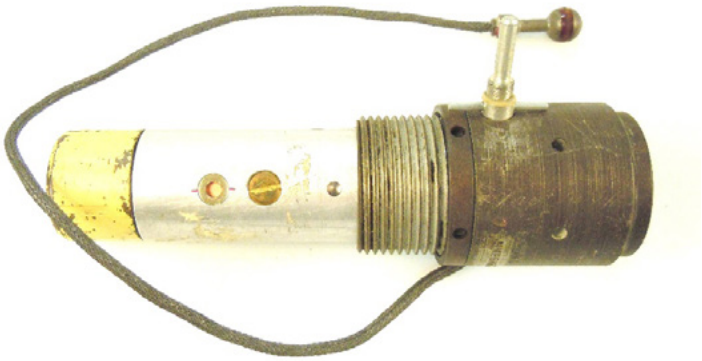
The ATK mechanical time (MT) series of fuzes are routinely used with non-explosive Russian aircraft bombs such as the RBK carrier units for cluster munitions, the ZAB parachute flare series and the Photab photoflash bomb. The fuze is often referred to as electromechanical in nature since it is armed 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. Three versions exist: ATK-EB, ATK-EA and ATK-B. The ATK-EB is the version more commonly found. The "E" (Э) refers to the electropyrotechnic nature of the arming process.

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

AVU



© Dutch EOD Center

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	60 (booster plus other pyrotechnic charges)
AUW (g)	1,970
DIMENSIONS (mm)	658×598×191
COUNTRY OF ORIGIN	Russian Federation/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 impact inertia always acting. 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 electropyrotechnic initiating cable protruding from a tail assembly is a telltale that an electropyrotechnic fuze of some sort is present.

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

UZRGM-2

ORDNANCE SUB-CATEGORY	Grenade fuze
DIMENSIONS (mm)	104 (39mm prominent from grenade body)
COUNTRY OF ORIGIN	Russian Federation/Bulgaria

The UZRGM and UZRGM-2 (for *universal'nyi zapal, ruchnaya granata modernizirovannyi*, universal igniter hand grenade improved) 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.

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.

A-670M

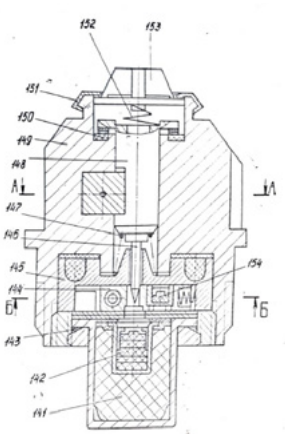
© Left: SESU and Right: Arcus

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	Unknown
AUW (g)	49
DIMENSIONS (mm)	69×20
COUNTRY OF ORIGIN	Russian Federation

The A-670M is a point-detonating fuze used with 30×165mm high-explosive incendiary (HE-I) and high-explosive tracer rounds. Such canon rounds are often associated with 2A38, 2A42 and 2A72 canons employed by a range of armoured fighting vehicles (BMP-2, BMP-3, BMD-2, BMD-3, BTR-80A and BTR-90) but also attack helicopters such as the KA-50, KA-52 and MI-28.

These fuzes have more often been found as AXO on cannon rounds such as the 3UOR6. The fuze has a pyrotechnic self-destruct element that is initiated by setback.

9E246M



© SESU

ORDNANCE SUB-CATEGORY	Impact fuze
EXPLOSIVE FILL (g)	Unknown
AUW (g)	Unknown
DIMENSIONS (mm)	Unknown
COUNTRY OF ORIGIN	Russian Federation

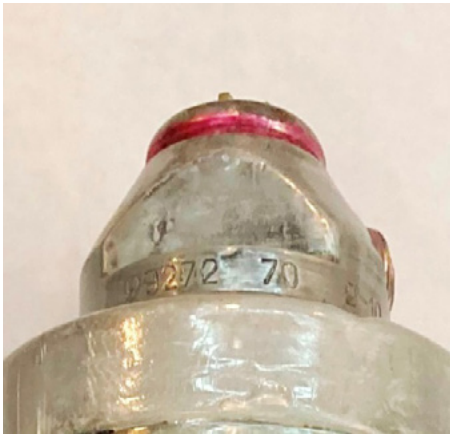
The 9E246M is an improved impact fuze used on the 9N210 submunition. Unlike its predecessor the 9E246, the 9E246M has a pyrotechnic self-destruct element. The fuze is slightly smaller than the 9E246M1 fuze used on the 3-O-16 submunition but is believed to have a similar design. Incorporating a small lateral slider, with the firing pin acting as a holding device on that slider until the arming process initiates on expulsion from the carrier rocket. Even with the self-destruct element, these fuzes have been noted for high failure rates.

Some sources indicate that a square imprint on the sphere on the side of the submunition indicates that a holding device has moved away from the striker assembly and that the fuze has armed.

Fuzes have also been known to break off the parent 9N210 submunition on impact. If found separated, it should be remembered that the fuze alone still contains primers, a pyrotechnic train and a small booster and should be treated with caution.

The 9N210 is carried by 9M27K uragan artillery rockets.

9E272



© Roly Evans

ORDNANCE SUB-CATEGORY	Impact fuze
EXPLOSIVE FILL (g)	Unknown
AUW (g)	Unknown
DIMENSIONS (mm)	Unknown
COUNTRY OF ORIGIN	Russian Federation

The 9E272 is an improved impact fuze used on the 9N235 submunition. Like the 9E246M it has a pyrotechnic self-destruct element. More information is required concerning the exact differences between these fuzes although they are believed to be minor. Even with the self-destruct element, these fuzes have been noted for high failure rates during the conflict. Fuzes have also been known to break off the parent 9N235 submunition on impact. If found separated it should be remembered that the fuze alone still contains primers, a pyrotechnic train and a small booster and should be treated with caution.

The 9N235 may be carried by both 220mm URAGAN and 300mm SMERCH artillery rockets.

