



120MM SYSTEMHOUSE

PASSION FOR TECHNOLOGY.

 RHEINMETALL

120 MM SYSTEM HOUSE

RHEINMETALL DEFENCE: INVENTOR OF 120 MM SMOOTHBORE WEAPON AMMUNITION SYSTEM

Due to ongoing increasing threats from the MBT side focusing to the duel position MBT-MBT as well as from the widened tasks of MBT-missions in e.g. built-up areas or supporting the infantry on battlefield the 120 mm System House Rheinmetall is in a permanent innovation process in order to create new technology to encounter modern threats.

Consolidating the 120 mm technology leadership there has been in the last decades a huge enhancement in the Rheinmetall weapon ammunition system leading to advanced ammunition family generations as well as advanced generation of the origin L44 weapon with longer barrel (L55) or muzzle-breaks (L47 LLR) in order for mounting on lighter combat vehicles.

Rheinmetall is known as the world's most innovative and efficient supplier of 120 mm weapon ammunition equipment. Apart from its outstanding skills in MBT ammunition weapon system integration, the company has extensive experience in international consortia and is a long-standing partner of the armed forces of Germany, NATO and other friendly nations.

As a matter of course Rheinmetall's products are compliant to international standards including the REACH EU law regulation.

1960–1970:

Rheinmetall invented the 120 mm smoothbore technology together with the ammunition family based on the innovative technology of Combustible Cartridge Case (CCC).

1974–79:

Rheinmetall won the competition of the US Army. The winner Rheinmetall procured the Rheinmetall 120 mm smoothbore weapon/ammunition system as the main armament for the Abrams M1-fleet of 7000 MBTs by a licence contract between Rheinmetall/US-Government.

After 1980:

The Rheinmetall 120 mm smooth bore technology diffused around the world and became the most used calibre on MBTs worldwide.



DM63 Family
Armour Piercing



DM78A1/DM88
Target Practice



DM11
HE-FRAG
programmable



Rh31
HE-FRAG



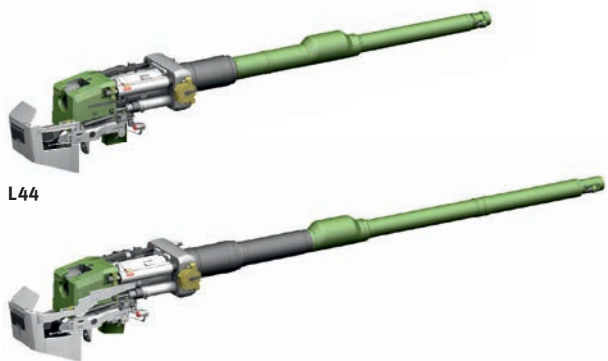
Rh88/DM98
Target Practice



DM58
Target Practice



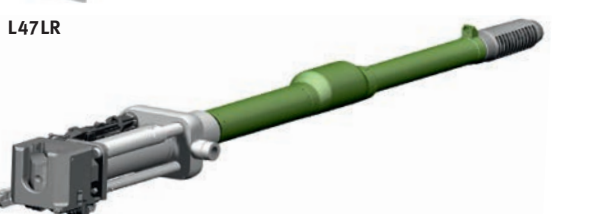
DM21
KE-PELE



L44



L55



L47LR



L47LLR



120 mm L44 operated by M1 Abrams MBT



Leclerc's 120 mm L52 main gun uses Rheinmetall smoothbore technology



Leopard 2

APFSDS-COMBAT ROUNDS

120MM APFSDS DM63 FAMILY

The world's first and unique temperature-independent high-performance tungsten tank round.

The cartridge 120 mm DM63 family-APFSDS is the world's first temperature-independent high-performance tank round. The purpose of this ammunition is to destroy modern generations of main battle tanks; even at long ranges of engagement. Based on tungsten technology, the DM63 family is the most advanced KE round for 120 mm smoothbore tank guns on the market today.

Rheinmetall Defence uses a special state-of-the-art tungsten penetrator, that is capable of overcoming the most extreme cutting and bending forces of modern explosive reactive armour. This makes it possible to defeat modern types of tank armour, including multi-layer and composite arrays and reactive armour systems at all ranges of engagement. Fired from L44 and L55 tank barrels, the ammunition is extremely accurate. Upgrading from L44-barrel to L55-barrel gains a benefit of an huge increase of combat distance.

The ammunition's unique temperature-independent propulsion unit (TIPS®) which is based on the SCDB®-technology underscores Rheinmetall's cutting edge position in the world of APFSDS rounds. As opposed to conventional tank ammunition, there is no decline in the DM63 family terminal ballistic and target engaging performance at the lower end of the temperature scale.

