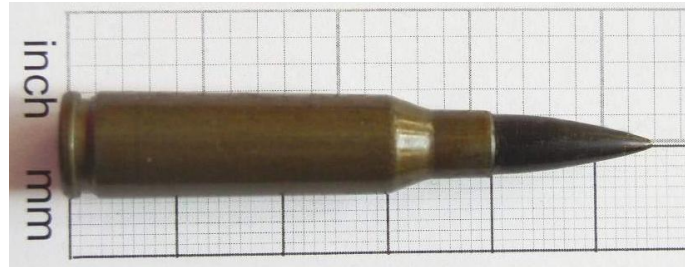


5.45×39mm

5.45×39mm M74



5.45×39mm cartridge

Type	Rifle	
Place of origin	■ Soviet Union	
Service history		
In service	1974–present	
Used by	Soviet Union/Russian Federation, former Soviet republics, former Warsaw Pact	
Wars	Afghan War, Georgian Civil War, First Chechen War, Second Chechen War, Yugoslav Wars	
Production history		
Designed	early 1970s	
Specifications		
Case type	Steel, rimless, bottleneck	
Bullet diameter	5.60 mm (0.220 in)	
Neck diameter	6.29 mm (0.248 in)	
Shoulder diameter	9.25 mm (0.364 in)	
Base diameter	10.00 mm (0.394 in)	
Rim diameter	10.00 mm (0.394 in)	
Rim thickness	1.50 mm (0.059 in)	
Case length	39.82 mm (1.568 in)	
Overall length	57.00 mm (2.244 in)	
Rifling twist	255 mm (1 in 10 inch) or 195 mm (1 in 7.68 inch)	
Primer type	Berdan or Small rifle	
Maximum pressure	380.00 MPa (55,114 psi)	
Ballistic performance		
Bullet weight/type	Velocity	Energy
3.2 g (49 gr) 5N7 FMJ mild steel core	915 m/s (3,000 ft/s)	1,340 J (990 ft·lbf)
3.43 g (53 gr) 7N6 FMJ hardened steel core	880 m/s (2,900 ft/s)	1,328 J (979 ft·lbf)
3.62 g (56 gr) 7N10 FMJ enhanced penetration	880 m/s (2,900 ft/s)	1,402 J (1,034 ft·lbf)
3.68 g (57 gr) 7N22 AP hardened steel core	890 m/s (2,900 ft/s)	1,457 J (1,075 ft·lbf)

5.2 g (80 gr) 7U1 subsonic for silenced AKS-74UB	303 m/s (990 ft/s)	239 J (176 ft·lbf)
Test barrel length: 415 mm (16.3 in) and 200 mm (7.9 in) for 7U1 Source(s): ^[1]		

The **5.45×39mm** cartridge is a rimless bottlenecked rifle cartridge. It was introduced into service in 1974 by the Soviet Union for use with the new AK-74 assault rifle. It gradually supplemented then largely replaced the 7.62×39mm round in service.

History



Service rifle cartridges cases: (Left to right)
7.62x54mm R, 7.62x51mm NATO, 7.62x39mm,
5.56x45mm NATO, 5.45x39mm.

The 5.45×39mm cartridge was developed in the early 1970s by a group of Soviet designers and engineers under the direction of M. Sabelnikova. Further group members were: L. I. Bulavsky, B. B. Semin, M. E. Fedorov, P. F. Sazonov, V. Volkov, V. A. Nikolaev, E. E. Zimin and P. S. Korolev.

The 5.45×39mm is an example of an international tendency towards relatively small sized, light weight, high velocity military service cartridges. Cartridges like the 5.45×39mm, 5.56×45mm NATO and Chinese 5.8×42mm allow a soldier to carry more ammunition for the same weight compared to their larger and heavier predecessor cartridges and produce relatively low bolt thrust and free recoil impulse, favouring light weight arms design and automatic fire accuracy.^[2]