GO-2

© VMZ Sopot

ORDNANCE SUB-CATEGORY	Fuze – mechanical point-detonating
EXPLOSIVE FILL (g)	10 (tetryl/PETN)
AUW (g)	204
DIMENSIONS (mm)	131×40
COUNTRY OF ORIGIN	Russian Federation/Bulgaria

The GO-2 is a simple mechanical point-detonating fuze. It is used on OG-9 and OG-15 high-explosive fragmentation rounds fired by the smoothbore SPG-9 recoilless gun and the 2A28 recoilless gun found on the BMP-1.

It should be noted that this fuze is not marketed as bore-safe and even when found as AXO, EOD operators should be mindful that the primer is in line with the striker. The weighted setback sleeve should provide a graze function if the recoilless projectile glances a target.

Fuzes prepared for firing should have the nose cap with beige fabric tab removed. Older versions of this fuze employ a tetryl booster, newer versions use a PETN booster. One Bulgarian version (Arsenal) of the GO-2 is designated the AF71, the VMZ Sopot version is marketed as the GO-2. The GO-2 is also fitted to more modern OG-7 rounds.

OG-9 and OG-15 projectiles fitted with the GO-2 fuze which have been involved in fires and have been ejected from the seat of an explosion (for example, an armoured fighting vehicle or ammunition dump) should be assumed to be armed and treated with caution.

DTM-75

© Left: Roly Evans Right: Soviet Manual

ORDNANCE SUB-CATEGORY	Fuze – mechanical time
EXPLOSIVE FILL (g)	Unknown (black powder)
AUW (g)	580
DIMENSIONS (mm)	140×63
COUNTRY OF ORIGIN	Russian Federation

The DTM-75 is a common mechanical time fuze associated with 122mm and 152mm carrier and other non-HE projectiles. It dates from the 1970s. Like most artillery fuzes, it arms by setback and centripetal force. A slider maintains the detonator out of line until setback unlocks a detent on firing.

If found as AXO, the DTM-75 may have a transport cap fitted. Unlike the German ZtZ. S30, the fuze of which the DTM-75 is a copy, the fuze has no self-destruct powder train element.

M-5M

Left: © Dutch EOD Center. Right: © SESU

ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	7 (tetryl)
AUW (g)	77g
DIMENSIONS (mm)	68×39
COUNTRY OF ORIGIN	Russian Federation

The M-5M is a simple point-detonating mortar fuze. It is often used with 60mm HE mortar rounds, although it is also compatible with 82mm rounds. Since the windshield is made of bakelite, the fuze may be mistaken for common Chinese point-detonating fuzes, although it is Russian.

As with many older Russian fuzes, the booster contains tetryl.

The M-5M, employing a simple setback sleeve and creep spring, arms by setback. The fuze has fewer holding devices than other Russian mechanical setback fuzes and should be treated with caution. The fuze functions only instantaneously (superquick), there is no delay setting.

The Bulgarian M-5A has an aluminium rather than bakelite windshield. Otherwise, the fuze is identical. While not widely seen, use of such an old fuze may indicate shortage of mortar fuzes in certain locations.

MUV-4

© Bob Seddon

ORDNANCE SUB-CATEGORY	Mine – booby-trap switch – fuze
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	Not applicable
DIMENSIONS (mm)	117×17
COUNTRY OF ORIGIN	Russian Federation

The MUV-4 (МУВ-4) is a mechanical fuze that is initiated by pull. It is typically employed with a trip wire and is used as booby-trap or victim operated initiator. The M-10 thread on the MD-5 detonator enables use with any mine, typically a fragmentation mine. The MUV-4 is typically used with OZM-72, MON-50 and MON-90 mines, although it can also be used with MON-100 and MON-200 mines.

The fuze arms by removal of the large thinner round pin. This releases a spring-loaded plunger, which slowly pushes its way through a silicone gel. Once armed, two locking balls and the green plastic fuze top are discarded. If no plastic fuze top is visible, the fuze is armed. The MUV-4 fuze typically operates with a pull of less than 1kg.

The MUV-4 is an improvement on the MUV-3 with a redesigned hydraulic arming delay element. The fuze can be marked in different colours, each representing an arming delay: green indicates 130 minutes; black, 85 minutes; red, 60 minutes; white, 45 minutes and colourless, 25 minutes.

Even when separated from its detonator, the cocked striker of this mine represents a risk. The fuze should never be pointed at anybody.

T90

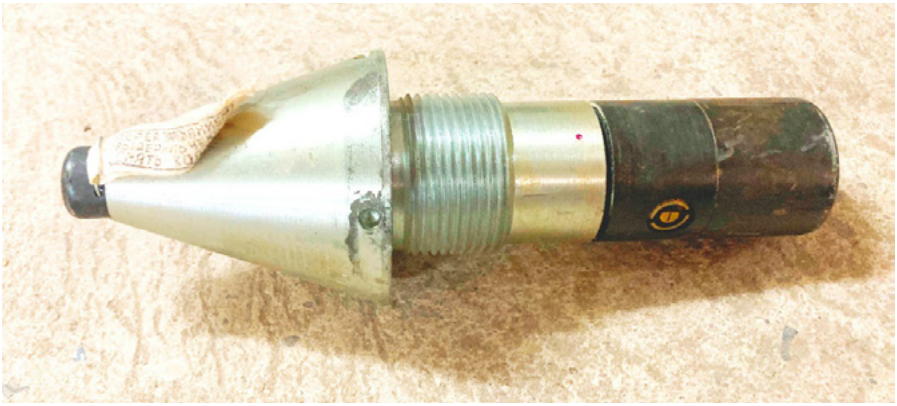
© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Fuze – mechanical time
EXPLOSIVE FILL (g)	2 (igniferous composition)
AUW (g)	482
DIMENSIONS (mm)	108×41
COUNTRY OF ORIGIN	Russian Federation/China

The T90 is an mechanical time superquick fuze employed with 122mm and 152mm artillery carrier projectiles. Typically, the T90 is employed with illumination projectiles such as the 122mm S-4 and the 152mm 3VS17. The T90 arms by setback and centripetal force.

The fuze is very easy to mistake for the V-90, with the main difference being that the V90 employs a 15g of tetryl fuze booster. The V90 will be indented with the marking "B-90" just above the fuze thread. The T90 will be marked "T-90" at the equivalent position. The V90 tends to be employed with high-explosive 122mm and 152mm artillery projectiles. Both types of fuze are fitted with a metal shipping cap.

