TC 3-22.249

# LIGHT MACHINE GUN
# M249 Series

**May 2017**

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This publication supersedes FM 3-22.68, 21 July 2006.

**Headquarters, Department of the Army**

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*Training Circular
No. 3-22.249

Headquarters
Department of the Army
Washington, DC,16 May 2017

# Light Machine Gun M249 Series

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# Preface

Training Circular (TC) 3-22.249 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. Terms for which TC 3-22.249 is the proponent publication (the authority) are marked with an asterisk (*) in the glossary. Definitions for which TC 3-22.249 is the proponent publication are boldfaced in the text. For other definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition.

The principal audience for TC 3-22.249 is all members of the profession of arms. Commanders and staffs of Army headquarters serving as joint task force or multinational headquarters should also refer to applicable joint or multinational doctrine concerning the range of military operations and joint or multinational forces. Trainers and educators throughout the Army will also use this publication.

Commanders, staffs, and subordinates ensure that their decisions and actions comply with applicable United States, international, and in some cases host-nation laws and regulations. Commanders at all levels ensure that their Soldiers operate in accordance with the law of war and the rules of engagement. (See FM 27-10.)

This publication applies to the active Army, the Army National Guard (ARNG)/Army National Guard of the United States (ARNGUS), and the United States Army Reserve (USAR).

Uniforms depicted in this manual were drawn without camouflage for clarity of the illustration.

The proponent of TC 3-22.249 is the United States Army Maneuver Center of Excellence. The preparing agency is the Maneuver Center of Excellence, Fort Benning, Georgia. Send comments and recommendations on DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) to Commander, Maneuver Center of Excellence, Directorate of Training and Doctrine, Doctrine and Collective Training Division, ATTN: ATZB-TDD (TC 3-22.249), 1 Karker Street, Fort Benning GA 31905-5410; by email to usarmy.benning.mcoe.mbx.doctrine@mail.mil, or submit an electronic DA Form 2028.

# Introduction

TC 3-22.249 is comprised of nine chapters and six appendices and is specifically tailored to the individual Soldier's use of the M249 light machine gun. TC 3-22.249 provides specific information about the weapon, aiming devices, and attachments, followed by sequential chapters on the tactical employment of the weapon system.

This TC is organized in a progressive manner; each chapter or appendix builds upon the information from the previous section. The organization of this training circular provides a logical sequence of information which directly supports the Army's training strategy for the weapon at the individual level.

Chapters 1 through 4 describe the weapon, aiming devices, mountable equipment, and accessories associated with the machine gun. General information is provided in the chapters of the manual with more advanced information placed in appendix A, Ammunition, and appendix B, Ballistics.

Chapters 5 through 9 provide employment, stability, aiming, control, and movement information. This portion focuses on the Soldier skills needed to produce well-aimed bursts. Advanced engagement concepts are provided in appendix C of this publication. Appendix D of this publication provides common tactical drills used in training and combat to directly support tactical engagements. Finally, appendix E of this publication provides a common location for reference in this and future weapons publications.

TC 3-22.249 does not cover the specific automatic rifle and light machine gun training strategy, ammunition requirements for the training strategy. Separate training circulars cover those areas.

TC 3-22.249 applies to all Soldiers regardless of experience or position. TC 3-22.249 is designed specifically for the Soldier's use on the range during training and as a reference while deployed.

## Chapter 1

# Overview

Chapter 1 describes the principles of proper weapons handling, tactical applications and control measures for handling the weapon. An overview of the concepts of overmatch as it pertains to a Soldier's individual weapon system is also discussed in this chapter.

Each Soldier is responsible for placing accurate and effective fires on threat targets with their individual weapon. To do this each Soldier must understand the functional elements of the shot process, the principles of operation of the weapon, the characteristics and description of ballistics and ammunition, and the various engagement techniques essential to building the Soldier's proficiency with their weapon system. The combination of knowledge and practice, builds and sustains the skills to achieve accurate and precise shots consistently during combat operations. (See figure 1-1).

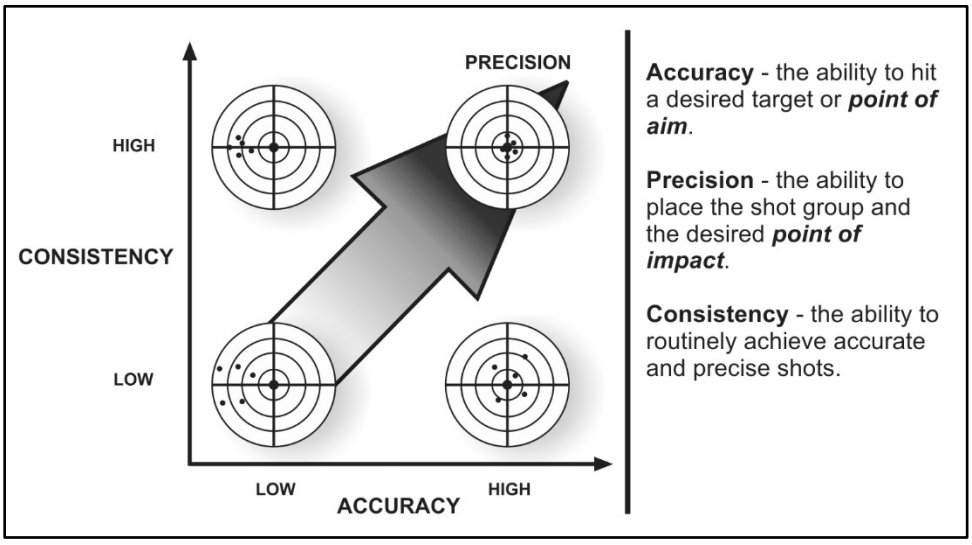



**Figure 1-1. Employment skills**

# SAFE WEAPONS HANDLING

1-1. Safe weapons handling procedures are a consistent and standardized way for Soldiers to handle, operate, and employ the weapon safely and effectively. Weapons handling is built on three components; the Soldier, the weapon, and the environment, which are discussed below:

- The Soldier must maintain situational understanding of friendly forces, the status of the weapon, and the ability to evaluate their environment to properly handle any weapon. The smart, adaptive, and disciplined Soldier is the primary safety mechanism for all weapons under their control.
- The weapon is the primary tool of the Soldier to defeat threats in combat. The Soldier must know how to operate the mechanical safeties built into the weapons they employ, as well as the principles of operation for those weapons.
- The environment is the Soldier's surroundings. The Soldier must be aware of muzzle discipline, the nature of the target, and what is behind the target.

1-2. Soldiers must be cognitively aware of three distinct weapons handling measures, listed below, to safely and effectively handle weapons:

- Rules of firearms safety.
- Weapons safety status.
- Weapons control status.

1-3. The weapon handlings measures directly support the components of safe weapons handling. The weapons handling measures are designed to provide redundant safety measures when handling any weapon or weapon system, not just automatic rifles or light machine guns.

1-4. The redundancy allows for multiple fail-safe measures to provide the maximum level of safety in training and operational environments. A Soldier would have to violate two of the rules of firearms safety or violate a weapon safety status to have a negligent discharge.

***Note***. Unit standard operating procedures (SOPs), range SOPs, or the operational environment may dictate additional safety protocols; however, the rules of firearms safety are always applied. If a unit requires Soldiers to violate these safety rules for any reason, such as for the use of blank rounds or other similar training munitions during training, the unit commander must take appropriate risk mitigation actions.

# RULES OF FIREARMS SAFETY

1-5. The rules of firearms safety are standardized for any weapon a Soldier may employ. Soldiers must adhere to these precepts during training and combat operations, regardless of the type of ammunition employed, except as noted above.

## RULE 1: TREAT EVERY WEAPON AS IF IT IS LOADED

1-6. Any weapon handled by a Soldier must be treated as if it is loaded and prepared to fire. Whether or not a weapon is loaded should not affect how a Soldier handles the weapon in any instance.

1-7. Soldiers must take the appropriate actions to ensure the proper weapon status is applied during operations, whether in combat or training.

## RULE 2: NEVER POINT THE WEAPON AT ANYTHING YOU DO NOT INTEND TO DESTROY

1-8. Soldiers must be aware of the orientation of their weapon's muzzle and what is in the path of the projectile if the weapon fires. Soldiers must ensure the path between the muzzle and target is clear of friendly forces, noncombatants, or anything the Soldier does not want to strike.

1-9. When this is unavoidable, the Soldier must minimize the amount of time the muzzle is oriented toward people or objects they do not intend to shoot while simultaneously applying the other three rules of firearms safety.

## RULE 3: KEEP FINGER STRAIGHT AND OFF THE TRIGGER UNTIL READY TO FIRE

1-10. Soldiers must not place their finger on the trigger unless they intend to fire the weapon. The Soldier is the most important safety feature on any weapon. Mechanical safety devices are not available on all types of weapons. When mechanical safeties are present, Soldiers must not rely upon them solely for safe operation knowing that mechanical measures may fail.

**1-11.** Whenever possible, Soldiers should move the weapon to mechanical safe when a target is not present. If the weapon does not have a traditional mechanical safe, the trigger finger acts as the primary safety.

## RULE 4: ENSURE POSITIVE IDENTIFICATION OF THE TARGET AND ITS SURROUNDINGS

1-12. The disciplined Soldier can positively identify the target and knows what is in front of and what is beyond it. The Soldier is responsible for all bullets fired from their weapon including the projectile's final destination.

1-13. Application of this rule minimizes the possibility of fratricide, collateral damage, or damage to infrastructure or equipment. It also prepares the Soldier for any follow-on bursts that may be required.

# WEAPON SAFETY STATUS

1-14. Weapon safety status is a standard code that uses common colors (green, amber, red, and black) to represent the level of readiness for a given weapon. Each color represents a specific series of actions that are applied to a weapon. The colors are used in training and combat to place or maintain a level of safety relevant to the current task or action of a Soldier, small unit, or group. The following weapon safety statuses are used for all M249-series weapons.

***Note***. If the component, assembly, or part described is unclear, refer to the weapon's technical manual (TM) or chapter 2 of this publication.

## GREEN

1-15. The color green signifies that the weapon's ammunition or magazine is removed, its chamber is empty, its bolt is locked open, and the selector is set to SAFE.

***Note***. The command given to direct a GREEN safety status is GREEN AND CLEAR or GO GREEN.

## AMBER

1-16. The M249-series machine gun ***does not have*** an amber status. Units are not authorized to place the weapon into any form of amber status.

***Note***. Weapons that fire from the open bolt do not allow the safety to be engaged when the bolt is forward. For more information, see the weapon's TM.

**WARNING**

**Units are NOT authorized to employ the HALF-LOAD except aviation units that are employing door-mounted systems on an Army aircraft.**

## RED

1-17. The color red signifies that the machine gun ammunition is loaded onto the feed tray or that the magazine is inserted into the weapon, the bolt is locked to the rear, and the selector is set to SAFE.

***Note***. The command given to direct a RED safety status is MAKE READY.

## BLACK

1-18. The color black signifies that the machine gun ammunition is loaded onto the feed tray or that the magazine is inserted into the weapon, the bolt is locked to the rear, the selector switch is set to fire, and the Soldier's finger is on the trigger ready to engage.

***Note***. The command given to direct a BLACK safety status is driven by the unit's standard operating procedure (SOP), rules of engagement, or the command FIRE.

1-19. Table 1-1 shows the weapon safety status for the M249-series weapons.

**Table 1-1. Weapons safety status for M249-series weapons**

| STATUS | GREEN | AMBER | RED | BLACK |
|---|---|---|---|---|
| **Function** | **CLEAR** | **N/A** | **READY, SAFE** | **READY, FIRE** |
| **Commands** | **GREEN AND CLEAR** | **N/A** | **MAKE READY** | **SOP / ROE / FIRE** |
| **Ammunition** | None | N/A | On Feed Tray | On feed tray |
| **Bolt** | Forward | N/A | Open | Open and Locked to the rear |
| **Chamber** | Empty | N/A | Empty | Empty |
| **Safety** | Fire | N/A | Safe | Fire |
| **Trigger** | OFF | N/A | OFF | ON |

***Note.*** The M249-series machine gun does NOT have an Amber status. Units are not authorized to place the weapon into form of Amber status. It emphasizes the importance of Safety First.

**WARNING**

**Units are NOT authorized to employ the HALF-LOAD except aviation units that are employing door-mounted systems on an Army aircraft.**

# WEAPON CONTROL STATUS

1-20. A weapons control status is an air defense control measure declared for a particular area and time by an area air defense commander, or delegated subordinate commander, based on the rules of engagement designed to establish the freedom for fighters and surface air defense weapons to engage threats (JP 3-01). The weapons control status outlines the target identification conditions under which friendly elements may engage a perceived threat with direct fire.

**1-21.** Table 1-2 provides a description of the standard weapons control status used during tactical operations, both in training and combat. Table 1-2 describes when the firer is authorized to engage a threat target once the threat conditions have been met.

**Table 1-2. Weapons control status**

| | |
|---|---|
| **WEAONS HOLD** | Engage only if engaged or ordered to engage. |
| **WEAONS TIGHT** | Engage only if target is positively identified as enemy. |
| **WEAONS FREE** | Engage targets not positively identified as friendly. |

1-22. A weapons control status and a weapons safety status are implemented and available to leaders to prevent fratricide and to limit collateral damage. Typically, postures or statuses are suited to the area of operation or type of mission and should always be outlined clearly to all Soldiers in the operations order (OPORD), warning order (WARNORD), or fragmentary order (FRAGORD).

# OVERMATCH

1-23. Overmatch is the Soldier applying their learned skills, employing their equipment, leveraging technology, and applying the proper force to create an unfair fight in favor of the Soldier. To achieve and maintain overmatch against any threat, this publication focuses on providing information to develop the Soldier's direct fire engagement skills using the following attributes:

- Smart, the ability to routinely generate understanding through changing conditions.
- Fast, the ability to physically and cognitively outmaneuver adversaries.
- Lethal, deadly in the application of force.
- Precise, consistently accurate when applying power to ensure delivery of the right effects in time, space, and purpose.

1-24. The Soldier must understand the key elements that build the unfair advantage and exploit them at every opportunity during tactical operations. The overmatch components are described below:

- Target detection, acquisition, and identification is the ability of the Soldier to detect and positively identify any suspected target as hostile at greater distances than their adversary. The Soldier must rely upon their training and their ability to leverage the capabilities of their optics, thermals, and sensors.
- Engagement range provides the Soldier with weapons, aiming devices, and ammunition capable of striking and defeating a threat at a greater range than the adversary can detect or engage the friendly force with effective fires.
- Limited visibility gives the Soldier an advantage through technology and techniques and compounds the adversary's disadvantages during limited visibility conditions.
- Precision provides a weapon and ammunition package that enhances the Soldier's consistent application of bursts with a level of precision greater than the adversary's.
- Speed is the weapon, aiming devices, and accessories a Soldier employs, which must work in unison seamlessly, be intuitive to use, and leverage natural motion and manipulations to facilitate rapid initial and subsequent bursts during an engagement at close quarters, mid, and extended ranges.
- Terminal performance ensures that precise bursts delivered at extended ranges provide the highest probability to defeat the threat through exceptional ballistic performance.

1-25. Although not a component of overmatch, exceptional training is critical to create smart, fast, lethal, and precise Soldiers. Training builds proficiency in a progressive, logical, and structured manner and provides Soldiers with the skills necessary to achieve overmatch against any adversary. The training program must provide the Soldier with experience in all the components of overmatch in the shortest amount of time.

## TARGET DETECTION, ACQUISITION, AND IDENTIFICATION

1-26. The first component of overmatch at the Soldier level is the ability to detect targets as far away as possible during limited and low visibility conditions. TC 3-22.249 describes the aiming devices for the service automatic rifle and light machine gun that enhance the Soldier's target detection and acquisition skills. The Soldier must be able to detect, acquire, and identify targets at ranges beyond the maximum effective range of their weapon and ammunition. In addition, this manual also provides key recognition information to build the Soldier's skills in correctly identifying potential targets as friend, foe, or noncombatant (neutral) once detected.

## ENGAGEMENT RANGE

1-27. To ensure small-unit success, the Soldier requires a weapon system that can engage threats at ranges greater than those of their adversaries. The weapon system creates a standoff distance advantage that allows friendly forces to destroy the target outside the threat's maximum effective range.

1-28. Range overmatch provides a tactical engagement buffer that accommodates the Soldier's time to engage with precision fires. For example, a Soldier that has the capability to effectively engage personnel targets at a range of 500 meters will have range overmatch of 10 to 20 percent over a threat rifleman. The

10 to 20 percent range difference is equivalent to a distance of 40 to 80 meters, which is approximately the distance a maneuvering threat can traverse in 15 to 40 seconds.

1-29. Figure 1-2 portrays the battlefield from the Soldier's perspective. With mobile, maneuvering threats the target acquisition capabilities must complement the engagement of those threats at the maximum effective range of the weapon, optic, and ammunition.

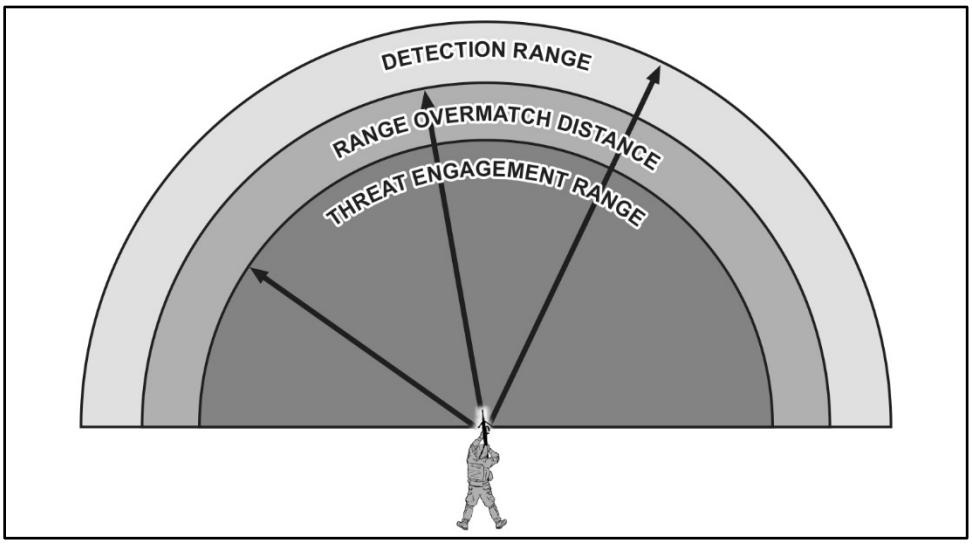



**Figure 1-2. Small unit range overmatch**

## LIMITED VISIBILITY

1-30. Soldiers must be able to detect, acquire, identify, and engage threats in all light conditions regardless of the tactical situation. Aiming devices are provided that minimize the effects of limited visibility (but not completely) to ensure Soldiers can engage threats in all light conditions.

1-31. Image intensifiers and thermal optics provide a significant overmatch capability, but they also have limitations and disadvantages. A general discussion of their capabilities, particularly what those systems can view within the spectrum of light is provided in chapter 3. Soldiers must understand what can be seen or viewed and what cannot be seen or viewed when using their assigned equipment. Understanding the advantages and limitations of their equipment has a direct impact on force protection, fratricide, collateral damage prevention, and maintaining overmatch during tactical operations.

## PRECISION

1-32. The Army M249 is designed with a specific level of accuracy out to its maximum effective range. Magnified aiming devices and superior ammunition assures the level of accuracy is consistent and reliable. The Soldier must build the skills to use the magnified aiming devices effectively to deliver precision fires during tactical engagements.

## SPEED

1-33. The close fight requires rapid manipulations, a balance of speed and accuracy, and very little environmental concerns. Soldiers must move quickly and efficiently through their manipulations of the fire control process to maintain the maximum amount of muzzle orientation on the threat through the shot process. The Soldier's second-nature efficiency of movement comes only from regular practice, drills, and repetition.

1-34. The foundation of speed of action is built through understanding the weapon, ammunition, ballistics, and principles of operation of the aiming devices. Speed of action is reinforced during drills (appendix D) and the training program of the unit.

1-35. The goal of training to overmatch is to increase the speed at which the Soldier detects a threat, identifies it as hostile, and executes the shot process with the desired target effect. TC 3-22.249 provides the requisite information in a progressive manner to build and reinforce Soldier understanding, confidence, and ability to execute tactical operations with speed and smooth fluidity of motion.

## TERMINAL BALLISTIC PERFORMANCE

1-36. Terminal ballistic performance is the action of a projectile from the time it strikes an object downrange until it comes to rest. The ammunition used with the light machine gun performs exceptionally well out to its maximum effective range and beyond. Appendix A, Ammunition, and Appendix B, Ballistics, provides information about the various munition types available for training and combat, the capabilities and purpose, and the service (combat) round's terminal ballistic performance.

1-37. Soldiers must understand the capabilities of their ammunition, whether designed for training or combat use. An understanding of the ammunition's capabilities creates a respect for the weapon and ammunition, reinforces the precepts of safe weapons handling, and creates an understanding of the appropriate skills necessary to deliver lethal fires.

1-38. Soldiers who understand "how and why" their weapon system, aiming devices, ammunition, and work or function procedures develop a comprehensive understanding. Soldiers' level of understanding, coupled with a rigorous training program that builds and strengthens their skills, creates more proficient Soldiers. The proficiencies and skills the Soldiers display during training translate into smart, fast, lethal, and precise Soldiers for the small unit during decisive, action combat operations.

## Chapter 2

# Principles of Operation

Chapter 2 provides the general characteristics, description, major components, and principles of operation for the M249-series light machine gun (LMG). Chapter 2 provides a general overview of the mechanics and theory of how the weapon operates, key terms and definitions related to their functioning.

## DESCRIPTION

2-1. The M249 is a gas-operated, belt or magazine-fed, air-cooled, fully automatic weapon that fires from the open-bolt position. The M249 has a maximum rate of fire of 850 rounds per minute. Primarily, ammunition feeds into the weapon from a 200-round ammunition box containing a disintegrating, metallic split-link belt. As an emergency means of feeding, the M249 can use an M16-series rifle or an M4-series carbine magazine, but doing so increases the chances of malfunctions. The gunner can fire the M249 from the shoulder, with a bipod or tripod, or on a machine gun mount. The weapon system has a standardized mounting surface for various optics, pointers, illuminators, and equipment to secure items with common mounting and adjustment hardware.

2-2. The quick-change barrel is air cooled and has a fixed headspace. The bolt is a multiple lug type which rotates into a positive locked position in the barrel extension prior to firing. Gas is taken from the barrel acting on a piston directly fixed to the bolt carrier (slide). The gas pressure on the old style barrel is based on the gas exhaust system and is controlled by a two-position regulator; one for normal conditions, the other for delivering additional power for adverse conditions. The new style barrel has a preset gas orifice and rotation of the regulator has no effect on its operation. The new barrel has a folding carrying handle, also. The M249 is equipped with a spare barrel in addition to the weapon barrel assembly

2-3. The LMG consists of components, assemblies, subassemblies, and individual parts. Soldiers must be familiar with these items and how they interact during an operation as described below:

- Components are a uniquely identifiable group of fitted parts, pieces, assemblies or subassemblies that are required and necessary to perform a distinctive function in the operation of the weapon. Components are usually removable as one piece and are considered indivisible for a particular purpose or use.
- Assemblies are a group of subassemblies and parts that are fitted to perform a specific set of functions during an operation and cannot be used independently for any other purpose.
- Subassemblies are a group of fitted parts that perform a specific set of functions during operation. Subassemblies are compartmentalized to complete a specific task. They may be grouped with other assemblies, subassemblies, and parts to create a component.
- Parts are the individual items that perform a function when attached to a subassembly, assembly, or component that serves a specific purpose.

# MAJOR COMPONENTS

2-4. The LMG consists of eight major components: the barrel assembly, buffer assembly, bolt and operating rod assembly, driving spring rod assembly, trigger housing assembly, cover assembly, feed tray, and receiver assembly. These components are described below including their associated assemblies, subassemblies, and parts.

2-5. The definitions of each of the major components listed below are from TM 9-1005-201-10. Figure 2-1, on page 2-3, illustrates each of the components.

- Barrel assembly. Houses cartridge for firing, directs projectile, and supports fixed front sight. (Old style barrel to be replaced with new style barrel by attrition.) The latest barrels have a monoblock design that eliminates the separate gas collar and gas regulator.
- Heatshield. Protects operator's hands from a hot barrel.
- Receiver assembly. Serves as a support for all major components. Houses action of weapon and through a series of guide rails, controls functioning of weapon.
- Rear sight assembly. Rear sight is adjustable for both windage and elevation.
- Cover and feed mechanism assembly. Provides support for rear sight and means for gaining access to feed tray. By means of cam and lever action, feeds linked belt ammunition and holds cartridges in position for stripping, feeding, and chambering. Cover also provides a mounting base for optical device.
- Feed pawl assembly. Feeds linked belt ammunition, positions and holds cartridges in position for stripping, feeding and chambering.
- Feed tray assembly. Serves as a guide for positioning cartridges to assist in chambering.
- Cocking assembly. Pulls the moving parts rearward. Moves in a guide rail fixed to the right side of the receiver.
- Buttstock and buffer assembly. Serves as a shoulder support for aiming and firing machine gun. Contains a folding shoulder rest and a hydraulic buffer. Old style buttstock does not contain a hydraulic buffer. (Old style buttstock to be replaced by modification work order.)
- Bolt assembly. Provides stripping, cambering, firing, and extraction, using the propellant gases and recoil spring for power.
- Slide assembly. Houses the bolt assembly, firing pin and roller assembly and cam bolt assembly to lock and unlock.
- Piston assembly. Transfers power from propelling gases to bolt and slide assemblies to function the machine gun (move recoiling parts rearward).
- Spring, helical compression. Provides power to the piston assembly for moving slide and bolt assemblies forward during weapon functioning.
- Return rod and transfer mechanism assembly or rod assembly operating. Absorbs recoil from bolt, slide, and piston assemblies at the end of recoil movement, and transfers recoil pressure to the buffer in the buttstock.
- Trigger mechanism assembly. Houses the trigger, sear and safety, and controls the firing of the machine gun.
- Hand guard assembly. Provides thermal insulation to protect the operator's hands from heat.
- Sling and snap hook assembly. Provides a means of carrying the weapon.
- Bipod assembly. Supports machine gun in prone/sitting position. The telescopic legs can be individually adjusted to three different lengths.
- Gas cylinder assembly. Locks bipod in place on receiver and provides passageway for operating gases.

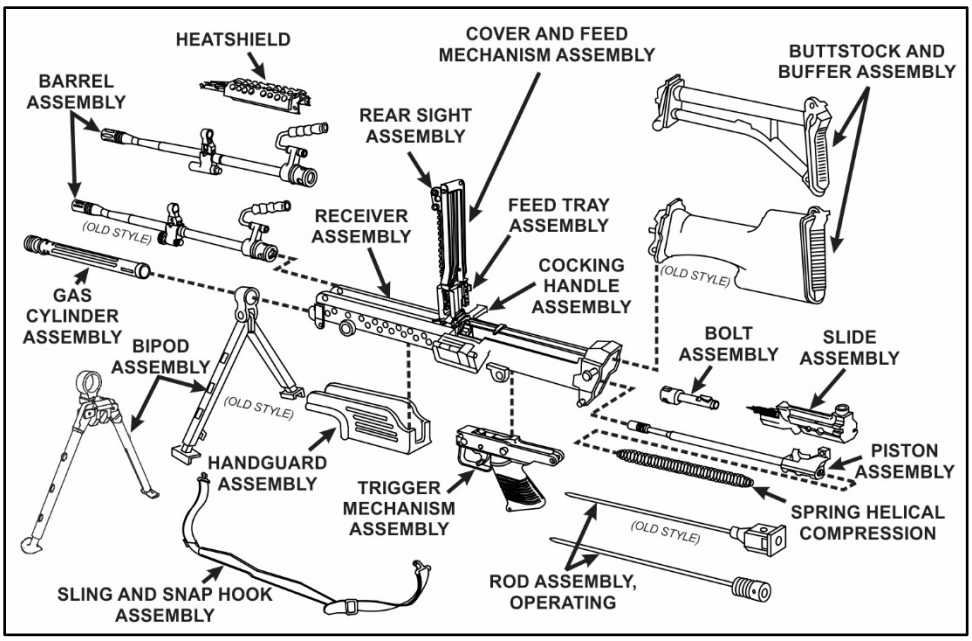



**Figure 2-1. M249 components**

2-6. Additional information about the characteristics and components of the M249 can be found in TM 9-1005-201-10. Soldiers use the technical manual for preventative maintenance checks and services, operations under normal conditions, and detailed information about the principles of operation.

2-7. Each variant of the light machine gun have subtle capabilities differences. The primary differences are shown in table 2-1, and are specific to the weapon's barrel assembly, sling assembly, and tripod.

**Table 2-1. Model version comparison**

| OLD STYLE BARREL | NEW MONO BLOCK BARREL |
|---|---|
| Carrying handle: Folding (three position) | Integral gas collar and gas regulator has no parts to disassemble. |
| Compensator: Minimizes muzzle flash, reduces and lessens muzzle climb. | |
| Gas collar: Setting has no effect on cyclic rate. Only function is to lock gas regulator into barrel assembly. | |
| **M249 WITH EQUIPMENT** | **M249 WITH EQUIPMENT (LMG)** |
| Equipped with sling assembly and two each magazine and cartridge. | Equipped with sling assembly, tripod adapter assembly, and magazine adapter. |
| | Used in the LMG role and mounted on the tripod. |

# CYCLE OF FUNCTION

2-8. The cycle of function is the mechanical process a weapon follows during operation. The information provided below is specific to the cycle of function as it specifically pertains to the M249.

2-9. The eight-step cycle of function begins when the gunner places the first round of the belt in the feed tray groove or inserts the magazine into the magazine well and the trigger is pressed. The sear is pulled down by the trigger, disengaging it from the sear notch on the bottom of the operating rod, and initiating forward movement of the operating group under the force of the expanding drive spring. It ends when the gunner releases the trigger and the sear again engages. More than one step may occur at the same time. The phases of the cycle of function in order are—

- Feeding.
- Chambering.
- Locking.
- Firing.
- Unlocking.
- Extracting.
- Ejecting.
- Cocking.

2-10. Semiautomatic and automatic weapons use operating systems to complete the cycle of functioning. The M249 series weapons use an indirect impingement gas operating system. The M249's system uses a portion of the high pressure gas from the cartridge being fired to physically move the assemblies and subassemblies to complete the cycle of function.

## FEEDING

2-11. As the bolt starts its forward movement, the feed lever is forced to the right causing the feed pawl assembly to turn in the opposite direction. As the feed lever moves to the right, it forces the feed pawl assembly over the next round in the belt. The feed pawl assembly is ready to place the next round into the tray groove when the rearward action occurs again. As the bolt moves to the rear after firing, the feed roller forces the feed lever to the left. The feed lever is forced to turn moving the feed pawl to the right. The feed pawl assembly places a round in the tray groove. See figure 2-2.

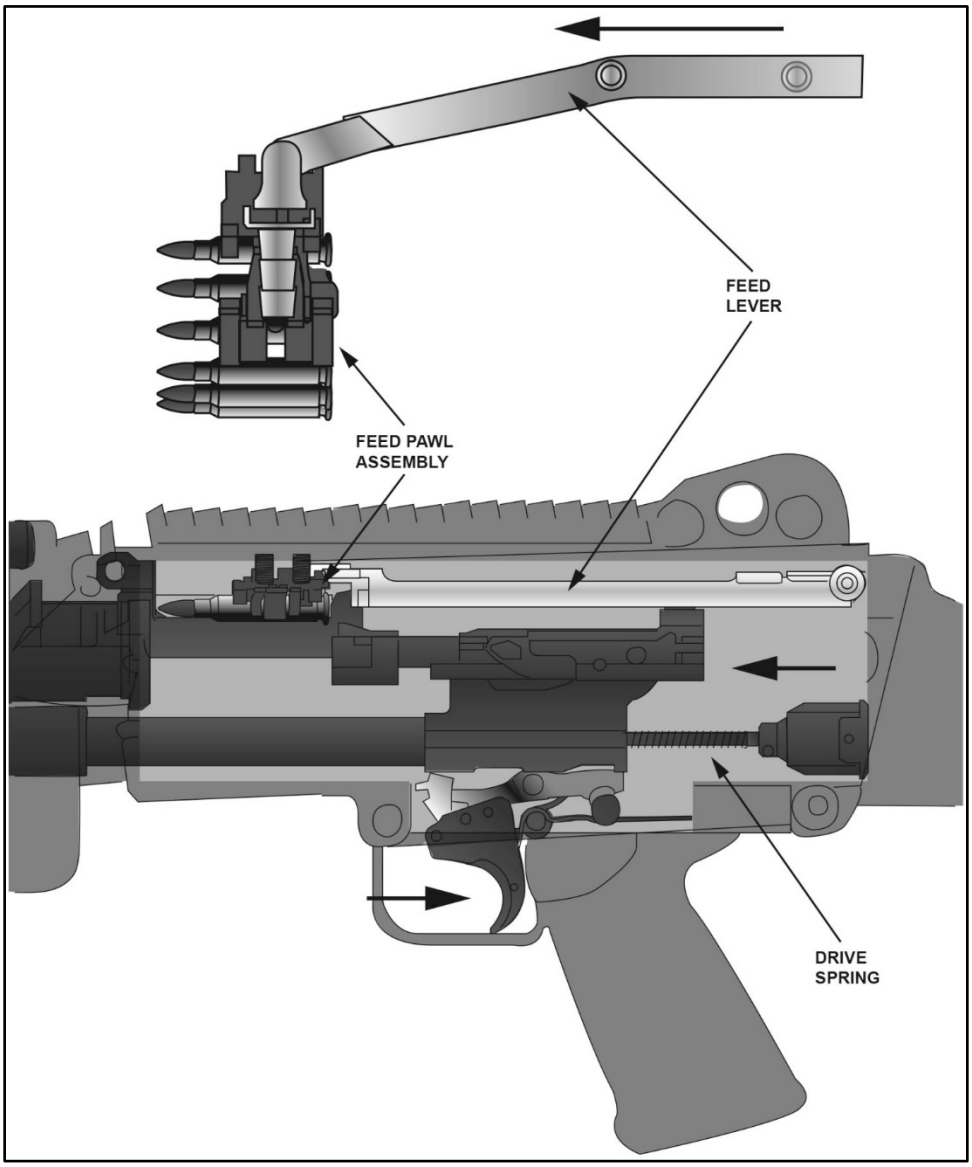



**Figure 2-2. Feeding**

## CHAMBERING

2-12. As the bolt travels forward, the stripping lug engages the rim of the round. The pressure of the front and rear cartridge retaining pawl holds the round so that positive contact is made with the stripping lug of the bolt. The front cartridge retaining pawl prevents forward movement of the link as the round is stripped from the belt. The stripping lug carries the round forward. The chambering ramp causes the nose of the round to

be cammed downward into the chamber. When the round is fully seated in the chamber, the extractor snaps over the rim of the round and the ejector on the rail inside the receiver is depressed. See figure 2-3.

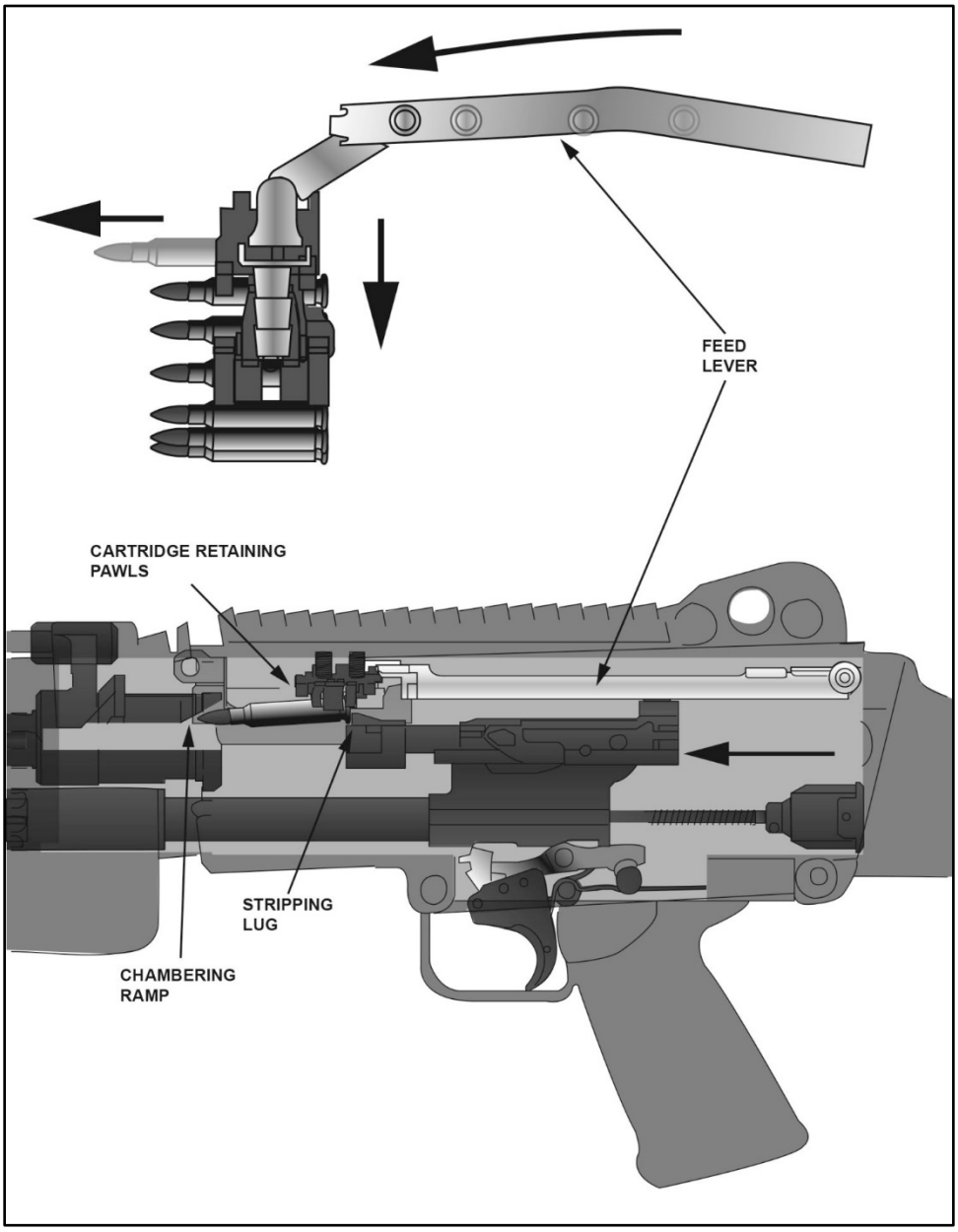



**Figure 2-3. Chambering**

## LOCKING

2-13. The bolt enters the barrel socket as the round is chambered. The locking lugs contact the bolt camming surfaces inside the barrel and start turning the bolt counterclockwise. The action of the bolt into the slide assembly, as the piston continues forward, turns the bolt to complete its counterclockwise rotation. Locking is now complete. See figure 2-4.

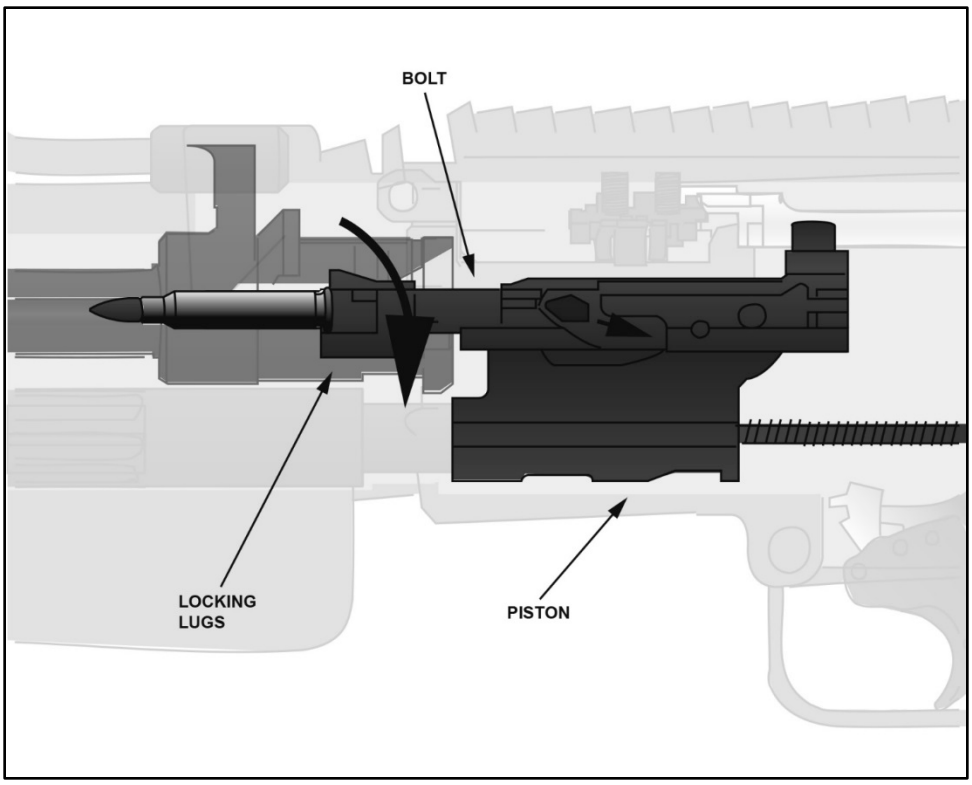



**Figure 2-4. Locking**

## FIRING

2-14. After the bolt is fully forward and locked, the piston continues to go forward, independent of the bolt, for a short distance. The slide assembly carries the firing pin through the face of the bolt. The firing pin strikes the primer of the round and the primer fires the round. See figure 2-5.

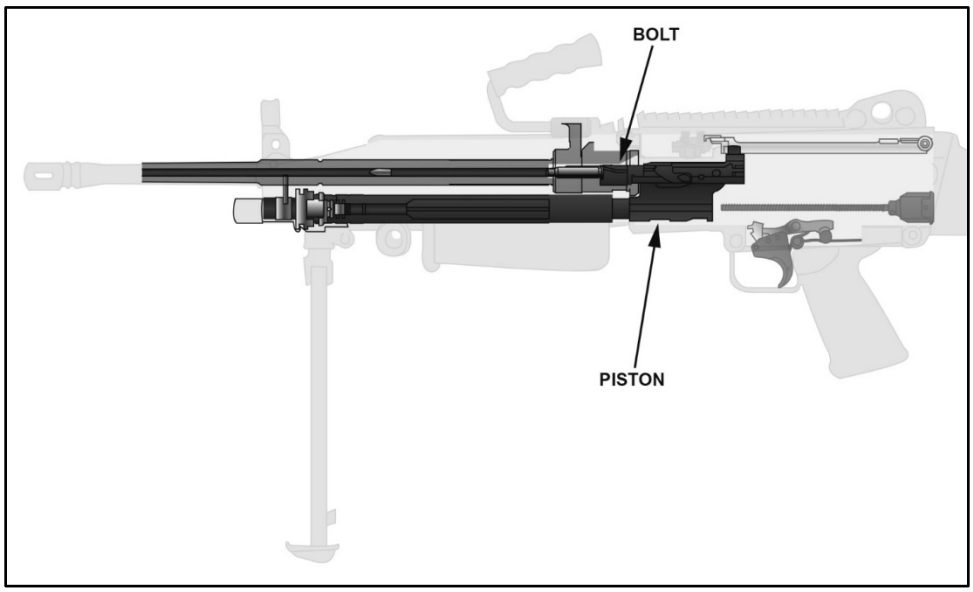



**Figure 2-5. Firing**

## UNLOCKING

2-15. After the round is fired and the bullet passes the gas port, part of the expanding gases go into the gas regulator. The rapidly expanding gases enter into the gas cylinder from the gas regulator, forcing the piston to the rear. As the piston continues to the rear, the slide assembly, also moving to the rear, causes the bolt to begin its clockwise rotation. The locking lugs of the bolt contact the bolt camming surfaces inside the barrel. As the bolt continues toward the rear, it completes the clockwise rotation. The rotation and movement to the rear unlocks the bolt from the barrel socket. See figure 2-6.

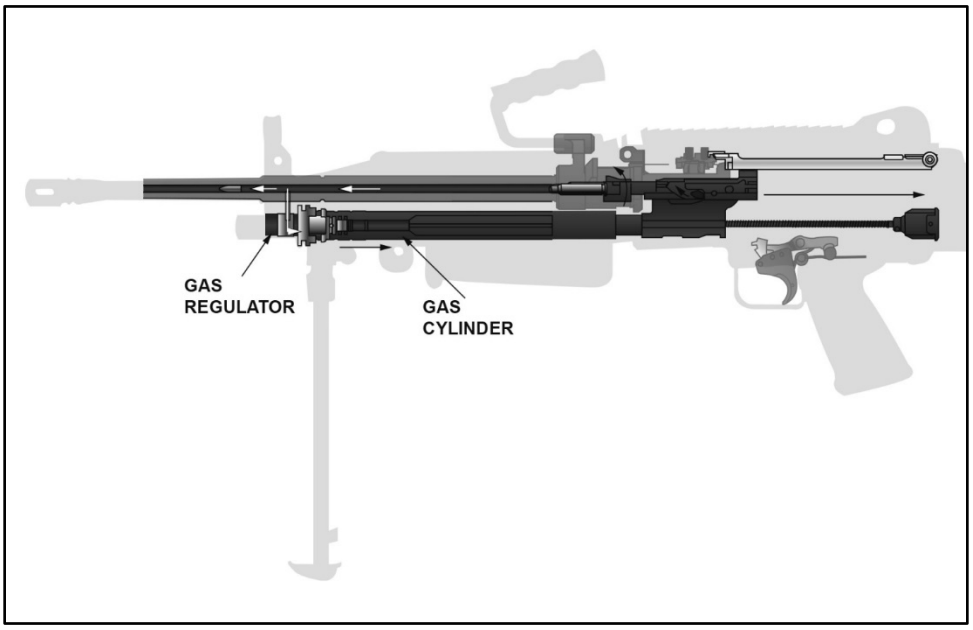



**Figure 2-6. Unlocking**

## EXTRACTING

2-16. Extracting begins during the unlocking cycle. As the piston and bolt move to the rear, the extractor will pull the cartridge case from the chamber. See figure 2-7.

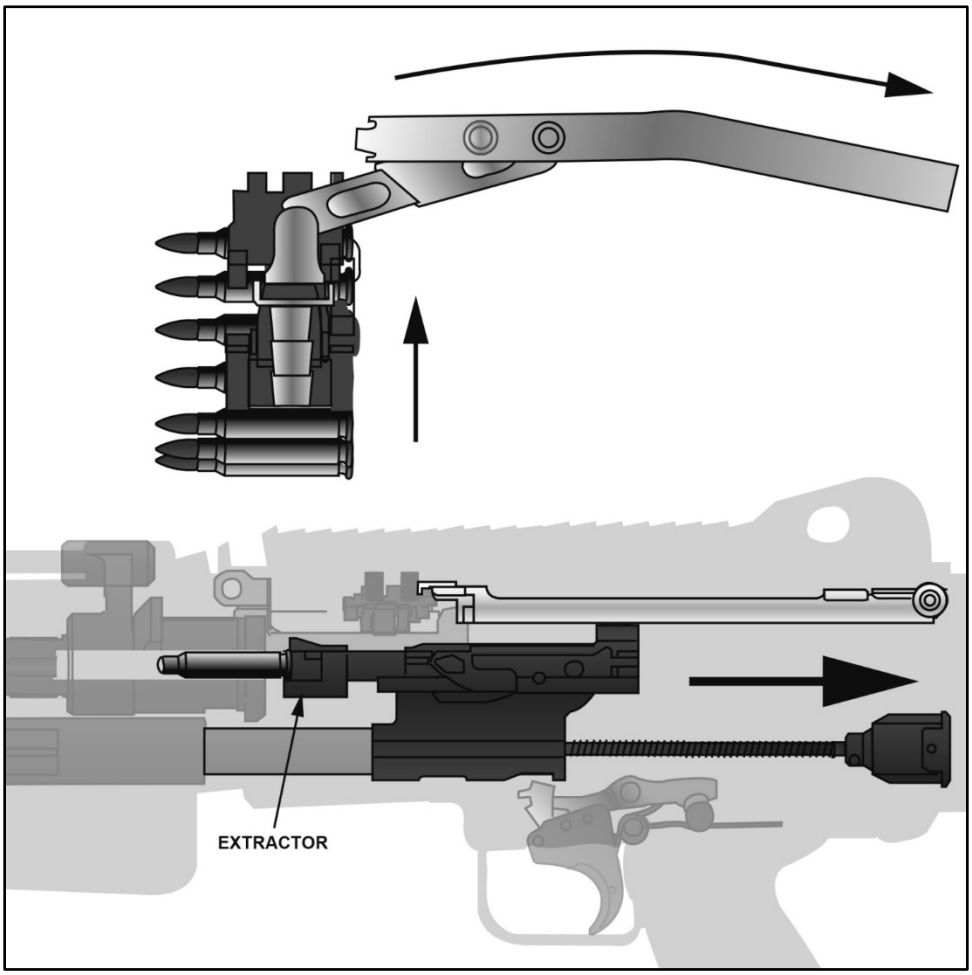



**Figure 2-7. Extracting**

## EJECTING

2-17. The bolt passes the ejector as the cartridge case is pulled from the chamber. As the bolt presents the ejector to the bolt face, the cartridge impacts the ejector. The extractor continues to grip the right side of the cartridge and causes it to spin from the weapon through the ejection port. The empty belt links are forced off the right side of the feed tray by the next round being positioned for feeding. See figure 2-8.

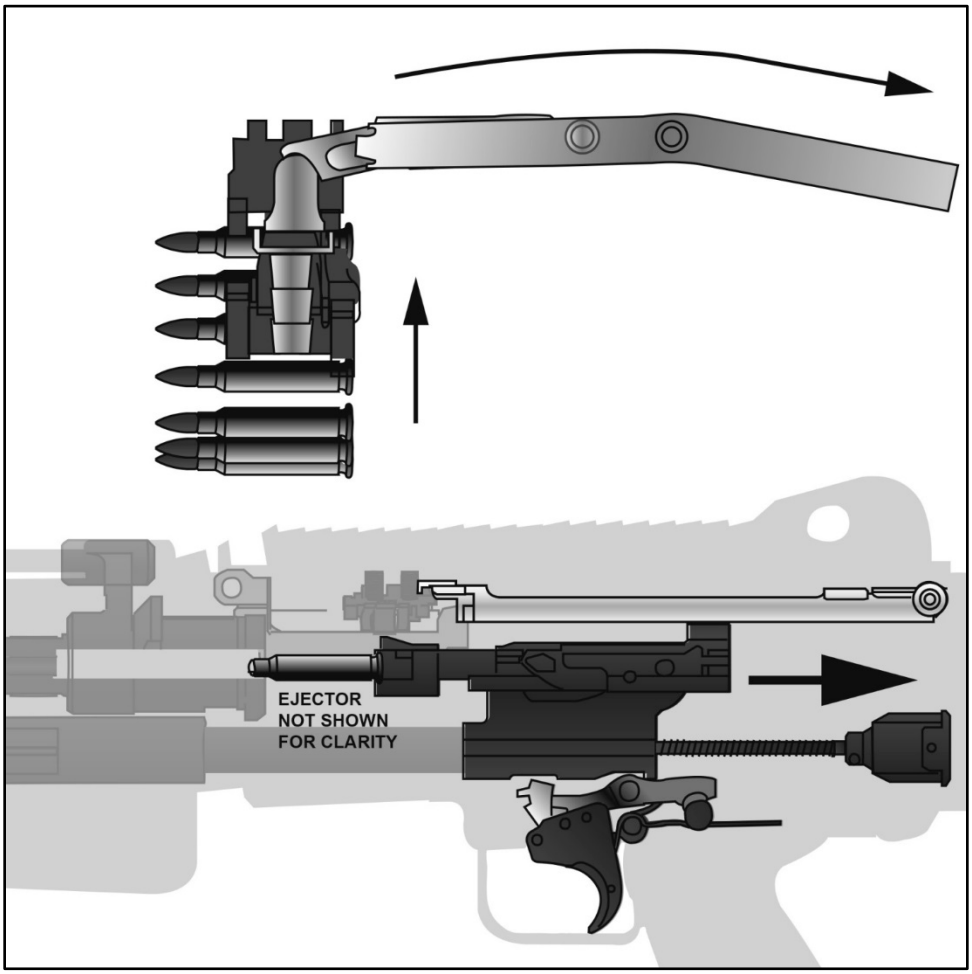



**Figure 2-8. Ejecting**

## COCKING

2-18. The recoiling piston assembly retracts the slide and firing pin, allowing the bolt to return to the extended position after unlocking. As long as the trigger is held to the rear, the M249 light machine gun will continue to complete the eight steps of functioning automatically. When the trigger is released and the sear engages the sear notch of the piston assembly, the cycle of functioning is stopped and the weapon is cocked. See figure 2-9.

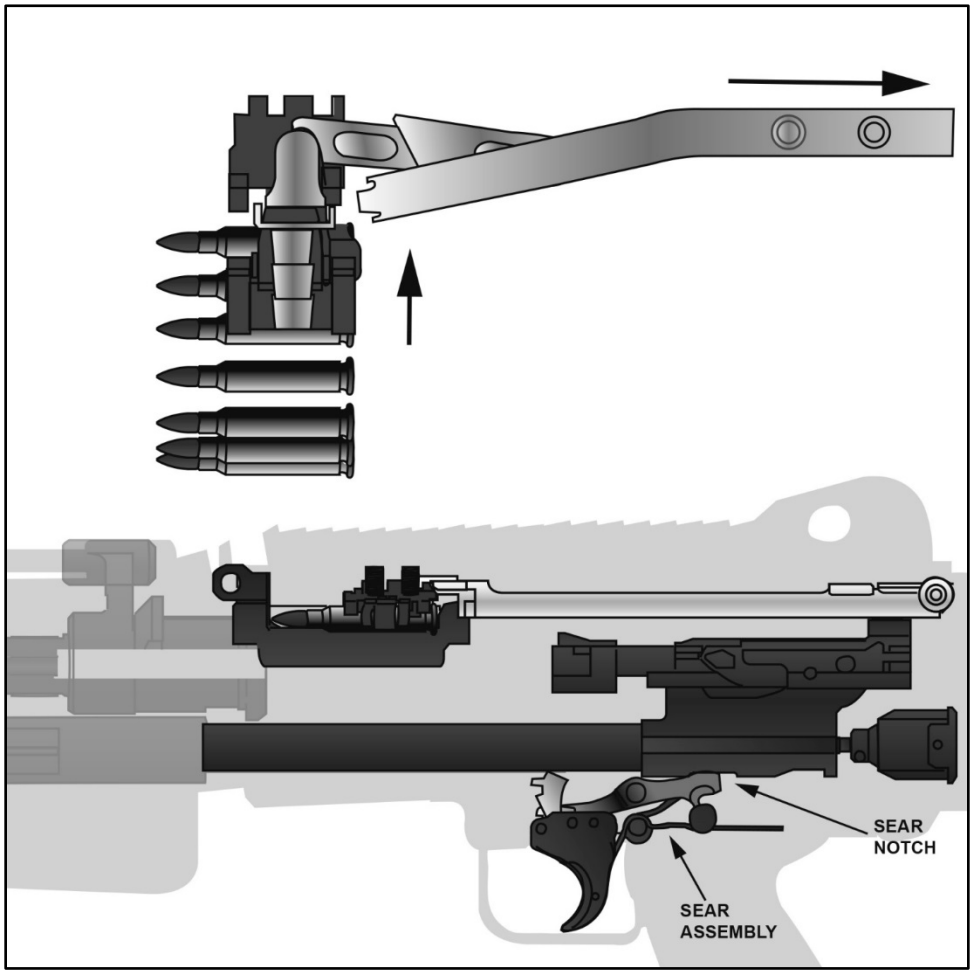



**Figure 2-9. Cocking**

# COOLING

2-19. Cooling is the process of dissipating heat from the weapon during firing. Although not part of the cycle of functioning, cooling the weapon during firing is critical to ensure the weapon continues to operate efficiently. Firing a round generates heat and pressure within the chamber and bore, which radiates outward through the metal of the barrel.

2-20. Burning propellant powders raises the temperature of the weapon to over one thousand degrees Fahrenheit. Some of the heat produced during firing is retained in the chamber, bore, and barrel during firing and poses a significant hazard to the firer. How the weapon absorbs the heat and dissipates or removes the heat is a function of engineering and design. The M249 weapon system must have a means to radiate the heat outward, away from the barrel, to allow continuous firing.

2-21. There are three methods to reduce the thermal stress on a weapon. The M249 series of weapons uses all three of these methods to varying degrees to cool the chamber, bore, and barrel to facilitate continuous operation. These three methods of cooling are radiation, conduction, and convection.—

## RADIATION COOLING

2-22. Radiation cooling allows for the dissipation of heat into the surrounding cooler air. Radiation cooling is the least efficient means of cooling, but is common to most small arms weapons,

## CONDUCTION COOLING

2-23. Conduction cooling occurs when a heated object is in direct physical contact with a cooler object. Conduction cooling on a weapon usually results when high chamber operating temperatures transfer into surrounding surfaces such as the barrel and receiver of the weapon. The transfer from the chamber to the cooler metals has the net effect of cooling the chamber. Thermal energy is then carried away by other means, such as radiant cooling, from these newly heated surfaces.

## CONVECTION COOLING

2-24. Convection cooling requires the presence of a moving air current. The moving air has greater potential to carry away heat. The hand guards and adaptive rail system are designed to facilitate air movement. The heat shield reflects heat energy away from the hand guard and back towards the barrel. The net effect is an updraft that brings the cooler air in from the bottom. The process establishes a convection cycle as heated air is continually replaced by cooler air.

***Note.*** Weapons that fire from the open bolt position have distinct advantages. The heated cartridge case is extracted and expelled immediately from the weapon as the bolt moves to the rear removing the heat source. The barrel is open at both ends when the bolt remains locked to the rear allowing for faster cooling of the barrel due to air circulation. The system does not place a round into the hot chamber except when actually firing. This reduces the potential for a cookoff. A cookoff is a round that spontaneously ignites due to residual heat in the chamber.

2-25. Soldiers should be aware of the principles of the weapon's cooling methods direct effects on their line of sight when viewing a target through an aiming device. Dissipating heat along the length of the barrel can create a mirage effect within the line of sight which can cause a significant error to the true point of aim when using magnified optics.

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## Chapter 3

# Aiming Devices

Every weapon has a fixed or attached device for aiming. Soldiers must be familiar with the various aiming devices, how they operate, and how to employ them correctly for the best effect. Chapter 3 provides the principles of operation of the most widely available aiming devices, and provides general information concerning their capabilities, function and use.

An aiming device is used to align the Soldier, the weapon, and the target to make an accurate and precise shot. Each aiming device functions in a different manner. To employ the weapon system to its fullest capability, the Soldier must understand how their aiming devices function.

Different types of aiming devices are useful in different settings. The main categories of devices include the iron sight (leaf sight), thermal weapon sight (TWS), and available pointing devices.

## FUNCTIONS

3-1. Soldiers use an aiming device to align themselves, the weapon, and the target to make an accurate and precise shot. Each aiming device functions in a different manner. The Soldier must understand how the aiming device functions to employ the weapon system to its fullest capability.

3-2. The following aiming devices are described within this chapter:

- Iron. The iron sight represents the mechanical sighting system available on the weapon. The mechanical sighting system for the M249 consists of the rear aperture and the front sight post.
- Optics. The optics aiming devices are predominantly for day firing with limited night capability. The available optic found within this manual is the machine gun optic (MGO).
- Thermal. Thermals are electronic sighting systems that provide a view of the field of view based on temperature variations. The numerous variants of thermal optics are grouped into one type, which is the thermal weapon sight (TWS).
- Pointer, illuminator, laser. The pointer, illuminator, laser aiming devices use either a laser beam, flood light, or other light to aim the weapon at the target. The light machine gun uses four types of pointers, illuminators, and lasers listed below:
  - Infrared aiming light.
  - Advanced Target Pointer/Illuminator/Aiming Light (ATPIAL).
  - Dual Beam Aiming Laser–Advanced (DBAL-A2).
  - Illuminator, integrated, small arms (STORM).

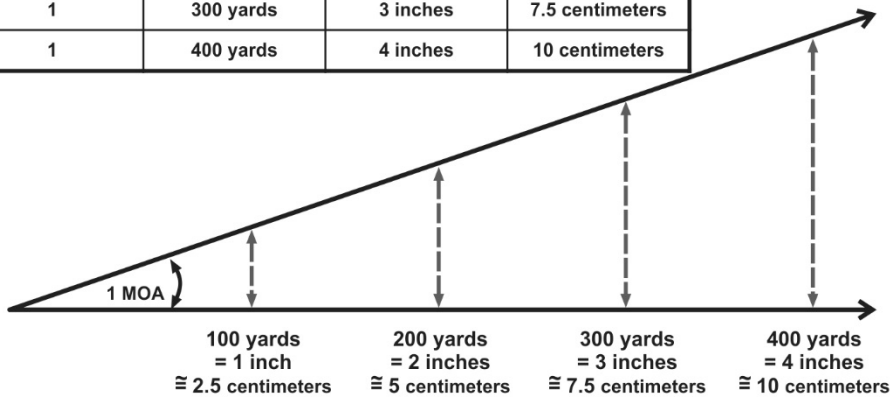
## UNITS OF ANGULAR MEASUREMENT

3-3. Two major units of angular measurement the Army uses: milliradians (mils) and minutes of angle (MOA). Mils and MOAs describe a measurement of accuracy when firing a weapon, system, or munition. Mils and MOAs typically include the accuracy of a specific weapon, the performance of ammunition, and the ability of a shooter to fire the weapon.