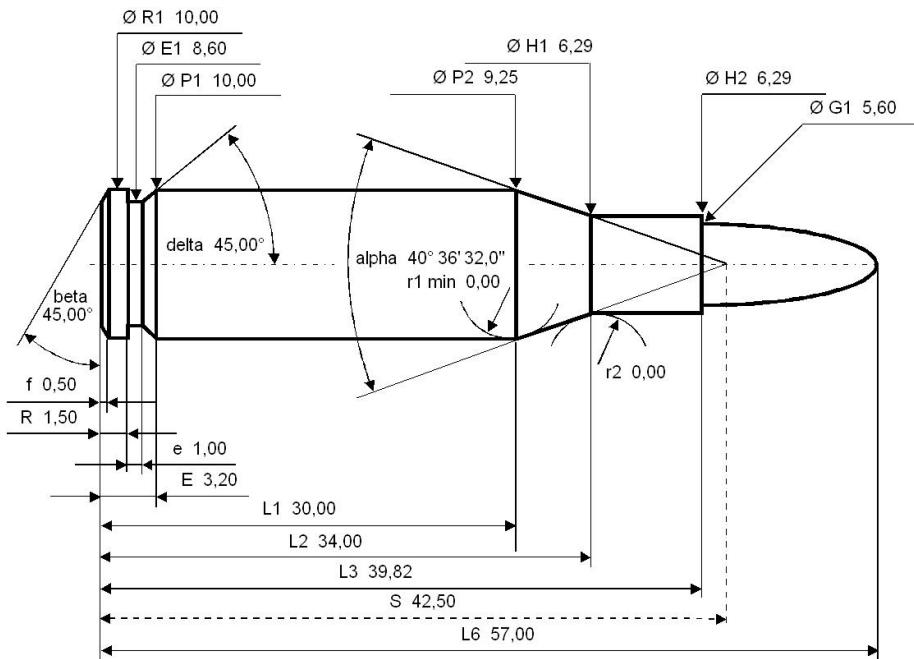
The Soviet original military issue **5N7** cartridge variant introduced in 1974 are loaded with full metal jacket bullets that have a somewhat complex construction. The 3.2 g (49.4 gr) boattail projectile has a gilding-metal-clad jacket. The unhardened steel core is covered by a thin lead coating which does not fill the entire point end, leaving a hollow cavity inside the nose. The bullet is cut to length during the manufacturing process to give the correct weight. The 5N7 uses a boattail design to reduce drag and there is a small lead plug crimped in place in the base of the bullet. The lead plug, in combination with the air space at the point of the bullet, has the effect of moving the bullet's center of gravity to the rear; the hollow air space also makes the bullet's point prone to deformation when the bullet strikes anything solid, inducing yaw. The brown-lacquered steel case is Berdan primed. Its 39.37 mm (1.55 in) length makes it slightly longer than the 7.62×39mm case which measures exactly 38.60 mm (1.52 in). The primer has a copper cup and is sealed with a heavy red lacquer. The propellant charge is a ball powder with similar burning characteristics to the WC 844 powder used in 5.56×45mm NATO ammunition. The 5N7 cartridge weight is 10.75 g (165.9 gr).

Tests indicate the free recoil energy delivered by the 5.45×39 mm AK-74 assault rifle is 3.39 J (2.50 ft·lb), compared to 6.44 J (4.75 ft·lb) delivered by the 5.56×45mm NATO in the M16 assault rifle and 7.19 J (5.30 ft·lb) delivered by the 7.62×39mm in the AKM assault rifle.^[3]

Military 5.45×39mm ammunition was produced in the former Soviet Union, GDR and Yugoslavia, and is produced in Bulgaria, Poland and Romania. In the former Soviet Union this ammunition is produced in Russia, Kyrgyzstan, Uzbekistan and Ukraine.

Cartridge dimensions

The 5.45×39mm has 1.75 ml (27 grains H₂O) cartridge case capacity.



5.45×39mm maximum C.I.P. cartridge dimensions.^[4]

Americans would define the shoulder angle at $\frac{\alpha}{2} \approx 20.3^\circ$. The common rifling twist rate for this cartridge is 255 mm (1 in 10 inches), 4 grooves, Ø lands = 5.40 mm, Ø grooves = 5.60 mm, land width = 2.60 mm and the primer type is either berdan or small rifle.

According to the official C.I.P. (Commission Internationale Permanente Pour L'Epreuve Des Armes A Feu Portatives) guidelines the 5.45×39mm case can handle up to 380 MPa (55,000 psi) piezo pressure. In C.I.P. regulated countries every rifle cartridge combo has to be proofed at 125% of this maximum C.I.P. pressure to certify for sale to consumers.

Wounding effects

Early ballistics tests done demonstrated a pronounced tumbling effect with high speed cameras.^[5] Some Western authorities believed this bullet was designed to tumble in flesh to increase wounding potential. At the time, it was believed that yawing and cavitation of projectiles was primarily responsible for tissue damage. Martin Fackler conducted a study with an AK-74 assault rifle using live pigs and ballistic gelatin demonstrating that the 5.45×39mm 5N7 round does not reliably fragment or cause unusual amounts of tissue disruption.^[6] Most organs and tissue were too flexible to be severely damaged by the temporary cavity effect caused by yaw and cavitation of a projectile. With the 5.45 mm bullet, tumbling produced a temporary cavity twice, at depths of 100 and 350 mm. This is comparable to modern 7.62×39mm ammunition and to (non-fragmenting) 5.56 mm ammunition.