V-24A



© Roly Evans

ORDNANCE SUB-CATEGORY	Fuze rocket point-detonating
EXPLOSIVE FILL (g)	55 (tetryl)
AUW (g)	2,650
DIMENSIONS (mm)	229×80
COUNTRY OF ORIGIN	Russian Federation

The V-24A is a relatively dated electromechanical point-detonating fuze used on air-to-surface S-24 240mm rockets. It is armed by setback, with the setback sleeve acting as an inertia weight enabling a graze function. The shipping cap is typically removed by the armourers immediately prior to flight. The setting bolt is found near the gaine of the fuze and is obscured by the fuze pocket once fitted to the S-24.

This fuze is extremely sensitive and rockets which have failed to function should not be jarred or dropped. Ideally, they should be destroyed in situ.

RV-25

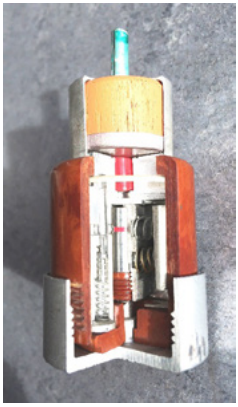
© US DoD

ORDNANCE SUB-CATEGORY	Fuze rocket proximity
EXPLOSIVE FILL (g)	20 (tetryl)
AUW (g)	4,820
DIMENSIONS (mm)	454×170
COUNTRY OF ORIGIN	Russian Federation

The RV-25 is a proximity fuze used on air-to-surface S-25 266mm rockets. The fuze employs a combination of mechanical and electrical arming and may be set for impact or proximity mode.

The fuze body is made of bakelite. It is not known how long the firing capacitor within this fuze takes to discharge, so prudent use of soak time (safe waiting period) and caution are advised for EOD operators.

VP-7M



ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	10 (PETN)
AUW (g)	96
DIMENSIONS (mm)	96×76
COUNTRY OF ORIGIN	Russian Federation/Bulgaria

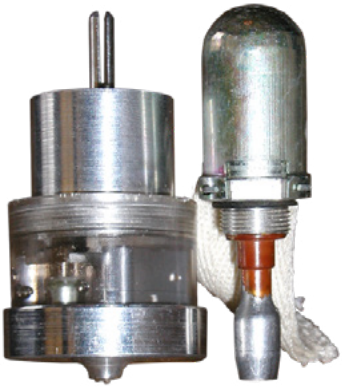
The VP-7M is the fuze found on the PG-7M recoilless rocket. It has two parts, a piezo element in the nose of the warhead and the main fuze element at the base of the warhead. The fuze arms by setback.

On firing, a small inertia weight firing pin assembly initiates pyrotechnic pellet that acts as a holding device on a shutter. Once the pyrotechnic pellet is burnt, the two lateral springs can push the slider from a position where a short circuit exists to a position where a circuit can be completed on crushing of the piezo crystal in the nose.

Even if no impact occurs, the self-destruct element should initiate after approximately 900m of flight.

Unless a PG-7 projectile has failed to detonate, and has broken apart on impact, this fuze is unlikely to be encountered by EOD operators. All PG-7 type warheads which have failed to function should be treated with care and preferably destroyed in situ.

VP-22



ORDNANCE SUB-CATEGORY	Fuze
EXPLOSIVE FILL (g)	10 (PETN)
AUW (g)	80
DIMENSIONS (mm)	96×76
COUNTRY OF ORIGIN	Russian Federation/Bulgaria

The VP-22 (ВП-22) fuze is an improvement on the VP-7M. The basic design is very similar. However, there are differences, such as spring tensions in order to reduce failure rates. The fuze body is made of aluminium and plastic rather than bakelite used with the VP-7M. The piezo nose element is designated the VP-16GCh and the base fuze element is designated VP-22DCh.

The fuze is used not only on the RPG-22 disposable launcher, but the two different elements are employed on other recoilless rockets. The base element, or a close variant of it, is used on one of the shaped charges within the PG-7R, PG-26, PG-27 and PG-29. The VP-16GCh piezo nose element is used on the PG-16, PG-18 and PG-26.

Unless a PG-7 projectile has failed to detonate, and has broken apart on impact, this fuze is unlikely to be encountered by EOD operators. All PG-7 type warheads which have failed to function should be treated with care and ideally destroyed in situ.

V5-K

© Dutch EOD Center

ORDNANCE SUB-CATEGORY	Fuze – unguided rocket
EXPLOSIVE FILL (g)	Unknown
AUW (g)	168
DIMENSIONS (mm)	119×40
COUNTRY OF ORIGIN	Russian Federation/Bulgaria/Serbia

The V-5K is a point-detonating fuze used on 57mm explosive fragmentation rockets, such as the S-5K, S-5MO and S-5KO. The V-5K employs a version of the standard Soviet setback sleeve/creep spring/locking ball design.

On firing, setback causes the setback sleeve to compress the creep spring. This releases the locking balls, and as setback eases the firing pin is freed and able to contact the primer on impact. Once armed, the creep spring remains the only holding device separating the firing pin and primer.

The fuze is similar to the GO-2 used on 73mm HE-Frag recoilless ammunition. Since the firing pin is in line with the primer, even when the fuze is not armed, this item should be not considered bore-safe. Caution is advised. Unlike the V-5 fuze, also used with S-5 HE rockets, the V-5K has no self-destruct element.

RALEC F3

ORDNANCE SUB-CATEGORY	Fuze artillery proximity
EXPLOSIVE FILL (g)	Unknown
AUW (g)	626
DIMENSIONS (mm)	151×61
COUNTRY OF ORIGIN	France

The RALEC F3 is a proximity fuze with a point-detonating function which is associated with NATO-standard 155mm HE ammunition. Selection is made by turning the white dial on the tip of the nose. The fuze arms by means of setback and centripetal force.

On firing, an ampoule containing electrolyte is broken, which can then enable charging of a capacitor. Centrifugal force distributes the electrolyte and moves a contact in order to ready the circuit and moves the rotor in line.

