

BATTLESIGHT ZERO (BZO):
Who has it right?

By
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“A BZO (Battlesight zero) is the sight settings placed on your rifle for combat. In combat, your rifle’s BZO setting will enable engagement of point targets from 0–300 yards/meters in a no wind condition.” - Marine Corps Reference Publication 3-01A Rifle Marksmanship

“Battlesight zero: A sight setting that soldiers keep on their weapons. It provides the highest probability of hitting most high-priority combat targets with minimum adjustment to the aiming point, a 250 meter sight setting as on the M16A1 rifle, and a 300 meter sight setting as on the M16A2 rifle.” - Department of Army Field Manual 3-22.9

Per both the Marine Corps and Army field manuals, a proper Battle-sight zero will allow a Soldier or Marine to engage an enemy threat without adjusting the elevation of their iron sights from point-blank range or zero yards/meters out to 300 yards/meters. See Figure 1 at the end of this article (excerpt from U.S. Army TM 9-1005-319-10/USMC TM 05538C-10/1A). Note that the Marine Corps teaches and uses yards and the Army teaches and uses meters. For edification, 300 yards is roughly 274 meters and 300 meters is roughly 328 yards. A 300 yard/meter BZO makes sense for most combat situations. However, the Army and Marine Corps differ in how to set a BZO on a rifle or carbine. To add even more confusion, numerous well-known shooting schools and private trainers teach a different method for placing a proper BZO setting. Additionally, a certain special operations unit advocates and teaches a 100 yard zero. Who is right? Which method is best? Why?

To answer these questions and others we need to address some of the myths and misconceptions floating around regarding the proper Battlesight zero to place on a Soldier’s or a Marine’s M16A2/A3/A4 Rifle or M4A1 Carbine iron sights. We are only going to address iron sights in this article and save a look at combat optics for a future issue.

The Stoner family of rifles and carbines have been with the U.S. military and some of our allies for over 40 years. While not without its problems, it has proven itself worthy on numerous battlefields around the world. Some may argue that the 5.56mm caliber is inadequate for large two-legged critters, but the purpose of this article is not to address that point. Instead consider what might be the best method to BZO these firearms given a particular mission parameter.

We need to consider the ballistics, both external and terminal, of the 5.56mm round in relation to a proper BZO. Both the Army and the Marine Corps teach that the maximum effective range of the M16A2/A3/A4 is 500 meters on a point target (individual enemy) and 800 meters on an area target (i.e. troops in the open). Part of the Marine Corps’ known distance qualification course is engaging a stationary black ‘E’ Silhouette style

(human-shaped) targets, called “B-Mod,” 23.5” wide and 39” tall on a white background with 10 rounds at a distance of 500 yards from the prone position. It is not uncommon for Expert rated Marines to hit 10 out of 10. This is a great test of basic marksmanship. It also provides Marines with confidence in themselves and their weapons. However, on a battlefield seldom does the enemy remain stationary or perfectly silhouetted at a known distance, nor is the soldier or Marine always in a stable prone or sand-bagged position. Also, on an asymmetric battlefield, like Iraq, the rules of engagement may not allow you to shoot at a potential combatant if you can’t identify that they are a threat. 500 yards or even 300 yards is a long distance to pick out camouflaged combatants, as well as determine their intentions, without a quality optic. Finally, we have to consider what the lethality of the 5.56mm round is at those distances.

Let’s look at the lethality of the 5.56mm round first. Extensive testing done by the Department of Defense Subject Matter Expert Ballistics panel recently concluded that besides proper shot placement, the biggest aspect of producing lethal wounds was the yawing and fragmenting effect of the round when it impacted soft tissue. This requires a velocity above 2500 feet per second, preferably above 2700 fps, for M193, M855, or MK262 Mod 1 ammo. This equates to a lethal range of approximately 200 meters with a 20” M16A2/A3/A4 rifle or 150 meters with a 14.5” M4A1 carbine. That is not to say that a shot beyond that range will not be lethal, only that the probability begins dropping dramatically. As an example at 500 yards the velocity of the 5.56mm rounds is approximately 1500 to 1700 feet per second, which is equivalent to the muzzle velocity of a .22 LR Hyper-Velocity round. Again, can you kill someone at that distance with a 5.56mm round? Yes. There have been Marines and Soldiers who have done so during our recent conflict at that distance. However, the likelihood of inflicting a lethal wound with a 5.56mm round is significantly diminished past 200 meters.