The 120 mm DM63 family can be fired at temperatures ranging from -46°C to $+71^{\circ}\text{C}$ (Climate Zones C2 – A1). In combat, the temperature-independent muzzle velocity results in a superior first shot kill probability at all temperatures. The round's specially designed combustible cartridge case with additives reduces barrel erosion significantly.

The DM63 family is designed with gas-pressure stage compliance to the lowest gas pressure L44-Interface-Control-Document in order to assure a crew safe firing also from all Leo2A4 fleets.



DM53 cartridges still found in the inventories of some Leopard 2 user countries can be modified in order to match the design status of the DM63 family. This upgraded cartridge is known as the DM53A1.

KEY CHARACTERISTICS

- Superior performance against state-of-the-art main battle tanks even at long ranges of engagement
- Superior performance against explosive reactive armour technologies
- Very high first shot kill probability
- Temperature-independent propelling system
- Superior terminal ballistic performance even at low temperatures
- Very narrow divergence of the muzzle velocity within the temperature range
- Compliance in all Leopard 2 A4 to A7
- Excellent LOVA characteristics
- Usable in Climate Zones C2 – A1
- Significantly reduced barrel erosion, especially at high temperatures
- Additional behind armour effects through an incendiary unit
- Can be fired by any 120 mm smoothbore tank gun



Protection of modern generations of main battle tanks are simulated by proving ground targets.

TECHNICAL DATA**Muzzle velocity**

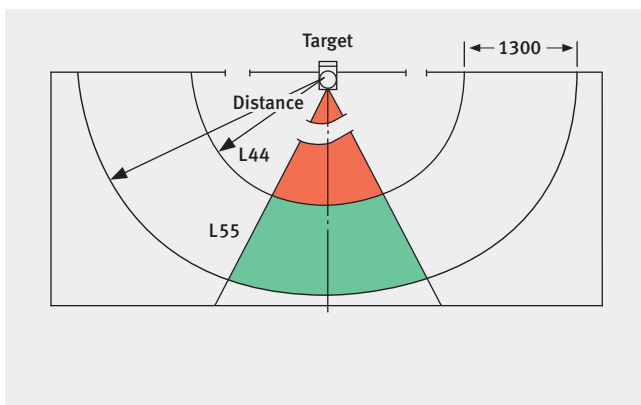
L44 tank gun 1,650 m/s at 21°C
(1,585 m/s to 1,665 m/s from -46°C to +71°C)

L55 tank gun 1,720 m/sec at +21°C
(1,655 m/s to 1,735 m/s from -46°C to +71°C)

Cartridge weight approx. 21.4 kg

TID <0.2 mils

Largest range of engagement 4,000 m

INCENDIARY UNIT

Increase of combat distance through upgrading from L44 barrel to L55 barrel

120 mm APFSDS DM63A1/DM53A1 are designed with an additional behind armour effect due to the embedded incendiary unit.



HE-COMBAT FAMILY

NEW MODULAR CARTRIDGE CONCEPT

120 MM HE PROGRAMMABLE DM11 AND 120 MM HE IMPACT RH31

Traditionally used primarily for engaging enemy armour, the role of modern main battle tanks has widened considerably, keeping pace with the altered mission spectrum of today's armed forces. For example, MBT are often called in to support the infantry during operations in built-up areas. In such cases, their task is to destroy dismounted enemy forces and long range antitank weapons, especially when occupying field fortifications, buildings and other forms of cover. The new HE-rounds can also be used to attack targets positioned behind cover (e.g. behind walls). Outstanding performance will also be achieved against dismounted infantry and earth bunkers.

Earlier families of multipurpose ammunition only have limited abilities to meet contemporary operational requirements. This led Rheinmetall to develop a new family of 120mm HE ammunition that can be fired from any tank with a 120mm smoothbore gun L44 as well as L55.



A high end programmable round DM11, developed under contract of the German MoD which needs a cap of MBT modification in order to program the DM11 Rheinmetall completed the family with a point detonating round Rh31, which needs no modification of the MBT unless the conventional new ballistic card.

The new HE-cartridge unit is under modular design, consisting of propulsion section, warhead and fuze. Due to this modular design the conventional PD-round Rh31 is also recommended as a basic defence procurement which can be upgraded in an efficient and economic process to the multi-programmable round DM11 with the three fuze modes: airburst, PD with designed delay, PD. Rh31 is qualified with respect to NATO-standards and is fielded.

The full-calibre projectile features a retractable fin tail assembly. The round has been designed to successfully engage soft and semi-hard targets even at long ranges. A mixture of designed heavy metal fragments and natural steel fragments, coupled with high-performance explosive, assures massive destruction in the target zone.

When fired in airburst mode, the new DM11-round can be used to take out a wide variety of different targets. In this case, an electronic time fuze detonates the warhead at a predetermined distance from the target.

