Jane's Ammunition Handbook 2008-2009

Edited by Leland Ness
and Anthony G Williams

Seventeenth Edition

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4.6× 30 family of ammunition: **(1)** *Ultimate Combat/Copper-Plated Steel/DM11-AA30;* **(2)** *Combat steel;* **(3)** *FMJ/DM21-AA31/Copper Plated Lead;* **(4)** *Police/Action;* **(5)** *Spoon-nose;* **(6)** *Tracer;* **(7)** *Subsonic;* **(8)** *Copper training;* **(9)** *Hard frangible;* **(10)** *Soft frangible;* **(11)** *Blank; and* **(12)** *Drill* 1043706

are 100 per cent non-toxic. RUAG Ammotec, Germany developed an additional type of Armour-Piercing (AP) round especially for the German armed forces when they adopted the MP7 A1. The cartridge has a two-component bullet of 2 g weight and has the German armed forces model number DM11 and a NATO code of AA30. Ballistics of the DM11 are comparable to those of the Ultimate Combat cartridge. All ammunition types can be fired with a suppressor fitted and the gun functions normally in the semi-automatic or automatic modes.

Hornady Manufacturing Corp. in the US commenced production of this round in 2006.

A full range of ammunition types have been developed and these are listed here:

- **Ultimate Combat (RO, UK)/ Copper-Plated Steel Bullet (Fiocchi, Italy):** 2 g copper-plated solid-steel bullet; penetrates NATO-CRISAT target up to 300 m; replaces the earlier Combat steel type; noise level with suppressor fitted is 111 dBA.
- **Combat steel:** 1.7 g copper-plated solid-steel bullet; penetrates NATO-CRISAT target up 200 m; replaced by the later Ultimate Combat type.
- **Copper-plated lead:** 2.5 g; copper-plated lead solid.
- **Full Metal Jacket:** 3.2 g; delivers maximum energy in this calibre.
- **Soft Point:** 2.6 g; conventional jacketed bullet with lead core and sharp lead tip; developed to match the US-FBI ballistic reference test requirements.
- **Police (RO, UK)/ Action (RUAG Ammotech, Germany):** 2 g solid deformation bullet for maximum energy transfer at minimum penetration depth; penetrates NIJ Class IIIA body armour at up to 100 m.
- **Spoon-nose:** 1.7 g.
- **Tracer:** 2 g red tracer; traces to 300 m.
- **Subsonic:** 5 g tungsten-based copper-plated solid bullet; penetrates NATO-CRISAT target up to 90 m; noise level with suppressor fitted is 103 dBA.
- **Copper training:** 2 g copper solid; training and combat round with low unit cost; penetrates NATO-CRISAT target at up to 100 m.
- **Hard frangible:** 2 g sintered-metal powder bullet for training; disintegrates on hard surfaces.
- **Soft frangible:** 2 g injection-moulded plastic and metal bullet for combat use in sensitive areas such as aircraft, oil-drilling platforms and nuclear installations.
- **Blank:** Used in combination with safety blank-firing attachment of MP7/MP7 A1, which retains at least three rounds if live rounds are fired in error.
- **Drill:** Solid dummy cartridge for weapon drill and training.

Armament
H&K MP7 and MP7 A1 sub-machine gun; H&K P46 pistol.

Specifications
Lengths:
complete round: 38.5 mm
case: 30 mm
Diameters:
rim: 8 mm
bullet: 4.65 mm
Weights:
complete round: 6.2–9.5 g, depending on bullet type
bullet: 1.7 g, 2.0 g, 3.2 g and 5.0 g
Muzzle Velocity (MV): 1.7 g: 760 m/s
2.0 g: 720 m/s
2.5 and 2.6 g: 620 m/s
5 g (subsonic): 320 m/s
Muzzle energy: 1.7 g: 490 J
2.0 g: 520 J
2.5 and 2.6 g: 480 J
5 g (subsonic): 250 J
Chamber pressure: 355 MPa

Contractor
Heckler & Koch.

4.6× 30 from Hornady: FMJ (top) and Barrier rounds (Hornady) 1153651

Equivalent rounds
Italy
Contractor
Fiocchi Munizioni SpA.
Copper-plated steel bullet: copper-plated steel solid, 2.0 g; MV 720 m/s

Switzerland/Germany
Contractor
RUAG Ammotec.
Sintox Action HP: lead-free CuZn solid hollow-point; 2.0 g; MV 685 m/s
SintoxDM 21/AA31 ball: PbSb core in steel jacket plated with Cu alloy; 2.6 g; MV 600 m/s
Sintox DM 11/AA30 AP: 2.0 g Armour-Piercing with steel core in CuZn alloy jacket; MV 685 m/s
Blank: Star folded brass case

United Kingdom
Contractor
BAE Systems, Land Systems UK.
Ultimate Combat: copper-plated solid-steel bullet; 2 g; MV 720 m/s (supersedes Combat Steel cartridge)
Combat Steel: copper-plated solid-steel bullet; 1.7 g; MV 740 m/s (superseded by Ultimate Combat cartridge)
Copper-Plated Lead: copper-plated lead solid; 2.5 g; MV 630 m/s
Police: solid deformation bullet; 2 g; MV 720 m/s (supersedes Spoon-nose cartridge)
Spoon-nose: 1.7 g; MV 740 m/s (obsolete, superseded by Police cartridge)
Tracer: 2.0 g (under development)
Subsonic: tungsten-based copper-plated solid bullet; 5 g; MV 320 m/s (under development)
Copper training: copper solid; 1.7 g; MV 740 m/s (is superseded by Hard Frangible)
Hard Frangible: sintered-metal powder bullet; 2 g; MV 720 m/s
Soft Frangible: injection-moulded plastic and metal bullet; 1.7 g; MV 740 m/s (obsolete, superseded by Hard Frangible)
Blank: Folded brass case
Drill: Solid dummy cartridge

United States
Contractor
Hornady.Manufacturing Corp.
Ball: FMJ: jacketed lead core; 2.6 g; MV 620 m/s
Barrier: jacketed soft point with lead core; 2.6 g; MV 620 m/s

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5.45 × 18 cartridge

Synonyms
5.45 mm Soviet pistol; 5.45 mm 7N7, 5.45 mm MPTs.

Development
Aleksandr I Bochin developed this cartridge in 1979 for use in the PSM ultra-compact pistol issued to police and military security troops. It became known in the West shortly after its development, but nothing was known of its parent weapon until 1983. The Drel pistol in 5.45 × 18 was derived from the .22 LR Margo and was introduced at a later date. The Ots-23 Drotik is a select-fire pistol manufactured by Tula KBP.

Description
The round uses a bottlenecked rimless case, carrying an unusual Full Metal Jacket (FMJ) bullet with a flat tip and a compound core. The bullet is unusually

5.45 mm Russian pistol cartridge, top, compared with the 9 mm Parabellum (Anthony G Williams) 1122008

long, being 14.3 mm, or 2.62 times the calibre; conventional pistol bullets are usually about 1.5 calibres long. The bullet has a gilding-metal jacket and a core which comprises a steel front half and a lead rear. This, again, is unusual in a pistol bullet but generally duplicates the construction of rifle bullets of similar calibre, such as the 5.56 × 45 mm SS109 and the 5.45 × 39 mm.

The Tula Cartridge Works manufactures two loadings: the military MPTs (7N7) which weighs 2.5 g and is fired at 320 m/s, and the PSO, an export version with a lead core, which weighs 2.68 g and is fired at 315 m/s.

Stopping power does not surpass the 6.35 mm Browning cartridge, but experiments in the UK have demonstrated the bullet's formidable capacity for penetrating soft body armour. The bottlenecked cartridge case is an unusual complication in a blowback weapon, but Russian sources claim that the PSM is unusually reliable.

As well as the PSM pistol and its export version, the IZh-75, the round was chambered in the experimental Drel and OTs-23 Drotik pistols.

Armament
PSM pistol and the IZh-75 export version.

Specifications
Round length: 24.9 mm
Round weight, nominal: 4.8 g
Case length: 17.8 mm
Rim diameter: 7.55 mm
Head diameter: 7.55 mm
Bullet diameter: 5.64 mm
Bullet weight: 2.5–2.68 g
Muzzle Velocity (MV): 315–320 m/s
Muzzle energy: 124–137 J

Contractor
Tula Cartridge Plant Production.

Equivalent rounds
Russian Federation
Contractor
Barnaultransmash JSC.
Ball: FMJ; 2.6 g; MV 315 m/s

5.7 × 28 cartridge

Synonyms
5.7 mm FN; 5.7 mm P90.

Development
This cartridge was developed by FN in the mid-1980s for the P90 compact sub-machine gun. The initial bullet used was the SS90, which had a plastic core within a pointed, conical metal jacket. However, in the mid-1990s NATO established a requirement for a new Personal Defence Weapon (PDW) cartridge to replace the 9 × 19 round in pistols and SMGs. A primary requirement was improved penetration of body armour; the bullet had to penetrate the CRISAT target (a 1.6 mm titanium plate plus 20 layers of kevlar) out to at least 150 m, with sufficient remaining energy to inflict a disabling wound. FN therefore developed the SS190 bullet, with a composite core of hardened steel in the front part and aluminium at the rear. Subsonic (Sb193 – white tip), tracer (L191 – red tip) and JHP (SS192 – green tip) loadings have also been developed.

Competitive NATO trials of the 5.7 mm FN and 4.6 mm HK ammunition were held; however, although both rounds met the requirements, agreement could not be reached on which to choose as the 9 mm replacement. All three rounds – the 5.7 mm, the 4.6 mm and the 9 mm – are therefore in service in different NATO countries.

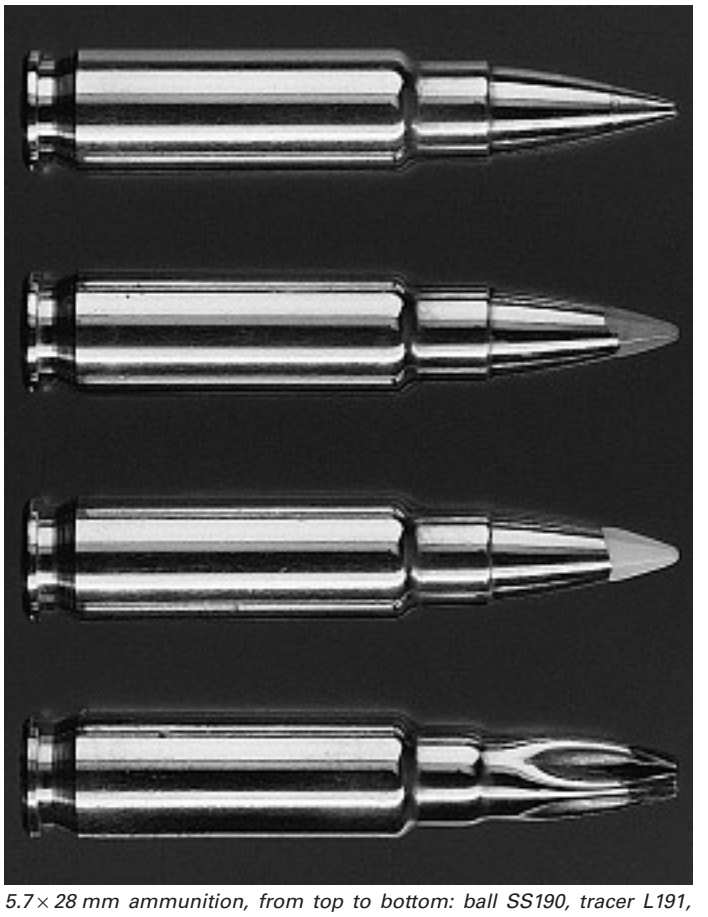
Both the P90 and the Five-seveN® pistol have been acquired in some numbers, mainly by police and military special units.

5.7 mm FN P90 cartridge, early SS90 loading (middle), compared with the 4.6 × 30 HK (top) and the 9 × 19 (bottom) (Anthony G Williams) 1122001

Sectioned UTM 5.7 × 28 Man Marker Round (Anthony G Williams) 1162147

Description
The case is rimless, bottlenecked, steel and Berdan primed. The streamlined bullet is composed of a steel and aluminium core within a steel jacket. The ball SS190 projectile can penetrate body armour (48 layers of Kevlar BS 1500) or a Kevlar helmet at more than 150 m.

Armament
FN Herstal P90 personal weapon and Five-seveN® pistol.



5.7 × 28 mm ammunition, from top to bottom: ball SS190, tracer L191, subsonic Sb193 and blank 0002387

The gun and ammunition have been developed by CBJ Tech AB. At the time of the abortive competition for a new NATO PDW round the 6.5 × 25 was marketed by SAAB-Bofors, but development is now being continued by CBJ with a view to identifying a partner company to produce the weapon system.

Description

The 6.5 × 25 CBJ cartridge has the same overall dimensions as the 9 × 19 Parabellum cartridge and generates the same level of firing impulse. The cartridge case is of brass initially, but with aluminium alloy planned for later production. The brass cartridges weigh 7.5 g, the alloy ones 5 g. The projectile of the standard ball round is a 4 mm sub-calibre tungsten bullet held in a plastic sabot, fired at a muzzle velocity of 830 m/s from a 200 mm barrel, or 780 m/s from a 125 mm pistol barrel. It is claimed to offer superior penetration to the 5.56 mm NATO SS109/M855 ball, and to be effective against most grades of body armour and against lightly-armoured vehicles such as Armoured Personnel Carriers (APCs). Advantages claimed for the 6.5 × 25 CBJ cartridge include a high impact velocity, a high hit probability thanks to the flat trajectory, high energy transfer to the target and low levels of barrel wear and corrosion. By the 200 m range, the velocity and energy have dropped to 632 m/s and 400 J. At the claimed maximum combat range of 400 m, the figures are 468 m/s and 220 J.

As well as the ball round, other loadings are a spoon-tip ball (ST) for more rapid yawing on impact, a high energy transfer (HET) full-calibre hollow-point bullet for reduced penetration, a heavy full-calibre subsonic armour-piercing round (Subsonic AP), a reduced penetration training loading (TRP) with a saboted tungsten powder bullet to match the trajectory of the ball round, and a full-calibre Frangible load for short-range training, which matches the trajectory of the HET. In addition, blank and drill rounds are made.

6.5 × 25 CBJ cartridges with brass and light alloy cases, compared with a 9 × 19 round (Olof Janson) 1162191

Armament

CBJ MS Personal Defence Weapon.

Contractor

CBJ Tech AB.

Specifications

	Ball and ST Ball	HET	Subsonic AP	TRP	Frangible
Case length:	25 mm	25 mm	25 mm	25 mm	25 mm
Rim diameter:	9.9 mm	9.9 mm	9.9 mm	9.9 mm	9.9 mm
Round length:	30 mm	30 mm	30 mm	30 mm	30 mm
Round weight (nominal):	7.5 g	7.5 g	12.5 g	7.5 g	7.5 g
Bullet diameter:	4.0 mm	6.5 mm	6.5 mm	4.0 mm	6.5 mm
Bullet weight:	2.0 g	2.5 g	8.0 g	1.8 g	2.5 g
Muzzle Velocity (MV):	830 m/s	830 m/s	310 m/s	850 m/s	830 m/s
Muzzle energy:	689 J	861 J	384 J	650 J	861 J

6.5 × 25 CBJ cartridges. From left to right: ball (tungsten), ST (spoon-tip), HET (high energy transfer: reduced penetration), subsonic AP, TRP (training, reduced penetration), frangible, blank, drill (CBJ Tech/Olof Janson) 1162192

7 mm Penna cartridges

Synonyms

7 × 23 (7 × 28, 7 × 28R, 7 × 36 and 7 × 42 also planned).

Development

This 7 × 23 cartridge was developed by Leonardo Penna of Q.S. Progetta Meccanica S.a.S, for use in a self-loading pistol. The rimmed 7 × 28R was intended for use in a revolver, the 7 × 28 Penna L and 7 × 36 Penna E intended for carbines, while the 7 × 42 Penna MG was planned for a military rifle. Initially the production emphasis was on the 7 × 23 described here and this was undertaken by Penna, mass production by Fiocchi was also planned. Fiocchi has not thus far advertised the availability of the ammunition, and the current status of the Penna rounds is unclear.

Description

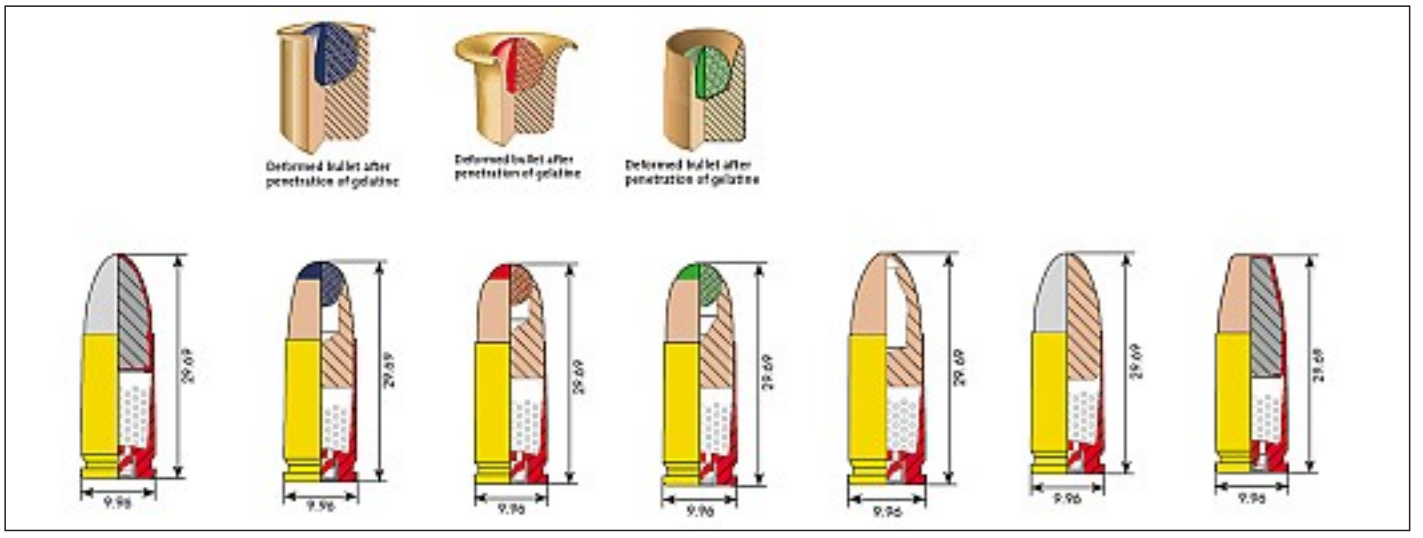
The 7 × 23 Penna uses a straight-cased, rimless cartridge case. The initial production phase has cartridges turned from the solid with particularly thick walls; the company has stated that mass-produced cases will be made by drawing as usual, but will retain the thick walls (possibly because the P7000 pistol range uses a blowback mechanism so a strong case would provide an extra safety factor).

Several bullets with different ballistics are offered: a round-nosed, brass-plated lead bullet weighing 4.5 g, a round-nosed lead-free bullet weighing 3.2 g and a pointed monolithic brass bullet weighing 3.0 g. Lightweight aluminium bullets have also been produced experimentally.

Armament

Penna P7000 and P7070 self-loading pistols.