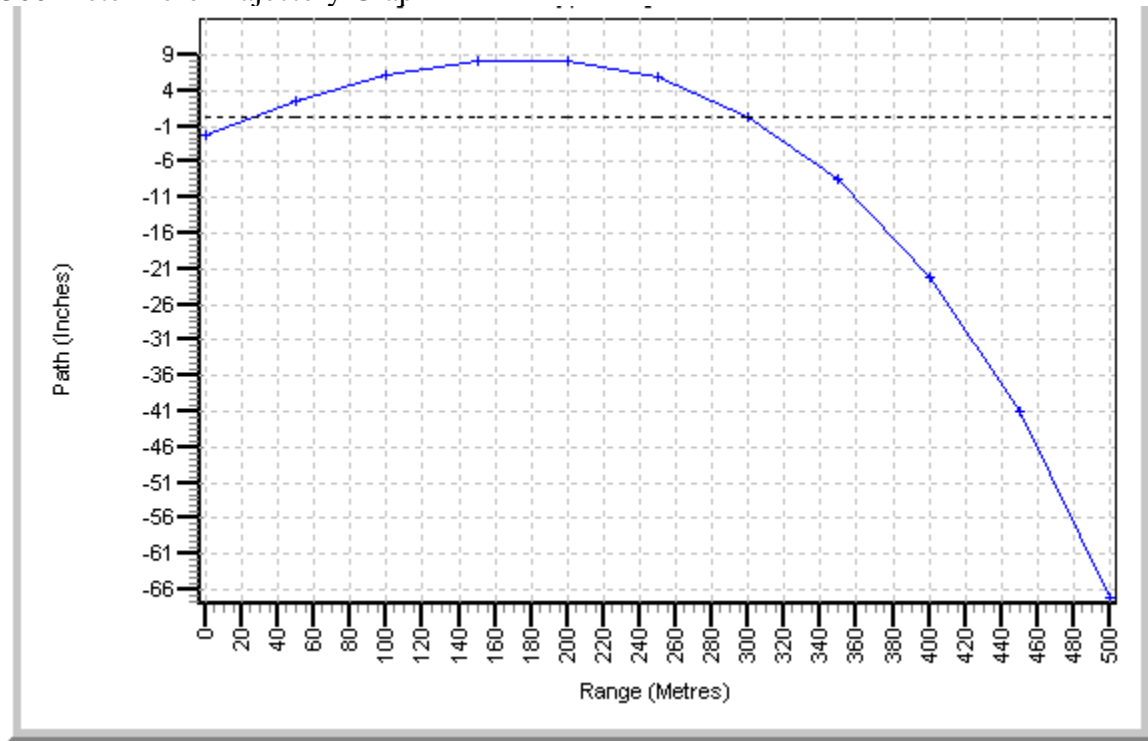
Okay, so DOD ballistics SMEs have established that 200 meters is probably the maximum lethal range for the 5.56mm round on two-legged critters. Also, keep in mind that the BZO distances of 200 yards, 300 yards, and 300 meters are the true zeros. 25 meters, 36 yards, and 50 yards are just the initial intersection of rounds during its trajectory. Zeroing at 25 meters, 36 yards, and 50 yards is only to get you on paper and close to where you should be shooting at 300 meters, 300 yards, and 200 yards respectively. You will still need to confirm and refine your BZO at those appropriate distances.

Now let’s look at external ballistics and trajectory of the various recommended BZOs.

US Army Recommendations:

The US Army recommends a 25/300 Meter BZO. This BZO calls for the zeroing of M16A2/A3, M16A4, and M4A1 at 25 Meters with the setting of the rear elevation at $8/3+1$, $6/3+1$, and $6/3$ respectively using the small (long range) aperture (Please refer to Figure 1 at the end of this article). The standard is for the soldier to shoot a 4cm (1.5") group at 25 meters. The Army extrapolates that a soldier will then be able to shoot a 48cm (19") group at 300 meters. Once this standard is achieved, then the rear elevation setting is moved to $8/3$ or $6/3$. However, the trajectory of the rounds does not seem to have been considered when the Army chose the 25/300 meter BZO as the maximum ordinate during flight rises almost 9" above the line of sight around 200 meters. In keeping with the Army's standards for shooting groups this would place most shots 15" above line of sight at 200 meters. Thus, if aiming at the enemy combatant's chest soldiers would shoot high (head and neck area) between 150 to 250 meters with little room for error regarding windage.