## MINUTE OF ANGLE

3-4. A MOA is an angular unit of measurement equal to 1/60th of a degree (see figure 3-1). The most common use of MOA is to describe the distance of change required when zeroing a weapon. One MOA equals 1.047 inches per 100 yards. For most applications, a Soldier can round this to 1 inch at 100 yards or 1.1 inches at 100 meters to simplify their arithmetic.

| MOA | At Distance | Equals | |
|---|---|---|---|
| 1 | 100 yards | 1 inch | 2.5 centimeters |
| 1 | 200 yards | 2 inches | 5 centimeters |
| 1 | 300 yards | 3 inches | 7.5 centimeters |
| 1 | 400 yards | 4 inches | 10 centimeters |




Angle dimension exaggerated for clarity. Examples are not to scale. Centimeter (cm) conversions are approximate.

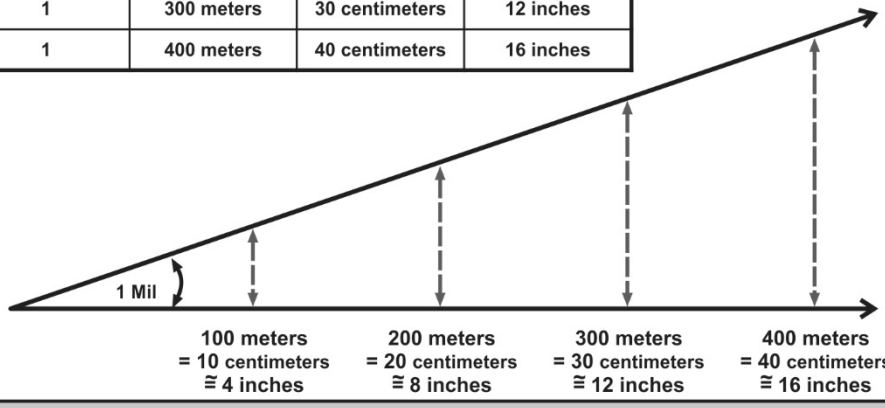
| Minute of Angle (MOA) Unit of Measurement | |
|---|---|
| Degree = 60 MOA | 360 degrees x 60 MOA = 21,600 MOA |
| Circle = 360 degrees | 1 MOA at 100 yards = 1 inch. |
| Smaller measurements of an MOA are described in fractions (such as 1/2 MOA), not seconds. | |

**Figure 3-1. Minute of angle example**

## MILS

3-5. The mil is a common unit of angular measurement for direct fire and indirect fire applications (see figure 3-2).

| Mil | At Distance | Equals | |
|---|---|---|---|
| 1 | 100 meters | 10 centimeters | 4 inches |
| 1 | 200 meters | 20 centimeters | 8 inches |
| 1 | 300 meters | 30 centimeters | 12 inches |
| 1 | 400 meters | 40 centimeters | 16 inches |




| MILS Unit of Measurement | |
|---|---|
| Degree = 17.78 mils | 360 degrees x 17.78 mils |
| Circle = 360 degrees | 1 mil at 100 meters = 10 centimeters. |

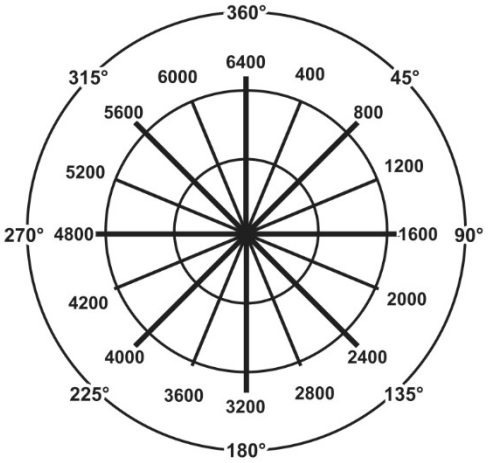



**Figure 3-2. Mil example**

3-6. Soldiers use the mil to degree relationship to describe military reticles, ballistic relationships, aiming devices, and on a larger-scale map reading and indirect fire.

## BALLISTIC RETICLE

3-7. A ballistic reticle is a series of fine lines in the eyepiece of an optic, such as an MGO or TWS used as a measuring scale with aiming or alignment points. Reticles use either mils or MOA for the unit of measurement. (See figure 3-3.)

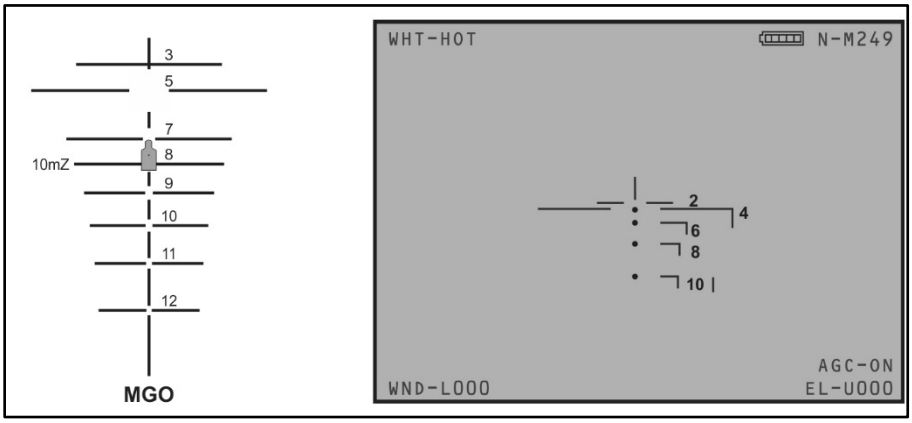



**Figure 3-3. Machine gun optic reticle and thermal reticle examples**

## STADIA RETICLE (STADIAMETRIC RETICLE)

3-8. Commonly used in the thermal weapon sight, a stadia reticle provides a means of rapidly determining the approximate range to target of a viewed threat based on its standard dimensions. The stadia reticle (sometimes referred to as stadiametric or choke sight) can provide approximate range to target information using width or height of a viewed dismounted target using standard threat dimensions (see figure 3-4).

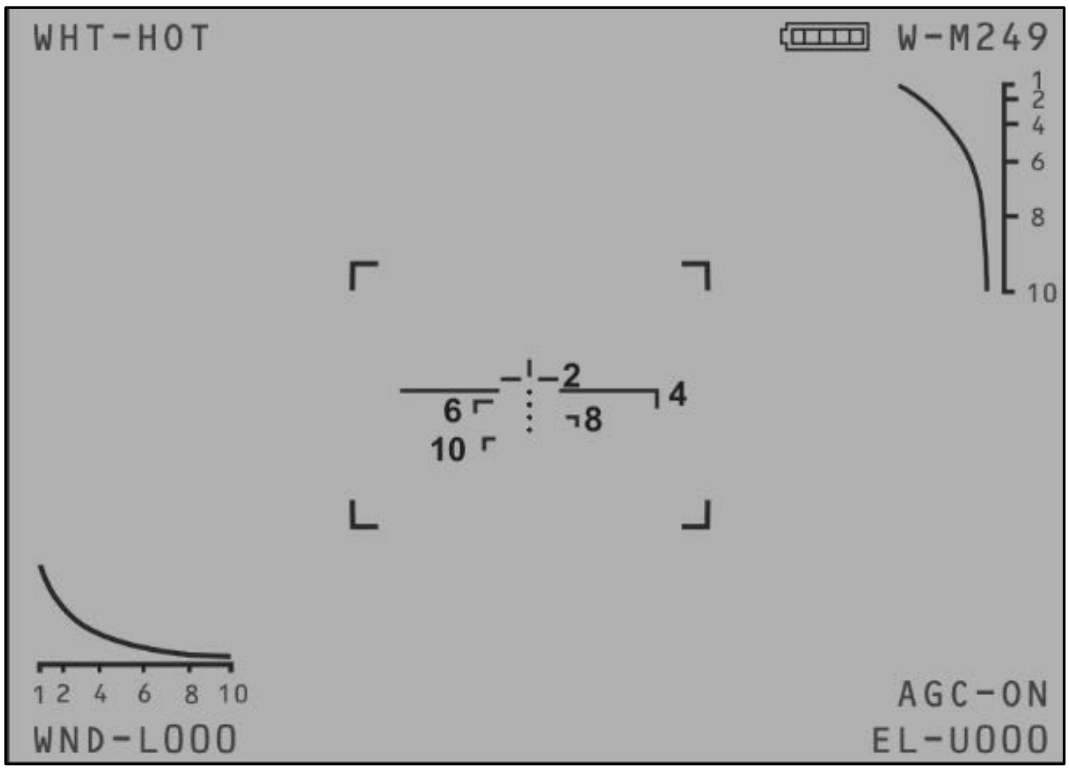



**Figure 3-4. Stadia reticle example**

3-9. The M249 reticle has two stadia reticles within the thermal weapons sight—vertical and horizontal as described below:

- Vertical stadia. The vertical stadia is to the right of the center portion of the sight picture. Soldiers use the vertical stadia to evaluate the range to target of a standing dismounted threat.
- Horizontal stadia. The horizontal stadia is to the left of the center portion of the sight picture. Soldiers can use the horizontal stadia to evaluate the range to target threat based on the width of a tank.

3-10. The thermal sight has a wide field of view and a narrow field of view (see figure 3-5 and figure 3-6, page 3-6).

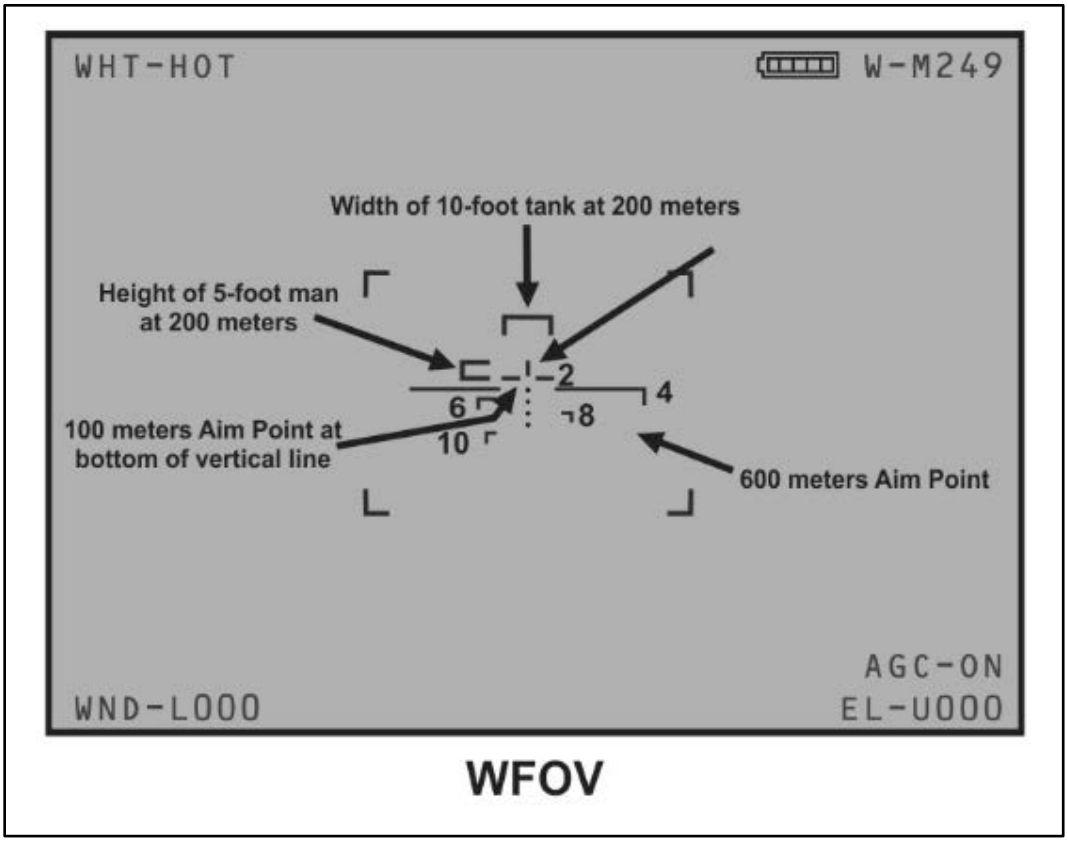



**Figure 3-5. Thermal weapons sight, wide field of view reticle, example**

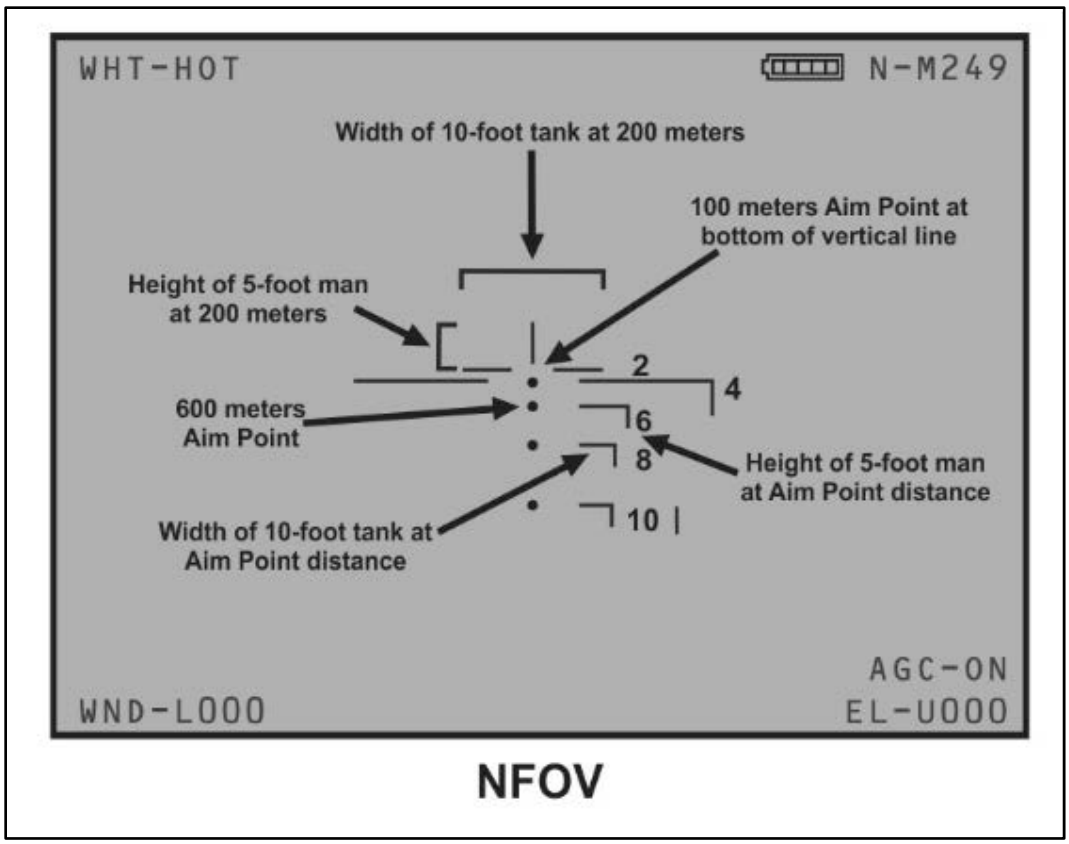



**Figure 3-6. Thermal weapons sight, narrow field of view reticle, example**

# ELECTROMAGNETIC SPECTRUM

3-11. Soldiers must understand how thermal and other optics function and aid in the detection process, but more appropriately, what the device can see. Each device develops a digital representation of the scene or view it observes based on what frequencies or wavelengths it detects within the electromagnetic spectrum. Thermal devices see differences in heat.

- Thermal optics equipment operates in the mid- and far-wavelength of the infrared band, which is the farthest of the infrared wavelengths from visible light. Thermal optics cannot translate (see) visible light. Thermal optics cannot see infrared equipment such as infrared strobe lights, infrared chemical lights, illuminators, or laser pointers. Thermal optics can identify emitted radiation only in the form of heat (see figure 3-7, page 3-7).
- Image intensifier (I2) equipment, such as night vision devices, use the near area of the infrared spectrum that is closest to the frequencies of visible light. Image intensifiers use visible light to create a digital picture of the scene as well. Image intensifier systems cannot see or detect heat or heat sources.

3-12. Generally, the sights operate on the principles of convection, conduction, and radiation (mentioned in chapter 2 of this publication). The sight picks up or translates the infrared wavelength (or light) that the target scene emits through one of those three methods.

3-13. Soldiers must be aware that these optics have difficulty imaging through the elements listed below:

- Rain, which absorbs the infrared emitted by the target making it difficult to see.
- Water acts as a mirror and generally reflects infrared providing a false thermal scene.
- Glass acts similar to water interfering with the sensor's ability to accurately detect emitted radiation behind the glass.

3-14. Situations where infrared can see better are listed below:

- Smoke will not obscure a target unless the chemical obscurant is extremely hot and dense, or if the target is sitting on top of the smoke source.
- Dust may interfere with the accurate detection of the emitted thermal signature due to dust and debris density between the sensor and the target scene. Dust typically does not obscure the infrared signature unless its temperature is similar to the target's temperature.

3-15. Figure 3-7, depicts the areas of the electromagnetic spectrum. The figure details the various wavelengths within the spectrum where the aiming devices, night vision devices, and equipment operate. Figure 3-7 illustrates where these items can and cannot see the others, respectively, within their operating range.

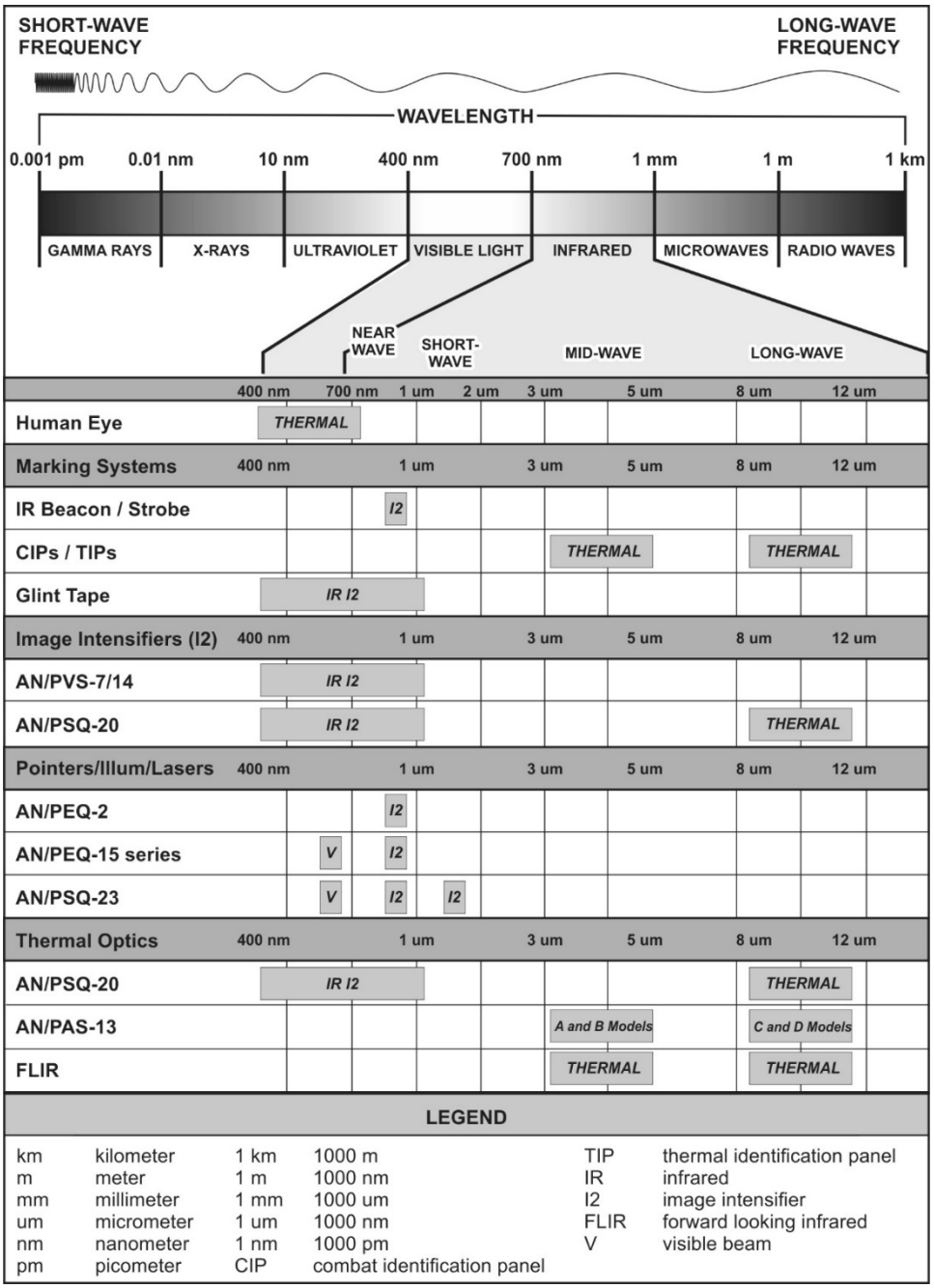



**Figure 3-7. Electromagnetic spectrum**

# OPTICS

3-16. Optics are sighting aids for weapons that provide enhanced aim point reticles. The optics may include magnified fields of view. Optics are specific to day operations, although they may be used during limited visibility or night operations. They do not have any method of enhancing low light conditions.

3-17. Optics enhance the Soldier's ability to engage targets accurately and at extended ranges. The available optic for mounting on the M249 light machine gun are—

- Iron sight.
- M145 straight telescope. (Refer to TM 9-1240-415-13&P for the technical data, proper mounting and zeroing this equipment.)

## IRON SIGHT

3-18. The M249's front sight is hooded and semifixed. The iron sight uses the front sight post to create the proper aim. Soldiers use the front sight post centered in the rear aperture. The front sight is only adjustable by the unit armor. The rear sight assembly mounts on the top of the cover and feed mechanism assembly. The rear sight assembly includes adjustments for both azimuth (wind) and elevation. Appendix F and the respective weapon's technical manual has specific instructions for zeroing these aiming devices.

3-19. The elevation knob drum on the rear sight aperture has range settings from 300 meters to 1000 meters. Each click of the elevation knob moves the sight aperture 180 degrees or one-half turn. Each click of the elevation knob equals a one-half mil change in elevation, which is 0.5 cm at 10 meters. The gunner uses the windage knob to adjust windage. Each click of the knob also equals a one-half mil change, which is 0.5 cm at 10 meters. An indexed, sliding scale allows the gunner to center the rear sight aperture. Each index line is equal to a half-mil change in direction or a half-cm change of impact at 10 meters. See figure 3-8.

| IRON SIGHT | | |
|---|---|---|
|  | | |
| **FUNCTION** | **SINGLE CLICK** | |
| ZERO WINDAGE | M249 | White Line |
| ZERO ELEVATION | M249 | 400 Meters |
| WINDAGE | M249 | 0.5 cm at 10 Meters |
| ELEVATION (RANGE) | M249 | 0.5 cm at 10 Meters |
| | **LEGEND** | |
| cm centimeters | | |

**Figure 3-8. Iron sight**

## MACHINE GUN OPTIC, M145

3-20. The M145 machine gun optic (MGO) is a telescopic sight. The telescope magnifies targets by 3.4 times. The telescope shows the strike of the round more clearly and allows more accurate shooting. In low light conditions, looking through the sight without the laser filter allows for more accurate target detection than with the naked eye. The lens cover protects the lens when the gunner transports or stores the sight. An O-ring keeps moisture out of the battery.

3-21. The M145 straight telescope must remain matched with the same weapon and attached at the same slot in the rail system. Otherwise, it must be rezeroed. If the MGO must be removed for storage, Soldiers must record the serial number and the rail slot to retain zero.

***Note***. The weapon must be rezeroed if the MGO is not returned to the same rail slot on the adaptive rail system.

### Advantages

3-22. The telescope has an 8.2-mm diameter exit pupil, which provides excellent vision in low light levels and allows for rapid target acquisition. The adjustments on brightness allow the Soldier to have the desired brightness from full daylight to blackout conditions.

3-23. The zeroing adjustment increments in both windage and elevation are 2.5 mm at 10 meters for each detent (click of movement) and five inches (127 mm) at 500 meters.

3-24. The stadia reticle pattern has a ballistic drop compensation from 300 meters to 1200 meters.

### Disadvantages

3-25. The telescope has an eye relief of approximately three inches (70 mm). If the eye relief is not correct, the image size is reduced.

3-26. The optic's ocular view is limited when engaging targets in close quarters engagements.

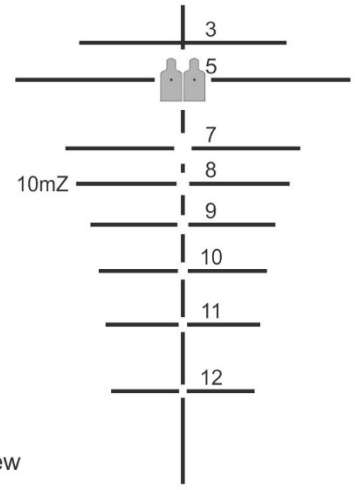
3-27. Figure 3-9, page 3-10, illustrates the M145 straight telescope sight.



| M145 STRAIGHT TELESCOPE | | |
|---|---|---|
| DIMENSIONS | | |
| LENGTH | 7.0 in | 17.8 cm |
| BATTERY LIFE | 175 hours average (New Battery) | |
| WEIGHT | 24 oz | 681 g |

| FUNCTION | SINGLE CLICK | |
|---|---|---|
| | 10 METERS | 500 METERS |
| ZERO WINDAGE | 2.5 mm | 5 inches |
| ZERO ELEVATION | 2.5 mm | 5 inches |

**RETICLE**




**NOTE:** 500 m reticle view

**LEGEND**

| | | | | | |
|---|---|---|---|---|---|
| cm | centimeters | in | inches | mZ | meter zero |
| g | grams | mm | millimeters | oz | ounces |

**Figure 3-9. Machine gun optic reticle**

# THERMAL SIGHTS

3-28. Thermal sights are target acquisition and aiming sensors that digitally replicate the field of view based on an estimation of the temperature. Thermal sights use advanced forward-looking infrared technology that identifies the infrared emitted radiation (heat) of a field of view and translates those temperatures into a gray- or color-scaled image. The TWS is capable of target acquisition under conditions of limited visibility, such as darkness, smoke, fog, dust, and haze. The TWS operates effectively during the day and night.

3-29. The TWS is composed of five functional groups (see figure 3-10).

- Objective lens. The objective lens receives infrared light emitting from an object and its surroundings. The objective lens magnifies and projects the infrared light.
- Detector assembly. The detector assembly senses the infrared light and coverts it to a video signal.
- Sensor assembly. The sensor electronics processes the video for display on the liquid crystal display (LCD) array in the field of view.
- Liquid crystal display array and eyepiece. The LCD array provides the infrared image along with the reticle selected. The light from the LCD array is at the eyepiece.
- User controls. The control electronics allows the user to interface with the device to adjust the contrast, thermal gain, sensitivity, reticle display, and magnification.

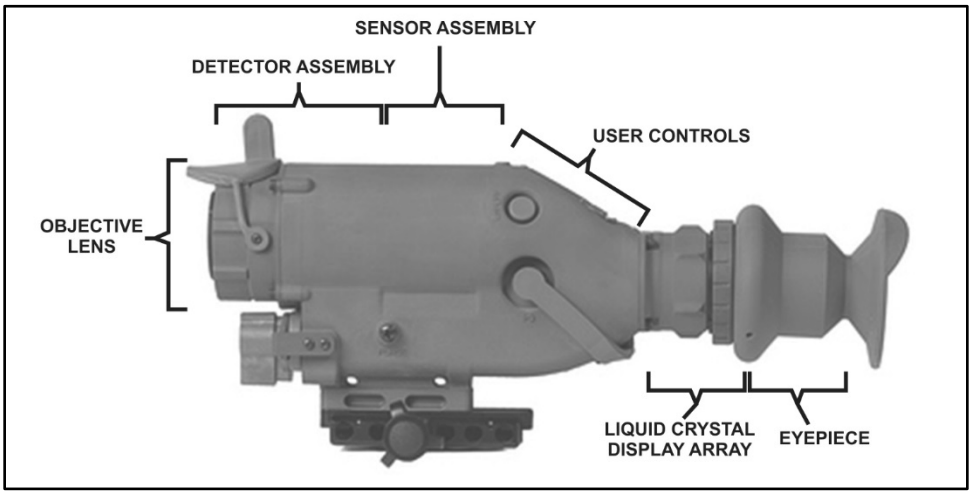



**Figure 3-10. Thermal weapon sight example**

3-30. A small detector used in thermal sensors or optics to identify infrared (IR) radiation with wavelengths between 3 and 30 um (micrometer). The thermal optic calculates and processes the thermal scene into a correlating video image signal based on the temperature identified. The optics can differentiate thermal variations of 1 degree Celsius of the viewable scene. The optics variations generate a corresponding contrasting gradient that develops a thermal representation on the LCD screen in the eyepiece.

## AN/PAS-13 SERIES OF WEAPON THERMAL SIGHTS

3-31. There are several versions of weapons thermal sights available for use across the force. Soldiers must be familiar with their model and version of the weapon thermal sight. They must know the specific procedures for alignment and operation of their weapon thermal sight. The official model nomenclature identifies the various models and versions as listed below:

- Version 1 (v 1). Light Weapons Thermal Sight (LWTS).
- Version 2 (v 2). Medium Weapons Thermal Sight (MWTS).
- Version 3 (v 3). Heavy Weapons Thermal Sight (HWTS).

3-32. Weapons thermal sights are silent, lightweight, and compact, and have durable battery-powered infrared imaging sensors that operate with low battery consumption. (See figure 3-11 on page 3-12.)



| VERSION | | |
|---|---|---|
| **Light Weapon Thermal Sight (LWTS)** | **Medium Weapon Thermal Sight (MWTS)** | **Heavy Weapon Thermal Sight (HWTS)** |
| AN/PAS-13C (v1) | AN/PAS-13C (v2) | AN/PAS-13C (v3) |
| AN/PAS-13D (v1) | AN/PAS-13D (v2) | AN/PAS-13D (v3) |
| AN/PAS-13E (v1) | AN/PAS-13E (v2) | AN/PAS-13E (v3) |

**NOTE:** The MWTS does not include the ballistic reticle for the M4- or M16-series weapons.

**Figure 3-11. Weapon thermal sights by version**

## ADVANTAGES

3-33. Military grade mil radiant s are designed with the following advantages:

- Small and lightweight.
- Real-time imagery. Devices provide real-time video of the thermal scene immediately after power on.
- Long-lasting battery life. Low power consumption over time.
- Reliable. Long mean time between failures (also known as the MTBF).
- Quiet. The lack of a cooling element allows for a very low operating noise level.
- One optic fits on multiple weapons. The adaptive rail system (ARS) rail mounting bracket allows for the same optic to be used on other weapons.
- The F and G models attach to the front of other aiming devices to improve their capabilities and to eliminate the zeroing procedures for the device.

## DISADVANTAGES

3-34. Weapons thermal sight devices have limitations that Soldiers should take into consideration, particularly during combat operations. The primary disadvantages are:

- Cannot interpret (see) multispectral infrared. Thermal systems view a specific wavelength for emitted radiation (heat variations) and do not allow viewing of all aiming and marking devices at night.
- Reliance on rechargeable batteries and charging stations. Although the batteries are common and have a relatively long battery life, additional equipment is required to charge them. If common nonrechargeable (alkaline) batteries are used, typically a separate battery adapter is required.
- Cannot interpret thermal signatures behind glass or water effectively.
- Cannot always detect friendly marking systems worn by dismounts.

# POINTERS, ILLUMINATORS, LASERS

3-35. Pointers, illuminators, and laser devices for small arms weapons emit a collimated beam of infrared light for precise aiming and a separate infrared beam for illumination. The devices operate in one single mode at a time as selected by the user. A selector switch on the device or a remote mechanism installed on the weapon activates the laser. The basic two modes or functions are:

- Pointer. When used as a pointer or aiming device, a small, pinpoint beam is emitted from the device. The infrared beam provides an infrared visible point when it strikes an object or target. The infrared beam operates in the 400- to 800-nanometer wavelength and can be seen only by I2 optics, such as the AN/PVS-7 or -14 night-vision devices.
- Illuminator. Typically used to illuminate a close quarters area as an infrared flood light. The illuminator provides a floodlight effect for the Soldier when used in conjunction with I2 night vision devices.

***Note***. Laser is an acronym for light amplified stimulated emitted radiation, but is predominantly used as a proper noun.

3-36. The following devices (see table 3-1) are the most common laser pointing devices available for use on the M249 weapon.

**Table 3-1. Laser aiming devices for the M249 series**

| Laser Aiming Device | Device Name | Reference |
|---|---|---|
| AN/PEQ-2A | Target Pointer, Illuminator, Aiming Light (TPIAL) | TM 9-5855-1915-13&P |
| AN/PEQ-15 | Advanced Target Pointer/Illuminator/Aiming Light (ATPIAL) | TM 9-5855-1914-13&P |
| AN/PEQ-15A | Dual Beam Aiming Laser–Advanced 2 (DBAL–A2) | TM 9-5855-1912-13&P |
| AN/PSQ-23 | Illuminator, Integrated, Small Arms (STORM) | TM 9-5855-1913-13&P |

***Note***. The ATPIAL, DBAL-A2, and STORM have collocated infrared and visible aiming lasers. A single set of adjusters move both aiming beams. Although the aiming lasers are collocated, Soldiers should zero the laser they intend to use as their primary pointer to ensure accuracy and consistency during operation.

## AN/PEQ-2A TARGET POINTER, ILLUMINATOR, AIMING LIGHT (TPIAL)

3-37. The AN/PEQ-2A aiming device is a Class IIIB laser devices that emit a collimated beam of infrared light for precise aiming and a separate infrared beam for illumination of the target or target area (see figure 3-12, page 3-14). Both beams can be independently zeroed to the weapon and to each other. The beams can be operated individually or in combination in both high and low power settings.

***Note***. The infrared illuminator has an adjustable bezel to vary the size of the illumination beam based on the size and distance of the target.

3-38. The aiming devices are used with night observation devices. Soldiers can use the devices as handheld illuminators or pointers or they can mount the devices on the weapon with the included brackets and accessory mounts. In the weapon-mounted mode, the aiming devices can be used for direct fire and to illuminate and designate targets.

3-39. Pressing on either the ON/OFF switch lever or the button on the optional cable switch activates the aiming light. Either switch connects power from two AA batteries to an internal electronic circuit which

produces the infrared laser. Internal lenses focus the infrared light into a narrow beam. Rotating the mechanical adjusters with click detents controls the direction of the beam. The adjusters zero the aiming light to the weapon.

**CAUTION**

A safety block is provided for training purposes to limit the operator from selecting high power modes of operation.

3-40. The information in figure 3-12 can be found in the equipment's technical manual for Soldier reference.



| TM 9-5855-1915-13&P | | |
|---|---|---|
| **DIMENSIONS** | | |
| **LENGTH** | 6.4 in | 16.3 cm |
| **WIDTH** | 2.8 in | 7.1 cm |
| **HEIGHT** | 1.2 in | 3 cm |
| **WEIGHT** | 9.5 oz | 269 g |

| **POWER** | |
|---|---|
| **BATTERY LIFE** | 100 hours >32° |
| | 36 hours <32° |
| **POWER SOURCE** | 2 each AA batteries |

| **MODE OF OPERATION** | | | |
|---|---|---|---|
| **MODE** | **MARKINGS** | **TGT LASER** | **ILLUM LASER** |
| O | OFF | OFF | OFF |
| 1 | AIM LO | LOW POWER | OFF |
| 2 | DUAL LO | LOW POWER | LOW POWER |
| 3 | AIM HI | HIGH POWER | OFF |
| 4 | DUAL LO/HI | HIGH POWER | LOW POWER |
| 5 | DUAL HI | HIGH POWER | HIGH POWER |

| **LASER** | **DIVERGENCE** | **WAVELENGTH** |
|---|---|---|
| IR BEAM | 0.3 mRad | 820 to 850 nm |
| IR ILLUMINATOR | 3.0 mRad | 820 to 850 nm |

| **LEGEND** | | | | | | | |
|---|---|---|---|---|---|---|---|
| cm | centimeters | in | inches | mRad | milliradians | tgt | target |
| g | grams | IR | infrared | nm | nanometers | | |
| hi | high | lo | low | oz | ounces | | |

**Figure 3-12. AN/PEQ-2A**

## AN/PEQ-15 ADVANCED TARGET POINTER, ILLUMINATOR, AIMING LIGHT (ATPIAL)

3-41. The AN/PEQ-15 ATPIAL is a multifunctional laser that emits both a visible and infrared light for precise weapon aiming and target and area illumination. Soldiers can use the ruggedized system as a handheld illuminator or pointer or they can mount the system to weapons equipped with an M4- or M5-ARS (Military Standard [MIL-STD] 1913).

- Visible light can be used to boresight the device to a weapon without the need of night vision goggles. Users can select a visible red-dot aiming laser to provide precise aiming of a weapon during daylight or night operations.
- Infrared lasers emit a highly collimated beam of infrared light for precise weapon aiming. A separate infrared-illuminating laser can be adjusted from a flood light mode to a single point spot-divergence mode.

3-42. The lasers can be used as handheld illuminator pointers, or can be weapon-mounted with included hardware. The co-aligned visible and infrared aiming lasers emit through laser ports in the front of the housing. These highly capable aiming lasers allow for accurate nighttime aiming and system boresighting.

3-43. The AN/PEQ-15 has an integrated rail grabber molded into the body to reduce weight and additional mounting hardware. (Refer to TM 9-5855-1914-13&P for more information.)

**CAUTION**

The AN/PEQ-15 can be used during force-on-force training in the low power modes only. High power modes can be used on live-fire ranges exceeding 220 meters only.

3-44. The AN/PEQ-15, ATPIAL's (see figure 3-13, page 3-16) visible aiming laser provides for active target acquisition in low light conditions and close-quarters combat situations. The aiming laser allows users to zero using the borelight without using night observation devices. When used in conjunction with night observations devices, the infrared aiming and illumination lasers provide for active, covert target acquisition in low light or complete darkness.

3-45. The ATPIAL visible and infrared aiming lasers are co-aligned. A single set of adjusters moves both aiming beams and the user can boresight and zero using either aiming laser. The following information is an extract from the equipment’s technical manual for Soldier reference.



| TM 9-5855-1914-13&P | | |
|---|---|---|
| **DIMENSIONS** | | |
| **LENGTH** | 4.6 in | 11.7 cm |
| **WIDTH** | 2.8 in | 7.1 cm |
| **HEIGHT** | 1.9 in | 4.1 cm |
| **WEIGHT** | 7.5 oz | 213 g |

| **POWER** | |
|---|---|
| **BATTERY LIFE** | >6 hours in DUAL HIGH (DH) mode |
| **POWER SOURCE** | 1 each DL-123A, 3 volt |

**MODE OF OPERATION**

| POSITION | MODE | REMARKS |
|---|---|---|
| VIS AL | Vis Aiming Laser | Turns Visible Aim Laser On |
| O | OFF | Prevents inadvertent laser burst |
| P | Program | Sets the desired IR pulse rate |
| AL | AIM LOW | Sets Aiming Laser to Low Power |
| DL | DUAL LOW | Sets Aiming Laser and Illuminator to Low Power |
| AH | AIM HIGH | Sets Aiming Laser to High Power |
| IH | ILLUM HIGH | Sets IR Illuminator to High Power |
| DH | DUAL HIGH | Sets IR Aim and Illuminator to High Power |

| LASER | DIVERGENCE | WAVELENGTH |
|---|---|---|
| IR BEAM | 0.5 mRad | 820 to 850 nm |
| IR ILLUMINATOR | 1.0 to 105 mRad | 820 to 850 nm |
| VISIBLE AIMING | 0.5 mRad | 605 to 665 nm |

**LEGEND**

| | | | | | |
|---|---|---|---|---|---|
| AL | aiming laser | in | inches | nm | nanometers |
| cm | centimeters | IR | infrared | oz | ounces |
| g | grams | mRad | milliradians | vis | visibilty |

**Figure 3-13. AN/PEQ-15, ATPIAL**

## AN/PEQ-15A, DUAL BEAM AIMING LASER–ADVANCED 2 (DBAL-A2)

3-46. The AN/PEQ-15A, DBAL-A2 is a multifunctional laser device that emits infrared pointing and illumination light, as well as a visible laser for precise weapon aiming and target and area illumination. The visible and infrared aiming lasers are co-aligned enabling the visible laser to be used to boresight both aiming lasers to a weapon without the need for night vision devices. This ruggedized system can be used as a handheld illuminator/pointer or can be mounted to weapons equipped with an adapter rail system (MIL-STD-1913).

- Visible light can be used to boresight the device to a weapon without the need of night vision goggles. A visible red-dot aiming laser can also be selected to provide precise aiming of a weapon during daylight or night operations.
- Infrared lasers emit a tightly focused beam of infrared light for precise aiming of the weapon. A separate infrared illumination provides supplemental infrared illumination of the target or target area. The infrared illuminator has an adjustable bezel to vary the size of the illumination beam onto the size and distance of the target (flood to point divergence).
- The lasers can be used as hand-held illuminator pointers, or can be weapon-mounted with included hardware. These highly capable aiming lasers allow for accurate nighttime aiming and system boresighting.

3-47. The AN/PEQ-15A, DBAL-A2 visible aiming laser provides for active target acquisition in low light conditions and close quarters combat situations, and allows users to zero using the borelight without using night vision devices. When used in conjunction with night vision devises, its infrared aiming and illumination lasers provide for active, covert target acquisition in low light or complete darkness.

3-48. The DBAL-A2 visible and infrared aiming lasers are co-aligned. A single set of adjusters moves both aiming beams, and the user can boresight or zero using either aiming laser. The following information is an extract from the equipment's technical manual for Soldier reference (see figure 3-14, page 3-18).



| TM 9-5855-1912-13&P | | |
|---|---|---|
| **DIMENSIONS** | | |
| **LENGTH** | 3.5 in | 8.7 cm |
| **WIDTH** | 2.9 in | 7.4 cm |
| **HEIGHT** | 1.9 in | 4.8 cm |
| **WEIGHT** | 8 oz | 224 g |

| **POWER** | |
|---|---|
| **BATTERY LIFE** | >5.5 hours in IR DUAL HIGH mode |
| **POWER SOURCE** | 1 each DL-123A, 3 volt |

| **MODE OF OPERATION** | | |
|---|---|---|
| **POSITION** | **MODE** | **REMARKS** |
| AL | LOW POWER | Low power for aim laser |
| AH | HIGH POWER | High power for aim laser |
| VIS A | VIS AIM RED | Aiming or marking laser for daylight |
| VIS A | VIS AIM GREEN | Aiming or marking laser for daylight |

| **LASER** | **DIVERGENCE** | **WAVELENGTH** |
|---|---|---|
| IR BEAM | 0.3 mRad | 840 nm |
| IR ILLUMINATOR | 0.5 to 75 mRad | 840 nm |
| VISIBLE AIM, RED | 0.3 mRad | 635 nm |
| VISIBLE AIM, GREEN | 0.5 mRad | 532 nm |

| **LEGEND** | | | | | |
|---|---|---|---|---|---|
| cm | centimeters | IR | infrared | oz | ounces |
| g | grams | mRad | milliradians | | |
| in | inches | nm | nanometers | | |

**Figure 3-14. AN/PEQ-15A, DBAL-A2**

## AN/PSQ-23, ILLUMINATOR, INTEGRATED, SMALL ARMS (STORM)

3-49. The AN/PSQ-23 is a battery-operated laser range finder and digital magnetic compass with integrated multifunctional lasers. The illuminator, integrated, small arms device is commonly referred to as the STORM laser. The visible and infrared aiming lasers are co-aligned enabling the visible laser to boresight both aiming lasers to a weapon without the need for night vision devices. Soldiers can use the ruggedized system as a handheld illuminator and pointer or they can mount it to weapons equipped with an M4 or M5 adapter rail system (MIL-STD-1913) as listed below:

- Laser range finder provides range to target information from 20 meters to 10,000 meters with an accuracy of +/- 1.5 meters.
- Digital magnetic compass provides azimuth information and limited elevation information to the operator. The azimuth accuracy is +/- 0.5 degrees to +/- 1.5 degrees. The elevation accuracy is +/- 0.2 degrees. The digital magnetic compass can identify banks or slopes up to 45 degrees with an accuracy of +/- 0.2 degrees.
- Visible light provides for active target acquisition in low light and close quarters combat situations without the need for night vision devices.
- Infrared laser emits a tightly focused beam of infrared light for precise aiming of the weapon. A separate infrared illumination provides supplemental infrared illumination of the target or target area. The infrared illuminator has an adjustable bezel to vary the size of the illumination beam onto the size and distance of the target (flood to point divergence).
- Infrared illuminator of the STORM features is separately adjustable with adjustable divergence. The STORM is fixed in the device housing and is set parallel to the rail mount.

***Note***. The STORM's laser range finder and digital magnetic compass may be used in combination to obtain accurate positioning information for targeting purposes and other tactical applications.

3-50. The integrated visible aim laser and illumination lasers provide active, covert target acquisition in low light or complete darkness when used in conjunction with night vision devices. The STORM also is equipped with a tactical engagement simulation laser, which allows it to be used in a laser-based training environment.

3-51. The following information is an extract from the equipment's technical manual for Soldier reference (see figure 3-15, page 3-20).



| TM 9-5855-1913-13&P | | |
|---|---|---|
| **DIMENSIONS** | | |
| **LENGTH** | 7.3 in | 18.5 cm |
| **WIDTH** | 3.5 in | 9.0 cm |
| **HEIGHT** | 1.9 in | 4.8 cm |
| **WEIGHT** | 20.8 oz | 590 g |

| **POWER** | |
|---|---|
| **BATTERY LIFE** | >5.5 hours in IR DUAL HIGH mode |
| **POWER SOURCE** | 2 each DL-123A, 3 volt |

| **MODE OF OPERATION** | | |
|---|---|---|
| **POSITION** | **MODE** | **REMARKS** |
| VH | VIS HIGH | Aim or mark in daylight/indoor |
| AH | AIM HIGH | IR operates on high power |
| IH | ILLUM HIGH | IR/Illum operates on high power |
| DH | DUAL HIGH | IR/Illum both operate on high power |
| **BUTTON** | **MODE** | **REMARKS** |
| L | Laser activate | Activates aiming laser |
| R | Range/compass | Press/hold 3 sec to enter menu power |

| **LASER** | **DIVERGENCE** | **WAVELENGTH** |
|---|---|---|
| IR BEAM | 0.5 mRad | 820 to 850 nm |
| IR ILLUMINATOR | 1.0 to 100 mRad | 820 to 850 nm |
| VISIBLE AIM, RED | 0.5 mRad | 605 to665 nm |
| LASER RANGE FINDER | 1.0 mRad | 1570 nm |

| **LEGEND** | | | | | |
|---|---|---|---|---|---|
| cm | centimeters | in | inches | nm | nanometers |
| g | grams | IR | infrared | oz | ounces |
| illum | illumination | mRad | milliradians | sec | seconds |

**Figure 3-15. AN/PSQ-23, STORM**

## Chapter 4

# Mountable Equipment

The M249 light machine gun series of weapons have wide a variety of attachments to increase Soldier lethality, situational awareness, and overmatch. The attachments can be applied in various locations on the weapon system. Soldiers must understand what the attachments are, how to position them correctly, how to align them with the weapon system, and how to integrate them to maximize the system's capabilities.

Chapter 4 explains how to mount the various attachments onto the adaptive rail system. The chapter describes the weapons, aiming devices, and accessories available for mounting, and includes general information on the proper mounting location as well as their capabilities.

## ADAPTIVE RAIL SYSTEM

4-1. The adaptive rail system (ARS) and rail grabbers are designed for M249-series weapons to mount aiming devices and accessories.

4-2. The ARS provides a secure mounting point for various accessories that may be mounted on the weapon's top, left, and right. Each rail groove has an incremental number identifying the slot location, starting from the rear of the weapon.

4-3. Soldiers should record the attachment or equipment's serial number (if applicable), the location of the attachment (for example, markings between lugs), and any boresight or alignment settings specific to the equipment at that location.

4-4. Once complete, the Soldier should mark the mounting bracket to identify the tightened position with a permanent marker. Marking the mounting bracket allows for rapid identification of loosening hardware during firing. Soldiers must periodically verify that the mounting hardware does not loosen during operation. During zeroing or zero confirmation operations, Soldiers should retighten the mounting hardware after the first five rounds.

4-5. Soldiers must ensure the equipment is firmly affixed to the ARS before tie-down is complete. If the attachments are loose, their accuracy and effectiveness will be degraded.

## MOUNTABLE ACCESSORIES

4-6. Mountable accessories are items that may be attached to a weapon but are not required for operation. Mountable accessories assist with stabilizing the weapon or provide white-light illumination for specific tactical operations.

4-7. These devices are authorized as needed by the small unit. Some mountable accessories are aftermarket (commercial-off-the-shelf, or COTS) items that use the ARS for semi-permanent attachment.

## BIPOD

4-8. Bipods are highly adjustable and enhance stability. The gas cylinder group holds the bipod group in place. Bipods can be used in combination with a sand sock or other buttstock support to provide an extremely stable firing platform. (See figure 4-1.)

4-9. The bipod is an additional means to stabilize the weapon in various shooting positions. Despite primarily being used in the prone position, bipods can be used for additional support in alternate shooting positions while using barricade supports. The bipod provides additional support which facilitates acquisition of muscle relaxation and natural point of aim. The use of bipods in barricade shooting can increase the Soldier's efficiency and probability of a first round hit while engaging targets.

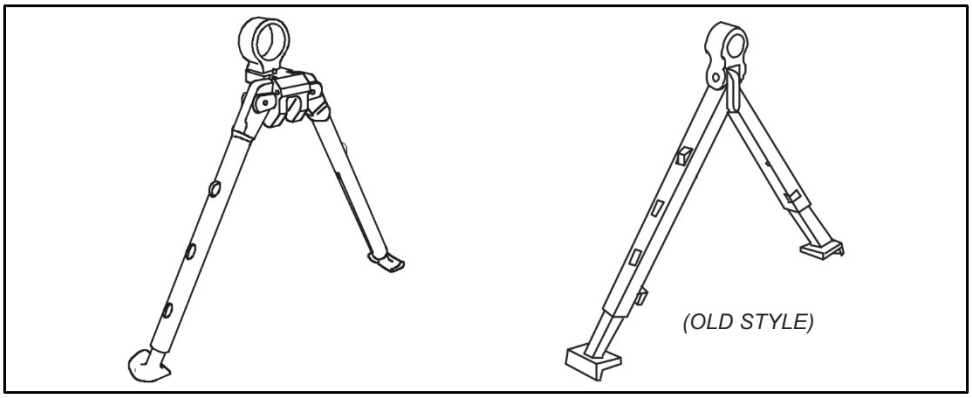



**Figure 4-1. Adjustable bipod**

## TRIPOD

4-10. The tripod provides a stable and relatively lightweight base that is superior to the bipod legs of the weapon. The tripods consist of a folding tripod leg assembly, pintle, and the traversing and elevating (T&E) mechanism. The tripod can accept various adapters.

4-11. The M192 tripod is a component assembly designed as a defensive ground mounting system for machine guns. The tripod is an additional means to stabilize the weapon in various shooting positions. The tripod provides additional support which facilitates acquisition of muscle relaxation and natural point of aim. For more information on the use of tripods, refer to TM 9-1005-344-10. (See figure 4-2.)

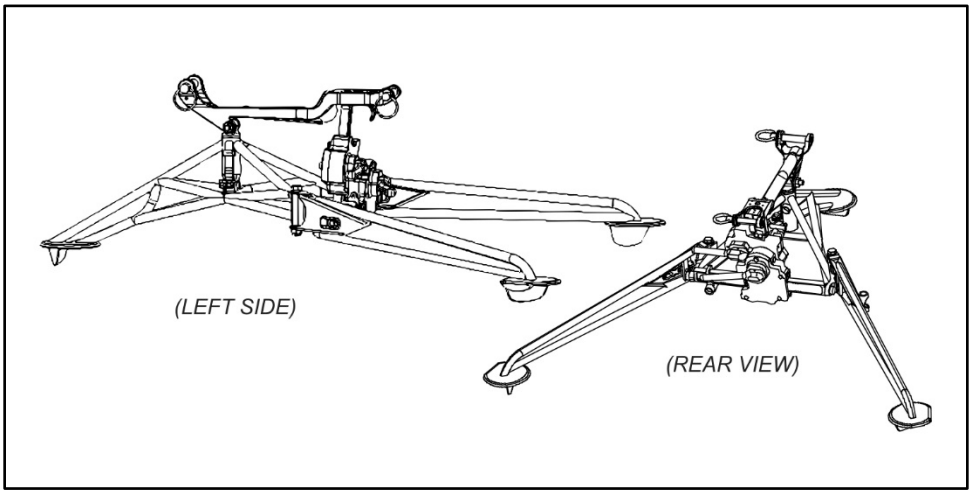



**Figure 4-2. M192 tripod**

## TRAVERSING AND ELEVATING MECHANISM

4-12. The T&E mechanism (figure 4-3) provides controlled manipulation, and the ability to engage predetermined targets. The mechanism has a lock assembly, elevation assembly, and traversing assembly. The T&E is used with tripods mounted on the traverse bar. Specific adapters must be used with the T&E for various weapons.

4-13. The M192 machine gun ground mount is a system with an integrated T&E mechanism. The traverse bar and mounting bracket assembly serves as the rear support for the T&E, which in turn supports the rear of the M249 light machine gun. The scale range is 0 to approximately 530 mils in elevation with 1 mil readability. The traverse bar is joined to the frame assembly by two shoulder bolts, and the elevation bar fits into a quick release socket on the bottom of the mounting bracket assembly. The traverse scale range is 0 to approximately 900 mil in 1-mil increments. Refer to TM 9-1005-344-10 for more information about the use and operation of the different variants of the T&E mechanism.

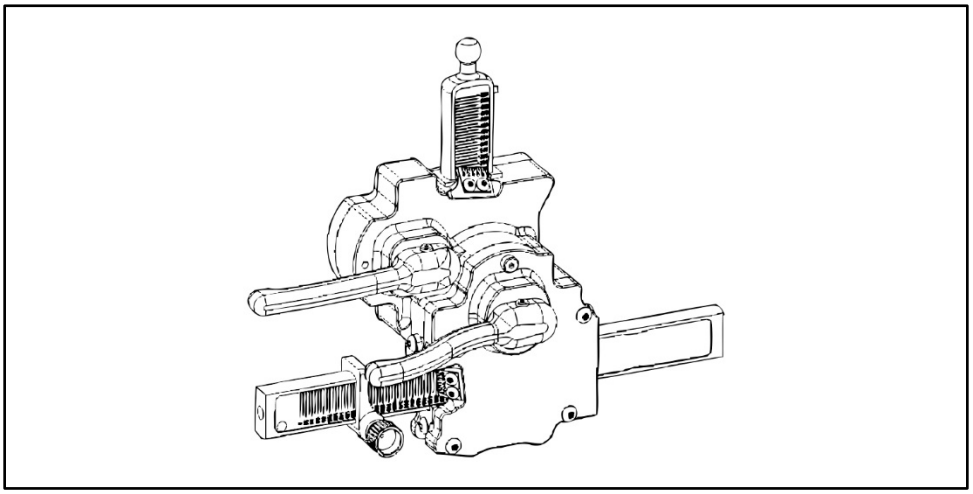


**Figure 4-3. M192 traversing and elevating mechanism**

## VERTICAL FOREGRIP

4-14. Vertical foregrips assist with transitioning from target to target in close quarter combat. (See figure 4-4.) The further out the Soldier mounts the vertical foregrip, the smoother and quicker the transition between multiple targets will be; however, the Soldier should not mount the vertical foregrip so far forward that using the vertical foregrip is uncomfortable.

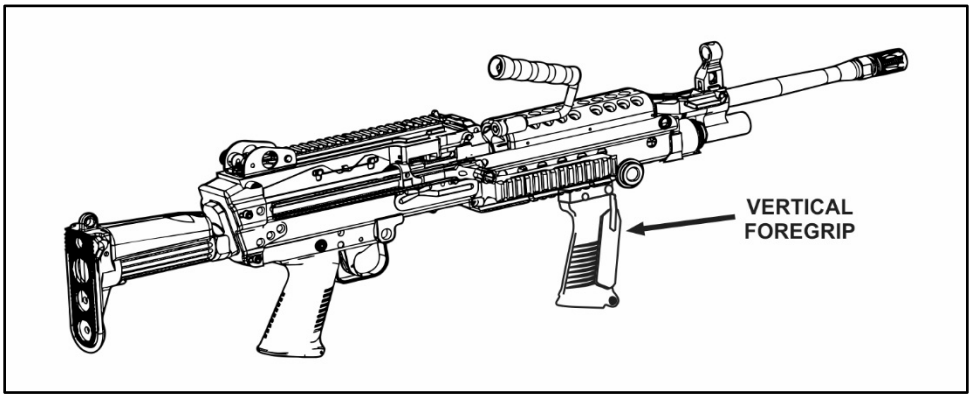



**Figure 4-4. Vertical foregrip, example**

## MOUNTED LIGHTS

4-15. Weapon-mounted lights are issued throughout the Army. The purpose of the weapon-mounted lights is to provide illumination and assist in target acquisition and identification during limited visibility operations.

4-16. Most weapon-mounted lights provide selection between white light and infrared capabilities. The Soldier determines whether to use the weapon-mounted light based upon mission, enemy, terrain and weather, troops and support available, time available, civil considerations (known as METT-TC), and unit SOPs. The weapon-mounted lights should be mounted so that the Soldier can activate and deactivate them efficiently and so that their placement does not hinder the use of any other attachment or accessory. Soldiers must attach the lights correctly to prevent negligent or unintentional discharge of white light illumination during movement or climbing.

## Chapter 5

# Employment

The light machine gunner's primary role is to engage the enemy with well-aimed bursts. The light machine gunner is the subject matter expert for employment of the light machine gun, and advises the rifle squad leader of the best way to employ the light machine gun. (Refer to ATP 3-21.8 for more information.)

Consistently hitting a target with precision is a complex interaction of factors occurring immediately before, during, and after the round fires. The interactions include maintaining postural steadiness, establishing and maintaining the proper aim on the target, stabilization of the weapon while pressing the trigger, and adjusting for environmental and battlefield conditions.

## FIRING SITUATIONS

5-1. Every Soldier must adapt to the firing situation, integrate the rules of firearms safety, manipulate the fire control, and instinctively know when, how, and where to shoot. The Soldier's ability to hit the target under conditions of extreme stress rely upon the following:

- Interpret and act upon perceptual cues related to the target, front and rear sights, rifle movement, and body movement.
- Execute minute movements of the hands, elbows, legs, feet, and cheek.
- Coordinate gross motor control of their body positioning with fine motor control of the trigger finger.

5-2. The Soldier's goal when shooting is to fire well-aimed bursts, regardless of the weapon system. The Soldier must properly point the weapon (sight alignment and sight picture), and fire the weapon without disturbing the aim. Soldiers must master sight alignment, sight picture, and trigger control, which are defined below:

- Sight alignment. Sight alignment is the relationship between the aiming device and the firer's eye. The focus of the firer's eye needs to be on the front sight post or reticle to achieve proper and effective aim. The Soldier must maintain sight alignment throughout the aiming process.
- Sight picture. The sight picture is the placement of the aligned sights on the target.
- Trigger control. Trigger control is the skillful manipulation of the trigger that causes the rifle to fire without disturbing the aim.

## SHOT PROCESS

5-3. The shot process is the basic outline of an individual engagement sequence all firers consider during an engagement, regardless of the weapon employed. The shot process formulates all decisions, calculations, and actions that lead to firing the burst. The shot process may be interrupted at any point before the sear disengaging and firing the weapon should the situation change. The shot process has three distinct phases:

- Pre-shot.
- Shot.
- Post-shot.

5-4. Soldiers must understand and correctly apply the shot process to achieve consistent, accurate, well-aimed shots. The sequence of the shot process does not change; however, the application of each element

may vary based on the conditions of the engagement. Every shot that the Soldier takes has a complete shot process. Grouping, for example, is simply moving through the shot process several times in rapid succession.

5-5. The shot process allows the Soldier to focus on one cognitive task at a time. The Soldier must maintain the ability to mentally organize the shot process's tasks and actions into a disciplined mental checklist, and focus their attention on activities which produce the desired outcome—a well-aimed burst.

5-6. The level of attention allocated to each element during the shot process is proportional to the conditions of each individual shot. Table 5-1 provides an example of a shot process.

**Table 5-1. Shot process, example**

| | |
|---|---|
| Pre-shot | Position |
| | Natural Point of Aim |
| | Sight Alignment/Picture |
| | Hold |
| Shot | Refine Aim |
| | Breathing Control |
| | Trigger Control |
| Post-shot | Follow-through |
| | Recoil Management |
| | Call the Shot |
| | Evaluate |

# FUNCTIONAL ELEMENTS OF THE SHOT PROCESS

5-7. Functional elements of the shot process are the linkage between the Soldier, the weapon system, the environment, and the target that directly impact the shot process and ultimately the consistency, accuracy, and precision of the shot. When used appropriately, they build a greater understanding of any engagement. The functional elements are interdependent. An accurate shot, regardless of weapon system, requires the Soldier to establish, maintain, and sustain all of the four functional elements defined below:

- Stability. The Soldier stabilizes the weapon to provide a consistent base to fire from and maintain through the shot process until the recoil pulse has ceased. This process includes how the Soldier holds the weapon, uses structures or objects to provide stability, and the Soldier's posture on the ground during an engagement.
- Aim. Aim is the continuous process of orienting the weapon correctly, aligning the sights, aligning on the target, and the appropriate lead and elevation (hold) during a target engagement.
- Control. Control entails all the conscious actions of the Soldier before, during, and after the shot process that the Soldier specifically is in control of. The first of which is trigger control. This includes whether, when, and how to engage. It incorporates the Soldier as a function of safety, as well as the ultimate responsibility of firing the weapon.
- Movement. Movement is the process of the Soldier moving during the engagement process. It includes the Soldier's ability to move laterally, forward, diagonally, and in a retrograde manner while maintaining stabilization, appropriate aim, and control of the weapon.