7 × 23 Penna (bottom) compared with 9 × 19 (Anthony G Williams) 1162159



MEN 9× 19 rounds: Ball; QD-PEP; QD 1; QD 2; PTP; PFP; SD. With expanded bullets shown above their cartridges (MEN) 1153665

Korea, South
Contractor
Poongsan Metal Corp.
Ball 9A: FMJ; 7.45 g; MV 353 m/s
JHP 9B: 7.45 g; MV 356 m/s

Malaysia
Contractor
SME Ordnance Sdn Bhd.
Ball: FMJ; 7.45 g; MV 396 m/s

Mexico
Contractor
Industrias Tecnos SA (formerly Aguila).
Ball: FMJ; 8.03 g; MV 340 m/s
Ball: FMJ; 7.45 g; MV 381 m/s
HP IQ: Hollow-Point; 4.21 g; MV 472 m/s

Pakistan
Contractor
Pakistan Ordnance Factories.
Ball 2Z: FMJ; MV 395 m/s

Poland
Contractor
Mesko Zaklady Metalowe.
Ball: FMJ, ogival; 8 g; MV 350 m/s
JSP: 8 g; MV 340 m/s
LRN: 8 g; 345 m/s
AP: 5.9 g; 470 m/s
KPO ball: Anti-ricochet; 7.4 g; MV 360 m/s
Shot load: Lead shot; 3.7 g; MV 500 m/s

Portugal
Contractor
INDEP.
Ball M347: FMJ; lead core; 7.45 g; MV 396 m/s
Ball M419: FMJ; lead core, hardened steel jacket; 8 g; MV 396 m/s
Ball Luger: FMJ; lead core; 8 g; MV 392 m/s
Ball M420 training: Ogival head; 7.45 g; MV 377 m/s

Romania
Contractor
Arsenalul Armatei.
Ball: FMJ; 7.45 g; MV 380 m/s

Contractor
RomArm SA.
Ball: FMJ; 7 g; MV 380 m/s
Ball: FMJ; 8 g; MV 380 m/s

Contractor
Romtehnica.
Ball: FMJ; 7.45 g; MV 380 m/s

Russian Federation
Contractor
Barnaul Cartridge Plant.
Ball: FMJ; 7.5 g; MV 370 m/s
PRS Ball: Reduced ricochet FMJ; 7.5 g; MV 365 m/s

Contractor
LVE (Novosibirsk Low-Voltage Equipment).
Ball: FMJ; 8.8 g; V_{25} 350 m/s
AP 7N21: 5.4 g; MV 445–470 m/s

Contractor
Tula Cartridge Plant.
Ball: FMJ; 7.46 g; V_{10} 358 m/s

Contractor
Ulyanovsk Mechanical Plant.
Ball: FMJ; 7.4 g; MV 340–350 m/s
Ball: FMJ; 8.0 g; MV 340–350 m/s
Ball: FMJ sealed-base; 8.0 g; MV 340–350 m/s
Ball FP: FMJ; Flat-Point; 8.0 g; MV 340–350 m/s
HP: 8.0 g; MV 340–350 m/s
AP 7N21: 5.4 g; MV 445–470 m/s

Contractor
Russian Federation arsenals.
AP 7N21: Composite bullet with subcalibre AP steel core which separates from the rest of the bullet on hitting armour; high-pressure loading; 5.3 g; MV 460 m/s
AP 7N31: Composite bullet with subcalibre AP steel core which separates from the rest of the bullet on hitting armour; very-high-pressure loading (limited to purpose-designed guns); 4.2 g; MV 600 m/s

Serbia
Contractor
Prvi Partizan.
Ball: FMJ; 8 g; MV 390 m/s
Ball: FMJ; 8 g; MV 365 m/s
Ball: FMJ; 7.5 g; MV 407 m/s

Contractor
Yugoimport-SDPR.
Ball: FMJ; 7.45 g; MV 343 m/s
Ball: FMJ; 8 g; MV 327 m/s
JHP: 7.45 g; MV 344 m/s
LRN: 8 g; MV 328 m/s
Ball: FMJ, cylindro-conoidal; 8 g; MV 328 m/s
Subsonic ball: FMJ; 9.5 g; MV 296 m/s
Subsonic JHP: 9.5 g; MV 297 m/s

Slovakia
Contractor
Povazské Strojárne Povzbroj.
Ball: FMJ; 7.5 g; $V_{12.5}$ 360 m/s

Contractor
Technopol International JSC.
Ball: FMJ; 6.15 g; V_{25} 389 m/s
Ball: FMJ; 6.15 g; V_{25} 397 m/s
Ball: FMJ; 7.5 g; V_{25} 348 m/s
Ball FP: FMJ Flat-Point (FP); 7.5 g; V_{25} 350 m/s
Ball: FMJ; 7.5 g; V_{25} 349 m/s
LFN: Lead Flat-Nosed; 7.8 g; V_{25} 337 m/s
Ball: FMJ; 8 g; V_{25} 341 m/s
Ball FP: FMJ FP; 8 g; V_{25} 345 m/s
Ball: FMJ; 8 g; V_{25} 357 m/s

South Africa
Contractor
PMP, a division of Denel (Pty) Ltd.
Ball: FMJ; 7.45 g; MV 401 m/s
Tracer: FMJ; 6.95 g; MV 386 m/s
Blank: Rosette crimp
Subsonic: 8.13 g; MV 340 m/s
Monad: FMJ, plastic ogive 3.5 g; MV 575 m/s; this bullet is designed to defeat auto glass and steel with little or no subsequent deflection

Spain
Contractor
General Dynamics Santa Barbara Sistemas.
Ball: FMJ; MV 425 m/s

Sweden
Contractor
Bofors AB.
HP: FMJ, lead-antimony core inside steel jacket; 6.75 g; MV 420 m/s; designed to penetrate body armour
Ball M39B: FMJ; 6.8 g; MV 420 m/s
Practice M39: Steel ball 5.3 mm diameter held in plastic bullet; total bullet weight 1.4 g
AP HP: Armour-Piercing steel bullet, gilding-metal clad, lead core; 6.75 g; MV 420 m/s
Blank M39: Plastic bullet
Tracer FFV740: FMJ; 6 g; used in Miniman anti-tank weapon subcalibre trainer
Tracer FFV840: FMJ; 5.5 g; MV 300 m/s; used in Carl Gustaf recoilless gun subcalibre trainer

Contractor
Norma Precision AB.
Ball: Bronze, ogival; 6.7 g; MV 390 m/s
JHP 19021: 7.4 g; MV 355 m/s
Ball 19022: FMJ; 7.5 g; MV 355 m/s
Ball: Cylindro-conoidal; 7.5 g; MV 355 m/s
JSP 19026: 7.5 g; MV 355 m/s

Contractor
Nammo Vanasverken AB.
Nammo is now producing 'green' ammunition: lead-free, non-toxic primer and projectile, with reduced gasses. This is combat ammunition with full military performance. It is known as Ball HP (High Performance) to STANAG 4090; in 2006, qualification was in progress.
Ball BNT 7HP: FMJ; copper core in steel clad jacket; 6.75 g; MV 440 m/s; penetrates 3 mm mild steel plate at 70 m (cf 5–10 m for standard ball)
Ball: FMJ; 7.5 g; MV 380–410 m/s

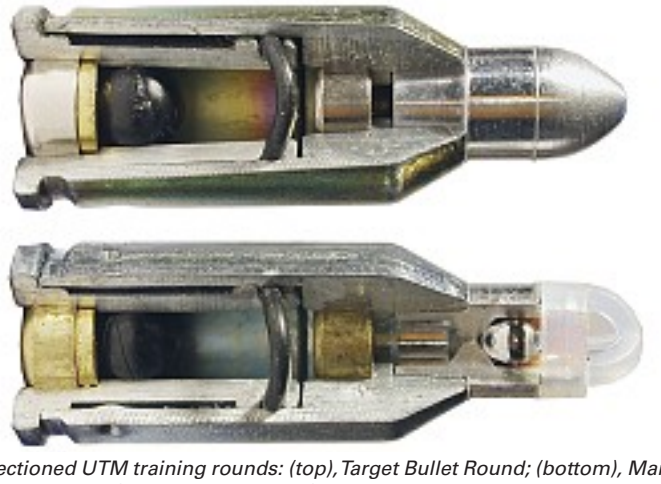
Switzerland
Contractor
RUAG Ammotec.
Ball: FMJ; 8 g; MV 365 m/s
Self: FMJ; lead-free projectile; 6.4 g; MV 400 m/s
Ball subsonic: FMJ; 9.5 g; MV 315 m/s
SeCa: JDP; lead-free projectile; 6.5 g; MV 400 m/s
Subsonic ball: JHP; 9.5 g; MV 315 m/s

Turkey
Contractor
Makina ve Kimya Endüstrisi Kurumu (MKEK).
Ball: FMJ, ogival; 8 g; MV 370 m/s

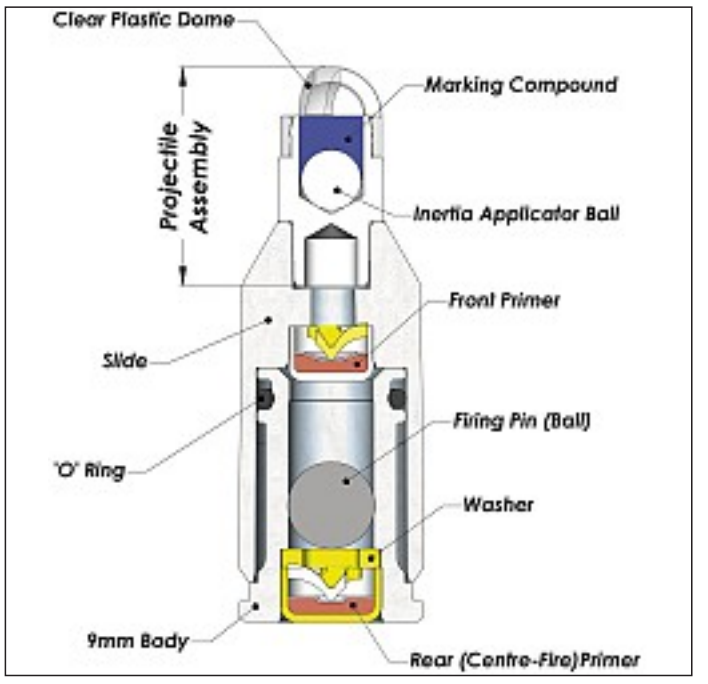
United Arab Emirates
Contractor
Adcom Manufacturing.
Ball M882: FMJ; lead core; 8.02 g; MV 370 m/s

United Kingdom
Contractor
BAE Systems Land Systems (formerly RO Defence).
Ball: FMJ; 7.45 g; V_{16} 395 m/s
JSP: 6.16 g; V_{16} 425 m/s

Contractor
Primetake Ltd.
Ball: FMJ; 7.45 g; MV 396 m/s
Tracer: FMJ; 7.45 g; MV 396 m/s



Sectioned UTM training rounds: (top), Target Bullet Round; (bottom), Man Marker round (Anthony G Williams) 1127400



Schematic of UTM 9× 19 MMR (UTM) 1322800

Contractor
Conjay.
Carbine ball: CBXX; 6.8 g; MV 460 m/s in 254 mm barrel
CBAP: CarBine Armour-Piercing; 5.51 g; MV 495 m/s; this round is no longer in production

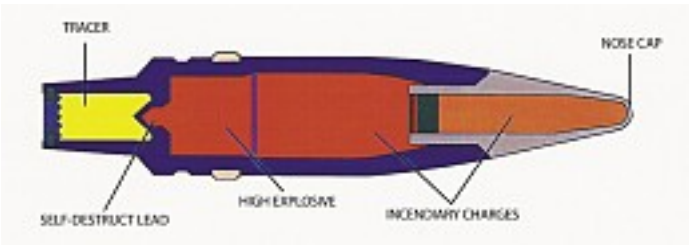
Contractor
Ultimate Training Munitions (UTM).
The UTM suite of 9 mm training ammunition is designed for use with a temporary gun conversion kit to prevent live ammunition from being fired. Ammunition operation is based on an expanding cartridge principle utilising blowback action facilitated by the UTM gun conversion.
Man Marker Round (UTM MMR): Composite bullet, containing coloured wax marking compound; 0.45 g; MV 102 m/s; ME 2.6 J; produces >130 dB(c)
Target Bullet Round (UTM TBR): Solid aluminium bullet; 0.48 g; MV 114 m/s; produces >130 dB(c)
Battlefield Blank Round (UTM BBR): Produces >139 dB(c); 1 m Safety standoff; cycles weapons without need for a Blank Firing Attachment
Silent Blank Round (UTM SBR): 0 m Safety standoff; cycles weapons without need for Blank Firing Attachment; does not discharge any gases through barrel; provides sufficient shock to activate simulator sensors

United States
Contractor
3-D Ammunition Inc.
Ball: FMJ; 9.52 g; MV 290 m/s
Ball: FMJ; 8.0 g; MV 320 m/s
Ball: FMJ; 7.45 g; MV 350 m/s
JHP: 9.52 g; MV 294 m/s
JHP: 7.45 g; MV 350 m/s
LRN: 8.1 g; MV 320 m/s

Contractor
Black Hills Ammunition.
Ball: FMJ; 7.4 g; MV 350 m/s
JHP: 7.4 g; MV 350 m/s
JHP +P: 7.4 g; MV 400 m/s
JHP +P: 8.0 g: MV 381 m/s
JHP: 8 g; MV 350 m/s
Ball: FMJ; 9.5 g; MV 300 m/s
JHP: 9.5 g; MV 300 m/s

Contractor
CCI-Speer.
Ball: FMJ; 7.45 g; MV 350 m/s
JHP: Gold Dot: 7.45 g; MV 366 m/s. 8.04 g; MV 350 m/s. 9.53 g; MV 300 m/s
Ball +P: 8.0 g; 371 m/s
JHP: Gold Dot +P: 8.04 g; MV 350 m/s
TMJ Lawman: Total Metal Jacket; 7.45 g; MV 366 m/s. 8.04 g; MV 332 m/s; 9.53 g; 300 m/s
TMJ Blazer: Light-alloy case; 7.45 g; MV 349 m/s; 8.04 g; 332 m/s. 9.53 g; 290 m/s

Contractor
Cor-Bon Ammunition.
JHP +P: 5.8 g; MV 457 m/s
JHP +P: 7.4 g; MV 411 m/s
JHP +P: 8.1 g; MV 381 m/s
Frangible: Glaser Blue (contains lead shot); 5.18 g; MV 503 m/s
Frangible: Glaser Silver (contains lead shot); 5.18 g; MV 503 m/s



25 mm Mk2 MPT SD (GD-OTS) 1162156

East request; the tungsten-alloy penetrator is held in a lightweight plastic sabot assembly, with the nose protected by a plastic windshield; the penetrator is provided with a tracer element that burns for 4 seconds; the muzzle velocity at 21°C is a nominal 1,440 m/s; penetration at 1,000 m is more than 40 mm of Rolled Homogeneous Armour (RHA) at an angle of 60°; at 2,000 m, penetration is more than 30 mm; standard deviation is less than 0.5 mil

TP-T M936: Inert steel body with aluminium nose cone and a tracer in rear, which burns >3 seconds; 180 g; MV 1,100 m/s.

TPCSDS-T M937: Short-range cone-stabilised training round ballistically similar to APDS and APFSDS out to 1,000 m, with a maximum range of less than 4,200 m.

France

Contractor

Nexter Systems (formerly Giat Industries).

HE-I-T: Steel thin-walled shell with tracer socket formed on base, filled Hexal, red tracer; nose-impact fuze providing self-destruction; 183 g; MV 1,100 m/s

APDS-T: Tungsten-carbide subprojectile in alloy/plastic sabot; with red tracer; 183 g; MV 1,100 m/s

APFSDS-T: No information available

TP: Steel shell body, empty; dummy fuze; 180 g; MV 1,100 m/s

TP-T: Steel two-section shell body, front empty, rear carrying red tracer; 180 g; MV 1,100 m/s

TP OXER: For training in reduced areas

HEI, SAPHEI, SAPHEI-T, AP-HC, APHC-T and APDS loadings were formerly made but are no longer offered.

Germany

Contractor

Diehl GmbH.

HE-I: self-destruction 3.7 to 5 seconds; 195 g; MV 1,100 m/s

SAP-HE: self-destruction 3.7 to 5 seconds; 195 g; MV 1,100 m/s

TP-T: 195 g; MV 1,100 m/s

PELE® DM 283: Penetrator with Enhanced Lateral Efficiency; fragmenting AP round, with a steel body and a low-density core surrounded by tungsten balls for additional fragmentation effect; in development

Italy

Contractor

Simmel Difesa S.p.A.

HEI-T: Nose-fuzed with tracer, filled with Hexal P30

SAPHEI-T: Steel pointed projectile with alloy ballistic cap containing incendiary mixture, tail tracer

TP-T: Inert projectile representing API-T, with tracer

APDS-T: Tungsten penetrator in plastic sabot; weight of complete round 486 g

Netherlands

Contractor

Eurometaal NV, now closed.

AP-I-T: Steel pointed projectile with alloy ballistic cap containing incendiary mixture, tail tracer; 185 g; MV 1,100 m/s

TP-T: Inert projectile representing AP-I-T, with tracer; 180 g; MV 1,100 m/s

APDS-T: Tungsten penetrator in plastic sabot

Norway

Contractor

Nammo Raufoss AS.

Multipurpose MPT-SD Mark 2: Steel body with HE-I fillings, the incendiary extending into the nose cap; dark ignition red tracer to 2,500 m in rear, with heat relay to effect Self-Dest (SD) after 5.3 seconds flight; 183.5 g; MV 1,089 m/s

Multipurpose M84A1: Similar to MPT-SD but without tracer; 183.5 g; MV 1,089 m/s

Multipurpose MPT-SD Low Drag: Similar to MPT-SD Mrk 2 but using a low-drag projectile body which improves terminal velocity at 2,000 m by 54 per cent, reduces the time of flight to 2,000 m by 25 per cent and gives increased terminal effects

Training rounds: Nammo also produces plastic blank and short-range training rounds

Armour Piercing Explosive (APEX): A multi-purpose round with enhanced penetrative capabilities; tungsten carbine penetrator within plastic nose cap, with delayed-action fuze and HEI elements in the body, plus a base-bleed element; intended for aircraft use, and being developed for the F-35 JSF.

Nexter Systems 25 × 137 rounds for M811 cannon 0502148

Romania

Contractor

RomArm SA.

APFSDS-T: Round weight 440 g; MV 1,405 m/s; will penetrate 35 mm armour at 60° impact at 1,000 m

FAPDS-T: Round weight 440 g; MV 1,310 m/s

TPDS-T: Round weight 436 g; MV 1,410 m/s

Turkey

Contractor

MKEK (Makina ve Kimya Endüstrisi Kumuru).

HEI-T M792: Standard specifications

APDS-T M791: Standard specifications

TP-T M793: Standard specifications

United States

Contractor

Alliant Techsystems Inc (ATK), Defense Systems.

M792 HEI-T/SD: Steel thin-walled projectile loaded 30.2 g HE and with red tracer (traces for 6.0 s); fuzed PD M758 with self-destruct; projectile weight 184 g; MV 1,100 m/s; time of flight to 2,000 m 3.6 s; dispersion .55 ×.55 mr

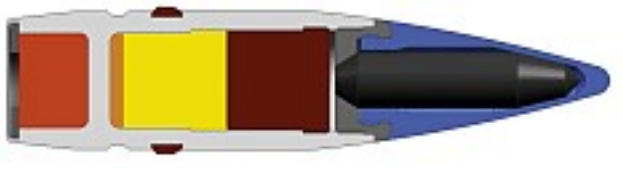
M791 APDS-T: Tungsten-alloy penetrator 102 g in alloy/plastic discarding sabot with red tracer (traces for 2.2 s); projectile weight 134 g; cartridge weight 455 g; MV 1,345 m/s; penetrates 25 mm RHA at 60° at 1,300 m; time of flight to 2,000 m 1.7 s; dispersion .30 × .30 mr

FAPDS-T: Identical to M791 save for frangible core optimised for defeat of aircraft targets; 135 g; trace visible for 2.2 seconds; MV 1,330 m/s

APFSDS-T FANG: FANG stands for Fin-Stabilised Armour-Piercing Next-Generation and is a tungsten-penetrator round designed to meet future armour threats; armour penetration is given as 31 mm set at 60° at 2,000 m; time of flight to 2,000 m is 1.6 seconds with MV of 1,410 m/s; cartridge weight 450 g; tracer burns for 1.6 seconds

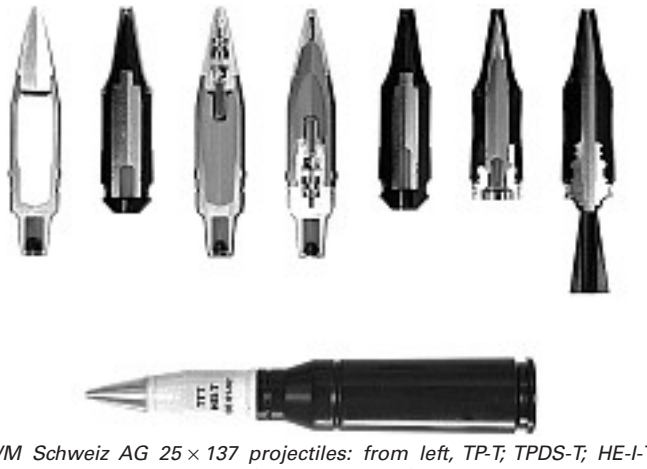
M793 TP-T: Hollow steel shell with alloy nose cap and rear tracer, empty, ballistically matched to M792 and Mk 210 HEI-T rounds; projectile, 184 g; MV 1,100 m/s

M910 TPDS-T: Inert subprojectile with tracer, in alloy/plastic discarding sabot; training round ballistically matched to M791 and APDS-T Frangible rounds to a range of 8,000 m; cartridge weight 415 g; trace visible for 4 seconds; time of



Nammo APEX projectile (Nammo) 1192862

Cutaway of the RWM Schweiz 25 × 137 FAPDS-T round as produced for Canadian forces 0002314



RWM Schweiz AG 25 × 137 projectiles: from left, TP-T; TPDS-T; HE-I-T; SAP-HE-I-T; FAPDS-T; APDS-T (no longer made); and APFSDS-T 0502931

FAPDS: This resembles the APDS in form but uses a frangible subprojectile which, after penetrating the target, disintegrates into fragments to cause widespread internal damage. 190 g; MV 1,285 m/s

TP: Steel shell, filled inert; dummy fuze. 230 g; MV 1,160 m/s
TP-T: Steel shell, filled inert with red tracer; dummy fuze; 230 g; MV 1,160 m/s
TPDS-T: Steel subprojectile in alloy/plastic sabot, with tracer; 190 g; MV 1,285 m/s

25 × 218 round

Development

The round is the result of a complex development history, commencing with the acquisition by the USSR of the Bofors 25 mm Anti-Aircraft (AA) gun in the late 1930s. The original 25 × 205 SR Bofors cartridge went through various permutations in the USSR before emerging in its present form after the Second World War. In the 1950s, the M-110 gun (normally in a vertically stacked twin mounting) formed the standard AA and surface-fire cannon of hte Soviet navy and its allies. In addition to Russian and Chinese production, described below, it is probably also manufactured in North Korea, although no information is available. As far as can be determined, this ammunition is no longer produced within Russia itself.

