= Rheinmetall 120 mm gun =

The Rheinmetall 120 mm gun is a smoothbore tank gun designed and produced by the West German Rheinmetall @-@ DeTec AG company , developed in response to Soviet advances in armor technology and development of new armored threats . Production began in 1974 , with the first version of the gun , known as the L / 44 as it was 44 calibers long , used on the German Leopard 2 tank and soon produced under license for the American M1A1 Abrams and other tanks . The American version , the M256 , uses a coil spring recoil system instead of a hydraulic system . The 120 @-@ millimetre (4 @.@ 7 in) gun has a length of 5 @.@ 28 metres (17 @.@ 3 ft) , and the gun system weighs approximately 3 @,@ 317 kilograms (7 @,@ 313 lb) .

By 1990 , the L / 44 was not considered powerful enough to deal with the future Soviet armour , which stimulated an effort by Rheinmetall to develop a better main armament . This first revolved around a 140 @-@ millimetre (5 @.@ 5 in) tank gun named Neue Panzerkanone 140 (" new tank gun 140 ") , but later turned into a compromise which led to the development of an advanced 120 mm gun , the L / 55 , based on the same internal geometry as the L / 44 and installed in the same breech and mount . The L / 55 is 1 @.@ 3 metres (4 @.@ 3 ft) longer , giving an increased muzzle velocity to ammunition fired through it . As the L / 55 retains the same barrel geometry , it can fire the same ammunition as the L / 44 .

This gun was retrofitted into German and Dutch Leopard 2s , and chosen as the main gun of the Spanish Leopard 2E and the Greek Leopard 2HEL . It was tested on the British Challenger 2 as a potential replacement for its current weapon , the rifled L30 120 mm cannon .

A variety of ammunition has been developed for use by tanks with guns based on Rheinmetall 's original L / 44 design . This includes a series of kinetic energy penetrators , such as the American M829 series , and chemical energy anti @-@ tank warheads . Recent ammunition includes a wide range of new anti @-@ personnel rounds and demolition munitions , giving tanks armed with the L / 44 and its derivatives greater versatility on the modern battlefield . The LAHAT , developed in Israel , is a gun @-@ launched missile which has received interest from Germany and other Leopard 2 users , and is designed to defeat both land armour and combat helicopters . The Israelis also introduced a new anti @-@ personnel munition which limits collateral damage by controlling the fragmentation of the projectile .

= = Background = =

Because of concerns about the inability of the 105 @-@ millimetre (4 @.@ 1 in) L7 tank gun then in use across NATO forces to penetrate new Soviet armor , as proved in German tests on four T @-@ 62 Soviet tanks captured by Israel following the June 1967 Six Day War , Rheinmetall was paid for the development of a new tank gun , a project started in 1965 , as the Bundeswehr felt a more powerful gun was needed for its new tanks . The first instance of a larger Soviet tank gun was witnessed on the chassis of a modified T @-@ 55 in 1961 . In 1965 , the Soviet Union 's T @-@ 62 made its first public appearance , armed with a 115 @-@ millimeter (4 @.@ 5 in) smoothbore tank gun . The Soviet decision to increase the power of its tank 's main armament had come when , in the early 1960s , an Iranian tank commander defected over the Soviet border in a brand @-@ new M60 Patton tank , which was armed with the British Royal Ordnance L7 . Despite the introduction of the T @-@ 62 , in 1969 their T @-@ 64 tank was rearmed with a new 125 @-@ millimeter (4 @.@ 9 in) tank gun , while in 1972 Nizhny Tagil began production of the T @-@ 72 tank , also armed with the 125 @-@ millimeter (4 @.@ 9 in) gun . For example , at the fighting at Sultan Yakoub , during the 1982 Lebanon War , the Israeli government claimed to have destroyed nine Syrian T @-@ 72s with the Merkava main battle tank , armed with an Israeli production version of the American M68 105 @-@ millimeter (4 @.@ 1 in) tank gun (which in turn was based on the British L7) . Whether or not true , the Soviets test @-@ fired a number of Israeli M111 Hetz armor @-@ piercing discarding sabot rounds at Kubinka , finding the 105 @-@ millimeter (4 @.@ 1 in) round was able to perforate the T @-@ 72 's sloped front section plate but not its turret armor . In response , the Soviets developed the T @-@ 72M1 . This led Israel to opt for a 120 mm tank gun

during the development process of the Merkava III main battle tank . This case is similar to the American decision to replace the M68 105 @-@ millimeter (4 @.@ 1 in) tank gun with Rheinmetall 's 120 mm gun in 1976 ; the introduction of the T @-@ 64A had raised the question within the armor community whether the new ammunition for the existing gun caliber could effectively deal with the new Soviet tank .