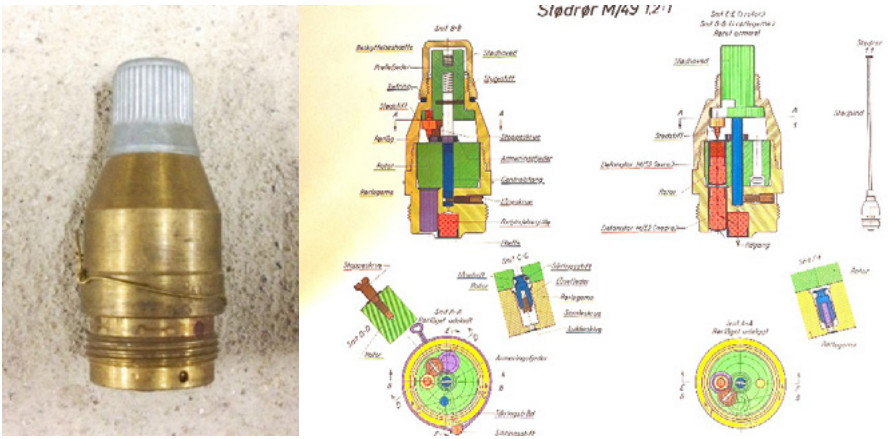
KZ 984

ORDNANCE SUB-CATEGORY	Multi-option artillery fuze
EXPLOSIVE FILL (g)	21.5 (RDX)
AUW (g)	700
DIMENSIONS (mm)	141×60
COUNTRY OF ORIGIN	Slovakia

The KZ-984 is a point-detonating fuze compatible with NATO 2-inch fuze wells made by Konstukta-Defence, based in Slovakia. The fuze arms by setback and centripetal force. Setback arming includes a setback sleeve in the nose and a detent on the rotor positioned adjacent to the fuze threads. A setting bolt enables selection of superquick and delay functions. While a relatively simple mechanical design, the fuze conforms to the relevant NATO STANAGs.

The KZ-984 has been confirmed as used with Slovakian M107 155mm artillery rounds.

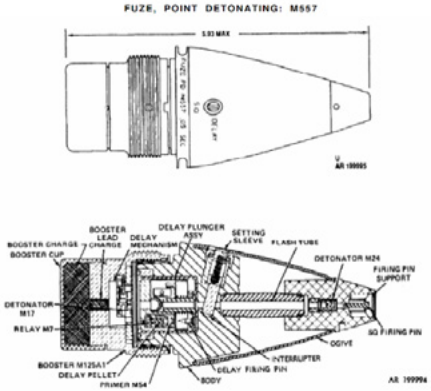
M/49



ORDNANCE SUB-CATEGORY	Fuze mortar point-detonating
EXPLOSIVE FILL (g)	Unknown
AUW (g)	Unknown
DIMENSIONS (mm)	Unknown
COUNTRY OF ORIGIN	Sweden

The M/49 is a percussion made by Forsvarets Krigsmateriel Forvaltning in Sweden. The fuze has a brass pin that acts as an extra holding device. This, and the silver fuze cap, are removed before firing. The fuze arms by setback, a detent holding the rotor out of line.

M557



ORDNANCE SUB-CATEGORY	Fuze artillery point-detonating
EXPLOSIVE FILL (g)	15 (PETN booster plus M55 detonator)
AUW (g)	976
DIMENSIONS (mm)	151×61
COUNTRY OF ORIGIN	United States

The M557 is a point-detonating fuze commonly used with NATO 155mm HE artillery projectiles. It has been in use since the 1960s. This mechanical fuze has a firing pin and detonator in the distinctive nose cap. A firing pin support acts as a holding device that maintains separation between the pin and the M24 detonator. A flash channel leads to an interrupter.

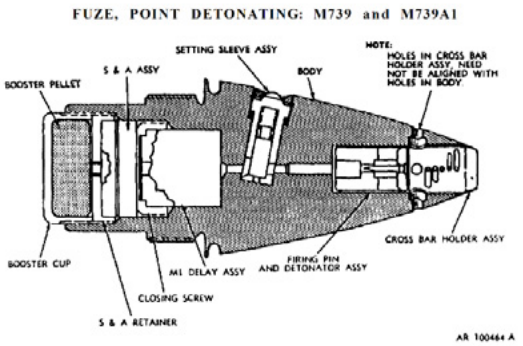
A setting bolt/sleeve on the windshield operates the interrupter with either delay or superquick options. The delay element involves a pyrotechnic composition positioned on a masking device that is moved by operation of the setting bolt. As with most artillery projectile fuzes, the M557 arms by setback and centrifugal force.

If found as AXO, EOD operators are advised that burning this fuze provides no assurance that the delay element of the superquick detonator has been initiated.

Some old versions have a tetryl booster.

The M557 is easy to confuse with the improved M739 point-detonating fuze. The model code is often stencilled into the windshield just above the fuze thread. It might also be digitally printed onto the fuze body. The M572 is also almost identical to the M557, the main difference being that the M572 has a cavity filled with epoxy resin. This stiffens the fuze structure, improving resilience to the acceleration forces on the fuze windshield.

M739



ORDNANCE SUB-CATEGORY	Fuze artillery point-detonating
EXPLOSIVE FILL (g)	19 (A5 booster plus stemming and detonators)
AUW (g)	976
DIMENSIONS (mm)	152×61
COUNTRY OF ORIGIN	United States

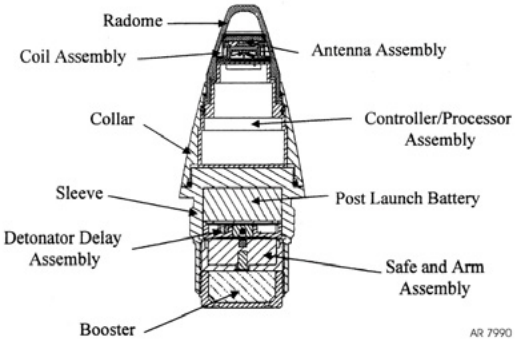
The M739 is a point-detonating fuze commonly used with NATO 155mm HE artillery projectiles. The fuze is similar to the M557 but there are important differences. These differences are relevant when designing an RSP. The M739 mechanical fuze has a firing pin and detonator, but it is situated in the main fuze body, not within the distinctive nose cap. A firing pin is held by a support wire. A flash channel leads to an interrupter.