5.45×39mm cartridge variants

Enhanced penetration cartridges

As body armor saw increasing use in militaries, the original 5N7 standard service cartridge bullet construction was changed several times to improve penetration. This resulted in the 7N6, 7N10, 7N22 and 7N24 cartridge 5.45×39mm variants.

The **7N6** bullet has a 1.43 g (22.1 gr) steel rod penetrator. Since 1987 this penetrator is hardened to 60 HRC. The latter 7N6 cartridge can penetrate a 6 mm thick St3 steel plate at 300 m and 6Zh85T body armour at 80 m. 7N6 bullets have a red identification ring above the cartridge neck. The US Army's Ballistic Research Laboratory measured a ballistic coefficient ($G7 BC$) of 0.168 and form factor ($G7 i$) of 0.929 for the 7N6 projectile, which indicates good aerodynamic efficiency and external ballistic performance for the bullet diameter.^{[7][8]}

The **7N10** "improved penetration" cartridge was introduced in 1992. The size of the steel penetrator was increased to 1.76 g (27.2 gr) and the lead plug in front of it was discarded. In 1994 the 7N10 design was improved by filling the air space with lead. Upon impacting a hard target, soft lead is pressed sideways by the steel penetrator, tearing the jacket. The 7N10 cartridge replaced the previous variants as standard Russian service round and can penetrate a 16 mm thick St3 steel plate at 300 m and 6Zh85T body armour at 200 m. 7N10 bullets have a violet/purple identification ring above the cartridge neck.

The **7N22** armour-piercing bullet, introduced in 1998, has a 1.75 g (27.0 gr) sharp-pointed steel penetrator and retains the soft lead plug in the nose for jacket discarding. 7N22 bullets can be identified by their red identification ring above the cartridge neck and a black tip.^[9]

The recent **7N24** "super-armor-piercing" cartridge has a penetrator made of tungsten carbide. The 7N24 round is loaded with a 4.15 g (64.0 gr) projectile containing a 2.1 g (32.4 gr) penetrator which is fired with a muzzle velocity of 840 m/s (2,756 ft/s) yielding 1,464 J (1,080 ft·lbf) muzzle energy.

Tracer cartridges

Besides that the tracer cartridges **7T3** and **7T3M** were developed. These bullets can be identified by their green marked tips. The 3.23 g (50 gr) tracer projectile has a shorter ogival profile and for 7T3 ammunition burns out to 800 m (870 yd) and for 7T3M ammunition ignites at 50 m (55 yd) burning out to 850 m (930 yd).

Training and instruction cartridges

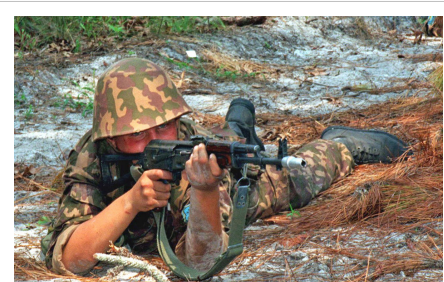
For training purposes the blank cartridges **7H3**, **7H3M** and **7Kh3** were developed. These round have a hollow white plastic imitation projectile. When these training rounds are used, the barrel of the gun is fitted at the muzzle with a Blank Fire Adapter to produce a gas pressure build-up for cycling the gun, as well as a breakup aid for their plastic projectiles.^[10]

For instruction purposes the **7H4** training or dummy cartridge (which has longitudinal grooves) was developed.

Special purpose cartridges

For special purposes the **7U1** subsonic cartridge with a black and green painted meplat and **CAP** cartridge for underwater were developed.

The 7U1 subsonic cartridge weight is 11 g (170 gr) and is loaded with a 5.2 g (80 gr) projectile which is fired with a muzzle velocity of 303 m/s (994 ft/s) yielding 239 J (176 ft·lbf) muzzle energy. Accuracy of fire at 100 m (109 yd)



Kazakhstan Army soldier training with an AKS-74 assault rifle equipped with a Blank Fire Adaptor.