5-8. The functional elements define the tactical engagements that require the Soldier to make adjustments to determine appropriate actions, and compensate for external influences on their shot process. Soldiers can rapidly engage targets with precision when all functional elements are applied.

5-9. The shooter must consider the functional elements of time, target size, target distance, and their own skills and capabilities to minimize induced errors of the burst.

5-10. Each weapon, tactical situation, and sight system will have preferred techniques for each step in the shot process and within the functional elements to produce precision and accuracy in a timely manner. How fast or slow the shooter progresses through the process is based on target size, target distance, and firer's capability.

5-11. The most complex form of shooting is under combat conditions when the Soldier and the enemy is moving under limited visibility conditions. Soldiers and leaders must refine their skills continuously and move training from the simplest engagement to the most complex. Applying the functional elements during the shot process builds a firer's speed while maintaining consistency, accuracy, and precision during complex engagements. Each of the functional elements and the Soldier's actions to consider during the shot process are described later in this manual.

# TARGET ACQUISITION

5-12. Target acquisition is the ability of a Soldier to rapidly recognize threats to the friendly unit or formation. Target acquisition is a critical Soldier function before any shot process begins. Target acquisition includes the Soldier's ability to use all available optics, sensors, and information to detect potential threats as quickly as possible.

5-13. Target acquisition requires the Soldier to apply an acute attention to detail continuously based on the tactical situation. The target acquisition process includes all the actions a Soldier must execute rapidly, which are—

- Detect potential threats (target detection).
- Identify the threat as friend, foe, or noncombatant (target identification).
- Prioritize the threat(s) based on the level of danger they present (target prioritization).

## TARGET DETECTION

5-14. Soldiers must master a series of skills to perform effective target detection. Detection is an active process performed during combat operations with or without a clear or known threat presence. The Soldier's detection skills enable all engagements and are built upon the following three skill sets:

- Scan and search. Scan and search is a rapid sequence of various techniques to identify potential threats. Soldier scanning skills determine potential areas where threats are most likely to appear.
- Acquire. Acquire is a refinement of the initial scan and search based on irregularities in the environment.
- Locate. Locate is the Soldier's ability to determine the general location of a threat and to engage with accuracy or to inform the small-unit leader of contact with a potential threat.

### Scan and Search

5-15. Scanning and searching is the art of observing an assigned sector. The goal of the scan and search is a deliberate detection of potential threats based on irregularities in the surrounding environment. Environment irregularities include irregular shapes, colors, heat sources, movement, or actions the Soldier perceives as being out of place as compared to the surrounding area.

5-16. Soldiers use the following five basic search and scan techniques to detect potential threats in combat situations:

- Rapid scan. Rapid scan is used to detect obvious signs of threat activity quickly. Rapid scan is usually the first method used, whether on the offense or fighting in the defense.
- Slow scan. Soldiers conduct the more deliberate scan using various optics, aiming devices, or sensors if no threats are detected during the rapid scan. The slow scan is best conducted in the defense or during slow movement or tactical halts.
- Horizontal scan. Soldiers use horizontal scans when operating in restricted or urban terrain. A horizontal scan is a horizontal sweeping scan that focuses on key areas where potential threats may be over watching their movements or positions.
- Vertical scan. The vertical scan is an up and down scan in restricted or urban environments to identify potential threats that may be observing the unit from an elevated position.
- Detailed search. Soldiers use a detailed search when no threats are detected using other scanning methods. The detailed search uses aiming devices, thermal weapon systems, magnified optics, or other sensors to slowly and methodically review locations of interest where the Soldier would be positioned if they were the threat (where would I be if I were them?).

### Acquire

5-17. Target acquisition is the discovery of any object in the operational environment such as personnel, vehicles, equipment, or objects of potential military significance. Target acquisition occurs during target scan and search as a direct result of observation and the detection process.

5-18. During the scan and search, Soldiers are looking for target signatures, which are signs or evidence of a threat. Tactically, Soldiers look for threat personnel and obstacles (including explosive hazards such as mines, unexploded ordinance, and improvised explosive devices), vehicles, or anti-tank missile systems. These target signatures can be identified by sight, sound, or smell.

### Locate

5-19. Target location is the determination of where a target is in the operational environment in relation to the shooter, small unit, or element. Locating a target or series of targets is the result of the search and acquisition actions of each Soldier in the small unit.

5-20. Once a target is located, the Soldier rapidly and efficiently communicates the threat location to the rest of the unit. Methods used to announce a located target depend on the Soldier's specific position, graphic control measures for the operation, unit standard operating procedure (SOP), and time available.

### Detection Best Practices

5-21. Threat detection is a critical skill that requires thoughtful application of the sensors, optics, and systems at the Soldier's disposal. Finding potential threats as quickly and effectively as possible provides the maximum amount of time to defeat the threat. Soldiers should be familiar with the following best practices to increase target detection:

- Scan with the unaided eye first, then with a magnified optic.
- Practice using I2 and thermal optics in tandem during limited visibility.
- Understand the difference between I2 and thermal optics; what they can see and what they can't. (See chapter 3 of this publication.)
- Thermal optics are the preferred sight for target acquisition and engagement, day or night.
- Don't search in the same area as others in the small unit. Overlap, but do not focus on the same sector.
- Practice extreme light discipline during limited visibility including infrared light discipline.
- Think as the threat. Search in areas that would be most advantageous from their perspective.
- Detecting threats is exponentially more difficult when operating in a chemical, biological, radiological, nuclear (CBRN) environment. Practice detection skills with personal protective equipment/individual protective equipment and understand the constraints and limitations, day and night.

## TARGET IDENTIFICATION

5-22. Identifying (or discriminating) a target as friend, foe, or noncombatant (neutral) is the second step in the target acquisition process. The identification process is complicated by the increasing likelihood of having to discriminate between friend or foe and combatant or noncombatant in urban settings and restricted terrain. To mitigate fratricide and unnecessary collateral damage, Soldiers use all of the situational understanding tools available and develop tactics, techniques, and procedures for performing target discrimination.

## Classifications

5-23. The Soldier must be able to positively identify the threat as one of the following three classifications:

- Friend. Any force, U.S. or allied, that is jointly engaged in combat operations against an enemy of the U.S. in a theater of operation.
- Foe (enemy combatant). Any individual who has engaged in acts against the U.S. or its coalition partners in violation of the laws and customs of war during an armed conflict.
- Noncombatants. Personnel, organizations, or agencies that are not taking a direct part in hostilities. Noncombatants include individuals such as medical personnel, chaplains, United Nations observers, media representatives, or those out of combat such as the wounded or sick. The Red Cross or Red Crescent are examples of organizations classified as noncombatants.

## Fratricide Prevention

5-24. Units can designate friendly vehicles from enemy vehicles using marking systems. Typically, these marking systems are derived from the unit tactical standard operating procedure or other standardization publications, and applied to the personnel, small units, or vehicles as required:

- Markings. Unit markings are defined within the unit SOP. They distinctly identify a vehicle as friendly in a standardized manner.
- Panels. VS-17 panels provide a bright recognition feature that allows Soldiers to identify friendly vehicles through the day sight during unlimited visibility. Panels do not provide a thermal signature.
- Lighting. Chemical or light emitting diode lights provide a means of marking vehicles at night. However, chemical lights are not visible through a thermal sight. An infrared variant is available for use with night vision devices. Lighting systems do not provide for thermal identification during day or limited visibility operations.
- Beacons and strobes. Beacons and strobes are unit-procured, small-scale, compact, battery-operated flashing devices that operate in the near infrared wavelength. They are clearly visibly through night vision optics, but cannot be viewed through thermal optics.

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***Note***. Beacons and strobes generate illumination signals that can be viewed only by I2 optics. The signal cannot be viewed by thermal optics. Leaders and Soldiers are required to be aware of which optic can view these systems effectively when developing their SOPs and when using them in training or combat.

Beacons and strobes have the potential to be viewed by enemy elements with night vision capabilities. Units should tailor use of the beacon using mission, enemy, terrain and weather, troops and support available, time available, civil considerations (known as METT-TC).

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- Symbols. Unit symbols may be used to mark friendly vehicles. An inverted V, for example, painted on the flanks, rear, and fronts of a vehicle aid in identifying a target as friendly. Unit symbols are typically applied in an area of operations and not during training. Symbol marking systems do not provide for thermal identification during day or limited visibility operations.

## TARGET PRIORITIZATION

5-25. The Soldier must prioritize each target and carefully plan their shots to ensure successful target engagement when faced with multiple targets. The keys to a successful engagement of multiple targets are the Soldier's mental preparedness and the ability to make split-second decisions. The proper mindset allows the Soldier to react instinctively and control the pace of the battle rather than reacting to the adversary threat.

## Threat Levels

5-26. Targets are prioritized into three threat levels-

- Most dangerous. A threat that can defeat the friendly force and is preparing to do so. Most dangerous targets must be defeated immediately.
- Dangerous. A threat that can defeat the friendly force, but is not prepared to do so. Dangerous targets are defeated after all most dangerous targets are eliminated.
- Least dangerous. Any threat that cannot defeat the friendly force, but can coordinate with other threats that are more prepared. Least dangerous targets are defeated after all threats of a higher threat level are defeated.

## Multiple Targets

5-27. When multiple targets of the same threat level are encountered, the targets are prioritized according to the threat they represent. The standard prioritization of targets establishes the order of engagement. Firers engage similar threats by the following guide:

- Near before far.
- Frontal before flank.
- Stationary before moving.

5-28. The prioritization of targets provides a control mechanism for the shooter and facilitates maintaining overmatch over the presented threats. Firers should prepared to deviate from the prioritization guide based on the situation, the collective fire command, or any changes to the target's activities.

# Chapter 6
# Stability

Stability is the ability of the Soldier to create a stable firing platform for the engagement. The Soldier stabilizes the weapon to provide a consistent base from which to fire and maintain the shot process until the recoil impulse has ceased. Stability includes how the Soldier holds the weapon, how the Soldier uses structures or objects to provide stability, and the Soldier's posture on the ground during an engagement. A stable firing platform is essential during the shot process, whether the Soldier is stationary or moving.

Chapter 6 provides the principles of developing a stable firing platform, describes the interaction among the Soldier, the weapon, and the surroundings, and the methods to achieve the greatest amount of stability in various positions. Chapter 6 explains how the stability functional element supports the shot process and interacts and integrates the other three elements. Stability provides a window of opportunity to maintain sight alignment and sight picture for the most accurate burst.

## SUPPORT

6-1. Stability is provided through four functions: support, muscle relaxation, natural point of aim, and recoil management. These functions provide the Soldier the means to best stabilize their weapon system during the engagement process

6-2. The placement or arrangement of sandbags, equipment, or structures that directly provide support to the receiver assembly of the weapon to provide increased stability. The shooter stabilizes the light machine gun using a bipod, tripod, or vertical foregrip along with their bone and muscle support to provide additional stability to the weapon.

6-3. Support can be natural or artificial or a combination of both. Natural support comes from the shooter's bones and muscles. Artificial support comes from objects outside the shooter's body. The more support a position provides, the more stable the weapon. Principles of firing positions are described in the following paragraphs.

### LEG POSITION

6-4. The position of the Soldier's legs varies greatly depending on their firing position. The position may require the legs to support the Soldier's body weight, to support the firing elbow, or to meet other firing position requirements. When standing unsupported, the body is upright with the legs staggered and knees slightly bent. In the prone position, the firer's legs may be spread apart flat on the ground or bent at the knee. In the sitting position, the legs may also serve an intricate part of the firing position.

### STANCE AND CENTER OF GRAVITY

6-5. The stance and center of gravity relate to the firer's balance and posture before, during, and after the shot. The position and center of gravity does not apply when firing from the prone position. The position and center of gravity specifically relates to the Soldier's ability to maintain the stable firing platform during firing, when absorbing the recoil impulses, and when aggressively leaning toward the target area during the shot process.

## FIRING ELBOW

6-6. The Soldier must place their firing elbow properly during the shot process. Proper elbow placement provides consistent firing hand grip while standing, sitting, or kneeling and provides support stability in the prone position.

## NONFIRING ELBOW

6-7. The Soldier's placement of the nonfiring elbow during the shot process supports the machine gun in the all positions. The nonfiring elbow must be used with the firing elbow to stabilize the weapon when firing.

## FIRING HAND

6-8. Proper placement of the firing hand aids in trigger control. The Soldier places the pistol grip in the 'V' formed between the thumb and index finger. The pressure applied is similar to a firm handshake grip. Different Soldiers have different size hands and length of fingers, so there is no set position of the finger on the trigger. To grip the weapon, the Soldier places the back strap of the weapon's pistol grip high in the web of their firing side hand between the thumb and index (trigger) finger. The Soldier's trigger finger is indexed on the trigger mechanism assembly, well outside of the trigger guard. The Soldier grasps the pistol grip with their remaining fingers ensuring there is no gap between their middle finger and the trigger guard.

## NONFIRING HAND

6-9. Proper placement of the nonfiring hand is based on the firing position and placement of the nonfiring elbow to provide the stability of the weapon. Placement is adjusted during supported and unsupported firing to maximize stability.

6-10. The placement of the nonfiring hand varies if the firer is manipulating the T&E mechanism. The ideal positon of the nonfiring hand provides additional support to stabilize the light machine gun by applying additional pressure as far forward as possible on the weapon during the shot process. The nonfiring hand can be used as reference point when applying the firer's head to the stock of the weapon.

## BUTT STOCK

6-11. Correct placement of the butt stock in the firing shoulder aids in achieving a solid stock weld. Side to side placement varies depending on the equipment the Soldier wears while firing. The butt stock is placed high enough in the shoulder to allow for an upright head position.

6-12. The vertical placement of the butt stock varies from firing position to firing position. A general guideline to follow is the higher the position from the ground, the higher the butt stock is in the shoulder.

## STOCK WELD

6-13. The placement of the firer's head on the stock of the weapon is the stock weld. Correct stock weld is critical to sight alignment. The firer rests the full weight of the head on the stock. The head position is as upright as possible to give the best vision through the aiming device. The stock weld allows for scanning additional targets not seen through the aiming device.

6-14. When establishing the stock weld, the Soldiers brings the machine gun up to their head, not their head down to the machine gun. The firer's head remains in the same location on the stock while firing, but the location may change when positions are changed. The bony portion of the cheek placed on the stock is the basic starting point. Soldiers adapt to their facial structure to find the optimal placement that allows for both sight alignment and repetitive placement.

6-15. Figure 6-1 shows the differences in head placement, which effects sight alignment. The firer on the right is NOT resting the full weight of their head on the stock. The picture on the left shows the skin of the firer's head being pushed down by the full weight of their head. The peer coach can observe and quickly correct the Soldier's position in the picture on the left.

***Note***. The amount of flesh and the bone structure of each Soldier's face varies. Firers who apply downward force simply to achieve the appearance in the correct image (left) in figure 6-1 will not have relaxation and will not have a repeatable placement. The goal is to have alignment with consistent placement.

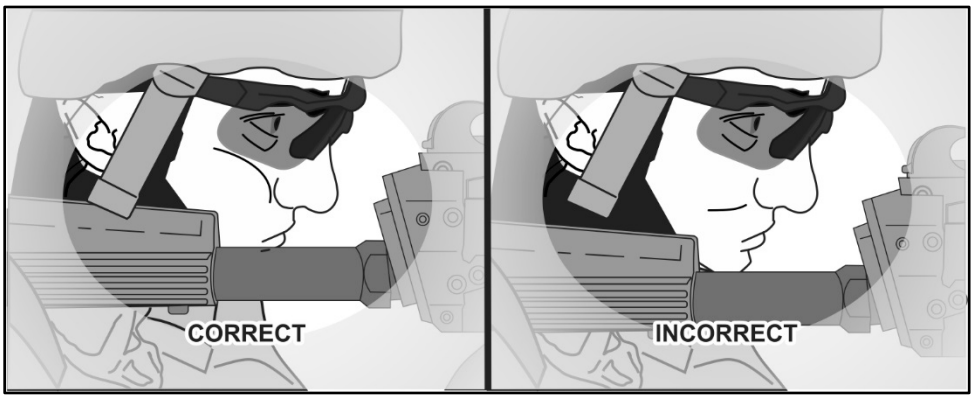



**Figure 6-1. Stock weld**

## MUSCLE RELAXATION

6-16. Muscle relaxation is the Soldier's ability to maintain orientation of the weapon appropriately during the shot process while keeping the major muscle groups from straining to maintain the weapon system's position. Relaxed muscles contribute to support stability. General principles for correct muscle relaxation are listed below:

- Strained or fatigued muscles detract from stability.
- As a rule, the more support from the shooter's bones the less they require from their muscles.
- The more skeletal support, the more stable the position, as bones do not fatigue or strain.
- As a rule, the less muscle support required, the longer the shooter can stay in position.

## NATURAL POINT OF AIM

6-17. The natural point of aim is the point where the barrel naturally orients when the shooter's muscles are relaxed and supported. The natural point of aim is built upon the following principles:

- The closer the natural point of aim is to the target, the less muscle support required.
- The more stable the position, the more resistant to recoil it is.
- More of the shooter's body on the ground equals a more stable position.
- More of the shooter's body on the ground equals less mobility for the shooter.

6-18. When a Soldier aims at a target, the lack of stability creates a wobble area, where the sights oscillate slightly around and through the point of aim. When the wobble area is larger than the target, the Soldier must steady their position or refine their position to decrease the size of their wobble area before trigger squeeze.

***Note***. The steadier the position, the smaller the wobble area. The smaller the wobble area, the more precise the burst.

6-19. To check a firer's natural point of aim, the Soldier should assume a good, steady position and get to the natural pause. Soldier's should close their eyes, go through one cycle, and then open their eyes on the natural pause. Where the sights are laying at this time, is the natural point of aim for that position. If the sights are not on their point of aim for their target, they should make small adjustments to their position to get the reticle, or front sight post, back on their point of aim. The Soldier repeats this process until the natural point of aim is on the point of aim on their target.

## RECOIL MANAGEMENT

6-20. Recoil management is the result of a Soldier assuming and maintaining a stable firing position which mitigates the disturbance of one's sight picture during the weapon's cycle of function.

6-21. The Soldier's firing position manages recoil using the weapon's system support, the weight of the Soldier's body, and the placement of the Soldier's weapon during the shot process. Proper recoil management allows the Soldier's sights to rapidly return to the target and allows for faster follow-up bursts.

## SHOOTER–GUN ANGLE

6-22. The shooter-gun angle is the relationship between the shooters upper body and the direction of the weapon. Typically, the angle is different from firing position to firing position, and directly relates to the Soldier's ability to control recoil. Significant changes in the shooter-gun angle can result in eye relief and stock weld changes.

***Note***. Units with a mix of left- and right-handed shooters can take advantage of each Soldier's natural carry positions, by placing left-handed shooters on the right flanks, and right-handed shooters on the left flanks. The Soldier's natural carry alignment places the muzzle away from the core element and outward toward potential threats, and reduces the challenges of firing when moving laterally.

## FIELD OF VIEW

6-23. The field of view is the extent that the human eye can see at any given moment. The field of view is based on the Soldier's view without using magnification, optics, or thermal devices. The field of view is what the Soldier sees, and includes the areas where the Soldier can detect potential threats.

## CARRY POSITIONS

6-24. There are five primary carry positions. The leader can direct the primary carry positions or the Soldier can assume the carry positions based on the tactical situation. The primary positions are—

- Hang.
- Safe hang.
- Collapsed low ready.
- Low ready.
- Ready (or ready up).

## HANG

6-25. Soldiers use the hang position when they need their hands for other tasks and no threat is present or likely (see figure 6-2). The weapon is slung and the safety is engaged. Soldiers should not use the hang carry position when the weapon control status is RED.

| Carry Position: | Hang |
|---|---|
| When Used: | No threat is likely or present. Typically used when not in a tactical environment. |
| Command: | ASSUME HANG |
| Advantages: | Provides the maximum amount of Soldier mobility and freedom of movement and use of their hands. |
| Disadvantages: | Least accessibility to the weapon and the fire controls. Requires the most time to transition to a stable firing position. Maintains minimum amount of physical security. |




**Figure 6-2. Hang carry, example**

## SAFE HANG

6-26. The Soldier uses the safe hang position when no immediate threat is present and their hands are not necessary for other tasks (see figure 6-3). In the safe hang carry, the weapon is slung and the Soldier has gripped the weapon's pistol grip. The Soldier sustains Rule 3, keeping the finger off the trigger until ready to engage when transitioning to the ready or ready up position.

6-27. In the safe hang position, the Soldier can move in any direction while simultaneously using their firing hand to orient the muzzle at the ground. The safe hang carry provides control of the weapon, flexibility in movement, and positive control of the weapon's fire controls.

| Carry Position: | Safe Hang |
|---|---|
| When Used: | No immediate threat is likely or present. Used to maintain positive control of the weapon, the fire controls, and weapon orientation during movement. |
| Command: | ASSUME SAFE HANG |
| Advantages: | Provides some Soldier mobility while maintaining positive control of the weapon and weapon orientation. |
| Disadvantages: | Reduced use of hands. |

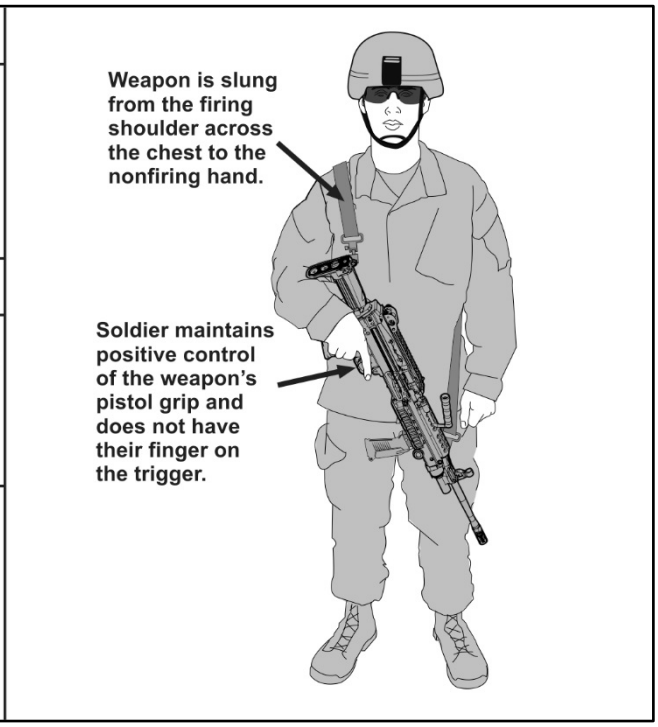



**Figure 6-3. Safe hang, example**

## COLLAPSED LOW READY

6-28. Soldiers use the collapsed low ready position when a greater degree of muzzle control and readiness to respond to threats or weapon retention is necessary (such as crowded environments). In the collapsed low ready, the firing hand is secure on the weapon's pistol grip. Soldiers place their nonfiring hand on the hand guards or vertical foregrip (see figure 6-4). The collapse low carry allows a Soldier to navigate crowded or restrictive environments while simultaneously minimizing or eliminating the muzzle covering (flagging) by maintaining positive control of the muzzle orientation.

| Carry Position: | Collapsed Low Ready |
|---|---|
| When Used: | A greater degree of muzzle control and readiness is required. Used in restricted or crowded environments, urban terrain, or when positive control of weapon orientation is required. |
| Command: | ASSUME COLLAPSED |
| Advantages: | Provides some Soldier mobility while maintaining positive control of the weapon and weapon orientation. Increased readiness. |
| Disadvantages: | Use of hands limited. |




**Figure 6-4. Collapsed low ready, example**

## LOW READY

6-29. The low ready carry position provides the highest level of readiness with the maximum amount of observable area for target acquisition purposes. The Soldier does the following when using the low ready position:

- The weapon is slung, the butt stock is in the Soldier's shoulder, and the muzzle is angled down at a 30- to 45-degree angle and oriented towards the Soldier's sector of fire.
- The Soldier positions their hand on the pistol grip with the index finger straight and out of the trigger guard. From this carry, the Soldier is ready to engage threats within a very short amount of time with minimal movement. (See figure 6-5.)
- The Soldier maintains observation to the sector of fire. The Soldier looks over the top of their optics or sights to maintain situation awareness of their sector. The Soldier's head remains upright.

| Carry Position: | Low Ready |
|---|---|
| When Used: | Contact with threats is likely and direct fire engagements are probable. |
| Command: | GO LOW READY |
| Advantages: | Readiness is increased to provide for rapid engagement when the weapons control status conditions are met. |
| Disadvantages: | Reduced awareness laterally and to the rear. |

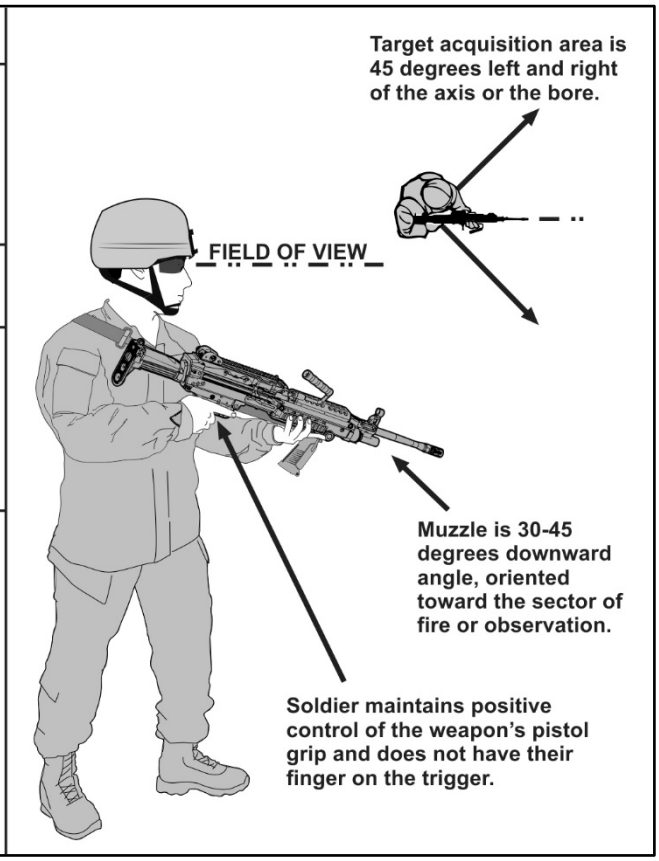



**Figure 6-5. Low ready, example**

### READY OR READY UP

6-30. Soldiers use the ready position when enemy contact is imminent (see figure 6-6). Soldiers use the ready carry when they are preparing or already prepared to engage a threat.

6-31. In the ready the weapon is slung, the toe of the butt stock is in the Soldier's shoulder, and the Soldier orients the muzzle toward a threat or the most likely direction of enemy contact. The Soldier is looking through their optics or sights. The Soldier's nonfiring side hand remains on the hand guards or on the vertical foregrip. The firing hand remains on the pistol grip with the firing finger off the trigger until the decision to engage a target is made.

| Carry Position: | Ready or Ready Up |
|---|---|
| When Used: | Contact with threats is imminent, the orientation of the muzzle is in the most probable target location, and the Soldier is prepared to engage. |
| Command: | MAKE READY |
| Advantages: | The highest level of readiness to engage a threat or threats. Rapid transition from target acquisition to engagement. |
| Disadvantages: | Reduced awareness laterally and to the rear. Requires the Soldier to maintain situational awareness laterally while actively acquiring targets. |

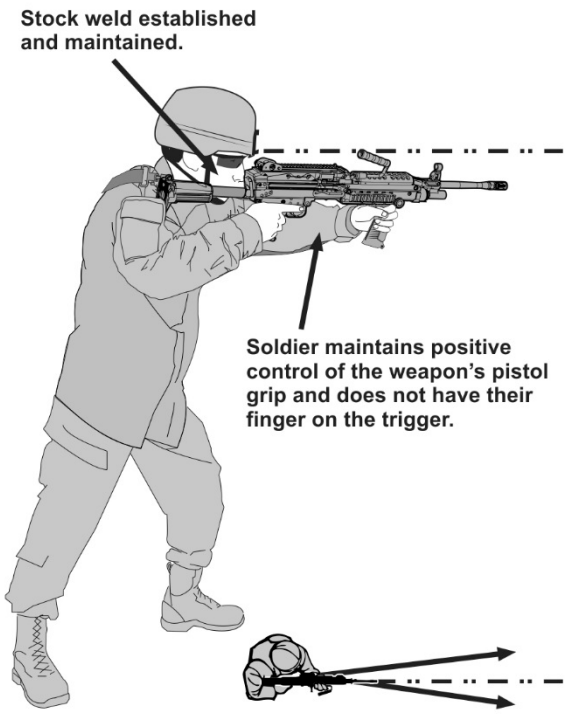



**Figure 6-6. Ready position or ready up, example**

## STABILIZATION

6-32. The Soldier must stabilize their weapon, whether firing from a stationary position or while on the move. To create a stabilized platform, Soldiers must understand the physical relationship between the weapon system, the shooter's body, the ground, and any other objects touching the weapon or shooter's body. The more contact the shooter has to the ground determines how stable and effective their position is. The situation and tactics determines the actual position used.

6-33. When a shooter assumes a stable firing position, movement from muscle tension, breathing, and other natural activities within the body transfer to the weapon and the shooter must compensate for them.

6-34. Failing to create an effective platform to fire from is a stabilization failure. A stabilization failure occurs when a Soldier fails to—

- Control the movement of the barrel during the arc of movement.
- Adequately support the weapon system.
- Achieve their natural point of aim.

6-35. The failures compound the firing occasion's errors, which directly correlate to the accuracy of the burst taken. To maximize the Soldier's stability during the shot process, they correctly assume various firing positions when stationary, or offset the induced errors with other firing skills during tactical movement.

6-36. As a rule, positions that are lower to the ground provide a higher level of stability. When the center of gravity elevates, the level of stability decreases as shown in figure 6-7.

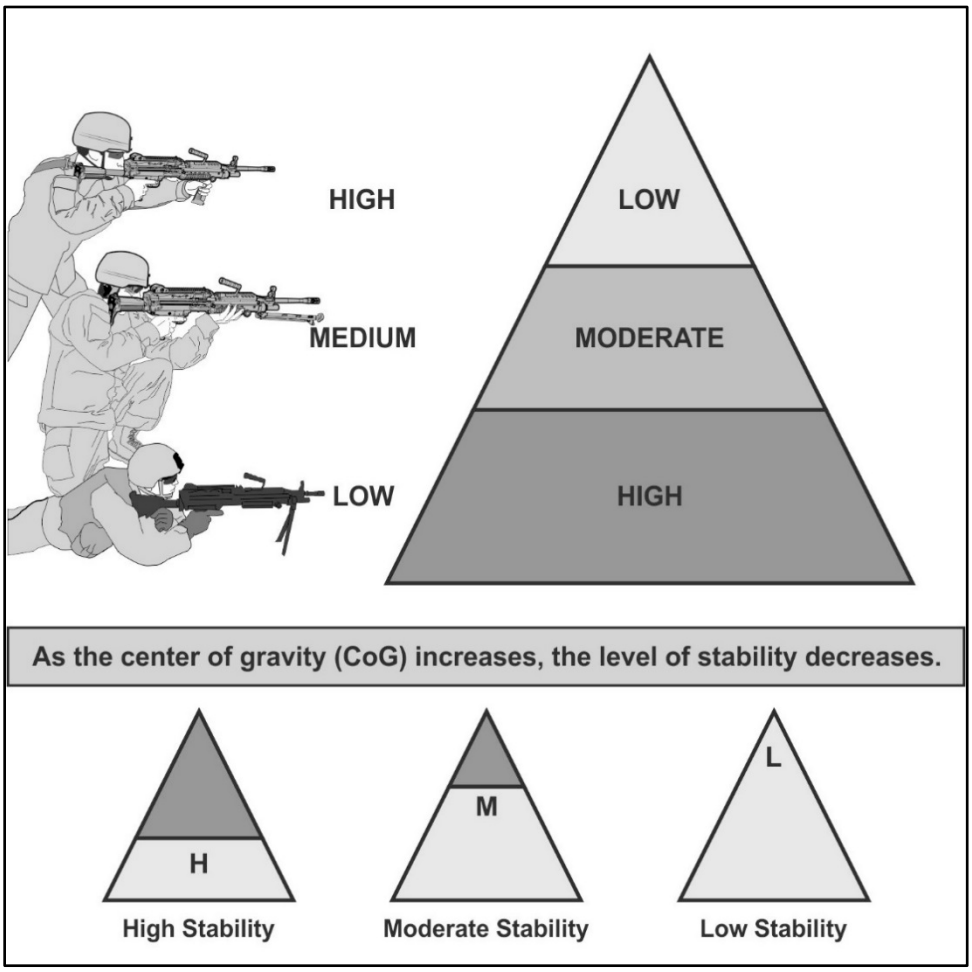



**Figure 6-7. Firing position stability example**

# FIRING POSITIONS

6-37. The nature of combat does not always allow time for a Soldier to get into a particular position. Soldiers need to practice firing in a variety of positions, including appropriate variations. The primary positions described below are highest to lowest. The position variations are subbullets of the primary positions in the list below:

- Standing.
  - Standing, unsupported.
  - Standing, supported.
- Kneeling. The kneeling position is very common and useful in most combat situations. The kneeling position is supported or unsupported.
  - Kneeling, unsupported.
  - Kneeling, supported.

- Sitting. There are three types of sitting positions: Crossed-ankle, crossed-leg, and open-leg. All positions are easy to assume, present a medium silhouette, provide some body contact with the ground, and form a stable firing position. The positions allow easy access to the sights for zeroing.
  - Sitting, crossed ankle.
  - Sitting, crossed leg.
  - Sitting, open leg.
- Prone. The prone position is the most stable firing position due to the amount of the Soldier's body that is in contact with the ground. The majority of the firer's frame is behind the light machine gun to assist with recoil management. The Soldier positions their frame from either the bipod- or tripod-mounted light machine gun.
  - Prone, supported.

6-38. Soldiers must practice the positions dry frequently to establish their natural point of aim for each position and to develop an understanding of the restrictive nature of their equipment during execution. With each dry repetition, the Soldier's develops the ability to change positions rapidly and correctly, translating into efficient movement and consistent stable firing positions. The paragraphs below discuss the firing positions defined above.

## STANDING, UNSUPPORTED

6-39. Soldiers should use the standing, unsupported position for closer targets or when time is not available to assume a steadier position such as short range employment. The Soldier should lean their upper body slightly forward to aid in recoil management. Figure 6-8 illustrates the key focus areas for the standing supported position.

| | |
|---|---|
| 1 Support: | Unsupported |
| 2 Leg Position: | Standing, firm, feet shoulder-width apart. |
| 3 Stance / Center of Gravity: | Aggressive lean forward toward the target. |
| 4 Firing Elbow: | Tucked toward the shooter's side. |
| 5 Nonfiring Elbow: | Slightly outward. |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | Extended as forward as possible, for aid in recoil and transitioning. |
| 8 Butt Plate: | Highest point of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter body is approximately 45 degrees to the gun-target line. |

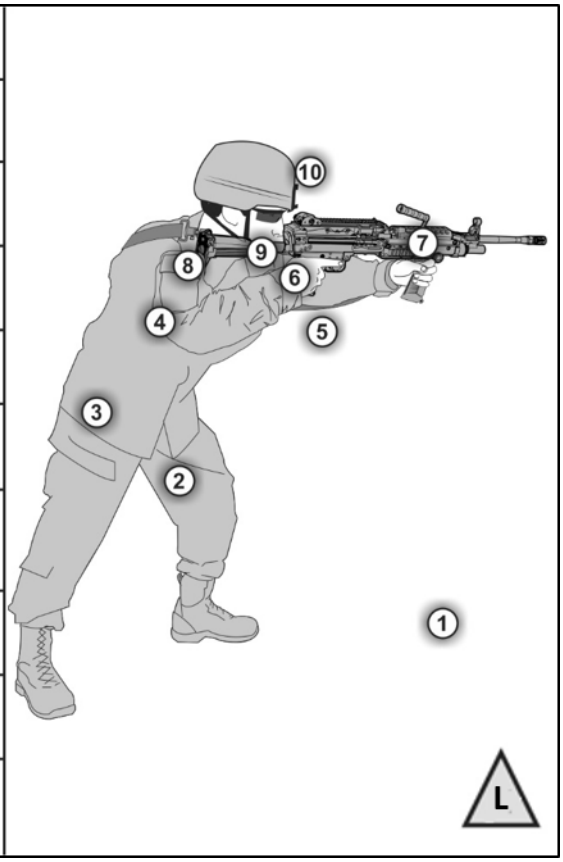



**Figure 6-8. Standing, unsupported, example**

## STANDING, SUPPORTED

6-40. The standing supported position uses the bipod, tripod, or artificial support to steady the position. The Soldier uses their rear legs and upper body to apply forward pressure to aid in recoil management. Figure 6-9 illustrates the key focus area for the standing supported position.

- Nonfiring hand. The nonfiring hand holds the hand guards firmly to provide additional support to stabilize the machine gun if needed. Hand positioning varies depending on the type of support used.
- Bipod/tripod. The use of the bipod or tripod can be utilized if the situation and/or supporting structure being used permits it.

| | |
|---|---|
| 1 Support: | Weapon is supported using a structure, bipod, or equipment. |
| 2 Leg Position: | Standing, firm, feet shoulder-width apart. |
| 3 Stance / Center of Gravity: | Aggressive lean forward toward the target. |
| 4 Firing Elbow: | Tucked toward the shooter's side. |
| 5 Nonfiring Elbow: | Extended to provide nonfiring hand support. |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | Firm grasp on the handguards, push against the artificial support. |
| 8 Butt Plate: | Highest point of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter body is approximately 45 degrees to the gun-target line. |

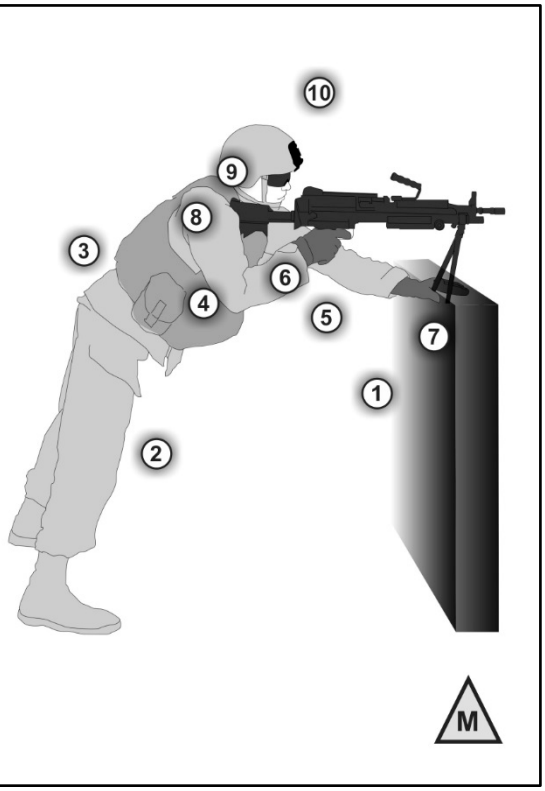



**Figure 6-9. Standing, supported, example**

## KNEELING, UNSUPPORTED

6-41. The kneeling unsupported position does not use artificial support. Figure 6-10 shows the optimum unsupported kneeling position. The firer should be leaning slightly forward into the position to allow for recoil management and quicker follow-up bursts. The primary goal of this firing position is to establish the smallest wobble area possible. Key focus areas for kneeling unsupported are as follows:

- Nonfiring elbow. Place the nonfiring elbow directly underneath the machine gun as much as possible. The Soldier should place their elbow either in front of or behind the kneecap. Placing their elbow directly on the kneecap causes their elbow to roll and increases the wobble area.
- Leg position. The Soldier should bend their nonfiring leg approximately 90 degrees at the knee so it is directly under the machine gun. The firing-side leg should be perpendicular to the nonfiring leg. The firer may rest their body weight on the heel. Some firers lack the flexibility to do this and may have a gap between their buttocks and the heel.
- Aggressive (stretch) kneeling. The Soldier should put all their weight on their nonfiring foot, thigh to calf, upper body leaning forward, nonfiring triceps on nonfiring knee, and their firing leg stretched behind them for support. The aggressive kneeling position is highly effective for rapid fire and movement.

| | |
|---|---|
| 1 Support: | Unsupported Soldier uses nonfiring knee when possible. |
| 2 Leg Position: | Firing knee on the ground, foot under seat. Nonfiring leg bent approximately 90 degrees and under weapon. |
| 3 Stance / Center of Gravity: | Slight lean into the target area. All weight on nonfiring foot, thigh to calf. |
| 4 Firing Elbow: | Tucked toward the shooter's side. |
| 5 Nonfiring Elbow: | Tricep on the nonfiring knee for self-support. Elbow underneath rifle. Elbow NOT ON KNEE. |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | Firm grasp on the handguards to control wobble. |
| 8 Butt Plate: | Mid to high point of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter body is approximately 30 degrees to the gun-target line. |

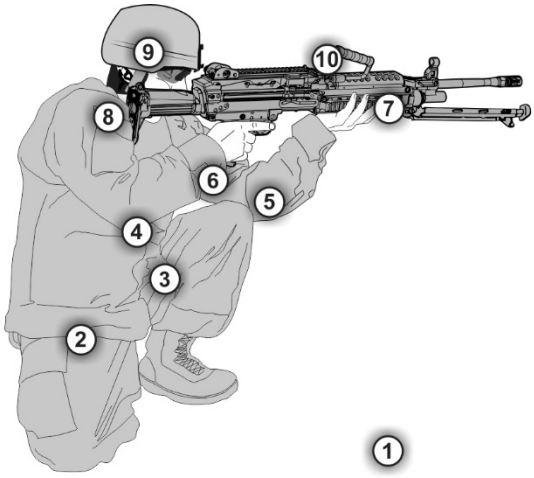



**Figure 6-10. Kneeling, unsupported, example**

## KNEELING, SUPPORTED

6-42. The kneeling supported position uses the bipod or artificial support to steady the position (see figure 6-11). Contact by the nonfiring hand and elbow with the artificial support is the primary difference between the kneeling supported and unsupported positions since it assists in the stability of the weapon. Body contact is good, but the barrel of the machine gun must not touch the artificial support. Forward pressure is applied to aid in recoil management. The key focus areas for the kneeling supported position are applied in the following ways:

- Nonfiring hand. The nonfiring hand holds the hand guards firmly and is also pushed against the artificial support. Hand positioning will vary depending on the type of support used.
- Nonfiring elbow. The nonfiring elbow and forearm may be used to assist with the weapon's stability by pushing against the artificial support. The contact of the nonfiring elbow and forearm with the structure varies depending on the support used and the angle to the target.
- Bipod/tripod. The use of the bipod or tripod can be utilized if the situation and/or the supporting structure being used permits it.

| | |
|---|---|
| 1 Support: | Supported using available structure or equipment. |
| 2 Leg Position: | Nonfiring knee on the ground, foot under seat. Firing leg bent approximately 90 degrees outward. |
| 3 Stance / Center of Gravity: | Slight lean toward target area. All weight on firing foot and pressure on the artificial support. |
| 4 Firing Elbow: | Tucked toward the shooter's side, pressed against the inside of the firing thigh. |
| 5 Nonfiring Elbow: | Extended. May be pushed against the artificial support for stability. |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | Firm grasp on the handguards, push against the artificial support. |
| 8 Butt Plate: | Mid to high point of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter body is approximately 30 degrees to the gun-target line. |

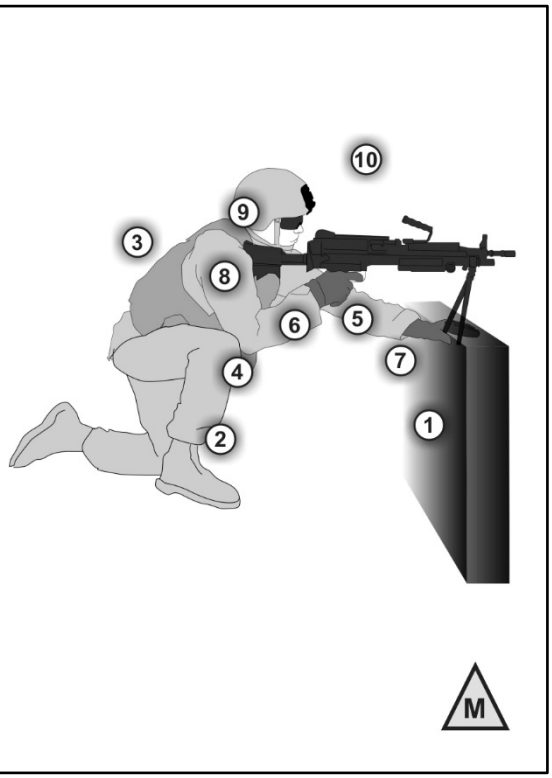



**Figure 6-11. Kneeling, supported, example**

## SITTING, CROSSED-ANKLE

6-43. The sitting, crossed-ankle position provides a broad base of support and places most of the body weight behind the weapon (see figure 6-12). The Soldier's body weight placed behind the weapon allows quick recoil recovery and recoil impulse absorption. The Soldier should perform the following positions to assume a good, crossed-ankle position:

- Face the target at a 10- to 30-degree angle.
- Place the nonfiring hand under the hand guard or the vertical foregrip.
- Bend at the knees and break fall with the firing hand.
- Push backward with the feet to extend the legs and place the buttocks to the ground.
- Cross the nonfiring ankle over the firing ankle.
- Bend forward at the waist.
- Place the nonfiring elbow on the nonfiring leg below knee.
- Grasp the machine gun butt with the firing hand and place the machine gun butt into the firing shoulder pocket.
- Grasp the pistol grip with the firing hand.
- Lower the firing elbow to the inside of the firing knee.
- Place the cheek firmly against the stock to obtain a firm stock weld.
- Move the nonfiring hand to a location under the hand guard that provides the maximum bone support and stability for the weapon.

| | |
|---|---|
| 1 Support: | Unsupported Soldier uses body for weapon support. |
| 2 Leg Position: | Nonfiring leg crossed over firing leg at 90 degrees, ankles inter-locked. |
| 3 Stance / Center of Gravity: | Soldier's frame sitting against the ground for maximum stability, shot recovery, and recoil absorption. |
| 4 Firing Elbow: | Resting on the inside of the firing thigh for support. |
| 5 Nonfiring Elbow: | Resting on the outside of the nonfiring thigh (NOT on the knee). |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | Firmly grasping the handguards or vertical foregrip for support. |
| 8 Butt Plate: | Midpoint of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter is approximately 30 degrees off the gun-target line. |

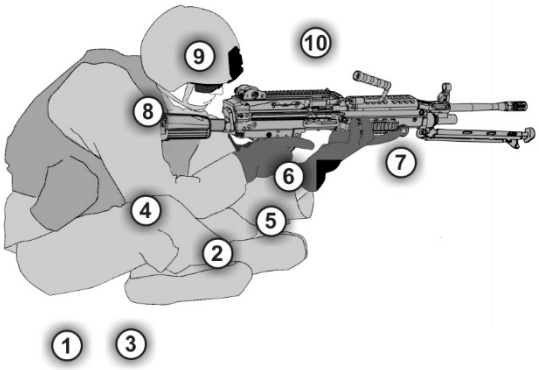



**Figure 6-12. Sitting position, crossed-ankle, example**

## SITTING, CROSSED-LEG

6-44. The crossed-leg sitting position provides a base of support and places most of the Soldier's body weight behind the weapon for quick recoil recovery (see figure 6-13). Soldiers may experience a strong pulse beat in this position due to restricted blood flow to their legs and abdomen. An increased pulse causes a larger wobble area. Soldiers perform the following positions to assume a good, crossed-leg position:

- Place the nonfiring hand under the hand guard or vertical foregrip.
- Cross the nonfiring leg over the firing leg.
- Bend at the knees and break the fall with the firing hand.
- Place the buttocks to the ground close to the crossed legs.
- Bend forward at the waist.
- Place the nonfiring elbow on the nonfiring leg at the bend of the knee.
- Establish solid butt stock position in the firing shoulder pocket.
- Grasp the pistol grip with the firing hand.
- Lower the firing elbow to the inside of the firing knee.
- Place the cheek firmly against the stock to obtain a firm stock weld.
- Place the nonfiring hand under the hand guard to provide support.

| | |
|---|---|
| 1 Support: | Unsupported Soldier uses body for weapon support. |
| 2 Leg Position: | Nonfiring leg crossed over firing leg in a crossed sitting position. |
| 3 Stance / Center of Gravity: | Soldier's frame sitting against the ground for maximum stability, shot recovery, and recoil absorption. |
| 4 Firing Elbow: | Resting on the inside of the firing thigh for support. |
| 5 Nonfiring Elbow: | Resting on the outside of the nonfiring thigh (NOT on the knee). |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | Firmly grasping the handguards or vertical foregrip for support. |
| 8 Butt Plate: | Midpoint of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter is approximately 30 degrees off the gun-target line. |

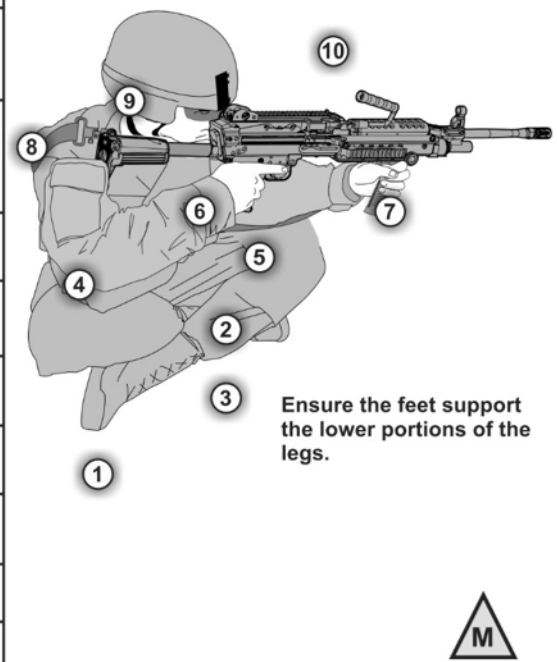



**Figure 6-13. Sitting position, crossed-leg, example**

## SITTING, OPEN LEG

6-45. The open leg sitting position is the preferred sitting position when shooting with combat equipment (see figure 6-14). The open-leg position places less of the body weight behind the weapon than other sitting positions. Perform the following to assume a good, open-leg position:

- Face the target at a 10- to 30-degree angle to the firing of the line of fire.
- Place the feet approximately shoulder width apart.
- Place the nonfiring hand under the hand guard or vertical foregrip.
- Bend at the knees while breaking the fall with the firing hand. Push backward with the feet to extend the legs and place the buttocks on ground.
- Place the both the firing and nonfiring elbow inside the knees.
- Grasp the machine gun butt with the firing hand and place into the firing shoulder pocket.
- Grasp the pistol grip with the firing hand.
- Lower the firing elbow to the inside of the firing knee.
- Place the cheek firmly against the stock to obtain a firm stock weld.
- Move nonfiring hand to a location under the hand guard that provides maximum bone support and stability for the weapon.

| | |
|---|---|
| 1 Support: | Unsupported Soldier uses their body for limited weapon support. |
| 2 Leg Position: | Open leg stance using seat and heels to provide balance. |
| 3 Stance / Center of Gravity: | Soldier's frame sitting against the ground for maximum stability, shot recovery, and recoil absorption. |
| 4 Firing Elbow: | Resting on the inside of the firing thigh for support. |
| 5 Nonfiring Elbow: | Resting on the inside of the nonfiring thigh (NOT on the knee). |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | Firmly grasping the handguards or vertical foregrip for support. |
| 8 Butt Plate: | Midpoint of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter is approximately 30 degrees off the gun-target line. |

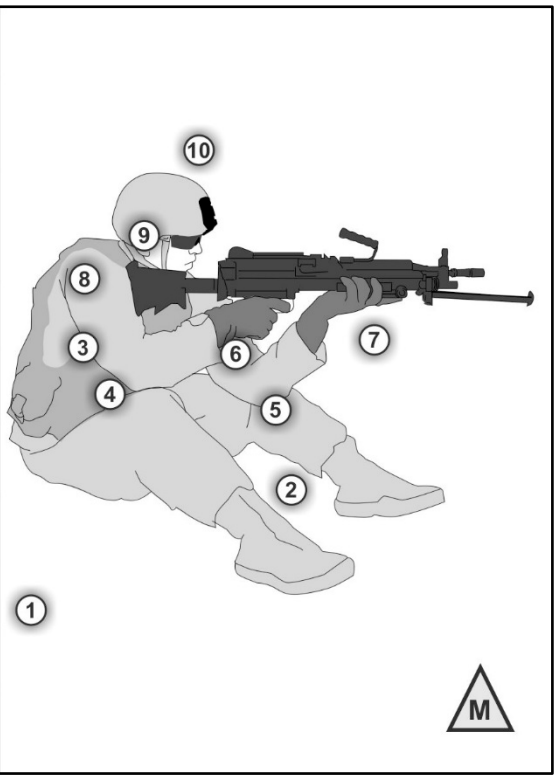



**Figure 6-14. Sitting position, open leg, example**

## PRONE, SUPPORTED

6-46. The prone, supported position allows for the use of support, such as the bipod or tripod (see figure 6-15). Soldiers must build a stable, consistent position that focuses on the following key areas:

- Firing hand. The firer should have a firm handshake grip on the pistol grip and place their finger on the trigger where it naturally falls.
- Nonfiring hand. The nonfiring hand is placed to maximize control of the weapon and where it is comfortable on the weapon or support.
- Leg position. The firer's legs may be spread with heels as flat as possible on ground or the firing side leg may be bent at the knee to relieve pressure on the stomach.

| | |
|---|---|
| 1 Support: | Supported with sandbag, equipment, or structure. |
| 2 Leg Position: | Spread with heels flat against the ground or the firing side leg bent at the knee to relieve pressure. |
| 3 Stance / Center of Gravity: | Prone position maximizes the Soldier's frame against the ground for maximum stability. |
| 4 Firing Elbow: | Used to provide stability to the weapon. |
| 5 Nonfiring Elbow: | Used to provide stability to the weapon. |
| 6 Firing Hand: | Grasping pistol grip, finger off the trigger until ready to fire. |
| 7 Nonfiring Hand: | As far forward as possible for maximum stability. |
| 8 Butt Plate: | Midpoint of shoulder to absorb recoil impulse. |
| 9 Stock Weld: | Firm stock weld. |
| 10 Shooter, Gun Angle: | Shooter body is nearly in-line with the gun-target line. |

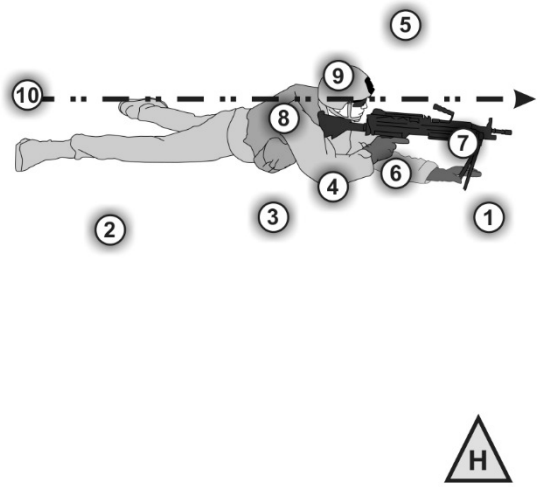



**Figure 6-15. Prone, supported, example**

# Chapter 7

# Aim

Aim is the functional element of the shot process. Aim is the continuous process of orienting the weapon correctly, aligning the weapon's sights, aligning the weapon on the target, and applying the appropriate lead and elevation during a target engagement. Soldiers conduct aiming through pre-shot, shot, and post-shot to apply lethal fires in a responsible manner with accuracy and precision.

Aiming is the application of perfectly aligned sights on a specific part of a target. Sight alignment is the first and most important part of the aiming process.

## COMMON ENGAGEMENTS

7-1. The aiming process for engaging stationary targets consists of the following Soldier actions, regardless of the aiming devices optic, sight, or magnification.

- Weapon orientation. The direction of the weapon when held in a stabilized manner.
- Sight alignment. The physical alignment of the aiming device, including the—
  - Iron sight and the front sight post.
  - Optic reticle.
  - Ballistic reticle (day or thermal).
- Sight picture. The target as viewed through the line of sight.
- Point of aim. The specific location where the line of sight intersects the target.
- Desired point of impact. The round's desired strike location to achieve the desired outcome (incapacitation or lethal strike).

7-2. Typically, Soldiers apply the aim to the largest, most lethal area of any target presented. Soldiers use battlesight zero, center of visible mass (CoVM). The center of visible mass is the initial point of aim on a target of what can be seen by the Soldier. The CoVM does not include what the target size is expected or anticipated to be. For example, a target located behind a car exposes its head. The CoVM is in the center of the head, not the estimated location of the center of the overall target behind the car.

## WEAPON ORIENTATION

7-3. The Soldier orients the weapon in the direction of the detected threat. Weapon orientation includes both the horizontal plane (azimuth) and the vertical plane (elevation). Weapon orientation is complete once the sight and threat are in the Soldier's field of view.

## HORIZONTAL WEAPONS ORIENTATION

7-4. Horizontal weapons orientation covers the frontal arc of the Soldier, spanning the area from the left shoulder, across the Soldier's front, to the area across the right shoulder (see figure 7-1).

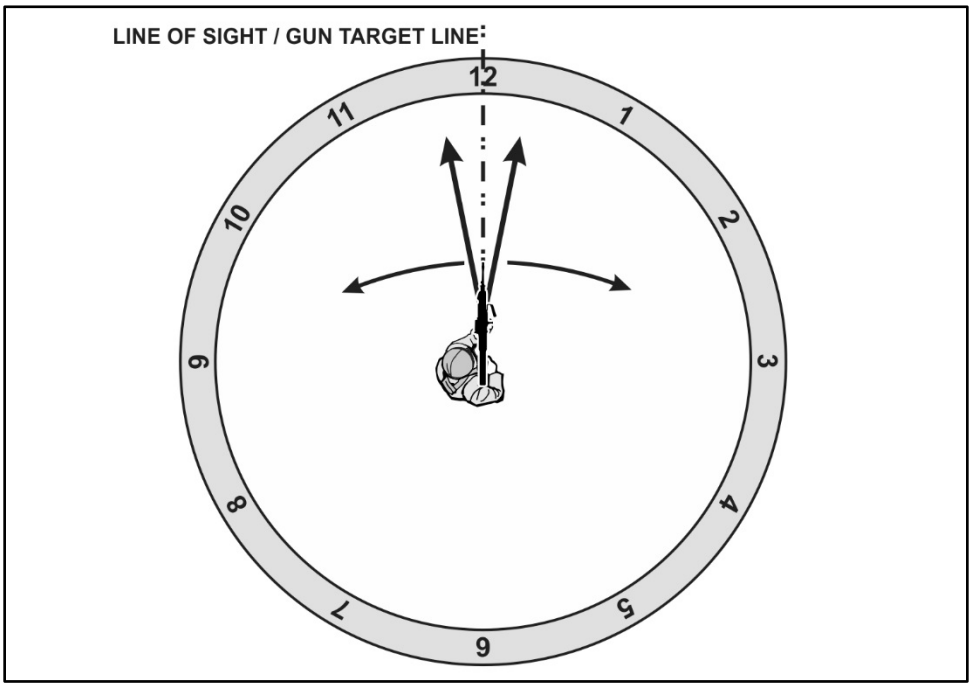



**Figure 7-1. Horizontal weapons orientation, example**

## VERTICAL WEAPONS ORIENTATION

7-5. Vertical weapons orientation includes all the aspects of orienting the weapon at a potential or confirmed threat in elevation. Vertical weapons orientation is most commonly applied in restricted, mountainous, or urban terrain where threats present themselves in elevated or depressed firing positions (see figure 7-2).

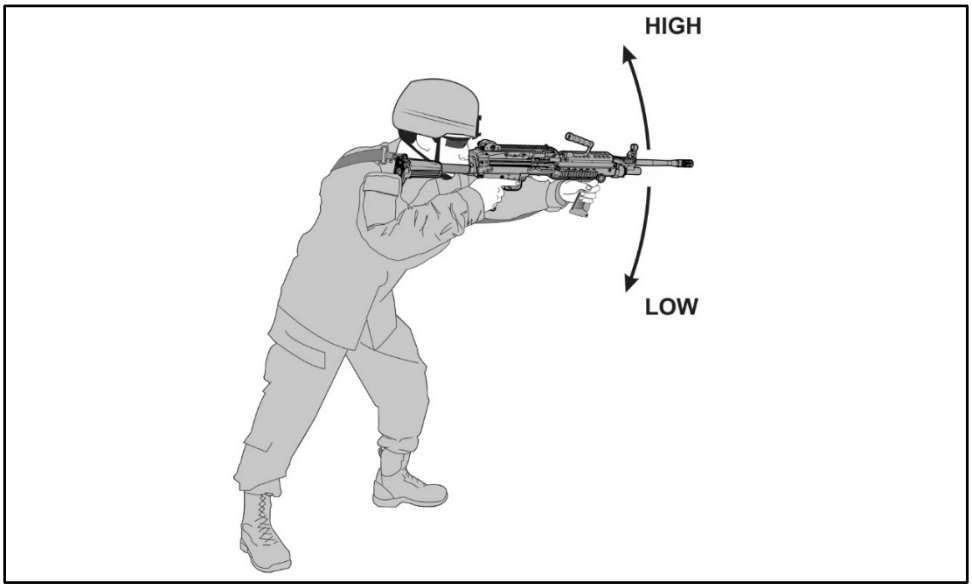



**Figure 7-2. Vertical weapons orientation, example**

# SIGHT ALIGNMENT

7-6. Sight alignment is the relationship between the aiming device and the firer's eye. The process used by a Soldier depends on the aiming device employed with the weapon.