A setting bolt/sleeve on the windshield operates the interrupter with either delay or superquick options. Between the delay pellet and the booster sits the safe-to-arm assembly. As with most artillery projectile fuzes, the M739 arms by setback and centrifugal force.

If found as AXO, EOD operators are advised that burning this fuze provides no assurance that the delay element of superquick detonator has been initiated.

The M739 is easy to confuse with the improved M557 point-detonating fuze. It is often distinguishable by a green glaze appearance. The model code is often stencilled into the windshield just above the fuze thread. It might also be digitally printed onto the fuze body.

M782 MOFA



ORDNANCE SUB-CATEGORY	Fuze artillery multi-function
EXPLOSIVE FILL (g)	19 (PBXN-5 booster plus stemming and detonators)
AUW (g)	748
DIMENSIONS (mm)	151×61
COUNTRY OF ORIGIN	United States

The M782 multi-option artillery fuze (MOFA) can act in as a point-detonating, time and proximity (variable time) fuze. The point-detonating has superquick and delay options. An electronic timing system controls the time function. A proximity sensor in the nose is also enabled by an electronic microcomputer. If set for point-detonating mode, the fuze initiates by means of a crush switch

The fuze was designed with EOD considerations in mind. The voltage in the battery bleed resistor and processor should dissipate within 30 minutes of arming and failure. Another circuit is incorporated into the design to discharge the battery as a fail-safe.

Fuzes are packaged in lots of eight per M2A1 container.

ANTI-DISTURBANCE DEVICES

MS-3

© Dutch EOD Center and Danish EOD and Search Center

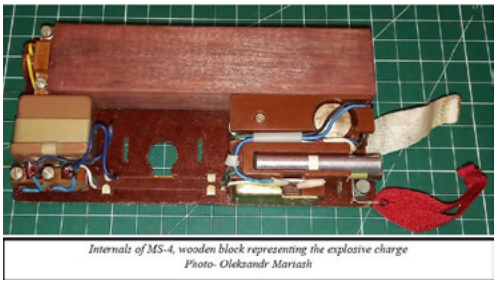
ORDNANCE SUB-CATEGORY	Anti-disturbance device
EXPLOSIVE FILL (g)	310 (TNT)
AUW (g)	630
DIMENSIONS (mm)	110×65
COUNTRY OF ORIGIN	Russian Federation/Romania

The MS-3 is a Russian anti-disturbance device. It functions by means of pressure release. It was originally designed for use with bounding fragmentation AP mines, such as the OZM-72, although it can also readily be employed with anti-vehicle mines, or with any object of sufficient weight (4kg) to act as a holding device.

The device can easily be mistaken for a PMN. The prominent protrusion of part of the pressure-release mechanism on the cover of the device is the easiest way of telling the difference. Otherwise, the device looks almost identical to a PMN with a brown bakelite body and black rubber cover. The marking "MC-3", along with the lot number and year of manufacture, and the explosive type, are usually marked on the cover. The mine contains more TNT (310g) than a PMN (220–240g). The diameter of the MS-3 is the same as an OZM-72.

The device is very similar in function to a PMN with some key differences. The cylinder spring is in compression. Once armed, it is prevented from pushing the cylinder upwards, so that the firing pin assembly can impact the detonator and booster assembly, by a weight placed on the cover. Remove the weight and the spring can align the cylinder; the final holding device is removed and the device will function. The MS-3 is described in some old marketing literature Russian manufacturers as a "surprise mine". An inert practice version U-MS-3 exists. It is usually marked "Y-MC-3" on the cover. Confirmed use of the MS-3 should be actively and accurately recorded to improve threat assessment for deminers and EOD operators. Great caution should be exercised when dealing with suspected MS-3 devices. Attempts to remove holding charges with remote and semi-remote techniques such as hook and line must only be undertaken with great care.

MS-4



Internals of MS-4, wooden block representing the explosive charge
Photo- Oleksandr Mariash

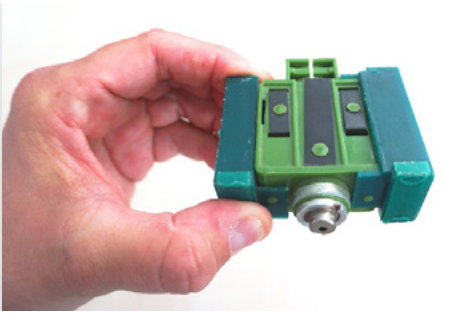
ORDNANCE SUB-CATEGORY	Anti-disturbance device
EXPLOSIVE FILL (g)	120 (TNT)
AUW (g)	410
DIMENSIONS (mm)	155 (length), 92 (width), 31 (depth)
COUNTRY OF ORIGIN	Russian Federation (former USSR)
FUZE	Single-impulse pressure 275kg

The MS-4 (MC-4) may be used as a delayed action initiator or as a booby-trap firing device. Its overall body colour is yellow/green, and all device components are contained within a hinged metal container. This device is most often used as an initiator for larger explosive charges.

In timed initiation mode, the MS-4 may be set for a time delay ranging from 15 minutes to 360 hours. As a booby-trap device, the MS-4 will initiate if it is tilted more than 20 degrees in any axis. It also has an anti-movement mode and contains a trembler switch, which will operate if the device detects movement. When employed in booby-trap mode, the device may have an arming delay set for 10 or 20 minutes. The mode of the device is set by a three-position selector switch, which is not visible when the initiator is enclosed within its metal container.

The MS-4 does not have a self-destruct or self-neutralization capability and the operating life of the system with new batteries is approximately 6 months. Given the potential for this device to operate in long delay time mode, a remote means of render safe is strongly recommended.

ML-7



ORDNANCE SUB-CATEGORY	Anti-disturbance device
EXPLOSIVE FILL (g)	30 (PVV-5A), 10 (tetryl)
AUW (g)	100
DIMENSIONS (mm)	110×65
COUNTRY OF ORIGIN	Russian Federation
FUZE	VGMS-1

The ML-7 is a small anti-disturbance device. It is made of green plastic with a central fuze position. Aside this are two booster capsules in small shallow metal drums (each containing 5g tetryl). Each dark green side jacket contains 15g of 40 PVV-5A explosive. The VGMS-1 fuze is similar to that used by a PFM-1 mine, incorporating a viscous arming delay. The safety pin is removed to arm the fuze. Once removed, the ML-7 will arm within 5 minutes. The pin often has a red ribbon attached. Discarded ribbons/pins can be a good telltale of the presence of an ML-7.