Description

This round uses a rimless, bottlenecked brass case with a sharply stepped shoulder. Two main types of round are known to have been manufactured, and they are still in production: a High-Explosive Incendiary Tracer (HE-I-T) and an Armour-Piercing Tracer (AP-T). The steel projectile of the HE-I-T (known as the UOZR-85M) weighs 280 g and incorporates a copper or gilding-metal rotating band with a Point-Detonating (PD) all-weather nose fuze containing a self-destruct element. The HE-I content weighs 19.1 g, and the tracer burns for at least 3 seconds.

The 281 g AP-T (UBR-85) uses a steel projectile with a nose cap and contains a tracer element that burns for at least 4 seconds.

It is assumed that training rounds are also available.

Armament

M-110 and M-110-PM automatic naval guns on 2M3, 2M3M and 2M8 mountings; Norinco Type 61 twin-barrelled naval gun.

Specifications

Lengths:
complete round: 293 mm
case: 218.7 mm
projectile: approx 115 mm
Diameters:
rim: 34.9 mm
bourrelet: 24.7 mm
Weights:
complete round: 640 g
projectiles:
HE-I-T: 280 g
AP-T: 281 g

Ammunition for 25 mm naval cannon compared: a drill round for the Oerlikon 25 × 184 KBB (top), compared with the Russian 25 × 218 round (bottom) (Anthony G Williams) 1121109

Norinco 25 mm HE-I-T naval cartridge for the Type 61 naval gun 0002316

Ranges:
surface targets:
maximum: 2,800 m
effective: 2,200 m
air targets:
maximum: 2,800 m
effective: 1,500 m
Operational temperature range: –40 to +50°C
Muzzle velocity: 900 m/s
Muzzle energy: 113 kJ

Equivalent rounds

China
Contractor
China North Industries Corp (Norinco).
HE-I-T: Steel shell loaded 11.5 g RDX; nose-impact fuze, probably with self-destruction; 282 g; MV 880 m/s

Russian Federation
Contractor
Russian Federation arsenals.
HE-I-T UOZR-132: Steel shell filled TNT and fitted with base tracer, three copper driving bands; nose-impact fuze; 288 g; MV 900 m/s
HE-I-T: Steel shell filled TNT and fitted with base tracer, two copper driving bands; nose-impact fuze; 285 g; MV 900 m/s
HE-I OZR-85M: Steel shell filled 11 g A-IX-2 high-explosive/incendiary composition; nose-impact fuze MG-25; 250 g; MV 900 m/s
AP-T BR-85: Pointed steel shot with base tracer; 260 g; MV 900 m/s

27 × 145 B ammunition

Synonyms

27 mm Mauser; 27 mm BK 27.

Development

The Mauser BK 27 gun system was developed primarily for the MultiRole Combat Aircraft (MRCA) which later became the Tornado. Development of the gun was completed in 1976, and the Mauser BK 27 is now the integral gun armament of Tornado strike aircraft in service with Germany, Italy, Saudi Arabia and the UK. The Mauser BK 27 is also used on the Alpha Jet and is the gun armament of the Swedish JAS 39A Gripen (in service with Sweden and ordered by South Africa) and the European Eurofighter (EF 2000) developed by Germany, Italy, Spain and the UK. In April 2000, Eurofighter orders stood at Germany 180, Italy 121, Spain 87 and the UK 232. Over 3,100 BK 27 guns have been produced.

The Mauser Drakon Close-In Weapon System (CIWS) was a naval gun system mounting four BK 27-pattern cannon producing a combined cyclic rate of fire of 7,200 rds/min. It failed to be adopted by any navy.

The Mauser MN 27/30 GS naval gun mounting, originally intended to accommodate either the Mauser BK 27 or an MK 30 cannon, has been superseded by the MLG 27 light naval gun system. Carrying a single BK 27 cannon, it is on order to replace all existing 20 and 40 mm air-defence guns and mountings operated by the German Navy and has also achieved export sales. A land-based version of the MLG 27 is now being offered for short-range air defence.

Diehl PELE 27 × 145 B round (Diehl) 1153676

Mauser has developed the UGP 27 universal gun pod, together with Aerotek of South Africa. The UGP 27 contains a single BK 27 cannon and may be used with a wide range of trainer, ground attack and fighter aircraft.

All types of full-calibre 27 × 145 B ammunition used with the BK 27 and its derivatives have matching ballistics and the same overall weights and dimensions according to Stanag 3820.

Mauser-Werke Oberndorf GmbH (now part of Rheinmetall DeTec) is the developer for this ammunition and remains the main contractor for the Tornado programme. Also involved with the production of the 27 × 145 B ammunition

RWM 27 × 145 B FAP round (RWM) 1340414

family are BAE Systems RO Defence of the UK, BPD Difesa e Spazio (now Simmel Difesa SpA) of Italy, and Diehl Stiftung of Germany.

The UK Ministry of Defence awarded Nammo Raufoss AS of Norway a contract to develop a MultiPurpose (MP) 27 mm round for the Royal Air Force's Tornado squadrons. The result, the M90, has qualified for service.

Description

The types of full-calibre 27 × 145 B ammunition fired from the Mauser BK 27 revolver aircraft cannon can be put into three main categories: air-to-air combat, air-to-ground combat and training ammunition. To these can be added the Nammo Raufoss MP rounds, the Armour-Piercing Fin-Stabilised Discarding-Sabot (APFSDS) anti-missile round developed for the Drakon CIWS, and the Frangible Armour-Piercing Discarding-Sabot (FAPDS) round for the MLG 27, which is also known as FRAP (Fragmenting Payload).

The cartridge case used with all rounds is of lacquered steel. It has an electrical current-dependent primer in the base and contains approximately 85 g of triple-base multiperforated propellant.

Rounds are delivered to the revolving feed magazine on the gun in belts connected by DM 80 steel cartridge belt links. On the EF 2000, rounds are delivered to the feed mechanism linklessly.

Full-Calibre ammunition

There are three types of Mauser 27 mm full-calibre High-Explosive (HE) ammunition: HE DM 21, HE DM 31 and the self-destruct HE-SD DM 11. They are all designed for operations against aircraft in air-to-air combat. All have an electro-magnetic nose fuze which functions even at extremely flat impact angles. A delayed action in the fuze ensures good fragmentation after the projectile has entered the target.

There are five types of Armour-Piercing (AP) and Semi-Armour-Piercing (SAP) cartridge: AP DM 43, APHE DM 13, APHE-SD DM 23, SAPHE DM 53 and SAPHE-SD DM 43. The AP DM 43 uses a tungsten-carbide penetrator to produce the armour-penetration effects, while zirconium in the penetrator nose and around the base provides an additional incendiary effect. The APHE DM 13 and APHE-SD DM 23 both have a mechanical delayed-action base fuze, with or without a Self-Destruct (SD) element. An incendiary composition is pressed into the projectile nose to create an additional incendiary effect. Aluminium powder is added to the explosive charge which, in conjunction with the detonation cloud and atmospheric oxygen, creates additional flaming and increases the blast effect. The SAPHE DM 43 and SAPHE-SD DM 53 both have a mechanical delayed-action base fuze while the projectile tip carries an incendiary charge and a zirconium sponge pellet. These SAPHE rounds are intended for use against armoured and unarmoured targets.

The DM 103 FAP (Frangible Armour Piercing: RWM designation PEB 327) comprises a frangible tungsten alloy core and tungsten balls, both contained within a plastic matrix in an aluminium body. On impact the frangible tungsten core penetrates the outer skin of the target and then progressively breaks up as it passes through the structure, thereby releasing a highly energetic fragment cloud. This causes damage deep inside the target and ensures a high kill probability. The FAP round can be deployed in both air-to-ground and air-to-air roles and has the same trajectory as the standard 27 mm ammunition. Due to the design concept, the FAP round is intrinsically safe from ricochets as the core breaks up on impact with the ground.

A MultiPurpose (MP) projectile will function against a 2 mm dural plate at impact angles between 0 and 87° International at normal combat ranges but will not function against a 0.5 mm dural plate placed directly in front of the gun muzzle. No fuze is involved, as the MP projectile relies on a drop-safe pyrotechnic ignition train. When impacting against aircraft-type targets, the projectile will detonate approximately 300 mm inside the aircraft. Fragments are distributed in a cone with an opening angle of approximately ±20° against the line of fire.

Training ammunition

There are five 27 mm Training Practice (TP), Target Practice – Tracer (TP-T), Target Practice with Reduced Ricochet Risk (TP-RRR or German mrA) and Target Practice – Frangible (TP-FRAN) cartridges: TP DM 28, TP-T DM 58, TP-RRR DM 68, TP-FRAN DM 38 and the inert DM 10 drill round.

The TP-FRAN projectile body consists of an aluminium alloy body with shear lines and is filled with iron-powder pellets. On impact at angles between 0 and 80° International, no effective fragments will ricochet from the target, be it water, sand, wood, concrete or steel. This substantially reduces the ricochet risk against aircraft during practice firings.

The TP-RRR projectile consists of three parts: nose, body and base – which upon impact with sand, stone, water, steel or concrete, and at striking angles of between 0 and 85 degrees NATO, disintegrates into at least three pieces each of poor aerodynamic shape. These fragments have shown nearly zero capability to enter or cross the flight path of the firing aircraft. This round is qualified by the Bundesamt für Waffen und Beschaffnung (BWB).

A non-ricochet TPFP-T round, developed in conjunction with Schweizerische Unternehmungun für Waffensystem, is used by the German Luftwaffe at the Tornado training unit based at Holloman Air Force Base in New Mexico, USA.

Another non-ricochet round is the Nammo TP-RRR or TP-R3 (Reduced Ricochet Risk), which was qualified in 2001 by the German BWB as the DM68. This disintegrates into high-drag pieces on impact.

Recocking cartridge

The DM 72 is a recocking cartridge for the BK 27 gun system, intended to recock the gun in the event of a misfire.

Sub-Calibre ammunition

An APFSDS round was developed for the Mauser Drakon CIWS. It consists of a long-rod tungsten-alloy penetrator with high-strength mechanical properties. The fin-stabilised penetrator is accelerated by a three-segment aluminium

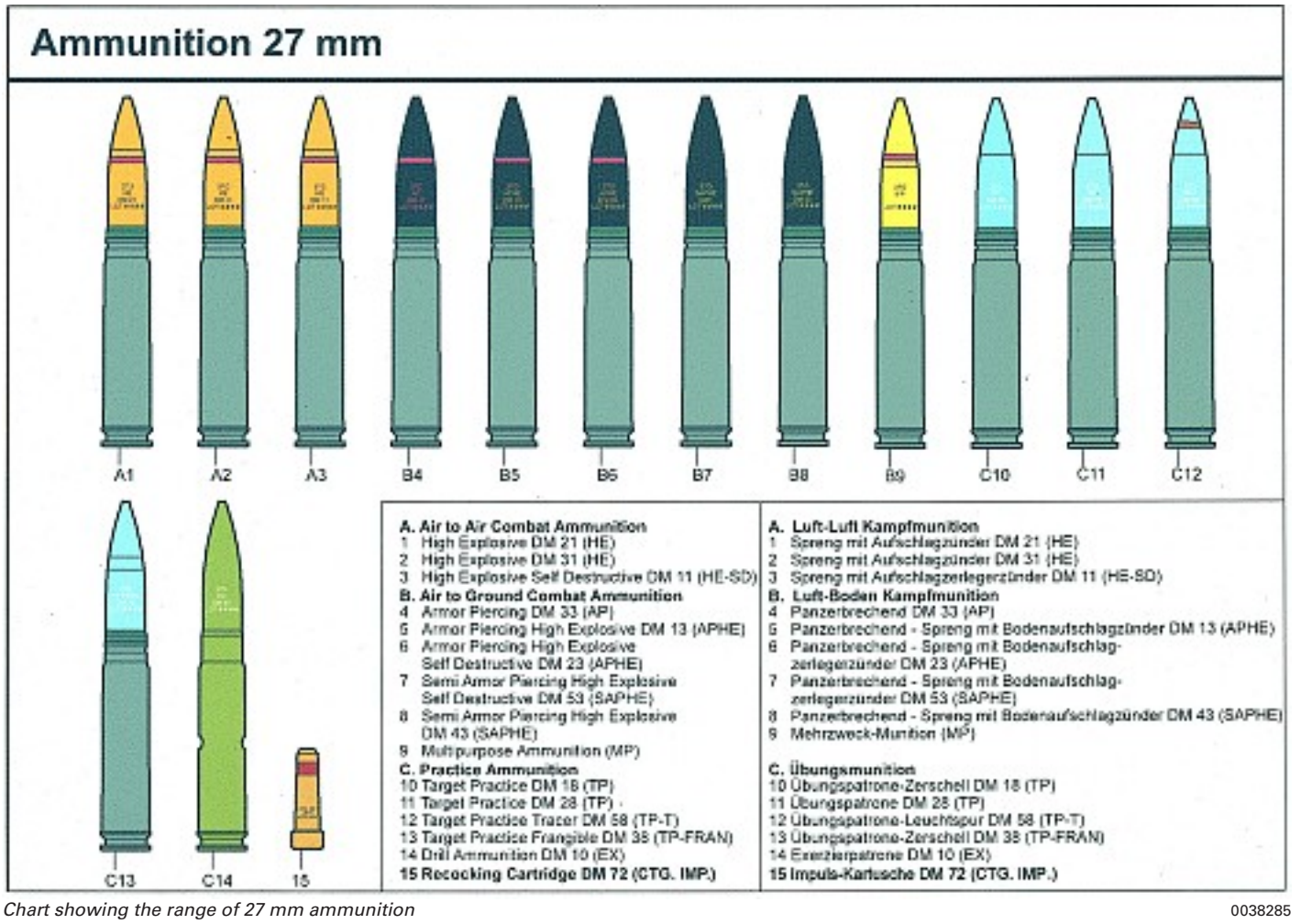


Chart showing the range of 27 mm ammunition 0038285

(RDX/aluminium). The fuze has a self-destruct mechanism operating between 6 and 15 seconds after firing, using a pyrotechnic chain to time the self-destruct point.

The HE-I projectile weighs 245 g, while a complete round weighs 441 g. The muzzle velocity is 810 m/s.

The training round used to simulate the air-to-air HE-I is the 30 mm Target-Practice Tracer (TP-T) Type F 2570. It is fitted with an inert nose plug filled with an inert powder and matches the ballistics of the 30 mm HE-I projectiles exactly. The projectile weight is 245 g, and the complete round weighs 440 g.

There were two earlier versions of the HE-I round which are no longer in production: the Type F 7570 with an ML68 fuze and the HE-I Type F 7571 with an MR381 fuze.

HEI – Type F 5270

This is also a type of High-Explosive Incendiary (HEI) round. It is used in the air-to-ground role and is provided with a nose-mounted MR3001 impact fuze. At one time, this round was known as an Anti-Personnel High-Explosive Incendiary (APHEI). It is filled with 30 g of high-temperature-tolerant Hexal (RDX/aluminium). There is no self-destruct mechanism.

The HE-I projectile weighs 275 g, while the weight of a complete round is 490 g. The muzzle velocity is 775 m/s.

The training round used to simulate this HE-I round is the TP F 2270. It is fitted with an inert nose plug filled with an inert substance and matches the ballistics of the air-to-ground HE-I projectile exactly. The projectile weight is 275 g, and the complete round weighs 490 g.

There are two earlier versions of air-to-ground HE-I round that are no longer in production: the Obus Anti-Personnel Explosif Incendiaire (OAPEI) Type F 5270 with an MRX70 fuze and the OAPEI Type F 5271 with an MR31 fuze.

SAPHEI – Type F 7670

Intended primarily for air-to-air combat, this Semi-Armour-Piercing High-Explosive Incendiary (SAPHEI) round is known as the 30 mm Type F 7670. It uses a thick-walled heat-treated steel projectile with a blunt nose, covered by a light alloy windshield to retain a ballistic match with other rounds in the DEFA 30 mm family. The base of the projectile is occupied by a delayed-action base fuze known as the MR3005, with an arming distance of 20 m from the muzzle and a self-destruct time between 6 and 15 seconds. When the fuze functions, it detonates the explosive payload, which weighs 18 g, to create high fragmentation effects behind the target armour. The projectile can penetrate up to 20 mm of armour.

The weight of the projectile used with this round is 275 g, and the weight of a complete round is 490 g. The muzzle velocity is 775 m/s.

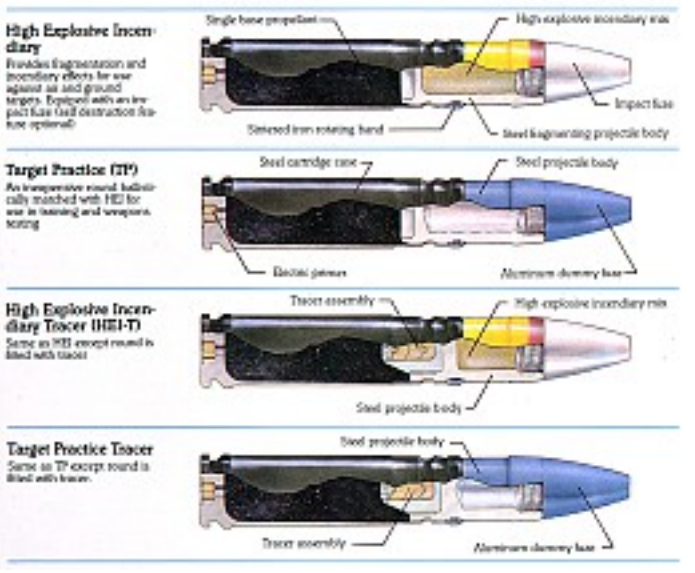
API-T – OPIT Type F 5970

This Armour-Piercing Incendiary Tracer (API-T) round, no longer produced, is known as the 30 mm Modèle F 5970. It is intended for the air-to-ground attack of hard targets such as armoured vehicles. The projectile uses a cold-drawn steel body with thin sidewalls, carrying a heat-treated special steel blunt nose slug that acts as the armour penetrator. It is capable of piercing approximately 20 mm of armour plate. The projectile nose is covered by a light alloy windshield to retain a ballistic match with the other rounds in the DEFA 30 mm family. The projectile body is filled with 20 g of an incendiary composition, and a tracer element is mounted in the projectile base.