- Iron sight. The relationship among the front sight post, rear sight aperture, and the firer's eye. The firer aligns the tip of the front sight post in the center of the rear aperture and their eye. The firer maintains focus on the front sight post, simultaneously centering it in the rear aperture.
- Optics. The relationship between the reticle and the firer's eye. Optics includes the appropriate eye relief or distance of the Soldier's eye from the optic itself. Soldiers must achieve a full-centered field of view with no shadow on magnified optics.
- Thermal. The relationship among the firer's eye, the eyepiece, and the reticle.
- Pointers, illuminators, lasers. The relationship among the firer's eye, the night-vision device placement and focus, and the laser aiming point on the target.

***Note***. Small changes matter. 1/1000 of an inch deviation at the weapon can result in up to an 18-inch deviation at 300 meters.

7-7. The human eye can focus clearly on only one object at a time. To achieve proper and effective aim, the focus of the firer's eye needs to be on the front sight post or reticle (see figure 7-3). The most accurate sight alignment for the shot process is with the firer's eye on the front sight post or reticle.

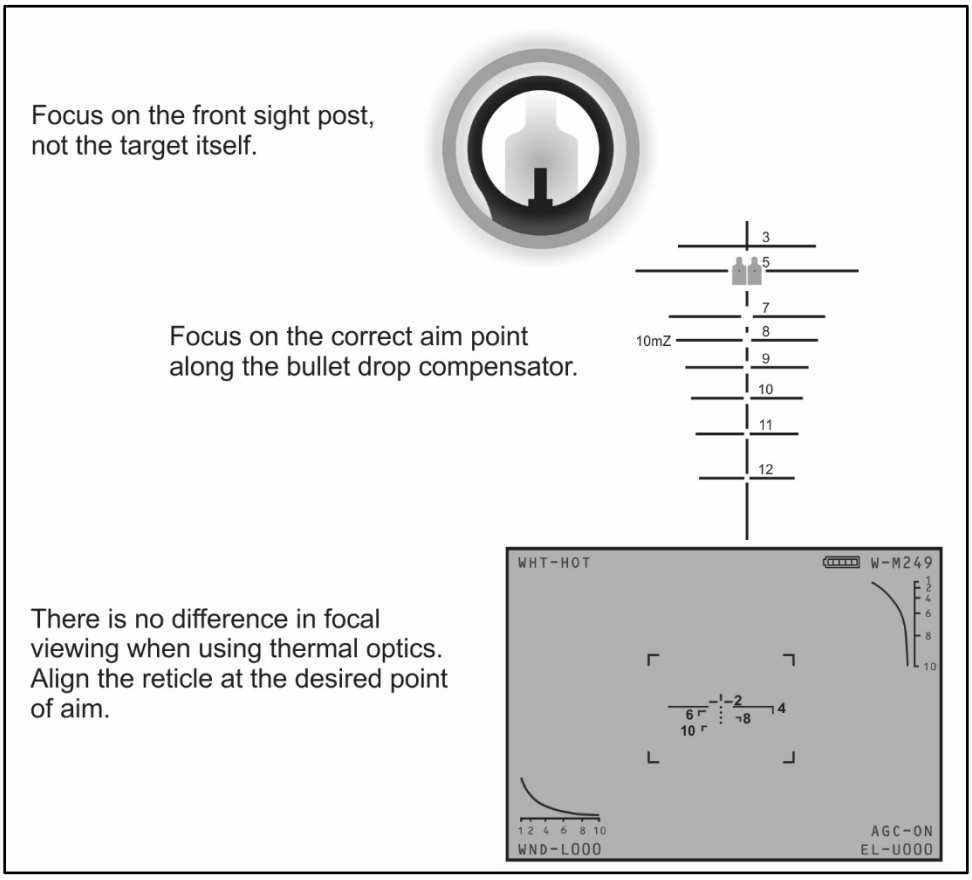



**Figure 7-3. Front sight post/reticle aim focus, examples**

7-8. Firers rest the full weight of their heads on the stock to achieve consistent sight alignment. The firers allow their dominant eye to look through the center of the aiming or sighting device. If the firer's head placement is subjected to change during the firing process or between bursts, the Soldier will experience difficultly achieving accurate fire.

## SIGHT PICTURE

7-9. The sight picture is the placement of the aligned sights on the target itself. The Soldier must maintain sight alignment throughout the positioning of the sights. Sight picture is not the same as sight alignment.

7-10. Soldiers use two sight pictures during the shot process; pre-shot and post-shot. Soldiers must remember the sight pictures of the shot to complete the overall shot process.

- Pre-shot sight picture. Encompasses the original point of aim, sight picture, and any holds for target or environmental conditions.
- Post-shot sight picture. What the Soldier must use as the point of reference for any sight adjustments for any subsequent burst.

## POINT OF AIM

7-11. The point on the target is the continuation of the line created by sight alignment. The point of aim is a point of reference used to calculate any hold the Soldier deems necessary to achieve the desired results of the round's impact. The point of aim should be the target's CoVM for engagements against stationary targets under 400 meters with negligible wind, and a weapon that has a 400-meter confirmed zero. The point of aim does not include any hold off or lead changes.

## DESIRED POINT OF IMPACT

7-12. The desired point of impact is the location where the Soldier wants the projectile to strike the target. Typically, this is the CoVM. At any range different than the weapon's zero distance, the Soldier's desired point of impact and their point of aim will not align. Therefore, the Soldier must determine the hold off necessary to achieve the desired point of impact.

## COMMON AIMING ERRORS

7-13. Orienting and aiming a weapon correctly is a practiced skill. Through drills and repetitions, Soldiers build the ability to repeat proper weapons orientation, sight alignment, and sight picture as a function of muscle memory. The most common aiming errors include—

- Nondominant eye use. The Soldier gets the greatest amount of visual input from their dominant eye. Eye dominance varies Soldier to Soldier. Some Soldier's dominant eye is the opposite of their dominant hand. For example, a Soldier who writes with their right hand and learns to shoot rifles right handed might learn that their dominant eye is the left eye (this is called cross-dominant). Soldiers with strong cross-dominant eyes should consider firing using their dominant eye side while firing from their nondominant hand side. Soldiers can train to fire from either side of the weapon, but may not be able to shoot effectively using their nondominant eye.
- Incorrect zero. Regardless of how well a Soldier aims, if the zero is incorrect, the round will not travel to the desired point of impact without adjustment with subsequent rounds (see appendix E of this publication).
- Light conditions. Limited visibility conditions contribute to errors aligning the sight, selecting the correct point of aim, and determining the appropriate hold. Soldiers may offset the effects of low light engagements with image intensifier (I2) optics, use of thermal optics, or the use of laser pointing devices with I2 optics.
- Battlefield obscurants. Smoke, debris, and haze are common conditions on the battlefield that disrupt the Soldier's ability to correctly align their sights, select the proper point of aim, or determine the correct hold for a specific target.
- Incorrect sight alignment. Soldiers may experience incorrect sight alignment when failing to focus on the front sight post or reticle.

- Incorrect sight picture. Typically, incorrect sight picture occurs when the threat is in a concealed location, is moving, or sufficient winds between the shooter and the target exist that are not accounted for during the hold determination process. The failure directly impacts the Soldier's ability to create and sustain the proper sight picture during the shot process.
- Improper range determination. Improper range determination results in an improper hold at ranges greater than the zeroed range for the weapon.

# COMPLEX ENGAGEMENTS

7-14. A complex engagement includes any shot that cannot use the CoVM as the point of aim to ensure a target hit. Complex engagements require a Soldier to apply various points of aim to successfully defeat the threat.

## FIRING CONDITIONS

7-15. Complex engagements have an increased level of difficulty due to environmental, target, or shooter conditions that create a need for the firer to rapidly determine a ballistic solution and apply that solution to the point of aim. One or more of the conditions listed below characterizes increased engagement difficulty:

- Target conditions:
  - Range to target.
  - Moving targets.
  - Oblique targets.
  - Evasive targets.
  - Limited exposure targets.
- Environmental conditions:
  - Wind.
  - Angled firing.
  - Limited visibility.
- Shooter conditions:
  - Moving firing position.
  - Canted (tilted to one side or the other) weapon engagements.
  - CBRN operations engagements.

7-16. Each of these firing conditions may require the Soldier to determine an appropriate aim point that is not the CoVM. This Soldier calculated aim point is called the hold. During any complex engagement, the Soldier serves as the ballistic computer during the shot process. The hold represents a refinement or alteration of the CoVM point of aim at the target to counteract certain conditions during a complex engagement for—

- Range to target.
- Lead for targets based on their direction and speed of movement.
- Counterrotation lead required when the Soldier is moving in the opposite direction of the moving target.
- Wind speed, direction, and duration between the shooter and the target at ranges greater than 300 meters.
- Greatest lethal zone the target presents to provide the most probable point of impact to achieve immediate incapacitation.

7-17. The Soldier applies the appropriate aim (hold) based on the firing instances presented. Hold determinations are discussed in two formats, immediate and deliberate. All Soldiers must be familiar with the immediate hold determination methods. Soldiers should apply hold determination methods naturally when the engagement conditions require them. The determinations are provided in target form measurements based on a standard E-type silhouette dimension approximately 20-inches wide by 40-inches tall.

### IMMEDIATE HOLD DETERMINATION

7-18. Immediate holds are based on the values of a target form, where the increments shown are sufficient for rapid target hits without ballistic computations. The immediate hold determinations are not as accurate as the deliberate method and are used for complex target engagements at less than 300 meters. Figure 7-4 illustrates immediate hold locations for azimuth (wind or lead).

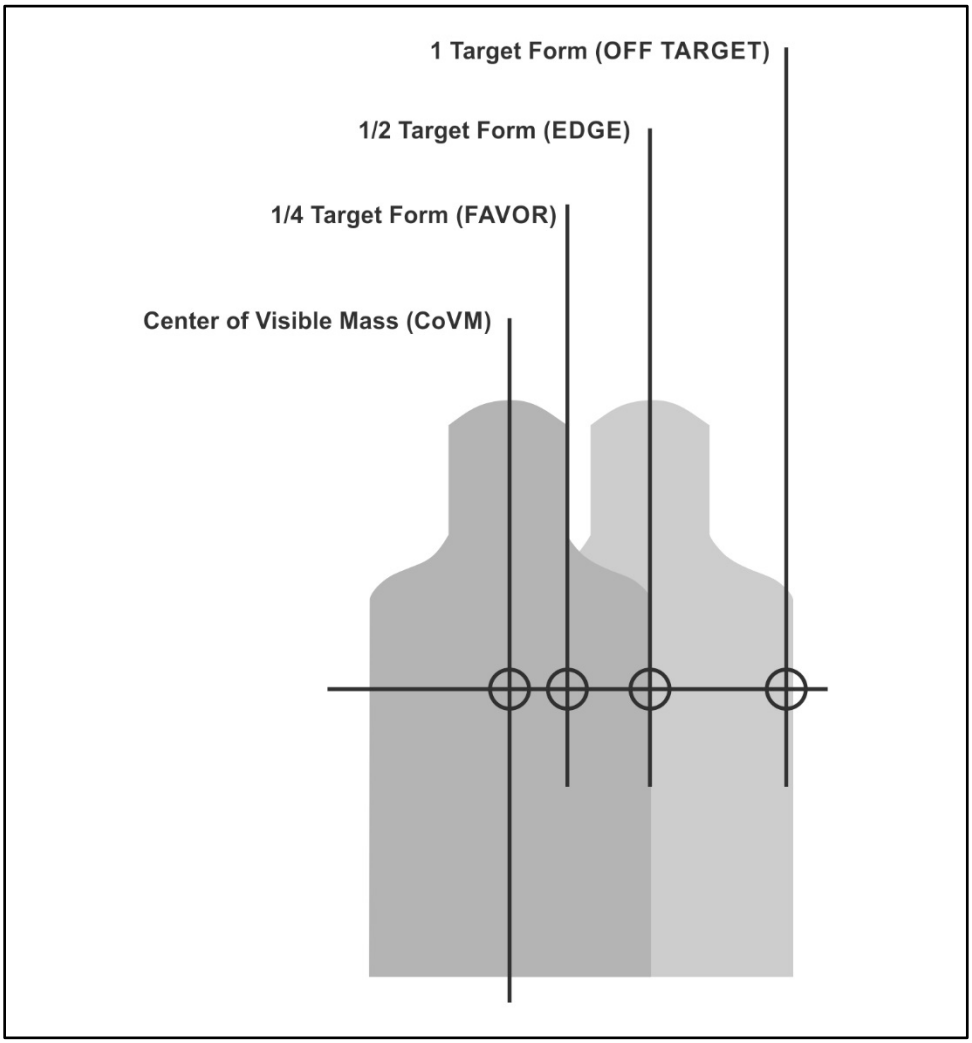



**Figure 7-4. Immediate hold locations for windage and lead, example**

## TARGET CONDITIONS

7-19. Soldiers must consider several aspects of the target to apply the proper point of aim on the target. The target's posture, or how it is presenting itself to the shooter, consists of—

- Range to target.
- Nature of the target.
- Nature of the terrain (surrounding the target).

### RANGE TO TARGET

7-20. Rapidly determining an accurate range to target is critical to the success of the Soldier at mid and extended ranges. There are several range determination methods shooters should be confident in applying to

determine the proper hold off for pending engagements. There are two types of range determination methods, immediate and deliberate.

## IMMEDIATE RANGE DETERMINATION

7-21. Immediate methods of range determination afford the shooter the most reliable means of determining the most accurate range to a given target. The immediate methods include—

- Close quarters engagements.
- Laser range finder.
- Front sight post method.
- Recognition method.
- 100-meter unit of measure method.

### Close Quarters Engagements

7-22. Short-range engagements are probable in close terrain (such as urban or jungle) with engagement ranges typically less than 50 meters. Soldiers must be confident in their capabilities, equipment, and zero to defeat threats they encounter.

7-23. Employment skills include swift presentation and application of the shot process (such as quick acquisition of sight picture) to maintain overmatch. At close ranges, perfect sight alignment is not as critical to the accurate engagement of targets. The Soldier present the weapon rapidly and the burst is fired with the front sight post placed roughly center mass on the desired target area. The front sight post must be in the rear sight aperture.

### Laser Range Finder

7-24. Equipment like the AN/PSQ-23, STORM have an on-board laser range finder that is accurate to within +/- 5 meters. Soldiers with the STORM attached can rapidly determine the most accurate range to target and apply the necessary hold offs to ensure the highest probability of incapacitation, particularly at extended ranges.

### Front Sight Post Method

7-25. Soldiers can use the area of the target that is covered by the front sight post of the machine gun to estimate the target range. Shooters can compare the appearance of the front sight post on a target at known distances to establish a mental reference point for determining range at unknown distances. The amount of the target that the front sight post covers varies depending upon the range because the apparent size of the target changes as the distance to the target changes. In addition, the shooter's eye relief and perception of the front sight post affects the amount of the target that is visible.

### Recognition Method

7-26. When observing a target, the amount of detail seen at various ranges gives the shooter a solid indication of the range to target. Shooters should study and remember the appearance of a person when they are standing at 100-meter increments. During training, Soldiers should note details such as size and the characteristics of uniform and equipment for targets at those increments.

7-27. Once Soldiers are familiar with and memorize the characteristics of standing threats at 100-meter increments out to 500 meters, they should study the targets in a kneeling position and then in the prone position. Shooters can establish a series of mental images that can help them determine range on unfamiliar terrain by comparing the appearance of positions at known ranges from 100 meters to 500 meters. Soldiers should study the appearance of other familiar objects such as weapons and vehicles, also. The list below is a general description of what the target looks like at various ranges:

- 100 meters. The target can be clearly observed in detail and facial features can be distinguished.
- 200 meters. The target can be clearly observed, although there is a loss of facial detail. The color of the skin and equipment is still identifiable.

- 300 meters. The target has a clear body outline and usually face color remains accurate, but remaining details are blurred.
- 400 meters. The body outline is clear, but the remaining detail is blurred.
- 500 meters. The body shape begins to taper at the ends. The head becomes indistinct from the shoulders.

### 100-meter Unit of Measure Method

7-28. Shooters must visualize a distance of 100 meters (generally visualizing the length of a football field) on the ground to determine the total distance to the target using the 100-meter unit of measure method. Next, Soldiers estimate how many of these units can fit between the shooter and the target.

7-29. The greatest limitation of the unit of measure method is that its accuracy is directly related to how much of the terrain is visible. The greater the range, the greater the greater the limitation. If a target appears at a range of 500 meters or more, and only a portion of the ground between the Soldier's shooter and the target can be seen, it becomes difficult to use the unit of measure method of range estimation with accuracy.

7-30. Proficiency in the unit of measure method requires constant practice. Throughout training, continuous comparisons should be made between the range estimated by the shooter and the actual range as determined by pacing or other, more accurate measurements.

## MOVING TARGETS

7-31. Moving targets are those threats that appear to have a consistent pace and direction. Targets on any battlefield will not remain stationary for long periods of time. Soldiers must have the ability to deliver lethal fires at a variety of moving target types and be comfortable and confident in the engagement techniques. There are two methods for defeating moving targets, tracking and trapping.

### Tracking Techniques

7-32. The gunner aims at a point ahead of the target equal to the estimated number of leads, maintains this lead by tracking the target (manipulates the weapon at the same angular speed as that of the target), and then fires. Tracking places the gunner in position for a second burst if the first one misses.

### Trapping Techniques

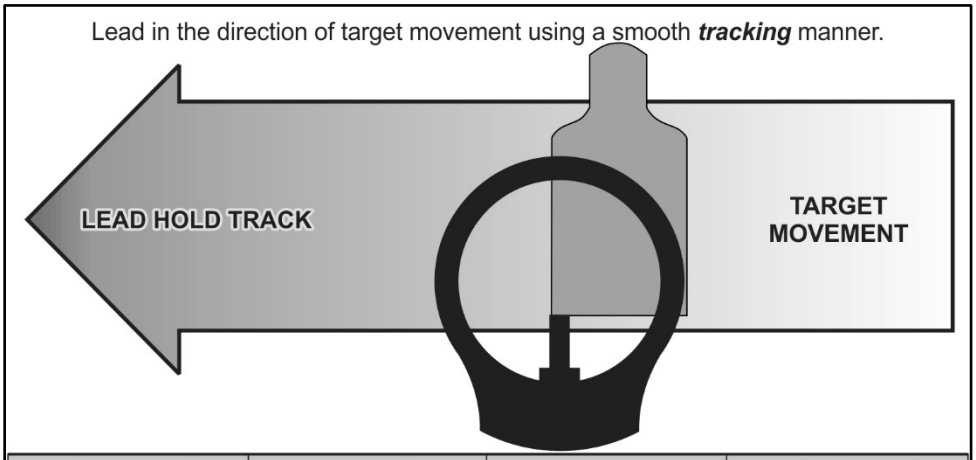
7-33. The gunner establishes an aiming point forward of the target and along the target path. He pulls the trigger as the target reaches the appropriate point in regard to lead.

## HOLD FOR MOVING TARGETS

7-34. The immediate hold for moving targets includes an estimation of the speed of the moving target and an estimation of the range to that target. Figure 7-5 illustrates the immediate holds for all the moving parts.

7-35. To hit a moving target, the machine gun must be aimed far enough ahead of the target to cause the bullet and target to arrive at the same point at the same time. This distance is measured in target lengths. One target length as seen by the gunner is one lead.

7-36. For a moving directly at the gunner, the aiming point is below the center base of the target depending on range and slope of the ground. For a target moving directly away from a gunner, the aiming point is above the center base of the target. Too much lead is better than too little because the target moves into the beaten zone, and observation of the strike of the rounds is easier relative to the target




| RANGE TO TARGET | WALKING | RANGE WALK | TACTICAL RUSH |
|---|---|---|---|
| 500 m | 3 FORM | 5 FORM | 10 1/2 FORM |
| 400 m | 2 FORM | 4 FORM | 8 FORM |
| 300 m | 1 1/2 FORM | 2 1/2 FORM | 5 1/2 FORM |
| 200 m | 1 FORM | 1 1/2 FORM | 3 1/2 FORM |
| 100 m | 1/2 EDGE | 1 FORM | 1 1/2 FORM |

| LEGEND | |
|---|---|
| m | meter |

**Figure 7-5. Immediate holds for moving targets, example**

### OBLIQUE TARGETS

7-37. Oblique threats are threats that are moving diagonally toward or away from the shooter. Oblique targets present a unique problem set to shooters because the target may be moving at a steady pace and direction; however, the target's oblique direction of travel makes them appear to move slower.

7-38. Soldiers should adjust their hold based on the angle of the target's movement from the gun-target line. The following guide helps Soldiers determine the appropriate change to apply to the moving target hold to engage the moving oblique threats (see figure 7-6).

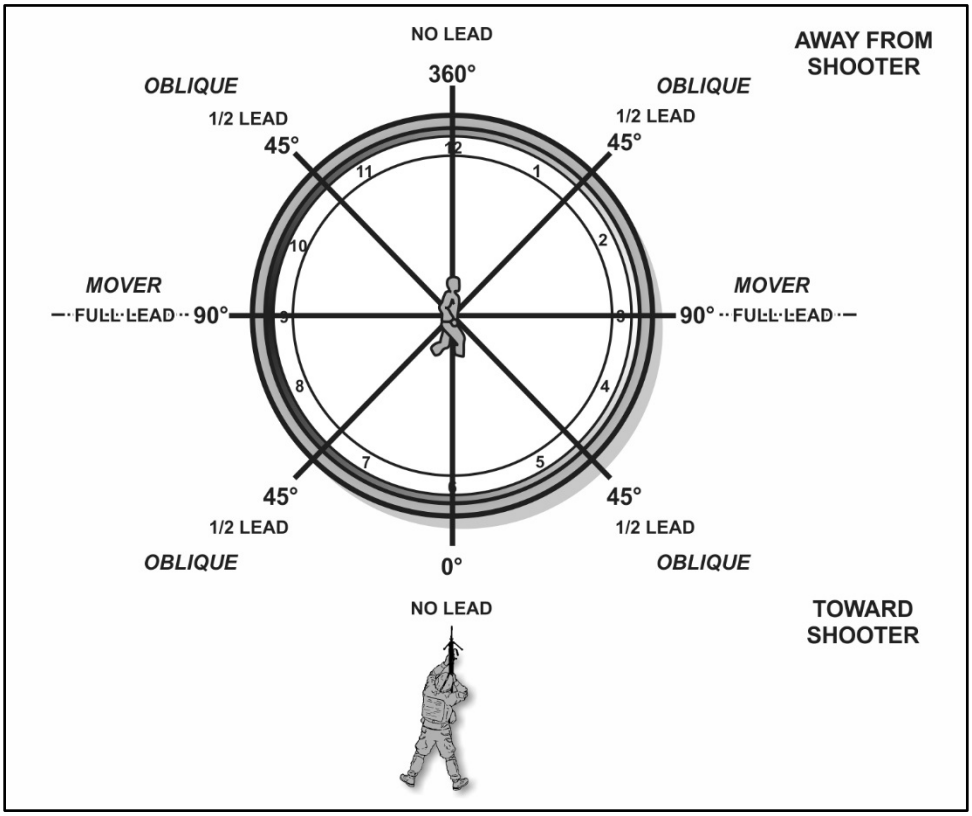



**Figure 7-6. Oblique target, example**

## ENVIRONMENTAL CONDITIONS

7-39. The environment can complicate the shooter's actions during the shot process with excessive wind or requiring angled firing limited visibility conditions. Soldiers must understand the methods to offset or compensate for these firing occasions, and prepare to apply these skills to the shot process.

### WIND

7-40. Wind is the most common variable. Wind has the greatest effect on ballistic trajectories, where it physically pushes the projectile off the desired trajectory during flight (see appendix B of this TC). Shooters can compensate for the effects of wind provided they understand how wind effects the projectile and the terminal point of impact. The elements of wind effects are—

- The time the projectile is exposed to the wind (range).
- The direction from which the wind is blowing.
- The velocity of the wind on the projectile during flight.

## Wind Direction and Value

7-41. Winds from the left blow the projectile to the right, and winds from the right blow the projectile to the left. The amount of the effect depends on the time of (projectile's exposure) the wind speed and direction. To compensate for the wind, the firer must first determine the wind's direction and value.

7-42. The clock system can be used to determine the direction and value of the wind (see figure 7-7). Picture a clock with the firer oriented downrange towards 12 o'clock.

7-43. Once the direction is determined, the value of the wind is next. The value of the wind is how much effect the wind has on the projectile. Winds from certain directions have less effect on projectiles. The chart below shows that winds from 2 to 4 o'clock and 8 to 10 o'clock are considered full-value winds and have the most effect on the projectile. Winds from 1, 5, 7, and 11 o'clock are considered half-value winds and have roughly half the effect of a full-value wind. Winds from 6 and 12 o'clock are considered no-value winds and have little or no effect on the projectile.

**EXAMPLE**

A 10-mph (miles per hour) wind blowing from the 1 o'clock direction would be a half-value wind and has the same effect as a 5 mph, full-value wind on the projectile.

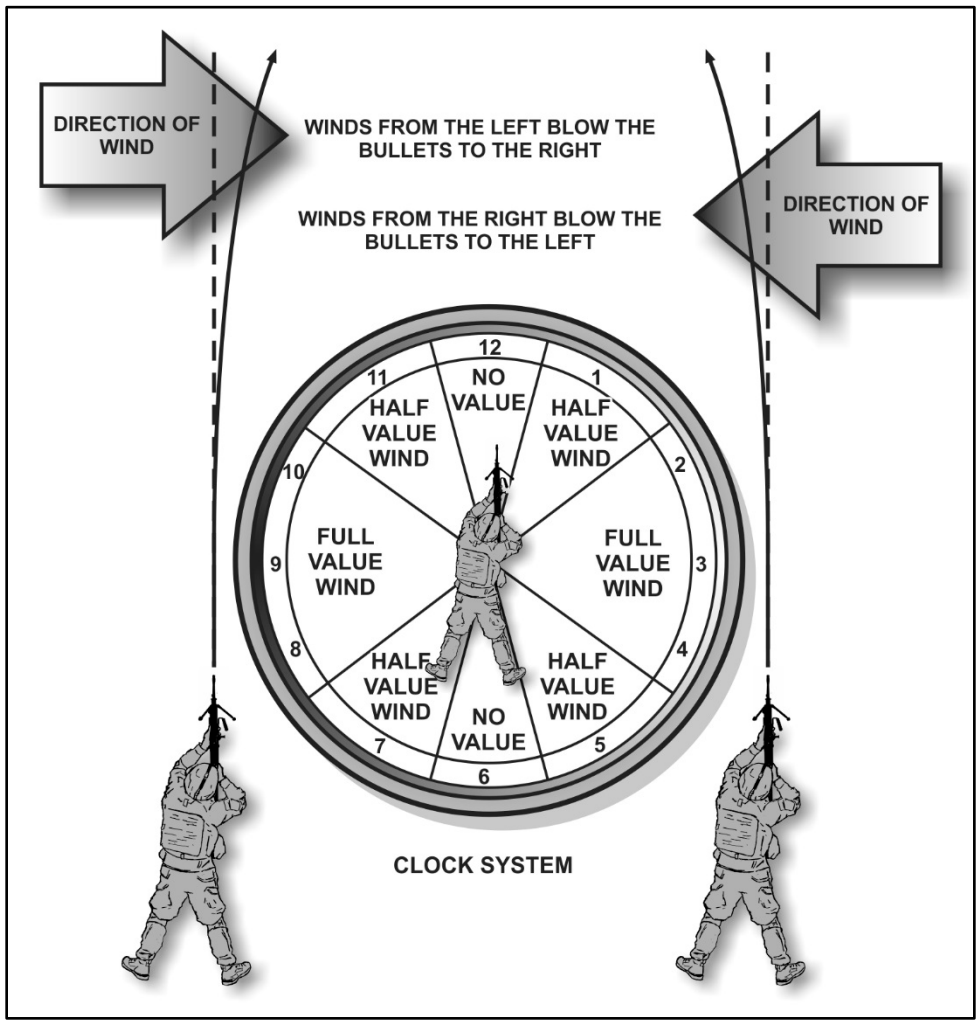



**Figure 7-7. Wind value**

7-44. The wind pushes the projectile in the direction the wind is blowing (see figure 7-8). The amount of effects on the projectile depends on the time of exposure, direction of the wind, and speed of the wind. To compensate for wind, the Soldier uses a hold in the direction of the wind (into the wind).

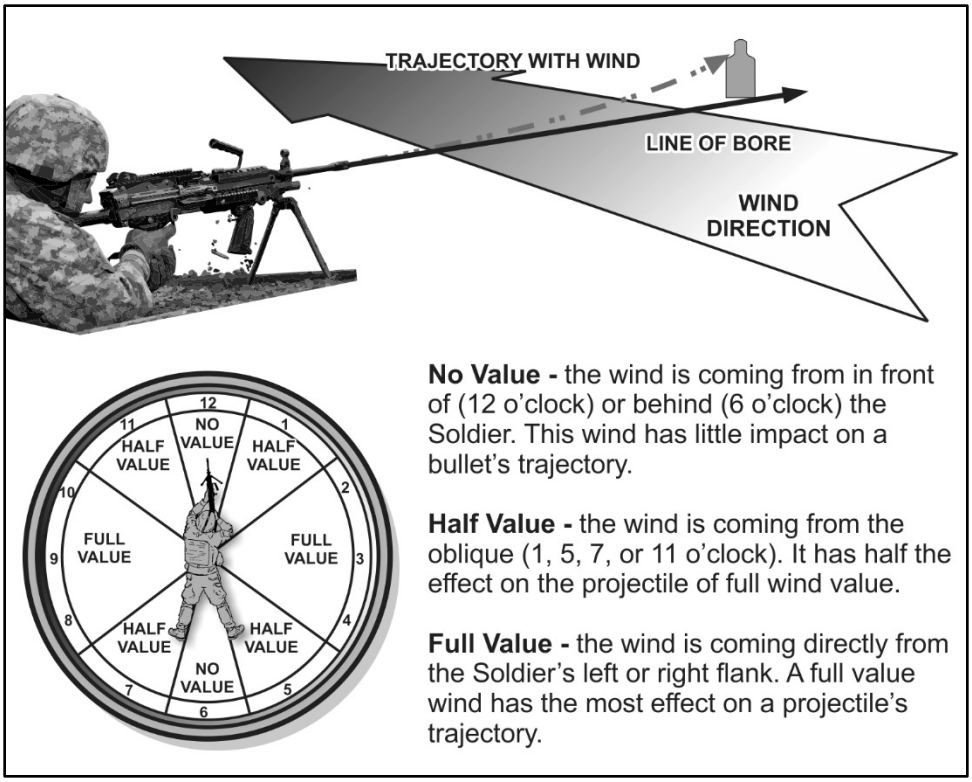



**Figure 7-8. Wind effects**

## Wind Speed

7-45. Wind speeds can vary from the firing line to the target. An average of the winds blowing on the range determines the wind speed. The firer's focus should be on the winds between the midrange point and the target. The wind at the one-half to two-thirds mark has the most effect on the projectile since that is the point where most projectiles lose a large portion of their velocity and are beginning to destabilize.

7-46. The wind speed blowing at the Soldier's location may not be the same as the wind speed blowing on the way to the target. The Soldier can observe the movement of items in the environment downrange to determine the wind speed. Each environment has different vegetation that reacts differently. Downrange wind indicators include the following:

- 0 to 3 mph, hardly felt, but smoke drifts.
- 3 to 5 mph, felt lightly on the face.
- 5 to 8 mph, keeps leaves in constant movement.
- 8 to 12 mph, raises dust and loose paper.
- 12 to 15 mph, causes small trees to sway.

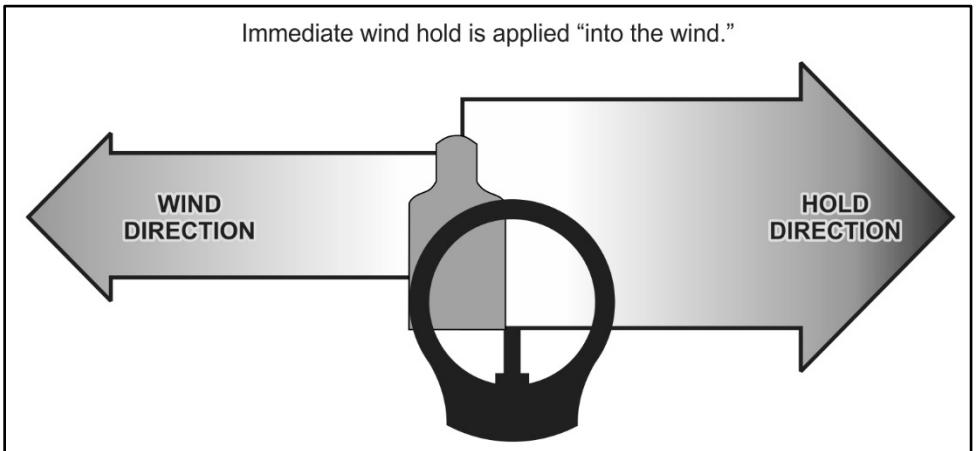
## Wind Estimation

7-47. Soldiers must be comfortable and confident in their ability to judge the effects of the wind to consistently make accurate and precise shots. Soldiers use wind indicators between themselves and the target that provide windage information to develop the proper compensation or hold off. To estimate the effects of the wind on the shot, Soldiers need to determine the three windage factors below:

- Velocity (speed).
- Direction.
- Value.

## Immediate Wind Hold

7-48. Using a hold involves changing the point of aim to compensate for the wind drift. For example, if wind causes the bullet to drift ½ form to the left, the aiming point must be moved ½ form to the right. (See figure 7-9.)




| RANGE TO TARGET | 0-5 mph | 6-10 mph | 11-15 mph |
|---|---|---|---|
| 500 m | 1 FORM | 2 FORM | 3 FORM |
| 400 m | 1/2 EDGE | 1 FORM | 2 FORM |
| 300 m | CBoVM | 1/2 EDGE | 1 FORM |
| 200 m | CBoVM | CBoVM | 1/2 EDGE |
| 100 m | CBoVM | CBoVM | CBoVM |

| LEGEND | | | | | |
|---|---|---|---|---|---|
| CBoVM | center base of visible mass | m | meter | mph | miles per hour |

**Figure 7-9. Wind hold, example**

7-49. Firers must adjust their points of aim into the wind to compensate for its effects. If they miss a distant target and wind is blowing from the right, they should aim to the right for the next burst. A guide for the initial adjustment is to split the front sight post on the edge of the target facing the wind.

7-50. Newly assigned Soldiers should aim at the target's center of visible mass for the first burst, and then adjust for wind when they are confident that wind caused the miss. Experienced firers should apply the appropriate hold for the first burst, but should follow the basic rule—when in doubt, aim at the center of mass.

### LIMITED VISIBILITY

7-51. Soldiers must be lethal at night and in limited visibility conditions, as well as during the day. The Soldiers' lethality depends largely on whether they can fire effectively with today's technology, such as night vision devices, infrared aiming devices, and TWSs.

7-52. Limited visibility conditions may limit the viewable size of a threat or cause targets to be lost after acquisition. In these situations, Soldiers may choose to apply a hold for where a target is expected to be rather than wait for the target to present itself for a more refined reticle lay or sight picture.

7-53. Soldiers may switch between optics, thermals, and pointers to refine their point of aim. To rapidly switch between aiming devices during operations in limited visibility, the Soldier must ensure accurate alignment, boresighting, and zeroing of all associated equipment. Soldiers achieve confidence in the equipment through drills related to changing the aiming device during engagements, executing repetitions with multiple pieces of equipment, and practicing nonstandard engagement techniques using multiple aiming devices in tandem (infrared pointer with night vision devices, for example).

## GUNNER CONDITIONS

7-54. The ability to aim properly while the shooter is moving, has the weapon canted, or is fighting in a CBRN environment creates additional difficulties. Shooters can mitigate their conditions to ensure an effective point of aim and target defeat.

### TACTICAL MOVEMENT

7-55. A Soldier moving tactically in any direction and attempting to engage a target may require an increase or decrease in the lead applied to a target. The following rules apply:

- As the Soldier is moving in the same direction as the target or the target is stationary, the Soldier must apply counterlead to offset their forward movement. The counterlead (or counterrotation) is based upon the range to target, the speed of the Soldier, and the speed of the target. Typically, this movement negates the need for any lead hold off.
- The Soldier applies twice the amount of lead when moving in the opposite direction of the threat.

### CANTED WEAPON

7-56. If the weapon must be tilted (canted) in one direction or another to engage a target, the strike of the bullet is in the direction of the canted weapon and low. When firing a canted weapon, the elevation becomes the azimuth, and the azimuth becomes the elevation in relation to the aim point.

### CLOSE RANGE

7-57. At close range, the effects of cant are specific to the line of sight and the axis of the bore. Soldiers should apply the offset to the target based on the angle of the cant.

### EXTENDED RANGE

7-58. The general rule is to apply the aim point in an equal amount in the opposite direction of the cant to ensure the highest probability of a hit.

# COMPOUND CONDITIONS

7-59. When combining difficult target firing occasion information, Soldiers can apply the rules specific to the situation to determine the appropriate amount of hold off to apply.

7-60. The example below shows the application of different moving target directions with varying speed directions. Figure 7-10, is a general example of applying multiple hold off information to determine complex ballistic solutions for an engagement. The same concept applies to immediate and deliberate methods of determining hold.

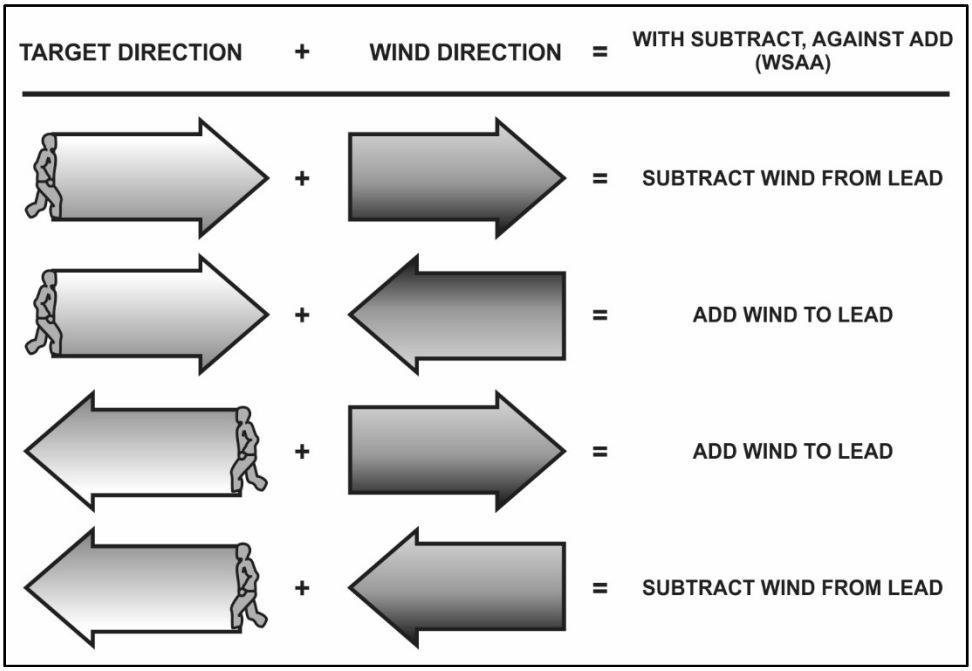



**Figure 7-10. Compound wind and lead determination, example**

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# Chapter 8
# Control

The control element considers all the conscious actions that the Soldier is in control of before, during, and after the shot process. The control process incorporates the Soldier as a safety function, as well as giving them the ultimate responsibility of firing the weapon. Proper trigger control, without disturbing the sights, is the most important aspect of control and the most difficult to master.

Combat is the ultimate test of a Soldier's ability to apply the functional elements of the shot process and firing skills. Soldiers must apply the employment skills mastered during training to all combat situations (for example, attack, assault, ambush, or urban operations). Although these tactical situations present problems, the application of the functional elements of the shot process require two additions: Changes to the rate of fire and alterations in weapon and target alignment. Chapter 8 discusses the engagement techniques to which Soldiers must adapt and the continuously changing combat engagements.

## ARC OF MOVEMENT

8-1. When firing, the Soldier is the weapon’s fire control system, ballistic computer, stabilization system, and means of mobility. Control refers to the Soldier’s ability to regulate these functions and maintain the discipline to execute the shot process at the appropriate time.

8-2. Regardless of how well-trained or physically strong a Soldier is, a wobble area (or arc of movement) is present, even when the Soldier provides sufficient physical support of the weapon. The arc of movement may be observed as the sights moving in a W shape, a circular shape, vertical (up and down) pulses, or horizontal arcs depending on the individual Soldier, regardless of their proficiency in applying the functional elements. The wobble area or arc of movement is the lateral, horizontal, and front-to-back variance in the movement that occurs in the sight picture (see figure 8-1).

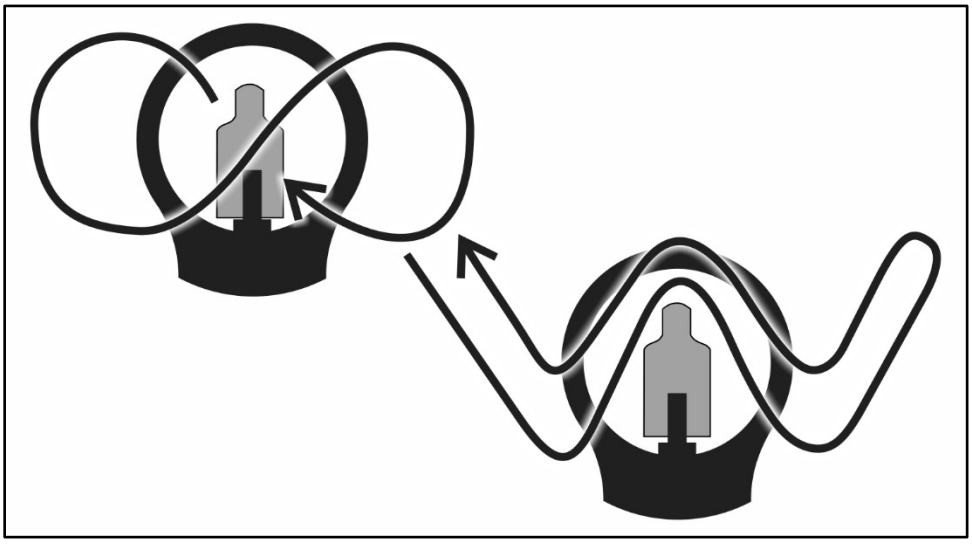


**Figure 8-1. Arc of movement, example**

8-3. The control element consists of several supporting Soldier functions and includes all the actions to minimize the Soldier's induced arc of movement. Executed correctly, the control element provides the best engagement window of opportunity to the firer. The Soldier physically maintains positive control of the shot process by managing—

- Trigger control.
- Breathing control.
- Workspace.
- Calling the shot (firing or shot execution).
- Follow-through.

# TRIGGER CONTROL

8-4. Trigger control is firing the weapon while maintaining proper aim and adequate stabilization until the bullet leaves the muzzle. Trigger control and the shooter's position work together to allow the sights to stay on the target long enough for the shooter to fire the weapon and the bullet to exit the barrel.

8-5. Stability and trigger control complement each other and integrate during the shot process. A stable position assists in aiming and reduces unwanted movements during trigger squeeze without inducing unnecessary movement or disturbing the sight picture. A smooth, consistent trigger squeeze, regardless of speed, allows the shot to fire at the Soldier's moment of choosing. When the shooter achieves both a solid position and a good trigger squeeze, any induced shooting errors can be attributed to the aiming process for refinement.

8-6. Placing the finger where it naturally lays on the trigger facilitates smooth trigger control. Natural placement of the finger on the trigger allows for the best mechanical advantage when applying rearward pressure to the trigger (see figure 8-2) as shown below:

- Trigger finger placement. The trigger finger lays naturally across the trigger after achieving a proper grip. There is no specified point on the trigger finger that must be used. The trigger finger placement is not the same for all Soldiers due to different size hands. Trigger finger placement allows the Soldier to engage the trigger in the most effective manner.
- Trigger squeeze. The Soldier pulls the trigger in a smooth, consistent manner adding pressure until the weapon fires. Regardless of the speed at which the Soldier is firing, the trigger control is always smooth.
- Trigger reset. The Soldier must retain focus on the sights while resetting the trigger.

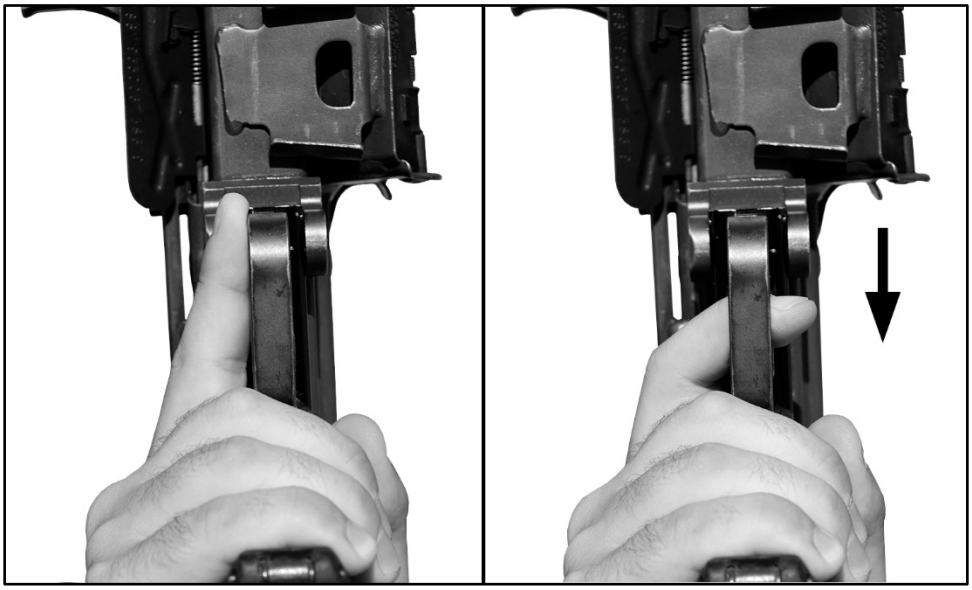


**Figure 8-2. Natural trigger finger placement, example**

## BREATHING CONTROL

8-7. The shooter controls their breathing to reduce the amount of movement of the weapon during the shot process. During training, the Soldier learns a method of breathing control that best suits their shooting style and preference. Breathing control is the relationship of the respiratory process (free or under stress) with the decision to execute the trigger squeeze.

8-8. Breathing induces unavoidable body movement that contributes to wobble or the arc of movement during the shot process. Soldiers cannot completely eliminate all motion during the shot process, but they can significantly reduce its effects through practice and technique. A common technique is firing on the natural pause during grouping and zeroing.

8-9. Failure to maintain proper aiming and trigger control, rather than breathing, is the likely cause of vertical dispersion during grouping. Refer to appendix E of this publication for proper target analysis techniques.

## WORKSPACE MANAGEMENT

8-10. The workspace is an area approximately 8 to 10 inches in front of and centered on the Soldier's chin. The workspace is where the majority of weapon manipulations take place. (See figure 8-3, page 8-4.)

8-11. Conducting manipulations in the workspace allows the Soldier to keep their eyes oriented towards a threat or towards their individual sector of fire while conducting critical weapons tasks that require hand and eye coordination. Use of the workspace creates efficiency of motion by minimizing the distance the weapon has to move from the firing position to the workspace, then returning to the firing position.

8-12. Location of the workspace changes slightly in different firing positions. There are various techniques to use the workspace. Some examples of using the workspace are leaving the buttstock in the shoulder, tucking the buttstock under the armpit for added control of the weapon, or placing the buttstock in the crook of the elbow.

8-13. Below is the workspace management area upon which Soldiers should focus their attention:

- Selector lever, to change the weapon's status from safe to fire.
- Cocking handle, to smoothly use the cocking handle during operation including any corrective actions to overcome malfunctions, loading, unloading, or clearing procedures.
- Cover assembly, the smooth functioning of the cover assembly during reloading procedures, clearing procedures, or malfunction corrective actions.
- Chamber check, the sequence used to verify the status of the weapon's chamber.

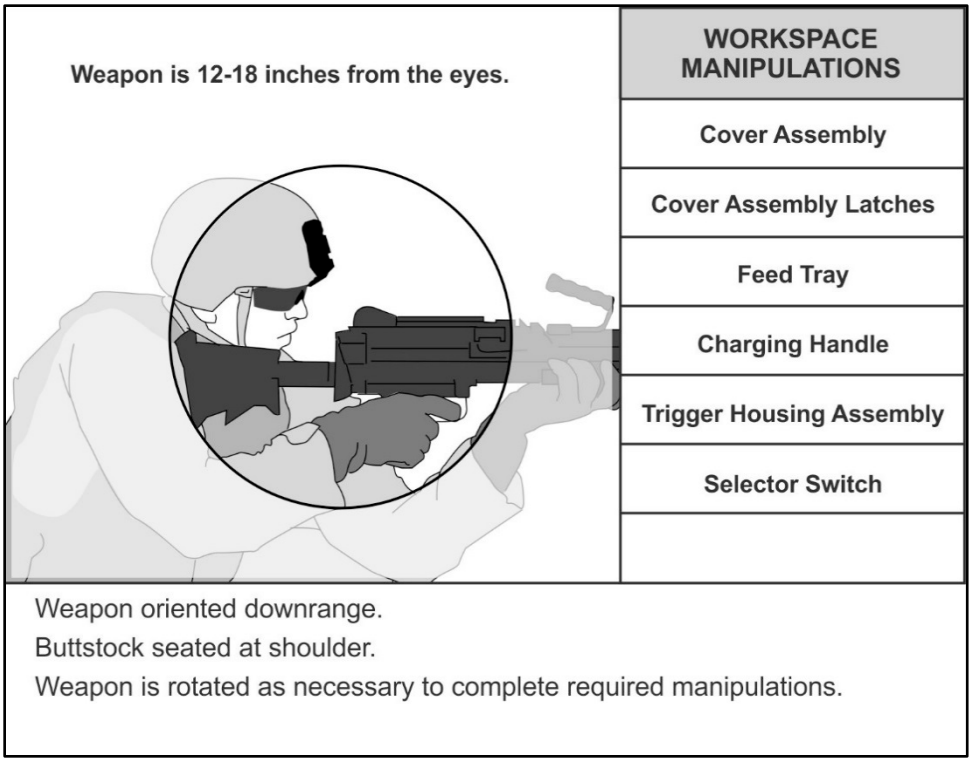



**Figure 8-3. Workspace, example**

# CALLING THE SHOT

8-14. Knowing precisely where the sights are when the weapon discharges is critical for shot analysis. Errors such as flinching or jerking of the trigger can be seen in the sights before discharge.

8-15. Calling a shot refers to a firer stating exactly where they think the first round of the burst will strike by recalling the sights in relationship to the target when the weapon fires. Normally, calling a shot is expressed in clock direction and inches from the desired point of aim.

8-16. The shooter is responsible for the point of impact of every round fired from their weapon. Therefore, the Soldier must ensure the target area is clear of friendly and neutral actors in front of and behind the target. Soldiers must be aware of the environment the target is positioned in, particularly in urban settings; friendly or neutral actors may be present in other areas of a structure that the projectile can pass through.

# RATE OF FIRE

8-17. The shooter must determine how to engage the threat with the weapon on the current burst as well as subsequent bursts. Following the direction of the team leader, the Soldier controls the rate of fire to deliver consistent, lethal, and precise fires against the threat.

## SUSTAINED FIRE

8-18. Sustained fire is moderately paced at the discretion of the Soldier. Typically, Soldiers use sustained fire in a training environment or a secure defensive position. Sustained fire is approximately 50 rounds per minute in 6 to 9-round bursts with 4 to 5 seconds between bursts including a barrel change after 10 minutes of sustained firing. Sustained firing is the Soldier's normal rate of fire and allows the most time to focus on the functional elements in the shot process. Sustained fire reinforces all previous training.

### RAPID FIRE

8-19. Rapid fire is approximately 100 rounds per minute, fired in 6- to 9-round bursts with 2 to 3 seconds between bursts, including a barrel change every 2 minutes. Typically, Soldiers use rapid fire for multiple targets or combat scenarios where they do not have overmatch of the threat. Soldiers should be well-trained in all aspects of sustained firing before attempting any rapid fire training.

8-20. Soldiers who display a lack of knowledge of employment skills should not advance to rapid fire training until these skills are learned and mastered.

### CYCLIC FIRE

8-21. Cyclic is approximately 850 rounds per minute, fired in continuous bursts, with a barrel change every minute. Soldiers use cyclic fire to apply suppressive fires with accuracy and when the need for precise fires, although desired, is not as important. Automatic or burst fires drastically decrease the probability of a hit due to the rapid succession of recoil impulses and the inability of the Soldier to maintain proper sight alignment and sight picture on the target.

8-22. Soldiers should be well-trained in all aspects of sustained firing before attempting any cyclic training.

## FOLLOW-THROUGH

8-23. Follow-through is the continuous mental and physical application of the shot process' functional elements after the burst has been fired. The firer's head stays in contact with the stock, their firing eye remains open, and their body position and breathing remain steady.

8-24. Follow-through consists of all actions the shooter controls after the bullet leaves the muzzle. Firers must complete the shot process with follow-through. The follow-through actions are executed in a general sequence as follows:

- Recoil management. Includes the bolt assembly recoiling completely and returning to the locked position.
- Recoil recovery. Returning to the same pre-shot position and reacquiring the sight picture. The shooter should have a good sight picture before and after the burst.
- Trigger/sear reset. Once the ejection phase of the cycle of function is complete, the weapon initiates and completes the cocking phase. As part of the cocking phase, all mechanical components associated with the trigger disconnect and the sear is reset. Any failures in the cocking phase indicate a weapon malfunction and the shooter must take the appropriate action. The shooter maintains trigger finger placement and releases pressure on the trigger until the sear is reset. At this point, the sear is reset and the trigger is prestaged for a subsequent or supplemental engagement if needed.
- Sight picture adjustment. Counteracting the physical changes in the sight picture caused by recoil impulses and returning the sight picture onto the target aiming point.
- Engagement assessment. Once the sight picture returns to the original point of aim, the firer confirms the impact of the burst, assesses the target's state, and immediately selects one of the following courses of action:
  - Subsequent engagement. The target requires additional (subsequent) bursts to achieve the desired target effect. The shooter starts the pre-shot process.
  - Supplemental engagement. The shooter determines the desired target effect is achieved and that another target may require servicing. The shooter starts the pre-shot process.
  - Sector check. All threats have been adequately serviced to the desired effect. The shooter then checks their sector of responsibility for additional threats as the tactical situation dictates. The unit's SOP dictates any vocal announcements required during the post-shot sequence.
  - Correct malfunction. If the firer determines during the follow-through that the weapon failed during one of the phases of the cycle of function, they make the appropriate announcement to their team and immediately execute corrective action.

# MALFUNCTIONS

8-25. A malfunction occurs when any weapon fails to complete any phase of the cycle of function correctly. When a malfunction occurs, the Soldier's priority to defeat the target as quickly as possible remains. The malfunction, Soldier capability, and the secondary weapon capability determine if, when, and how to transition to a secondary weapon system.

## SECONDARY WEAPON

8-26. The Soldier controls which actions must be taken to ensure the target is defeated as quickly as possible based on secondary weapon availability and capability, and the level of threat presented by the range to target and its capability present. The list below describes the general use of secondary weapons:

- Secondary weapons can defeat the threat. Soldiers transition to a secondary weapon for the engagement. If no secondary weapon is available, Soldier announces their status to the small team, and moves to a covered position to correct the malfunction.
- Secondary weapons cannot defeat the threat. Soldiers quickly move to a covered position, announce their status to the small team, and execute corrective action.
- No secondary weapons. Soldiers quickly move to a covered position, announce their status to the small team, and execute corrective action.

## CORRECTIVE ACTION

8-27. A properly functioning weapon is the end state of any corrective action. Typically, the phase in which the malfunction occurred within the cycle of function identifies the general problem. From a practical, combat perspective, malfunctions are recognized by their symptoms. Although some symptoms do not specifically identify a single point of failure, they provide the best indication on which corrective action to apply.

8-28. To overcome the malfunction, the Soldier must first avoid overanalyzing the issue. The Soldier must train to execute corrective actions immediately without hesitation or investigation during combat conditions. The two general types of corrective action are defined below:

- Immediate action is the simple, rapid actions or motions the Soldier takes to correct basic disruptions in the weapon's cycle of function. The Soldier takes immediate action when a malfunction occurs, for example, when the trigger is squeezed and the piston assembly moves forward with the firing pin resulting in an audible click.
- Remedial action is a skilled technique applied to a specific problem or issue with the weapon when taking immediate action cannot correct the problem. Soldiers take remedial action when the cycle of function is interrupted. For example, when the Soldier squeezes the trigger and either has little resistance during the squeeze (mush) or the trigger cannot be squeezed causing an interruption in the cycle of function.

8-29. No single corrective action solution can resolve all or every malfunction. Soldiers need to understand what failed to occur as well as any specific sounds or actions of the weapon to apply the appropriate correction measures.

8-30. Immediate action can correct rudimentary failures during the cycle of function. Common failures are listed below:

- Failure to fire happens when a round is locked into the chamber, the weapon is ready to fire, the select switch is placed on fire, and the trigger is squeezed. The piston assembly moves forward with the firing pin (audible click), and the weapon does not fire.
- Failure to feed happens when the bolt assembly is expected to move back into the battery, but is prevented from moving all the way forward. A clear gap between the bolt assembly and the rear edge of the barrel assembly can be seen.
- Failure to chamber happens when the round is being fed into the chamber, but the bolt assembly does not fully seat forward, failing to chamber the round and lock the bolt locking lugs with the barrel extension's corresponding lugs.

- Failure to extract happens when, either automatically or manually, the extractor loses its grip on the cartridge case or the bolt seizes movement rearward during extraction that leaves the cartridge case partially removed or fully seated.
- Failure to eject occurs when, either automatically or manually, a cartridge case is extracted from the chamber fully, but does not leave the upper receiver through the ejection port.

8-31. Remedial action requires the Soldier to quickly identify one of four issues and apply a specific technique to correct the malfunction. Soldiers must perform remedial action to correct the following types of malfunctions or symptoms:

- Immediate action fails to correct the symptom occurs when a malfunction that initiated the Soldier to execute immediate action and multiple attempts failed to correct the malfunction.
- Double feed occurs when a round is chambered and not fired and a subsequent round is fed without the chamber being clear.
- Charging handle impingement occurs when a round becomes stuck between the bolt assembly and the charging handle where the charging handle is not in the forward, locked position.

8-32. Although there are other types of malfunctions or disruptions to the cycle of function, those listed above are the most common. Any other malfunction requires additional time to determine the true point of failure and an appropriate remedy.

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***Note***. When malfunctions occur in combat, the Soldier must announce STOPPAGE or another similar term to their small unit, quickly move to a covered location, and correct the malfunction as rapidly as possible. If the threat is too close to the Soldier or friendly forces, and the Soldier has a secondary weapon, the Soldier should immediately transition to secondary to defeat the target prior to correcting the malfunction.

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## RULES FOR CORRECTING A MALFUNCTION

8-33. To clear a malfunction, the Soldier must—

- Apply Rule No. 1. Soldiers must remain coherent of their weapon and continue to treat their weapon as if it is loaded when correcting malfunctions.
- Apply Rule No. 2. Soldiers must ensure the weapon's orientation is appropriate for the tactical situation and not flag other friendly forces when correcting malfunctions.
- Apply Rule No. 3. Take the trigger finger off the trigger and keep it straight along the lower receiver placed outside of the trigger guard.
- Do not attempt to place the weapon on safe (unless otherwise noted). Most stoppages do not allow the weapon to be placed on safe because the sear has been released or the weapon is out of battery. Attempting to place the weapon on SAFE wastes time and potentially damages the weapon.
- Treat the symptom. Each problem has its own specific symptoms. Soldiers can quickly correct the malfunction if they react to what the weapon is telling them.
- Maintain focus on the threat. The Soldier must keep their head and eyes looking downrange at the threat, not at the weapon. If the initial corrective action fails to correct the malfunction, the Soldier must quickly move to the next most probable corrective action.
- Look last. Do not look and analyze the weapon to determine the cause of the malfunction. Execute the drill that has the highest probability of correcting the malfunction.
- Check the weapon. Once the malfunction is clear and the threat is eliminated, deliberately check the weapon when in a covered location for any potential issues or contributing factors causing the malfunction and correct them.

## PERFORM IMMEDIATE ACTION

8-34. The Soldier should perform the following immediate actions instinctively:

- Hear the piston assembly move forward with an audible click.
- Pull and lock the charging handle to the rear.

- Observe the ejection port to see if a cartridge case, belt link, or round ejects.
- Push the charging handle forward to its lock position.
- Continue the shot process to reassess.

***Note***. If a cartridge case, belt link, or round fails to eject, take remedial action.

## PERFORM REMEDIAL ACTION

8-35. The Soldier must have a clear understanding of where the weapon failed during the cycle of function to perform remedial action. Soldiers execute remedial action when one of the following conditions exist:

- Immediate action does not work.
- The trigger refuses to be squeezed.
- The trigger feels like mush when squeezed.

