What is an armor piercing round

Ammunition type designed to penetrate armour Iron projectiles were initially successful against wrought iron armor but struggled against compound and steel armor, which emerged in the late 19th century. As a result, new forged steel rounds with hardened points replaced the Palliser shot. Initially made from ordinary carbon steel, these rounds evolved alongside improving armor quality. The introduction of cemented steel armor prompted the development of projectiles containing nickel and chromium. A soft metal cap, known as "Makarov tips," was also introduced to increase penetration and prevent damage to the point or shell body. Prior to World War I, shot and shells were cast from special chromium steel before being forged and annealed. The tempering treatment, which gave the projectiles their hardness and toughness profile, remained a closely guarded secret. These projectiles could receive a small bursting charge, making them shells rather than shots. During World War II, projectiles used highly alloyed steels containing nickel-chromium-molybdenum, but in Germany, this was later changed to silicon-manganese-chromium-based alloys due to scarcity. The latter alloy proved more brittle and prone to shattering on highly sloped armor, which could result in premature detonation of the high-explosive filling. Advanced methods of differentially hardening projectiles were developed during this period, leading to more reliable performance. The APHE system demonstrated reliable performance, with minimal damage to its interior comparable to that experienced during solid shot tests. The use of APHE since the 1870s showed an understanding of trade-offs between reliability, damage, and penetration. For tank use, this meant prioritizing both. In contrast, naval projectiles had larger bursting charges but significantly less high-explosive content due to size constraints. Instead, anti-tank versions focused on maximizing penetration and fragment production after armor breach, utilizing a rear-mounted delay fuze for detonation. The armour-piercing cap is a type of penetrating cap used to lower the initial shock of impact on a rigid projectile, preventing it from shattering. These caps have a blunt profile and often feature a thin aerodynamic cap to improve long-range ballistics. Some armour-piercing shells contain an explosive charge, known as a "bursting charge", which is designed to increase the shell's penetrating ability. However, smaller-calibre shells may use alternative fillings, such as inert materials or incendiary charges. Armour-piercing high-explosive (APHE) shells, on the other hand, contain an explosive filling and were initially referred to as "shells" to distinguish them from non-explosive "shots". The use of APHE shells became more widespread during World War II, particularly in anti-tank applications. Modern anti-tank warfare primarily employs discarding-sabot kinetic energy penetrators, such as APDS. Full-calibre armour-piercing shells are no longer the primary method of conducting anti-tank warfare, except in artillery applications above 50 mm calibre. Instead, semi-armour-piercing high-explosive (SAPHE) shells have become more prevalent due to their increased effectiveness against soft targets. High-explosive anti-tank (HEAT) shells are a type of shaped charge used to defeat armoured vehicles. These shells are highly effective at defeating plain steel armour but less so against composite and reactive armour. Their effectiveness is independent of velocity, making them suitable for use over long ranges. HEAT shells, also known as hollow charge or shaped charge warheads, were developed during World War II. These explosive projectiles use the Munroe effect to create a superplastic metal stream that penetrates solid vehicle armor. Introduced in the latter part of the war, HEAT rounds revolutionized anti-tank warfare by allowing one infantryman to destroy any extant tank with a handheld weapon. This innovation dramatically altered mobile operations. Prior to World War II, Swiss inventor Henry Mohaupt promoted shaped-charge warheads internationally and demonstrated his invention to British and French ordnance authorities before the war. The French communicated the technology to the U.S. Ordnance Department, who invited Mohaupt to work on the bazooka project. By mid-1940, Germany had introduced its first HEAT round, the 7.5 cm fired by the Kw.K.37 L/24 tank and self-propelled gun. The Panzerfaust and Panzerschreck gave German infantrymen the ability to destroy tanks from 50 to 150 meters away with relative ease of use and training. In contrast, British PIAT was cumbersome and required troops to approach armor suicidally close. The first British HEAT weapon, a rifle grenade using a 2+1/2-inch cup launcher, was issued in 1940. By 1943, the PIAT was developed, combining a HEAT warhead with a spigot mortar delivery system. The development of armour-piercing artillery shells during World War II led to improvements in their design, particularly with regards to increasing penetration depth at longer ranges. Initially, smaller-diameter early projectiles exhibited poor ballistic shape and higher drag due to