The projectile used with this round weighs 275 g, and the weight of a complete round is 490 g. The muzzle velocity is 765 m/s.

This round is no longer in series production.

The range of 30 × 113 B ammunition produced by Giat Industries for 30 mm DEFA guns: from top to bottom, TP; TP OXAS; TP-T; HE-I; HEI; and SAPHEI 0063259



Range of 30 × 113 B ammunition produced by Hellenic Defence Systems (EAS) S.A. for 30 mm DEFA guns 0084693

TP-T – OXT Type F 5970

This Target-Practice Tracer (TP-T) round acts as a general-purpose training round for the 30 mm DEFA family. Known as the Modèle F 3170, it has a thick-walled steel body with an inert nose plug. The interior is hollow and empty, and the base is occupied by the same tracer-element assembly as that used on the 30 mm API-T OPIT Modèle F 5970.

The projectile used with this round weighs 245 g, and the weight of a complete round is 490 g. The muzzle velocity is 795 m/s.

TP – OXL Type F 2570

This Target-Practice (TP) training round has an inert ballasted projectile.

TP – OXAS Type F 2270

The OXAS projectile has the same ballistic characteristics as the SAPHEI combat round. The complete round weighs approximately 475 g, and the projectile weighs 275 g.

Armament

Direction des Etudes et Fabrications d'Armement (DEFA) and Giat Industries Series 552/553 guns; Giat 30M554 gun; Giat 30M781 cannon; Vektor 55C5 gun; M230 chain gun. (All Giat products now known as Nexter Systems).

Authorised fuzes

See text.

Specifications

For specific details of each round, see text.
Weights:
- **complete round:**
  - **HE-I Type 7572:** 441 g
  - **HE-I Type 5272 SAPHEI:** 490 g
- **projectile:**
  - **HE-I Type 7572:** 245 g
  - **HE-I Type 5272 SAPHEI:** 275 g
  - **propellant:** approx 50 g

Lengths:
- **complete round**: 200 mm
- **cartridge case:** 113 mm

Projectile diameter, maximum: 29.99 mm
Case diameter, maximum:
- **over band:** 33.8 mm
- **over rim:** 33.4 mm

Chamber pressure: 294 MPa
Operating temperature range: –54 to +74°C
Firing safety temperature limits: –60 to +100°C

Contractor

Round manufacturer: Giat Industries. (Now Nexter Systems).
Propellant manufacturer: Société Nationale des Poudres Explosif (Groupe SNPE).

30 mm UOF-84 HE-I round for the AK-630 CIWS 0502131

of the drive band. The tracer element burns for at least 10 seconds. The self-destruct time is approximately 16 seconds.

Inert practice and drill rounds are known to exist.

APDS-T

This round is known as the BPS 'Kerner' and the projectile consists of a tungsten-alloy core surrounded by a yellow plastic sabot.

Armament

30 mm GSh-6-30K gun on AK-630 CIWS and Kashtan CIWS; AO-18L gun on AK-306 mounting.

Authorised fuzes

HE-I and HE-T: MG-32 Point-Detonating (PD).

Specifications

Type:	**HE-I**	**HE-T**	**APDS-T**
Designation:	UOF-84	UOR-84	BPS "Kerner"
Weights			
round:	832 g	828 g	
projectile:	390 g	386 g	304 g
propellant:	117 g	118 g	
explosive:	48.5 g	11 g	none
Lengths			
round:	291 mm	290 mm	
projectile:	149.5 mm	149.5 mm	
case:	165 mm	165 mm	165 mm
Rim diameter:	40 mm	40 mm	40 mm

30 mm UOR-84 HE-T round for the AK-630 CIWS 0502132

Muzzle velocity:	900 m/s	900 m/s	1,120 m/s
Muzzle energy:	158,000 J	156,000 J	191,000 J
Chamber pressure:	3,600 kg/cm² (353 MPa)	3,600 kg/cm² (353 MPa)	3,600 kg/cm² (353 MPa)

Equivalent rounds

Bulgaria
Contractor
Arcus Co.
Type: HE-I, HE-T
Description: Standard specifications

Romania
Contractor
RomArm.
Type: OF-84 HE-T, OR-84 HE
Description: Muzzle velocities given as 890 m/s and round weights as 833 g (HE-T) and 837 g (HE); otherwise, standard specifications

Russian Federation
Contractor
Pozis.
Type: HE-I, HE-T
Description: Standard specifications

Contractor
Pribor.
Type: HE-I, HE-T
Description: Standard specifications

30 × 165 ammunition for Russian Federation aircraft cannon

Development

The 30 × 165 Russian Federation ammunition was developed from the 1970s in three versions, for army, navy and air-force weapons. Each has its own series of loadings to suit their specific needs and weapons. The army ammunition additionally differs from the navy and air-force versions in having percussion priming rather than electric priming.

The ammunition in the 30 mm aircraft-gun category is used in the twin-barrelled GSh-30 (Su-25 strike aircraft) and GSh-30K (Mil Mi-24P helicopter), the six-barrelled GSh-6-30 (MiG-27 strike aircraft) and the single-barrelled GSh-301 (MiG-29, Su-27 fighters). The GSh-30 is a scaled-up GSh-23 that fires at 2,500 to 3,000 rds/min. The GSh-6-30 resembles a Gatling-type gun but is gas-operated (starting the gun cycle involves compressed air), with a rate of fire from 4,500 to 5,000 rds/min. The GSh-301 is a recoil-operated gun firing at 1,500 to 1,800 rds/min.

Description

Russian Federation 30 mm aircraft cannon ammunition is fixed; it has close affinities to the ammunition used for the 30 mm AO-18 rotary gun used on naval AK-630 Close-In Weapon Systems (CIWS); see separate entry. However, the projectiles used with the aircraft guns differ in several respects. The projectiles use a single wide copper drive band and are securely fixed to the coated light steel cartridge cases by two rows of spaced crimps engaging in cannelures on the projectile. They are also shorter due to a different fuze shape. The rimless cartridge cases contain 6/7 FlAv pyroxyline powder propellant initiated by an electrical primer.

All these 30 mm rounds were designed to operate over a temperature range of –60 to +80°C. All rounds in the family are stated to be capable of withstanding a fall from a height between 5 and 10 m onto a hard surface.

There are six main types of round in the 30 mm aircraft-cannon ammunition range:

- Armour-Piercing Tracer (AP-T)
- Armour-Piercing Explosive (APE)

CC 'multiple-element projectile' round for 30 × 165 aircraft cannon (top) with a cutaway of projectile (bottom) to reveal some of the 28 dense metal fragments carried 0502134

- High-Explosive Incendiary (HEI)
- High-Explosive Incendiary Tracer (HFI-T)
- High-Explosive Incendiary Balloon and
- Cargo-Carrying (CC), a special type of fragmentation round.

The CC is also known as the 30 mm 'multi-element projectile'. The projectile consists of a thin-walled container body with 28 bullet-shaped fragments spaced around a central explosive, the total payload weighing 117 g (projectile weight is 404 g). The forward end of the projectile sidewall is crimped over a light metal windshield, providing a streamlined ballistic outline for the projectile. When the small central explosive payload detonates under the control of an internal delay train at a range of 800 to 1,300 m from the gun muzzle (1.1 to 1.5 seconds after firing), the walls break open, and the windshield is blown off. This enables the ejected 28 dense metal fragments, each weighing 3.5 g, to travel forward, forming an initial 8° cone and leaving the projectile debris behind to fall to the ground. The sub-projectiles are claimed to be highly effective against personnel in the open and against lightly armoured material, such as parked aircraft. It therefore has some similarities with the Oerlikon AHEAD rounds, but the fuze timing is fixed instead of being set on firing.

The HEI round has a more conventional function and appearance. It has a nose-fuzed Point-Detonating (PD) AG-30 or AG-30D streamlined steel-walled 390 g projectile containing 48.4 g of HE. The HEI-T projectile is marginally lighter (387 g) and contains a tracer element, reducing the HE content to

Specifications

Types:	**HEI**	**HEI-T**	**APHE**	**AP-T**	**HEI Balloon**	**CC**
Designations:	UOF-84	OFZT	BR	BT	FZ	ME
Weights						
cartridge:	832 g	829 g	832 g	845 g	830 g	846 g
projectile:	390 g	387 g	390 g	403 g	388 g	404 g
Lengths						
cartridge:	284 mm	284 mm	284 mm	284 mm	284 mm	284 mm
case:	165 mm	165 mm	165 mm	165 mm	165 mm	165 mm
Rim diameter:	40 mm	40 mm	40 mm	40 mm	40 mm	40 mm
Muzzle velocity:	860–890 m/s	860–890 m/s	860–890 m/s	850–880 m/s	860–890 m/s	860–890 m/s
Muzzle energy:	144–154 kJ	144–154 kJ	144–154 kJ	146–156 kJ	144–154 kJ	144–154 kJ
Chamber pressure:	3,600 kg/cm² (353 MPa)	3,600 kg/cm² (353 MPa)	3,600 kg/cm² (353 MPa)	3,600 kg/cm² (353 MPa)	3,600 kg/cm² (353 MPa)	3,600 kg/cm² (353 MPa)

Arcus 30 × 165 HEI round for aircraft guns (Arcus) 1127428

Arcus 30 × 165 AP-T round for aircraft guns (Arcus) 1127430

Sectioned 30 × 165 HEI round (Arcus) 1127429

Sectioned 30 × 165 AP-T round (Arcus) 1127431

43.3 g. The HE-I Balloon is similar to the HEI but is fitted with a flat-nosed, high-sensitive BSh-30N fuze intended to be detonated on impact with balloon fabric; it also contains a self-destruct element operating 12 to 20 seconds after leaving the gun muzzle. The AP-T round weighs 844 g and can penetrate 20 mm of armour set at 60° at a range of 1,300 m. The tracer element burns for 2 seconds. This is similar to the projectile used in the 2A42 Army AA gun. The APHE projectile contains 14.6 g of explosive, and the equivalent armour penetration is reduced to 15 mm. Muzzle velocities for most loadings vary between 860 and 890 m/s, depending on the barrel length of the gun.

An inert Target-Practice (TP) round also exists, designated UP.

Armament
GSh-30, GSh-30K, GSh-6-30 and GSh-301 aircraft gun mountings.

Authorised fuzes
HEFI and HEFI-T: PD AG-30 or AG-30D.

Contractors
Pribor.
Type: HEFI, AP-T
Description: Standard specifications
Pozis, Tatarstan
Type: HEFI, AP-T, CC
Description: Standard specifications

Equivalent rounds
Bulgaria
Contractor
Arcus Co.
Type: HEI, AP-T
Description: Standard specifications; the projectiles are coloured blue.

India
Contractor
Indian Ordnance Factories.
Type: HE, TP
Description: For GSh-301 guns; standard specifications. Known as '30 mm Ghasha' ammunition

Romania
Contractor
RomArm.
Type: HE OF-84, AP-T
Description: For GSh-30 L guns; HE OF-84 standard specifications; the AP-T appears to be a local development capable of penetrating 20 mm of armour at 500 m; complete AP-T round weight is 850 g; projectile weight is 448 g; tracer element burns for a minimum of 5 seconds

Serbia
Contractor
Sloboda A.D.
Type: HE, HEI, AP, AP-T, TP
Description: Standard specifications; HE filling is RDX, HEI an RDX + aluminium mix

30 × 170 Oerlikon ammunition

Synonyms
30 mm KCB.

Development
When originally produced, the series of 30 mm automatic cannon now generally known as the Oerlikon Contraves 30 × 170 KCB series was designated the Hispano-Suiza HS-831 series. The designation was officially changed when Hispano-Suiza became part of Oerlikon Contraves AG but is often retained. The 30 mm cannon design involved was virtually a scaled-up version of the 20 mm HS-820 (now known as the Type KAD) cannon and has been produced in several forms.

Two different loadings of the 30 × 170 have seen service. The original type was for the HS-831A gun, used only by France (in the AMX 13 SPAAG) and Saudi Arabia (AMX 30 SPAAG). These were mainly brass-cased, and used heavy shells with a conical ogive and a brass driving band. Muzzle velocity was 920 m/s. Most production is for the slightly modified HS-831L: this uses steel cases with lighter shells having a more conventional ogive and sintered iron driving bands. Muzzle velocity is 1,080 m/s. The two types are not interchangeable due to the different ballistics.

RWM Schweiz's KCB ammunition family was used as the basis for the 30 mm Rarden gun ammunition family but ammunition for the KCB and Rarden L21 is not qualified as inter-operable.

Description
RWM Schweiz 30 × 170 KCB rounds are fixed, with the steel projectiles rigidly fitted into the lacquered steel cartridge cases by crimping points which engage in cannelures on the projectile body. A single sintered-iron drive band is used on the streamlined projectiles.

The same 170 mm long-necked cartridge cases are used for all types of round in the KCB family and are each filled with 160 g of an NC single-base propellant. The rim diameter is 42.8 mm. A percussion primer is threaded into the base of the cartridge case. All types of projectile are ballistically matched and have a Muzzle Velocity (MV) of 1,080 m/s.

RWM Schweiz's 30 mm KCB ammunition family includes the following rounds:

HE-I
The High-Explosive Incendiary (HE-I) projectile is a thin-walled steel shell pressed from a steel blank by a technique ensuring high fragmentation. The filling is 40 g of Hexal P30 which, when detonated, has been demonstrated to produce an average of 1,133 fragments (of which only 0.05 g is dust), in addition to the blast and incendiary effects. The projectile nose is occupied largely by an impact nose fuze originally known as the Type F-831-L3, now the KZC-L3. The rain-safe fuze has a muzzle safety distance of 20 m and causes the projectile to self-destruct after approximately 6 to 11 seconds. The fuze functions at a delayed interval after impact to maximise the blast and fragmentation effects in the target. The explosive filling also produces an incendiary effect.

HE-I-T
This High-Explosive Incendiary Tracer (HE-I-T) projectile is much the same as the HE-I, but the base of the projectile is occupied by a tracer element, so the explosive filling is reduced to 25 g of Hexal P30. After firing, the tracer burns for an average of four seconds, during which time the projectile will have reached a range of approximately 2,700 m.

SAPHEI
The projectile for this Semi-Armour-Piercing High-Explosive Incendiary (SAPHEI) round is manufactured from tempered steel and has relatively thick walls. As the nose of the shell is blunt for armour penetration efficiency, it is covered by a light aluminium windshield to maintain the

30 × 170 KCB ammunition from RWM Schweiz and Royal Ordnance: from left, TP; TP-T; HE-I; HE-I-T; and SAPHEI 0502139

correct aerodynamic outline. The base of the projectile is occupied by a base-impact fuze, known as the BZC-L5, which functions after a short delay following an impact to detonate 20 g of Hexal P30 inside the target armour. In this way, blast, fragmentation and incendiary effects are added to the target penetration. The fuze provides projectile self-destruct after 6 to 11 seconds.

TP
This Target-Practice (TP) training round is a hollow steel shell containing an inert material. The nose fuze is replaced by an aluminium plug, with an outline corresponding to operational KCB rounds.

TP-T
This Target-Practice Tracer (TP-T) training round uses exactly the same projectile as the TP, but the rear of the shell is occupied by a tracer element. After firing, the tracer burns for an average of four seconds, during which time the projectile will have reached a range of approximately 2,700 m.

ABM
Currently at early prototype stage, this Air-Bursting Munition (ABM) is an HE round with a programmable fuze.

Armament
Oerlikon KCB, fitted to a range of ground and naval mountings: HS 661 towed anti-aircraft gun; AMX-13 and AMX-30 twin self-propelled anti-aircraft guns; Flying Tiger (Biho) twin 30 mm self-propelled anti-aircraft gun system (South Korea); Sabre twin-turret fitted in prototype form to AMX-10RC, AMX-30, Chieftain and Steyr chassis; TCM 30 twin naval mounting; Oerlikon Contraves GCM series of twin naval mountings; DS 30 B naval mounting; Emerlec 30 twin naval mounting.

KCB ammunition can also be fired by 30 mm L21 Rarden guns, but Rarden ammunition cannot be fired from KCB-series cannon.

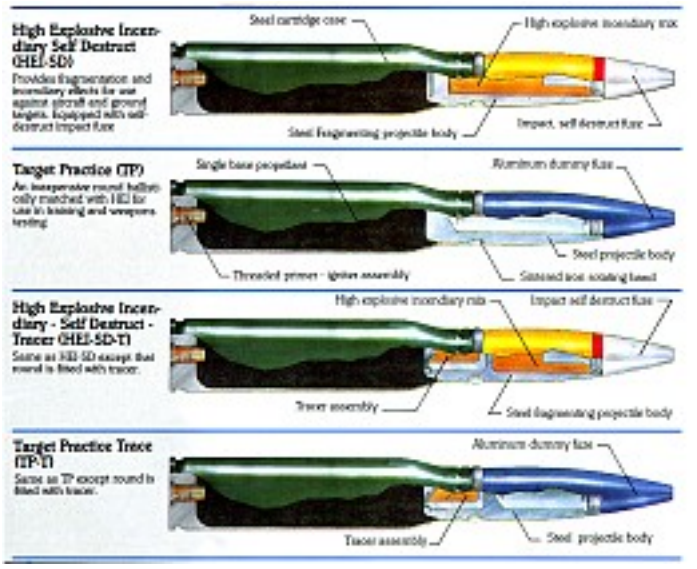
Oerlikon Contraves, including RWM Schweiz AG (the former Oerlikon Contraves-Pyrotec), is now part of Rheinmetall DeTec AG.

Authorised fuzes
Integral – see text.

Specifications

Type:	**HE-I**	**HE-I-T**	**SAPHEI**	**TP**	**TP-T**
Weights:					
complete round:	870 g	870 g	870 g	870 g	870 g
projectile:	360 g	360 g	360 g	360 g	360 g
filling:	40 g	25 g	20 g	none	none
Lengths:					
complete round:	285.25 mm	285.25 mm	285.25 mm	285.25 mm	285.25 mm
cartridge case:	170.3 mm	170.3 mm	170.3 mm	170.3 mm	170.3 mm
Rim diameter:	42.8 mm	42.8 mm	42.8 mm	42.8 mm	42.8 mm
Muzzle velocity:	1,080 m/s	1,080 m/s	1,080 m/s	1,080 m/s	1,080 m/s
Flight time:					
to 1,000 m:	1.08 s	1.08 s	1.08 s	1.08 s	1.08 s
to 2,000 m:	2.61 s	2.56 s	2.61 s	2.61 s	2.56 s
to 3,000 m:	4.93 s	4.83 s	4.93 s	4.93 s	4.83 s
Chamber pressure:	4,200 bar	4,200 bar	4,200 bar	4,200 bar	4,200 bar

Contractor
RWM Schweiz AG, formerly Oerlikon Contraves-Pyrotec.
Type: See text
Break-up: A practice round with the thin-walled plastic projectile filled with pressed iron powder which breaks up soon after leaving the muzzle; production and sales rights taken over from NWM de Kruithoorn



30 × 170 KCB ammunition produced by Hellenic Arms Industry (EBO) 0084694

Equivalent rounds
Argentina
Contractor
Dirección General de Fabricaciones Militares.
Type: HE-I (EINC-AD), HE-I-T-SD (Self-Destruct) (EINC-T-AD), AP (SPEINC), TP-T (EJT)
Description: Manufacturers are Fabrica Militar 'Fray Luis Beltran' of Santa Fe; standard specifications

France
Contractor
Nexter Systems.
Formerly produced HEI-SD, HEI-T-SD, TP and TP-T rounds; these are no longer offered but may still be encountered

Greece
Contractor
Hellenic Arms Industry SA (EBO).
Type: HE-I-SD, HE-I-SD-T, TP, TP-T
Description: Standard specifications

Korea, South
Contractor
Daewoo Ammunition Corp.
Type: HE-I, HE-I-T, TP-T
Description: Standard specifications

Contractor
Poongsan Corp.
Type: HEIT-SD K154, HEI-SD K155, TP-T K156, HEIT-PD K160, HEI-PD K161
Description: All these rounds are basically to standard specifications, but the fuzes differ slightly (PD K515, SD K503) and arm after a distance of 18 m

United Kingdom
Contractor
BAE Systems, RO Defence.
Type: TP, TP-T, HE-I, HE-I-T, SAPHEI
Description: Standard specifications

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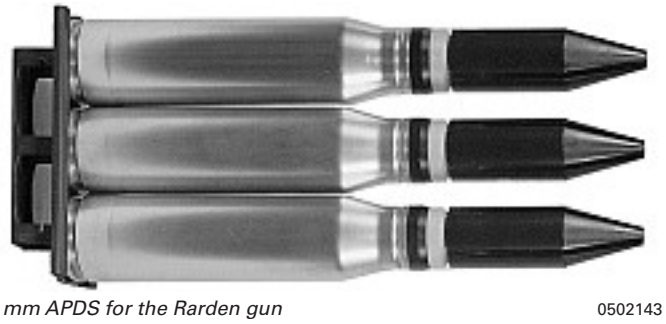
30 × 170 Rarden gun ammunition

Development
The first 30 mm Rarden gun appeared in 1966 and the first service examples, the L21A1, followed during the early 1970s. The design philosophy called for an anti-armour gun with the emphasis on accuracy, as opposed to high rates of fire, combined with the ability to be mounted in light turrets. The ammunition selected for the Rarden was based on that developed in Switzerland for the 30 mm Hispano-Suiza 831 L (now Oerlikon Contraves KCB) cannon family, but subsequent development has resulted in what may be regarded as a separate ammunition family.