8-36. The Soldiers lifts the feed tray cover and removes the ammunition belt when one of the two symptoms, double-feed or charging handle impingement, exists. Next, the Soldier lifts the feed tray to look into the chamber area to quickly assess the type of malfunction. Once complete, the Soldier visually inspects the chamber area, bolt face, and charging handle. Lastly, the Soldier completes the actions below depending on which symptom exists:

- Double-feed. The Soldier must remove the ammunition from the feed tray, clear the weapon, confirm the chamber area is clear, secure an ammunition belt onto the feed tray, and charge the weapon.
- Charging handle impingement. The Soldier attempts to clear the weapon. If unsuccessful, the Soldier must not attempt to force the charging handle to the rear using their foot or a heavy object. The Soldier must—
  - Open the cover assembly and disassemble the weapon.
  - Remove the round or fired cartridge, using a cleaning rod or ruptured cartridge extractor if necessary.

***Note***. Keep rearward pressure on the charging handle until after the gunner or the assistant gunner has removed the buffer assembly.

## COOK-OFF

8-37. Rapid and continuous firing of 200 or more rounds in sequence without cooling, severely elevates chamber temperatures. While unlikely, elevated temperatures may cause a malfunction known as a cook-off. A cook-off may occur while the round is locked in the chamber due to excessive heating of the ammunition. Rapid exposure to the cooler air outside of the chamber may instigate a cook-off due in part to the change in pressure.

8-38. If the Soldier determines that they have a potential cook-off situation they should leave the weapon directed at the target, or in a known safe direction, and move the safety selector switch to safe. The Soldier should wait 15 minutes for the weapon to cool. After waiting for the weapon to cool, the Soldier should clear the weapon, perform remedial action, and change the barrel.

**WARNING**

**Ammunition cook-off is not likely in well-maintained weapons used within normal training and combat parameters.**

**Soldiers and unit leadership need to consider the dangers of keeping rounds chambered in weapons that have elevated temperatures due to excessive firing. Or clearing ammunition that has the potential to cook-off when exposed to the cooler air outside of the chamber.**

**Exposure to the colder air outside of the chamber has the potential to cause the cook-off of ammunition. Keeping ammunition chambered in severely elevated temperatures also has the potential to cause the cook-off of ammunition.**

***Note***. For more information about troubleshooting, malfunctions, and replacing components, see organizational and direct support maintenance publications and manuals.

# TRANSITION TO SECONDARY WEAPON

8-39. A secondary weapon, such as a pistol, is the most efficient way to engage a target at close quarters when the primary weapon malfunctions. The Soldier controls which actions must be taken to ensure the target is defeated as quickly as possible based on the threat presented.

8-40. The firer transitions by taking the secondary weapon from the HANG or HOLSTERED position to the READY UP position, reacquiring the target, and resuming the shot process as appropriate.

8-41. Refer to the appropriate secondary weapon's training publications for the specific procedures to complete the transition process.

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## Chapter 9

# Movement

The movement functional element is the process of the Soldier moving tactically during the engagement process. The movement functional element includes the Soldier's ability to move laterally, forward, diagonally, and retrograde while maintaining stabilization, appropriate aim, and control of the weapon.

Proper application of the shot process during movement is vital to combat operations. The most complex engagements involve movement of both the Soldier and the adversary. The importance of sight alignment and trigger control are highest during movement. The movement of the Solider degrades stability, the ability to aim, and creates challenges to proper trigger control.

## MOVEMENT TECHNIQUES

9-1. The Soldier uses vertical and horizontal tactical movements. Each tactical movement requires specific considerations to maintain and adequately apply the other functional elements during the shot process.

9-2. Soldiers use vertical movements to change their firing posture or negotiate terrain or obstacles while actively seeking, orienting on, or engaging threats. Vertical movements include actions taken to—

- Change among any of the primary firing positions; standing, crouched, kneeling, sitting, or prone.
- Negotiate stairwells in urban environments.
- Travel across inclined or descending surfaces, obstacles, or terrain.

9-3. Soldiers use horizontal movements to negotiate the battlefield while actively seeking, orienting on, or engaging threats. Soldiers use one or all four of the horizontal movement techniques listed below to maintain weapon orientation on the threat:

- Forward. Movement directly toward the adversary.
- Retrograde. Movement rearward away from the threat while maintaining weapon orientation on the threat.
- Lateral right or left. Lateral, diagonal, forward, or retrograde movement to the right or left.
- Turning left, right, or about. Actions the Soldier takes to change the weapon orientation left, right, or to the rear followed by the Soldier's direction of travel turning to the same orientation.

## FORWARD MOVEMENT

9-4. Forward movement is continuous progress toward the adversary or route of march. Forward movement is the most basic form of movement during an engagement.

9-5. During forward movement, Soldiers should perform the following techniques:

- Roll the foot heel to toe to provide the best stable firing platform.
- Ensure their feet fall closely in line during movement. The straight-line movement reduces the arc of movement and visible bouncing of the sight picture.
- Keep their hips as stationary as possible. Use the upper body as a turret, twisting at the waist, maintaining proper platform with the upper body.
- Ensure that when shooting while moving, they are very close to their natural walking gait and come directly from the position obtained while stationary.

- Keep their weapon at the ready position and always maintain awareness of their surroundings to their left and right at all times during movement.
- Maintain an aggressive position.
- Keep the muzzle of the weapon facing downrange toward the expected or detected threat.

## RETROGRADE MOVEMENT

9-6. Retrograde movement is where the orientation of the weapon remains to the Soldier's front while the Soldier methodically moves rearward.

9-7. During retrograde movement, the Soldier should perform the following techniques:

- Take only one or two steps to open the distance or reposition the feet.
- Place the feet in a toe-to-heel manner and drop the center body mass by consciously bending the knees, using a reverse combat glide.
- Maintain situational awareness of team members, debris, and terrain.
- Use the knees as a shock absorber to steady the body movement to maintain the stability of the upper body, stabilizing the weapon sight(s) on the target.
- Ensure all movement is smooth and steady to maintain stability.
- Bend forward at the waist to put as much mass as possible behind the weapon for recoil management.
- Keep the muzzle oriented downrange toward the expected or detected threat.
- Keep the hips as stationary as possible. Use the upper body as a turret, twisting at the waist, maintaining proper platform with the upper body.

## LATERAL MOVEMENT

9-8. Lateral movement is where the Soldier maintains weapon orientation downrange at the expected or detected threat while moving to the left or right. In the most extreme cases, the target is offset 90 degrees or more from the direction of movement.

9-9. During lateral movement, Soldiers should perform the following techniques:

- Place their feet heel to toe and drop their center mass by consciously bending the knees.
- Use the knees as a shock absorber to steady the body movement to maintain the stability of the upper body, stabilizing the machine gun sight(s) on the target.
- Ensure all movement is smooth and steady to maintain stability.
- Bend forward at the waist to put as much mass as possible behind the weapon for recoil management.
- Roll the foot, heel to toe, as they place the foot on the ground and lift it up again to provide for the smoothest motion possible.
- Keep the weapon at the alert or ready carry. Do not aim on the target until ready to engage.
- Maintain awareness of the surroundings, to the left and right, at all times during movement.
- Trigger control when moving is based on the wobble area. The Soldier shoots when the sights are most stable, not based on foot position.
- Keep the muzzle of the weapon facing downrange toward the threat.
- When moving, the placement of the feet should be heel to toe.
- Do not overstep or cross the feet, because this can decrease the Soldier's balance and center of gravity.
- Keep the hips as stationary as possible. Use the upper body as a turret, twisting at the waist, maintaining proper platform with the upper body.

***Note***. Engaging adversaries to the firing side while moving laterally is difficult. The twist required to achieve a full 90-degree offset requires proper, repetitive training. The basic concept of movement must be maintained, from foot placement to platform.

Twisting at the waist does not allow the weapon to be brought to a full 90 degrees off the direction of travel, especially with nonadjustable buttstocks. The Soldier must drop the nonfiring shoulder and roll the upper body toward the nonfiring side. Rolling the upper body toward the nonfiring side causes the weapon and upper body to cant at approximately a 45-degree angle, relieving some tension in the abdominal region, allowing the Soldier to gain a few more degrees of offset.

## TURNING MOVEMENT

9-10. Soldiers use the turning movement to engage widely dispersed targets in the oblique and on the flanks. Turning skills are just as valuable in a rapidly changing combat environment as firing on the move (such as lateral movement) skills and should be used with the alert carry only.

9-11. Which direction the Soldier is turning or which side is the Soldier's strong side is unimportant. The Soldier must maintain the weapon at an exaggerated low-alert carry for the duration of the turn.

9-12. Soldiers must maintain muzzle awareness at all times. Soldiers ensure that the muzzle does not begin to come up on target until their body is completely turned toward the threat.

9-13. When executing a turn to either side, the Soldier must perform the following techniques:

- Look first. Turn head to the direction of the turn first.
- Weapon follows the eyes. The Soldier moves the weapon smoothly to where the eyes go.
- Follow with the body. The body begins movement with the movement of the weapon. Soldiers finish the body movement smoothly to maintain the best possible stability for the weapon.
- Maintain situational awareness. The Soldier must be completely aware of the surrounding terrain, particularly for tripping hazards. When necessary, Soldiers should visually check their surroundings during the turning action and return their vision to the target area as quickly as possible.

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## Appendix A

# Ammunition

Appendix A discusses the characteristics and capabilities of the different ammunition available for the M249 LMG weapons. Appendix A includes general ammunition information such as packaging, standard and North Atlantic Treaty Organization (known as NATO) marking conventions, the components of ammunition, and general principles of operation. The information within this appendix is 5.56 mm for the M249-series weapons only.

## SMALL ARMS AMMUNITION CARTRIDGES

A-1. Ammunition for use in light machine guns is described as a cartridge. A small arms cartridge (see figure A-1) is an assembly consisting of a cartridge case, a primer, a quantity of propellant, and a bullet. The following terminology describes the general components of all small arms ammunition cartridges (known as SAA cartridges):

- Cartridge case. The cartridge case is a brass, rimless, center-fire case that provides a means to hold the other components of the cartridge.
- Propellant. The propellant (or powder) provides the energy to propel the projectile through the barrel and downrange towards a target through combustion.
- Primer. The primer is a small explosive charge that provides an ignition source for the propellant.
- Bullet. The bullet or projectile is the only component that travels to the target.

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***Note***. Dummy cartridges are composed of a cartridge case and bullet, with no primer or propellant. Some dummy cartridges contain inert granular materials to simulate the weight and balance of live cartridges.

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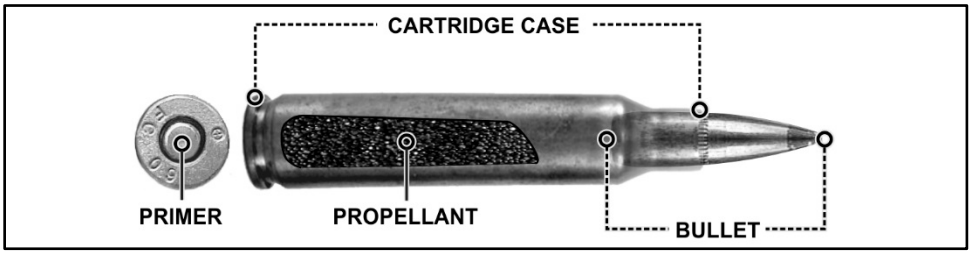



**Figure A-1. Small arms ammunition cartridge**

## CARTRIDGE CASE

A-2. Ball, tracer, armor-piercing, blank, and dummy are the types of bullets used for various purposes.

A-3. The cartridge case is made of steel, aluminum, or a brass combination (70 percent copper and 30 percent zinc) for military use. The M249-series weapons is a rimless cartridge case with an extraction groove (shown in figure A-2). The cartridge cases are designed to support center-fire operation.

A-4. Center-fire cases have a centrally located primer well or pocket in the base of the case, which separates the primer from the propellant in the cartridge case. The cases are designed to withstand pressures generated during firing and are used for most small arms.

A-5. All 5.56-mm ammunition uses the rimless cartridge case. A rimless cartridge is where the rim diameter is the same as the case body. A rimless cartridge uses an extractor groove to facilitate the cycle of functioning. The design allows for the stacking of multiple cartridges in a magazine.

A-6. The cartridge case expands tightly to the chamber walls, providing rear obturation to contain the burning propellant when the round is fired.

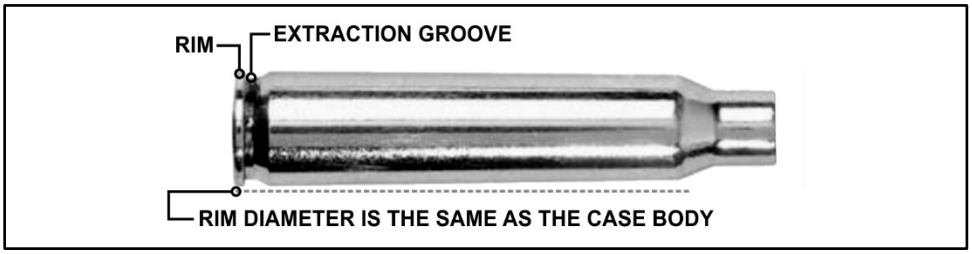



**Figure A-2. Cartridge case**

## PROPELLANT

A-7. Cartridges are loaded with various propellant weights that impart sufficient velocity, within safe pressure, to obtain the ballistic projectile performance required. The propellants are either a single-base (nitrocellulose) or double-base (nitrocellulose and nitroglycerine) composition.

A-8. The propellant (see figure A-3) may be a single-cylindrical or multiple-perforation, a ball, or a flake design to facilitate rapid burning. Most propellants are coated to assist with combustion rate control. A final graphite coating facilitates propellant flow and eliminates static electricity when loading the cartridge.

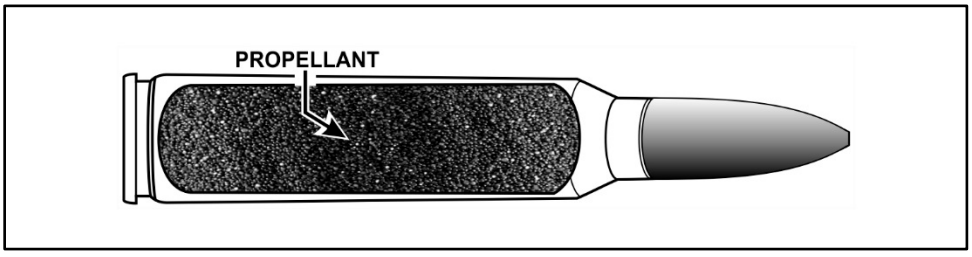



**Figure A-3. Propellant**

## PRIMER

A-9. Center-fire, small arms cartridges contain a percussion primer assembly. The assembly has a brass or gilding metal cup (see figure A-4). The cup contains a pellet of sensitive explosive material secured by a paper disk and a brass anvil.

A-10. The weapon firing pin striking the center of the primer cup base compresses the primer composition between the cup and the anvil, causing the composition to explode. Holes or vents located in the anvil or closure cup allow the flame to pass through the primer vent, igniting the propellant.

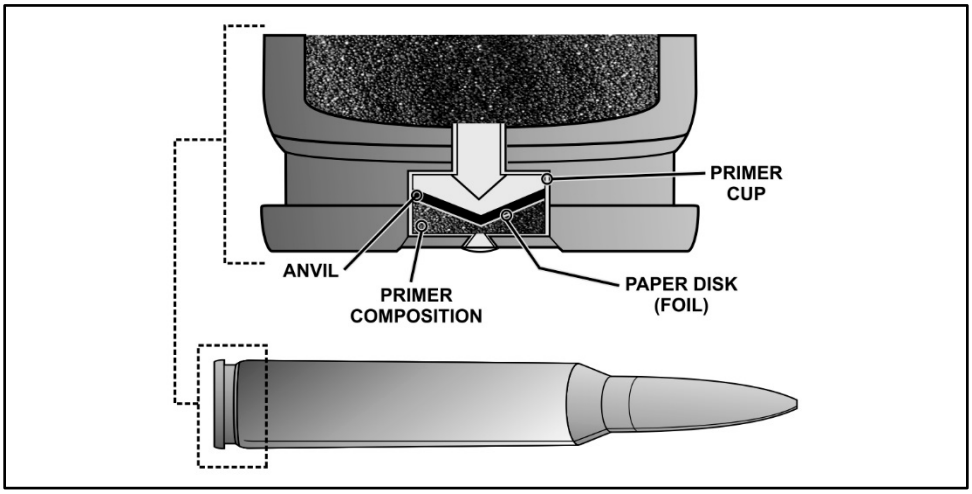



**Figure A-4. Example of primer in detail**

## BULLET

A-11. The bullet is a cylindrically shaped lead or alloy projectile that engages with the rifling of the barrel. Newer projectiles have a copper slug with an exposed steel penetrator as with the M855A1. The bullets used today are either lead (lead alloy) or assemblies of a jacket and a lead or steel core penetrator. The lead used in lead-alloy bullets is combined with tin, antimony, or both for bullet hardness. The alloying reduces barrel leading and helps prevent the bullet from striping (jumping) the rifling during firing.

A-12. Soldiers use jacketed bullets (see figure A-5) to obtain high velocities. Jacketed bullets are better suited for semiautomatic and automatic weapons. A bullet jacket may be either gilding metal, gilding metal-clad steel, or copper plated steel. In addition to a lead or steel core, they may contain other components or chemicals that provide a terminal ballistic characteristic for the bullet type.

A-13. Some projectiles may be manufactured from plastic, wax, and plastic binder and metal powder, two or more metal powders, or various combinations based on the cartridge's use.

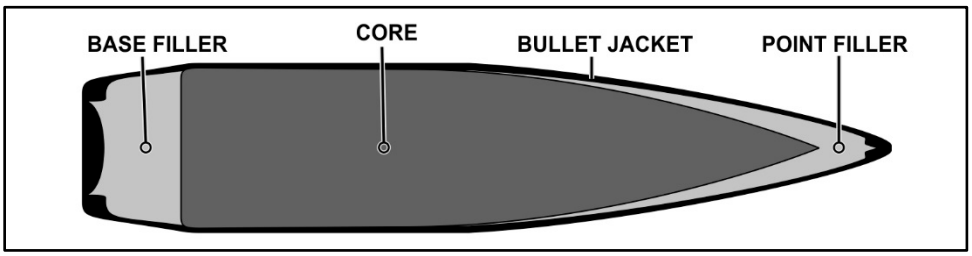



**Figure A-5. Bullet, armor-piercing cartridge, example**

# SMALL ARMS AMMUNITION TYPES

A-14. Soldiers use several types of small arms ammunition for the M249-series weapons for training and combat. Each of these ammunition types provides a different capability and has specific characteristics. The most common types of ammunition for the light machine gun are described in the following paragraphs.

## BALL

A-15. The ball cartridge (see figure A-6) is intended for use in light machine guns against personnel and unarmored targets. The bullet, as designed for general purpose combat and training requirements, normally consists of a metal jacket and a lead slug.

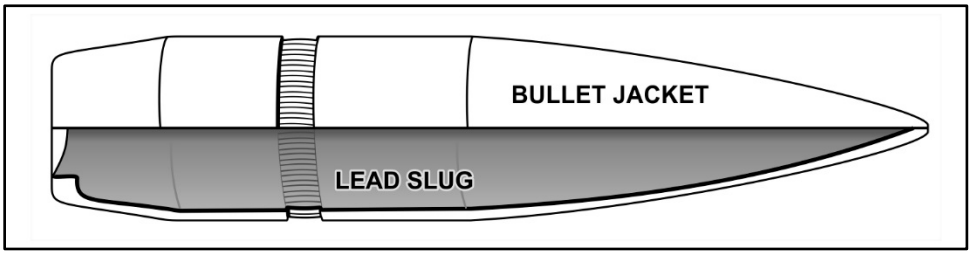



**Figure A-6. Ball cartridge**

## TRACER

A-16. A tracer round (known as a TCR or T) contains a pyrotechnic composition in the base of the bullet to permit visible observation of the bullet's in-flight path or trajectory and point of impact. (See figure A-7.) The propellant ignites the pyrotechnic composition when the round is fired, emitting a bright flame visible by the firer. Tracer rounds may be used to pinpoint enemy targets, to ignite flammable materials, and for signaling purposes.

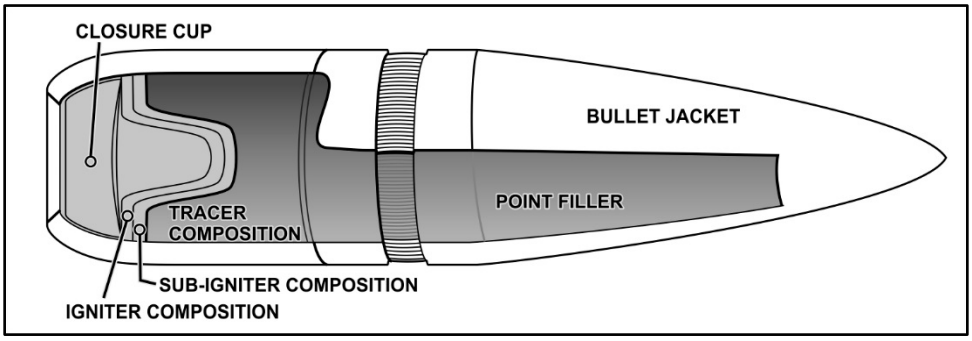



**Figure A-7. Ball with tracer cartridge**

## ARMOR PIERCING

A-17. The armor-piercing cartridge (see figure A-8) is intended for use against personnel and light armored and unarmored targets, concrete shelters, and similar bullet-resistant targets. The bullet is made of a metal jacket and a hardened steel-alloy core. In addition, it may have a lead base filler and a lead point filler.

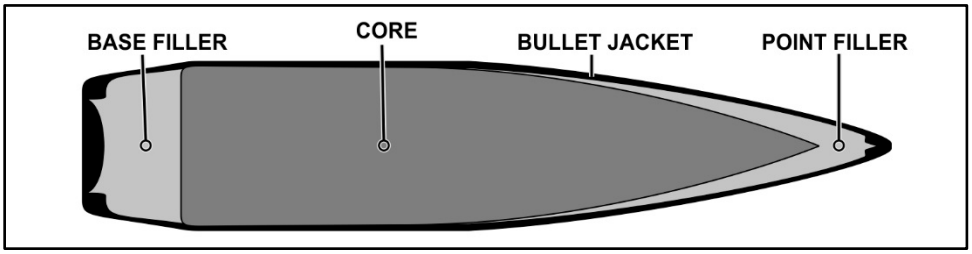



**Figure A-8. Armor-piercing cartridge**

## BLANK

A-18. The absence of a bullet or projectile distinguishes a blank cartridge (see figure A-9). Soldiers use a blank cartridge to simulate fire, in training maneuvers, and for ceremonial purposes. The rounds consist of a roll crimp (knurl) or cannelure on the body of the case, which holds a paper wad in place instead of a projectile. Newer cartridges have rosette crimp (7 petals) and an identification knurl on the cartridge case.

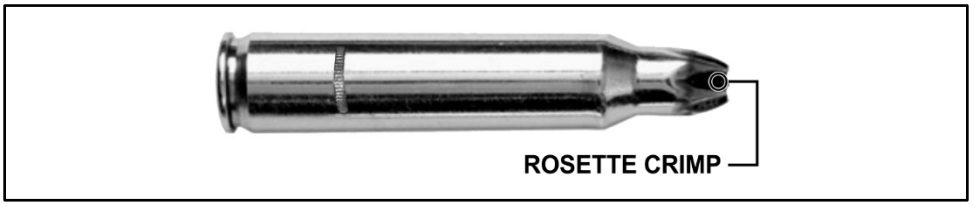



**Figure A-9. Blank cartridge**

## CLOSE COMBAT MISSION CAPABILITY KIT

A-19. The close combat mission capability kit cartridge (see figure A-10) is used for training purposes only.

A-20. The M249 automatic rifle conversion adapter kit provides safety, in-service reliability, and maintainability. The kit is easy to install with a simple exchange of the bolt. The kit adapts the host weapon to the fire-linked, 5.56-mm, M1071, man-marking ammunition with the feel and function of live ammunition. The kit includes fail-safe measures to prevent the discharge of a standard live round.



**Figure A-10. Close combat mission capability kit cartridge**

### DUMMY

A-21. Soldiers use the dummy cartridge (see figure A-11) for loading weapons and simulated firing practice to detect errors in employment skills when firing weapons. The round is completely inert and consists only of an empty cartridge case and ball bullet. Soldiers identify cartridges by the holes through the side of the case or the longitudinal corrugations in the case and by the empty primer pocket.

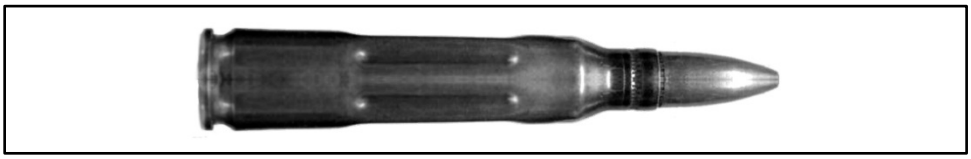


**Figure A-11. Dummy cartridge**

## COLORS, MARKINGS, AND SYMBOLS

A-22. Small arms ammunition is identifiable by color coding specification per type and intended use. Table A-1, identifies the color code specifications that are applied to the tips of 5.56-mm ammunition.

A-23. Markings stenciled or stamped on munitions or their containers include all information needed for complete identification.

A-24. Packaging and containers for small arms ammunition are clearly marked with standard NATO symbols identifying the contents of the package by type of ammunition, primary use, and packaging information. The most common NATO symbols are described according to Standardization Agreement (known as STANAG) (see table A-1).

A-25. Small arms ammunition (less than 20 millimeters) is not color-coded under MIL-STD-709D. Marking standards for small arms ammunition are outlined in TM 9-1305-201-20&P and TM 9-1300-200. The TMs describe the color coding system for small arms projectiles. The bullet tips are painted a distinctive color so the user can identify them quickly. Table A-1 describes the general color codes for all types of 5.56-mm small arms ammunition (refer to TM 9-1300-200 for more information).

**Table A-1. Small arms color coding and packaging markings**

| Ammunition Type | Color Coding | Package Marking |
|---|---|---|
| Ball | No Color or Green (M855) |  |
| Tracer (TCR or T) | Orange Tip |  |
| Armor Piercing (AP) | Black Tip |  |
| Blank (BLK) | Cringed or Capped End |  |
| Close Combat Mission Capabilities Kit (CCMCK)<br>Dummy | Black Cartridge and Tip, or Perforated Cartridge | None |
| **Special Markings** | **Color Code** | **Package Marking** |
| NATO Standard | |  |
| Interchangeable - suitable for use in similar caliber NATO weapons | |  |
| Bandoleers - ammunition is packaged in bandoleers | |  |
| Clipped - ammunition is packaged in clips for use with a speed loader | |  |

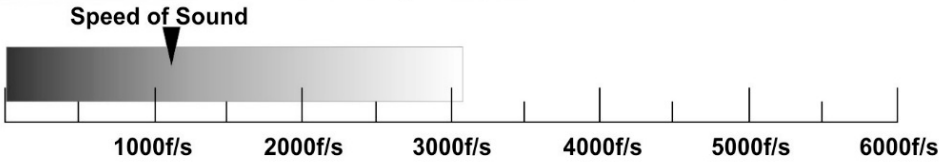
## 5.56-MM AMMUNITION

A-26. Tables A-2 through A-7, on pages A-8 through A-13, provide a brief description of the ten types of commonly used 5.56-mm ammunition for training and combat. Some types of 5.56-mm ammunition have more than one applicable Department of Defense Identification Code (also known as DODIC); those identifications codes provide clarity and ease for the unit's ammunition resource manager.

**Table A-2. 5.56-mm, M855, ball**

| Cartridge, 5.56-mm, M855, Ball | | | |
|---|---|---|---|
| DODIC | A059 | AA33 | Green Tip |
| Model: | M855 |  | |
| Type: | Ball | | |
| Weight: | 190 grain | | |
| Length: | 57.4 mm | 2.26 in | |
| Color Code: | | Green Tip | |
| Markings: |  |  |  |
| **Case** | | | |
| Type: | Center Fire | Description: | 5.56 x 45 mm |
| **Propellant** | | | |
| Type: | WC844 | Double Base | Nitrocellulose, |
| Weight: | 26.1 gr | 0.06 oz | Nitroglycerine |
| **Primer** | | | |
| Type: | Center Fire, Percussion | | |
| **Bullet** | | | |
| Type: | Ball, Copper Alloy Jacket | | |
| Design: | Conical steel insert and lead antimony alloy, cylindrical core, copper alloy jacket. | | |
| Weight: | 62 gr | 0.14 oz | |
| Length: | 23 mm | 0.906 in | |
| Tracer: | None | | |
| **Characteristics** | | | |
| Chamber Pressure: | 3792 bars | 55000 psi | |
| Velocity: | 922 m/sec | 3025 ft/sec | 2.69 mach |
| Kinetic Energy (Ek) | 1708 J | 1260 FtLbs | |

**Velocity to Speed of Sound**




**Special Features**

The M855's steel insert is effective against most types of fabric body armor while its three-piece construction achieves good effects against unprotected personnel targets.

| LEGEND | | | |
|---|---|---|---|
| FtLbs | foot pounds | J | Joules |
| f/s | foot per second | mm | millimeters |
| ft/sec | feet per second | m/sec | meters per second |
| gr | grain | oz | ounce |
| in | inches | psi | pounds per square inch |

**Table A-3. 5.56-mm, M855A1, enhanced performance round, ball**

## Cartridge, 5.56-mm, M856A1, Tracer

| | |
|---|---|
| DODIC | A063 |
| Model: | M856A1 |
| Type: | Tracer |
| Weight: | 190 grain |
| Length: | 57.4 mm |
| Color Code: | |
| Markings: | |




### Case

| | | | |
|---|---|---|---|
| Type: | Center Fire | Description: | 5.56 x 45 mm |

### Propellant

| | | | |
|---|---|---|---|
| Type: | WC844 | Double Base | Nitrocellulose, Nitroglycerine |
| Weight: | 24.7 gr | 0.06 oz | |

### Primer

| | |
|---|---|
| Type: | Center Fire, Percussion |

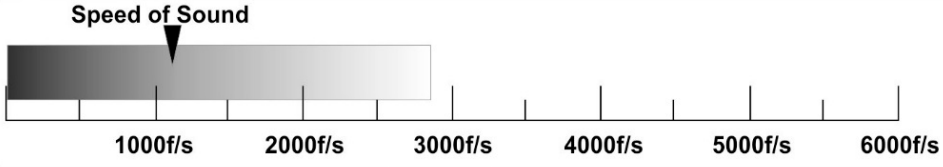
### Bullet

| | | |
|---|---|---|
| Type: | Tracer | |
| Design: | Lead alloy core in copper alloy jacket with incendiary compound fill in hollow base. | |
| Weight: | 63.7 gr | 0.15 oz |
| Length: | 29.3 mm | 1.154 in |
| Tracer: | None | |

### Characteristics

| | | | |
|---|---|---|---|
| Chamber Pressure: | 3792 bars | 55000 psi | |
| Velocity: | 875 m/sec | 2870 ft/sec | 2.55 mach |
| Kinetic Energy (Ek) | 1580 J | 1165 FtLbs | |

### Velocity to Speed of Sound




### Special Features

**Because the M856 loses mass as it travels, it necessitates a 1:7 barrel twist to keep it stable in flight.**

### LEGEND

| | | | |
|---|---|---|---|
| FtLbs | foot pounds | J | Joules |
| f/s | foot per second | mm | millimeters |
| ft/sec | feet per second | m/sec | meters per second |
| gr | grain | oz | ounce |
| in | inches | psi | pounds per square inch |

**Table A-4. 5.56-mm, M856A1, tracer**

## Cartridge, 5.56-mm, M856A1, Tracer

| | |
|---|---|
| DODIC | A063 |
| Model: | M856A1 |
| Type: | Tracer |
| Weight: | 190 grain |
| Length: | 57.4 mm |
| Color Code: | |
| Markings: | |




2.26 in

Orange Tip





### Case

| | | | |
|---|---|---|---|
| Type: | Center Fire | Description: | 5.56 x 45 mm |

### Propellant

| | | | |
|---|---|---|---|
| Type: | WC844 | Double Base | Nitrocellulose, Nitroglycerine |
| Weight: | 24.7 gr | 0.06 oz | |

### Primer

| | |
|---|---|
| Type: | Center Fire, Percussion |

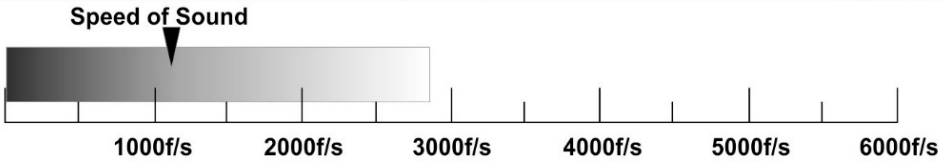
### Bullet

| | | |
|---|---|---|
| Type: | Tracer | |
| Design: | Lead alloy core in copper alloy jacket with incendiary compound fill in hollow base. | |
| Weight: | 63.7 gr | 0.15 oz |
| Length: | 29.3 mm | 1.154 in |
| Tracer: | None | |

### Characteristics

| | | | |
|---|---|---|---|
| Chamber Pressure: | 3792 bars | 55000 psi | |
| Velocity: | 875 m/sec | 2870 ft/sec | 2.55 mach |
| Kinetic Energy (Ek) | 1580 J | 1165 FtLbs | |

### Velocity to Speed of Sound




### Special Features

Because the M856 loses mass as it travels, it necessitates a 1:7 barrel twist to keep it stable in flight.

### LEGEND

| | | | |
|---|---|---|---|
| FtLbs | foot pounds | J | Joules |
| f/s | foot per second | mm | millimeters |
| ft/sec | feet per second | m/sec | meters per second |
| gr | grain | oz | ounce |
| in | inches | psi | pounds per square inch |

**Table A-5. 5.56-mm, M995, armor piercing**

## Cartridge, 5.56-mm, M995, Armor Piercing

| | |
|---|---|
| DODIC | AA69 |
| Model: | M995 |
| Type: | Armor Piercing |
| Weight: | 180 grain |
| Length: | 57.4 mm |
| Color Code: | |
| Markings: | |




### Case

| | | | |
|---|---|---|---|
| Type: | Center Fire | Description: | 5.56 x 45 mm |

### Propellant

| | | | |
|---|---|---|---|
| Type: | WCR845 | Double Base | Nitrocellulose, |
| Weight: | 27.5 gr | 0.06 oz | Nitroglycerine |

### Primer

| | |
|---|---|
| Type: | Center Fire, Berdan |

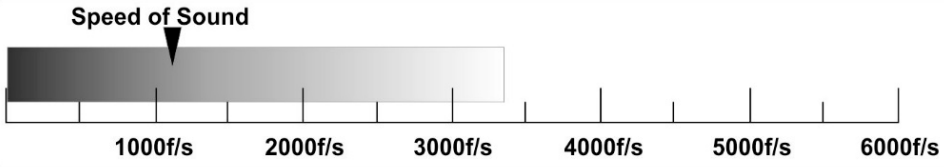
### Bullet

| | | | |
|---|---|---|---|
| Type: | Armor Piercing, Tungsten-Cobalt core | | |
| Design: | Tungsten-Cobalt core located by aluminum cup in copper alloy jacket | | |
| Weight: | 52 gr | 0.12 oz | |
| Length: | 29.3 mm | 1.154 in | |
| Tracer: | None | | |

### Characteristics

| | | | |
|---|---|---|---|
| Chamber Pressure: | 3465 bars | 55000 psi | |
| Velocity: | 1013 m/sec | 3324 ft/sec | 2.95 mach |
| Kinetic Energy (Ek) | 1729 J | 1276 FtLbs | |

### Velocity to Speed of Sound



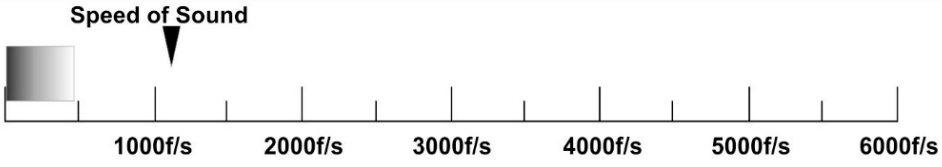

### Special Features

**The M995 was designed for use in all U.S. 5.56 mm weapons, it will penetrate 12 mm of steel at 100 meters to defeat light-armored vehicles and other barrier materials on the battlefield.**

### LEGEND

| | | | |
|---|---|---|---|
| FtLbs | foot pounds | J | Joules |
| f/s | foot per second | mm | millimeters |
| ft/sec | feet per second | m/sec | meters per second |
| gr | grain | oz | ounce |
| in | inches | psi | pounds per square inch |

**Table A-6. 5.56-mm, M1042, close combat mission capability kit**

| Cartridge, 5.56-mm, M1042, Close Combat Mission Capability Kit | | | |
|---|---|---|---|
| DODIC | AB09 (blue tip) | AB10 (red tip) | AB11 (yellow tip) |
| Model: | M1042 |  | |
| Type: | CCMCK | | |
| Weight: | 94.86 grain | | |
| Length: | 57.4 mm | 2.26 in | |
| Color Code: | Blue, red, or yellow plastic tip | | |
| Markings: | | | |
| **Case** | | | |
| Type: | Rim Fire | Description: | 5.56 x 45 mm |
| **Propellant** | | | |
| Type: | 0 | Double Base | Nitrocellulose, |
| Weight: | gr | 0 oz | Nitroglycerine |
| **Primer** | | | |
| Type: | Rim Fire | | |
| **Bullet** | | | |
| Type: | CCMCK | | |
| Design: | 0 | | |
| Weight: | 6.9 gr | 0.02 oz | |
| Length: | 29.3 mm | 1.154 in | |
| Tracer: | None | | |
| **Characteristics** | | | |
| Chamber Pressure: | 0 bars | 0 psi | |
| Velocity: | 149 m/sec | 488 ft/sec | 0.43 mach |
| Kinetic Energy (Ek) | 5 J | 4 FtLbs | |
| **Velocity to Speed of Sound** | | | |
|  | | | |
| **Special Features** | | | |
| The CCMCK is a user-installed weapons modification system used for short-range force on force training. The M1042 is a low velocity marking ammunition that prevents the weapon from firing service ammunition. Fail-safe is achieved by utilizing a 3 mm offset firing pin, which will only work with the M1042 rim fire primer. In the event that a live 5.56 mm cartridge is chambered and the trigger is pulled, the conversion will offset. | | | |

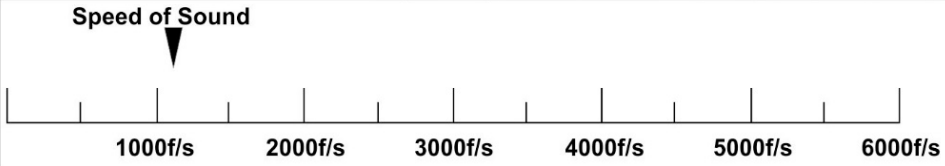


| LEGEND | | | |
|---|---|---|---|
| FtLbs | foot pounds | J | Joules |
| f/s | foot per second | mm | millimeters |
| ft/sec | feet per second | m/sec | meters per second |
| gr | grain | oz | ounce |
| in | inches | psi | pounds per square inch |

**Table A-7. 5.56-mm, M200, blank**

| Cartridge, 5.56-mm, M200, Blank | | | |
|---|---|---|---|
| DODIC | A080 | | |
| Model: | M200 | | |
| Type: | Blank | | |
| Weight: | 107 grain | | |
| Length: | 48.3 mm | 1.902 in | |
| Color Code: | | Rosette Crimp | |
| Markings: |  |  | |
| **Case** | | | |
| Type: | Center Fire | Description: | 5.56 x 45 mm |
| **Propellant** | | | |
| Type: | HPC 13 | Double Base | Nitrocellulose, |
| Weight: | 7 gr | 0.02 oz | Nitroglycerine |
| **Primer** | | | |
| Type: | Center Fire, Berdan | | |
| **Bullet** | | | |
| Type: | Blank, NA | | |
| Design: | NA | | |
| Weight: | NONE | | |
| Length: | NA | 0 in | |
| Tracer: | NA | | |
| **Characteristics** | | | |
| Chamber Pressure: | 0 bars | psi | |
| Velocity: | m/sec | ft/sec | 0 mach |
| Kinetic Energy (Ek) | 0 | 0 | |

**Velocity to Speed of Sound**




**Special Features**

The M200 cartridge is designed for simulated firing in training exercises and for saluting purposes. The cartridge is identified by a rosette-crimp closure of the case mouth.

**LEGEND**

| | | | |
|---|---|---|---|
| FtLbs | foot pounds | J | Joules |
| f/s | foot per second | mm | millimeters |
| ft/sec | feet per second | m/sec | meters per second |
| gr | grain | oz | ounce |
| in | inches | psi | pounds per square inch |

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## Appendix B

# Ballistics

Ballistics is the science of the processes that occur from the time a firearm is fired to the time when the bullet impacts its target. Soldiers must be familiar with the principles of ballistics to understand how the projectiles function, perform during flight, and the actions of the bullet when it strikes the intended target. The profession of arms requires Soldiers to understand their weapons, how their weapons operate, their functioning, and their employment.

## BALLISTIC CATEGORIES

B-1. The flight path of a bullet has three stages: The travel down the barrel, the path through the air to the target, and the actions the bullet takes upon impact with the target. These stages are defined in separate categories of ballistics: internal, external, and terminal ballistics.

### INTERNAL BALLISTICS

B-2. Internal ballistics is the study of the projectile's propulsion. Internal ballistics begin from the time the firing pin strikes the primer to the time the bullet leaves the muzzle. Once the primer is struck, the priming charge ignites the propellant. The expanding gases caused by the burning propellant create pressures, which push the bullet down the barrel. The bullet engages the lands and grooves (rifling) imparting a spin on the bullet that facilitates stabilization of the projectile during flight. Internal ballistics ends at shot exit, where the bullet leaves the muzzle. (See figure B-1.)

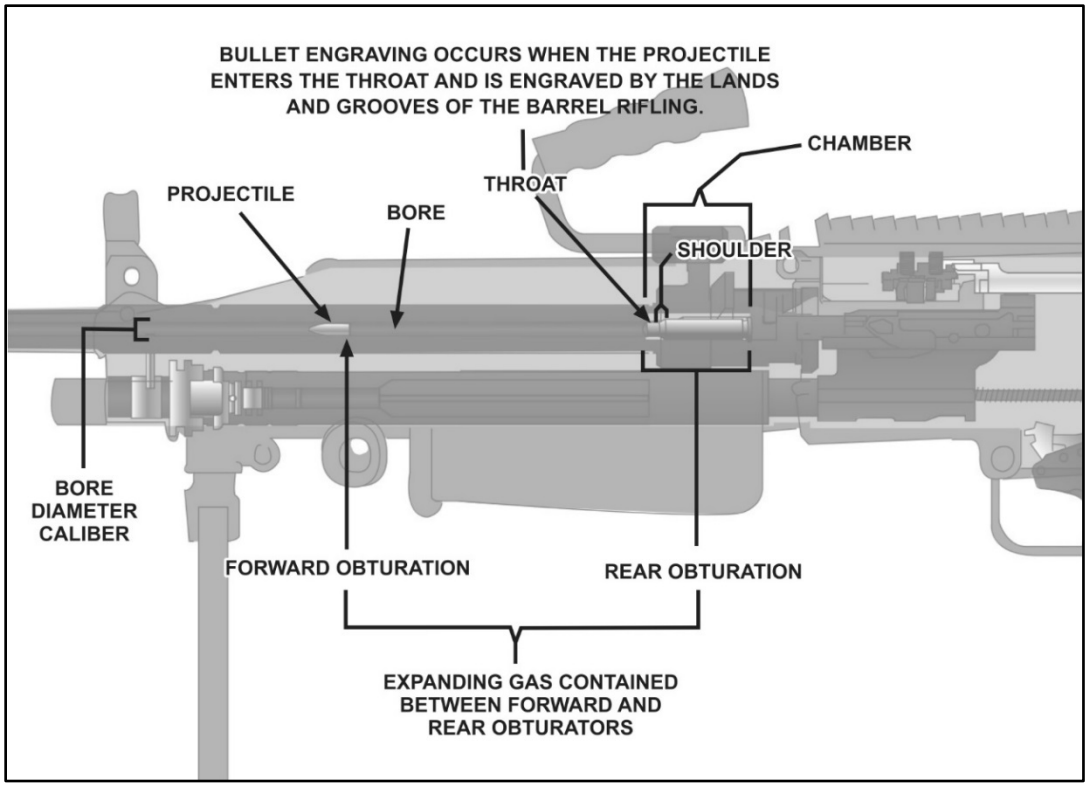



**Figure B-1. Internal ballistic terms**

B-3. Several key terms are used when discussing the physical actions of internal ballistics—

- Bore. The interior portion of the barrel forward of the chamber.
- Chamber. The part of the barrel that accepts the ammunition for firing.
- Grain (gr). A unit of measurement of either a bullet or a projectile. There are 7000 grains in a pound, or 437.5 grains per ounce.
- Pressure. The force the expanding gasses generate from the combustion (burning) of the propellant. Pressure is measured in pounds per square inch (psi).
- Shoulder. The area of the chamber that contains the shoulder. The shoulder forces the cartridge and projectile into the entrance of the bore at the throat of the barrel.
- Muzzle. The end of the barrel.
- Throat. The entrance to the barrel from the chamber. The projectile is introduced to the lands and grooves within the barrel at the throat.

## EXTERNAL BALLISTICS

B-4. External ballistics is the study of the physical actions and effects of gravity, drag, and wind along the projectile's flight to the target. External ballistics includes only general physical actions that cause the greatest change to the projectile's flight. (See figure B-2.) External ballistics begins at shot exit and continues through the moment the projectile strikes the target.

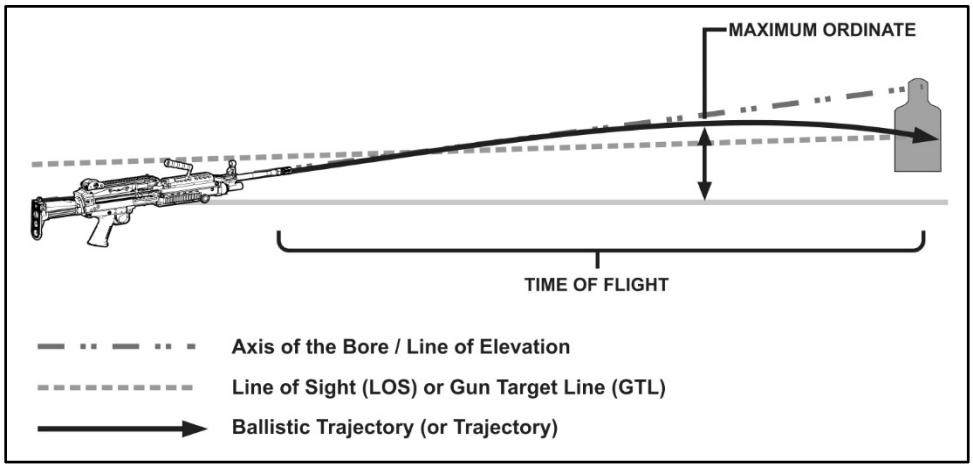



**Figure B-2. External ballistic terms**

B-5. Soldiers use the following terms and definitions to describe the actions or reactions of the projectile during flight. The terminology below is standard when dealing with any weapon or weapon system, regardless of caliber (see figure B-3):

- Axis of the bore (line of bore). The line passing through the center of the bore or barrel.
- Line of sight (LOS) or gun target line. A straight line between the sights or optics and the target. The LOS is never the same as the axis of the bore. The LOS is what the Soldier sees through the sights and can be illustrated by drawing an imaginary line from the firer's eye through the rear and front sights out to infinity. The LOS is synonymous with the gun target line when viewing the relationship of the sights to a target.
- Line of elevation. The angle from the ground to the axis of the bore.
- Ballistic trajectory. The path of a projectile when influenced only by external forces, such as gravity and atmospheric friction.
- Maximum ordinate. The maximum height the projectile travels above the line of sight on its path to the point of impact.
- Time of flight. The time taken for a specific projectile to reach a given distance after firing.

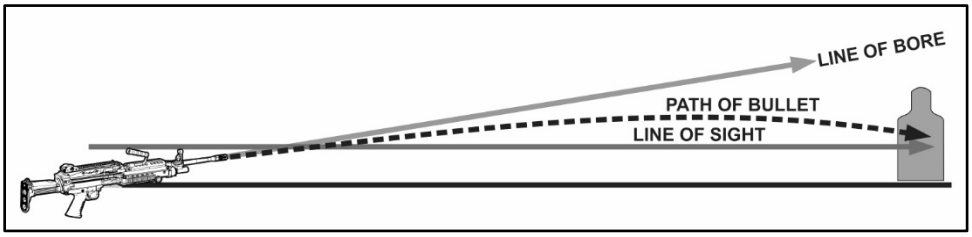



**Figure B-3. Trajectory**

- Jump. A vertical jump in an upward and rearward direction caused by recoil. Typically, it is the angle, measured in mils, between the line of departure and the line of elevation.
- Line of departure. The line of the projectile at shot exit.
- Muzzle. The end of the barrel.
- Muzzle velocity or velocity. The velocity of the projectile measured at shot exit. Muzzle velocity decreases over time due to air resistance. For small arms ammunition, velocity (V) is represented in feet per second (f/s).
- Twist rate. The rotation of the projectile within the barrel of a rifled weapon based on the distance to complete one revolution. The twist rate relates to the ability to gyroscopically spin-stabilize a projectile on rifled barrels improving its aerodynamic stability and accuracy. The twist rate of the M249-series weapon is a right hand, one revolution in every seven inches of barrel length (or R 1:7 inches).
- Shot exit. The moment the projectile clears the muzzle of the barrel; when the barrel no longer supports the bullet.
- Oscillation. The movement of the projectile in a circular pattern around its axis during flight.
- Drift. The lateral movement of a projectile during its flight caused by its rotation or spin.
- Yaw. A deviation from stable flight by oscillation. Crosswind or destabilization when the projectile enters or exits a transonic stage can cause yaw.
- Grain (gr). A unit of measurement of either a bullet or projectile. There are 7000 grains in a pound or 437.5 grains per ounce.
- Pressure. The force the expanding gasses generate from the combustion (burning) of the propellant. For small arms, pressure is measured in pounds per square inch (psi).
- Gravity. The constant pressure of the earth on a projectile at a rate of about 9.8 meters per second squared regardless of the projectile's weight, shape, or velocity. Commonly referred to as bullet drop, gravity causes the projectile to drop from the line of departure. Soldiers must understand the effects of gravity on the projectile when zeroing as well as how it applies to determining the appropriate hold off at ranges beyond the zero distance.
- Drag (air resistance). The friction that slows down the projectile while moving through the air. Drag begins immediately upon the projectile exiting the barrel (shot exit). Drag slows the projectile's velocity over time and is most pronounced at extended ranges. Each round has a ballistic coefficient that is a measurement of the projectile's ability to minimize the effects of air resistance (drag) during flight.
- Trajectory. The path of flight that the projectile takes upon shot exit over time. For the purposes of this manual, the trajectory ends at the point of impact.
- Wind. Wind has the greatest variable effect on ballistic trajectories. The effects of wind on a projectile are most noticeable in three key areas between half and two-thirds the distance to the target:
  - Time (T). The amount of time the projectile is exposed to the wind along the trajectory. The greater the range to target, the greater time the projectile is exposed to the wind's effects.
  - Direction. The direction of the wind in relation to the axis of the bore. The relation compensates for the direction of the projectile's drift.

- Velocity (V). The wind's speed during the projectile's trajectory to the target. Variables in the overall wind velocity affecting a change to the ballistic trajectory include sustained rate of the wind and gust spikes in velocity.

### TERMINAL BALLISTICS

B-6. Terminal ballistics is the science of the actions of a projectile from the time it strikes an object until it comes to rest (called terminal rest). The following are basic terms as they relate to terminal ballistics:

- Kinetic energy. A unit of measurement of the projectile's delivered force. Kinetic energy is the delivered energy that a projectile possesses due to its mass and velocity at the time of impact. Kinetic energy is directly related to the projectile's penetration against the target.
- Penetration. The ability or act of a projectile to enter a target's mass based on its delivered kinetic energy. When a projectile strikes a target, the level of penetration into the target is known as the impact depth. The impact depth is the distance from the point of impact to the moment the projectile stops at its terminal resting place. Ultimately, the projectile stops when it has transferred its momentum to an equal mass of the medium (or arresting medium).

B-7. Against any target, penetration is the most important terminal ballistic consideration. Soldiers must be aware of the penetration capabilities of their ammunition against their target, and the most probable results of the terminal ballistics.

B-8. The 5.56-mm projectile's purpose is to focus the largest amount of momentum (energy) on the smallest possible area of the target to achieve the greatest penetration. The 5.56-mm projectiles are designed to resist deformation on impact to enter the target's mass. The steel tip of the penetrator allows for reduced deformation through light skin armor or body armor, and the heavier steel penetrator allows for increased soft tissue damage.

## ACTIONS AFTER THE TRIGGER SQUEEZE

B-9. Once the trigger is squeezed, the ballistic action begins. Although not all ammunition and weapons operate in the same manner, the following list describes the general events that occur on the M249-series weapons when the trigger is squeezed:

- The slide and piston assembly carries the firing pin through the face of the bolt.
- The firing pin is pushed forward, striking the cartridge percussion primer assembly.
- The primer is crushed, pushing the primer composition through the paper disk, and on to the anvil, detonating the primer composition.
- The burning primer composition is focused evenly through the primer cup vent hole, igniting the propellant.
- The propellant burns evenly within the cartridge case.
- The cartridge case wall expands from the pressure of the burning propellant, firmly locking the case to the chamber walls.
- The expanded cartridge case, held firmly in place by the chamber walls and the face of the bolt, provides rear obturation, keeping the burning propellant and created expanding gasses in front of the cartridge case.
- The expanding gasses force the projectile firmly into the lands and grooves at the throat of the bore, causing engraving.
- Engraving causes the scoring of the softer outer jacket of the projectile with the lands and grooves of the bore. Engraving allows the projectile to spin at the twist rate of the lands and grooves, and provides a forward obturation seal. The forward obturation keeps the expanding gasses behind the projectile to push it down the length of the barrel.
- As the propellant continues to burn, the gasses created continue to seek the path of least resistance. As the cartridge case is firmly seated and the projectile is moveable, the gas continues to exert its force on the projectile.

- Once the projectile passes the gas port on the top of the barrel, a small amount of gas is able to escape from propelling the projectile. The escaping gas is directed up through the gas port and rearward through the gas tube, following the path of least resistance. The diameter of the gas port limits the amount of gas allowed to escape.
- As the end of the projectile leaves the muzzle, it is no longer supported by the barrel itself. Shot exit occurs.
- Upon shot exit, most of the expanding and burning gasses move outward and around the projectile causing the muzzle flash.
- At shot exit, the projectile achieves its maximum muzzle velocity. From shot exit until the projectile impacts an object, the projectile loses velocity at a steady rate due to air resistance.
- As the round travels along its trajectory, gravity causes the bullet to drop consistently.
- As the actual line of departure is an elevated angle from the line of sight, the projectile appears to rise and then descend. The rise and fall of the projectile is the trajectory.
- The round achieves the highest point of its trajectory typically over halfway to the target, depending on the range to target. The high point is called the round's maximum ordinate or max ord.
- From the max ord, the projectile descends into the target.
- The round strikes the target at the point of impact, which, depending on the firing event, may or may not be the desired point of impact, and is seldom the point of aim.

B-10. Once the projectile strikes a target or object, it delivers its kinetic energy (force) at the point of impact.

## TERMINAL BALLISTICS BEGIN

B-11. Once terminal ballistics begin, no bullets follow the same path or function. Generally speaking, the projectile penetrates objects where the delivered energy (mass times velocity squared, divided by 2) is greater than the mass, density, and area of the target at the point of the delivered force. There are other contributing factors, such as the angle of attack, yaw, oscillation, and other physical considerations that are not included in this ballistic discussion.

## STRUCTURE PENETRATION

B-12. The following common barriers in built-up areas can prevent penetration by a 5.56-mm round fired at less than 50 meters (M855) including—

- Single row sandbags.
- A 2-inch thick concrete wall (not reinforced with rebar or similar item).
- A 55-gallon drum filled with water or sand.
- A metal ammunition can filled with sand.
- A cinder block filled with sand (the block may shatter).
- A plate glass windowpane at a 45-degree angle (glass fragments will be thrown behind the glass).
- A brick veneer.

***Note***. The M855A1 enhanced performance round has increased capabilities for barrier penetration compared with the M855 as shown above.

B-13. Although most structural materials repel single 5.56-mm rounds, continued and concentrated firing can breach (penetrate through) some typical urban structures.

B-14. The best method for breaching a masonry wall is to fire short bursts in a U-shaped pattern. The distance from the firer to the wall should be minimized for best results; ranges as close as 25 meters are relatively safe from ricochet.

B-15. Ball ammunition and armor-piercing rounds produce almost the same results, but are more likely to ricochet to the sides and rearward back at the firer (called spit-back).

***Note***. Soldiers must ensure the appropriate level of personal protective equipment is worn when conducting tactical and collective tasks, particularly at ranges less than 50 meters.

B-16. The 5.56-mm round can be used to create either a loophole (about 7 inches in diameter) or a breach hole (large enough for a man to enter). When used against reinforced concrete, the M16 rifle and the M249 machine gun cannot cut the reinforcing bars.

## SOFT TISSUE PENETRATION

B-17. A gunshot wound, or ballistic trauma, is physical damage sustained from the entry of a projectile. The degree of tissue disruption caused by a projectile is related to the size of the cavities the projectile creates as it passes through the target's tissue. When striking a personnel target, there are two types of cavities created by the projectile; permanent and temporary wound cavities.

### Permanent Wound Cavity

B-18. The permanent cavity refers to the specific, physical hole left in the tissues of soft targets by the pass-through of a projectile. The cavity is the total volume of tissue crushed or destroyed along the path of the projectile within the soft target.

B-19. Depending on the soft tissue composition and density, the tissues are either elastic or rigid. Elastic organs stretch when penetrated, leaving a smaller wound cavity. Organs that contain dense tissue, water, or blood are rigid, and can shatter from the force of the projectile. When a penetrating bullet shatters a rigid organ, the bullet causes massive blood loss within a larger, permanent wound cavity. Although typically fatal, striking these organs may not immediately incapacitate the target.

### Temporary Wound Cavity

B-20. The temporary wound cavity is an area that surrounds the permanent wound cavity. The projectile passes through the tissue at greater than 2000 feet per second causing the tissue around the permanent cavity to propel outward (stretched) in an almost explosive manner from the path of the bullet. This forms a temporary recess or cavity 10 to 12 times the bullet's diameter.

B-21. Tissue such as muscle, some organs, and blood vessels are elastic and can be stretched by the temporary cavity with little or no damage and have a tendency to absorb the projectile's energy. The temporary cavity created slowly reduces in size over time, although typically not returning completely to the original position or location.

***Note***. Projectiles that do not exceed 2000 feet per second velocity on impact do not provide sufficient force to cause a temporary cavity that can incapacitate a threat.

B-22. The extent of the cavitation (the bullet's creation of the permanent and temporary cavities) is related to the characteristics of the projectile, which are defined below:

- Kinetic energy. The delivered mass at a given velocity. Higher delivered kinetic energy produces greater penetration and tissue damage.
- Yaw. Any yaw at the point of impact increases the projectiles surface area as it strikes the target, decreasing kinetic energy, but increasing the penetration and cavity size.
- Deformation. The physical changes of the projectile's original shape and design due to the impact of the target. Deformation increases the projectile's surface area and the size of the cavity created after penetration.
- Fragmentation. The fracturing of a projectile into multiple pieces or subprojectiles. The multiple paths of the fragmented subprojectiles are unpredictable in size, velocity, and direction. The bullet jacket, and for some types of projectiles, the lead core, fracture, creating small, jagged, sharp edged pieces that are propelled outward with the temporary cavity. Fragments can sever tissue, causing

large, seemingly explosive-type words. Bone fragments caused by the bullet's strike can have the same effect.

- Tumbling. Tumbling is the inadvertent end-over-end rotation of the projectile. A projectile tumbles as it strikes the target; traveling through the tissues with a larger diameter. Tumbling causes an extremely severe permanent cavity as it passes through the soft tissue. A tumbling projectile can change direction erratically within the body due to its velocity and tendency to strike dense material with a larger surface area.

B-23. Once inside the target, the projectile's purpose is to destroy soft tissues with fragmentation. The ball ammunition is designed to not flatten or expand on impact, which would decrease velocity and delivered energy. For the M855-series cartridge, the penetrator tends to bend at the steel-core junction, fracture the weaker jacketed layer, and fragment into pieces when striking an object.

## Incapacitation

B-24. Incapacitation with direct fire is the act of ballistically depriving a target of the ability, strength, or capability to continue its tactical mission. To assist in achieving the highest probability of incapacitation with a single shot, the projectile's design allows it to tumble, ricochet, or fragment after impact.

B-25. The projectile or its fragments must hit a vital, blood-bearing organ or the central nervous system to incapacitate the threat effectively. The projectile's limited, fragmentation potential after entry maximizes the soft tissue damage and increases the potential for rapid incapacitation.

## Lethal Zones

B-26. The Soldier's primary point of aim at any target by default is the center of visible mass. The center of visible mass allows for a tolerance that includes the greatest margin of error with the highest probability of a first round hit. The combat conditions may require more precise fires at partially exposed targets or targets that require immediate incapacitation.