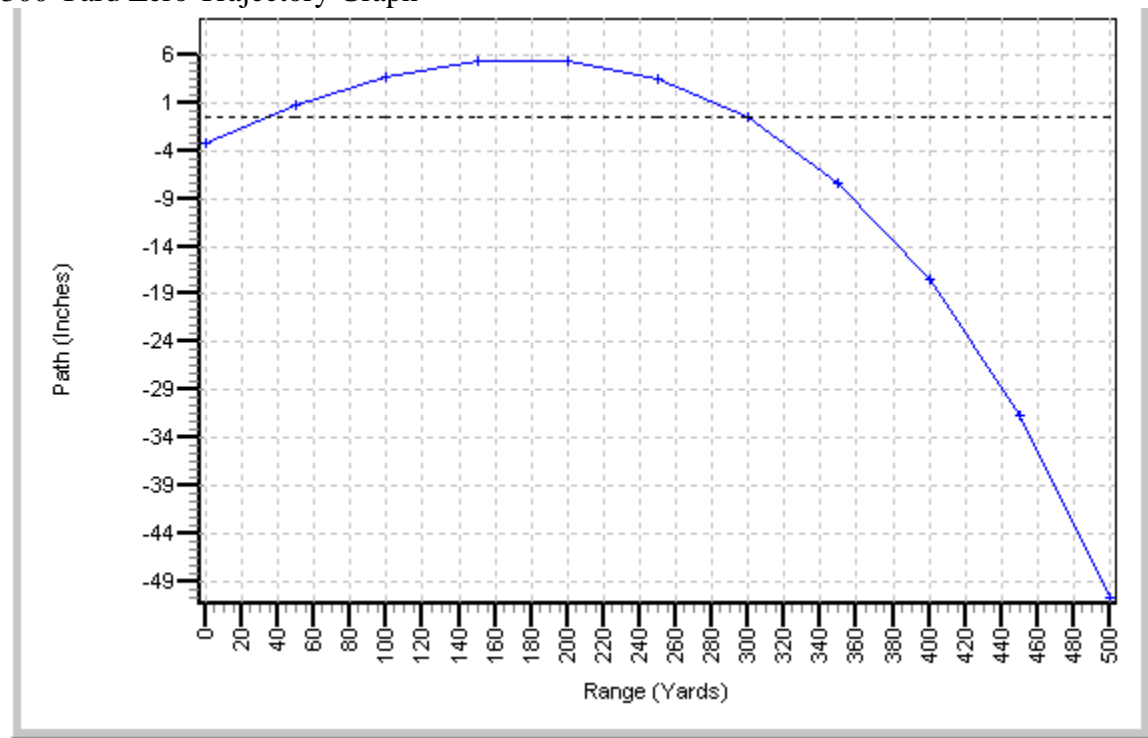
300 Meter Zero Trajectory Graph



US Marine Corps Recommendations:

The Marine Corps recommends a 36/300 yard BZO. This BZO calls for zeroing the M16A2/A3/A4 and M4A1 at 36 yards with the setting of the rear elevation at 8/3 and 6/3 using the small (long range) aperture. This provides a trajectory with a maximum ordinate during flight of just over 4.5" above the line of sight at around 200 yards. Thus, with a standard of 12" groups at 300 yards for Marines this would allow for most rounds to impact roughly 9" above the line of sight. With an aiming point on the enemy's chest the rounds would land high on the upper chest just below the neck between the 150 and 200 yards. This BZO will allow more room for error on the part of the shooter, thus slightly better than the 25/300 meter zero.