Alternatively, the fuze in the DM11-round can be programmed to detonate the warhead upon impact or after a programmable delay. When the delay mode is selected, the warhead detonates after penetrating a building wall or roof.

Once the cartridge has been loaded, the fuze can be (re-) programmed any time while chambered in order to give the tank crew the maximum flexibility when engaging different enemy targets on battlefield. According to the target to be engaged the crew can choose between the fuze-modes "point detonation", "point detonation with delay" or "air burst detonation".

The round can be used in climatic categories C2 – A1. Required function specification is given in the temperature range from -46°C to $+63^{\circ}\text{C}$. Safe firing is given in the temperature range from -46°C up to $+71^{\circ}\text{C}$.

The DM11 is fully qualified and in mission use with the United States Marine Corps. Introduction into other nations inventory has started in 2013.



- Point detonation with delay

If the target is positioned behind a wall, the “point detonation with delay mode” can be selected to ensure that the projectile penetrates the wall before the explosive charge is initiated. In the delay mode the detonation signal is suppressed for a given time ensuring delayed detonation behind possible covers.



- Programmable air burst (time fuze)

After determining the distance to the target, the fuze time period and cannon super-elevation are automatically synchronized by the tank's fire control system to ensure that the explosive charge detonates at a defined distance in front of the target and at a defined height.



- Point detonation

The "Impact detonation without time delay" mode is suitable, for example, in engaging lightly armoured vehicles. It also serves as the basic (or default) mode, meaning that the cartridge automatically reverts to the impact mode if programming is disrupted. In this case, a reduced area effect is achieved, when the projectile hits the ground.

120 MM HEDM11 PROGRAMMABLE



KEY CHARACTERISTICS

Optimum effectiveness in the target zone due to tactical alteration of fuze function when cartridge is already chambered

- Airburst mode
- Time delay
- Impact

BROAD RANGE OF APPLICATIONS:

- Antitank positions
- Targets behind walls/in defilade
- Targets in bunkers/field fortifications
- Area targets/dismounted units in the open
- Light- and medium-weight armoured vehicles
- Vessels
- Armored tank howitzer
- Reinforced concrete walls
- Very safe to handle and transport due to use of insensitive explosives.

TECHNICAL DATA

Muzzle velocity

L44 tank gun approx. 970m/s

L55 tank gun approx. 1,000m/s

Shrapnel range

DM11 Superior

Rh31 Extensive

Very high number of design fragments

Weight of fragments approx. 9 kg

Maximum effective range

DM11 5,000 m

Rh31 3,500 m

Cartridge weight appr. 29 kg

TID <0.22 mils

120MM HE RH31



KEY CHARACTERISTICS

For customers who would avoid a system retrofit for a programmable ammunition or would execute this retrofit at a later point of time the Rh31 is available. These cartridges are identical to the DM11, but are fitted with a cheaper non-programmable impact fuze. Thanks to the cartridge's modular design, the Rh31 has growth potential, and can be upgraded to match the design status of the DM11 in a efficient and economic upgrade process.

The module 'warhead' of Rh31 is identical and can be reused in DM11. The module 'propulsion section' of Rh31 is identical to the full-calibre target practice round DM58 and can be reused and assembled to DM58 in order to save budget at the TP-procurement (see page 15).

- Inexpensive
- Highly effective against masonry, structures (e.g. concrete or brick walls), field fortifications as well as light- and medium-weight armoured vehicles
- Ground impact results with massive area effect
- Very safe to handle and transport due to use of insensitive explosive



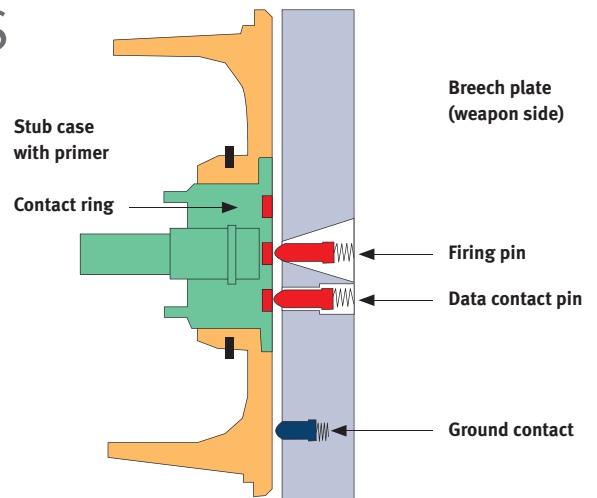
HE-PROGRAMMABLE ROUNDS

NECESSARY MBT-VEHICLE RETROFITS FOR PROGRAMMING THE 120MM HE DM11 PROGRAMMABLE ROUND

In addition to the Leopard 2 MBT-family in principle every 120mm-smoothbore platform (e.g. Abrams M1, Leclerc, Centauro 2, etc.) can be modified to the capability of programming the 120mm DM11 programmable round by applying the ICD-technical interface data.