B-27. Ideally, the point of aim is anywhere within a primary switch area. The point maximizes the possibility of striking major organs and vessels, rendering a clean, one-shot kill (see figure B-4, page B-8.)

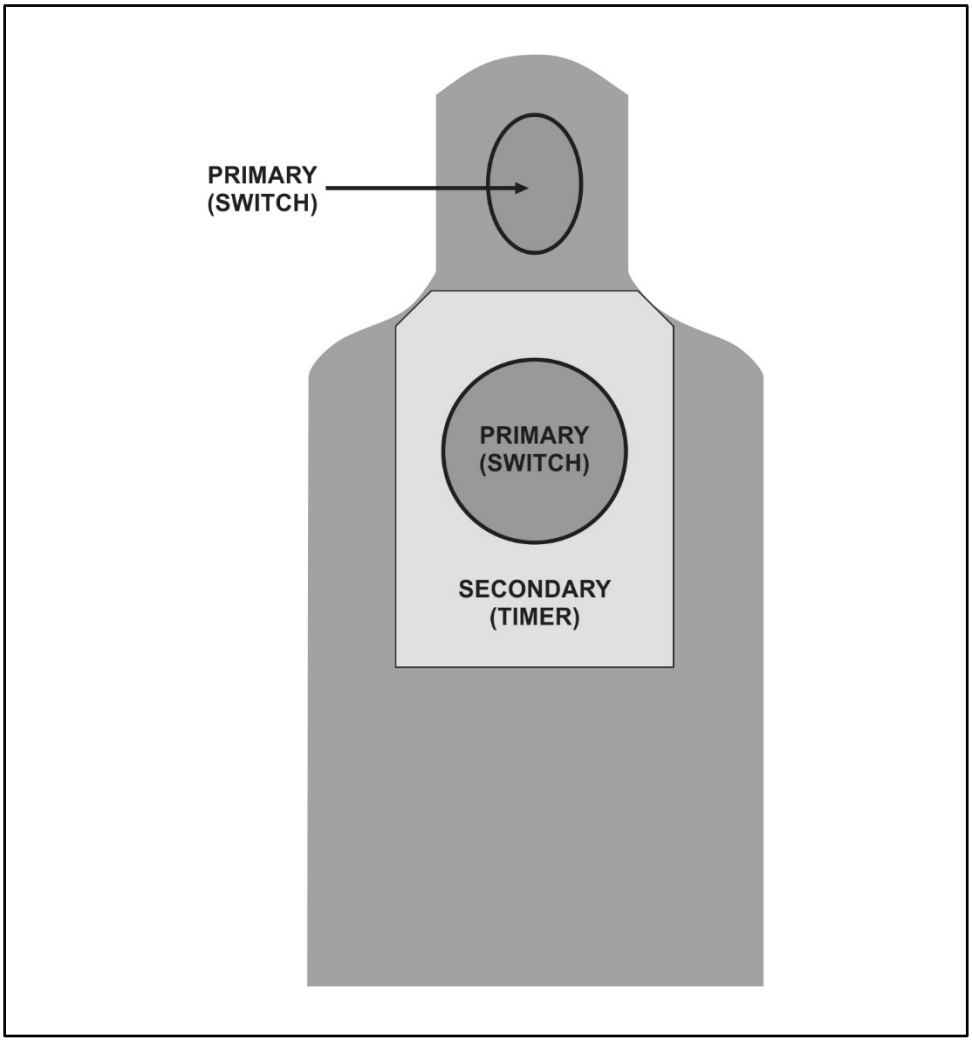



**Figure B-4. Lethal zone example**

B-28. Soldiers should weight shots to the head with caution. The head is the most frequently moved body part and is the most difficult to hit with precision. Soldiers should consider shots to other exposed body parts, such as the pelvic area.

B-29. Shots to the pelvic area are used when the target is not completely visible or when the target is wearing body armor that prevents the Soldier from engaging the primary zone. The pelvic area is rich in large blood vessels and a shot here has a good possibility of impeding enemy movement by destroying the pelvic or hitting the lower spine. Two types of shots (discussed below) are circuitry shots (switches) and hydraulic shots (timers).

## Circuitry Shots (Switches)

B-30. Circuitry shots, or switches, are strikes to a target that deliver immediate incapacitation. Immediate incapacitation is the sudden physical or mental inability to initiate or complete any physical task. To accomplish immediate incapacitation, the central nervous system must be destroyed by hitting the brain or spinal column. All bodily functions and voluntary actions cease when the brain is destroyed and if the spinal column is broken, all functions cease below the break.

## Hydraulic Shots (Timer)

B-31. Hydraulic shots, or timers, are impacts on a target where immediate incapacitation is not guaranteed. These types of ballistic trauma are termed timers because after the bullet strikes, the damage caused requires time for the threat to have sufficient blood loss to render them incapacitated. Hydraulic shots, although ultimately lethal, allow for the threat to function in a reduced capacity for a period of time.

B-32. For hydraulic shots to eliminate the threat, they must cause a 40 percent loss of blood within the circulatory system. If the shots do not disrupt the blood flow at a rapid pace, the target can continue their mission. Once two liters of blood are lost, the target transitions into hypovolemic shock and becomes incapacitated.

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## Appendix C

# Machine Gun Theory

Appendix C illustrates the characteristics of machine gun fire, the types of enemy targets Soldiers engage, and how to apply machine gun fire on those enemy targets.

## CHARACTERISTICS OF FIRE

C-1. The gunner's or leader's knowledge of the machine gun is not complete until they learn about the action and effect of the projectiles when fired. The following definitions help the leader, gunner, and assistant gunner understand characteristics of fire of the platoon's machine guns.

### LINE OF SIGHT

C-2. Line of sight (LOS) is an imaginary line drawn from the firer's eye through the sights to the point of aim.

### BURST OF FIRE

C-3. A burst of fire is a number of successive rounds fired with the same elevation and point of aim when the trigger is held to the rear. The number of rounds in a burst can vary depending on the type of fire employed.

### TRAJECTORY

C-4. Trajectory is the curved path of the projectile in its flight from the muzzle of the weapon to its impact. The major factors influencing trajectory are the velocity of the round, gravity, rotation of the round, and air resistance. As the range to the target increases, so does the curve of trajectory. (See figure C-1.)

### MAXIMUM ORDINATE

C-5. Maximum ordinate is the highest point above the LOS that the trajectory reaches between the muzzle of the weapon and the base of the target. Maximum ordinate always occurs at a point about two-thirds of the distance from the weapon to the target and increases with range. Like trajectory, maximum ordinate increases as the range increases. (See figure C-1.)

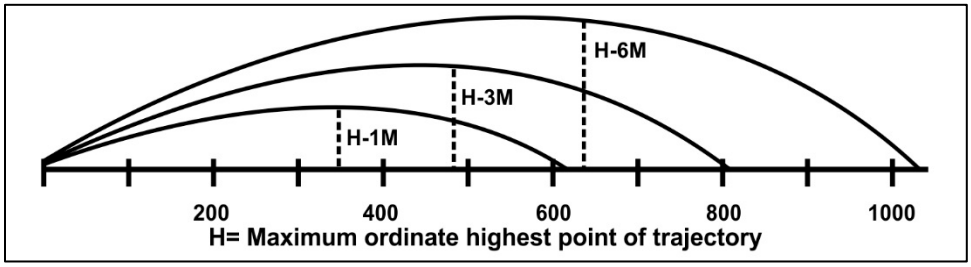



**Figure C-1. Trajectory and maximum ordinate, example**

## CONE OF FIRE

C-6. The cone of fire is the pattern formed by the different trajectories in each burst as they travel downrange. Vibration of the weapon and variations in ammunition and atmospheric conditions contribute to the trajectories making up the cone of fire. (See figure C-2).

## BEATEN ZONE

C-7. The beaten zone is the elliptical pattern formed when the rounds within the cone of fire strike the ground or target. The size and shape of the beaten zone changes as a function of the range to the target and to the slope of the target, but is normally oval or cigar shaped. The density of the rounds decreases toward the edges. Gunners and automatic riflemen should engage targets to take maximum advantage of the beaten zone. The simplest way of engaging targets to take maximum advantage of the beaten zone is to aim at the center base of the target. Most rounds will not fall over the target, and falling short creates ricochets into the target. (See figure C-2).

### Effective Beaten Zone

C-8. Due to dispersion, only part of the beaten zone in which 85 percent of the rounds fall is considered the effective beaten zone.

### Effect of Range on the Beaten Zone

C-9. As the range to the target increases, the beaten zone becomes shorter and wider. Conversely, as the range to the target decreases, the beaten zone becomes longer and narrower.

### Effect of Slope on the Beaten Zone

C-10. The length of the beaten zone for given ranges varies according to the slope of the ground. On rising ground, the beaten zone becomes shorter but remains the same width. On ground sloping away from the gun, the beaten zone becomes longer but remains the same width.

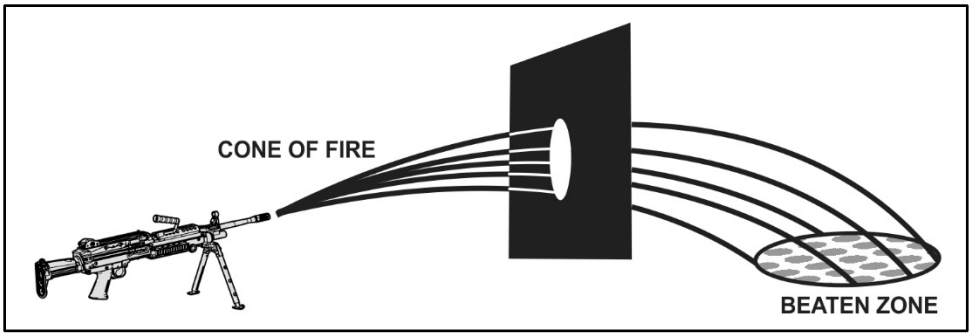



**Figure C-2. Cone of fire and beaten zone, example**

## DANGER SPACE

C-11. The danger space is the space between the muzzle of the weapon and the target where the trajectory does not rise above 1.8 meters (the average height of a standing Soldier) including the beaten zone. Gunners should consider the danger space of weapons when planning overhead fires.

## CLASSIFICATIONS OF AUTOMATIC WEAPONS FIRE

C-12. The U.S. Army classifies automatic weapons fires with respect to the ground, target, and weapon.

## FIRES WITH RESPECT TO THE GROUND

C-13. The Army classifies fires with respect to the ground, which includes grazing and plunging fire. Dead space is the folds or depressions in the ground that prevent a target from being engaged from a fixed position.

### Grazing Fires

C-14. Automatic weapons achieve grazing fire when the center of the cone of fire does not rise more than one meter above the ground. Soldiers employ grazing fire in the final protective line in the defense. Grazing fire is possible only when the terrain is level or sloping uniformly. Dead space encountered along the final protective line must be covered by indirect fire, such as from an M203/M320. When firing over level or uniformly sloping terrain, the M240 series and the M249 can attain a maximum of 600 meters of grazing fire. The M2/M2A1 can attain a maximum of 700 meters.

### Plunging Fires

C-15. Plunging fire occurs when there is little or no danger space from the muzzle of the weapon to the beaten zone. Plunging fires happen when Soldiers fire weapons at long range, when they fire from high ground to low ground, when they fire into abruptly rising ground, or when they fire across uneven terrain, which results in a loss of grazing fire at points along the trajectory. (See figure C-3.)

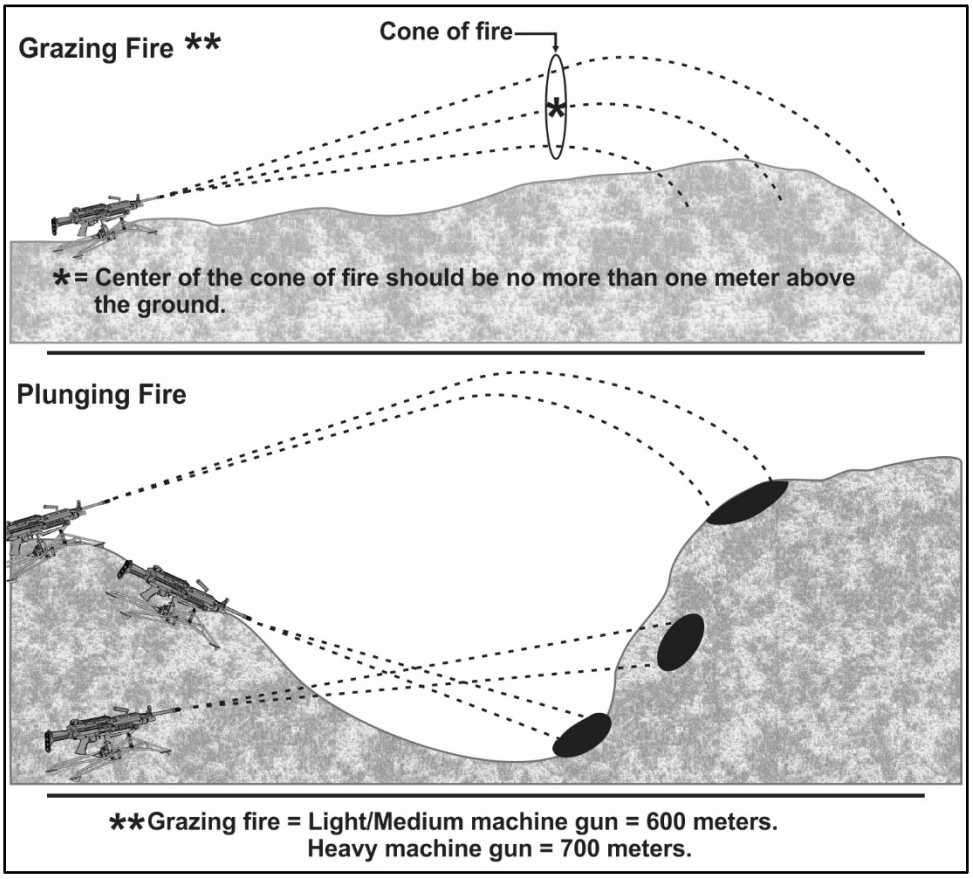



**Figure C-3. Classes of fire with respect to the ground**

## FIRES WITH RESPECT TO THE TARGET

C-16. Classification of fires with respect to the target include enfilade, frontal, flanking, and oblique fire. (See figures C-4, C-5, and C-6, pages C-5 and C-6). Normally, the enemy presents the three types of targets to the gun teams. Gun teams must engage as these targets as they are presented by the enemy. For example, if the enemy presents its flank to the gun team as they move past the gun team's position from the left or right, the gun team will have no choice but to employ flanking fire on the enemy.

C-17. Leaders and gunners should strive at all times to position their gun teams where they can best take advantage of the machine gun's beaten zone on an enemy target. Channeling the enemy using terrain or obstacles so the enemy approaches a friendly machine gun position from the front in a column formation is one example. In this situation, the Soldiers would employ machine gun enfilade fire on the enemy column. The effects of the machine gun's beaten zone would be much greater than if it engaged an enemy column from the flank.

### Enfilade Fire

C-18. Enfilade fire occurs when the long axis of the beaten zone coincides or nearly coincides with the long axis of the target. Enfilade fire can be frontal fire on an enemy column formation or flanking fire on an enemy line formation. Enfilade fire is the most desirable class of fire with respect to the target because it makes maximum use of the beaten zone. Leaders and gunners should always strive to position the guns to engage enemy targets with enfilade fire. (See figure C-4 and figure C-6, page C-6.)

### Frontal Fire

C-19. Frontal fire occurs when the long axis of the beaten zone is at a right angle to the front of the target. Frontal fire is highly desirable when engaging a column formation. Frontal fire becomes enfilade fire as the beaten zone coincides with the long axis of the target. (See figure C-4 and figure C-5, page C-6.) Frontal fire is not as desirable when engaging a line formation because normally, the majority of the beaten zone falls below or after the enemy target.

### Flanking Fire

C-20. Flanking fire is delivered directly against the flank of the target. Flanking fire is highly desirable when engaging an enemy line formation. Flanking fire becomes enfilade fire as the beaten zone coincides with the long axis of the target. (See figures C-5 and C-6, page C-6.) Flanking fire against an enemy column formation is least desirable because normally, the majority of the beaten zone falls before or after the enemy target.

### Oblique Fire

C-21. Gunners and automatic riflemen achieve oblique fire when the long axis of the beaten zone is at an angle other than a right angle to the front of the target. (See figure C-4 and figure C-6, page C-6.)

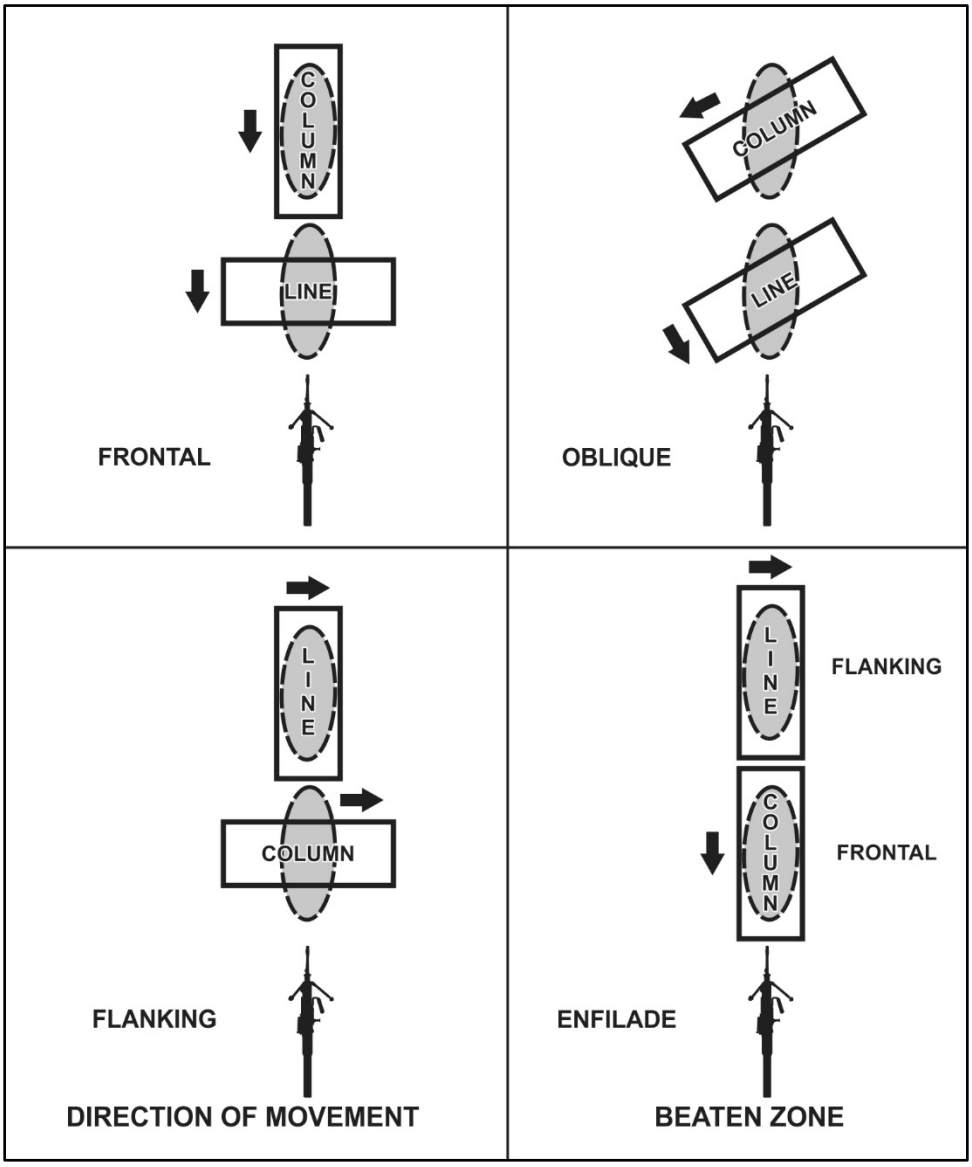



**Figure C-4. Classes of fire with respect to the target**

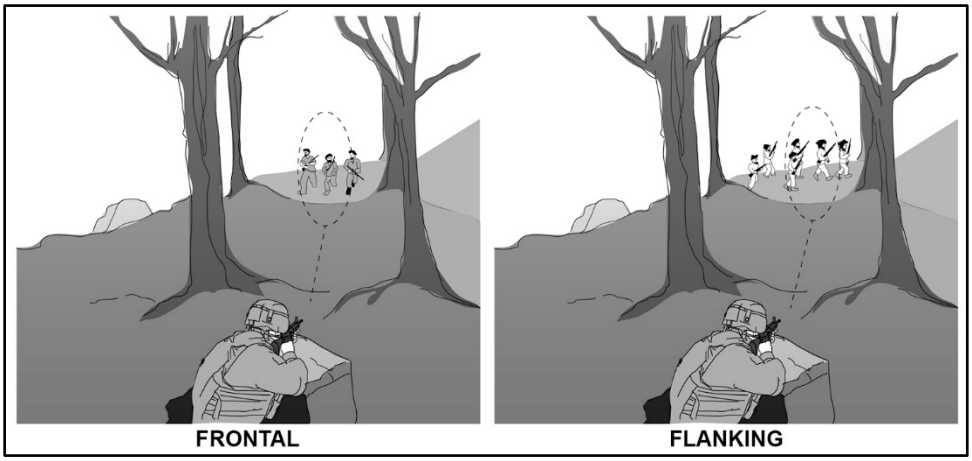



**Figure C-5. Frontal fire and flanking fire**

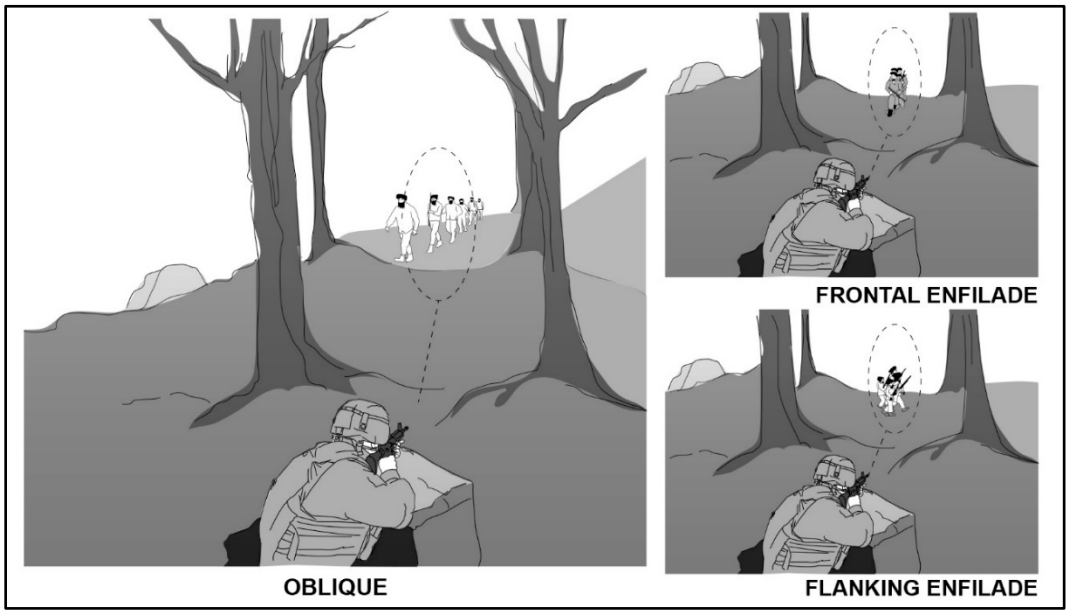



**Figure C-6. Oblique fire and enfilade fire**

## FIRES WITH RESPECT TO THE MACHINE GUN

C-22. Classification of fires with respect to the weapon include fixed, traversing, searching, traversing and searching, swinging traverse, and free gun fires. (See figure C-7, page C-8.)

### Fixed Fire

C-23. Gunners deliver fixed fire against a stationary point target when the depth and width of the beaten zone covers the target with little or no manipulation needed. After the initial burst, the gunners follow changes or movement of the target without command.

### Traversing Fire

C-24. Traversing disperses fires in width by successive changes in direction, but not elevation. Gunners deliver traversing fires against a wide target with minimal depth. When engaging a wide target requiring traversing fire, the gunner selects successive aiming points throughout the target area. The aiming points

should be close enough together to ensure adequate target coverage. However, the aiming points do not need to be so close that the gunner is wasting ammunition by concentrating a heavy volume of fire in a small area.

## Searching Fire

C-25. Searching distributes fires in-depth by successive changes in elevation. Gunners employ searching fire against a deep target or a target having depth and minimal width, requiring changes only in the elevation of the gun. The amount of elevation change depends upon the range and slope of the ground.

## Traversing and Searching Fire

C-26. The traversing and searching class of fire is a combination of successive changes in direction and elevation resulting in the distribution of fires in width and depth. Gunners employ traversing and searching fire against a target whose long axis is oblique to the direction of fire.

## Swinging Traverse

C-27. Gunners employ swinging traverse fire against targets that require major changes in direction but little or no change in elevation. Targets may be dense, wide, in close formations moving slowly toward or away from the gun, or vehicles or mounted troops moving across the front. If the gun is tripod mounted, the gunner loosens the traversing slide lock lever enough to permit the gun to swing laterally. When firing swinging traverse, normally the gunner fires the weapon at the cyclic rate of fire. Swinging traverse consumes an enormous amount of ammunition and does not have a beaten zone because each round seeks its own area of impact.

## Free Gun

C-28. Gunners deliver free gun fire against moving targets, rapidly engaging with fast changes in both direction and elevation. Examples are aerial targets, vehicles, mounted troops, or infantry in relatively close formations moving rapidly toward or away from the gun position. When firing free gun, normally, the gunner fires the weapon at the cyclic rate of fire. Free gun fire consumes an enormous amount of ammunition and does not have a beaten zone because each round seeks its own area of impact.

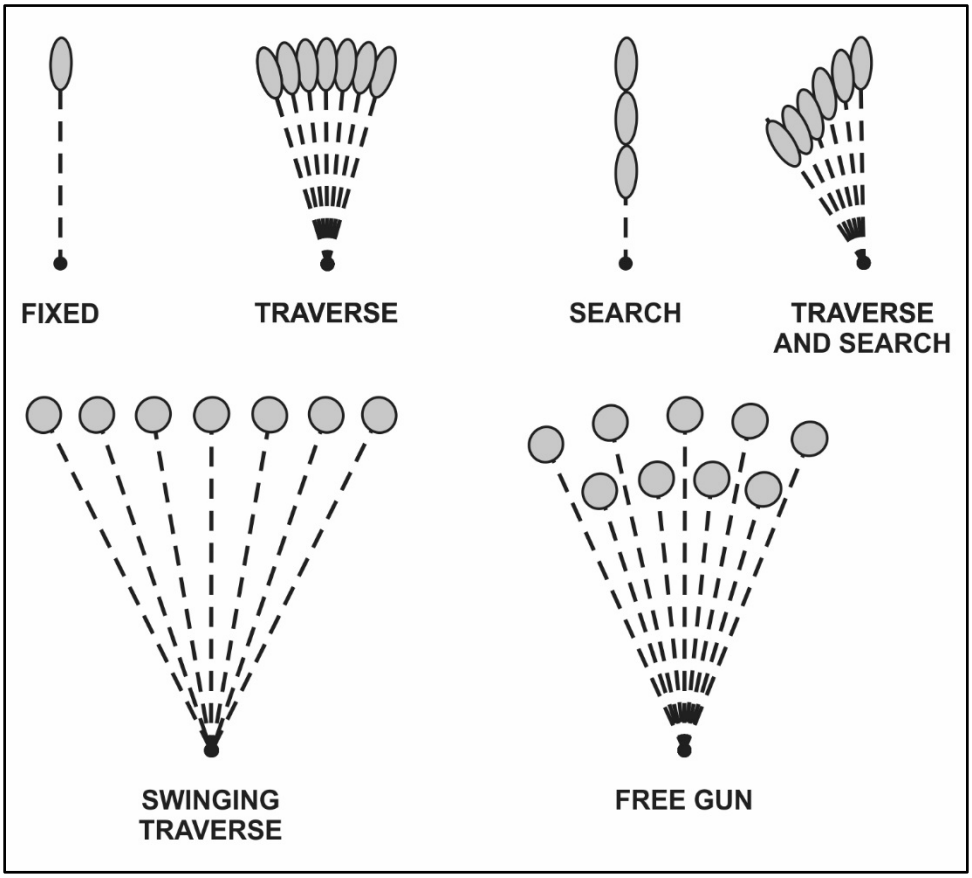



**Figure C-7. Classes of fire with respect to the gun**

## APPLICATION OF FIRE

C-29. Application of fire is the method the gunner uses to cover an enemy target area. The weapons squad leaders and gunners must be able to recognize the different types of targets found in combat before they can train applications of fire methods. The squad leaders and gunners must know how to distribute and concentrate their fire and how to maintain the proper rate of fire. Normally, the gunner is exposed to two types of targets in the squad or platoon area of operation, enemy soldiers and supporting automatic weapons. Leaders must ensure targets have priority and are engaged immediately.

C-30. Gunners must distribute machine gun fire over the entire target area. Improper distribution of fire results in gaps that allow the enemy to escape or use their weapons against friendly positions without opposition.

C-31. The method of applying fire to a target is generally the same for either a single gun or a pair of guns. Direct lay is pointing the gun for direction and elevation so the sights align directly on the target. Fire is delivered in width, depth, or in a combination of the two. To distribute fire properly, gunners must know where to aim, how to adjust their fire, and the direction to manipulate the gun. The gunner must aim, fire, and adjust on a certain point of the target. The leader may use binoculars to facilitate fire adjustment.

## SIGHT PICTURE

C-32. The sight picture is the placement of the aligned sights on the target. The gunner uses the MGO to apply the appropriate range and lead. The gunner aims with the intent of placing the cone of fire centered on the base of target, which takes full advantage of the cone of fire and the beaten zone.

## BEATEN ZONE

C-33. The gunner ensures the center of the beaten zone is maintained at the center base of the target for maximum effect from each burst of fire throughout their firing. When this is done, projectiles in the upper half of the cone of fire will pass through the target if the cone of fire has height, and projectiles in the lower half of the beaten zone may ricochet into the target. (See figure C-8.)

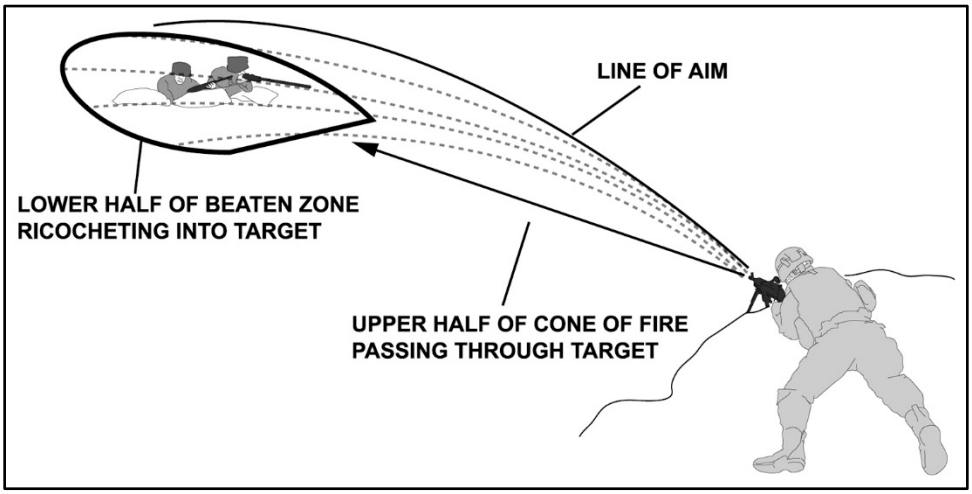



**Figure C-8. Line of aim and placement of center of beaten zone on target**

C-34. The gunner must move their beaten zone in a certain direction over the target. The direction depends on the type of target and whether the target is engaged with a pair of guns or a single gun. When engaging targets other than point targets with a pair of guns, the targets are divided so fire is distributed evenly throughout the target area. Fire delivered on point targets or a specific area of other target configurations is called concentrated fire.

## TARGET ENGAGEMENTS BY TYPES OF TARGETS

C-35. Gunners engage targets throughout their respective sectors. They must know how to engage all types of targets, either individually or with other gunners.

C-36. Normally, gunners' targets in combat are enemy troops in various formations or displacements, which require distribution and concentration of fire. The targets often have width and depth. The application of machine gun fire is designed to completely cover the area in which the enemy is known or suspected to be. The targets may be easy to see or may be indistinct and difficult to locate. The size of the target, stated in terms of the number of aiming points required to engage it completely, determines its type.

C-37. When a single gunner is assigned targets they are responsible for covering the entire target. When a pair of gunners engage an enemy target, normally, each gunner is responsible for covering one half of the target. The gunners must be prepared to engage the entire target should the other gun go down.

C-38. The machine gun can provide units with a self-defense capability against hostile low-flying, low-performance aircraft. The unit employs machine guns as part of the unit's local defense in the air defense role. The machine guns are not components of an integrated and coordinated air defense system. Unless otherwise directed, gunners should engage hostile aircraft within range of the gun (about 800 meters maximum effective range). The commander or leader makes the decision to engage. Typical targets are surveillance, reconnaissance, and liaison aircraft; troop carriers; helicopters; and drones.

## ENGAGEMENT AND EMPLOYMENT

C-39. The mission is to impose maximum attrition upon the attacking enemy such as low-flying, low-performance aircraft. Leaders and commanders consider the following defensive design factors when employing machine guns for air defense:

- Defensive design should produce an equally balanced defense in all directions, unless a forced route of approach exists.
- Machine guns should be sited so the maximum number of targets can be engaged, continuous fire can be delivered, and likely routes of approach are covered.

## TARGET SELECTION AND ENGAGEMENT CONTROL

C-40. Target selection and engagement control actions depend upon visual means. The sites selected for guns must provide maximum observation and unobstructed sectors of fire. Units that have been furnished with machine guns in sufficient numbers should site them within mutual support distances of 90 to 360 meters. Leaders assign each gun crew a primary and secondary sector of fire. Weapon crews maintain constant vigilance in their primary sectors of fire, regardless of the sector in which the guns are engaged.

## DISTRIBUTION, CONCENTRATION, AND RATE OF FIRE

C-41. The size and nature of the enemy target determines how to apply machine gun fire. Automatic weapons fire in one of three rates, rapid, sustained, or cyclic. The rates of fire for each machine gun are shown in table C-1. Normally, the situation dictates the rate used, but the availability of ammunition and the need for barrel changes play important roles as well. The gunner must control the rate of fire to cover the target adequately, but not waste ammunition or destroy the barrel.

## DISTRIBUTED AND CONCENTRATED FIRE

C-42. Distributed fire is delivered in width and depth such as at an enemy formation. Concentrated fire is delivered at a point target such as an automatic weapon or an enemy fighting position.

## RAPID FIRE

C-43. Rapid rate of fire places an exceptionally high volume of fire on an enemy position. Normally, machine gunners engage targets at the rapid rate to suppress the enemy quickly and to quickly gain fire superiority. Rapid fire requires more ammunition than sustained fire and requires frequent barrel changes.

## SUSTAINED FIRE

C-44. Once the enemy has been suppressed and fire superiority gained, machine gunners fire at the sustained rate. Sustained fire conserves ammunition and requires infrequent barrel changes only, but it might not be enough volume of fire to suppress or destroy.

## CYCLIC RATE OF FIRE

C-45. To fire the cyclic rate, the gunner holds the trigger to the rear while the assistant gunner feeds ammunition into the weapon. Usually, the gunner uses this rate of fire only to engage aerial targets in self-defense or to fire the final protective fires in the defense to protect the perimeter. Cyclic rate of fire produces the highest volume of fire the machine gun can fire, but can permanently damage the machine gun and barrel and should be used only in case of emergency.

## TARGET ENGAGEMENT DURING LIMITED VISIBILITY

C-46. Gunners have difficulty detecting and identifying targets during limited visibility. The leader's ability to control the fires of their weapons is reduced; therefore, they may instruct the gunners to fire without command when targets present themselves.

C-47. Gunners should engage targets only when they can identify the targets, unless ordered to do otherwise. For example, if one gunner detects a target and engages it, the other gunner observes the area fired upon and adds fire only if they can identify the target or if ordered to fire.

C-48. Gunners should use tracer ammunition if possible as it helps a gunner engage targets during limited visibility. However, it is important to note that in certain circumstances the enemy will have an easy time

identifying the machine gun's position if the gunner uses tracer ammunition. Gunners need to balance their need to engage targets with their need to keep the guns safe before deciding to employ tracers. If firing unaided, gunners must be trained to fire low at first and adjust upward; doing so overcomes the tendency to fire high.

C-49. When two or more gunners are engaging linear targets, linear targets with depth, or deep targets they do not engage these targets as they would when visibility is good. With limited visibility, the center and flanks of these targets may not be defined clearly. Therefore, each gunner observes their tracers and covers what they believe to be the entire target.

## TECHNIQUES

C-50. Techniques of fire include assault fire, overhead fire, and fire from a defilade position. Only automatic rifles use assault fire.

### Assault Fire

C-51. Automatic riflemen use assault fire when in close combat. Assault fire involves firing without the aid of sights using the shoulder position. From this position, automatic riflemen adjust their fire by observing the tracer and impact of the bullets on the target area. Additional considerations for automatic riflemen using assault fire include—

- Maintaining alignment with the rest of the assault element.
- Reloading rapidly.
- Aiming low and adjusting the aim upward toward the target.
- Distributing fires across the objective when not engaging enemy automatic weapons.

### Overhead Fire

C-52. Gunners can use overhead fire when there is sufficient low ground between the machine gun and target area of the maneuver friendly forces. A machine gun on a tripod can deliver this type of fire because of the small and uniform dispersion of the cone of fire. Gunners must accurately estimate the range to the target and establish a safety limit imaginary line parallel to the target where fire would cause casualties to friendly Soldiers. Gun crews and leaders must be aware of this safety limit. Leaders must designate signals for lifting or shifting fires. Gunners should not attempt overhead fires if the terrain is level or slopes uniformly, if the barrel is badly worn, or if visibility is poor.

## GUNNER'S RULE

C-53. The gunner's rule can be applied when the friendly troops are at least 350 meters in front of the gun position and range to the target is 850 meters or less. (See figure C-9, page C-12.) The rule follows:

- Lay the gun on the target with the correct sight setting to hit the target.
- Without disturbing the lay of the gun, set the rear sight at a range of 1600 meters.
- Look through the sights and notice where the new line of aim strikes the ground. This is the limit of troop safety. When the feet of the friendly troops reach this point, fire must be lifted or shifted.

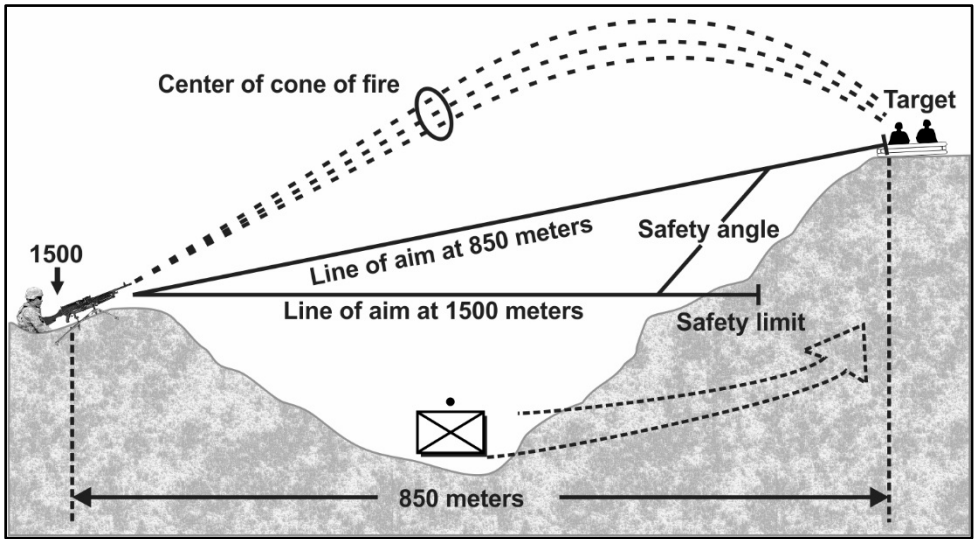



**Figure C-9. Application of gunner's rule**

## LEADER'S RULE

C-54. When the range to the target is greater than 850 meters, gunners should deliver overhead fire in an emergency only. Even then, fire should extend only to a range at which the tracers or strike of the bullets can be seen by the gunner. In this situation the leader's rule applies. (See figure C-10.) The platoon or section leader uses the leader's rule only when the target is greater than 850 meters. The rule follows:

- Select a point on the ground where it is believed friendly troops can advance with safety.
- Determine the range to this point by the most accurate means available.
- Lay the gun on the target with the correct sight setting to hit the target.
- Without disturbing the lay of the gun, set the rear sight to 1600 meters or the range to the target plus 500 meters, whichever is the greater of the two ranges. Under no conditions should the sight setting be less than 1500 meters.
- The point where the new line of aim strikes the ground:
  - If it strikes at the selected point, that point marks the limit of safety.
  - If it strikes short of the selected point, it is safe for troops to advance to the point where the line of aim strikes the ground and to an unknown point beyond. If fire is called for after friendly troops advance farther than the point where the line of aim strikes the ground, this farther point is determined by testing new selected points until the line of aim and selected point coincide.
  - If it clears the selected point, it is safe for troops to advance to the selected point and to an unknown point beyond. If it is advantageous to have troops advance beyond the selected point, this farther point must be determined by testing new selected points until the line of aim and selected point coincide. This point marks the line of safety.

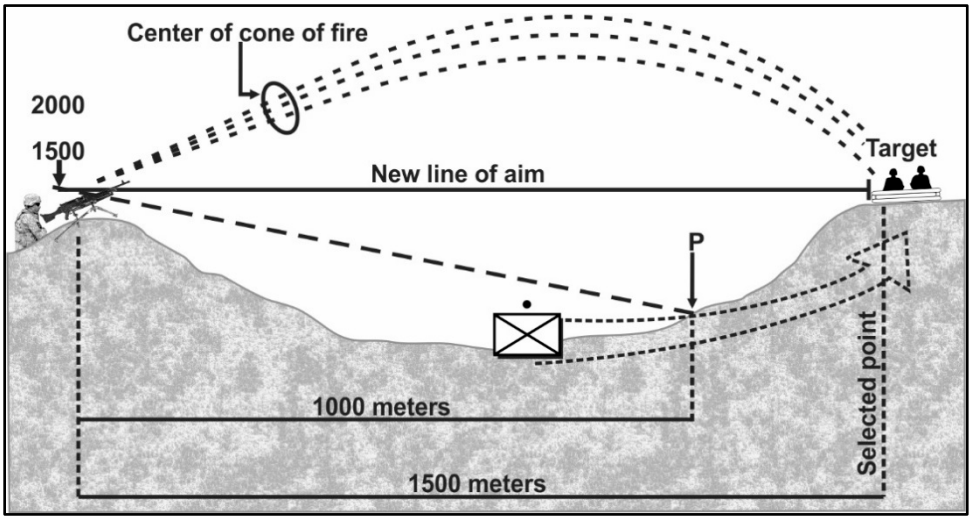



**Figure C-10. Application of leader's rule**

## FIRE FROM A DEFILADE POSITION

C-55. Defilade positions protect gunners from frontal or enfilading fires (see figure C-11). Cover and concealment may not provide the gunner with a view of some or all of the target area. In this instance, some other member of the platoon or squad must observe the impact of the rounds and communicate adjustments to the gunner (see figure C-12). Gunners and leaders must consider the complexity of laying on the target. They also must consider the gunner's inability to make rapid adjustments to engage moving targets, the ease with which targets are masked, and the difficulty in achieving grazing fires for a fire protective line.

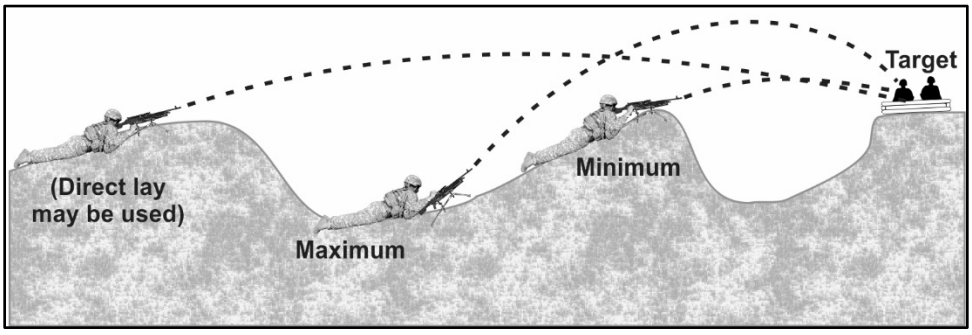



**Figure C-11. Defilade positions**

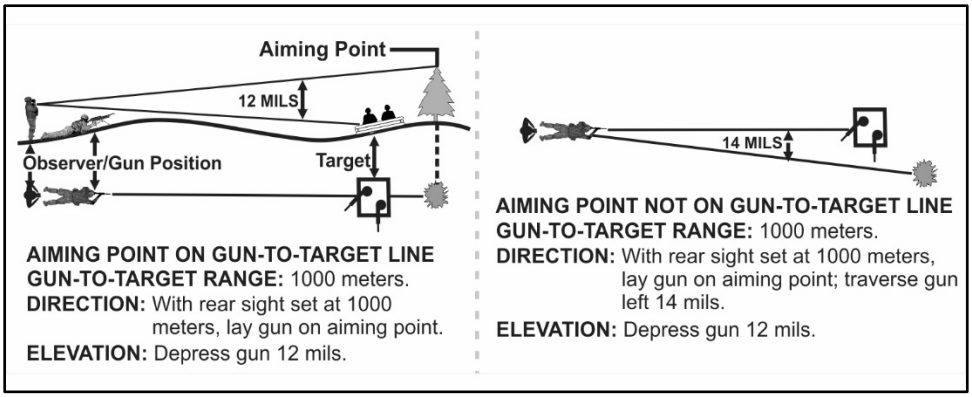



**Figure C-12. Observer adjusting fire**

# PREDETERMINED FIRES

C-56. Predetermined fires organize the battlefield for gunners. Predetermined fires allow the leader and gunner to select potential target areas with tactical significance or target areas where the gunner will most likely engage the enemy. The target areas include dismounted enemy avenues of approach, likely positions for automatic weapons, and probable enemy assault positions. The gunners use sectors of fire, final protective fire, or a principal direction of fire and selected target areas. The gunner's preparation maximizes the machine gun's effectiveness during clear as well as limited visibility. Preparation enhances fire control by reducing the time required to identify targets, determine range, and manipulate the weapon onto the target. Abbreviated fire commands and previously recorded data enable the gunner to aim or adjust fire on the target quickly and accurately. Gunners should fire on selected targets in daylight whenever practical to confirm data. The range card identifies the targets and provides a record of firing data. DA Form 5517, *Standard Range Card*, provides a record of firing data and aids defensive fire planning.

## TERMINOLOGY

C-57. Gunners need to know several terms associated with predetermined fire. The most common terms are defined in the following paragraphs.

### Sector of Fire

C-58. A sector of fire is an area to be covered by fire assigned to an individual, a weapon, or a unit. Normally, gunners are assigned a primary and a secondary sector of fire.

### Final Protective Fire (FPF)

C-59. Final protective fire (FPF) is an immediately available, prearranged barrier of fire to stop enemy movement across defensive lines or areas.

### Final Protective Line (FPL)

C-60. A final protective line (FPL) is a predetermined line along which grazing fire is placed to stop an enemy assault. If a final protective line is assigned, the machine gun is sighted along it except when other targets are being engaged. A final protective line becomes the machine gun's part of the unit's FPFs. A final protective line is fixed in direction and elevation. However, a small shift must be employed to prevent the enemy from crawling under the final protective line and to compensate for irregularities in the terrain or the sinking of the tripod legs into soft soil during firing. Fire must be delivered during all conditions of visibility.

C-61. A good final protective line covers the maximum area with grazing fire. Grazing fire can be obtained over various types of terrain out to a maximum of 600 meters. To obtain the maximum extent of grazing fire over level or uniformly sloping terrain, the gunner sets the rear sight at 600 meters. The gunner selects a point on the ground they estimate to be 600 meters from the machine gun; then aims, fires, and adjusts on that point. The gunner searches (downward) by lowering the muzzle of the weapon to prevent enemy soldiers from crawling under grazing fire.

### Principal Direction of Fire (PDF)

C-62. A principal direction of fire (PDF) is assigned to a gunner to cover an area having good fields of fire or has a likely dismounted avenue of approach. It also provides mutual support to an adjacent unit. Machine guns are sited using the PDF if an FPL has not been assigned. If a PDF is assigned and other targets are not being engaged, machine guns remain on the PDF. A PDF has the following characteristics:

- It is used only if a final protective line is not assigned; it then becomes the machine gun's part of the unit's final protective fires.
- When the target has width, direction is determined by aiming on one edge of the target area and noting the amount of traverse necessary to cover the entire target.
- The gunner is responsible for the entire wedge-shaped area from the muzzle of the weapon to the target, but elevation may be fixed for a priority portion of the target.

## Dead Space and Grazing Fire

C-63. The extent of grazing fire and dead space may be determined in two ways one of which is the preferred method. In the preferred method, the machine gun is adjusted for elevation and direction; then, a squad member walk along the final protective line while the gunner aims through the sights. In places where the Soldier's waist (midsection) falls below the gunner's point of aim, dead space exists. The gunner must use arm-and-hand signals to control the Soldier who is walking and to obtain an accurate account of the dead space and its location. The other method is to observe the flight of tracer ammunition from a position behind and to the flank of the weapon.

## Primary Sector of Fire

C-64. The primary sector of fire is assigned to the gun team to cover the most likely avenue of enemy approach from all types of defensive positions.

## Secondary Sector of Fire

C-65. The secondary sector of fire is assigned to the gun team to cover the second most likely avenue of enemy approach. It is fired from the same gun position as the primary sector of fire.

## Field Expedient Techniques

C-66. When laying the machine gun for predetermined targets, the gunner can use field expedients as a means of engaging targets when other sources are not available.

## Base Stake Technique

C-67. A base stake is used to define sector limits and may provide the lay of the FPL or predetermined targets along a primary or secondary sector limit. The base stake technique is effective in all visibility conditions. The gunner does the following:

- Lays the gun for direction along one sector limit to define the sector limits and emplaces a stake along the outer edge of the folded bipod legs. Rotates the legs slightly on the receiver so the gunner takes up the play. Uses the same procedure for placing a stake along the opposite sector limit.
- Lays the machine gun along the final protective line by moving the muzzle of the machine gun to a sector limit. Adjusts for elevation by driving a stake into the ground so the top of the stake is under the gas cylinder extension, which allows a few mils of depression to cover irregularities in the terrain.
- Lays the machine gun to engage other targets within a sector limit. Done in a primary sector by using the procedure described previously, except the gunner keeps the elevation fixed.

## Notched-stake or Tree-crotch Technique

C-68. The gunner uses the notched-stake or tree-crotch technique with the bipod mount to engage predetermined targets within a sector or to define sector limits. The technique is effective during all conditions of visibility and requires little additional materiel. The gunner uses the following steps:

- Drives either a notched stake or tree crotch into the ground where selected targets are anticipated. Places the stock of the machine gun in the nest of the stake or crotch and adjusts the weapon to hit the selected targets and to define their sector limits.
- Digs shallow, curved trenches or grooves for the bipod feet. (The trenches allow for rotation of the bipod feet as the gunner moves the stock from one crotch or stake to another.)

## Horizontal Log or Board Technique

C-69. This technique is used with the bipod or tripod mount to mark sector limits and engage wide targets. The technique is good for all visibility conditions and is best suited for flat, level terrain. The gunner uses the following steps.

***Bipod-Mounted Machine Gun***

C-70. Using a bipod-mounted machine gun, the gunner places a log or board beneath the stock of the weapon so the stock can slide across it freely. The gunner digs shallow, curved trenches or grooves for the bipod feet so the feet can rotate as they moves the stock along the log or board. (The gunner may mark the sector limits by notching or placing stops on the log or board. The gunner uses the bipod firing position and grip.)

***Tripod-mounted Machine Gun***

C-71. Using a tripod-mounted machine gun, the gunner places a log or boards beneath the barrel, positioning it so the barrel, when resting on the log or board, is at the proper elevation for grazing fire. When appropriate, the gunner marks the sector limits of the bipod as described in the preceding paragraph. (The technique is used only if a T&E mechanism is not available.)

# FIRE CONTROL

C-72. Fire control includes the planning, preparing, and applying fire on a target actions of the leader and Soldiers. The leader selects and designates targets. The leaders designate the midpoint and flanks or ends of a target also, unless they are obvious to the gunner. The gunner fires at the instant desired then adjusts fire, regulates the rate of fire, shifts from one target to another, and ceases fire. When firing, the gunner should continue to fire until the target is neutralized or until signaled to do otherwise by the leader.

C-73. Predetermined targets, including the final protective line or principal direction of fire, are engaged on order or by the SOP. The signal for calling these fires normally is stated in the defensive order. Gunners use arm-and-hand signals, voice commands, or pyrotechnic devices to control the predetermined targets. Gunners fire the final protective line or the principal direction of fire at the sustained rate of fire unless the situation calls for a higher rate. When engaging other predetermined targets, the sustained rate of fire is used also unless a different rate is ordered.

## METHODS OF FIRE CONTROL

C-74. The noise and confusion of battle may limit the use of some of these methods. Therefore, the leader must select a method or combination of methods to accomplish the mission.

### Oral

C-75. The oral fire control method can be effective, but sometimes the leader may be too far away from the gunner, or the noise of the battle may make it impossible for the gunner to hear. The primary means of the oral fire control method is the issuance of a fire command.

### Arm-and-Hand Signals

C-76. Arm-and-hand signals are an effective fire control method when the gunner can see the leader. All gunners must know the standard arm-and-hand signals. The leader gets the gunner's attention and points to the target. When the gunner returns the ready signal, the leader commands fire.

### Prearranged Signals

C-77. Prearranged signals are either visual or sound signals such as casualty-producing devices (rifle or claymore), pyrotechnics, whistle blasts, or tracers. The signals should be included in the SOPs. If the leader wants to shift fire at a certain time, they give a prearranged signal such as obscurants or pyrotechnics. Upon seeing the signal, gunners shift their fire to a prearranged point.

### Personal Contact

C-78. In many situations, the leader must issue orders directly to individual Soldiers. Infantry leaders use personal contact more than other methods. The leader must use maximum cover and concealment to keep from disclosing the position or themselves.

### Range Cards

C-79. When using the range card method of fire control, the leader must ensure all range cards are current and accurate. Once this is accomplished, the leader may designate certain targets for certain weapons with the use of limiting stakes or with fire commands. The leader also should designate no-fire zones or restricted fire areas to others. The vital factor in this method of fire control is gunners must be well-disciplined and pay attention to detail.

### Standard Operating Procedures

C-80. Standard operating procedures are actions to be executed without command and developed during the training of the squads. Their use eliminates many commands and simplifies the leader's fire control. Standard operating procedures, or certain actions and commands, can be developed to make gunners effective. Some examples follow:

- Observation. The gunners continuously observe their sectors.
- Fire. Gunners open fire without command on appropriate targets appearing within their sectors.
- Check. While firing, the gunners periodically check with the leader for instructions.
- Return fire. The gunners return enemy fire without order, concentrating on enemy automatic weapons.
- Shift fire. Gunners shift their fires without command when more dangerous targets appear.
- Rate of fire. When gunners engage a target, they initially fire at the rate necessary to gain and maintain fire superiority.

## SECURITY

C-81. Security includes all command measures to protect against enemy surprise, observation, and annoyance. The principal security measures against ground forces include employment of security patrols and detachments covering the front flanks and rear of the unit’s most vulnerable areas. The composition and strength of these detachments depends on the size of the main body, its mission, and nature of the opposition expected. The presence of machine guns with security detachments augments their firepower to delay, attack, and defend, by virtue of inherent firepower.

C-82. The potential of air and ground attacks on the unit demands every possible precaution for maximum security while on the move. Where this situation exists, the machine gun crew must be thoroughly trained in the hasty delivery of antiaircraft fire and of counterfire against enemy ground forces. The distribution of the machine guns in the formation is critical. The machine gun crew is constantly on the alert, particularly at halts, ready to deliver fire as soon as possible. If the leader expects a halt to exceed a brief period, they carefully choose machine gun positions to avoid unduly tiring the machine gun crew. If the leader expects the halt to extend for a long period, they can have the machine gun crew take-up positions to support the unit. The crew covers the direction from which they expect enemy activity as well as the direction from which the unit came. The leader selects positions permitting the delivery of fire in the most probable direction of enemy attack, such as valleys, draws, ridges, and spurs. Leaders choose positions offering obstructed fire from potential enemy locations.

## MACHINE GUNS IN THE OFFENSE

C-83. Offensive missions result from the employment of fire and movement. Each is essential and greatly depends upon the other. Without the support of covering fires, maneuvering in the presence of enemy fire can result in disastrous losses. Covering fires, especially providing fire superiority, allow maneuvering in the offense. However, fire superiority alone rarely wins battles. The primary objective of the offense is to advance, occupy, and hold the enemy position.

## MACHINE GUN AS A BASE OF FIRE

C-84. Machine gun fire from a support-by-fire position must be the minimum possible to keep the enemy from returning fire. Ammunition must be conserved so the guns do not run out of ammunition.

C-85. The weapons squad leader positions and controls the fires of all machine guns in the element. Machine gun targets include essential enemy weapons or groups of enemy targets either on the objective or attempting to reinforce or counterattack. In terms of engagement ranges, medium machine guns in the base-of-fire element may find themselves firing at targets within a range of 800 meters. The nature of the terrain, desire to achieve some standoff, and mission, enemy, terrain and weather, troops and support available, time available, civil considerations (known as METT-TC) prompts the leader to the correct tactical positioning of the base-of-fire element.

C-86. The machine gun delivers an accurate, high-volume rate of lethal fire on fairly large areas in a brief time. When accurately placed on the enemy position, machine gun fires secure the essential element of fire superiority for the duration of the firing. Troops advancing in the attack should take full advantage of this period to maneuver to a favorable position from where they can facilitate the last push against the enemy. In addition to creating enemy casualties, machine gun fire destroys the enemy's confidence and neutralizes their ability to engage the friendly maneuver element.

C-87. The base-of-fire element employs distinct phases of rates of fire:

- Initial heavy volume (rapid rate) to gain fire superiority.
- Slower rate to conserve ammunition (sustained rate) while still preventing return fire as the assault moves forward.
- Increased rate as the assault nears the objective.
- Lift and shift to targets of opportunity.

C-88. All vocal commands from the leaders to change the rates of fire are accompanied simultaneously by arm-and-hand signals.

C-89. Machine guns in the support-by-fire role should be set in and assigned a primary and alternate sector of fire as well as a primary and alternate position.

C-90. Machine guns are suppressive fire weapons used to suppress known and suspected enemy positions. Therefore, gunners cannot be allowed to empty all their ammunition into one bunker simply because it’s all they can identify at the time.

C-91. The support-by-fire position, not the assault element, is responsible for ensuring there is no masking of fires. The assault element might have to mask the support-by-fire line because it has no choice on how to move. The support-by-fire gunner’s job is to shift fires continually, or move gun teams or the weapons squad to support the assault and prevent masking.

C-92. The leader shifts and shuts down the weapon squad gun teams one at a time, not all at once. M203/M320 and mortar or other indirect fire can be used to suppress the enemy while the machine guns are moved to positions where they can fire.

C-93. Leaders must take into account the surface danger zones of the machine guns when planning and executing the lift and or shift of the support-by-fire guns. The effectiveness of the enemy on the objective plays a large role in how much risk leaders should take with respect to the lifting or shifting of fires.

C-94. Once the assault element masks the support-by-fire line, leaders shift or left fires to prevent enemy withdrawal or reinforcement.

## MACHINE GUN WITH THE MANEUVER ELEMENT

C-95. Under certain terrain conditions, and for proper control, machine guns may join the maneuver or assault unit. When this is the case, they are assigned a cover fire zone or sector.

C-96. The machine guns seldom accompany the maneuver element. The gun’s primary mission is to provide covering fire. The machine guns are employed only with the maneuver element when the area or zone of action assigned to the assault, platoon, squad or company is too narrow to permit proper control of the guns. The machine guns are moved with the unit then and readied to employ on order from the leader and in the direction needing the supporting fire.

C-97. When machine guns move with the element undertaking the assault, the maneuver element brings the machine guns to provide additional firepower. The weapons are fired from a bipod, in an assault mode, from the hip, or from the underarm position. They target enemy automatic weapons anywhere on the unit's objective. Once the enemy's automatic weapons have been destroyed (if any), the gunners distribute their fire over their assigned zone or sector. In terms of engagement ranges, the machine gun in the assault engages within 300 meters of its target and frequently at point-blank ranges.

C-98. Where the area or zone of action is too wide to allow proper coverage by the platoon's or weapons squad's organic medium machine guns, the platoon or squads can be assigned additional medium machine guns or personnel from within the company. Doing so may permit the platoon or squads to accomplish its assigned mission. The medium machine guns are assigned a zone or a sector to cover and move with the maneuver element.