When in anti-lift mode, the lid requires 300g of weight to prevent initiation. PVV-5A is a Russian RDX-based plastic explosive used in mines such as the MON-50. While the ML-7 is classically employed in a pressure-release function, it can also function by pull. The markings are found on one of the small sides of the main charges as well. The marking includes the abbreviation of the mine name ("мл-7" or "У-мл-7"), manufacturer code, batch number and year of manufacture. Some batches have no marking. Training devices У-мл-7 have the marking "Инерт" (inert) below the batch number. The ML-7 has also been referred to as a VP-11 in some literature.

Confirmed use of the ML-7 should be actively and accurately recorded to improve threat assessment for deminers and EOD operators. Great caution should be exercised when dealing with suspected ML-7 devices. Attempts to remove holding charges with remote and semi-remote techniques such as hook and line must only be undertaken with great care.

ML-8

© Open Source

ORDNANCE SUB-CATEGORY	Anti-disturbance device
EXPLOSIVE FILL (g)	80 (PVV-5A)
AUW (g)	370
DIMENSIONS (mm)	60×40
COUNTRY OF ORIGIN	Russian Federation

The ML-8 is an anti-lift device for use with landmines but also everyday objects. A pyrotechnic arming delay element arms the fuze after 120–150 seconds from the moment of the removal of the red cap with a 800mm nylon thread. A spring-loaded metal plate with two simple hinges at each end is held down by the mine or other object. This metal plate acts as a holding device on a cocked striker fuze.

Once weight is removed, its springs lift it and it no longer acts as a holding device. PVV-5A is a Russian RDX-based plastic explosive used in mines such as the MON-50. Like the ML-7, once the ML-8 is armed it cannot be disarmed. The presence of the transparent/white nylon thread discarded on the ground can be an indicator that an ML-8 is present.

The raised markings apply on the cap closing the rectangle casing of the ML-8. The marking includes the abbreviation of the mine name ("мл-8" or "У-мл-8"), manufacturer code, batch number and year of manufacture. Possible colours of the ML-8 are green, olive and brown. The casing of the ML-8 and the plastic cover can be of different colour.

Confirmed use of the ML-8 should be actively and accurately recorded to improve threat assessment for deminers and EOD operators. Great caution should be exercised when dealing with suspected ML-8 devices. Attempts to remove holding charges with remote and semi-remote techniques such as hook and line must only be undertaken with great care. This device has been used widely in Ukraine in conjunction with more visible AP mine systems, such as the MON-50 directional fragmentation mine and OZM-72 bounding fragmentation mine.

ENGINEER EQUIPMENT

KZ-6

© Left: t.me/razved Right: Lex Peverelli

ORDNANCE SUB-CATEGORY	Demolition charge
EXPLOSIVE FILL (g)	1,800 (TG-40)
AUW (g)	3,000
DIMENSIONS (mm)	292×112
COUNTRY OF ORIGIN	Russian Federation

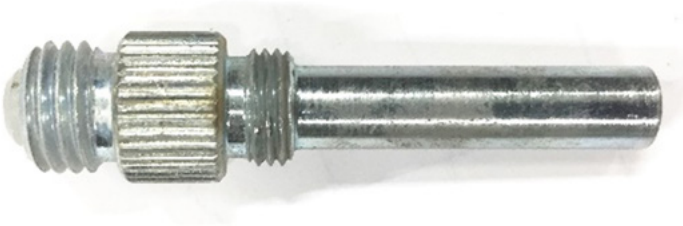
The KZ-6 is a demolition charge that incorporates a conical liner shaped charge. It is used for cutting/perforating metal and concrete. In its conventional application the M-10 thread can accept detonators associated with MUV fuzes or NM initiators such as the MD-5M. The black stencilled markings are found at the base of the munition.

TG-40 (ТГ-40) is a 40/60 mix of TNT ("Т" for "тротил", *trotil*) and RDX ("Г" for "гексоген", *geksogen*).

There is evidence to suggest that the KZ-6 has been adapted for use as an improvised aerial bomb. If so, this would be among the larger of such devices yet seen during the conflict. It is not clear how this an improvised aerial bomb is fuzed, although an in-line impact inertia fuze would be logical.

As with the fuzing of all improvised aerial bombs, caution is advised.

MD-5M



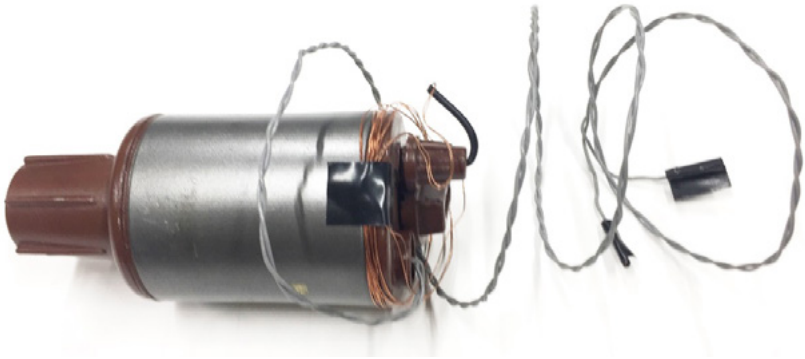
© Swiss EOD Center

ORDNANCE SUB-CATEGORY	Detonator
EXPLOSIVE FILL (g)	Lead azide, lead styphnate, tetryl
AUW (g)	9.7
DIMENSIONS (mm)	50×13
COUNTRY OF ORIGIN	Russian Federation

The MD-5M (МД-5М) is the standard Russian stab-sensitive detonator typically employed with mechanical cocker striker fuzes. The detonator has two threads, one to screw into the basis of a switch – typically a MUV switch – and the other to screw into the body of a mine such as a MON-50 or explosive charge.