In 1963 , Germany and the United States had already embarked on a joint tank program , known as the MBT @-@ 70 . The new tank carried a three @-@ man crew , with the driver in the turret , an automatic loader for the main gun , a 20 @-@ millimeter (0 @.@ 79 in) autocannon as secondary armament , an active hydropneumatic suspension and spaced armour on the glacis plate and the front turret . The new tank concept also had improved armament , a 152 @-@ millimeter (6 @.@ 0 in) missile @-@ launching main gun , designed to fire the MGM @-@ 51 Shillelagh anti @-@ tank missile . However , the German Army was interested in a tank gun which could fire conventional ammunition . Although there were attempts to modify the 152 @-@ millimeter (6 @.@ 0 in) tank gun to do so , the process proved extremely difficult , and the Germans began development of the future Rheinmetall 120 mm gun instead .

In 1967 , the German Ministry of Defense decided to re @-@ open a Leopard 1 improvement program , known as the Vergoldeter Leopard (" Gilded Leopard ") , later renamed the Keiler (" Wild Boar ") . Krauss @-@ Maffei was chosen as the contractor , and two prototypes were developed in 1969 and 1970 . This program grew into the Leopard 2 ; the first prototype of the new tank was delivered in 1972 , equipped with a 105 @-@ millimeter (4 @.@ 1 in) smoothbore main gun . Between 1972 and 1975 , a total of 17 prototypes were developed . The new 120 mm gun 's ten @-@ year development effort , which had begun in 1964 , ended in 1974 . Ten of the 17 turrets built were equipped with the 105 mm smoothbore gun , and the other seven were equipped with the larger 120 mm gun . Another program aimed to mount the 152 @-@ millimeter (6 @.@ 0 in) missile @-@ gun was also developed in an attempt to save components from the MBT @-@ 70 , but in 1971 the program was ended for economic reasons . Instead , the Germans opted for Rheinmetall 's 120 mm L / 44 smoothbore tank gun .

= = Design features = =

Rheinmetall 's L / 44 tank gun has a caliber of 120 mm , and a length of 44 calibers (5 @.@ 28 meters (17 @.@ 3 ft)) . The gun 's barrel weighs 1 @,@ 190 kilograms (2 @,@ 620 lb) , and on the M1 Abrams the gun mount weighs 3 @,@ 317 kilograms (7 @,@ 313 lb) , while the new barrel (L / 55) is 55 calibers long , 1 @.@ 30 meters (4 @.@ 3 ft) longer . The bore evacuator and the gun 's thermal sleeve , designed to regulate the temperature of the barrel , are made of glass @-@ reinforced plastic , while the barrel has a chrome lining to increase barrel life . Originally the gun had an EFC barrel life of ~ 1 @,@ 500 rounds , but with recent advances in propellant technology the average life has increased even further . The gun 's recoil mechanism is composed of two hydraulic retarders and a hydropneumatic assembly .

= = = Rheinmetall L / 44 120mm = = =

Production of the German Leopard 2 and the new 120 mm tank gun began in 1979 , fulfilling an order for the German Army . Although the American M1 Abrams was originally armed with the M68A1 105 mm gun (a version of the L7) , the United States Army had planned to fit the tank with a larger main gun at a later date , and the tank 's turret had been designed to accommodate a larger 120 mm gun . The larger gun was integrated into the M1A1 Abrams , with the first vehicle coming off the production line in 1985 The gun , known as the M256 , was based on the L / 44 tank gun , although manufactured at Watervliet Arsenal and modified to increase the resistance of the barrels to fracture and fatigue . Tanks armed with versions of Rheinmetall 's gun produced under licence include Japan 's Type 90 and South Korea 's K1A1 . The gun had made a huge turn in technological history .