In 2008 the Interface Control Document 120mm Tank Main Armament System was extended and the amendment “Interface with voltage supply and Bidirectional Data Transfer between System and loaded Cartridge” was signed in the framework of the Joint Configuration Board by German Government and US-Government in order to assure a full compatibility of modern programmable rounds on battle-field between the MBTs Leopard 2 and Abrams.

Focusing on the Leopard 2 MBT-family it has to be declared that the version Leopard 2A7 has the complete programming capability for the 120mm HE DM11 programmable round.

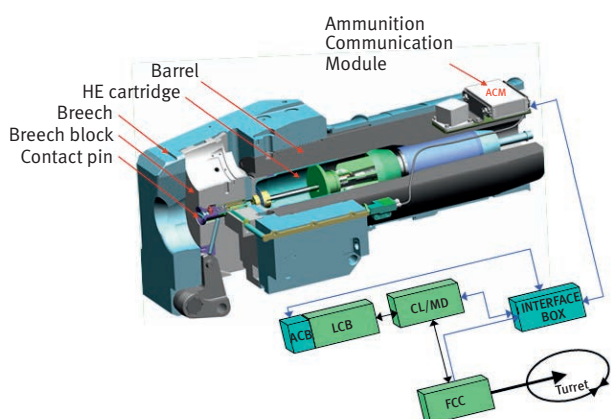


Leopard 2A6 of German Army

PROGRAMMER SOLUTION

But for all other users operating the MBT versions Leopard 2A4 to A6 Rheinmetall offers a low-cost programming kit, even in the case of retaining the analogue fire control system. This low-cost solution is meanwhile under contract for two Leo 2 users.

System integration



FCC = Fire Control Computer
 LCB = Loader's Control Box
 CL/MD = Central Logic/Main Distribution
 ACB = Add-on Control Box

Programmer kit components

ACB (Add-on Control Box) for status information and button to select HE PD with or without delay.



ACM (Ammunition Communication Module) physical fuze programming

Interface box generates all data for the ACM



Rheinmetall Demonstrator Leo 2A4

RHEINMETALL MBT GUN SYSTEMS 120 MM

WEAPON SYSTEM 120 MM L44

Rheinmetall started the development of the 120 mm weapon system at the beginning of the 1970s. With the introduction of Leopard 2 MBT to the German Army the Rheinmetall 120 mm L44 weapon system became the first NATO smoothbore gun. NATO wide comparative testing has shown the superiority of the Rheinmetall concept. Nowadays, except in Leopard 2, the 120 mm L44 gun is integrated as a standard gun in several foreign main battle tanks (e.g. M1 Abrahams/ USA, Type 90/Japan) and manufactured under license abroad.

This high performance weapon system gives the Leopard 2 MBT A4/A5 versions superior fire power at short and medium ranges. Other outstanding operation features include high precision in stationary and mobile combat situations and significant penetration capabilities of KE ammunition also developed by Rheinmetall.



120 mm L44

Due to the modularity of the Rheinmetall weapon systems the 120 mm L44 weapon system is prepared for integration of the programmer set and thus for use of the programmable air burst/time fuzed DM11 HE tank ammunition.

Technical Data – Weapon System 120 mm L44

Barrel length (mm)	5,300
Barrel mass (kg)	1,190
Weapon system mass (kg)	3,030 without protection module

Rheinmetall offers the proven 120 mm L44 weapon system as a very economical solution for modernization of older main battle tanks types such as Leopard 1A5, AMX30 and M60. These types tend to be equipped with 105 mm weapon systems. Replacing the 105 mm gun system with a Rheinmetall 120 mm weapon system, combined with integration of a new fire control system, these tanks obtain a firepower corresponding to Leopard 2A4. In comparison to a 105 mm weapon system, the muzzle energy of a 120 mm L44 weapon system is about 60% higher. Therefore, the vehicles can also withstand modern threats and remain in use for years.

WEAPON SYSTEM 120 MM L55

With this ultra-modern armament the Leopard 2A6/A7 MBT obtain a significant capability to withstand future challenges arising from conventional and advanced scenarios in the related target spectra. The extension of the barrel from 44 to 55 (by 1.3 m) calibre length, allows better utilization of the available gas energy, which is converted into a higher projectile velocity while firing. An important feature of the new weapon system is the modularity and compatibility with the Leopard 2 system. It can be integrated without substantial changes.