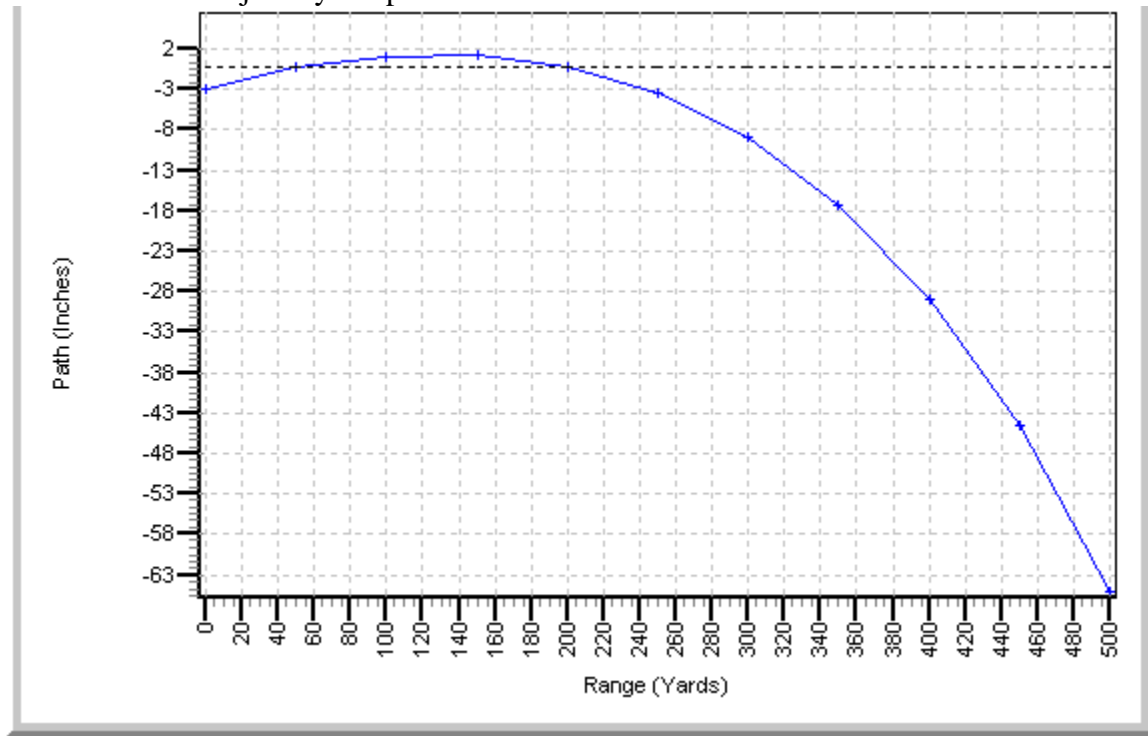
300 Yard Zero Trajectory Graph



Private Shooting School Recommendations:

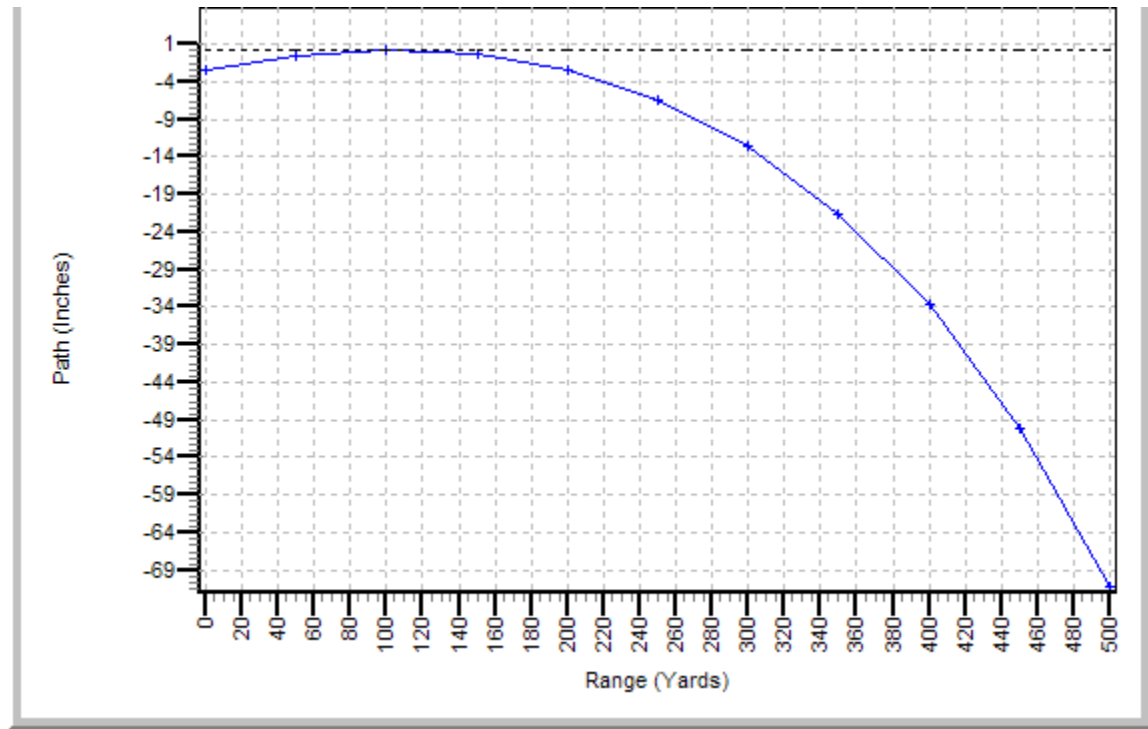
The BZO that is most common with the better-known shooting schools and instructors around the country is the 50/200 yard BZO. This BZO calls for zeroing the rifles and carbines using the large (0-200) apertures with the rear elevation set at 8/3 or 6/3. This zero provides a very flat trajectory with a maximum ordinate of just over 1.0" between 50 and 200 yards. Thus, when aiming center mass with a 12" standard at 300 yards one could expect that most rounds will impact within 4 to 5 inches from point of aim out to 250 yards. After that the trajectory drops fairly quickly with rounds impacting 6" below line of sight minus shooter error and 12" below with shooter error at 300 yards. However, 12" below center of the chest still has rounds impacting in the blood vessel-rich lower abdomen and groin area with more room for error regarding windage.