this, resulting in reduced effectiveness. However, advancements such as the application of pressure to press bar steel under 500 tons of force improved the aerodynamic profile of some projectiles. Later, large-calibre guns were able to penetrate significantly thicker armour at both close range (100 m) and longer ranges (1,500–2,000 m). To mitigate drag and improve impact velocities, ballistic caps were added to AP rounds. These hollow caps would break away upon impact, enhancing the projectile's aerodynamics. The development of armour-piercing composite rigid projectiles incorporated a high-density core made from materials such as tungsten carbide, encased within a lighter material shell. The development of armour-piercing composite non-rigid (APCNR) projectiles was influenced by the design of early Soviet rounds, which were similar to stubby arrows but lighter due to their smaller size. The APCNR projectile featured a high-density core within a shell of soft iron or another alloy, with soft metal flanges or studs added to increase the projectile diameter. This design allowed for better flight characteristics and retained velocity at longer ranges. The Germans deployed the initial APCNR design as a light anti-tank weapon, 2.8 cm schwere Panzerbüchse 41, early in World War II, followed by other variants like the 4.2 cm Pak 41 and 7.5 cm Pak 41. However, these early designs were eventually superseded by the APDS design, which dispensed with the outer light alloy shell once the round had left the barrel. The APCNR concept was later adopted in small-arms armour-piercing incendiary and HEIAP rounds, and its principles were applied to other projectiles. The development of the APCNR projectile was a significant advancement in armour-piercing technology, offering improved penetration capabilities and increased velocity at longer ranges compared to earlier designs. armour-piercing discarding sabot development saw significant advancements between 1940 and 1944 The French Edgar Brandt company created an early version, fielded in two calibres just before the French-German armistice. Afterwards, engineers joined forces with the UK's Armaments Research Department to improve upon this concept. L Permutter and S W Coppock led this collaboration. In mid-1944, APDS projectiles were introduced into service for the UK's QF 6-pdr anti-tank gun, later in September 1944 for the QF-17 pdr. The aim was to achieve increased impact velocity and armour penetration using a stronger material with reduced size. To make a gun capable of hitting tanks twice as effectively, engineers developed a special type of projectile called the armour-piercing fin-stabilized discarding sabot (APFSDS). This projectile uses fixed fins to stabilize its flight, allowing it to be much longer and thinner than traditional spin-stabilized ammunition. The long, thin shape of APFSDS projectiles gives them higher kinetic energy and penetration potential, making them more effective at hitting targets. They can also achieve higher velocities due to their streamlined shape, which reduces air resistance. In some cases, APFSDS projectiles are fired from smoothbore barrels, as the fin-stabilization negates the need for spin-stabilization through rifling. However, new technologies have allowed these projectiles to be used in rifled guns, expanding their capabilities and applications. APFSDS rounds generally consist of dense metal alloys, such as tungsten heavy alloys (WHA) or depleted uranium (DU), maraging steel being used in some earlier Soviet projectiles; DU alloys are cheaper and provide better penetration due to their higher density and self-sharpening capabilities. However, DU also poses pyrophoric risks, potentially becoming incendiary when exposed to oxygen during penetration. The use of WHAs is preferred over DU in most countries except the US and Russia, as they are less toxic. Bunker buster Armour-piercing bombs were utilised by aircraft during World War II to attack capital and other armoured ships. For instance, the Imperial Japanese Navy's 800 kg armour-piercing bombs, modified from naval shells, successfully sank the battleship USS Arizona. Armour-piercing rifle cartridges typically feature a penetrator made of hardened steel, tungsten, or tungsten carbide, often referred to as "hard-core bullets." These cartridges usually have their penetrators encased in copper or cupronickel jackets similar to those surrounding lead in conventional projectiles. Upon impact with a hard target, the copper case disintegrates, allowing the penetrator to continue its motion and penetrate deeper. Pistol armour-piercing ammunition also exists, utilising a design similar to that of rifle cartridges. Certain small calibre rounds, such as the FN 5.7mm, are inherently capable of piercing armour due to their high velocity and small size. Most modern active protection systems (APS) face challenges in defeating full-calibre AP rounds fired from large-calibre anti-tank guns due to the latter's mass, rigidity, short overall length, and thick body. APS typically employs fragmentation warheads or projected plates designed to counter HEAT and kinetic energy penetrator projectiles, which are the most common