The MD-5M has a KV-11 stab-sensitive primer composed of lead azide and lead styphnate and a No. 8 detonator body with a tetryl filling. The MD-5M can also be used with electromechanical devices, such as the NM initiator.

MVE-72



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ORDNANCE SUB-CATEGORY	Firing device
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	600
DIMENSIONS (mm)	150×65
COUNTRY OF ORIGIN	Russian Federation

The MVE is an electronic firing device that operates with a breakwire (collapsing circuit). The device consists of a metal cylinder casing, with a bakelite base. The bakelite base unscrews to accept a 1.5V battery. On the top of the device are two connection pods, one for the breakwire and one for the connecting wire to the initiator – which can be a simple electrical detonator or more likely an NM initiator.

If an NM initiator is used, the MVE-72 is often employed with area fragmentation weapons, such as the OZM-72 bounding or MON series directional fragmentation mines.

The metal body is usually painted olive green with markings stencilled in black. Some sources designate the item MVZ-72. Similar improved versions exist: MVE-NS, MVE-92 and MVE-08.

The device is viable for as long as the battery has a potential. The MVE-72 should deactivate when the battery is fully discharged. The device is armed by pulling a friction type igniter and has an arming delay of 50–180 seconds. The filament breakwire is extremely difficult to see with naked eyes and is a significant hazard where devices have been emplaced and vegetation has later grown and obscured the wire.

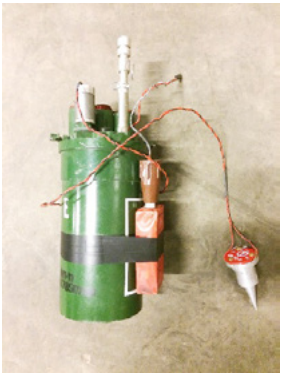
NM INITIATOR

ORDNANCE SUB-CATEGORY	Firing device
EXPLOSIVE FILL (g)	Lead azide, lead styphnate, tetryl
AUW (g)	9.7
DIMENSIONS (mm)	54×39
COUNTRY OF ORIGIN	Russian Federation

The NM initiator is the standard Russian electrical-mechanical initiator. It is a usually used in conjunction with an MD-5M detonator that is screwed into its base (use with an MD-2 detonator is also possible). The NM is more accurately an electromechanical device. A firing pin and spring assembly is in line with the primer of the MD-5M once attached. The firing pin is only retained by a thin shear ring holding device. A current of sufficient voltage burns a squib, the enclosed gas from which has sufficient pressure to rupture the retaining shear ring. The coiled spring then pushes the firing pin onto the primer of the MD-5M detonator.

The initiator has a distinct bakelite body. This initiator will typically be used with OZM-72 bounding and MON series directional fragmentation mines. It can be initiated by VP-13 and MVZ-72 firing devices.

NVU-PM/VP-13



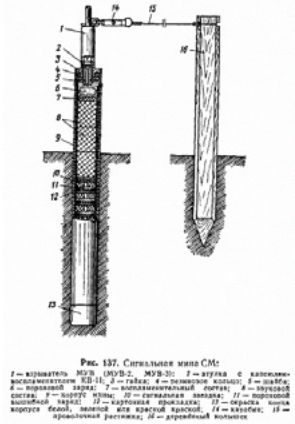
ORDNANCE SUB-CATEGORY	Firing device
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	2,000
DIMENSIONS (mm)	250×110
COUNTRY OF ORIGIN	Russian Federation

The NVU is a seismic initiation system that can be connected to up to five items of explosive ordnance, typically directional fragmentation or omni-directional mines. The top of the unit has five connections that can accept wires, typically from NM initiators. The device has a geophone that can detect ground vibrations within a radius of 15m. The device is sometimes referred to as "Kolada" (pack of cards).

The unit is powered by six 1.5V batteries in the base. The sensor body is green with black stencilled markings. The SV-20-P geophone is silver-coloured with a red connecting top. The unit is armed by initiating the MUV-4. The striker completes an electrical circuit, that will arm in six minutes after contact.

EOD operators are advised not to approach an identified unit if there are reasonable grounds to believe the battery still retains a charge. It should be noted that cutting wires to the VP-13 will initiate the next mine of the five in sequence. This device is typically fitted with a self-destruct charge in the form of a demolition charge and operates when the battery charge falls below the minimum potential. The self-destruct charge usually consists of an NM initiator, MD-5M and TNT demolition charge.

SM-320



© Yuri Shahramanyan and Soviet technical manual

ORDNANCE SUB-CATEGORY	Trip flare
AUW (g)	400
DIMENSIONS (mm)	278×25
COUNTRY OF ORIGIN	Russian Federation

The SM-320 (CM-320) "Signal mine", as it is known in Russian service, is neither an AP nor an AV mine. The best literal translation would be "trip flare". The flare has an M-10 screw thread that can accept the full range of MUV-type fuzes.

Typically, the SM-320 is initiated by trip wire. The signal mine body is made of steel and contains a pyrotechnic composition which, when initiated, emits 12–15 luminous stars to a height of 5–15m, with an audible report which can be heard up to 500m away. The colour of the flares emitted by the signal mine is indicated by the colour painted on the base of the mine body.

The SM-320 is supplied in kits with stakes for ground mounting. The SM-320 may easily be taped or fixed to buildings or street furniture for use in urban operations. It is often used in conjunction with tripwire-initiated bounding mines (OZM-72), directional fragmentation mines (MON series) or POM-2R hand-delivered fragmentation AP mines.

The factory, lot and year of manufacture are marked in black on the olive green body of the flare.

SZ-6

Image © Lex Peverelli

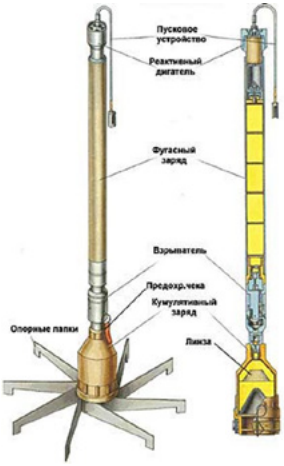
ORDNANCE SUB-CATEGORY	Demolition charge
EXPLOSIVE FILL (g)	5,900–6,100 (TNT)
AUW (g)	7,300
DIMENSIONS (mm)	395×142×98
COUNTRY OF ORIGIN	Russian Federation/Bulgaria

The SZ-6 (for *sosredotochennyye zaryady*, concentrated charge) is a demolition charge. While it is traditionally associated with maritime demolitions, it has been used as a demolition charge on land. In this role, the charge has been used in attempts to sabotage or destroy railway lines.