200 Yard Zero Trajectory Graph



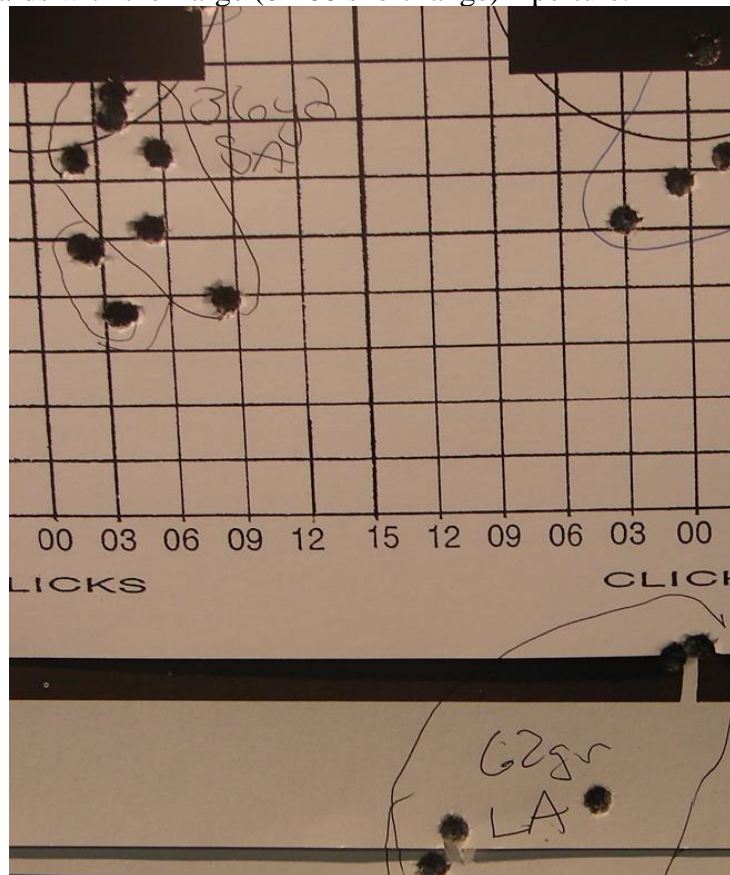
Special Operations Recommendations:

A less common BZO, but one used primarily by an elite U.S. military special operations unit, is the 100 yard zero. This BZO fits their particular mission profile, as they typically perform direct action missions that may require them to make very precise shots on threats out to 100 yard, but then immediately transition to close quarter battle actions inside enclosures. The 100 yard BZO is good for threat engagements inside 200 yards but the rounds drop off very quickly past that distance.