(R_{50}) is 35 mm (1.4 in)

Basic specifications

Cartridge designation	7N6	7N10	7N22	7T3 (tracer)	7Kh3 (training)
Cartridge weight	10.5 g (162 gr)	10.7 g (165 gr)	10.75 g (166 gr)	10.3 g (159 gr)	6.65 g (103 gr)
Bullet weight	3.43 g (52.9 gr)	3.62 g (55.9 gr)	3.68 g (56.8 gr)	3.23 g (49.8 gr)	0.24 g (3.7 gr)
Muzzle velocity	880 m/s (2,887 ft/s)	880 m/s (2,887 ft/s)	890 m/s (2,920 ft/s)	883 m/s (2,897 ft/s)	
Muzzle energy	1,328 J (979 ft-lbf)	1,402 J (1,034 ft-lbf)	1,457 J (1,075 ft-lbf)	1,259 J (929 ft-lbf)	
Accuracy of fire at 300 m (328 yd) (R_{50})	75 mm (3.0 in)	90 mm (3.5 in)	90 mm (3.5 in)	140 mm (5.5 in)	

- R_{50} at 300 m (328 yd) means the closest 50 percent of the shot group will all be within a circle of the mentioned diameter at 300 m (328 yd).
- The twist rate used in the AK-74M assault rifle that has been adopted as the new service rifle of the Russian Federation in 1991 is 200 mm (7.87 in).

Civil use

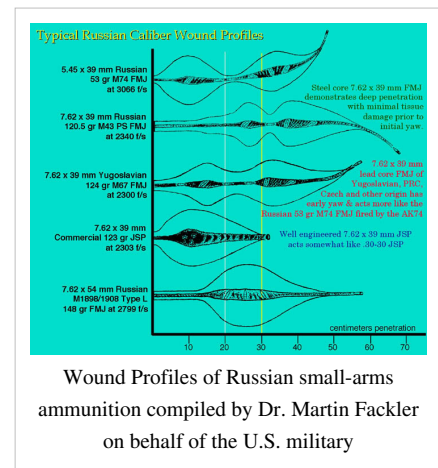
The 5.45×39mm was developed by the Soviet Union for military use and it was not intended to create civilian weapons in this chambering. Only few civilian 5.45×39mm weapons were developed and commercially offered. Non AK-74 platform rifles and commercial offerings include the East German Ssg 82 bolt action rifle and the Russian CRS-98 "Vepr-5, 45" semi-automatic carbine and Saiga semi-automatic rifle. In May 2008 the Smith & Wesson M&P15R was introduced. This was a standard AR-15 platform rifle chambered for the 5.45×39mm cartridge and was Smith and Wesson's first AR-variant rifle in a chambering other than 5.56×45mm NATO^[11] and is no longer in current (2012) production.^[12] The civilian version of the Israel Weapon Industries Tavor rifle for the US market includes an optional 5.45×39mm conversion kit.^[13]

Commercial 5.45×39mm ammunition

The US ammunition manufacturer Hornady produces commercial polymer-coated steel case 5.45×39mm ammunition loaded with 3.89 g (60.0 gr) polymer tipped V-MAX bullets with a stated ballistic coefficient (G1 BC) of 0.285.^{[14][15]} WOLF Performance Ammunition offers several Berdan primed commercial 5.45×39mm loads.^[16] The Russian ammunition manufacturer Barnaul Cartridge Plant also offers several Berdan primed commercial sporting and hunting 5.45×39mm cartridges. Barnaul states that their 5.45×39mm cartridges produce a maximal pressure of 294,2 MPa (41,054 psi) and have a bullet dispersion R_{100} of 25 mm (1.0 in) at a range of 100 m (109 yd), meaning every shot of a shot group will be within a circle of the mentioned diameter at 100 m (109 yd).^[17]

Cartridge designation	Hornady V-MAX	WOLF Performance FMJ HP	WOLF Military Classic FMJ	WOLF Military Classic HP SP	Barnaul FMJBT	Barnaul SPBT	Barnaul HPBT
Bullet weight	3.89 g (60.0 gr)	3.89 g (60.0 gr)	3.89 g (60.0 gr)	3.565 g (55.0 gr)	3.85 g (59.4 gr)	3.56 g (54.9 gr)	3.56 g (54.9 gr)
Muzzle velocity	856.5 m/s (2,810 ft/s)	895 m/s (2,936 ft/s)	860 m/s (2,822 ft/s)	881 m/s (2,890 ft/s)	860 m/s (2,822 ft/s)	878 m/s (2,881 ft/s)	883 m/s (2,897 ft/s)
Muzzle energy	1,427 J (1,053 ft-lbf)	1,558 J (1,149 ft-lbf)	1,439 J (1,061 ft-lbf)	1,384 J (1,021 ft-lbf)	1,424 J (1,050 ft-lbf)	1,372 J (1,012 ft-lbf)	1,388 J (1,024 ft-lbf)

Gallery



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External links

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- Terminal Ballistics Study - Bosnia - Military Medicine/December 2001 (http://www.findarticles.com/p/articles/mi_qa3912/is_200112/ai_n9010648)
- Photos of various different types of 5.45×39mm ammunition ([http://www.conjay.com/Ammunition for Armor Testing East 5.45mm x 40.htm](http://www.conjay.com/Ammunition%20for%20Armor%20Testing%20East%205.45mm%20x%2040.htm))
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