In addition to a newly developed muzzle reference system with a steel mirror, the weapon system has new thermal sleeves and a new stub case box. By optimizing the manufacturing processes an improvement of the material of the barrels is achieved. This provides a high potential for future ammunition developments by using a higher gas pressure.



120 mm L55

The Rheinmetall 120 mm L55 weapon systems can be offered including and excluding the programmer set for programmability and thus for use of the air burst/time fuzed DM11 HE tank ammunition. The 120 mm L55 weapon system can fire all available Rheinmetall ammunition qualified for Leopard 2. When using the powerful KE ammunition DM63 and the temperature independent propellant powder, the 120 mm L55 barrel allows an increase of combat range of 1,300 m in comparison to 120 mm L44 gun.

Development, technical testing and troop trials were successfully completed in 1998. Since 2000 the majority of the Leopard 2A5 fleets was retrofitted to Leopard 2A6 standard.

Technical Data – Weapon System 120 mm L55

Barrel length (mm)	6,600
Barrel mass (kg)	1,347
Weapon system mass (kg)	3,360 without protection module

WEAPON SYSTEMS 120 MM L47 AND 120 MM L47 LR (LOW RECOIL) FOR VEHICLES IN 30 TONNES CLASS

Based on the 120 mm L55 weapon system for Leopard 2A6/A7 high performance guns the 120 mm L47 gun is prepared for integration in Leopard 2A4/A5 and the 120 mm L47 LR (low recoil) gun is intended for integration in lighter tanks from 30 tonnes upwards.

These weapon systems meet the international defined interfaces for the 120 mm smoothbore gun and are designed to fire all available qualified Leopard 2 ammunition including DM63 KE and more powerful future KE.

The extension of the recoil path and the adaption of the muzzle brake leads the 120 mm L47 to a significant reduction of the recoil forces. Thus, the essential conditions are created to introduce available and future Rheinmetall 120 mm weapon and ammunition technology into light and medium sized platforms. This is approximately the same fire power as those of Leopard 2 MBT.



120mm L47LR

The Rheinmetall 120 mm L47 and 120 mm L47LR weapon systems can also be offered including and excluding the programmer set for programmability and thus for use of the air burst/time fuzed DM11 HE tank ammunition.

Technical Data – Weapon System 120 mm L47LR

Barrel length (mm)	5,640
Barrel mass (kg)	1,240
Weapon system mass (kg)	3,130 without protection module

WEAPON SYSTEMS 120 MM L47LLR (LIGHT LOW RECOIL) FOR VEHICLES IN 20 TONNES CLASS

In order to meet the demands for a significant increase in firepower of vehicles in the 20 tonnes class, the Rheinmetall 120 mm LLR weapon system is under development.

The 120 mm L47LLR has the ability to use the existing and qualified Rheinmetall ammunition for Leopard 2. Internationally this sets a new milestone in the field of light armoured vehicles.

Light and highly mobile vehicles gain nearly the firepower and precision of a modern main battle tank. The 120 mm L/47LLR is also equipped with the hardware kit to fire DM11 time fuzed ammunition.



120 mm L47LLR



120 mm L47LLR on trials stand

Technical Data – Weapon System 120 mm L47LLR

Barrel length (mm)	5,640
Barrel mass (kg)	950
Weapon system mass (kg)	2,950 without protection module

SUB-CALIBRE TARGET PRACTICE ROUNDS

SUB-CALIBRE TARGET PRACTICE ROUND 120 MM TP DM78 FAMILY/DM88

The 120 mm x 570 DM78/DM88 family is a newly developed practice cartridge which will supersede all previously introduced KE practice rounds. The DM78 is based on innovative acceleration and discarding technology, enabling a particularly low-cost guiding piece design avoiding a cost driving sabot.

The very low pressure level generated by the DM78/DM88 keeps erosion to a minimum, resulting in long barrel life. Moreover, because it has the same safety features as its predecessors in the DM38 family and the DM48, the new cartridge can be used on any tank range.

It is compliant to

- all climatic zones including C2 to A1,
- to existing packaging systems.

It is safe to fire up to +71° Celsius.

It can be used with the installed ballistics of the systems Leo 2A4/A5/A6/A7.



The safety range is compliant to Interface Control Document 120-000.00, Chapter 6.2.1 and ZDV 44/10, Chapter 15 (Schießsicherheit, Bordkanone 120 mm).

The newest result of Rheinmetall's permanent enhancement process is the DM88, which is an upgrade of the DM78/DM88 family, optimizing the tracer.