types of anti-armour ammunition in use today. APS systems often focus on disrupting HEAT projectiles by damaging their explosive filling, a shaped charge liner, or fuzing system. Alternatively, they can attempt to induce changes in yaw or pitch or fracture the rod of kinetic energy projectiles. The development of incendiary charges has played a significant role in shaping modern artillery and ammunition. One notable example is the SAPHEI designation, which indicates that an ammunition type contains a high explosive incendiary charge. In the context of British Littlejohn adaptor, ammunition was classified as armour-piercing, super-velocity (APSV). Historically, various sources have provided insights into the evolution and development of armor-piercing projectiles. Encyclopedia Britannica states that "armour-piercing projectile" refers to a specific type of ammunition designed to penetrate armor. Stanisław Torecki's 1982 work on "1000 słów o broni i balistyce" (1000 words on arms and ballistics) further elucidates the topic. The Bazooka, for instance, utilized high explosive incendiary charges to achieve significant penetration capabilities. In an article published in Popular Science in February 1945, it is mentioned that the Bazooka's grandfather was essentially a precursor to modern rocket-propelled bombs like the PC 1000 Rs. Ian Hogg's book "Grenades and Mortars" provides further context on the development of incendiary charges. Donald R. Kennedy's work "History of the Shaped Charge Effect, The First 100 Years – USA – 1983" also sheds light on the evolution of this technology. In the context of World War II, various sources have documented the use and effectiveness of armor-piercing ammunition. For example, John Brooks' book "The Battle of Jutland" discusses the historical significance of armored vessels during naval battles. Moreover, Popular Science magazine published an article in December 1944 that illustrated the working principle of APCBC type shells. Shirokorad's work "The God of War of the Third Reich" also explores the role of incendiary charges in military technology. In conclusion, understanding armor-piercing ammunition requires examining historical developments and technological advancements in this field. The Evolution and Functionality of Body Armor Body armor is designed to protect individuals from various projectiles, including bullets and shrapnel. Its development dates back to ancient times when warriors used metal or animal hides to shield themselves during battles. Today, body armor has evolved with advanced technologies providing superior protection and comfort. The two primary components of body armor are a carrier and ballistic panels. The carrier is made from durable and moisture-resistant material, while the ballistic panels are constructed from layers of ballistic fiber or metal plates. These panels absorb the force of an incoming round, dispersing the energy and preventing penetration. Body armor offers varying levels of protection based on its design, materials, and intended application. It ranges from Level IIA to Level IV, designed to withstand different types of ammunition, including handgun rounds, rifle rounds, and even armor-piercing rifle rounds. The type of ammunition used is a critical factor in body armor penetration. Body armor is rated by its ability to resist specific types of bullets, such as handguns or rifles. The level of body armor corresponds to the type of ammunition it can effectively resist. Ammunition's Role in Body Armor Interaction plays an instrumental role in determining body armor effectiveness. The bullet's design, including shape and material, impacts how it interacts with armor. Bullet velocity also affects the interaction between the two. High-velocity rounds carry more kinetic energy, which must be absorbed by body armor to prevent penetration. Body armor responds differently to various ammunition types. Lower-level armor slows down bullets, while higher-level armor incorporates ceramic or metal plates to shatter or deflect incoming rounds. While body armor significantly reduces the risk of fatal injury from gunfire, it doesn't make the wearer invincible. Body Armor vs Ammunition: Understanding the Threats Standard handgun rounds like FMJ are not effective against high-level body armor due to their lower velocity and energy. Rifle rounds have more penetrative power but also vary in performance depending on design and materials used. However, recent advancements in body armor technology have led to the development of high-grade armors capable of stopping rifle rounds and even armor-piercing ammunition. Armor-piercing rounds pose a significant threat to most body armors due to their hardened core, which retains its shape and energy upon impact. Understanding the relationship between ammunition and body armor is crucial for selecting the right armor. Not all ammunition is created equal, and knowledge of the specific types and threats involved is necessary to ensure adequate protection. To ensure your own well-being, remain aware of any relevant information and take necessary precautions. (Rewritten using IB method)

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