The UK Design Authority for 30 mm Rarden ammunition is BAE Systems Land Systems, Munitions.



30 mm APDS for the Rarden gun 0502143

Description
All 30 mm Rarden ammunition is fixed; the projectiles are crimped to the necked drawn brass cartridge cases by a crimping ring engaging in a cannelure, on the projectile. In most cases the drive bands are sintered iron pressed into place. The rounds are issued and loaded in charger clips of three.

The brass cartridge cases are 170 mm long and have an L16 (RO 673) percussion primer filled with 0.97 g of gunpowder G20 threaded into the base; the rim diameter is 42.9 mm. The cartridge case is filled with variable amounts of granular NRN 141/RDN propellant.

Ammunition available for the 30 mm Rarden gun includes the following types:

Sectioned 30 × 170 Rarden APDS round (Anthony G Williams) 1127500

Austria

81 mm HE Mk 4 bomb

Development
Hirtenberger Defence Systems developed this High-Explosive (HE) bomb.

Description
The streamlined body is of spheroidal graphitic cast iron; at the rear end are a tail tube and six fins of extruded aluminium alloy. A plastic obturating ring is fitted into a groove at the bourrelet, giving excellent gas sealing and ballistic regularity, and is discarded as the bomb leaves the muzzle of the mortar. A primary cartridge is screwed into the tail tube, and six or seven (super charge) horseshoe secondary charges clip around the tail tube above the fins.

Armament
HP M8 mortars, Vammas (Tampella), UK L16A1, A2, US M29 and similar 81 mm mortars.

Specifications
Length:
fuzed: 487 mm
unfuzed: 430 mm
Weight fuzed: 4.15 kg
Payload: 750 g TNT
Number of charges: ignition charge plus 7. M1 mortars may only use up to Charge 4, M29 up to Charge 5, L16 up to Charge 6
Fuze: PD super-quick DM 111A4, M935 or proximity M9815
Terminal effects: approx. 1,410 splinters with an average weight of 1.85 kg

Hirtenberger 81 mm HE Mk 4 bomb (Hirtenberger Defence Systems) 1162103

Charge	Max range w. 1,170 mm barrel	Max range w. 1,375 mm barrel	Max range w. 1,450 mm barrel	Pressure
0	536 m	607 m	638 m	12 MPa
4	4,335 m	4,649 m	4,720 m	45 MPa
5	5,100 m (not to be used with M1)	5,491 m	5,579 m	65 Mpa
6	5,770 m (not to be used with M1 or M29)	6,200 m	6,270 m	80 MPa
7	must not be used	6,669 m	6,746 m	95 MPa

Status
Available.

Contractor
Hirtenberger Defence Systems.

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81 mm LD HE bomb

Development
Hirtenberger AG developed this High-Explosive (HE) bomb. It is not currently offered but may still be encountered.

Description
This is the same as the HE70 bomb described in a separate entry, except that the secondary charges comprise six equal-sized increments instead of three large and three small, giving an increase in the ballistic performance.

Armament
Tampella, UK L16A1, US M29 and similar 81 mm mortars.

Hirtenberger 81 mm LD HE bomb 0502765

Specifications
Length fuzed: 487 mm
Weight fuzed: 4.15 kg
Payload: 750 g TNT or Comp B
Number of charges: P + 6
Fuze: impact super-quick and delay DM 113A3 or proximity
Max range:
1.17 m barrel: 5,770 m
1.45 m barrel: 6,270 m
Min range:
1.17 m barrel: 185 m
1.45 m barrel: 210 m
Muzzle velocity: 73–296 m/s
Chamber pressure: <800 bar
Average number of fragments: 1,400

Contractor
Hirtenberger AG.

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81 mm HC Smoke Mk 4 bomb

Development
Hirtenberger Defence Systems developed this HexaChlorethane HC-smoke bomb to provide a denser screen without the incendiary risk of phosphorus-based bombs.

Description
This bomb uses a similar body and tail unit to the illuminating bomb, though with a slightly shorter nose. A time fuze ignites an expelling charge at the required point and also ignites the smoke canisters, which are loaded with HC/zinc mixture. The nose cap is blown off, and the canisters are expelled, falling to the ground to emit smoke.

Armament
HP M8 mortars, Vammas (Tampella), UK L16A1, A2, US M29 and similar 81 mm mortars.

Hirtenberger 81 mm HC Smoke Mk 4 bomb 0502767

Specifications
Length fuzed: 615 mm
Weight fuzed: 3.8 kg
Fuze: MTSQ (DM93), or PD (DM111A4C1)
Payload: 1.5 kg hexachloroethane
Number of charges: up to 6 charges plus an ignition charge. M1 mortars may only use up to Charge 4, M29 up to Charge 5
Duration of smoke effect: 150 s

Charge	Max range w. 1,170 mm barrel	Max range w. 1,375 mm barrel	Max range w. 1,450 mm barrel	Pressure
0	556 m	628 m	642 m	12 MPa
4	4,100 m	4,340 m	4,463 m	53 MPa
5	4,765 m (not to be used with M1)	4,880 m	4,939 m	69 Mpa
6	5,200 m (not to be used with M1 or M29)	5,300 m	5,351 m	85 MPa

Contractor
Hirtenberger Defence Systems.

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81 mm RP Smoke Mk 4 bomb

Development
Hirtenberger Defence Systems developed this Red-Phosphorus Smoke bomb.

Description
This bomb uses a cylindrical aluminium body, with a light-alloy tail unit. The bomb contains a filling of Red Phosphorus (RP) composition formulated to produce the optimum smoke cloud. It will develop a low-lying cloud for a longer period than is possible with the more usual White Phosphorus (WP) filling.

81 mm Practice Mk 4 bomb

Development
Hirtenberger Defence Systems developed this Practice bomb for training purposes.

Description
The streamlined body is of spheroidal graphitic cast iron; at the rear end are a tail tube and six fins of extruded aluminium alloy. A plastic obturating ring is fitted into a groove at the bourrelet, giving excellent gas sealing and ballistic regularity, and is discarded as the bomb leaves the muzzle of the mortar. A primary cartridge is screwed into the tail tube, and six or seven (super charge) horseshoe secondary charges clip around the tail tube above the fins.

Armament
HP M8 mortars, Vammas (Tampella), UK L16A1, A2, US M29 and similar 81 mm mortars.

Specifications
Length:
fuzed: 487 mm
Weight fuzed: 4.15 kg
Payload: 750 g inert
Number of charges: Ignition charge plus 7. M1 mortars may only use up to Charge 4, M29 up to Charge 5, L16 up to Charge 6
Fuze: PD DM 111A4, M935 or dummy
Terminal effects: impact signature when fuze fitted

Hirtenberger 81 mm Practice Mk 4 bomb (Hirtenberger Defence Systems)
1162104

Charge	Max range w. 1,170 mm barrel	Max range w. 1,375 mm barrel	Max range w. 1,450 mm barrel	Pressure
0	536 m	607 m	638 m	12 MPa
4	4,335 m	4,649 m	4,720 m	45 MPa
5	5,100 m (not to be used with M1)	5,491 m	5,579 m	65 Mpa
6	5,770 m (not to be used with M1 or M29)	6,200 m	6,270 m	80 MPa
7	must not be used	6,669 m	6,746 m	95 MPa

Status
Available.

Contractor
Hirtenberger Defence Systems.

Belgium

Mecar A1 series mortar-bomb family

Description
The Mecar A1 series of 81 mm mortar bombs is used in M1 low-pressure, in M29/29A1 medium-pressure, and in M252 and L16 series high-pressure mortar systems and their equivalents. Five models of bomb are available and may be divided into two groups of ballistically matched bombs:

- M511A1, M512A1 and M513A1 and M572A1, using a common firing table; and
- M515A1 (and the obsolete M514A1), fired to a second firing table.

The bombs available are these:

- **M511A1:** Titanium TetraChloride (TTC, or FM)
- **M512A1:** High-Explosive (HE)
- **M513A1:** smoke/White Phosphorus (WP)
- **M515A1:** illuminating.
- **M572A1:** HE Training

Bombs are packed in three-round NATO-approved waterproof polymer containers. HE and smoke bombs have a maximum range of 5,500 m in high-pressure mortars, 4,500 m in medium-pressure and up to 2,500 m in low-pressure mortar systems.

The A1 propulsion system employs a primary cartridge comprising a screw-threaded primer and shotgun 'cigar-tube' type ignition cartridge and up to five horseshoe-type augmenting charges, the number of charges permitted to be used depending on the pressure capacity of the mortar. The base augmenting charge is coloured blue, and there are three translucent cased charges and a red-coloured super charge.

Charge 0 = Primary cartridge only
Charge 1 = Primary cartridge and one augmenting charge
Charge 2 = Primary cartridge, two augmenting charges (Charge 2 is the maximum for low-pressure mortars)
Charge 3 = Primary cartridge, three augmenting charges
Charge 4 = Primary cartridge, four augmenting charges (Charge 4 is the maximum for medium-pressure mortars)
Charge 5 = Primary cartridge, five augmenting charges (Charge 5 is used only in high-pressure mortar systems)

Mecar 81 mm M572A1 HE-TP bomb 0038430

Mecar 81 mm M512A1 HE bomb 0038427

Mecar 81 mm M513A1 smoke WP bomb 0038428

Mecar 81 mm M515A1 illuminating bomb 0038429

Specifications
Primary and augmenting charges
Primary cartridge: M519
Augmenting charges: M565

81 mm M512A1 HE bomb
Length: fuzed, 516 mm
Weight: fuzed, 4.1 kg
Filling: 1.03 kg Comp B
Body: nodular cast iron
Ranges: 100–4,500 m (Ch 0 to 4); to 5,500 m with Charge 5

81 mm M511A1 TTC (FM) smoke bomb
Length: fuzed, 516 mm
Weight: fuzed, 4.1 kg
Filling: 880 g TTC (FM)
Body: nodular cast iron
Ranges: 100–4,500 m (Ch 0 to 4); to 5,500 m with Charge 5

81 mm M513A1 smoke WP bomb
Length: fuzed, 516 mm
Weight: fuzed, 4.1 kg
Filling: 880 g WP
Body: nodular cast iron
Ranges: 100–4,500 m (Ch 0 to 4); to 5,500 m with Charge 5

81 mm M515A1 illuminating bomb
Length: fuzed, 625 mm
Weight: fuzed, 4.2 kg
Filling: parachute and flare canister
Body: steel
Ranges: 250–4,100 m (Ch 0 to 4); to 4,600 m with Charge 5

Status
In production.

Contractor
Mecar SA.

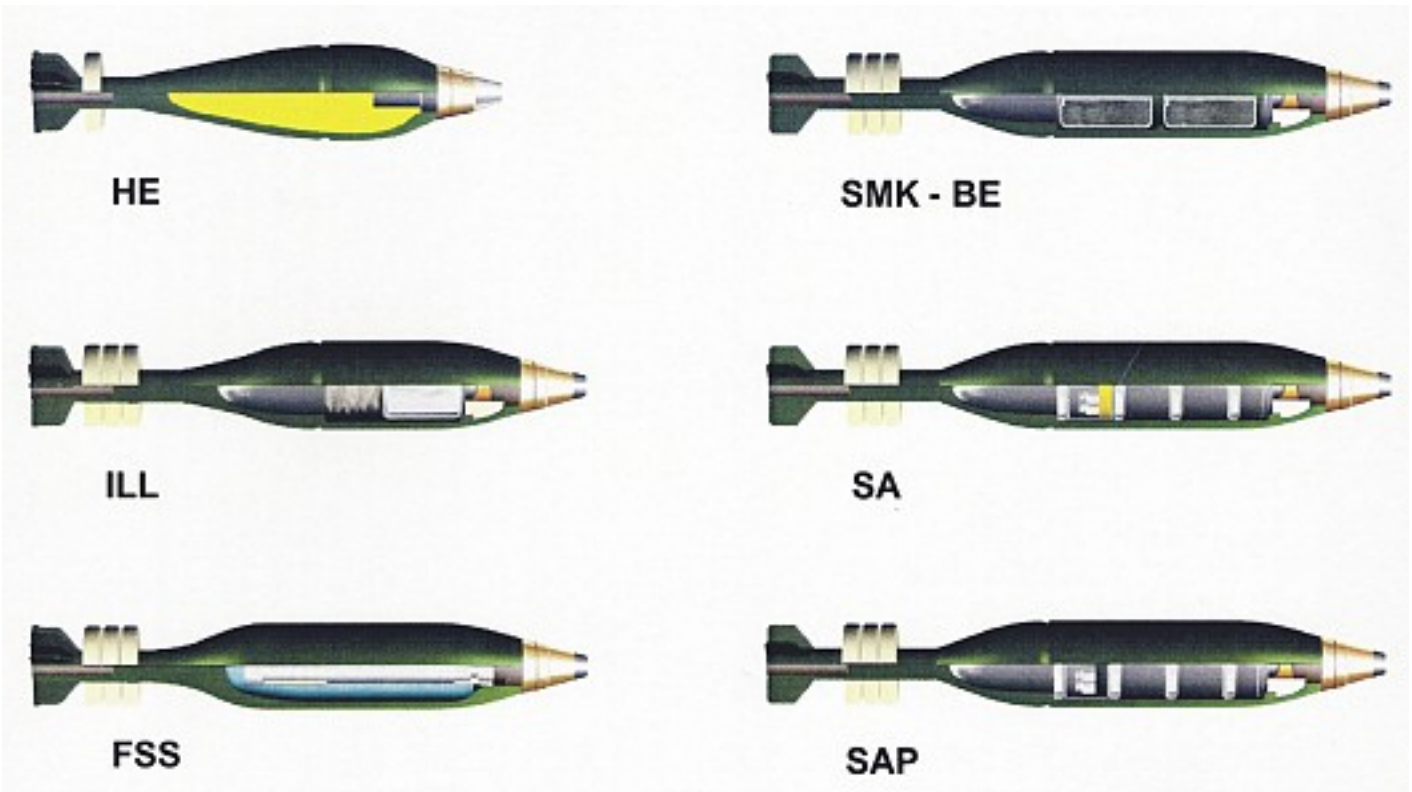
81 mm S8A1 submunition TP bomb

Development
Simmel Difesa developed this bomb for use as a training round to simulate the effect of the S6A2 submunition bomb.

Description
This bomb is the same as the S6A2 submunition bomb (see separate entry) except that the submunitions are filled with a smoke-producing compound to indicate their point of impact on the ground. The weights, dimensions and ballistic performance are identical in all respects to the service bomb.

Armament
81 mm TDA and other medium-pressure mortars.

Contractor
Simmel Difesa SpA.

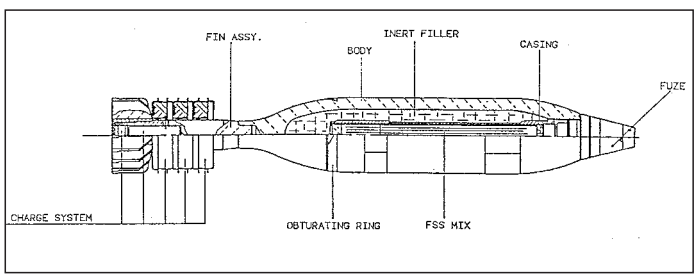


The Simmel Difesa range of 81 mm mortar bombs (Simmel Difesa) 1153661

81 mm S9A1 flash, sound and smoke bomb

Development
Simmel Difesa developed this bomb to provide a training bomb capable of indicating fall of shot at long ranges.

Description
The bomb consists of an aluminium-alloy body, the nose of which is threaded to accept a percussion fuze, and an extruded aluminium tail unit which is screwed into the end of the body. The bomb body is almost entirely filled with inert material; a central burster tube carries a charge of flash and sound mixture (black-powder-based). A primary cartridge is fitted into the tail tube, and six secondary charges fit around the tail tube in horseshoe containers.



Simmel 81 mm S9A1 flash, sound and smoke bomb 0502539

The bomb is fired in the normal way. On impact with the ground, the fuze ignites the flash and sound composition; this produces a strong signature capable of being seen over 1,000 m from the point of burst.

Armament
81 mm TDA and other medium-pressure mortars.

Specifications
Length fuzed: 570 mm
Weight: 4.2 kg in flight
Payload: 200 g flash/sound/smoke mixture
Number of charges: P + 6
Fuze: percussion, DM 111 or equivalent
Max range: 5,150 m
Max muzzle velocity: 294 m/s

Charge	Muzzle velocity	Airburst range	Elevation
1	120 m/s	1,300 m	800 mils
2	170 m/s	2,330 m	800 mils
3	221 m/s	3,400 m	871 mils
4	245 m/s	4,000 m	817 mils
5	276 m/s	4,700 m	764 mils
6	294 m/s	5,150 m	764 mils

Contractor
Simmel Difesa SpA.

Korea, South

81 mm M301A3 illuminating bomb

Development
Korea Explosives (now Hanwha Corporation) developed this bomb based on an original US pattern.

Description
This is a cylindrical bomb with a time fuze in the nose and a tailcone, tailboom and fins. The tailboom carries a percussion primer and an ignition cartridge; eight secondary increments in tubular fabric bags are attached alongside the tailboom by means of retaining clips.

The interior of the bomb contains the flare canister and parachute. Upon functioning of the time fuze, the flare is ignited and the tailcone is blown off, so that the canister and the parachute are ejected.

Armament
US M1, M29 and M29A1 mortars and similar.

United Kingdom

81 mm L41 HE mortar bomb

Description
The L41 series (current production version L41A4) high explosive/fragmentation bombs were developed by BAE Systems. They are of the conventional streamlined type, with a Spheriodal Graphite Cast Iron body. The primary cartridge is the L39A1 and up to six MK 4 L40A1 augmenting cartridges may be added to give a maximum range of 5,650 m. The bomb has been tested to STANAG 4225 "Safety Evaluation of Mortar Bombs".

This is the standard 81 mm HE mortar round of the British Army. A five-year contract to supply 80,000 rounds was signed with BAE Systems Land Systems (Munitions & Ordnance) Ltd. in 2001. This was followed by a three-year contract signed in April 2007 for a further 330,000 rounds. In addition to this, it was reported in June 2007 that an Urgent Operational Requirement for an extra 100,000 rounds for delivery by 31 March 2008 had been placed in view of heavy use in Afghanistan and Iraq.

Armament
British L16 mortars.

Status
In production. In current use with the British Army.

Contractor
BAE Systems Land Systems (Munitions & Ordnance) Ltd.

81 mm L41 HE mortar bomb
(BAE Systems)
1162165

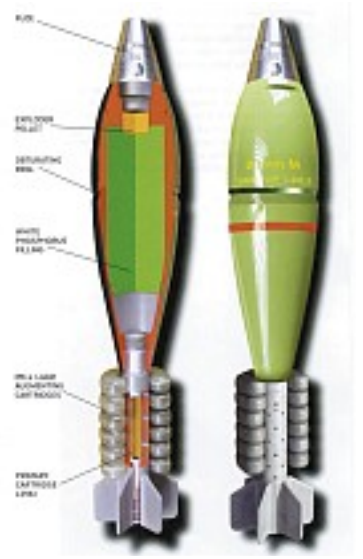
81 mm L42A3 White Phosphorus smoke bomb

Description
The L42A3 White Phosphorus smoke bomb is of the conventional streamlined type, ballistically matched to the L41 HE bomb. The primary cartridge is the L39A1 and up to six MK 4 L40A1 augmenting cartridges may be added to give a maximum range of 5,650 m. It normally uses an L127A4 Superquick fuze but the fuze cavity can also accept other NATO-standard fuzes. The bomb has been tested to STANAG 4225 "Safety Evaluation of Mortar Bombs".