= = = Rheinmetall L / 55 120mm = = =

The appearance of new Soviet tanks such as the T @-@ 80B during the late 1970s and early 1980s demanded the development of new technologies and weapons to counter the threat posed to Western armor . The T @-@ 80B had increased firepower and a new composite ceramic armor . The T @-@ 72 also went through a modernization program in an attempt to bring it up to the standards of the T @-@ 80B . In 1985 the new T @-@ 72B version entered production , with a new laminate armor protection system ; its turret armor , designed primarily to defeat anti @-@ tank missiles , surpassed the T @-@ 80B 's in protection .

The German government began the development of the Leopard 3 , although this was canceled after the fall of the Soviet Union . On 29 October 1991 , the governments of Switzerland , the Netherlands and Germany agreed to cooperate in the development of a modernization program for the Leopard 2 . Part of this program included the introduction of a longer 120 mm tank gun , a cheaper alternative to a brand new tank gun , increasing the maximum range of the gun by an estimated 1 @,@ 500 m (1 @,@ 600 yd) . Although the gun is longer , allowing for a higher peak pressure from the propellant , the geometry remains the same , allowing the gun to fire the same ammunition as that fired from the shorter version . The longer barrel allows ammunition to attain higher velocities ; for example , with new kinetic energy penetrators ammunition can reach velocities of around 1 @,@ 800 m / s (5 @,@ 900 ft / s) . The new barrel weighs 1 @,@ 347 kg (2 @,@ 970 lb) .

The longer tank gun has been retrofitted into the Leopard 2 , creating a model known as the Leopard 2A6 . Both the Spanish Leopard 2E and the Greek Leopard 2HEL , as derivatives of the Leopard 2A6 , use the 55 caliber @-@ long tank gun .

= = Ammunition = =

A variety of rounds have been developed for Rheinmetall 's tank gun . For example , a long line of armor @-@ piercing discarding sabot (APDS) rounds was developed by Rheinmetall . Originally , the Leopard 2 was outfitted with the DM23 kinetic energy penetrator , based on the Israeli M111 Hetz . The DM23 was eventually replaced by the DM33 , which was also adopted by Japan , Italy , Netherlands and Switzerland . The DM33 has a three @-@ part aluminum sabot and a two @-@ part tungsten penetrator , and is said to be able to penetrate 560 millimetres (22 in) of steel armor at a range of 2 @,@ 000 meters (2 @,@ 200 yd) . The DM43 is a further development of this round , co @-@ developed between Germany and France . The introduction of the longer barrel came hand in hand with the introduction of a new kinetic energy penetrator , the DM53 . With the projectile including sabot weighing in at 8 @.@ 35 kilograms with a 38 : 1 length to diameter ratio and with a muzzle velocity of 1 @,@ 750 meters per second (5 @,@ 700 ft / s) , the DM53 has an effective engagement range of up to 4 @,@ 000 meters (4 @,@ 400 yd) . A further development , called the DM63 , improved upon the round by introducing a new temperature @-@ independent propellant , which allows the propellant to have a constant pattern of expansion between ambient temperatures inside the gun barrel from ? 47 ° C (? 53 ° F) to + 71 ° C (160 ° F) . The new propellant powders , known as surface @-@ coated double @-@ base (SCDB) propellants , allow the DM63 to be used in many climates with consistent results . The new ammunition has been accepted into service with the Dutch and Swiss , as well as German , armies .

The United States developed its own kinetic energy penetrator (KEP) tank round in the form of an Armor @-@ Piercing Fin @-@ Stabilized Discarding @-@ Sabot (APFSDS) round , using a depleted uranium (DU) alloy long @-@ rod penetrator (LRP) , designated as the M829 , followed by improved versions . An immediate improvement , known as the M829A1 , was called the " Silver Bullet " after its good combat performance during the Gulf War against Iraqi T @-@ 55s , T @-@ 62s and T @-@ 72 tanks . The M829 series centers around the depleted uranium penetrator , designed to penetrate enemy armor through kinetic energy and to shatter inside the turret , doing much damage within the tank . In 1998 , the United States military introduced the M829A2 , which has an improved depleted uranium penetrator and composite sabot petals . In 2002 , production

began of the ($ 10 @,@ 000 per round) M829A3 using a more efficient propellant (RPD @-@ 380 stick) , a lighter injection @-@ molded sabot , and a longer (800mm) and heavier (10 kg / 22 lb) DU penetrator , which is said to be able to defeat the latest versions of Russian Kontakt @-@ 5 explosive reactive armor (ERA) . This variant is unofficially referred to by Abrams tank crews as the " super sabot " . In response to the M829A3 , the Russian army designed Relikt , the most modern Russian ERA , which is claimed to be twice as effective as Kontakt @-@ 5 . A further improved M829E4 round with a segmented penetrator to defeat Relikt has been under development since 2011 and was to be fielded as the M829A4 in 2015 .