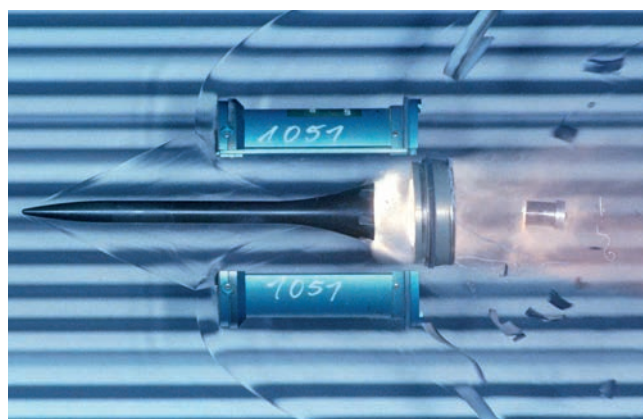
KEY CHARACTERISTICS

- Low-cost solution
- Same accuracy as previously introduced KE-TP (DM38-family and DM48)
- Safe handling; safe to fire up to +71°C
- Tracer visible to at least 2,500 m
- Advanced dual-based solvent-free, non-polluting propelling powder

TECHNICAL DATA

Muzzle velocity

L44 tank gun	approx. 1,710 m/s
L55 tank gun	approx. 1,790 m/s
Maximum gas pressure (+71°C)	450 MPa
Maximum gas pressure (+21°C)	360 MPa
Accuracy	≤0.2 mils
Maximum range	2,500 m
Climate zones	C2 – A1



FULL-CALIBRE TARGET PRACTICE ROUNDS

120 MM HE FULL-CALIBRE TARGET PRACTICE ROUNDS DM58 AND RH88/DM98

The requirements for the development of the modern new family of HE-combat rounds led Rheinmetall to complete the existing family of 120 mm HE (High Explosive) combat rounds DM11 and Rh31 ammunition with the development of new full-calibre target practice rounds. On the one hand there is a need of a new low cost full-calibre target practice (TP) ammunition. Therefore, Rheinmetall developed the 120mm Rh88/DM98 which is required by users training up to 2,500 m combat distance.

This ammunition can be fired from any tank with a 120 mm smoothbore gun in accordance with the specifications of the interface control document 120-000.00.

It is a concept with a few piece projectile with an aluminium rear part and a steel head with spike, using granular propellant and conventional tracer with a visibility of at least 2,500 m.

It is compliant to

- all climatic zones including C2 to A1,
- to existing packaging systems.

It is safe to fire up to +71° Celsius.



The hit accuracy is equal to DM11 and Rh31 up to 2,000 m and the in service training ammunition DM18-family. It can be used with the installed ballistics of the systems Leo 2A4/ A5/A6/A7. The safety range is compliant to Interface Control Document 120-000.00, Chapter 6.2.1 and ZDV 44/10, Chapter 15 (Schießsicherheit, Bordkanone 120 mm).

In order to complete the full-calibre target practice family Rheinmetall also offers the full-calibre practice round 120 mm DM58, developed under contract of German MoD, in order to be fully compliant with cartridge weight of the combat rounds 120 mm HE DM11 and 120 mm HE Rh31 of approximately 29 kg. Additionally the DM58 assures a Target Practice range of 3,000 m.

The 120 mm DM58 is also compliant to

- all climatic zones including C2 to A1,
- to existing packaging systems.

It is safe to fire up to +71° Celsius.

The hit accuracy is equal to DM11 and Rh31. The safety range is compliant to Interface Control Document 120-000.00, Chapter 6.2.1 and ZDV 44/10, Chapter 15 (Schießsicherheit, Bordkanone 120 mm).

TECHNICAL DATA

Rh88/DM98

Muzzle velocity	
L44 tank gun	approx. 1,140 m/s
L55 tank gun	approx. 1,185 m/s
Mass	approx. 21.6 kg
Total length	approx. 965 mm
Mass propellant	approx. 5.7 kg
Mass projectile	approx. 11.7 kg
Max. pressure (+71°C)	480 MPa

DM58

Muzzle velocity	
L44 tank gun	approx. 980 m/s
L55 tank gun	approx. 1,015 m/s
Mass	approx. 29.1 kg
Total length	approx. 885 mm
Mass propellant	approx. 5.5 kg
Mass projectile	approx. 18.8 kg
Max. pressure (+71°C)	570 MPa

TUNGSTEN-ALLOY-TECHNOLOGY

Rheinmetall Waffe Munition GmbH has been one of the world's top companies of the Defence industry for decades. Some of its core competencies are dominating the global market. Since 1980, the processing of tungsten alloy has been part of these core competencies.