Armament
British L16 mortars.

Status
In production. In current use with the British Army.

Contractor
BAE Systems Land Systems (Munitions & Ordnance) Ltd.



81 mm L42A3 White Phosphorus smoke bomb
(BAE Systems)
1162166

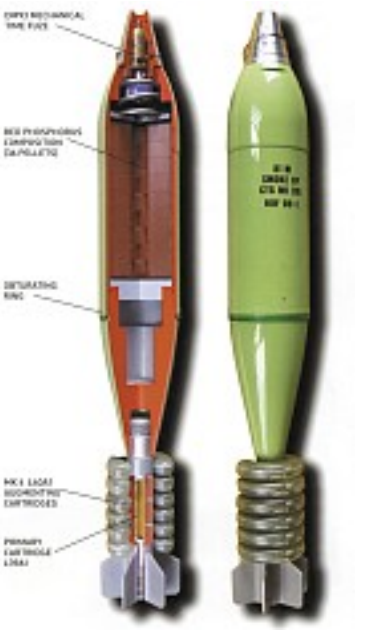
81 mm Red Phosphorus smoke bomb

Description
The Red Phosphorus smoke bomb was developed by BAE Systems and first entered service in 1995. The body of the bomb is of the extended, high-capacity type, and contains 36 individual red phosphorus pellets which are dispersed over a wide area when ejected at a normal altitude of 150 m. The primary cartridge is the L39A1 and up to six MK 4 L40A1 augmenting cartridges may be added to give a maximum range of 5,375 m. It normally uses a DM93 mechanical time fuze. The bomb has been tested to STANAG 4225 "Safety Evaluation of Mortar Bombs" and has a ten year storage life.

Armament
British L16 mortars.

Status
In production. In current use with a number of forces throughout the world.

Contractor
BAE Systems Land Systems (Munitions & Ordnance) Ltd.



81 mm Red Phosphorus smoke bomb
(BAE Systems)
1162167

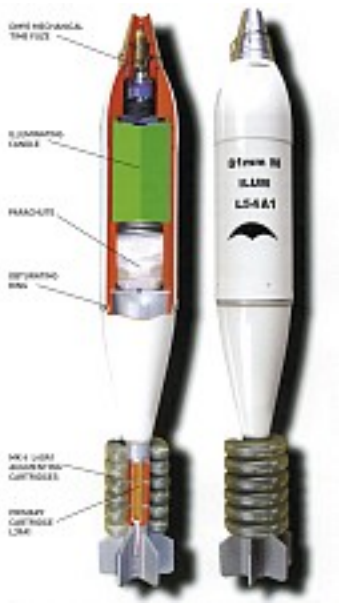
81 mm L54A1 Illuminating mortar bomb

Description
The L54A1 illuminating mortar bomb has been in service with UK forces for over 20 years. The body of the bomb is of the extended, high-capacity type, and contains a white light illuminating candle supported by a parachute. The candle burn time is 35 seconds and it produces 1,000,000 candela. The primary cartridge is the L39A1 and up to six MK 4 L40A1 augmenting cartridges may be added. It uses a DM93 mechanical time fuze to ensure that it is deployed at an appropriate altitude. The bomb has been tested to STANAG 4225 "Safety Evaluation of Mortar Bombs".

Armament
British L16 mortars.

Status
In production. In current use with the British Army and a number of forces throughout the world.

Contractor
BAE Systems Land Systems (Munitions & Ordnance) Ltd.



81 mm L54A1 Illuminating mortar bomb
(BAE Systems)
1162168

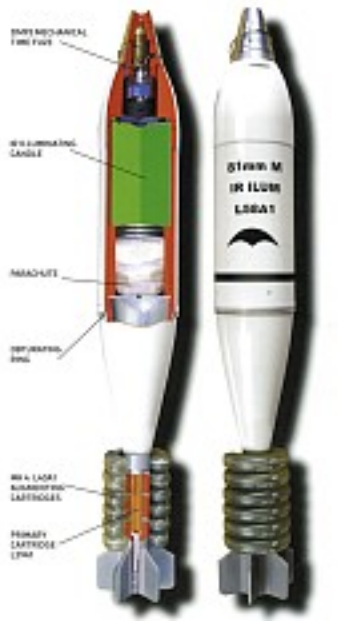
81 mm L58A1 Infrared Illuminating (IR) bomb

Description
The L58A1 infra-red illuminating mortar bomb is in service with the British Army. The body of the bomb is of the extended, high-capacity type, and contains a IR illuminating candle supported by a parachute. The candle burn time is two minutes and at an altitude of 500 m illuminates an area 400 m in diameter. The primary cartridge is the L39A1 and up to six MK 4 L40A1 augmenting cartridges may be added; the bomb is ballistically matched to the L54A1 White Light Illuminating bomb. It uses a DM93 mechanical time fuze to ensure that it is deployed at an appropriate altitude. The bomb has been tested to STANAG 4225 "Safety Evaluation of Mortar Bombs".

Armament
British L16 mortars.

Status
In production. In current use with the British Army.

Contractor
BAE Systems Land Systems (Munitions & Ordnance) Ltd.



81 mm L58A1 Illuminating (IR) bomb
(BAE Systems)
1162169

81 mm L27A1 practice bomb

Development
The Royal Armament Research and Development Establishment (RARDE) developed this bomb as the standard practice projectile for the L16 mortar.

Description
This practice bomb resembles the High-Explosive (HE) and smoke bombs but is completely inert except for the primary cartridge. It has a replaceable plastic obturating ring, and after firing, it can be recovered, fitted with a new ring and primary cartridge, and reused several times.

Armament
UK L16, US M242 mortars and similar high-pressure types.

Specifications
Length fuzed: 474 mm
Weight fuzed: 4.2 kg
Payload: inert
Number of charges: P
Fuze: dummy
Max range: 80 m

Contractor
BAE Systems RO Defence.

United States

81 mm M43A1 and M43A1B1 HE bomb

Development
US Army Ordnance developed these High-Explosive (HE) bombs after Brandt originals. These rounds are out of production and are no longer held in the US stockpile, but they may be found elsewhere.

Description
These bombs were introduced (as the M43) with the M1 mortar in the late 1930s. Subsequent modifications were relatively minor, and the bomb is still essentially the original Brandt design. It is a teardrop-shaped forged-steel bomb, with four gas-check grooves at the bourrelet and a welded-steel tail tube and fin assembly. The difference between the M43A1 and the M43A1B1 bombs is confined to manufacturing details and has no operational significance. A propulsion cartridge is fitted in the tail tube, and up to eight secondary increments fit between the tailfins and are secured by spring clips. These increments are in the form of leaves of smokeless powder contained in plastic envelopes. Although the round is obsolete in US service, it may still be encountered in other countries.

155 mm XM982 Excalibur projectile

Development

The 155 mm XM982 Excalibur projectile (formerly the Extended-Range Dual-Purpose Improved Conventional Munition, or ERDPICM) has been under development by the US Army for several years. In October 1996, responsibility for the programme was transferred from the Fire-Support Armaments Center, US Army Research, Development and Engineering Command (ARDEC) at Picatinny Arsenal, New Jersey, to the Program Manager, Sense And Destroy ARmor Munition (PM-SADARM), also located at Picatinny Arsenal. In the first half of 1997, PM-SADARM issued a Request For Proposal (RFP) to American and certain European industrial concerns for the Engineering and Manufacturing Development (EMD) phase of the XM982 programme. The RFP included a performance specification which allowed the bidders to propose designs which differed from that which ARDEC had developed up to that point.

In January 1998, a US industry team led by Raytheon Systems Company, formerly Texas Instruments, and including the then Primex Technologies, now General Dynamics, Ordnance and Tactical Systems (GD-OTS), and the KDI (then a division of Martin Electronics, now a division of L-3 Communications), was awarded a 45 month EMD contract. The successful proposal differed fundamentally from the US Army XM982 design. Rather than using both a Base-Bleed (BB) unit and a rocket motor to achieve ranges up to 45,000 m, the Raytheon-GD-OTS approach involves a gliding projectile which is fired conventionally, describes a ballistic trajectory up to apogee, and then glides to the target using lift generated by both the projectile body and four aft-mounted tailfins.

The basic EMD contract covered development of an XM982 Dual-Purpose Improved Conventional Munition (DPICM) projectile with options for the development of a SADARM-like variant and a unitary warhead variant. Additional options to the basic contract covered Low-Rate Initial Production (LRIP) for all three variants. If all contract options are exercised, the period of performance spans from 1998 to 2008.

Successful tests involving the launching of guidance packages for acceleration forces of 15,000 g were conducted during late 2000. Following the tests, Raytheon received a US Army USD100 million contract modification for the continued development of the XM982.

The programme was completely restructured in 2001. The first impetus came from the Field Artillery Center and School, which directed a switch to the unitary warhead as the first priority. Thus, the unitary variant was designated as Block I, the smart munition was designated as Block II, and a 'discriminating munition' that will 'detect, discriminate and engage specified target(s) located in complex and urban terrain' was designated as Block III. The second impetus came from congressionally mandated efforts to incorporate the Swedish TCM into the programme. The Excalibur/TCM programme merger began in April 2002, with the Memorandum of Understanding (MoU) following in December, and resulted in the adoption of the Bofors spinning tailfin assembly with eight fins and an integrated BB unit.

US Army development funding has been USD357 million through FY05, with a further USD114 million in FY06 and an estimated USD472 million extra through completion of the development program in FY11. In mid-2003, the production schedule was accelerated by adopting a 'spiral development' process that incorporates improvements over time, allowing early deliveries of a basic round, followed by progressive introduction of improved technologies and cost-cutting procedures. The current programme envisions the purchase of a total of 30,000 rounds for USD1,428 million.

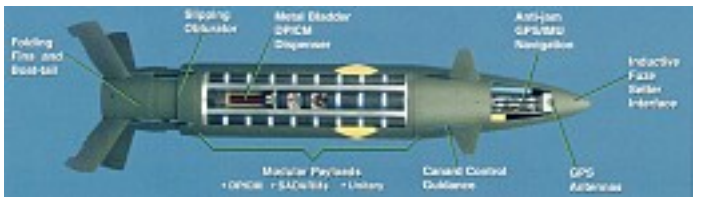
Development of the Block III is separately funded, with an initial increment of USD10 million in FY05, rising to USD75.3 million in FY09.

The system prime contractor is Raytheon. The main subcontractors are Bofors for the base and spinning fin assembly and the unitary payload, GD-OTS for the canard control actuators and the airframe, L-3/IEC for the Global Positioning System (GPS) receiver and inertial measurement unit, L-3/KDI for the proximity/Point-Detonating (PD)/delay fuze and the safe-and-arm assembly, Eagle Picher for the system battery, and Alliant Techsystems for the data-hold batteries.

In light of the December 2002 US/Swedish MoU, with Sweden to contribute SKR500 million (USD55.1 million) to the effort, Sweden hopes to begin taking delivery of service rounds in 2008.

The Excalibur programme was accelerated by an Urgent-Needs Statement approved in March 2005. Procurement of the Block IA-1 rounds began with a contract award for 140 rounds at USD144,000 each in June 2005, with deliveries scheduled for January 2006. Fielding of those rounds was originally scheduled to begin in March 2006, but delays in testing have pushed that back to the end of the year. The first delivery of the FY05 batch actually came in September 2006, intended for limited user trials in early 2007. Further procurement of the

Models of the three variants of the 155 mm XM982 ERDPICM projectile: from left, unitary warhead; DPICM; and SADARM 0055886



Cutaway illustration of a 155 mm XM982 ERDPICM projectile, showing the general layout 0055885

Block IA-1 will consist of 321 rounds at USD153,000 each for FY06 and 224 rounds for USD120,000 each in FY07. Low-rate production of the Block IA-2 rounds should begin with the 362 projectiles to be ordered in FY08 and 458 in FY09. The first trials firings of Block IA-2 with base-bleed were conducted in October 2006. Low-rate production of Block IB rounds is scheduled to begin in late 2009 with an IOC in late 2011. Procurement of the Block IB is planned to start around FY11. In Sweden, user tests are scheduled for mid-2005, although IOC with the FH-77BD is not expected until late 2008. The Block II is not funded as yet. The Block III has very little dedicated funding, most of it centring on studies of target discrimination.

The full-rate production contract was awarded to Raytheon in 2007 and covered a base year of 725 Block 1A-1 units (with an option for a further 300) and four option years of Block 1A-1 and 1A-2 projectiles. Maximum quantities to be ordered in the option years are about 3,500.

In December 2006 the Army released a market survey to identify firms interested in undertaking the 48 month system development & demonstration phase for the Block Ib Excalibur. This is to be a lower-cost alternative to the Block Ia, with improved performance. The requirements include a CEP of 10 meters or less with GPS and 30 meters in a GPS-jammed environment, a range of 35 to 40 km, a minimum range of 3 to 8 km, reliability of at least 90 percent, terminal effectiveness equal to the M107, and penetration of 10 to 20cm of concrete. Alliant Techsystems has announced its intention to submit a bit on this effort. In addition, the Swedish Army has further requirements for a range of 50 to 60 km from a 52 cal gun, incorporation of semi-active laser homing, and in-flight retargeting. The effort will be structured as a 15-month demonstration phase (for which two contractors may be chosen), then, if necessary, a downselect to one contractor for the design refinement/qualification phase.

As of April 2006, the army had developed and produced 7 out of 25 planned Portable Excalibur Fuze Setters (PEFS) that will incorporate the Rockwell Collins Defense Advanced Global Positioning System (GPS) Receiver (DAGR) and the ITT Advanced Systems Improvement Program (ASIP) Single-Channel Ground and Airborne Radio System (SINCGARS) and the Enhanced Portable Inductive Artillery Fuze Setter.

The Type Classification for urgent mateial release for the Block 1a-1 was granted in April 2007 and the first combat use of the Excalibur came in May 2007 when the I/82 Field Artillery fired a projectile north of Baghdad. By August several more had been fired and the vast majority fell within 4 meters of the target, spurring the Army to push for increased production rates. In October 2007 Congress was notified of a potential sale of 250 M892 Block Ia-2 Excaliburs with base bleet units, along with 2,400 MACS charges to Australia.

As of February 2007 the Army budget showed the following planned procurement:

Fiscal Year	Quantity	Funding (USD millions)
prior	448	86.1
2007	627	69.9
2008	197	28.6
2009	262	34.2
2010	717	64.8
2011	525	61.9
2012	1,235	85.9
2013	1,709	102.3
later	24,280	30,000

Not included in the table is the procurement of 291 for FMS in FY07 and 152 for the Marine Corps in FY08.

It is anticipated that a 105 mm equivalent of the XM982 will be developed.

Description

The 155 mm XM982 projectile, named Excalibur, is an extended-range autonomously guided projectile using a combination of high glide ratio lifting body airframe and tightly coupled GPS/Inertial Measuring Unit (GPS/IMU) guidance to achieve ranges up to 40 km from the M109A6 Paladin with a high degree of precision. The XM982 programme encompasses a family of three projectiles, differing in their respective payloads. The Block I carries a unitary penetrating warhead, the Block II carries Sensor-Fuzed Munitions (SFMs), and the Block III carries an undefined 'discriminating warhead'. Each of the three projectiles makes use of a common Guidance, Navigation and Control (GNC) section, canard systems and a common boat-tail and folding-fin-assembly design. In addition, the three variants share a number of common airframe and other hardware items.

The fuze being developed by the KDI division of L-3 features two firing inputs, one from the Height-Of-Burst (HOB) sensor, the other from the PD/delay sensor. The Radio Frequency (RF) antenna is a circular patch design currently used on the FMU-160/B fuze, while the RF front end uses a Gallium-Arsenide (GaAs) monolithic microwave integrated circuit developed for the M734A1 MultiOption Fuze (MOF) for mortars. The HOB uses a nominal burst altitude of 4.5 m (15 ft).

Sectioned model of a 155 mm XM982 ERDPICM projectile, showing the general layout (T J Gander) 0059314

The projectile is provided with a pre-installed internal fuze safe-and-arm device. The fuze is set inductively, using either a hand-held or integrated fuze setter/inductive data-transfer device. These devices also facilitate the transfer of initialisation data to the GPS/IMU GNC just prior to the firing of the projectile. The projectile is loaded and fired conventionally. The XM982 is compatible with all current bagged and developmental (M231/XM232 Modular Artillery Charge System, or MACS) propelling charges. Since the projectile is autonomously guided, precise gun-laying and charge-zoning are not necessary. A slipping obturator allows for compatibility with all currently fielded gun systems while keeping the spin rate imparted to the projectile at low levels.

After the projectile leaves the muzzle, the aft-mounted stabilising/lifting fins are deployed. Any imparted spin decays to a nominal rate, and the fin-stabilised projectile follows a basic course to apogee. During this upward part of the trajectory, the GPS unit is activated and calibrated and acquires satellite lock. At apogee, the four forward canards are deployed, and the GNC autopilot is energised. Based on the input from the ballistic flight computer, the autopilot translates course-correction demands into electrical impulses which, in turn, are sent to the canard drive motors. The canards are actuated in pairs, providing commutated, bank-to-turn navigation capability. The projectile glides to the predetermined latitude/longitude co-ordinates programmed into the ballistic flight computer during initialisation before firing. If the GPS unit is jammed during the glide phase of the trajectory, the tightly coupled IMU takes over and keeps the projectile on its last corrected heading.

When the projectile reaches the target, it executes a terminal manoeuvre appropriate to the particular warhead it is carrying. In the case of the Block II, this terminal manoeuvre precedes a submunition expulsion/dispense event. The expulsion/dispense height above the target is optimised for maximum submunition performance. For the unitary variant, the projectile is guided to impact with the target at an optimised angle of attack.

Performance specification requirements dictate that the XM982 be capable of maximum ranges of 30 to 40 km from an L/39 weapon (such as the M109A6, the M777 or the NLOS-C) and 50 to 60 km from an L/52 weapon (such as the FH77BD). The minimum range requirement is 6,000 to 8,000 m. The Circular Error of Probability (CEP) is to be 10 to 20 m at all ranges. The unitary warhead must be capable of penetrating 20 cm (8 in) of reinforced concrete, while still demonstrating high fragmentation.

The capabilities of the Excalibur will be introduced in a 'spiral' method that yields a rather complex taxonomy.

Block I is the unitary warhead, Block II is a sensor-fuzed munition, and Block III will use the discriminating seeker.

Block I has two components. Block IA is the initial version, and Block IB will add some 'technology-refresh' items and cost-reduction initiatives. Within Block IA, there are Block IA-1, which is a quick-reaction project to get something to the field quickly, and Block IA-2, which is fully compliant with the Operational Requirements Document (ORD). The ORD calls for a 30 km range; for a 20 m Circular Error of Probability (CEP), with 10 m as the objective; and for a reliability greater than 85 per cent. Block IA-1 will be close to the ORD accuracy and range figures, with a reliability percentage projected to be in the low 80s. Block IA-2 will bring the projectile up to ORD requirements and may add a Base-Bleed (BB) unit. It will be able to handle the full Charge 4 in the L/39 Paladin. BB plus the higher charge will yield a range of about 40 km in Paladin, 50 km in an L/52 weapon, and about 35 km in the L/38 NLOS-C element of the future combat system. Block IB rounds will certainly have BB, along with some new technology and, most importantly, cost-saving measures incorporated, including a Common-Guidance/Common-Sensing (CGCS) Inertial Measurement Unit (IMU).

Other capabilities being studied for the Excalibur following Spiral 1b include M-code GPS, new warheads (smoke, thermobaric, illumination and non-lethal), semi-active laser homing, and provision for time-on-target matching.

Armament
M199 cannon for M198 towed howitzer; M185 cannon for M109A1 to M109A4 series of self-propelled howitzers; M284 cannon for M109A5 and M109A6 Paladin self-propelled howitzers; XM777 lightweight towed howitzer.

Authorised fuzes
Integral – see text above.