# MACHINE GUNS IN THE OFFENSE

C-99. In the offense, the platoon leader has the option to establish their base-of-fire element with one or two machine guns, the M249 light machine gun, or a combination of the weapons. The platoon sergeant or weapons squad leader may position this element and control its fires when the platoon scheme of maneuver is to conduct the assault with the Infantry squads. The M240-series machine gun, when placed on a tripod, provides stability and accuracy at greater ranges than the bipod, but it takes more time to maneuver the machine gun should the need arise. The machine gunners target essential enemy weapons until the assault element masks their fires. The machine gunners can be used to suppress the enemy's ability to return accurate fire or to hamper the maneuver of the enemy's assault element. The fix the enemy in position and isolate them by cutting off their avenues of reinforcement. They then shift their fires to the flank opposite the one being assaulted and continue to target automatic weapons providing enemy support, and engage enemy counterattack. M240-series fires can be used to cover the gap created between the forward element of the friendly assaulting force and terrain covered by indirect fires when the indirect fires are lifted and shifted. On signal, the machine gunners and base-of-fire element displace to join the assault element on the objective.

# MACHINE GUNS IN THE DEFENSE

C-100. The platoon's defense centers on its machine guns. The platoon leader sites the rifle squad to protect the machine guns against the assault of a dismounted enemy formation. The machine guns provide the necessary range and volume of fire to cover the squad's front in the defense.

C-101. The primary requirement of a suitable defensive machine gun position is its effectiveness in accomplishing specific missions. The position should be accessible and afford cover and concealment. Machine guns are sited to protect the front, flanks, and rear of occupied portions of defensive positions, and to be mutually supporting. Usually, attacking troops seek easily traveled ground that provides cover from fire. Every machine gun should have three positions: Primary, alternate, and supplementary. The leader should choose each of these positions to ensure their sector is covered and the machine guns are protected on their flanks.

C-102. The leader sites the machine gun to cover the entire sector or to overlap sectors with the other machine guns. The engagement range may extend from more than 1000 meters where the enemy begins their assault to point-blank range. Machine gun targets include enemy automatic weapons and command and control elements.

C-103. Machine gun fire is distributed in width and depth in a defensive position. The leader can use machine guns to subject the enemy to increasingly devastating fire from the initial phases of their attack and to neutralize partial successes the enemy might attain by delivering intense fires to support counterattacks. The machine gun's tremendous firepower enables the unit to hold ground. The machine gun's firepower is what makes it the backbone or framework of the defense.

## M249-SERIES LIGHT MACHINE GUNS IN THE DEFENSE

C-104. In the defense, the machine gun provides sustained direct fires covering the most likely or most dangerous enemy dismounted avenues of approach. The machine gun protects friendly units against the

enemy's dismounted close assault. The platoon leader positions their machine guns to concentrate fires in locations where they want to inflict the most damage to the enemy. The platoon leader places the machine guns where they can take advantage of grazing enfilade fires, stand-off or maximum engagement range, and best observation of the target area. Machine guns provide overlapping and interlocking fires with adjacent units and cover tactical and protective obstacles with traversing or searching fires. When FPFs are called for, machine guns place a barrier of fixed, direct fire across the platoon or squad front. Leaders position machine guns to—

- Concentrate fires where they want to kill the enemy.
- Fire across the platoon and squad front.
- Cover obstacles by direct fire.
- Tie-in with adjacent units.

# AMMUNITION PLANNING

C-105. Leaders must carefully plan the machine guns' rates of fire as they relate to the mission and the amount of ammunition available. The weapons squad leader must understand the mission, the amount of available ammunition, and the application of machine gun fire needed to fully support all vital events of the mission. Planning ensures the guns do not run out of ammunition.

C-106. A mounted platoon or squad might have access to enough machine gun ammunition to support the guns throughout its operation. A dismounted platoon or squad, with limited resupply capabilities, has to plan only for the basic load to be available. In either case, leaders must take into account vital events the guns must support during the mission. They must plan the rate of machine gun fire needed to support the vital events, and the amount of ammunition needed for scheduled rates of fire.

C-107. The leader must make an estimate of the total amount of ammunition needed to support all the machine guns. Then, the leader must adjust the amount of ammunition used for each event to ensure enough ammunition is available for all phases of the operation. Examples of planning rates of fire and ammunition requirements for a platoon's or weapons squad's machine guns in the attack follow.

## KNOW RATE OF FIRE

C-108. Leaders must know the length of time their guns will be firing and their guns' rate of fire to ensure they have enough ammunition to complete the mission. Leaders must calculate the number of rounds needed to support every machine gun throughout all phases of the operation. Ammunition must be allocated for each vital event and to support movement with suppressive fire. As an example of the planning needed to use the M249 series in support-by-fire roles, table C-1 lists the M249-series rate of fire.

**Table C-1. M249 series rate of fire**

| | |
|---|---|
| ***SUSTAINED*** | 100 rounds per minute. |
| | Fired in 6- to 9-round bursts. |
| | 4-5 seconds between bursts (barrel change every 10 minutes). |
| ***RAPID*** | 200 rounds per minute. |
| | Fired in 10- to 12-round bursts |
| | 2-3 seconds between bursts (barrel change every two minutes). |
| ***CYCLIC*** | 650-950 rounds per minute. |
| | Continuous burst (barrel change every minute). |

## Appendix D

# Drills

Appendix D describes the various drills for the light machine gun and their purpose. The drill structure is designed to reinforce the most common actions in a logical sequence that all Soldiers need to routinely execute with their assigned equipment during training and combat.

These drills are used during Table III of the integrated weapons training strategy, as well as during routine maintenance, concurrent training, and during deployments. The drills found within this appendix are used to build and maintain skills needed to achieve proficiency and mastery of the weapon, and are to be ingrained into daily use with the weapon. These drills are conducted in all types of environments to include day, night, CBRN, and any other conditions that may be considered unusual.

## BUILDING CONFIDENCE

D-1. Each drill is designed to develop confidence in the equipment and Soldier actions during training and combat operations. As they are reinforced through repetition, they become second nature to the Soldier, providing smooth, consistent employment during normal and unusual conditions.

D-2. The drills provided are designed to build the Soldier's proficiency with the following principles.

- Mindset. Ensures Soldiers can perform tasks quickly and effectively under stress.
- Efficiency. Ensure the drills require the least amount of movement or steps to complete correctly; make every step count.
- Individual tactics. Ensure the drills link directly to employment in combat.
- Flexibility. Provide drills that are not rigid in execution. Units may alter the procedural steps depending on their equipment, configuration, or tactical need.

## MINDSET

D-3. Continuous combat is inherently stressful. Combat exhausts Soldiers and causes physiological changes that reduces their ability to perform tasks as quickly or effectively as necessary. The Soldier's ability to function under stress is the key to winning battles, since without the Soldier, weapons and tactics are useless. Individual and unit military effectiveness depends on the Soldier's ability to think clearly, accurately, and quickly, all with initiative, motivation, physical strength, and endurance.

D-4. The impact of physiological changes caused by the stress of combat escalates or de-escalates based on the degree of stimulation, causing Soldiers to attain different levels of awareness as events occur in the continually transitioning operational area around them. Maintaining a tactical mindset involves understanding one's level of awareness and transitioning between the levels of awareness as the situation requires escalation or de-escalation.

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***Note***. Soldiers can counter stress using the principles associated with Soldier resilience and performance enhancement. The Comprehensive Soldier and Family Fitness (CSF2) is designed to increase a Soldier's ability and willingness to perform an assigned task or mission and enhance their performance by assessing and training mental resilience, physical resilience, and performance enhancement techniques and skills. The initiative introduces many resources to train Soldiers on skills to counter stress. For more information about CSF2, see http://csf2.army.mil/.

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# EFFICIENCY

D-5. Efficiency is the minimization of time or resources to produce a desired outcome. Efficient movements are naturally faster than movements that contain excessive or wasteful actions.

D-6. By reducing the amount of effort, mental and physical, the movement becomes repeatable and the effect becomes predictable. Thus, the Soldier can focus on tactics while still producing accurate and precise fires.

# INDIVIDUAL TACTICS

D-7. Individual tactics are actions independent of unit SOPs or situations that maximize the Soldier's chance of survival and victory in a small arms, direct fire battle.

D-8. Examples of individual tactics include using cover and standoff or the manipulation of time and space between a Soldier and their enemy.

# FLEXIBILITY

D-9. The techniques presented in this publication are not meant to be prescriptive, as multiple techniques can be used to achieve the same goal. In fact, there is no singular one size fits all solution to machine gun fire; different types of enemies and scenarios require the use of different techniques. However, the techniques presented are efficient and proven techniques for conducting various machine gun related tasks. Should other techniques be selected, they should meet the following criteria:

- Reliable under conditions of stress.
- Repeatable under conditions of stress
- Efficiency in motion.
- Develop natural responses through repetition.
- Leverage overmatch capabilities

## RELIABLE UNDER CONDITIONS OF STRESS

D-10. Techniques should be designed for reliability when it counts—during combat. The technique should produce the intended results without fail, under any conditions and while wearing mission-essential equipment. Techniques should be tested under stress conditions that are as high stress as training allows.

## REPEATABLE UNDER CONDITIONS OF STRESS

D-11. As combat is a stressor, a Soldier's body responds to combat stress much as it does to any other stressful stimulus; physiological changes begin to occur igniting a variable scale of controllable and uncontrollable responses based on the degree of stimulation. Techniques should support or exploit the body's natural reaction to life-threatening stress.

## EFFICIENCY IN MOTION

D-12. The technique should be designed to create the greatest degree of efficiency of motion. It should contain only necessary movement. Excessive or unnecessary movement in a fighting technique costs time to execute. In a violent encounter, time can mean the difference between life and death.

D-13. Consider the speed at which violent encounters occur; an unarmed person can cover a distance of 20 feet in approximately one second. Efficiency decreases the time necessary to complete a task, which enhances the Soldier's safety.

## DEVELOP NATURAL RESPONSES THROUGH REPETITION

D-14. The technique should build reflexive reactions that a Soldier applies in response to a set of conditions when practiced correctly and in sufficient volume. A Soldier creates the muscle memory necessary to serve

them under conditions of dire stress only with correct practice. The goal is to create automaticity; the ability to perform an action without thinking through the steps associated with the action.

### LEVERAGE OVERMATCH CAPABILITIES

D-15. Machine gun engagements can occur at various distances. Fast and efficient presentation of the machine gun allows more time to stabilize the weapon, refine the aim, and control the shot required to deliver precise fires. This rapidly moves the unit toward the goal of fire superiority and gains and maintains the initiative. Speed should be developed throughout the training cycle and maintained during operations.

D-16. As distance between the Soldier and a threat decreases, so does the time to engage with well-placed lethal fires. As distance increases, the Soldier gains time to refine their aim and conduct manipulations.

## CONDUCT DRILLS

D-17. Certain tasks are integrated into drills to build the skills necessary to master the functional elements of the shot process. The drills are designed specifically to capture the routine, critical tasks or actions Soldiers must perform fluently and as a second nature to achieve a high level of proficiency.

D-18. Drills focus on the Soldier's ability to apply specific weapons manipulation techniques to engage a threat correctly, overcome malfunctions of the weapon or system, and execute common tasks smoothly and confidently.

### WEAPON CHECK

D-19. The weapon check is a visual inspection of the weapon by the Soldier. A weapon check includes, at a minimum, the following verifications:

- Weapon is clear.
- Weapon serial number.
- Aiming device(s) serial number.
- Attachment points of all aiming devices, equipment, and accessories.
- Functions check.
- Proper location of all attachments on the adaptive rail system.
- Zero information.
- Serviceability of all ammunition belts, drums, and magazines.

D-20. Soldiers initiate a weapon check when they first receive the weapon from the arms room or storage facility. Soldiers perform a weapon check when recovering the weapon when the weapons are stacked or secured at a grounded location, also.

D-21. Units may add tasks to this drill as necessary. Units may direct Soldiers to execute this drill at any time to support the unit's mission.

### SLING AND UNSLING

D-22. The sling and unsling drill exercises the Soldier's ability to change the location of the weapon on demand. The drill reinforces their ability to maintain situational and muzzle awareness during rapid changes of the weapon's sling posture. Drill B provides a fitment check between the weapon, the Soldier's load bearing equipment, and the Soldier's ability to move between positions while maintaining effective use of the weapon. When conducting this drill, Soldiers should—

- Verify the proper adjustment to the sling.
- Rotate the torso left and right to ensure the sling does not hang up on any equipment.
- Ensure the weapon does not interfere with tactical movement.

## EQUIPMENT CHECK

D-23. The equipment check drill is a pre-combat check (PCC), which ensures the Soldier prepares their aiming devices, equipment, and accessories. The Soldier ensures the following:

- Accessories have batteries.
- Equipment is secured correctly.
- Equipment does not interfere with tactical movement.
- Basic load of ammunition is stowed properly.

## LOAD

D-24. The load drill is predominantly an administrative loading function. The drill load allows the Soldier to develop reliable loading techniques.

## CARRY

D-25. The carry drill is a series of five methods the Soldier uses to carry the weapon. The five methods are linked closely with range operations in the training environment, but are tailored to combat operations specifically. The drill demonstrates the Soldier's proficiency moving between—

- Hang.
- Safe hang.
- Collapsed low ready.
- Low ready.
- Ready (or ready up).

D-26. A leader announces the appropriate carry term to initiate the drill. Each carry method should be executed in a random order a minimum of three times.

## FIGHT DOWN

D-27. The fight down drill builds the Soldier's understanding of how to move effectively and efficiently between firing postures. The drill starts at a standing position, and on command, the Soldier executes the next lower position or the position the leader announces. The fight down drill exercises the following positions in sequence:

- Standing.
- Kneeling.
- Sitting.
- Prone.

D-28. Each position should be executed a minimum of three times. Leaders can use the fight down drill in conjunction with the fight up drill.

## FIGHT UP

D-29. The fight up drill builds the Soldier's timing and speed while moving from various positions during operations. The drill starts in the prone position, and on command, the Soldier executes the next higher position or the position announced by the leader. The fight up drill exercises the following positions in sequence:

- Prone.
- Sitting.
- Kneeling.
- Standing.

D-30. Each position should be executed a minimum of three times. Leaders will use fight down drill in conjunction with the fight up drill.

D-31. Leaders may increase the tempo of the drill which increases the speed the Soldier needs to assume the next directed position. After the minimum five iterations are completed between the fight down drill and the fight up drill, the leader may switch between fight down and fight up at any time, at varying tempos.

## GO-TO-PRONE

D-32. The go-to-prone drill develops the Soldier's agility when they rapidly transition from a standing or crouched position to a prone firing position. Standard time should be less than three seconds.

D-33. Leaders announce the starting position for the Soldier to assume. Once the Soldier has correctly executed the start position to standard, the leader will announce, GO TO PRONE. The drill should be conducted a minimum of five times stationary and five times while walking.

D-34. Leaders should not provide preparatory commands to the drill and should direct the Soldier to go to prone when it is unexpected or at irregular intervals. Leaders may choose to include a tactical rush with the execution this drill.

## RELOAD AND BARREL CHANGE

D-35. Leaders execute the tactical reload and barrel change drill when the gun team is wearing complete load bearing equipment. Reload provides exercises to assure fast reliable reloading through repetition at all firing positions or postures. Leaders will incorporate the barrel change drill every third iteration to improve proficiency.

D-36. The Soldier should perform reload and barrel change from each of the following positions a minimum of three times each:

- Standing.
- Sitting
- Kneeling.
- Prone.

D-37. Leaders may include other drills while directing this drill to the Soldier to reinforce the training as necessary.

## CLEAR MALFUNCTION

D-38. The clear malfunction drill includes the three methods to clear the most common malfunctions on a light machine gun quickly while maintaining muzzle and situational awareness. Soldiers should perform all three variations of clearing a malfunction based on the commands from their leader.

D-39. Each of the three variations of this drill should be executed five times. Once complete, leaders should incorporate this drill with other drills to ensure the Soldier can execute the tasks at all positions fluently.

## UNLOAD AND SHOW CLEAR

D-40. Unload and show clear is predominantly an administrative unloading function, and allows the Soldier to develop reliable clearing techniques. This drill should be executed in tandem with load drill and should be executed so as to include the Soldier's linked ammunition as well as the emergency magazines the Soldier is carrying.

D-41. The drill can be executed without ammunition in the weapon. Leaders may opt to use dummy ammunition or spent cartridge cases as desired. In garrison environments, leaders should use this drill on demand, particularly prior to entering buildings or vehicles, to reinforce the Soldier's skills and attention to detail.

## MOUNT TO TRIPOD

D-42. Leaders execute the mount to tripod drill when the Soldier is wearing complete load-bearing equipment. This drill provides exercises to assure a fast and reliable means to mount the light machine gun through repetition.

D-43. Leaders should execute this drill five times. Once complete, leaders should incorporate this drill with other drills to ensure the Soldier can execute the task quickly and efficiently under any circumstance.

## MANIPULATE TRAVERSE AND ELEVATION MECHANISM

D-44. The manipulate traverse and elevation (T&E) mechanism drill develops the Soldier's ability to quickly shift from one target to another. The Soldier trains to use the traversing handwheel, the traversing slide lock, and the elevating handwheel.

D-45. Leaders use a basic machine gun target placed 10 meters away. Leaders announce the starting position for the Soldier to assume. The Soldier executes the start position to standard with the sights lined up correctly on the target. The leader announces a fire command directing the Soldier to switch through various targets using the T&E mechanism. Leaders conduct the drill until the Soldier can manipulate through the targets quickly and efficiently while maintaining proper sights on the target without looking at the T&E mechanism.

D-46. Leaders should not provide preparatory commands to the drill, and should direct the Soldier to go to the next target when it is unexpected or at irregular intervals. Leaders may choose to include another drill with the execution of this drill.

## Appendix E

# Zeroing

Zeroing a weapon is not a training exercise, nor is it a combat skills event. Zeroing is a maintenance procedure to place the weapon in operation based on the Soldier's skills and capabilities, the tactical scenario, aiming device, and ammunition. Zeroing achieves the desired relationship between the line of sight and the trajectory of the round at a known distance. The zeroing process ensures the Soldier, weapon, aiming device, and ammunition perform as expected at a specific range to target with the least amount of induced errors.

Soldiers must zero their aiming device to their weapon correctly to achieve a high level of accuracy and precision aiming. The Soldier must achieve a consistent grouping of a series of shots, then align the grouping's mean point of impact to the appropriate point of aim. Soldiers use the process described in this appendix with their weapon and equipment's technical manuals to complete the zeroing task.

## BATTLESIGHT ZERO

E-1. The term battlesight zero means the combination of sight settings and trajectory that greatly reduces or eliminates the need for precise range estimation, further eliminating sight adjustment, holdover or hold-under for the most likely engagements. The battlesight zero is the default sight setting for a weapon, the ammunition, and the aiming device combination.

E-2. An appropriate battlesight zero allows the firer to accurately engage targets out to a set distance without an adjusted, aiming point. For aiming devices that are not designed to be adjusted in combat, or do not have a bullet drop compensator, the selection of the appropriate battlesight zero distance is critical.

## ZEROING PROCESS

E-3. A specific process should be followed when zeroing. The process is time-efficient and produces the most accurate zero possible. The zero process includes a 10-meter laser borelight and zero and field zero (battlesight zero).

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***Note***. Although wind and gravity have the greatest effect on the projectile's trajectory, air density and elevation must be taken into consideration, also.

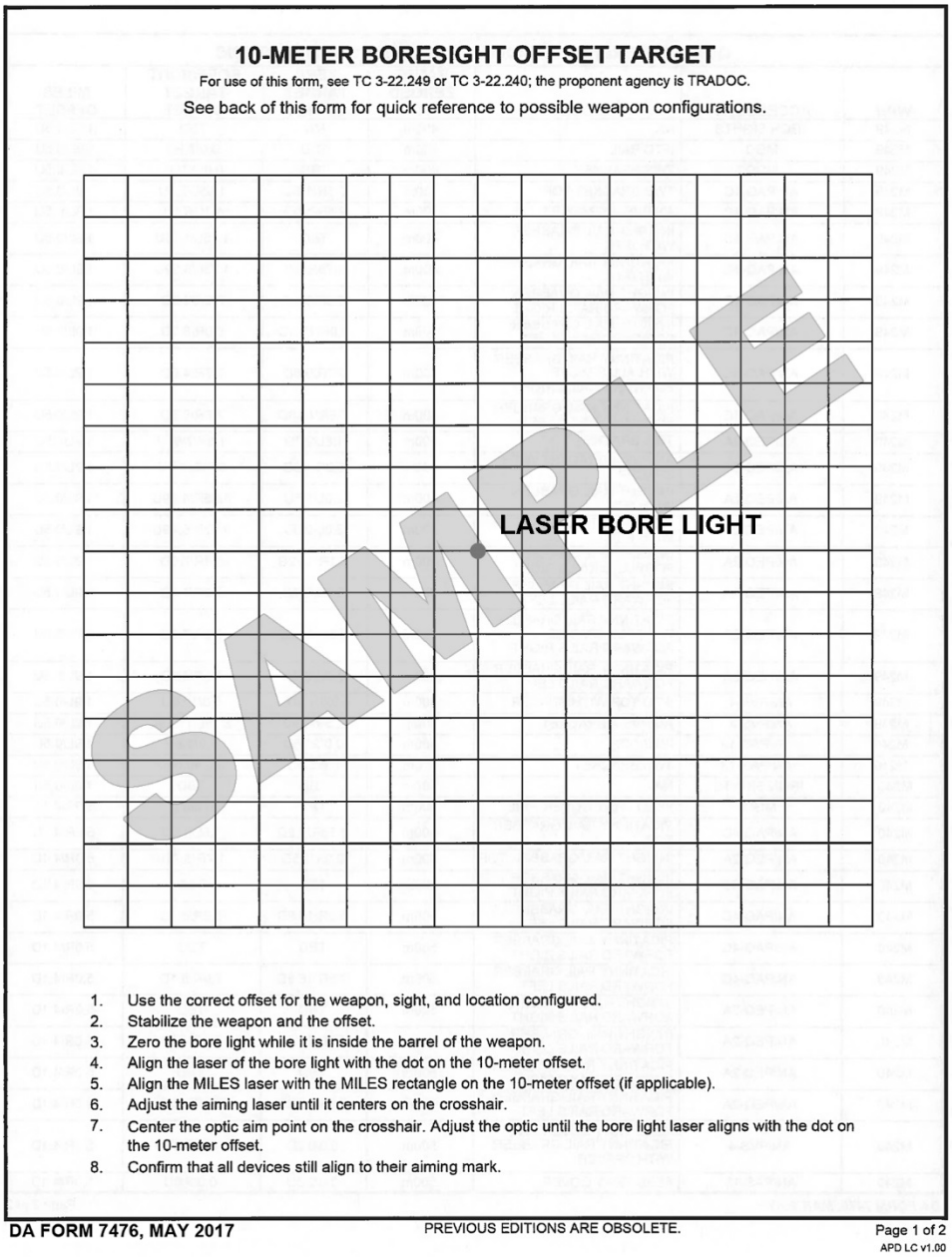
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## TEN METER LASER BORELIGHT AND ZERO

E-4. The borelight is an eye-safe laser that boresights optics, iron sights, and aiming lasers. Using the borelight saves range time and requires less rounds for the zeroing process. Borelighting is done with a borelight, which is centered in the bore of the weapon, and with an offset target placed 10 meters from the muzzle of the weapon. (See DA Form 7476, *10-Meter Boresight Offset Target* in figure E-1, page E-2 and figure E-2, page E-3.)

E-5. The gunner indexes or places the elevation knob on a range of 400 meters. The gunner centers the rear peep sight by rotating it clockwise (right) as far as it will go. The gunner then rotates the windage knob toward the muzzle until the sight is all the way to the right, and while counting the clicks, rotates the windage knob until it stops on the left side. The gunner divides the clicks by two. If the click is an uneven number, the gunner rounds it up. To center the sight, the gunner rotates the windage knob toward the center (right) while counting the appropriate number of clicks. The gunner adjusts the sliding scale at the rear of the sight

to center the large index line under the zeroed windage mark on the sight. Two threads should be showing on the front sight post. If more or less threads are showing, the gunner turns in the weapon for maintenance.



**10-METER BORESIGHT OFFSET TARGET**

For use of this form, see TC 3-22.249 or TC 3-22.240; the proponent agency is TRADOC.

See back of this form for quick reference to possible weapon configurations.

LASER BORE LIGHT

SAMPLE

1. Use the correct offset for the weapon, sight, and location configured.
2. Stabilize the weapon and the offset.
3. Zero the bore light while it is inside the barrel of the weapon.
4. Align the laser of the bore light with the dot on the 10-meter offset.
5. Align the MILES laser with the MILES rectangle on the 10-meter offset (if applicable).
6. Adjust the aiming laser until it centers on the crosshair.
7. Center the optic aim point on the crosshair. Adjust the optic until the bore light laser aligns with the dot on the 10-meter offset.
8. Confirm that all devices still align to their aiming mark.

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**Figure E-1. Example completed DA Form 7476 front**

| QUICK REFERENCE - POSSIBLE WEAPON CONFIGURATIONS | | | | | | |
|---|---|---|---|---|---|---|
| WPN | ACCESSORY | MOUNT | RANGE ZEROED TO | ZERO TARGET OFFSET | BORESIGHT TARGET OFFSET | MILES OFFSET |
| M249 | IRON SIGHTS | NA | 400m | NA | TBD | 1.9L/0.5U |
| M249 | MGO | IFTC RAIL | 400m | TBD | 0.0/7.9U | 1.9L/0.5U |
| M249 | MGO | TWS BRACKET | 400m | TBD | 0.0/2.15U | 1.9L/0.5U |
| M249 | AN/PAQ-4C | TWS BRACKET TOP | 400m | 0.5R/1.5U | 1.85L/7.7U | 1.9L/0.5U |
| M249 | AN/PAQ-4C | AN/PVS-4 BRACKET | 400m | 2.5R/1.5D | 4.1L/6.1U | 1.9L/0.5U |
| M249 | AN/PAQ-4C | INSIGHT RAIL GRABBER WITH IFTC | 400m | TBD | 1.75L/4.69U | 1.9L/0.5U |
| M249 | AN/PAQ-4C | PICATINNY RAIL GRABBER WITH IFTC | 400m | 1.75R/0.0 | 1.75L/5.39U | 1.9L/0.5U |
| M249 | AN/PAQ-4C | INSIGHT RAIL GRABBER FORWARD RAILS RIGHT | 400m | 5.9R/9.6D | 5.9R/4.0D | 1.9L/0.5U |
| M249 | AN/PAQ-4C | INSIGHT RAIL GRABBER FORWARD RAILS LEFT | 400m | 6.0R/13.3D | 6.0R/8.3D | 1.9L/0.5U |
| M249 | AN/PAQ-4C | PICATINNY RAIL GRABBER WITH ALL SPACER FORWARD RAILS RIGHT | 400m | 7.7R/9.6D | 7.7R/4.0D | 1.9L/0.5U |
| M249 | AN/PAQ-4C | PICATINNY RAIL GRABBER FORWARD RAILS LEFT | 400m | 7.6R/13.3D | 7.6R/8.3D | 1.9L/0.5U |
| M249 | AN/PEQ-2A | TWS BRACKET TOP | 400m | 1.8L/2.7D | 1.8R/7.95U | 1.9L/0.5U |
| M249 | AN/PEQ-2A | AN/PVS-4 BRACKET WITH SPACER | 400m | 5.0R/4.0D | 0.45L/6.5U | 1.9L/0.5U |
| M249 | AN/PEQ-2A | INSIGHT RAIL GRABBER WITH IFTC | 400m | 2.0L/1.5U | 1.95R/4.79U | 1.9L/0.5U |
| M249 | AN/PEQ-2A | PICATINNY RAIL GRABBER WITH IFTC | 400m | 2.0L/0.5D | 1.95R/6.49U | 1.9L/0.5U |
| M249 | AN/PEQ-2A | INSIGHT RAIL GRABBER FORWARD RAILS RIGHT | 400m | 6.1R/13.2D | 6.1R/7.6D | 1.9L/0.5U |
| M249 | AN/PEQ-2A | INSIGHT RAIL GRABBER FORWARD RAILS LEFT | 400m | 6.0R/9.4D | 6.0R/4.4D | 1.9L/0.5U |
| M249 | AN/PEQ-2A | PICATINNY RAIL GRABBER WITH ALL SPACER FORWARD RAILS RIGHT | 400m | 7.8R/13.2D | 7.8R/7.6D | 1.9L/0.5U |
| M249 | AN/PEQ-2A | PICATINNY RAIL GRABBER FORWARD RAILS LEFT | 400m | 7.6R/9.4D | 7.6R/4.4D | 1.9L/0.5U |
| M249 | AN/PVS-4 | IFTC TOP WITH SPACER | 400m | 0.0/4.3D | 0.0/10.0U | 1.9L/0.5U |
| M249 | AN/PVS-4 | AN/PVS-4 BRACKET | 400m | 2.5R/4.9D | 2.25L/11.25U | 1.9L/0.5U |
| M249 | AN/PAS-13 | IFTC TOP | 400m | 0.0/2.75D | 0.0/8.6U | 1.9L/0.5U |
| M249 | AN/PAS-13 | TWS BRACKET | 400m | 0.0/5.5D | 0.0/10.05U | 1.9L/0.5U |
| M240 | IRON SIGHTS | NA | 500m | TBD | TBD | 1.9L/0.5U |
| M240 | MGO | FEED TRAY COVER RAIL | 500m | NA | 0.0/0.0 | 5.0R/4.1D |
| M240 | AN/PAQ-4C | PICATINNY RAIL GRABBER TOP | 500m | 1.75R/2.2D | 1.5L/3.5U | 5.0R/4.1D |
| M240 | AN/PEQ-2A | INSIGHT RAIL GRABBER TOP | 500m | 2.0R/1.5D | 1.7R/3.71U | 5.0R/4.1D |
| M240 | AN/PAQ-4C | INSIGHT RAIL GRABBER FORWARD RAILS RIGHT | 500m | TBD | TBD | 5.0R/4.1D |
| M240 | AN/PAQ-4C | INSIGHT RAIL GRABBER FORWARD RAILS LEFT | 500m | 6.2R/16.8D | 6.2R/8.1D | 5.0R/4.1D |
| M240 | AN/PAQ-4C | PICATINNY RAIL GRABBER FORWARD RAILS RIGHT | 500m | TBD | TBD | 5.0R/4.1D |
| M240 | AN/PAQ-4C | PICATINNY RAIL GRABBER FORWARD RAILS LEFT | 500m | 7.9R/16.8D | 7.9R/8.1D | 5.0R/4.1D |
| M240 | AN/PEQ-2A | INSIGHT RAIL GRABBER FORWARD RAILS RIGHT | 500m | TBD | TBD | 5.0R/4.1D |
| M240 | AN/PEQ-2A | INSIGHT RAIL GRABBER FORWARD RAILS LEFT | 500m | 6.2R/12.8D | 6.2R/4.1D | 5.0R/4.1D |
| M240 | AN/PEQ-2A | PICATINNY RAIL GRABBER FORWARD RAILS RIGHT | 500m | TBD | TBD | 5.0R/4.1D |
| M240 | AN/PEQ-2A | PICATINNY RAIL GRABBER FORWARD RAILS LEFT | 500m | 7.9R/12.8D | 7.9R/4.1D | 5.0R/4.1D |
| M240 | AN/PVS-4 | FEED TRAY COVER RAIL PICATINNY RAIL GRABBER WITH SPACER | 500m | 0.0/6.2D | 0.0/6.0U | 5.0R/4.1D |
| M240 | AN/PAS-13 | FEED TRAY COVER | 500m | 0.0/2.3U | 0.0/8.0U | 5.0R/4.1D |

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SAMPLE

**Figure E-2. Quick reference card from back of DA Form 7476**

# FIELD ZERO 300 TO 700 METERS

E-6. The most important step in the zeroing process is zero confirmation from 300 meters to 700 meters. An automatic rifleman must know how to zero the M249 at a distance. They should select a target whose range is known (a known-distance target), to be between 300 and 700 meters. As the range increases, so does the difficulty of determining the exact center of the beaten zone relative to the target. Therefore, on the transition range, using a 300 rather than a 700-meter target simplifies adjustment of fire.

E-7. The automatic rifleman turns the elevation knob (closest to the buttstock) on the rear sight to the desired range setting to adjust for elevation. Range settings are graduated increments from 300 to 1000 meters. Even-numbered settings are on the left side of the scale wheel and are numbered 4, 6, 8, 10, which represent 400, 600, 800, and 1000 meters, respectively. Odd-numbered settings on the right side of the scale wheel, marked with the number 3 and three index lines represent 300, 500, 700, and 900 meters, respectively. Rotation of the elevation knob toward the muzzle (counterclockwise) increases the range while rotation toward the buttstock (clockwise) decreases the range. The gunner can turn the peep sight nine, 180-degree turns from top to bottom. To make the peep sight easier to grasp, the gunner turns the elevation knob to its highest point (1000 meters). The gunner makes the appropriate adjustment for the peep sight and then returns the sight to the desired range. Whenever readjusting the range, the gunner never changes the point of aim, since the point of aim is the center of the target.

E-8. The gunner indexes or places the elevation knob on the desired range to zero the automatic machine gun iron sights. The gunner centers the rear peep sight by rotating it clockwise (right) as far as it will go. The gunner then rotates the windage knob toward the muzzle until the sight is all the way to the right, and while counting the clicks, rotates the windage knob until it stops on the left side. The gunner divides the clicks by two. If the click is an uneven number, the gunner rounds it up. The gunner rotates the windage knob toward the center (right) while counting the appropriate number of clicks to center the sight. The gunner adjusts the sliding scale at the rear of the sight to center the large index line under the zeroed windage mark on the sight. Two threads should be showing on the front sight post. If more or less than two threads are showing, the gunner turns in the weapon for maintenance.

E-9. Leaders can confirm Soldiers on any range where Soldiers can see the impacts of their rounds. Groups should be fired and aiming devices should be adjusted. At a minimum, the confirmation should be done at ranges between 300 and 700 meters. If rounds are available, groups can be fired at various ranges to show the firers where their impact will hit.

E-10. When confirming zero at ranges past 100 meters, Soldiers must consider and act upon the effects of the wind, if necessary. If a zero is confirmed at 400 meters on a windy day, and then the weapon is fired at a later date in different wind conditions or no wind at all, the impact will change. (See figure E-3.)

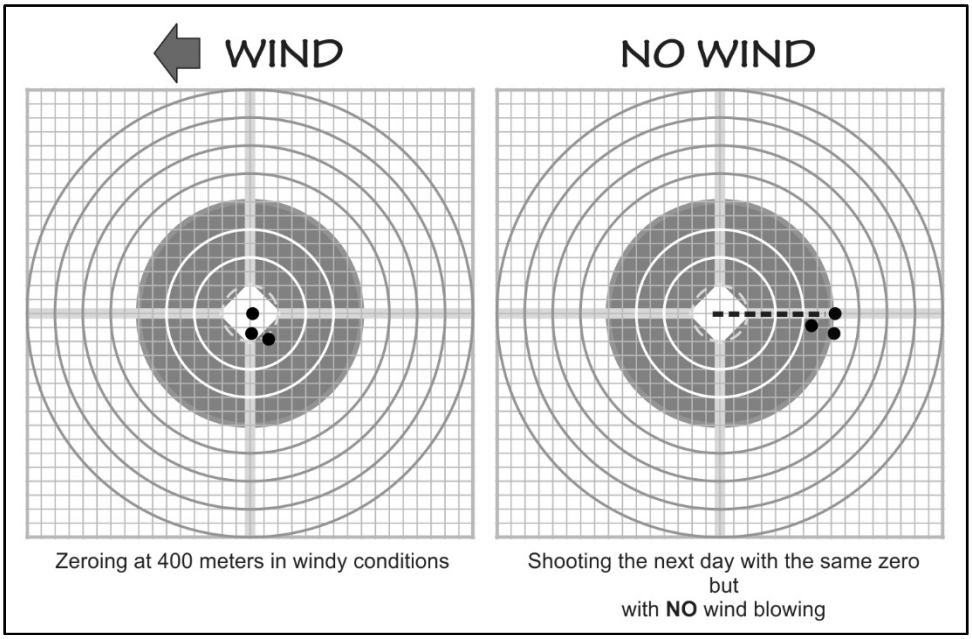



**Figure E-3. Wind effects on zero at 400 meters**

# DOWNRANGE FEEDBACK

E-11. Leaders must include feedback in all live-fire training. Soldiers must have precise knowledge of a bullet strike; feedback is not adequate when Soldiers cannot identify bullets from previous firings. To provide accurate feedback, trainers ensure that Soldiers triangulate and clearly mark previous shot groups on a zeroing target or receive a hard copy from the tower on an automated range.

> ***Note***. A common misconception is that wearing combat gear will cause the zero to change. Adding combat gear to the Soldier's body does not cause the sights or the reticle to move. The straight line between the center of the rear sight aperture and the tip of the front sight post either intersects with the trajectory at the desired point, or it does not. Soldiers should be aware of their own performance, to include a tendency to pull their bursts in a certain direction, across various positions, and with or without combat gear. A shift in point of impact in one shooting position may not correspond to a shift in the point of impact from a different shooting position.

E-12. A good zero is necessary to engage targets accurately. Whenever the Soldier deploys or does training in a new location, they should confirm the zero on their automatic rifle if possible, as elevation, barometric pressure, and other factors affect the trajectory of a round. There are multitudes of factors that can affect a zero, and the only sure way to know where the rounds are going is to fire the automatic rifle to confirm.

E-13. The zero on each assigned automatic rifle WILL NOT transfer to another automatic rifle. For example, if the windage zero on the Soldier’s iron sights is three minutes (3 mils) left of center, putting that same setting on another automatic rifle does not make the rifle zeroed. Rifles from different manufacturers means that there is a difference among all the weapons; thus, the zero does not transfer among the rifles.

E-14. Leaders recommend that Soldiers set up their equipment and dry practice in position with their gear on before coming to the range.

E-15. Standard in Training Commission (known as STRAC) Department of the Army Pamphlet (DA PAM) 350-38 allocates ammunition to conduct zeroing procedures using three-round burst grouping. Figure E-3 shows a similar three shot with one shot on the right edge of the group. If all the shots were taken into account in the three-shot group, the firer would probably adjust their zero from the right edge of the four-cm circle. The marking and analysis of shot groups is part of the grouping and zeroing process (see figure E-4).

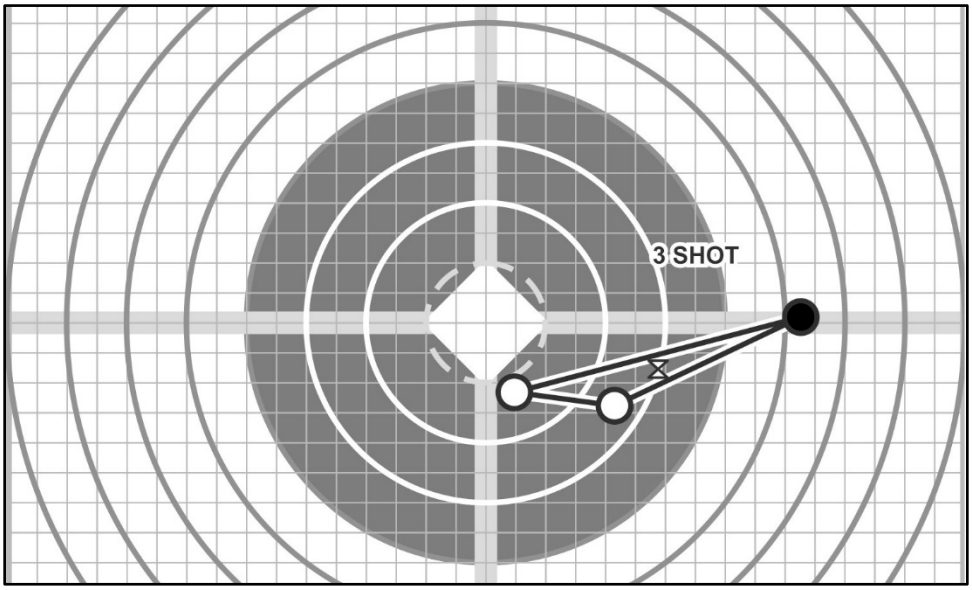



**Figure E-4. Grouping**

# MARKING THE SHOT GROUP

E-16. Leaders should mark shot groups using different colored markers so the firer can track their progress, if possible. Figure E-4 shows a technique for marking shot groups on a zero target. The technique allows the firer and coach to track their progress throughout the grouping and zeroing phase.

E-17. All sight adjustments are from the center of the group, called the mean point of impact, and not from the location of a single shot. When using a three-round group, a single shot that is outside of the rest of the group should not be counted in the group for sight adjustment purposes.

***Note***. Figure E-5 depicts the color variations in shades of gray.

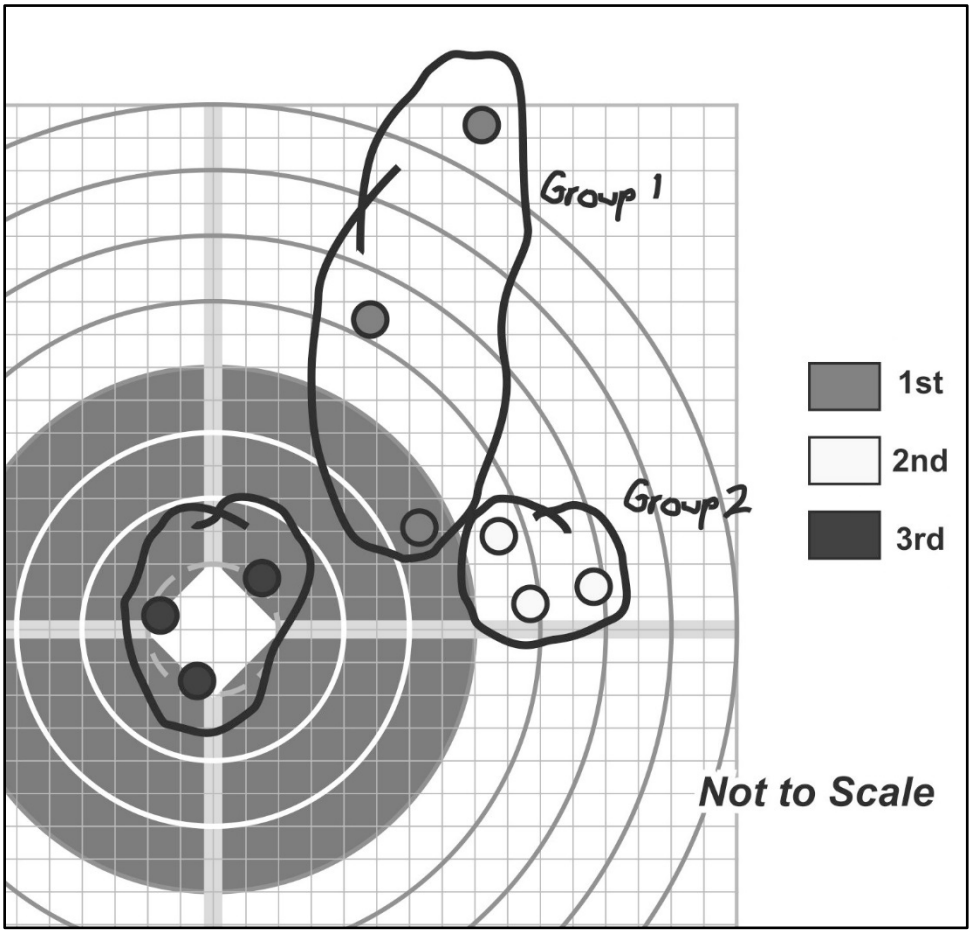



**Figure E-5. Marking shot groups**

E-18. The firer shoots and marks their first shot group with a colored marker. The Soldier places a line with that marker next to the 1 on the right side of the zero target to note the color of the first group. Soldiers fire and mark groups consistently until the groups are in the same location. Each sight adjustment is annotated in the same color as the group that was just fired.

# COACHING

E-19. Coaching is the process of having another Soldier observe the firer during the firing process to look for shooting errors that the firer themselves may not consciously know they are making.

## TYPES OF COACHES

E-20. Firing an automatic rifle properly requires the consistent and proper application of the elements of employment. Firing is about doing the right thing the same way at every burst. The small-arms trainer is the validation point for any questions during employment training. In most cases, once the group completes training, it is the firer's responsibility to realize and correct their own firing errors, but this process can be made easier through the use of a coach.

E-21. Two types of coaches exist, the experienced coach and the peer coach. Although each should execute coaching the same way, experienced coaches have a more thorough understanding of employment and should have more knowledge and practice in firing than the Soldiers they are coaching. Knowledge and skill does not necessarily come with rank; therefore, Soldiers serving as experienced coaches should be carefully selected for their demonstrated firing ability and their ability to convey information to firers of varying experience levels.

## EXPERIENCED COACHES

E-22. Experienced coaches are in shorter supply throughout the Army and are outnumbered by less skilled firers, in general. Usually, the lack of experienced coaches leads to one experienced coach watching multiple firers dependent upon the table or period of employment being fired. The experienced coach may find it helpful to make notes of errors they observe in the shooters and discuss them with the group after firing. It is often difficult for the coach to remember the errors that they observe in each and every firer.

## PEER COACHES

E-23. Using a peer coach, although generally not as effective as using an experienced coach, is a very useful technique. The advantage of using a peer coach is two-fold: A peer coach may use their limited knowledge of employment to observe the firer when an experienced coach is not available or is occupied with another firer. The peer coach can either talk the firer through the shooting errors that they have observed or bring any observed shooting errors to the attention of the experienced coach. Another advantage peer coaching is that the peer coach themselves, through the act of coaching, may observe mistakes the firer makes and learn from them before making the mistakes themselves. Many people grasp instruction more deeply when they are coaching others than when they are simply told to do something.

***Note***. Peer coaches can be limited by their level of training.

E-24. The coach can observe most of the important aspects of the elements of employment except for aiming. The coach and the firer must have an open dialog and relaxed learning environment to determine the unobservable errors of shooting. The firer cannot hesitate to ask the coach questions and the coach must not become a stressor during firing. The coach must have the ability to safely move around the firer to properly observe. There is no one ideal coaching position. The following section discusses the elements of shooting and how best the coach can observe them.

## STABILIZE

E-25. For the coach to observe how stable the shooter is, they may have to move to different sides of the shooter. To observe the shooter's nonfiring elbow, the coach needs to be on the shooter's nonfiring side. To observe the cant of the weapon (the sights on the weapon should be pointing towards 12 o'clock position, not 11 or 1 o'clock positions), the coach needs to watch the relationship of the front sight to the barrel from behind the shooter. The coach should look for all the other aspects of good positions as outlined in chapter 6 of this publication. The coach should observe the total amount of weapon movement on recoil, also. A good, stable position has minimal movement under recoil.

## AIMING

E-26. Determining the aspects of the firer's aiming (sight picture, sight alignment, point of focus) requires dialogue between the firer and the coach. Often, a shooter does not realize their aiming errors until they discover them on their own. Without the use of a sighting device, the coach must rely on drawings, discussions, or the use of an M15A1 aiming card (DVC-T-07-26) to determine where the firer is aiming on the target, their focus point during firing (which should be the front sight), and where their front sight was at the moment of firing in relation to the rear sight aperture and the point of aim on the target. Soldiers should use the technique in which the firer call their bursts. The technique involves calling the point on the target where the sights were located at the moment of firing and matching the point called with the impact locations on the target. Calling the burst helps the firer learn to focus on the front sight during the entire firing process.

E-27. When using optics, the shooter can tell the coach where they were holding, which is important with the MGO. Coaches must insure firers use the 400-meter aim point when zeroing at 10 meters.

## CONTROL

E-28. The ideal position for the coach to observe trigger squeeze is from the firer's nonfiring side because they have a better view of the speed of pull, finger position on the trigger, and release or pressure on the

trigger after firing. The coach can look from behind the shooter to observe the barrel for lateral movement caused by slapping the trigger during firing.

### COACHING FACTORS

E-29. All firing happens at the weapon; therefore, the coach should focus solely on the shooter during firing and not on what is happening downrange. The coach has no way to observe the bullet's impact on the target and to know what errors the firer made. The coach must watch the shooter during firing to determine errors and use the impacts to confirm their assumptions. For a coach to properly observe all aspects of firing they must be able to observe the shooter, safely, from both sides and the back. There is no prescribed coaching position. Coaching requires a relaxed atmosphere with open communication between the firer and the coach.

## SHOT GROUP ANALYSIS

E-30. Shot group analysis involves the firer correlating the impacts on paper with the mental image of how the bursts looked when fired. The coach cannot merely look at the holes in the paper to make an accurate analysis of the shot group. The coach must observe the firer than to try and analyze the target. All firing takes place at the weapon, and the holes in the paper are an indicator only of where the firer pointed the barrel when they fired the automatic rifle. When coaches are analyzing groups, they must question the firer about the group to make a determination of what caused the placement of the shots. (See figure E-6 and figure E-7, page E-10.)

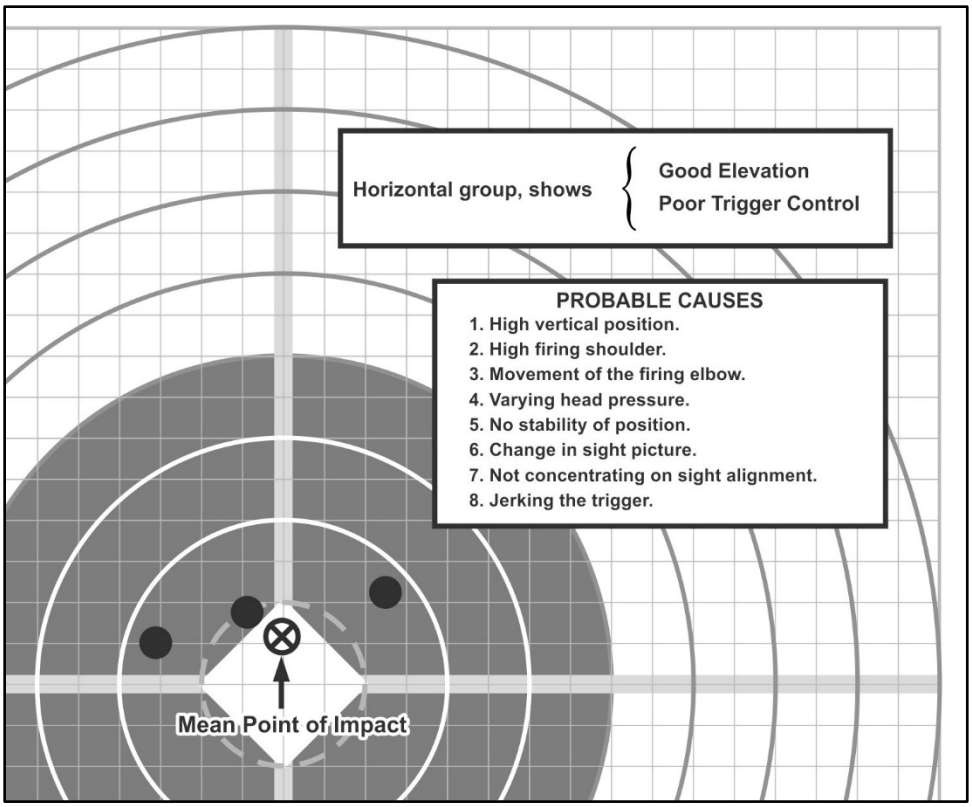



**Figure E-6. Horizontal diagnostic shots**

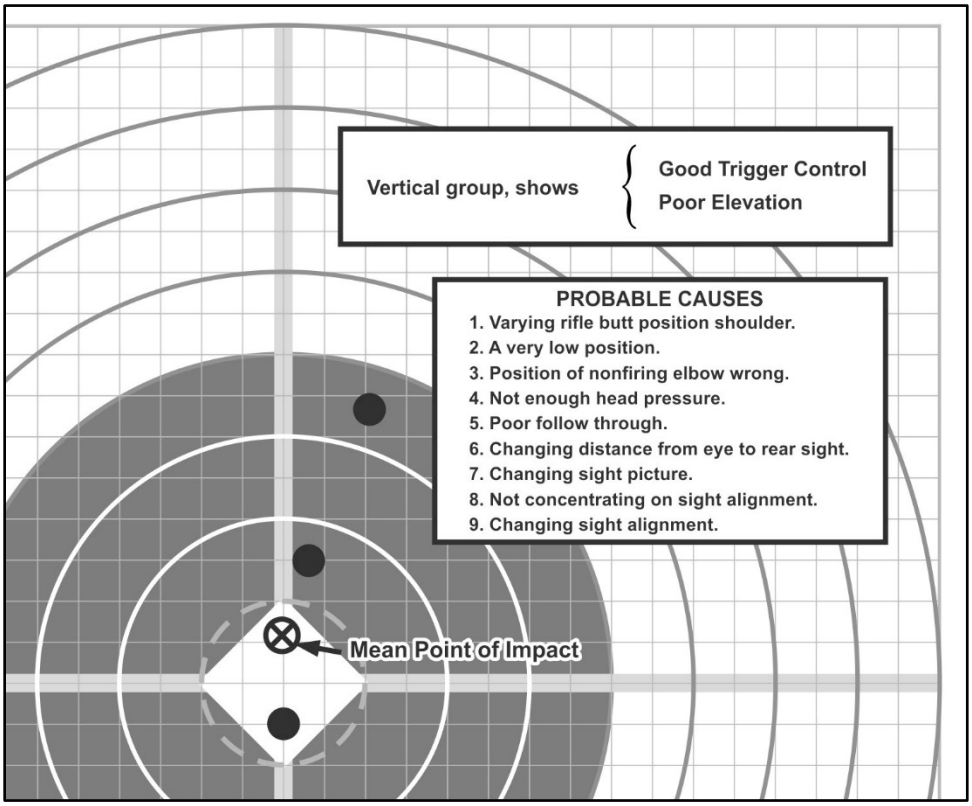



**Figure E-7. Vertical diagnostic shots**

E-31. Novice shooters may benefit from not marking their own shot group. When marking a shot group, an inexperienced or stressed Soldier may unintentionally make mental corrections. The mental corrections along with the mechanical corrections to their weapon causes further issues during follow-on shot groups. The experienced Soldier, knowing the zero process is aligning the sights to the location of the impact of the rounds, is less likely to make adjustments to their sight placement and the mechanical changes to the weapon. Having a coach or the employment instructor inform the Soldier of mechanical changes needed to the aiming device is an effective way to accomplish this method.

E-32. Observing the shooter must be accomplished before analyzing the target can become effective. Bullets strung vertically do not necessarily mean a breathing issue, nor do bullets strung horizontally indicate an absolute trigger squeeze problem. Coaches must learn to identify shooter errors during firing and use the bullet's impacts on the target to confirm their observations. Several firing errors can cause certain misplacements of impacts. The coach must realize that bullets go only where the firer points the barrel. The coach must determine the cause of the barrel to be pointed in those directions.

E-33. The key to proper coaching is becoming a shooting detective. The coach needs to observe the shooter, question the shooter, look at the evidence downrange, question the shooter again, make assumptions based upon the evidence available, and then act upon their assumptions. The coach and shooter must have a free and open dialog with each other in a relaxed atmosphere. Remember if a Soldier learns to shoot poorly, they will be capable only of shooting poorly.

## DISPLACEMENT OF SHOTS WITHIN A GROUP (FLYERS)

E-34. The weapon's capability to shoot groups varies dependent on the number of rounds fired through the barrel over its lifetime. The average expected group size is 4 centimeters at 10 meters; some guns may shoot slightly larger than this. If a shooter is firing groups larger than a normal group size, the next step should be to have a known skilled shooter attempt to fire and group with the shooter's weapon. If a proven, skilled shooter can fire groups of the normal size, then the issue is most likely with the original shooter. If the skilled shooter cannot fire within the accepted group size, there may be something wrong with the gun or barrel.

E-35. When looking at groups that are one or two shots away from the group body (one shot away for a three-round group), the coach must look objectively at the overall consistency of group placement. A bad shot or group might not indicate a poor grasp of the elements; every shooter has a bad shot now and again, and some shooters may even have a bad group now and again. Coaches need to use their experience to determine whether or not the firer had a bad shot, a bad group, or doesn't have a clear grasp of the elements and take the necessary steps to get the shooter to the end-state. The coach may have the firer shoot again and ignore the bad group or bad shot, hoping that the new group matches up with the previous shot groups, or the coach may need to pull the shooter off the line and cover the basic elements. Contrary to popular belief, mandating that a firer shoot over and over again in one sitting, until the firer gets it right is not a highly effective technique.

## BULLETS DISPERSED LATERALLY ON TARGET

E-36. Bullets displaced laterally could be caused by a lateral movement of the barrel due to an unnatural placement of the trigger finger on the trigger. The following may be reasons that the bullets are displacing laterally:

- The shooter may be misaligning the sights to the left and right slightly.
- The shooter may have the sights aligned properly but may have trouble keeping the target itself perfectly centered on the tip of the front sight.
- The shooter may be closing their eyes at the moment of firing or may be flinching.

## BULLETS DISPERSED VERTICALLY ON TARGET

E-37. Bullets displaced in a vertical manner could be caused by the following:

- The shooter may be watching the target instead of the front sight; thereby, misaligning the front sight in the rear sight aperture vertically. Happens more frequently from less stable positions (kneeling, unsupported positions) due to the natural movement of the weapon.
- Shooter may have trouble seeing the target and trouble keeping the tip of the front sight centered vertically on the target. The coach may consider using a larger target or a nonstandard aiming point such as a five-inch circle. Many shooters find it easier to find the center of a circle than a man-shaped target.
- The shooter may not have good support, which causes them to readjust their position at every shot and settle with the sights slightly misaligned.
- The shooter may be flinching or closing their eyes at the moment of firing.
- The shooter may be breathing while firing the rifle. (Breathing is not normally the case, most shooters instinctively hold their breath just before the moment of firing.)

## LARGE GROUPS

E-38. The shooter looking at the target instead of the front sight is the most common cause of large groups. Looking at the target instead of the front sight causes the shooter to place the front sight in the center of the target without regard for its location in the rear sight aperture. A small misalignment of the sights results in a large misplacement of shots downrange. Most shooters do not fire when their properly aligned sights are pointed all over the target, so a large group is most likely not a point of aim issue.

## GOOD GROUPS THAT CHANGE POSITION ON THE TARGET

E-39. When the shooter has good groups but they are located at different positions on the target, there can be a number of reasons. Two reasons are listed below:

- The shooter may be aligning the sights properly during shooting but picking up a different point of aim on the target each time.
- The shooter may be settling into a position with the front sight on target but the sights are misaligned. The shooter maintains the incorrect sight picture throughout the group but aligns the sights in a different manner during the next group. The coach tells the firer to focus on the front sight and to check the natural point of aim before each group.

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## Appendix F

# Qualification

Appendix F assists trainers with preparing and conducting machine gun marksmanship training. Marksmanship begins with proficiency achievement in nonfiring individual skills and ends with collective proficiency achievement in firing under demanding conditions.

## OBJECTIVES

F-1. The objective of machine gun marksmanship training is to produce gunners who can fire an accurate initial burst, adjust fire, and develop speed. Each of these functions are described in the paragraphs below.

### FIRE AN ACCURATE INITIAL BURST

F-2. Obtaining an accurate initial burst of fire on the target is essential to good marksmanship. The gunner estimates the range to the target, sets the sights, and applies marksmanship skills while engaging targets to achieve an accurate initial burst of fire.

### ADJUST FIRE

F-3. The assistant gunner must observe the strike of the rounds when the initial burst is fired. If the gunner misses the target, then they manipulate the T&E mechanism until they hit the target. The assistant gunner must be proficient in observing the strike of rounds and in observing and using tracers. The assistant gunner's proficiency helps the gunner relay the machine gun back on target.

### DEVELOP SPEED

F-4. Speed is essential to good marksmanship also. Practicing dry-fire and live-fire exercises increases the gunner's speed. Speed develops through extensive training that combines other skills when delivering fire. However, speed is less important than accuracy.

## BASIC MACHINE GUN TARGET

F-5. The 10-meter firing exercise (figure F-1, page F-2) uses the basic machine gun target (FSN 6920-078-5128 and NSN 6920-00-078-5123). The following explanation of the target, including the size of the aiming pasters and scoring spaces, aids in zeroing the machine guns and facilitates control during the 10-meter firing exercises. The target has four sections lettered A, B, C, and D. Each section has four point targets numbered 1, 2, 3, and 4; and two sets of area targets numbered 5 through 6 and 7 through 8. Each space is 4 cm wide and 5 cm high. The black aiming paster within the numbered scoring spaces is 1 cm square. The target is used to score two gunners. One gunner uses sections A and B and the other C and D.

### POINT TARGETS

F-6. Point targets on the basic machine gun target are pasters 1 through 4 of sections A, B, C, and D. Firing at point targets exposes the gunner to zeroing techniques and controlled burst fire techniques. Targets 1 through 4 can be used for qualification, also.

### AREA TARGETS

F-7. Area targets on the basic machine gun target consist of pasters 5 through 6, and 7 through 8 of sections A, B, C, and D. Target groups 5 through 6 provide the gunner with targets in-depth and allows them to use a series of aiming points to disburse fire across the target by using the T&E mechanism. Target group 7 through

8 provides the gunner with linear targets with depth. The 7 through 8 series of targets uses a series of aiming points to disburse fire across the target and in-depth by using the T&E mechanism.