One last interesting tidbit to throw into this equation is from the Army and Marine Corps Technical Manual for the M16A2. Per this TM one is led to believe that if a Soldier or Marine were to zero the M16A2 (and assuming also the A3/A4 and M4A1) at 300 yards or meters using the small (long range) aperture, and then flip up to the large (0-200 short range) aperture he would have a 200 yard/200 meter zero. See Figure 2 at the end of this article. We recently tested this TM “theory.” Like most theories that look good on paper, they often don’t stand the test in the field. We found that not only were the two zeros not the same, but that the large aperture shot groups were 6” low and 3” to the right at 50 yards. If we extrapolate this information out to two hundred yards the shot groups would be 24” low and 12” off to the right. Shooters would miss their intended targets entirely! When testing this TM “theory” we knew that we would see a difference in the elevations because the centers of the small aperture and the large aperture are not on the same plane, differing as much as 6 minutes of angle with the small aperture shooting higher. What did surprise us was the shift in windage, until we thought about the mechanics of the rear aperture sight. Because the rear aperture rotates on a threaded screw, when it is rotated from small to large it will move slightly to the right thus shifting the impact of the rounds to the right. (See accompanying picture for more details.)

The top group in the image below was shot at 36 yards with M855 5.56mm NATO ammo with the Small (long range) Aperture. The bottom group was shot with the same ammo and rifle at 50 yards with the Large (0-200 short range) Aperture.



M16A3 Rear Sight



So which BZO is best? In my humble opinion it is the 50/200 yard zero. However, mission, enemy, troops, and terrain often dictates your particular requirement. If I were a civilian or law enforcement officer I would zero with the large aperture at 50/200 yards and leave my sights alone, as most defensive or even offensive shots required by civilians or patrol officers will be well within 200 yards. However, as an infantryman in the open mountain ranges of Afghanistan I would consider the 36/300 yard zero with a small aperture, using the large aperture when inside of 100 yards (i.e. clearing small villages) when necessary. On the streets of Fallujah or Baghdad, I would prefer the large aperture zeroed at 50/200 yards. In the end, information is power. The more informed a soldier or Marine is with regards to Tactics, Techniques, & Procedures (TTPs) that are currently being used, the better decision they will make - as there is only 1*...their own.

“MY RIFLE”

The creed of a United States Marine

by

Maj. Gen. W. H. Rupertus, USMC

This is my rifle. There are many like it, but this one is mine.

My rifle is my best friend. It is my life. I must master it as I must master my life.

My rifle, without me is useless. Without my rifle, I am useless. I must fire my rifle true. I must shoot straighter than my enemy who is trying to kill me. I must shoot him before he shoots me. I will...

My rifle and myself know that what counts in this war is not the rounds we fire, the noise of our burst, nor the smoke we make. We know that it is the hits that count. We will hit . . .

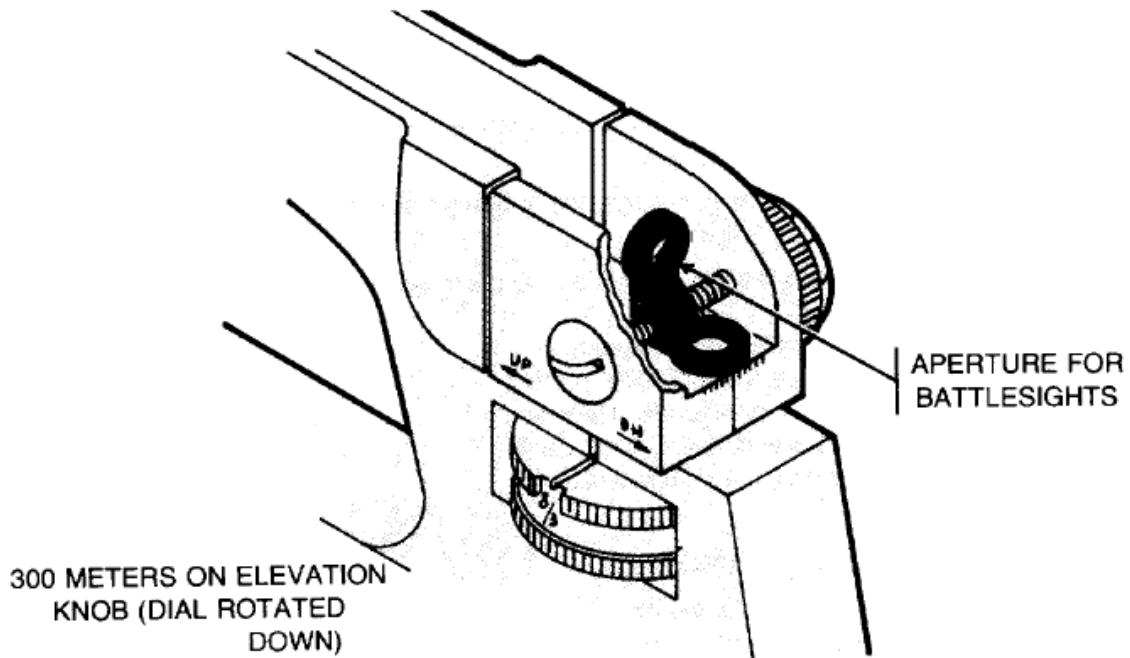
My rifle is human, even as I, because it is my life. Thus, I will learn it as a brother. I will learn its weaknesses, its strength, its parts, its accessories, its sights, and its barrel. I will ever guard it against the ravages of weather and damage. I will keep my rifle clean and ready, even as I am clean and ready. We will become part of each other. We will ...