Specifications
Provisional
Weight: 48.1 kg
Length: 990.6 mm
Ranges:
maximum: 30,000–50,000 m
minimum: 6,000–8,000 m

Contractors
Consortium comprising, among others, the following:
Raytheon Systems Co.
General Dynamics, Ordnance and Tactical Systems (GD-OTS).
KDI Precision Products, a division of L-3 Communications.
IEC.
Alliant Techsystems Inc (ATK).
Eagel Picher.
Bofors Defence AB.

155 mm Advanced Material Engineering cargo projectile

Development
This projectile was developed by the then Chartered Ammunition Industries, a subsidiary of Singapore Technologies Kinetics (STK), now Advanced Material Engineering Pte Ltd. The 155 mm cargo projectile has been under development since 1995 and was first shown in mid-1999. It is an extended-range projectile available either with or without a Base-Bleed (BB) unit and is intended to be fired from both 39-calibre and 52-calibre artillery systems using the locally produced C30 or C40 unitary propellant charges. This round has been in production since 1998 for use with the Singapore Armed Forces (SAF) 155 mm FH-2000 52-calibre gun-howitzers. Singapore did not commit to signing the cluster munitions ban in 2008.

Description
This 155 mm cargo projectile is a separate-loading munition, with a steel body and an overall profile resembling that of the US M864 series when the BB unit is in place. Unassisted projectiles use a Hollow Base (HB). The nose fuze well is threaded to accept a locally produced ETFA-2 Electronic-Time Fuze Artillery (ETFA) fuze.

The payload of this projectile consists of 64 Dual-Purpose (DP) (anti-personnel/anti-armour) bomblets produced in Singapore. Each bomblet is manufactured from high-strength pre-formed fragmentation steel plate around a Composition A5 shaped charge. The total weight of explosive carried in each projectile is 2.8 kg. Each bomblet has a mechanical Self-Destruct (SD) fuze with two trains, namely the primary and secondary explosive trains. The primary train functions in the SuperQuick (SQ) mode, while the secondary train functions by mechanical means to self-destruct in the event that the bomblet fuze fails to function on impact. The dud rate is stated to be less than 3 per cent. When the fuze functions, the average number of effective fragments produced is about 600 to 750, and the lethality area is greater than 198 m^2 for each bomblet. The shaped charge can penetrate more than 63 mm of Rolled Homogenous Armour (RHA).

In use, the ETFA-2 fuze is preset to function at an optimum height of 450 to 600 m above the target area. The fuze initiates an expulsion charge to separate the BB or HB unit from the projectile body and to eject the bomblets. The bomblets are dispersed by the centrifugal forces generated by the projectile spin; the maximum spin rate is 18,000 rpm. As each bomblet is ejected, a stabiliser ribbon is immediately deployed and extends to ensure that the bomblet falls with the shaped charge facing downwards. On impact, the primary explosive train will be initiated to detonate the explosive charge, producing lethal anti-personnel fragments and armour penetration.

The projectile is normally fired using locally developed C30 and C40 unitary propellant charges, although it is understood that Advanced Material Engineering is developing a Modular Artillery Charge System (MACS) with six modules for 52-calibre artillery systems and five modules for 39-calibre systems.

Range performances

	HB	BB
C30 charge, 39-calibre gun:	21,000 m	27,600 m
C40 charge, 52-calibre gun:	27,000 m	36,800 m

Armament
M1A2 cannon for M114A2 towed howitzer; M199 cannon for M198 towed howitzer; M126/M126A1 cannon for M109 self-propelled howitzer; M185 cannon for M109A1 to M109A4 series of self-propelled howitzers; M284

Dual-purpose bomblet carried by Advanced Material Engineering 155 mm cargo projectile 0093148

The instant of detonation of a 155 mm Bonus submunition 0055881

As each submunition descends, a stabilising disc is released, after which two wings and the Electro-Optical Unit (EOU) fold out. This action further reduces the rate of descent to about 45 m/s and initiates a rotating motion with a spin rate of 15 rev/s. Wings were selected in place of the usual parachute, as they are much less sensitive to strong winds and provide a smooth search pattern. The EOU is equipped with a multiband passive IR detector which is not switched on until the operational height above the target area has been detected by an onboard laser altimeter.

At an altitude approximately 175 m from the ground, the search phase is initiated, with the search footprint having a diameter of about 175 m. Thus, each submunition EOU can search an initial ground area of over 32,000 m^2. The search angle is formed by the submunition's 30° angle of tilt in relation to the line of descent. This enables each submunition to search for a target using a helical search pattern.

Once the EOU has locked on to a target, the warhead is initiated at the optimum distance (typically at a height of 150 m) for attacking the target's relatively vulnerable top armour; armour penetration is more than 100 mm of armour plate. The tantalum SFF (also referred to as an EFP – Explosively Formed Projectile) is formed in less than 300 µs and has an initial velocity greater than 2,000 m/s. If the submunition does not detect or attack a target, it will self-destruct after striking the ground.

The 155 mm Bonus is fitted with a base-bleed unit, to reach a maximum effective range of 27,000 m when fired from 39 calibre 155 mm barrels. When fired from 52 calibre barrels, it is expected that the maximum range will be 35,000 m. The minimum firing range is 4,000 m.

It is anticipated that future 155 mm propellant-charge systems will involve Modular Charge Systems (MCS).

Armament

Bonus can be fired from the following 155 mm artillery weapons: M1A2 cannon for M114A2 towed howitzer; M199 cannon for M198 towed howitzer: M126/M126A1 cannon for M109 self-propelled howitzer; M185 cannon for M109A1 to M109A4 series of self-propelled howitzers; M284 cannon for M109A5 and M109A6 Paladin self-propelled howitzers; XM2001/XM2002 Crusader Advanced Field Artillery System (AFAS); XM777 lightweight towed howitzer.

Bonus can also be fired from the following: Noricum GH N-45 gun-howitzer; Citefa Cala 30/2; Patria Vammas M-83 and 155 GH 52 howitzers (Finland); Nexter/Giat Industries TR and 155/52 guns and M114F howitzer (France); FH-70 field howitzer; Soltam Model 839P and 845P towed howitzers, M-71 gun-howitzer, M-68 gun-howitzer, M-46 field gun, and M114S howitzer (Israel); Otobreda 155/39TM howitzer (Italy); KH179 howitzer (South Korea); RDM M139 and M139/39 howitzers; STK FH-88 and FH-2000 gun-howitzers; Sitecsa 155/45 ST 012 gun-howitzer; M46/84 gun (Serbia); Santa Barbara SB 155/39 and 155/52 APU SBT-1 howitzers, M114 155/45 and M114 155/39 conversions (Spain); Bofors FH-77B howitzer (Sweden); Bison Fortress Gun (Switzerland); T65 howitzer and extended-range gun (Taiwan).

Bonus can also be fired from the following self-propelled 155 mm artillery weapons: Tamse VCA (Argentina); PLZ45 (China); Nexter/Giat Industries GCT and Caesar 155/52 (France); PzH 2000 and M44T (Germany); Soltam Rascal and Slammer (Israel); Otobreda Palmaria and M109L (Italy); Type 75 (Japan); K9 Thunder (South Korea); LIW G6 (South Africa); SFAW M109 Upgrade (Switzerland); XT-69 (Taiwan); and AS90 and Braveheart (UK).

Authorised fuzes

Electronic – Bofors Zelar, or any internationally adopted standard fuze; the round has been qualified with the M762A1 Electronic-Time (ET) fuze by United Defense for possible US applications.

Specifications

Complete round
Weight: 44.4 kg
Length: with fuze, 898 mm
Range
max, 52 calibre: 35,000 m
max, 39 calibre: 27,000 m
Submunition (2 per round)
Weight: 6.5 kg
Length: 82 mm
Diameter: 138 mm
Descent rate: 45 m/s
Spin rate: 15 rev/s
Perforation: >100 mm of armour steel at long stand-off

Contractors

BAE Systems Bofors of Sweden, a wholly owned affiliate of BAE Systems Land and Armaments of the United States.
Nexter of France.
Intertechnique SA of France.

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155 mm Buck practice bomblet projectile

Development

This 155 mm practice bomblet projectile was developed by Buck Werke GmbH & Co of Bad Reichenhall, Germany, to provide a realistic indication of the on-target effects and pattern spread of bomblet-carrying cargo projectiles, without the cost or hazards involved in the use of live operational cargo projectiles. The 155 mm carrier projectiles involved could be converted from existing in-production projectiles such as the 155 mm M116 series smoke HexaChloroethan-zinc (HC) projectile or from existing or recycled cargo projectile bodies. The practice bomblets involved are non-lethal and contain only pyrotechnics that produce impact flash, sound and smoke. There are no explosives or other hazardous components to clear after use and target areas involved can be entered by personnel with relative safety. Technical qualification was completed during 1992.

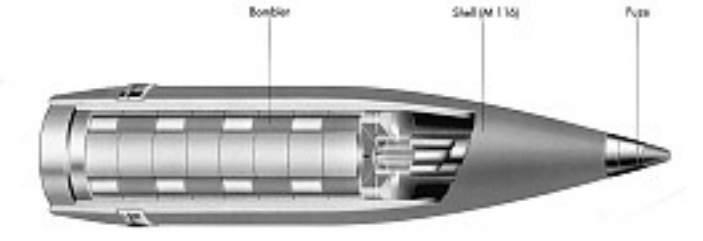
In addition to the Buck 155 mm practice bomblet projectile mentioned here, Rheinmetall DeTec has also proposed a similar projectile based on the DM 1396 carrier shell used for the 155 mm DM 642 cargo projectile and carrying 24 practice bomblets identical in function to those mentioned below. Weight of this practice projectile is 46.3 kg and length 899 mm, both unfuzed. The maximum range is 22,500 m.

Since the bomblets are non-explosive, the 2008 Dublin agreement on cluster munitions presumably does not apply to this round, although the withdrawal of the service rounds that it simulates would leave it with no role.

Description

The 155 mm projectile body used with the Buck 155 mm practice bomblet projectile can vary according to requirements.

There are two basic versions of the projectile qualified for service in Germany: the DM608 carries 20 bomblets and is ballistically matched to the M107 and DM21 rounds, and the DM618A1 carries 24 and is ballistically matched to the M483A1 and DM642 cargo rounds. The DM608 can be built by remanufacturing M116 smoke projectiles, while the DM618A1 can be made out of old M483 projectiles to save money.



Cutaway drawing of Buck 155 mm practice bomblet projectile, based on the M116 series smoke HC projectile 0502410

The projectile involved functions in exactly the same manner as an operational cargo round carrying bomblets. As the standard nose-mounted time fuze functions it ignites an expulsion charge in the ogive to create an internal overpressure which forces off the projectile's baseplate. The nylon ribbon stabilised practice bomblets are then ejected through the projectile base and scattered in exactly the same manner as operational bomblets. Assuming an ejection height of around 350 m the 20 practice bomblets will fall inside a 150 m diameter circle, similar to that assumed by the contents of an operational cargo projectile.

Each Buck practice bomblet weighs 279 g. As each bomblet lands, its pyrotechnic payload creates an aural impact signature, a flash visible by day or night, and a smoke cloud which remains visible for between 5 and 10 seconds; the practice bomblet is destroyed in the process. Any non-functioning practice bomblets can be readily identified and picked up safely.

Buck 155 mm practice bomblet projectiles can be fired from all existing 155 mm artillery systems using standard firing tables. Buck can adapt the practice bomblet payload for different types of carrier projectile.

Armament

M1A2 cannon for M114A2 towed howitzer; M199 cannon for M198 towed howitzer; M126/M126A1 cannon for M109 self-propelled howitzer; M185 cannon

Denel Naschem Assegai M2005 155 mm ERFB HE V-LAP projectiles
0093145

Santa Barbara SB 155/39 and 155/52 APU SBT-1 howitzers (Spain); Bofors FH-77B (Sweden); Extended-range gun (Taiwan); XM777 lightweight towed howitzer; and M198.

Self-propelled 155 mm howitzers: Tamse VCA 155; Norinco PLZ45 self-propelled gun howitzer (China); Giat Industries (now Nexter Systems) GCT and Caesar 155/52 (France); PzH 2000; Rheinmetall M109A3G and M44T (Germany); Majnoon (Iraq); Soltam Rascal and Slammer (Israel); Otobreda Palmaria and M109L (Italy); K9Thunder (South Korea); ZTS Zuzana (Slovakia); LIW G6 (South Africa); XT-69 (Taiwan); AS90 and Braveheart (UK); M109A4, M109A5 and M109A6 Paladin; XM2001/XM2002 Crusader Advanced Field Artillery System (AFAS) (US).

Authorised fuzes
Any NATO-standard PD, ET or proximity fuze.

Specifications
Weight, unfuzed: 41.8–43.4 kg
Filling: 4.5 kg TNH
Length: 804 mm
Design pressure: 450 MPa
Max body diameter: 154.75 mm
Max drive-band diameter: 157.86 mm
Qualification temperature: –46 to +63°C

Contractor
Naschem, a division of Denel (Pty) Ltd.

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155 mm GIWS DM 702 SMArt 155 ammunition system

Development
The designation SMArt 155 stands for *Suchzünder Munition für die Artillerie 155 mm* ('sensor-fuzed munition for the artillery 155 mm'). It has been under development since 1989 as an anti-armour and anti-artillery munition by Gesellschaft für Intelligente Wirksysteme mbH (GIWS), a subsidiary of Diehl and Rheinmetall headquartered in Nuremberg. The DM 702 SMArt 155 projectile is intended to match the exterior ballistics of the 155 mm DM 642 and M483A1 cargo rounds and can be handled in the same manner as a conventional round without the need to modify an artillery system in any way; it can be used with autoloader systems. The intention was that the DM 702 SMArt 155 would be capable of use close to 'own-troop' formations in close-combat battlefield situations.

The first drop test with a fully functioning submunition was successfully completed in late 1991. From 1991, the main task was the gun hardening of the round, completed in 1994. Full-scale development was completed in 1995. Company testing carried out during the first half of 1996 involved 12 projectiles, each with two submunitions, fired from 30-calibre and 52-calibre barrels out to a range of 27,000 m; 15 hits out of a possible 24 were scored. A small initial production batch followed, with further testing carried out in late 1996; six hits out of a possible 10 were achieved with five projectiles each with two submunitions. A production contract was placed in late 1997, with an initial figure of 10,000 units being reported. Production commenced in early 1998 to allow the SMArt 155 to be in service by the year 2000. The contract was to run until the end of 2002. The projectile is fielded with German Army PzH 2000 self-propelled artillery systems. Production is by Rheinmetall Industrie and Diehl.

In April 2001, GIWS entered an agreement with Alliant Techsystems (ATK) under which ATK was to manufacture the SMArt 155 and offer it for sale in the US. GIWS was to transfer SMArt 155 technology to the ATK Ammunition Systems Company at New Brighton, Minnesota, and to act as the US prime contractor for the manufacture of the projectiles, submunitions and other components. At that time, it was stated that ATK would deliver 200 SMArt projectiles to the US Army by the end of 2001 for operational testing and evaluation; the final total involved was to have been perhaps as many as 900 units. Low-rate production was to commence as early as 2003, with full production beginning in 2005. However, no such procurement had taken place by early 2004, although the US Army remains interested in a Search And Destroy ARmour Munition (SADARM) replacement.

The tests demonstrated a high effectiveness of the warhead and sensor, with performance being limited by software. Accordingly, GIWS began a Product-Improvement Programme (PIP) to optimise the sensor software for greater heights. Initial analysis showed promise, and in 1999, the German Ministry of Defence and GIWS signed a cost-sharing agreement for the PIP effort. The SMArt 155 Product Improvement (PI) was put through a series of tests in early 2002, culminating on 23 April of that year, when 15 rounds were fired against an armour array target set; the result was 100 per cent reliability, with seven direct hits and eight near misses. The new design was accepted for service, and deliveries of the new model began in June 2002. Of the 12,000 rounds believed to have been under contract, some 3,000 had been delivered by the time the new rounds began production. Changes to the round's design are limited to the sensor software and a realignment of the sensors. These alterations double the 'footprint' of the searching round to 35,000 m^2.

A collateral benefit of the PI upgrade is that it makes an extended-range version more practical. Ballistic tests have been conducted with what GIWS calls "very optimistic" results. The goal is to develop a version of the round with a range in excess of 40,000 m.

Future applications of SMArt-type submunitions could include Multiple-Launch Rocket System (MLRS) and airborne dispensers. A SMArt-D(AM) version, with a warhead liner consisting of tungsten balls, has been proposed for deployment by airborne dispenser systems.

Germany took delivery of its last batch of SMArt 155 rounds in late 2003. The second customer was Greece, which took delivery of its first batch in November 2003, with a second lot due for delivery in 2005. Late in 2001, Switzerland selected the round and subsequently placed a firm contract. This included a technology transfer to Switzerland, including qualification of a Swiss subcontractor. In the US, Alliant Techsystems has acquired rights to the SMArt 155 and is marketing it to the US Army as a Sadarm replacement.

Marketing continues, and in late 2004 GIWS and Alliant demonstrated the SMArt 155 in the UAE fired from a local G6 SP howitzer. The firms claimed perfect reliability and that 67 per cent of the targets engaged were scored as kills.

In November 2007 the British Army selected the SMArt 155 as its Ballistic Sensor Fuzed Munition (BSFM). The firm received a GBP 83 million contract for the supply of an unspecified quantity of these rounds for use with the British AS-90 SP artillery fleet. It is expected to enter service in 2011. At the same time the Australian MoD announced that they had finalized a deal worth AUD 14 million for SMArt 155 rounds and associated propelling charges, fuzes and inductive fuze setters.

Current development work is concentrated on algorithm refinement to enable the sensors to locate targets in urban environments. This means greater reliance on MMW and less on IR and mainly involves tweaking the sensor settings. The firm is also looking at the use of lasers to designate targets for the submunitions, but this appears to be a low priority given its limited probable utility in reducing collateral damage.

Few detailed specifications have yet been released regarding this projectile, so all data given here should be regarded as provisional.

Cross-sectioned model of the GIWS SMArt ammunition system, with drag parachute deployed (T J Gander)
0093147

Description
The 155 mm DM 702 SMArt 155 projectile carries two autonomous submunitions inside a thin-walled carrier shell provided with a single wide driving band and a base plug. The projectile has a similar external shape to that used on the 155 mm DM 642 cargo projectile.

The DM 702 SMArt 155 can be fitted with a DM 52A1 Electronic-Time (ET) fuze, which can be programmed to function over a target area. When the fuze functions, it ignites an expulsion charge inside the ogive to create pressure on an expulsion unit. Part of the expulsion unit acts as a piston, so that the expanding gas pressures inside the ogive press down on the submunition payload and force off the base plug.

The two submunitions are identical and employ a modular construction. They each consist of an orientation and stabilisation unit, a sensor fuze system and a warhead.

The orientation and stabilisation unit comprises a drag parachute, three outward-folding de-spin flaps and an autorotating parachute. The first two units control the submunition's aerodynamics after their ejection from the carrier shell, while the scanning of the target area in an inward spiralling motion is controlled by the autorotating parachute.

Specifications
Type: impact SQ
Weight: 110.9 g
Length:
overall: 74 mm
visible: 37 mm
Diameter: 40 mm
Optional delay: none

Contractor
China North Industries Corporation (Norinco).

MP-1B impact fuze
0021967

MP-5B impact fuze

Development
Norinco developed this fuze for export sales.

Description
The MP-5B is designed for export sales and is intended to interchange with Western fuzes such as the Borletti PDB332, the US M525 and similar fuzes. It is a mechanical impact fuze that functions only in SuperQuick (SQ) mode. A pyrotechnic delay is used for arming. The muzzle safe distance is 30 m. The fuze body is aluminium.

Armament
60 and 81 mm mortar bombs generally.

Specifications
Type: impact SQ
Weight: 234.2 g
Length:
overall: 95.7 mm
visible: 69 mm
Diameter: 49 mm
Optional delay: none

Contractor
China North Industries Corporation (Norinco).

MP-5B impact fuze 0021968

MP-6 impact fuze

Development
Norinco developed this fuze for the Chinese People's Liberation Army.

Description
The MP-6 is designed as a replacement for the MP-1A and the MP-1B (see separate entries), which lack modern safety features. The MP-6 uses a pyrotechnic delay for arming and is muzzle safe to 20 m. It has SuperQuick (SQ) function only. Like other current Norinco designs, the MP-6 is constructed of aluminium.

Armament
60 and 82 mm mortar bombs generally.