Stated NEQs for the SZ-6 range from 5,900 to 6,100g, depending on what booster is fitted. The number "6" alludes to the nominal main charge weight of 6kg. The main charge is TNT and the booster is RDX. Some sources state that the main charge is TG-50, which might give slightly more brisance if trying to cut thick metal.

If used underwater, a VPZ-1 firing device may be employed. Alternatively, an M-10 fuze thread can accept switches compatible with MD-2 and MD-5 detonators.

OZ-1



Left © Roly Evans Right: Soviet Manual

ORDNANCE SUB-CATEGORY	Entrenching charge
EXPLOSIVE FILL (g)	1,100 (A-IX-1)
AUW (g)	3,500
DIMENSIONS (mm)	900×420
COUNTRY OF ORIGIN	Russian Federation

The OZ-1 is designed to break the soil, especially in frozen conditions, in order to make manual digging easier. The system will disturb the earth to a depth of up to 2.5m depending on ground conditions. The A-IX-1 explosive can be found not only in the shaped charge in the bakelite cone but also in the green extension.

It is believed the shaped charge contains 450g of A-IX-1 and the extension contains 650g. The marking "KZ-OZ" should appear in black on the side of the bakelite cone while the marking "FZ-OZ" should appear in black on the side of the extension.

The bakelite charge is stabilized with a green metal stand of eight legs. More information is required on the complete mechanism and how both charges work in sequence. The charges can be used together or separately. OZ-1s have also been used to breach structures during urban warfare.

MISCELLANEOUS

9B899

© Sean Moorhouse

ORDNANCE SUB-CATEGORY	Surface-to-surface missile penetration aid
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	Approximately 2,500
DIMENSIONS (mm)	300 (length), approximately 100 (diameter)
COUNTRY OF ORIGIN	Russian Federation
FUZE	Not applicable

The 9B899 is an electronic countermeasure device deployed from the base of the 9M723-Iskander (SS-26 Stone) short-range ballistic missile. The device appears to be a programmable multi-channel inhibitor powered by a thermal battery. 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 terminal guidance of surface-to-air missile systems. The 9M723 Iskander missile has six cylindrical ports in its base, which are designed to house the 9B899 devices during transit, launch and flight. It is possible that the 9B899 may be fitted to variants of the air-launched Kh-47 Kinzhal missile.

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 body may indicate that the thermal battery has failed to function.

DM-11 SMOKE POT

© John Montgomery

ORDNANCE SUB-CATEGORY	Smoke pot
EXPLOSIVE FILL (g)	Not applicable
AUW (g)	3,100
DIMENSIONS (mm)	159×106
COUNTRY OF ORIGIN	Russian Federation

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 and appropriate personal protective equipment (PPE) should be worn when handling these items.

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 markings stencilled on the side. Some sources state that these devices are largely used by NBC defence troops.

KONTAKT- 5

© John Montgomery

ORDNANCE SUB-CATEGORY	Special purpose ammunition
EXPLOSIVE FILL (g)	34 (PDX)
AUW (g)	Unknown
DIMENSIONS (mm)	250×130×10
COUNTRY OF ORIGIN	Russian Federation

Kontakt-5 is an improved form of explosive reactive armour found in box containers on most main battle tanks and many armoured fighting vehicles in Ukraine. The Kontakt-5 is supposedly effective not only against tandem HEAT warheads but also APFSDS projectiles.

Plates are of different sizes dependent on where they are positioned on the vehicle. For a main battle tank, there are front plates for the front of the hull near the driver's position, side plates that sit above the track, and V-plates that protect the turret. Explosive sheets are contained in steel boxes – some boxes contain up to four sheets in a tray.

While not initiated by any form of fuzing, ERA still poses an explosive hazard. ERA should always be removed with a manual tool (for example, adjustable spanner or socket) rather than acetylene cutting equipment. ERA should be removed from armoured fighting vehicle prior to handover to waste metal personnel.

IMPROVISED DRONE MUNITIONS

INTRODUCTION

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UAVs have been used extensively by both the Russian Federation and the Ukrainian armed forces for intelligence, surveillance and reconnaissance (ISR), and as a means of directly attacking targets on the battlefield. UAVs have also been used to deliver a wide variety of AP and anti-vehicle mines. This activity is often conducted at night and may result in mines appearing with little warning in what were previously cleared areas. The types of munitions and warheads employed vary enormously and it is beyond the scope of this guide to provide comprehensive coverage of the types which may be encountered. Great care should be taken around all crashed UAVs due to the hazard posed by munitions and the possible presence of anti-handling devices.

DRONE-DROPPED MUNITIONS

Drone-dropped munitions may consist of modified military munitions, such as grenades, mortar bombs, submunitions (extracted from carrier shell and aircraft cluster bombs), and mines. Drone munitions based on improvised explosive devices (IEDs) normally consist of a small military explosive charge contained within a fragmentation collar and are fitted with an impact fuze, either electrical or mechanical, which is designed to function when the munition hits the ground or target. Sometimes, the fuzing systems of military munitions are modified for the munition to be employed by UAVs. These modifications often involve the deliberate removal of fuze safety and arming functions and usually increase the sensitivity and hazard associated with the munition.

FIRST PERSON VIEW (FPV) DRONE WARHEADS

© X/Twitter: @Hartreefock

FPV drones, or "kamikaze drones" as they are sometimes called, are single-shot weapons designed to attack targets on the battlefield. They may be used against armoured fighting vehicles, logistics vehicles, trench and field fortifications, and even groups of personnel located in the open. FPV drones are often fitted with underslung shaped charge warheads adapted from either rocket-propelled grenades or unserviceable AT missiles. The means of initiation is most often an improvised electrical switch mounted on the nose of the warhead. FPV drone warheads which have failed to function may be in a very sensitive condition and selective disruption, using IED disruptors, should be considered.

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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