In Unterlüß we operate a variety of modern production lines for the manufacturing of precise tungsten alloy components. Rheinmetall tungsten alloy products offer a combination of the following properties:

- very high density of up to 18.5 g/cm^3
- very high strength with excellent tensile properties (tensile strength R_m of up to $1,750 \text{ MPa}$)

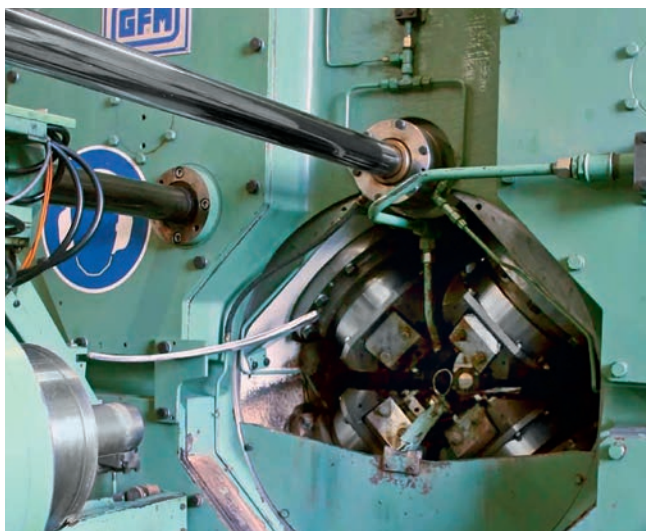
The production of heavy-metal components consists of a huge number of different manufacturing steps: First, tungsten powder is mixed with other metal powders. In a further step, the resulting alloy is isostatically pressed and, subsequently, sintered at more than $1,500^\circ\text{C}$. In order to obtain the mechanical properties required, the sintered components are cold-formed by hammering repeatedly. The final mechanical processing on the latest metal working lathes and milling machines guarantees a final geometry that complies with the highest requirements against tolerances.

Our products comply with the highest standards in terms of process safety and quality assurance. Further to the production lines mentioned previously, we also dispose of all necessary facilities to conduct quality inspections at the Unterlüß site.

Thus, during the manufacturing process, we are able

- to assess the chemical properties of the powder in a laboratory,
- to test the physical properties such as density, tensile strength and breaking elongation, as well as
- to conduct a final control of the finished component by means of an ultrasonic testing and a three-dimensional gaging machine.





AMMUNITION SERVICES

SURVEILLANCE, REUTILISATION AND RECYCLING

Rheinmetall offers additional service of surveillance and reutilization of ammunition. This service saves resources by monitoring during life time, reutilization and recycling of ammunition, ammunition components and the reuse of packaging.

Surveillance

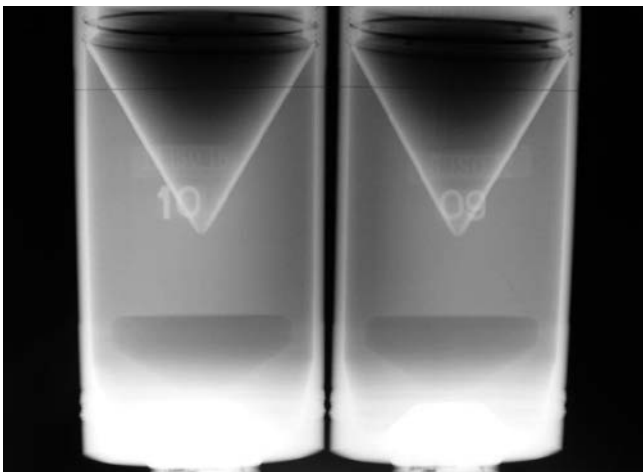
While practice ammunition is almost completely used (fired) after a short-term storage, delivered life munition (warstock) shall be usable without any functional loss even beyond the warranty period under appropriate storage conditions. This will be guaranteed by continual munition surveillance investigation.

Rheinmetall offers shelf life assessment programs including mechanical tests of components and chemical analysis of the explosives, fuze examination up to functional firing tests for interior and exterior ballistics assessment and hit performance tests.

Even under optimal storage conditions there might be functional losses in the very long-run at e.g. the propulsion components of the tank munition due to chemical decomposition processes which will then require a decision about the further use of the munition at a limited remaining shelf life.

Due to the modular design of most of RWM's tank rounds there are several options for the customer:

WARHEAD ASSESSMENT



X-ray

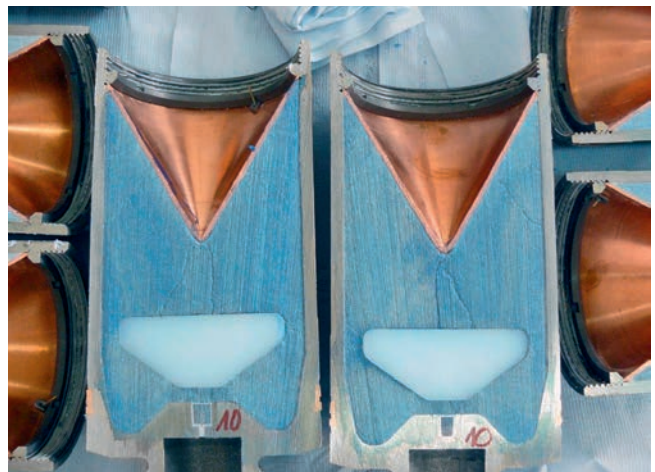
Short-term use of combat munition – as a consequence there will be a financial investment for the replacement of new combat munition.