Specifications
Type: impact SQ
Weight: 115 g
Length:
overall: 74.47 mm
visible: 38 mm
Diameter: 40 mm
Optional delay: none

Contractor
China North Industries Corporation (Norinco).

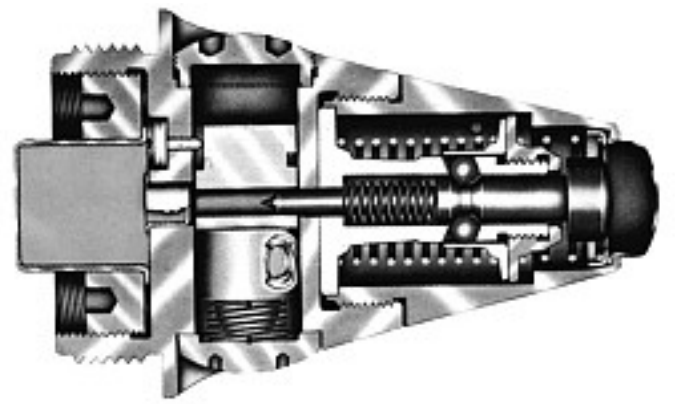
MP-6 impact and SQ fuze
0021969

the armed position, freeing it from engagement in the rotor. The rotor is then free to rotate and slide sideways, bringing a detonator under the firing pin.

Armament
60, 81 and 120 mm smoke bombs of Serbia and former Yugoslav manufacture.

Specifications
Type: impact, super-quick
Weight: 158.7 g
Length:
  overall: 80 mm
  exposed: 63 mm
Diameter : 46 mm
Optional delay: none
Arming distance: min 8 m

Contractor
Yugoimport-SDPR.



UT M70P1 impact fuze 0502629

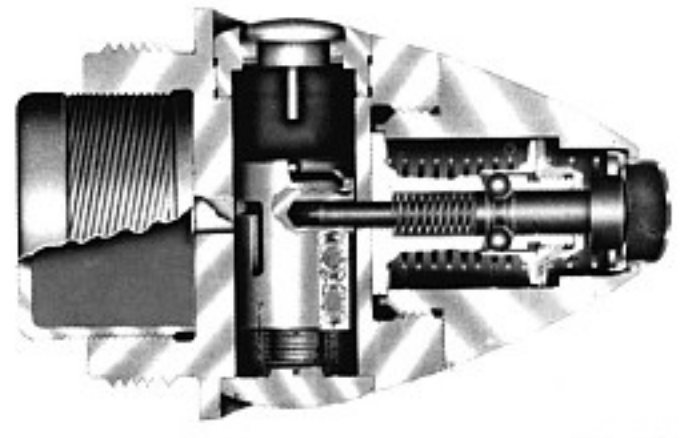
UTU M67 impact fuze

Development
Yugoimport-SDPR developed this fuze for former Yugoslav service mortars.

Description
This is a direct-action impact fuze with selectable delay. It uses a rotor which is locked by the firing pin when at rest. On firing, an inertia sleeve sets back, locks and then lifts the firing pin out of the rotor into the armed position. The rotor can then turn and move laterally across the fuze, the distance it moves depending on the setting of a turnscrew in the side. When set for SuperQuick (SQ) action, the rotor stops with a detonator lined up beneath the firing pin. On impact, this detonator is struck and transmits its effect directly to the fuze magazine. If the turnscrew is set for delay, the rotor moves to position a second detonator under the firing pin, which has a delay unit beneath it. Thus, from the time this is struck by the firing pin, there will be the usual 0.05 second delay before the effect is transmitted to the fuze magazine.

Armament
81 and 82 mm High-Explosive (HE) bombs of Serbia and former Yugoslav manufacture.

Specifications
Type: impact, SQ and delay
Weight: 285 g
Length overall: 91 mm



UTU M67 impact, SQ and delay fuze 0502627

Optional delay: 0.05 s
Arming requirement: min 8 m at 68–72 m/s

Contractor
Yugoimport-SDPR.

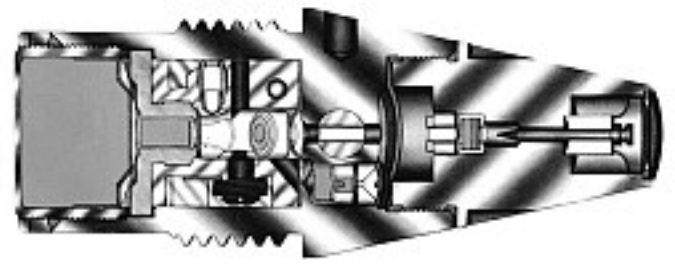
UTU M78 impact fuze

Development
Yugoimport-SDPR to suit the specific requirements of the M77 bomb.

Description
This is a SuperQuick (SQ) and delay fuze, the delay being set if required. The fuze operates on a combination of setback and centrifugal force, the specific bomb to which it is matched having a degree of spin stabilisation though fired from a smoothbore mortar.

The fuze relies upon a Semple rotor for safety; this rotor is spring tensioned and is restrained by a centrifugal detent, locking into a hole in the rotor. In the nose of the fuze is a firing pin and primary detonator, below this is a plug which can be turned by a turnscrew on the exterior of the fuze. The plug has a hole in it which, in the SQ position, aligns with a fire channel beneath the primary detonator. Adjacent to this plug is a delay lead and a secondary detonator. The rotor, which contains a detonator and a stem of explosive, lies beneath the plug and above the fuze magazine.

At rest the rotor is locked by a detent. On firing, this withdraws, but the rotor will not move until the centrifugal detent is withdrawn under the influence of spin. Once this frees, the rotor is free to turn under spring tension, positioning the detonator under the plug. On impact, if set for SQ action, the firing pin strikes the primary detonator and the flash passes down through the channel in the plug, firing the rotor detonator and then the magazine. If the plug is turned to the delay position the flash from the primary cannot pass through and diverts to the delay filling, burning through and firing the detonator. This in turn fires the rotor detonator through a fire channel and the magazine is fired as before.



UTU M78 impact SQ and optional delay fuze 0502630

Armament
120 mm High-Explosive (HE) rocket-assisted bomb M77.

Specifications
Type: impact, SQ with optional delay
Weight: 430.9 g
Length:
  overall: 102 mm
  exposed: 57 mm
Diameter: 40 mm
Optional delay: 0.05 s
Arming distance: min, 10 m

Contractor
Yugoimport-SDPR.

V9 impact fuze

Development
SNEM developed this fuze to meet a French military requirement.

Description
This impact SuperQuick (SQ) fuze generally resembles the better-known V19 series of fuzes (see separate entry), using a similar arming and Direct-Action (DA) mechanism, but without any optional delay facility. The fuze has an aluminium rear body and a nose cap which can be turned by hand between

V9 impact and SQ fuze 0021951

ROCKET FUZES

Fuchs Electronics BM21 proximity fuze

Development
The BM21 proximity fuze was designed by Fuchs Electronics to be used on the former Eastern-bloc 122 mm BM-21 Grad and similar artillery rockets. It can, however, be adapted to interface with rockets of similar dynamic characteristics with calibres from 100 to 160 mm. It has been in production since 1988 and was still being actively marketed in 2006.

The BM36 proximity fuze is a development of the BM21 fuze, intended for use with 122 mm BM-21 Grad extended-range rockets (see separate entry).

Description
The Fuchs Electronics BM21 radio proximity fuze is designed to detonate a warhead at an effective height above ground level to optimise the fragment spread of the warhead. The fuze's primary mode of operation is set for proximity action at a factory-set reference of a nominal 8 m. Should the proximity action fail, the fuze has a secondary independent Point-Detonating SuperQuick (PDSQ) back-up function.

The fuze is powered by an air-driven turbine and is mechanically armed after 0.5 seconds from launch. The proximity and Point-Detonating (PD) functions become operational after 12 seconds of flight. The fuze is fitted with a safe-and-arm device which incorporates a 180° out-of-line mechanical rotor that requires a minimum sustained wind velocity of 600 m/s to prepare the explosive train.

The BM21 proximity fuze can be used with aerodynamic brakes (drag rings).

The physical contours and dimensions of the BM21 proximity fuze closely follow those of the MRV and MRV-U PD fuzes.

The shelf-life is in excess of 10 years.

Fuchs Electronics BM21 proximity fuze 0058948

Specifications
Weight: nominal 1,150 g
Length: max 208.30 mm
Intrusion: 54.55 mm
Diameter: 64.0 mm
Screw thread: M45 × 2.00—6g
Max operating velocity: 600–900 m/s
Angle of impact: 15 to 90°
Operating temperature range: –40 to +60°C
Shelf-life: minimum 15 years

Interchangeability
PD – MRV and MRV-U.

Contractor
Fuchs Electronics (Pty) Ltd.

Fuchs Electronics BM36 proximity fuze

Development
The BM36 proximity fuze was designed by Fuchs Electronics to be used on the former Eastern-bloc 122 mm BM-21 Grad extended-range artillery rockets such as the 9M22M. Production commenced during 1994.

Description
The Fuchs Electronics BM36 radio proximity fuze is an upgraded version of the BM21 fuze (see separate entry), which allows for the higher burnout velocities of the extended-range rockets used with the 122 mm BM-21 Grad rocket system. The BM36 is claimed to be a highly reliable proximity fuze with a nominal 8 m burst height supported by a Point-Detonating SuperQuick (PDSQ) back-up function.

Power is provided by a wind-driven turbine generator. The fuze is mechanically armed 0.5 seconds after launch and the proximity and Point-Detonating (PD) functions become operational 5 seconds after leaving the launcher. The electronic safety time, as well as the height of burst, can be varied to suit customer requirements. The fuze is fitted with a safe-and-arm device which incorporates a 180° out-of-line mechanical rotor that requires a minimum sustained wind velocity of 600 m/s to prepare the explosive train.

Fuchs Electronics BM36 proximity fuze 0092288

Specifications
Weight: nominal 1,150 g
Length: 208.30 mm
Intrusion: 54.55 mm
Diameter: 64.0 mm
Screw thread: M45 × 2.00—6g
Operating temperature range: –40 to +60°C
Max operating velocity: 1,300 m/s
Angle of impact: 22 to 90°

Interchangeability
PD – MRV and MRV-U; Fuchs BM21.

Contractor
Fuchs Electronics (Pty) Ltd.

Fuchs Electronics M9120 proximity fuze

Development
The M9120A1 proximity fuze was designed by Fuchs Electronics to be used on the 127 mm Valkiri II (Bataleur) artillery rockets, but can be adapted to interface with rocket warheads on NATO and former Warsaw Pact rocket munitions with calibres from 120 to 160 mm. It is in production and in service with the South African National Defence Force (SANDF).

Description
The Fuchs Electronics M9120 radio proximity fuze is designed to detonate a warhead at an effective height above ground level, optimising the fragment spread of the warhead. The fuze's primary mode of operation is set for proximity action at a factory set reference of 9 m. Should the proximity action fail the fuze has a secondary independent super-quick point detonating back-up function. If required the point detonating (direct action) mode can be selected by a switch on the fuze body.

The fuze is powered by an air-driven turbine and is mechanically armed at a range of 300 m from the launcher. The proximity and point detonation functions become operational between 5 and 17 seconds of flight but alternative times can be factory set if required. The fuze is fitted with a 'Safe and Arm' device which incorporates a 180° out-of-line mechanical rotor which requires a minimum sustained windspeed velocity of 600 m/s to prepare the explosive train.

Fuchs Electronics M9120 proximity fuze 0058947

The M9120 fuze has been designed to accommodate velocities up to 1,300 m/s. Velocities of this order will be encountered on new generation extended range artillery rockets.

Interchangeability
See text.

Contractor
Fuchs Electronics (Pty) Ltd.

IDENTIFICATION OF SMALL ARMS AMMUNITION
CARTRIDGE IDENTIFICATION TABLES

Small Arms and Cannon Ammunition

This table is provided so that unknown cartridges or cartridge cases may be quickly identified. It includes many cartridges which, owing to obsolescence, are not described in the main database. The table is divided into sections corresponding to the standard cartridge shapes; within each section, the cartridges are listed in ascending order of the case length (excluding the bullet). Where more than one cartridge shares the same case length, they are in ascending order of the bullet diameter (calibre). To use the table, identify the cartridge shape; enter the relevant table at the case length and, if necessary, seek the calibre. The remaining dimensions serve as a check (with belted cases, the measurement of 'body diameter' is taken above the belt). Bear in mind that manufacturing tolerances mean that measurements may vary so the figures quoted here are approximate. The headstamp may also assist in deciding between similar cartridges such as the various 6.5 mm rifle rounds. This table is not comprehensive; it focuses on cartridges which are, have been or are likely to be used by military or police authorities. This includes the great majority of handgun cartridges but mainly military rifle, machine gun and of course cannon rounds. Commercial hunting rifle rounds are not included unless they have been offered in military weapons, but they can typically be identified by their headstamps.

Abbreviations in 'Title' column:

S&W = Smith & Wesson; **H&H** = Holland & Holland; **HK** = Heckler & Koch; **RhB** = Rheinmetall-Borsig, **Win.** = Winchester, **Rem.** = Remington, **IJA** = Imperial Japanese Army, **IJN** = Imperial Japanese Navy, **pdr** = pounder (nominal weight of projectile); **(SR)** = semi-rimmed; **(name in brackets)** = also known as/used in

Key to 'Type' column: (indicates dates weapon last in service or ammunition last known to be manufactured)

C19 = 19th Century; **WW1** = 20th Century up to 1918, including First World War (1914–18); **WW2** = from 1920s to 1945, including Second World War (1938–45); **C20** = second half of 20th Century; **current** = ammunition still in production; **exp** = experimental

P = pistol (single shot); **rev** = revolver; **auto** = automatic pistol; **ATR** = anti-tank rifle; **MG** = machine gun; **R** = rifle; **PDW** = personal defence weapon; **spot** = spotter/training (inc subcalibre); **GL** = grenade launcher; **AGL** = automatic grenade launcher; **silent** = designed for silent or silenced weapons; **SMG** = sub-machine gun; **AA** = anti-aircraft; **AC** = aircraft; **AFV** = armoured fighting vehicle; **AR** = artillery; **AT** = anti-tank; **N** = naval; **LLW** = Less Lethal Weapons: baton, rubber ball or chemical rounds.

1. Rimmed, straight cartridges

Title	Case length	Bullet diam	Rim diam	Body diam	Neck diam	Type
.22 SSS Rimfire (Short)	10.7	5.7	7.1	5.7	5.7	current silent
.32 S&W	15.4	8.0	9.6	8.6	8.6	current rev
.22 Long Rifle Rimfire	15.6	5.7	7.1	5.7	5.7	current R, P, rev, auto
.320 Revolver (British)	15.7	8.1	8.9	8.2	8.1	C20 rev
.32 Short Colt	16.0	8.0	9.5	8.1	8.0	C20 rev
.450 Revolver	17.5	11.6	13.0	12.1	12.1	C20 rev
.380 Revolver	17.8	9.5	10.8	9.7	9.6	C20 rev
.455 Webley Revolver	19.0	11.4	13.5	12.1	11.9	C20 rev
9 mm Federal	19.2	9.0	11.0	9.8	9.7	C20 rev
.38 S&W (.380 British)	19.7	9.1	11.0	9.8	9.8	current rev
.32 S&W Short	19.8	8.0	9.4	8.1	8.1	current rev
10.4 mm Italian Service	19.8	11.1	13.2	11.8	10.8	C20 rev
10.4 mm Swiss Revolver	19.9	10.8	13.4	11.2	10.9	C19 rev
9.4 mm Dutch Service	20.7	9.8	12.3	10.5	10.3	WW2 rev
9 mm Japanese revolver	21.8	9.0	11.0	9.8	9.5	WW2 rev
12.3 mm Udar-S	22	21.3	16.3	–	–	current rev
.476 Enfield	22.1	12.0	13.5	12.1	12.0	C19 rev
20 mm Dutch sub-calibre	22.1	19.9	22.1	20.6	20.4	C20 spot
9 mm Belgian Nagant	22.2	9.3	12.1	10.7	9.9	WW1 rev
7.5 mm Nagant (Swedish, Norwegian, Swiss)	22.4	8.2	10.3	9.1	8.2	C20 rev
.38/.357 paint (Simunition)	22.8	9.1	11.0	9.5	9.5	current rev (training)
.45 Auto Rim	22.8	11.5	13.1	12.1	12.0	C20 rev
.32 Long (S&W, Colt New Police)	23.4	8.0	9.6	8.6	8.6	current rev
10.6 mm German Ord.	24.7	10.9	12.9	11.4	11.4	WW1 rev
.44 S&W Russian	24.8	10.9	13.1	11.6	11.6	current rev
8 mm Rast-Gasser	26.3	8.1	9.5	8.5	8.4	C20 rev

1. Rimmed, straight cartridges — *continued*						
Title	**Case length**	**Bullet diam**	**Rim diam**	**Body diam**	**Neck diam**	**Type**
.38 Long Colt	26.3	9.1	11.2	9.6	9.6	C20 rev
.22 Win. Magnum rimfire	26.8	5.7	7.5	6.1	6.1	current R, rev
.32 H&R Magnum	27.1	8.0	9.3	8.5	8.5	current rev
8 mm Lebel	27.3	8.1	10.4	9.0	8.7	WW2 rev
.45 S&W Schofield	28.0	11.5	13.3	12.1	12.1	current rev
.44 Colt	28.2	11.3	12.3	11.7	11.6	W2 rev
.41 Long Colt	28.4	10.3	10.9	10.4	10.3	C20 rev
5.5 mm (5.75 mm) Velo-Dog	28.8	5.8	7.8	6.4	6.3	C20 rev
.38 Special (Colt, S&W)	29.3	9.1	11.1	9.5	9.5	current rev
.44 Special	29.5	11.0	13.0	11.6	11.6	current rev
.480 Ruger	32.4	12.1	13.6	12.7	12.7	current rev
.401 Herter's Powermag	32.5	10.2	12.2	10.8	10.7	C20 rev
.41 Magnum	32.5	10.4	12.4	11.0	11.0	current rev
.45 Colt Revolver	32.6	11.6	13.0	12.2	12.2	current rev
.44 Magnum	32.6	11.0	13.1	11.6	11.6	current rev
.357 Magnum	32.8	9.1	11.2	9.6	9.6	current rev
.32-20 Winchester	33.5	7.9	10.3	9.0	8.3	current rev
.454 Casull	35.3	11.5	13.0	12.2	12.1	current rev
.475 Linebaugh	35.3	12.1	13.6	12.7	12.7	current rev
.360 Dan Wesson	35.8	9.1	10.9	9.5	9.5	current rev
.44 Montenegrin	37.0	11.3	14.4	12.4	11.8	WW2 rev
12.3 mm Udar-T	40	12.3	16.3	–	–	current rev
.357 Rem Maximum	40.4	9.1	11.0	9.5	9.5	C20 rev
.475 Maximum	40.5	12.1	13.6	12.7	12.7	current rev
.500 S&W Magnum	41.1	12.7	14.0	13.3	13.3	current rev
.460 S&W Magnum	45.3	11.6	13.1	12.1	12.1	current rev
12.3 mm Udar	50	12.3	16.3	–	–	current rev
.577 Snider	50.8	14.5	19.0	16.8	15.3	C19 R
14.5 mm Spotter	51.0	14.6	16.8	15.5	15.4	C20 spot (alloy)
.45/70	53.5	11.6	15.2	12.7	12.1	C19 R
Vickers 1 pdr Mk III	69	37	44	39	38	WW1 AC
Vickers-Crayford 1.59 inch	79	40	48	44	43	WW1 AC
44 mm Flashball	83	44.8	–	45	45	current LLW
Vickers 1 inch	87	25	31	28	26	WW1 AC
1 inch Nordenfelt (1 inch aiming tube)	94	25	30	28	26	C19 N MG (WW2 spot)
20 × 99R ShVAK	99	20	25	22	21	WW2 AC, spot, R
37 mm L21/L60	103	37	42.8	39.4	39	current LLW
19 mm Szakats	114.2	18.4	29.7	23.0	20.4	WW1 exp AC
57 mm IJA Type 97	121	57	69	61	58	WW2 AFV, AC
37 mm LLW	122	36	42.7	39.4	39	current LLW
37 mm USN 'Heavy 1 pdr'	136	37	45	40	38	C19 N
37 mm US M4	145	37	45	40	38	WW2 AC