Both Germany and the United States have developed several other rounds . These include the German DM12 multi @-@ purpose anti @-@ tank projectile (MPAT) , based on the technology in a high explosive anti @-@ tank (HEAT) warhead . However , it has been found that the DM12 's armor @-@ killing abilities are limited by the lack of blast and fragmentation effects , and that the round is less valuable against lightly armored targets . The United States also has a MPAT type projectile , known as the M830 . This was later developed into the M830A1 , which allows the M1 Abrams to use the round against helicopters . The M1 Abrams can use the M1028 canister round , which is an anti @-@ personnel / anti @-@ helicopter munition , packed with over 1 @,@ 000 tungsten balls . The United States Armed Forces accepted a new demolition round , called the M908 Obstacle Defeating Round , based on the M830A1 MPAT , but with the proximity fuse replaced by a hardened nose cap . The cap allows the round to impact and embed itself in concrete , then exploding inside the target and causing more damage .

The Israeli Army introduced a new round known as the Laser Homing Anti @-@ Tank (LAHAT) projectile . Using a semi @-@ active laser homing guidance method , the LAHAT can be guided by the tank 's crew or by teams on the ground , while the missile 's trajectory can be selected to either attack from the top (to defeat enemy armor) or direct attack (to engage enemy helicopters) . Furthermore , the missile can be fired by both 105 @-@ millimeter (4 @.@ 1 in) and 120 mm tank guns . The LAHAT has been offered as an option for the Leopard 2 , and has been marketed by both Israel Military Industries and Rheinmetall to Leopard 2 users . Israeli Merkavas make use of a round known as the APAM , which is an anti @-@ personnel munition designed to release fragmentation at controlled intervals to limit the extent of damage . Fragments are shaped to have enough kinetic energy to penetrate body armor .

Poland has introduced a series of projectiles for Rheinmetall 's tank gun , including an armor @-@ piercing penetrator target practice round (APFSDS @-@ T @-@ TP) , a high @-@ explosive round , and a high @-@ explosive target practice (HE @-@ TP) projectile . The ammunition is manufactured by Zak?ady Produkcji Specjalnej Sp. z o.o.

= = Operators = =

Due to tank sales , Rheinmetall 's L / 44 tank gun has been manufactured for other nations . For example , the Leopard 2 armed with the 44 caliber long gun , has been sold to the Netherlands , Switzerland , Sweden , Spain , Austria , Denmark , Finland , and other countries . Egypt had manufactured 700 ? 800 M1A1 Abrams by 2005 , and in 2008 requested permission to build another 125 tanks ; their M256 main guns (the US version of the L / 44) were manufactured by Watervliet Arsenal . The M1A1 has also been exported to Australia , while the M1A2 Abrams has been exported to Saudi Arabia and Kuwait . The American license @-@ built M256 has also been offered by General Dynamics Land Systems as part of the M60 @-@ 2000 Main Battle Tank which would upgrade older M60 Patton tanks to have capabilities of their M1A1 Abrams at a reduced cost , though the company has not yet found a buyer .

The Leopard 2A6 and its longer L / 55 main gun have been exported for use by the Canadian Army , and the Netherlands upgraded part of its original fleet of Leopard 2s with the more powerful armament . The British Army has tested Rheinmetall 's longer gun , possibly looking to replace the current L30A1 120 mm L / 55 rifled main gun on the Challenger 2 . Two Challenger 2s were modified to undergo firing trials . World Industries Ace Corporation (WIA) , a Korea @-@ based powertrain company affiliated with Hyundai Kia Motors Group , is also producing the L / 55 under

license for the new K2 Black Panther , a fourth generation South Korean main battle tank .