Prolongation of shelf life – the modular design of the munition allows an exchange of overaged components like primers, propellant powder and combustible cartridge case. Since the warhead as a separate module does not need to be reworked, this option enables a new unrestricted use of the combat munition with a limited use of resources. A prolongation of the useful life comes into effect also at new legal requirements (REACH).

Exchange of modules – this is an option for the new modular 120 mm HE-family. A propulsion unit that has been stored for too long can be completely separated from the other modules (warhead and fuze).

In combination with a fuze dummy and an inert warhead a practice cartridge can be assembled at low costs for short term use. With a newly produced propulsion unit which will be assembled to the remaining modules fuze and warhead the customer receives again a combat round for unrestricted use.

Increase in performance (Upgrade) – the modular design of many munitions allows also a targeted exchange of components/modules. Via new technologies performance increases (e.g. the propulsion unit). By continuous use of the warhead RWM offers the introduction of the temperature independent propellant system TIPS for the DM53 cartridge that was delivered in the past to a DM53A1 (i.e. the DM63-Family-performance-level) as a qualified upgrade. This provides also a prolongation of product life.



Visual inspection

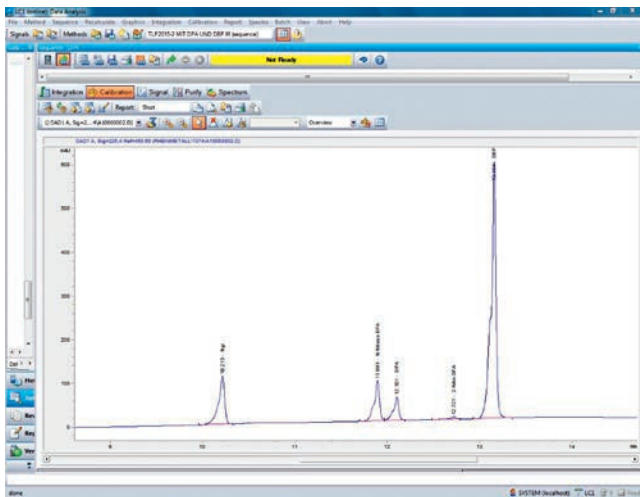
Packaging Recycling – Tank ammunition is particularly suitable for such a consideration because modern cartridges are required to be able to be used worldwide in all climate zones without any restrictions. The environmental conditions that have to be considered at storage, transport, handling and use require a qualification of complex “packaging systems” for individually packed cartridges during the development process of the ammunition. Up to now the costs for these packaging amount to about 12% (approx. 8% at practice munition) of the production costs of the entire cartridge.

Since the introduced packaging (outer packaging in wooden or steel variations depending on the customer) can be used for several procurement cycles along the logistic chain without any problems. There is an economic benefit by providing suitable ‘empty containers’ for a follow-up order for the customers.

In the best delivery state (pallets are not broken, individual packages are undamaged and complete) the significantly reduced handling effort at use with newly produced munition can lead to cost savings of more than 50% of the original packaging costs.

These options of a resource-conserving use of the munition can also be applied to other calibers; they will be offered and qualified by RWM, if there is an interest of the market.

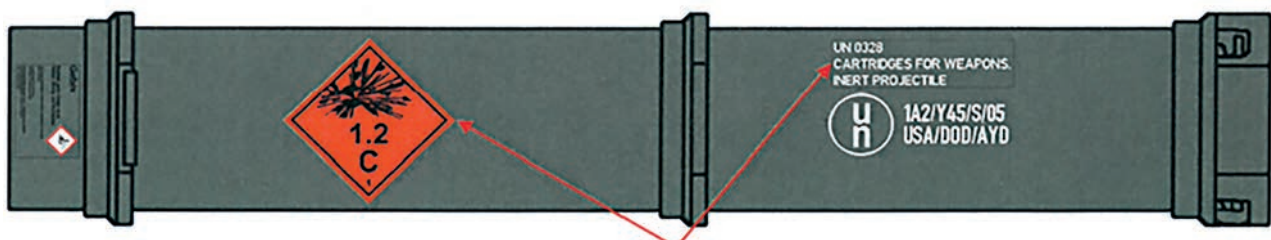
PROPELLANT ASSESSMENT



Determination of stabilizer content using HPLC



Chemical stability, weight loss test



Reuse of packaging

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