Before God I swear this creed. My rifle and myself are the defenders of my country. We are the masters of our enemy. We are the saviors of my life.

So be it, until victory is America's and there is no enemy, but Peace!

Figure 1

BATTLESIGHT ZERO (CONT)



U.S. Army TM 9-1005-319-10/USMC TM 05538C-10/1A

When battlesights are on your rifle:

- a. The front sight post and rear sight windage knob are adjusted so you can hit your point of aim at 300 meters.
- b. The unmarked aperture must be in the up position.
- c. The 300-meter mark is aligned with the mark on the left side of the receiver.

M16A2/3/4, M4, and M4A1 weapons. The unmarked aperture is used for zeroing and target engagement at all distances on the KD range. When engaging targets beyond 300 meters the windage knob should be adjusted to the range of the target. 400-meter targets are engaged on the setting 4 flush and 450-meter targets would be set on 4 plus two clicks.

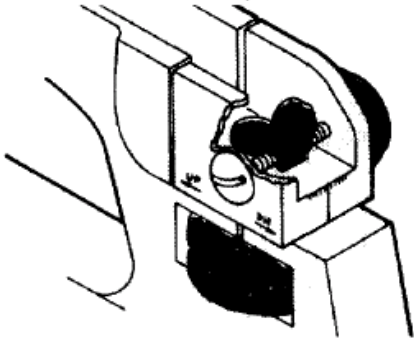
3. Basic training soldiers will only zero on the 25-meter range.

FM 3-22.9

Figure 2

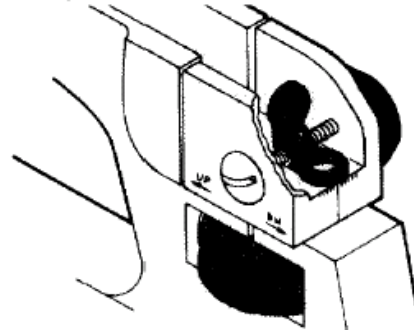
ADJUSTABLE REAR SIGHT HAS TWO APERTURES FOR RANGE

SHORT RANGE (0-200 METERS)



SHORT RANGE - This "larger" aperture is used for 0 - 200 meters range. As shown above, the sight is set for 0 - 200 meters. This larger aperture is only used when the rear sight is all the way down. In other words, the 300-meter mark is aligned with the mark on the left side of the receiver.

NORMAL RANGE
(300-800 METERS)



NORMAL RANGE - The aperture is unmarked and used for most firing situations. It is used in conjunction with the elevation knob for 300, 400, 500, 600, 700, and 800 meter targets.

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U.S. Army TM 9-1005-319-10/USMC TM 05538C-10/1A

SHOOTING AT NIGHT OR AT CLOSE RANGE

- a. Rotate the elevation knob down to the 300-meter mark.
 - b. Flip the unmarked aperture down and use the larger aperture marked "0-2."
- NOTE: The 0-2 aperture is preset for targets between 0 and 200 meters. Moving targets at close ranges are easier to hit if you use the larger aperture.

Sgt Dean Caputo, Arcadia CA PD, Colt Armorer Instructor, and Gunsite Range Master shooting an M16A3 on the Arcadia PD's excellent 50 yard indoor training range. He was kind enough to assist us during this testing, as well as allow us to use his department's facilities.