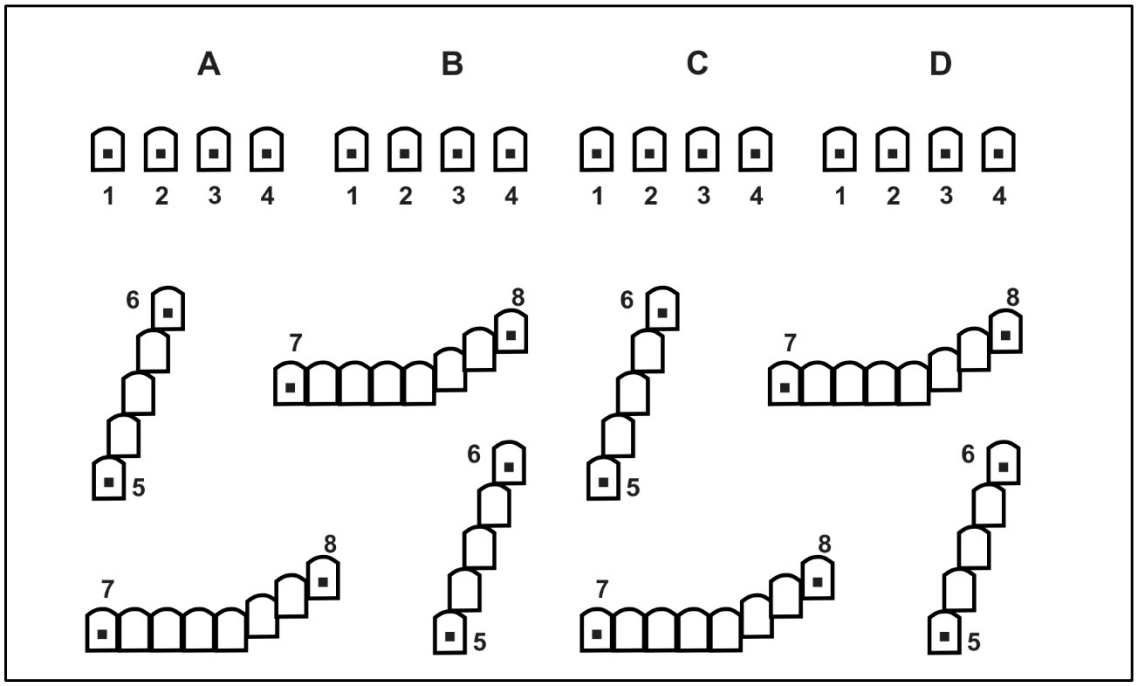



**Figure F-1. Basic machine gun target**

# BASIC GUNNERY, M249 ONLY, AUTOMATIC RIFLE ROLE

F-8. The automatic rifle produces the most casualties for the squad. Although the weapon has changed, its role has not. The automatic rifleman supports the Infantry squad in the offense and defense. The current automatic rifle, the M249 automatic rifle, is nearly as accurate as a standard rifle, but provides a volume of fire as heavy as that of a standard machine gun. Section II discusses general training techniques and employment principles for using the M249 automatic rifle as an automatic weapon.

# TEN-METER FIRE

F-9. Automatic riflemen learn to apply the marksmanship skills of automatic rifle marksmanship in live-fire exercises during 10-meter fires. Table F-1 familiarizes the Soldier with the weapon's characteristics, noise, and recoil. Each automatic rifleman learns to zero their M249 automatic rifle, conduct controlled burst fire at point targets, and use traverse and search techniques of fire on area targets. The 10-meter firing table is conducted on a 10-meter or multipurpose range using the basic, machine gun target. One automatic rifleman can use sections A and B while another uses sections C and D of the same, basic, machine gun target. The exercises are fired with the bipod from the prone position and the fighting position (if supported by the range). The 10-meter firing exercises are for practice and record qualification. All 10-meter firing exercises are recorded and scored so the automatic rifleman can assess their performance. The 10-meter firing is conducted in accordance with Firing Table I (table F-1). The paragraphs below describe the seven tasks for the 10-meter firing exercises.

**Table F-1. Firing Table I, M249 basic (10-meter) fire, automatic rifle role.**

| TASK | TIME | ROUNDS | | TARGET | TYPE FIRE |
|---|---|---|---|---|---|
| | | QTY | TYPE | | |
| 1 | No Limit | 12 | Ball/tracer | Pasters A1 and A2 | 3 single-round shot groups |
| 2[a] | No Limit | 6 | 4:1 | Pasters A3 and A4 | Fixed, 3-round burst each paster |
| 3[a] | No Limit | 15 | 4:1 | Pasters A5 through A6 | Fixed, 3-round burst each paster |
| 4 | No Limit | 24 | 4:1 | Pasters A7 through A8 | Fixed, 3-round burst each paster |
| 5[b] | 20 | 12 | 4:1 | Pasters B1 through B4 | Fixed, 3-round burst each paster |
| 6[ab] | 40 | 24 | 4:1 | Pasters B7 through B8 | Fixed, 3-round burst each paster |
| 7[b] | 40 | 15 | 4:1 | Pasters B5 through B6 | Fixed, 3-round burst each paster |

***Notes.*** The gunner fires pasters on sections A and B and the assistant gunner fires on sections C and D.

[a]Protective mask and gloves required at a minimum.

[b]Qualification task.

## TASK 1: ZERO

F-10. The automatic rifleman fires single shots to determine the weapon's zero for 10 meters. The task reinforces the dry-fire experience. The task lets the automatic rifleman practice loading while at the same time obtaining the tightest, most accurate shot group.

## TASK 2: CONTROLLED BURST FIRE

F-11. Using point targets, the automatic rifleman fires a 3-round burst. The task exposes automatic riflemen to automatic fire and the action of the weapon. The task introduces trigger control, also.

## TASK 3: CBRN TRAVERSE AND SEARCH FIRE

F-12. Task 3 requires the automatic rifleman to—

- Wear a protective mask and gloves.
- Change their body position to engage area targets in-depth.
- Fire a controlled burst.
- Use a series of aiming points to disburse fire across the target.

## TASK 4: TRAVERSE AND SEARCH FIRE

F-13. Task 4 requires the automatic rifleman to—

- Change position to engage area targets with width and depth.
- Fire a controlled burst.
- To use a series of aiming points to disburse fire across the target.

## TASK 5: TRAVERSE AND SEARCH FIRE

F-14. Task 5 allows the automatic rifleman to fire a controlled burst at a series of point targets while being timed.

### TASK 6: CBRN TRAVERSE AND SEARCH FIRE

F-15. Task 6 requires the automatic rifleman to engage area targets with width and depth while—

- Being timed.
- Changing position.
- Wearing a protective mask and gloves.

### TASK 7: TRAVERSE AND SEARCH FIRE

F-16. Task 7 requires the automatic rifleman to change position to engage area targets in-depth while being timed.

## TEN-METER CONDUCT OF FIRE

F-17. The trainer teaches the automatic riflemen the objectives of firing from the bipod-supported prone and fighting positions, on fire commands used on the basic range, on the basic machine gun marksmanship target, and on analyzing and scoring the target. The unit is organized in firing orders based on range constraints. Each firing order has an automatic rifleman and a coach. The coach helps the automatic rifleman during prefire checks and zeroing. The automatic rifleman relays signals to the tower operator, checks the automatic rifleman's position, and coaches them. During qualification, all coaches are absent. The automatic riflemen fire the seven tasks as follows:

### TASK 1: ZERO

- The automatic rifleman prepares the rear sight for zeroing and checks the front sight.
- The automatic rifleman assumes a good position.
- The tower operator instructs the automatic rifleman to prepare a single round.
- The tower operator commands the following and the automatic rifleman and coach repeat each element as it is given—
  - AUTOMATIC RIFLEMAN LOADS AND MOVES SAFETY TO FIRE.
  - FRONT (focuses on target or target area).
  - PASTER A1 (locates target) AND A2.
  - THREE HUNDRED (adjusts sights and acquires sight picture).
  - FIXED, ONE ROUND (method of fire).
  - COMMENCE FIRING (on command, fires when ready).

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***Note***. Throughout all firing exercises, the automatic rifleman performs the appropriate tasks during each element of the fire command. Instead of stating the method of fire, the tower operator states the number of rounds. This is for control. Omitting the rate specifies rapid fire, which is undesirable for the tasks.

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- The automatic rifleman loads one round, obtains the proper sight picture, and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- The tower operator gives the command to commence firing.
- The automatic rifleman engages paster A1 with three single shots when they are ready.
- The automatic rifleman moves downrange to observe, mark, and triangulate the shot group. The sight adjustments, using the rear peep sight and windage knob, are made at this time if the shot group is tight enough. If not, the automatic rifleman should fire another three rounds to ensure tight shot groups and consistently place those groups in the same location.
- The rifleman repeats steps 2 through 8 except that this time the automatic rifleman fires at paster A2.

***Note.*** If the automatic rifleman zeros the weapon using 9 rounds, they use the remaining 3 to confirm their zero. If the rifleman are unable to zero with 12 rounds, they are removed from the firing line for remedial training.

### TASK 2: CONTROLLED BURST FIRE

- The tower operator instructs the automatic rifleman to prepare a 6-round belt.
- When the fire command is given, the automatic rifleman and coach repeat each element as it is given—
  - AUTOMATIC RIFLEMAN
  - FRONT
  - PASTER A3 THROUGH A4
  - THREE HUNDRED
  - FIXED, THREE-ROUND BURST
  - AT MY COMMAND
- The automatic rifleman acquires the proper sight picture and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- The tower operator gives the command to fire.
- The automatic rifleman fires the first burst of three rounds at paster A3.
- Steps 2 through 6 are repeated, but the automatic rifleman fires at paster A4.

### TASK 3: CBRN TRAVERSE AND SEARCH FIRE

- The tower operator instructs the automatic rifleman to prepare a 15-round belt.
- The tower operator gives the order to mask by stating GAS. Once the Soldiers are masked and have their gloves on, the tower operator gives the fire command.
- When the fire command is given, the automatic rifleman and coach repeat each element as it is given—
  - AUTOMATIC RIFLEMAN
  - FRONT
  - PASTERS A5 THROUGH A6
  - THREE HUNDRED
  - TRAVERSE AND SEARCH, THREE-ROUND BURST
  - AT MY COMMAND
- The automatic rifleman acquires the proper sight picture and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- The tower operator gives the command to fire.
- Using the traverse and search technique, the automatic rifleman engages pasters A5 through A6, firing a three-round burst for each paster. Once complete, the trainer orders all clear.
- The automatic rifleman restores their mask to the carrier, removes their gloves, and moves downrange to observe and analyze their targets.

### TASK 4: TRAVERSE AND SEARCH FIRE

- The tower operator instructs the automatic rifleman to prepare a 24-round belt.
- The automatic rifleman and coach repeat each element from the trainer as follows:
  - AUTOMATIC RIFLEMAN
  - FRONT
  - PASTERS A7 THROUGH A8
  - THREE HUNDRED

- TRAVERSE AND SEARCH, THREE-ROUND BURST
- AT MY COMMAND

- The automatic rifleman acquires the proper sight picture and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- The automatic rifleman engages pasters A7 through A8, firing a three-round burst at each paster using the traverse and search technique.
- The automatic rifleman may move downrange to observe and analyze their targets.

### TASK 5: TRAVERSE AND SEARCH FIRE

- The tower operator instructs the automatic rifleman to prepare a 12-round belt.
- When the fire command is given, the automatic rifleman and coach repeat each element as it is given—
  - AUTOMATIC RIFLEMAN
  - FRONT
  - PASTERS B1 THROUGH B4
  - THREE HUNDRED
  - FIXED, THREE-ROUND BURST
  - AT MY COMMAND
- The automatic rifleman acquires the proper sight picture and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- The tower operator gives the command to fire.
- The automatic rifleman engages pasters 1 through 4 in 20 seconds, firing a three-round burst at each paster.
- The automatic rifleman may move downrange to observe and analyze the targets.

### TASK 6: CBRN TRAVERSE AND SEARCH FIRE

- The tower operator instructs the coach to prepare a 24-round belt.
- The tower operator gives the order to mask by stating Gas. Once the Soldiers are masked and have their gloves on, the tower operator gives the fire command.
- When the fire command is given, the automatic rifleman and coach repeat each element as it is given—
  - AUTOMATIC RIFLEMAN
  - FRONT
  - PASTERS B7 THROUGH B8
  - THREE HUNDRED
  - TRAVERSE AND SEARCH, THREE-ROUND BURST
  - AT MY COMMAND
- The automatic rifleman acquires the proper sight picture and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- The tower operator gives the command to fire.
- Using the traverse and search technique, the automatic rifleman engages pasters B7 through B8 in 40 seconds, firing a three-round burst at each paster. Once complete, the Soldiers are given the all clear order.
- The automatic rifleman restores their mask to the carrier, removes their gloves, and moves downrange to observe and analyze their targets.

### TASK 7: TRAVERSE AND SEARCH FIRE

- The tower operator instructs the automatic rifleman and coach to prepare a 15-round belt.
- When the fire command is given, the automatic rifleman and coach repeat each element as it is given—
  - AUTOMATIC RIFLEMAN
  - FRONT
  - PASTERS B5 THROUGH B6
  - THREE HUNDRED
  - TRAVERSE AND SEARCH, THREE-ROUND BURST
  - AT MY COMMAND
- The automatic rifleman acquires the proper sight picture and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- Using the traverse and search technique, the automatic rifleman engages pasters B5 through B6 in 40 seconds, firing a three-round burst at each paster.
- The automatic rifleman may move downrange to observe and analyze the target, and the coach scores it.

## TEN-METER QUALIFICATION FIRE

F-18. The first phase of qualification has firing tasks 2 through 4 of Firing Table I for practice, and tasks 5 through 7 of Firing Table I for record. Before firing, all Soldiers must be familiar with the tasks, the time allowed, the ammunition allowances, the procedures to follow in the event of a stoppage, and the penalties imposed.

### TIME AND AMMUNITION

F-19. Each automatic rifleman finishes zeroing before record fire. The trainer gives them individual fire commands for each task. The automatic rifleman fires task 5 in 20 seconds; task 6 in 40 seconds; and task 7 in 40 seconds.

### STOPPAGES

F-20. The automatic rifleman must apply immediate action if a stoppage occurs. If the stoppage is reduced, they continue to fire the course.

- If a stoppage occurs that cannot be reduced by immediate action, the automatic rifleman raises their hand and awaits assistance.
- Once the stoppage is reduced, the automatic rifleman completes firing beginning with the next task.
- If a stoppage is caused by an error on the part of the automatic rifleman, additional time is disallowed. The automatic rifleman receives the score they earned before the stoppage occurred.
- If the M249 automatic rifle must be replaced, then the automatic rifleman must zero the new weapon. The automatic rifleman may refire the exercise.
- Automatic riflemen who cannot fire a task or cannot complete firing in the time allowed (because of malfunctions) can finish the exercise in an alibi run after all other automatic riflemen complete firing. They fire only those tasks they failed to engage because of the malfunction.

### PENALTIES

F-21. Five points are deducted from the score of any automatic rifleman who fails to stop firing at the command or signal to cease fire. If an automatic rifleman fires at the wrong target or exercise, they lose the points for those rounds. An automatic rifleman whose target was fired upon by another automatic rifleman is permitted to refire the exercise.

### SCORES

F-22. Two automatic riflemen use a basic machine gun target for practice and qualification in table I. One automatic rifleman uses sections A for practice and B for qualification while the second uses sections C for practice and D for qualification. When scoring the 10-meter target, the trainer (not the automatic rifleman) counts the hits in sections B and D. One point is given for each round that impacts within the scoring space. The maximum point value is 3 points for each target. Rounds inside or touching the line on the target are considered a hit. When firing B/D1 through B/D4, the automatic rifleman engages 4 point targets with a maximum possible score of 12 points. When firing B/D5 through B/D6, the automatic rifleman engages 5 targets with a maximum possible score of 15 points. When firing pasters B/D7 through B/D8, the automatic rifleman engages eight targets for a maximum score of 24 points. During qualification firing, riflemen must achieve at least 35 points on Firing Table I. DA Form 7304, *Scorecard for M249AR,* (downloadable at http://apd.army.mil) is used to record scores.

### POSITION

F-23. Based on the mission-essential task list, the commander selects either the bipod-supported prone position or bipod-supported fighting position for qualification.

## TRANSITION FIRE

F-24. Transition firing provides the automatic rifleman with the experience necessary to progress from 10-meter firing to field firing at various types of targets at longer ranges. The automatic rifleman experiences and learns the characteristics of fire, field zeroing, and range determination. They use the adjusted, aiming point method of fire adjustment. The automatic rifleman conducts transition firing on a machine gun transition range or the multipurpose range complex. The transition exercises are fired with the bipod from the prone or fighting position. Each automatic rifleman fires the transition table twice, once for practice and once for qualification. Transition firing is fired and scored for both practice and qualification to provide feedback to the automatic rifleman. Firing Table II has eight tasks (table F-2).

**Table F-2. Firing Table II, M249 transition fire, limited visibility, automatic rifle role**

| *FIRING TABLE II—M249 TRANSITION FIRE<br>Limited Visibility, Automatic Rifle Role* | | | | | | |
|---|---|---|---|---|---|---|
| *TASK* | *TIME* | *ROUNDS* | | *TARGET* | *RANGE (M)* | *TYPE FIRE* |
| | | *QTY* | *TYPE* | | | |
| 1 | No Limit | 12 | 4:1 | Single E | 300 | Fixed, 3-round burst (field zero) |
| 2 | 5 sec | 6 | 4:1 | Single E | 200 | Fixed, 3-round burst |
| 3 | 10 sec | 6 | 4:1 | Double E | 400 | Fixed, 3-round burst |
| 4* | 10 sec | 6 | 4:1 | Single E | 100 | Fixed, 3-round burst |
| 5* | 15 sec | 6 | 4:1 | Single E | 300 | Fixed, 3-round burst |
| 6* | 20 sec | 12 | 4:1 | Single E<br>Single E | 100<br>300 | Fixed, 3-round burst |
| 7 | 20 sec | 12 | 4:1<br>4:1 | Single E<br>Double E | 200<br>400 | Fixed, 3-round burst |
| 8 | 20 sec | 18 | 4:1<br>4:1<br>4:1 | Single E<br>Single E<br>Double E | 100<br>200<br>400 | Fixed, 3-round burst |

***Notes.*** The unit commander determines the position.
Boresighting requires 12 rounds and seating the device requires 6 rounds.

*Qualification task.

## RANGE FACILITIES

F-25. The transition range has several firing lanes. Each lane is 10-meters wide at the firing line and 100-meters wide at a range of 800 meters. Ideally, each lane has a fighting position with an adjacent prone firing position.

## TARGETS

F-26. Two target configurations are used for the automatic rifle, single and double E-type silhouettes. The double represents an enemy automatic weapon, a priority target for the automatic rifleman (figure F-2). The targets are set at the ranges that an automatic rifleman is most likely to engage. All targets must be clearly visible from the firing positions. Electric targets are desirable.

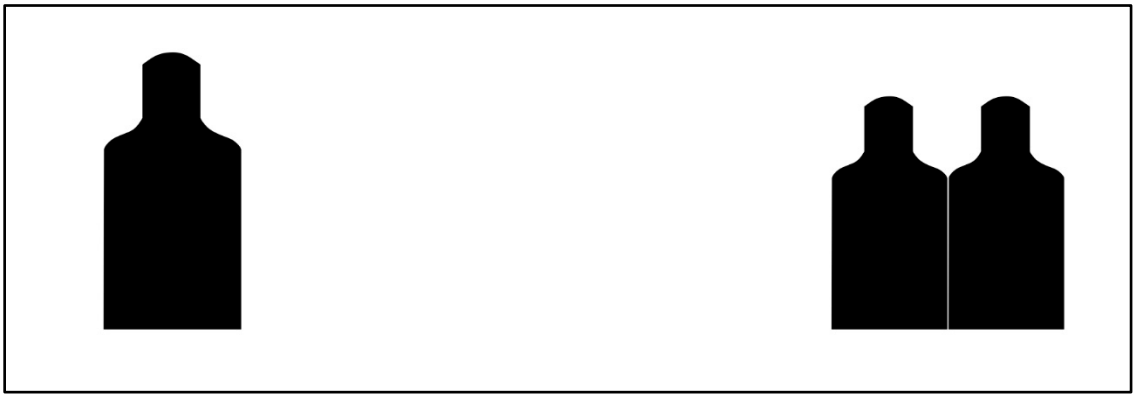


**Figure F-2. Single E-type and double E-type silhouette targets**

### STOPPAGES

F-27. Same as Firing Table I qualification fire.

### PENALTIES

F-28. Same as Firing Table I qualification fire.

### SCORES

F-29. Each target hit is worth 5 points, whether the firer hits the target on the first or second burst. There are 11 targets, so the maximum score is 55 points. The automatic rifleman must hit at least 7 (7 times 5 equals 35 points) targets out of the 11 to qualify. Trainers use DA Form 7304, which is the scorecard for the M249 automatic rifle, to record scores. Task 1 in the qualification firing table, field zero, is unscored.

### FIRING POSITION

F-30. Based on their mission-essential task list, the commander selects either the bipod-supported prone position or the bipod-supported foxhole firing position for qualification.

## TRANSITION CONDUCT OF FIRE

F-31. The unit is organized in firing orders based on range constraints. Each firing order has an automatic rifleman and a coach. The coach helps the automatic rifleman during prefire checks and zeroing. The coach also relays signals to the tower operator, checks the automatic rifleman's position, and coaches them except during qualification. The rifleman uses the bipod-supported prone and fighting positions. The automatic rifleman fires the eight tasks in the manner described in the following paragraphs:

### TASK 1: FIELD ZERO, SINGLE E-TYPE SILHOUETTE

F-32. The zero target may be located from 300 to 700 meters from the firing line, but the best range is 300 meters.

- The automatic rifleman prepares the rear sight for field zeroing and checks the front sight post.
- The automatic rifleman sets the range to the zero target on the elevation knob.
- The automatic rifleman assumes a good position.
- The tower operator instructs the automatic rifleman to prepare a 12-round belt.
- On hearing the fire command, the automatic rifleman and coach repeat each element as it is given.
  - AUTOMATIC RIFLEMAN
  - FRONT
  - TARGETS: TROOPS IN THE OPEN
  - THREE HUNDRED
  - FIXED, THREE-ROUND BURST
  - COMMENCE FIRING
- The automatic rifleman loads one 12-round belt of ammunition, obtains the proper sight picture, and gives an Up to the coach.
- The coach relays the Ready signal to the tower operator.
- The tower operator gives the command, commence firing.
- The automatic rifleman fires a three-round burst at the target when ready.
- The automatic rifleman observes the beaten zone. If the rounds miss the target, they adjust for windage and elevation.
- The automatic rifleman repeats Steps 8 through 9 with the remaining rounds until rounds start hitting the target. They record their zero.

### TASK 2: 200-METER, SINGLE E-TYPE SILHOUETTE

- The tower operator instructs the automatic rifleman to load one 66-round belt.
- The fire command is given once for tasks 2 through 8. The automatic rifleman and the coach repeat each element as it is given—
  - AUTOMATIC RIFLEMAN
  - FRONT
  - TARGET: TROOPS IN THE OPEN
  - ONE HUNDRED TO FOUR HUNDRED METERS
  - FIXED, THREE-ROUND BURST
  - AT MY COMMAND
- The automatic rifleman gives an Up to the coach.
- The coach gives the Ready signal to the tower operator.
- The tower operator commands fire
- The automatic rifleman scans the sector.
- A 200-meter, single E-type target is exposed for 5 seconds.
- The automatic rifleman determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a three-round burst.
- If they fail to hit the target, they fire another three-round burst at the target using the adjusted, aiming point method of fire adjustment.

### TASK 3: 400-METER, DOUBLE E-TYPE SILHOUETTE

- The automatic rifleman continues to scan the sector.
- A 400-meter, double E-type target is exposed for 10 seconds.
- The automatic rifleman determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a three-round burst.
- If they fail to hit the target, they fire another three-round burst at the target using the adjusted, aiming point method of fire adjustment.

### TASK 4: 100-METER, SINGLE E-TYPE SILHOUETTE

- The tower operator orders, GAS and the automatic rifleman and coach put on their masks and gloves.
- The automatic rifleman continues to scan the sector.
- A 100-meter, single E-type target is exposed for 10 seconds.
- The automatic rifleman determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a three-round burst.
- If they fail to hit the target, they fire another three-round burst at the target using the adjusted, aiming point method of fire adjustment.

### TASK 5: 300-METER, SINGLE E-TYPE SILHOUETTE

- The automatic rifleman continues to scan the sector while still wearing a protective mask and gloves.
- A 300-meter, single E-type target is exposed for 15 seconds.
- The automatic rifleman determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a three-round burst.

- If they fail to hit the target, they fire another three-round burst at the target using the adjusted, aiming point method of fire adjustment.

### TASK 6: 100-AND 300-METER, SINGLE E-TYPE SILHOUETTES

- The automatic rifleman continues to scan the sector while wearing a protective mask and gloves.
- A 100-meter and a 300-meter, single E-type target are exposed for 20 seconds.
- The automatic rifleman determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a three-round burst at each target.
- If they fail to hit the target, they fire another three-round burst at each target using the adjusted, aiming point method of fire adjustment.
- The tower operator orders All Clear. The automatic rifleman and coach restore their masks to their carriers and remove their gloves.

### TASK 7: 200-METER SINGLE AND 400-METER DOUBLE E-TYPE SILHOUETTES

- The automatic rifleman continues to scan the sector.
- The 200-meter, single E-type and the 400-meter, double E-type targets are exposed for 20 seconds.
- The automatic rifleman determines the range, places the proper setting on the rear sight, assumes the proper position, obtains correct sight alignment and sight picture, and fires a three-round burst at each target.
- If they fail to hit the target, they fire another three-round burst at each target using the adjusted, aiming point method of fire adjustment.

### TASK 8: 100- AND 200-METER SINGLE AND 400-METER DOUBLE E-TYPE SILHOUETTES

- The automatic rifleman continues to scan the sector.
- The 100-meter and 200-meter single E-type and 400-meter double E-type targets are exposed for 25 seconds.
- The automatic rifleman determines the range, places the proper setting on the rear sight, assumes the proper position, obtains correct sight alignment and sight picture, and fires a three-round burst at each target.
- If they to hit the target, they fire another three-round burst at each target using the adjusted, aiming point method of fire adjustment.

## TRANSITION FIRE, LIMITED VISIBILITY

F-33. Night or limited visibility fire requires the Soldier to use the TWS. They mount the sight, boresight the weapon at 10 meters (10-meter range), and zero the nightsight to the weapon at 25 meters (same transition or multipurpose machine gun range used in Firing Table II). Then they use the nightsight to detect and engage a series of targets at various ranges. The commander can use this training to assess the unit's mission-essential task list. Firing Tables II and III are so similar in their tasks and conduct of fire that the commander can opt to fire only Table II, but with the targets and ranges from Table III. This saves the commander from having to fire Table III at all.

### TIME AND AMMUNITION

F-34. Firing Table III provides ammunition requirements. No time requirements apply.

### STOPPAGES

F-35. Same as Firing Table I.

### PENALTIES

F-36. No penalties are used.

### SCORING

F-37. Rather than entering points, no points are used; commanders can use this training for assessment. DA Form 7304, which is the scorecard for the M249 automatic rifle, can be used to record the number of hits. The form is downloadable from http:// www.apd.army.mil.

### CONDITIONS

F-38. Firing Table III (table F-3) is for engaging targets out to 400 meters under ideal moonlight or during daylight conditions. If visibility is limited because of a lack of ambient light, commanders may use field expedient means to identify targets.

**Table F-3. Firing Table III, M249 transition fire, limited visibility, automatic rifle role**

| *FIRING TABLE III—M249 TRANSITION FIRE<br>Limited Visibility, Prone or Fighting Position, Bipod Supported Practice and Instructional, Automatic Rifle Role* | | | | | | |
|---|---|---|---|---|---|---|
| *TASK* | *TIME* | *ROUNDS* | | *TARGET* | *RANGE (M)* | *TYPE FIRE* |
| | | *QTY* | *TYPE* | | | |
| 1 | No Limit | 12 | 4:1 | Single E | 25 | Fixed, 3-round burst (zero) |
| 2 | No Limit | 6 | 4:1 | Single E | 200 | Fixed, 3-round burst |
| 3 | No Limit | 6 | 4:1 | Double E | 400 | Fixed, 3-round burst |
| 4 | No Limit | 6 | 4:1 | Single E | 100 | Fixed, 3-round burst |
| 5 | No Limit | 6 | 4:1 | Single E | 300 | Fixed, 3-round burst |
| 6 | No Limit | 6 | 4:1 | Single E | 100 | Fixed, 3-round burst |
| ***Notes.*** The unit commander determines the position.<br>Boresighting requires 12 rounds and seating the device requires 6 rounds. | | | | | | |

### TARGETS

F-39. Single E-type silhouette targets or double E-type silhouette targets are used.

### FIRING POSITION

F-40. The commander selects the bipod-supported foxhole firing position.

## QUALIFICATION STANDARDS

F-41. Qualification with the M249 automatic rifle requires the Soldier to achieve the minimum standards for 10-meter day and transition day firing tables.

### FIRING TABLE I W/CBRN

F-42. One point is allowed for each round that impacts in the scoring space (maximum of 3 for each space) for Firing Table I. The maximum possible score for Firing Table I is 51 points. A minimum of 35 points is required.

## FIRING TABLE II W/CBRN

F-43. For Firing Table II, 5 points are allowed for each target hit whether the target is hit on the first or second burst. The maximum score for Table Firing II is 55 points; at least 35 points must be scored on this table to qualify.

## TOTAL

F-44. The minimum total score is 70; the maximum total score is 106 (see table F-4). Figure F-3 (page F-15), which illustrates a completed DA Form 7304, shows the ratings.

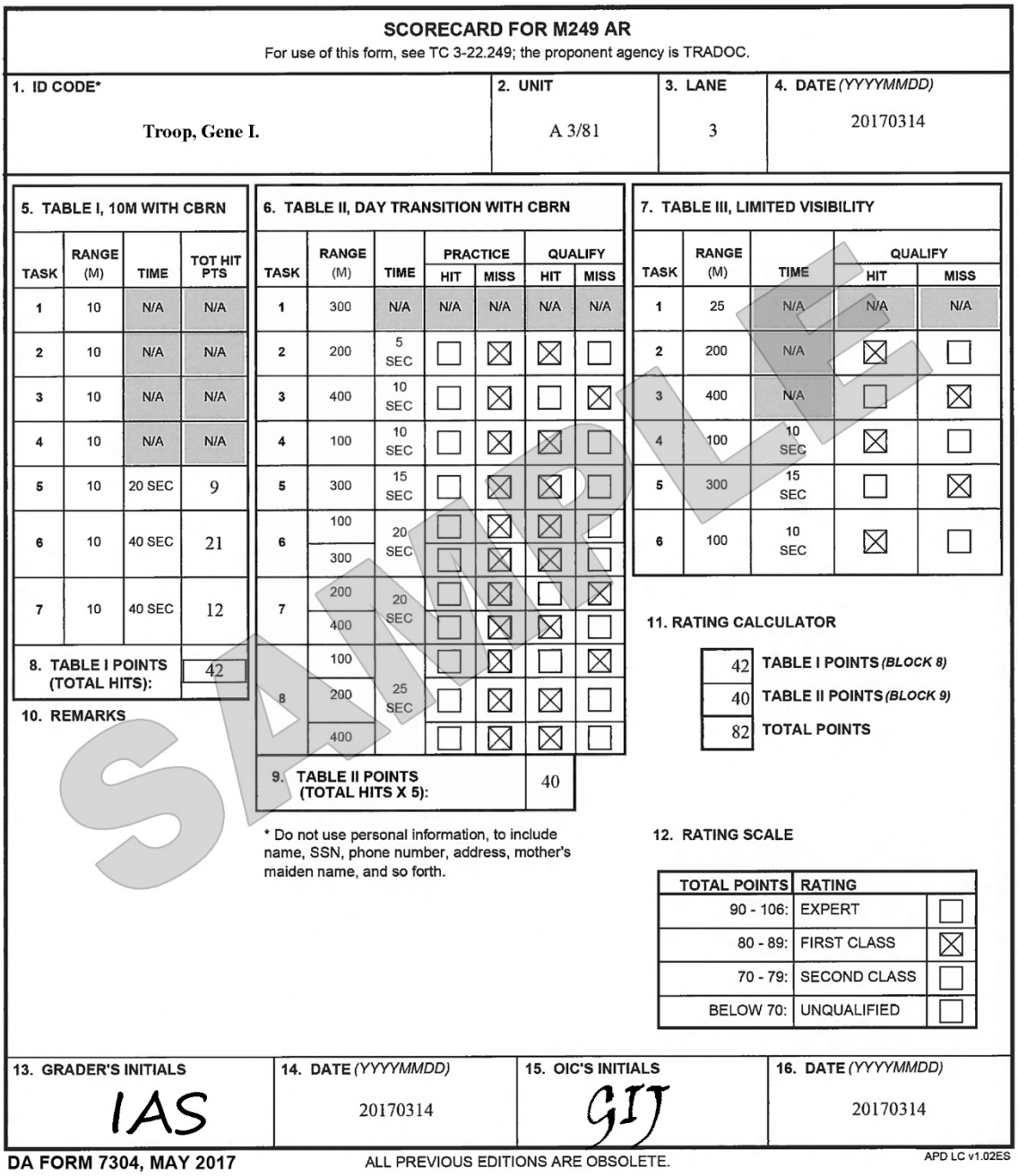
**Table F-4. M249 automatic rifleman ratings.**

| *RATING* | *MINIMUM* | *MAXIMUM* |
|---|---|---|
| Expert | 90 | 106 |
| Automatic Rifleman 1st Class | 80 | 89 |
| Automatic Rifleman 2d Class | 70 | 7 |
| Unqualified | 0 | 69 |

## SCORECARD

F-45. The trainer uses DA Form 7304 to record the automatic rifleman's performance on the M249 automatic rifle qualification range. DA Form 7304 is available for downloading from http:// www.apd.army.mil. DA Pam 350-38 provides STRAC ammunition requirements. (Blocks 1 through 4, and 13 through 16 are administration data):

- Block 5–Table I, 10 Meter. Task 5 has four target spaces; the firer may impact up to three rounds per target, so the firer can earn 12 points (4 x 3). Task 6 has eight. The firer may impact up to three rounds per target space, so he can earn 24 points (8 x 3) for Task 6. Task 7 has 5 target spaces. The firer may impact up to three rounds per target, so he can earn 15 points (5 x3). For a maximum of 51 points for Table I.
- Block 6–Table II, Day Transition. Mark each qualifying hit with an X, whether the firer hits the target on the first or second burst.
- Block 7–Table III, Limited Visibility. Mark each qualifying hit with an X whether the firer hits the target on the first or second burst.
- Block 8–Table I Points. Enter the sum of the points earned in Tasks 5, 6, and 7.
- Block 9–Table II Points. Enter total qualifying hits multiplied by 5.
- Block 11–Enter the total from each table, and then add them to obtain TOTAL POINTS.
- Block 12–Using the TOTAL POINTS in Block 12, determine the firer's RATING.



**SCORECARD FOR M249 AR**

For use of this form, see TC 3-22.249; the proponent agency is TRADOC.

| 1. ID CODE* | 2. UNIT | 3. LANE | 4. DATE (YYYYMMDD) |
|---|---|---|---|
| Troop, Gene I. | A 3/81 | 3 | 20170314 |

**5. TABLE I, 10M WITH CBRN**

| TASK | RANGE (M) | TIME | TOT HIT PTS |
|---|---|---|---|
| 1 | 10 | N/A | N/A |
| 2 | 10 | N/A | N/A |
| 3 | 10 | N/A | N/A |
| 4 | 10 | N/A | N/A |
| 5 | 10 | 20 SEC | 9 |
| 6 | 10 | 40 SEC | 21 |
| 7 | 10 | 40 SEC | 12 |
| 8. TABLE I POINTS (TOTAL HITS): | | | 42 |

**6. TABLE II, DAY TRANSITION WITH CBRN**

| TASK | RANGE (M) | TIME | PRACTICE HIT | PRACTICE MISS | QUALIFY HIT | QUALIFY MISS |
|---|---|---|---|---|---|---|
| 1 | 300 | N/A | N/A | N/A | N/A | N/A |
| 2 | 200 | 5 SEC | ☐ | ☒ | ☒ | ☐ |
| 3 | 400 | 10 SEC | ☐ | ☒ | ☐ | ☒ |
| 4 | 100 | 10 SEC | ☐ | ☒ | ☒ | ☐ |
| 5 | 300 | 15 SEC | ☐ | ☒ | ☒ | ☐ |
| 6 | 100 | 20 SEC | ☐ | ☒ | ☒ | ☐ |
| | 300 | | ☐ | ☒ | ☒ | ☐ |
| 7 | 200 | 20 SEC | ☐ | ☒ | ☐ | ☒ |
| | 400 | | ☐ | ☒ | ☒ | ☐ |
| 8 | 100 | 25 SEC | ☐ | ☒ | ☐ | ☒ |
| | 200 | | ☐ | ☒ | ☒ | ☐ |
| | 400 | | ☐ | ☒ | ☒ | ☐ |
| 9. TABLE II POINTS (TOTAL HITS X 5): | | | | | | 40 |

**7. TABLE III, LIMITED VISIBILITY**

| TASK | RANGE (M) | TIME | QUALIFY HIT | QUALIFY MISS |
|---|---|---|---|---|
| 1 | 25 | N/A | N/A | N/A |
| 2 | 200 | N/A | ☒ | ☐ |
| 3 | 400 | N/A | ☐ | ☒ |
| 4 | 100 | 10 SEC | ☒ | ☐ |
| 5 | 300 | 15 SEC | ☐ | ☒ |
| 6 | 100 | 10 SEC | ☒ | ☐ |

**11. RATING CALCULATOR**

| | |
|---|---|
| 42 | TABLE I POINTS (BLOCK 8) |
| 40 | TABLE II POINTS (BLOCK 9) |
| 82 | TOTAL POINTS |

**10. REMARKS**

* Do not use personal information, to include name, SSN, phone number, address, mother's maiden name, and so forth.

**12. RATING SCALE**

| TOTAL POINTS | RATING | |
|---|---|---|
| 90 - 106: | EXPERT | ☐ |
| 80 - 89: | FIRST CLASS | ☒ |
| 70 - 79: | SECOND CLASS | ☐ |
| BELOW 70: | UNQUALIFIED | ☐ |

| 13. GRADER'S INITIALS | 14. DATE (YYYYMMDD) | 15. OIC'S INITIALS | 16. DATE (YYYYMMDD) |
|---|---|---|---|
| IAS | 20170314 | GIJ | 20170314 |

DA FORM 7304, MAY 2017 ALL PREVIOUS EDITIONS ARE OBSOLETE. APD LC v1.02ES

SAMPLE

**Figure F-3. Completed DA Form 7304, example.**

# BASIC GUNNERY, MACHINE GUN ROLE

F-46. In basic marksmanship, the gunner executes live-fire exercises during the day and night. These exercises are conducted with the machine gun mounted on the tripod. Both the gunner and the assistant gunner practice and qualify. Basic gunnery includes 10-meter zero, 10-meter fire, field zero, practice and qualification transition fire, and fire in limited visibility.

# TEN-METER FIRE

F-47. Ten-meter fire trains the gunner to apply machine gun marksmanship in live-fire exercises. During ten-meter fire training, the Soldier becomes familiar with the weapon's characteristics, noise, and recoil. The training instills confidence in the Soldier with their weapon. Each gunner learns to zero their machine gun, conduct crew drill, fire controlled bursts at point targets, and use traverse and search techniques on area targets. The Soldier conducts ten-meter fire on a 10-meter or multipurpose range with the basic machine gun target. The gunner fires with the machine gun on the tripod, from both prone and fighting positions. Ten-meter firing exercises allow practice and are a part of record qualification. Therefore, all 10-meter firing exercises are recorded and scored so the gunner has an assessment of their performance. Ten-meter fire is conducted in accordance with Firing Table I (table F-5) below.

**Table F-5. Firing Table I, all weapons, basic (10-meter) fire**

| *FIRING TABLE I—ALL WEAPONS, BASIC (10 METER) FIRE<br>Prone or Fighting Position, Tripod, Practice and Qualification, Machine Gun Role* | | | | | |
|---|---|---|---|---|---|
| *TASK* | *TIME* | *ROUNDS* | | *GUNNER TARGETS (PASTERS)* | *TYPE FIRE* |
| | | *QTY* | *TYPE* | | |
| 1 | No Limit | 12 | Ball | A1 and A2 | 12 single rounds (zero) |
| 2 | No Limit | 28 | Ball | A3 and A4 | 5- to 7-round burst for each paster |
| 3 | No Limit | 35 | Ball | A5 and A6 | 5- to 7-round burst for each paster, traverse, and search |
| 4 | No Limit | 56 | Ball | A7 and A8 | 5- to 7-round burst for each paster |
| *5 | 45 sec | 56 | Ball | B7 and B8 | 5- to 7-round burst for each paster |
| *6 | 30 sec | 35 | Ball | B5 and B6 | 5- 7-round burst for each paster |
| ***Notes.*** The gunner fires pasters on sections A and B and the assistant gunner fires on section C and D.<br>*Qualification task | | | | | |

## GUNNER: ZERO, PRACTICE, AND QUALIFICATION

F-48. The Soldiers must perform the following tasks during practice and qualification.

### Task 1: Zero, Tripod

F-49. The gunner fires single shots to determine their weapon's zero for 10 meters. The task reinforces the dry-fire experience and allows the gunner to practice loading while providing the tightest, most accurate shot group they can (A1 and A2).

### Task 2: Controlled-burst Fire, Tripod

F-50. Task 2 exposes the gunner to automatic fire and the action of the weapon and at the same time introduces trigger control (A3 through A4). Using a point target, the gunner fires a burst of 5 to 7 rounds.

### Task 3: Traverse and Search Fire

F-51. Task 3 requires the gunner to make position changes or manipulate the T&E mechanism to engage linear targets with depth, to use controlled burst fire, and to use a series of aiming points to disburse fire across the target (A5 and A6).

### Task 4: Traverse and Search Fire

F-52. Task 4 requires the gunner to make body position changes or manipulate the T&E mechanism to engage area targets in-depth, to use controlled burst fire, and to use a series of aiming points to disburse fire across the target while wearing a protective mask and gloves (A7 and A8).

### Task 5: Traverse and Search Fire, Qualification

F-53. Task 5 requires the gunner to engage area targets with width and depth while changing position or manipulating the T&E mechanism during timed conditions (B7 and B8).

### Task 6: Search and Traverse Fire, Qualification

F-54. Task 6 requires the gunner to make position changes or manipulate the T&E mechanism to engage area targets in-depth during timed conditions (B5 and B6).

### Assistant Gunner: Ten-meter Practice and Qualification

F-55. After the gunner finishes firing, they and the assistant gunner swap positions. The assistant gunner then fires the same tasks in the 10-meter practice and qualification tables, but they fire at the pasters on sections C and D.

## TEN-METER CONDUCT OF FIRE

F-56. The training instructs the gunners on the objectives of firing from the tripod-supported prone or fighting positions. The gunners learn the fire commands used on the basic range. They learn about the basic machine gun marksmanship target, and how the target is analyzed and scored. The assistant helps the gunner during prefire checks and zeroing. In addition, the assistant gunner relays signals to the tower operator, checks the gunner's position, and provides any other assistance allowed. No assistant gunner is available during qualification fire. The six tasks are fired as follows:

### TASK 1: TRIPOD, ZERO

F-57. The gunner should zero their weapon in 9 rounds. The gunner should use the other 3 rounds to confirm the zero. If they cannot zero in 12 rounds, they leave the firing line and attend remedial training.

- The tower operator commands, MACHINE GUN TO BE MOUNTED HERE (weapon squad leaders indicate the firing points on the 10-meter line), FRONT (weapon squad leader points to the 10-meter targets), ACTION.
- At the command action, the machine gun crew places the machine gun into action (tripod mode).
- The gunner prepares the rear sight for zeroing and checks the front sight.
- The gunner assumes a good tripod position.
- The tower operator instructs the gunner to prepare a single round.
- The gunner and assistant gunner repeat each element of the following fire command:
  - FIRE MISSION — The gunner loads and moves the safety to F.
  - FRONT — The gunner focuses on the target or target area.
  - PASTERS A1 and A2 — The gunner locates the target.
  - FIVE HUNDRED — The gunner adjusts sights and acquires the sight picture.
  - FIXED, ONE ROUND — The gunner is given the method of fire.
  - COMMENCE FIRING — The gunner fires on command from tower operator, but when ready.
- The gunner loads one round, obtains the proper sight picture, and signals thumbs up to the assistant gunner.
- The assistant gunner relays the ready signal to the tower operator.
- The tower operator commands, COMMENCE FIRING.
- When ready, the gunner engages paster A1 with three single shots.
- The gunner moves downrange to observe, mark, and triangulate the shot group. They adjust as needed.
- The gunner repeats Steps 3 through 10 until they have zeroed or fired 12 rounds. If the gunner has not zeroed after 12 rounds, the gunner is removed from the firing line for retraining. Once the gunner zeroes, they fire the remaining rounds at paster A2 to confirm the zero.

## TASK 2, TRIPOD, CONTROLLED BURST FIRE, TRAVERSE

F-58. The tower operator instructs the gunner to prepare a 28-round belt.

- The gunner and assistant gunner repeat each element of the following fire command:
  - FIRE MISSION
  - FRONT
  - PASTERS A3 AND A4
  - FIVE HUNDRED
  - FIXED, FIVE- TO SEVEN-ROUND BURST
  - AT MY COMMAND
- The gunner acquires the proper sight picture and signals thumbs up to the assistant gunner.
- The assistant gunner relays the ready signal to the tower operator.
- The tower operator commands FIRE.
- The gunner engages pasters A3 and A4, firing a 5- to 7-round bursts at each paster, using traverse.

## TASK 3, TRIPOD, CONTROLLED BURST FIRE, TRAVERSE AND SEARCH

F-59. The tower operator instructs the assistant gunner to prepare a 35-round belt.

- The gunner and assistant gunner repeat each element of the following fire command:
  - FIRE MISSION
  - FRONT
  - PASTERS A5 AND A6
  - FIVE HUNDRED
  - TRAVERSE AND SEARCH, FIVE- TO SEVEN-ROUND BURST
  - AT MY COMMAND
- The gunner acquires the proper sight picture and signals thumbs up to the assistant gunner.
- The assistant gunner relays the ready signal to the tower operator.
- The tower operator commands FIRE.
- The gunner engages pasters A5 and A6, firing a 5- to 7-round bursts at each paster, using traverse and search.

## TASK 4, TRIPOD, CONTROLLED BURST FIRE, SEARCH AND TRAVERSE

F-60. The tower operator instructs the gunner to prepare a 56-round belt.

- The gunner and assistant gunner repeat each element of the following fire command:
  - FIRE MISSION
  - FRONT
  - PASTERS A7 AND A8
  - FIVE HUNDRED
  - TRAVERSE AND SEARCH, FIVE- TO SEVEN-ROUND BURST
  - AT MY COMMAND
- The gunner acquires the proper sight picture and signals thumbs up to the assistant gunner.
- The assistant gunner relays the ready signal to the tower operator.
- The tower operator commands FIRE.
- The gunner engages pasters A7 and A8, firing a 5- to 7-round burst at each paster, using the search and traverse technique.
- The gunner and assistant gunner move downrange to observe and analyze the targets.

### TASK 5, TRIPOD, QUALIFICATION, SEARCH AND TRAVERSE FIRE

F-61. After firing ends, the firing line is cleared and the trainers or safety officers move downrange and score the targets. Someone besides the gunner scores the gunner's target.

- The tower operator instructs the gunner to prepare a 56-round belt.
- The gunner and assistant gunner repeat each element of the following fire command:
  - FIRE MISSION
  - FRONT
  - PASTERS B7 AND B8
  - FIVE HUNDRED
  - TRAVERSE AND SEARCH, FIVE- TO SEVEN-ROUND BURST
  - AT MY COMMAND
- The gunner acquires the proper sight picture and signals thumbs up to the assistant gunner.
- The assistant gunner relays the ready signal to the tower operator.
- The tower operator commands FIRE.
- The gunner engages pasters B7 and B8, firing a 5- to 7-round burst at each paster, using the search and traverse technique. The gunner has 45 seconds to engage as many pasters as they can during the time allowed.

### TASK 6, TRIPOD, QUALIFICATION, TRAVERSE AND SEARCH

F-62. On completion of all firing, the firing line is cleared and the trainers or safeties move downrange and score the targets. Someone besides the firer scores the target.

- The tower operator instructs the assistant gunner to prepare a 35-round belt.
- The gunner and assistant gunner repeat each element of the following fire command:
  - FIRE MISSION
  - FRONT
  - PASTERS B5 AND B6
  - FIVE HUNDRED
  - TRAVERSE AND SEARCH, FIVE- TO SEVEN-ROUND BURST
  - AT MY COMMAND
- The gunner acquires the proper sight picture and signals a thumbs up to the assistant gunner.
- The assistant gunner relays the ready signal to the tower operator.
- The tower operator commands fire.
- The gunner engages pasters B5 and B6, firing a 5- to 7-round burst at each. The gunner uses traverse and search. The gunner has 30 seconds to engage as many pasters as they can.
- When the gunner and assistant gunner return from downrange, the tower operator commands OUT OF ACTION.
- The machine gun crew then takes the machine gun out of action (tripod mode).

## TEN-METER QUALIFICATION FIRE

F-63. The first phase of qualification has the gunner firing tasks 2 through 4 of Firing Table I for practice, and tasks 5 and 6 of Firing Table I for record. Before firing, all Soldiers must be familiar with the tasks, the time allowed, the ammunition allowances, the procedures to follow in the event of a stoppage, and the penalties imposed.

### TIME AND AMMUNITION

F-64. Each gunner completes zeroing before record fire. They receive individual fire commands for each task. They must fire task 5 in 45 seconds, and task 6 in 30 seconds.

### STOPPAGES

F-65. If a stoppage occurs, the gunner must apply immediate action. If the stoppage is reduced, they continue to fire the course.

- If a stoppage occurs that the gunner cannot reduce by immediate action, then they raise their hand and await assistance.
- Once they reduce the stoppage, the gunner completes firing, beginning with the next task.
- If gunner error causes a stoppage, additional time is disallowed. The gunner receives whatever score they had earned before the stoppage occurred.
- If the machine gun must be replaced, the gunner must zero it and fire the exercise again.
- Gunners who fail to fire a task or fail to do so in the time allowed due to malfunctions have another option: They can finish the exercise in an alibi run after all other gunners complete firing. They need only fire the tasks they failed to hit due to the malfunction.

### PENALTIES

F-66. Five points are deducted from the score of any gunner who fails to stop firing at the command or signal to cease fire. If a gunner fires at the wrong target or exercise, they lose the points for those rounds. A gunner whose target was fired upon by another gunner is permitted to refire the exercise.

### SCORING

F-67. On the 10-meter target, the trainer counts all scoring pasters in sections B and D (B/D5 to B/D6 and B/D7 to B/D8). The trainer awards 1 point for each round that impacts within the scoring space. The most points they can give the gunner for each paster is 7 points for the M249 or M240. Rounds that touch the line on the paster are considered hits. Someone besides the gunner scores the gunner's target. During qualification fire, the gunner must earn at least 63 points on Firing Table I on any of the weapons.

### SECTIONS B/D5 TO B/D6

F-68. When firing B/D5 through B/D6, the gunner engages five scoring pasters with 35 rounds (M249 or M240). They can earn up to 35 points for either the M249 or M240.

### SECTIONS B/D7 TO B/D8

F-69. When firing pasters B/D7 through B/D8, the gunner engages eight scoring pasters with 56 rounds (M249 or M240). They can earn up to 56 points for either the M249 or M240.

### POSITION

F-70. For practice and qualification, the gunner uses either a tripod-supported prone or tripod supported fighting position.

### FIRERS

F-71. The gunner and the assistant gunner both fire Table I.

## TRANSITION FIRE

F-72. Transition fire provides the gunner with the experience the need to progress from 10-meter fire to field fire at various types of targets at longer ranges. In a timed scenario, the gunner experiences and learns the characteristics of fire, field zeroing, range determination, and engagement of targets. They use the adjusted, aiming point method of fire adjustment. Transition fire occurs on a machine gun transition range or on the multipurpose range complex. Exercises are fired with the tripod prone or fighting position. However, the commander may direct that trainers conduct transition fire from the bipod prone or fighting position. Each gunner and assistant gunner fires transition fire twice, once for practice and once for qualification. They fire

the field zero (Task 1) only once during the practice phase. Transition fire is scored during both practice and qualification to provide feedback to the gunner. Firing Table II (see table F-6) has eight tasks.

**Table F-6. Firing Table II, all weapons, tripod transition fire**

| *FIRING TABLE II—ALL WEAPONS*<br>*Tripod Transition Fire, Prone or Fighting Position, Practice and Qualification, Machine Gun Role* | | | | | | |
|---|---|---|---|---|---|---|
| *TASK* | *TIME* | *ROUNDS* | | *TARGET* | *RANGE* | *TYPE FIRE* |
| | | *QTY* | *TYPE* | | | |
| 1 | No Limit | 28 | 4:1[b] | | 500 | Fixed, 5- to 7-round burst (field zero) |
| 2[a] | 10 sec | 14 | 4:1[b] | Single E | 400 | Fixed, 5- to 7-round burst |
| 3[a] | 15 sec | 14 | 4:1[b] | Double E | 500 | Fixed, 5- to 7-round burst |
| 4[a] | 20 sec | 14 | 4:1[b] | Double E | 600 | Fixed, 5- to 7-round burst |
| 5[a] | 30 sec | 14 | 4:1[b] | Double E | 800 | Fixed and area, 5- to 7-round burst |
| 6[a] | 30 sec | 28 | 4:1[b] | Single E<br>Double E | 400<br>600 | Fixed, 5- to 7-round burst |
| 7[a] | 45 sec | 28 | 4:1[b] | Double E<br>Double E | 700<br>800 | Fixed and area, 5- to 7-round burst |
| 8[a] | 45 sec | 42 | 4:1[b] | Single E<br>Double E<br>Double E | 400<br>500<br>600 | Fixed, 5- 7-round burst |
| ***Notes.*** The unit commander determines the firing position.<br>[a]Qualification task.<br>[b]Ball to tracer ratio (mix), that is, four ball rounds are loaded for every one tracer round loaded. | | | | | | |

## RANGE FACILITIES

F-73. The transition range has several firing lanes. Each lane is 10 meters wide at the firing line and 100 meters wide at a range of 800 meters. Ideally, each lane has a fighting position with an adjacent prone firing position.

## TARGETS

F-74. The E-type silhouette targets are cardboard (NSN 6920-00-795-1806) and plastic (NSN 6920-00-071-4780). Both single and double are needed for qualification. The double E-type silhouette represents an enemy automatic weapon, which for the gunner is a priority target (see figure F-4, page F-22). The targets are at various ranges that the gunner might engage. All targets are plainly visible from the firing positions. Electrical targets are desirable.

## STOPPAGE

F-75. Firing Table I criteria are used.

## PENALTIES

F-76. Firing Table I criteria are used.

## SCORES

F-77. Ten points are given for each target hit, whether hit on the first or second burst. The total possible points are 110. The gunner must hit at least 7 targets (70 points) out of 11 exposures to qualify. Trainers use DA Form 85, *Scorecard for M249 and M240 Machine Guns*, to record scores (see figure F-5, page F-28). The form is available for downloading at http:// www.apd.army.mil.

### POSITION

F-78. Transition fire should be fired from the tripod, but the commander may specify that the gunner should fire from the bipod.

### FIRERS

F-79. The gunner and the assistant gunner both fire table II.

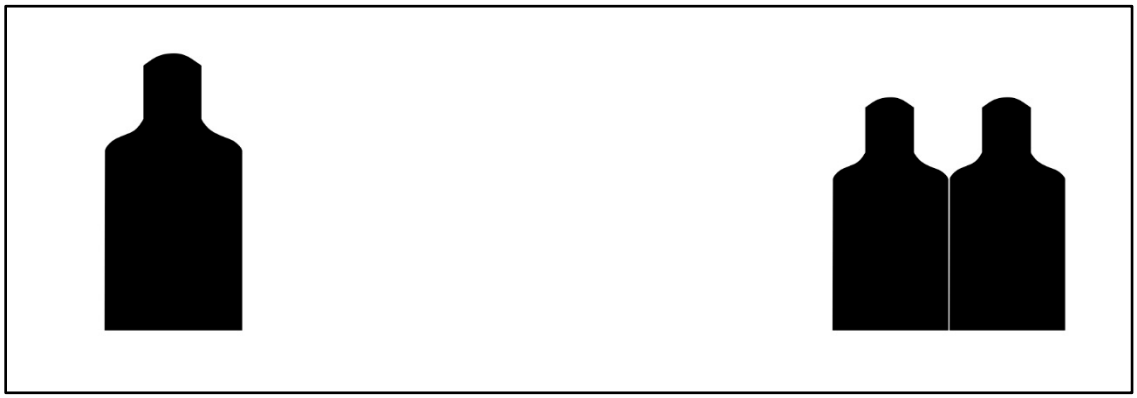


**Figure F-4. Single and double E-type silhouette targets**

## TRANSITION CONDUCT OF FIRE WITH TRIPOD, PRACTICE

F-80. The unit is organized in firing orders based on range constraints. Each firing order has a gunner and an assistant gunner. The assistant gunner helps the gunner during prefire checks and zeroing. The assistant gunner relays signals to the tower operator, checks the gunner's position, and helps with target detection and adjustments during qualification. The gunner uses the bipod-supported prone or fighting position. The gunner fires the eight tasks as follows:

### TASK 1: FIELD ZERO, 500-METER, DOUBLE E-TYPE SILHOUETTE

F-81. The tower operator commands MACHINE GUN TO BE MOUNTED HERE (weapon squad leader points to the firing points on the transition line), FRONT (weapon squad leader points to the targets), ACTION.

- At the command ACTION, the machine gun crew places the machine gun into action (tripod mode).
- The gunner prepares the rear sight for field zeroing, and then checks the front sight blade.
- The gunner sets the range to the zero target on the range scale. The preferred range is 500 meters.
- The gunner assumes a good position.
- The tower operator tells the assistant gunner to prepare a 28-round belt.
- The gunner and assistant gunner repeat each element of the fire command exactly as follows:
  - FIRE MISSION
  - FRONT
  - TARGETS, TROOPS IN THE OPEN
  - FIVE HUNDRED
  - FIXED, FIVE- TO SEVEN-ROUND BURST
  - AT MY COMMAND
- The gunner loads one 28-round belt of ammunition, gets the proper sight picture, and signals thumbs up to the assistant gunner.
- The assistant gunner relays the ready signal to the tower operator.
- The tower operator commands fire.
- When ready, the gunner fires a 5- to 7-round burst at the target.

- The gunner observes the beaten zone. If the rounds miss the target, the gunner adjusts windage and elevation.
- After adjusting, the gunner refires and observes the impact with the remaining rounds until the rounds impact on the target. The gunner records the zero.

### TASK 2: 400-METER, SINGLE E-TYPE SILHOUETTE

F-82. The tower operator tells the gunner to load one 154-round belt and the gunner takes the actions listed below:

- When the fire command is given, the gunner and assistant gunner repeat each element. For tasks 2 through 8, it is only given once.
  - FIRE MISSION
  - FRONT
  - TARGET, TROOPS IN THE OPEN
  - ONE HUNDRED TO EIGHT HUNDRED METERS
  - FIXED, FIVE- TO SEVEN-ROUND BURST
  - AT MY COMMAND
- The gunner signals thumbs up to the assistant gunner.
- The assistant gunner signals ready to the tower operator.
- The tower operator commands, FIRE.
- The gunner scans the sector.
- A 400-meter, single E-type target is exposed for 10 seconds.
- The gunner determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a 5- to 7-round burst.
- If the gunner fails to hit the target, they fire another 5- to 7-round burst. To adjust fire, the gunner uses the adjusted, aiming point method.

### TASK 3: 500-METER DOUBLE E-TYPE SILHOUETTE

F-83. The gunner and assistant gunner continue to scan the sector as follows:

- A 500-meter, double E-type target is exposed for 15 seconds.
- The gunner determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a 5- to 7-round burst.
- If the gunner fails to hit the target, they fire another 5- to 7-round burst. To adjust fire, the gunner uses the adjusted, aiming point method.

### TASK 4: 600-METER, DOUBLE E-TYPE SILHOUETTE

F-84. The gunner and assistant gunner continue to scan the sector as follows:

- A 600-meter, double E-type target is exposed for 20 seconds.
- The gunner determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a 5- to 7-round burst.
- If the gunner fails to hit the target, they fire another 5- to 7-round burst. To adjust fire, they use the adjusted, aiming point method.

### TASK 5: 800-METER, DOUBLE E-TYPE SILHOUETTE

F-85. The gunner and assistant gunner continue to scan the sector as follows:

- An 800-meter, double E-type target is exposed for 30 seconds.
- The gunner determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a 5- to 7-round burst.
- If the gunner fails to hit the target, they fire another 5- to 7-round burst using the adjusted, aiming point method of fire adjustment.

### TASK 6: 400-METER, SINGLE AND 600-METER, DOUBLE E-TYPE SILHOUETTES

F-86. The gunner and assistant gunner continue to scan the sector as follows:

- A 400-meter single E-type target and a 600-meter double E-type target are exposed for 30 seconds.
- The gunner determines the range, places the proper setting on the rear sight, assumes the proper position, obtains the correct sight alignment and sight picture, and fires a 5- to 7-round burst at each target.
- If the gunner fails to hit the target, they fire another 5- to 7-round burst at each target using the adjusted, aiming point method of fire adjustment.

### TASK 7: 700- AND 800-METER, DOUBLE E-TYPE SILHOUETTES

F-87. The gunner and assistant gunner continue to scan the sector as follows:

- 700-meter and 800-meter, double, E-type targets are exposed for 45 seconds.
- The gunner determines the range, places the proper setting on the rear sight, assumes the proper position, obtains correct sight alignment and sight picture, and fires a 5- to 7-round burst at each target.
- If the gunner fails to hit the target, they fire another 7-round burst at each target using the adjusted, aiming point method of fire adjustment.

### TASK 8: 400-METER SINGLE AND 500- AND 600-METER DOUBLE E-TYPE SILHOUETTES

F-88. The gunner and assistant gunner continue to scan the sector as follows:

- The 400-meter, single, E-type silhouettes, and the 500- and 600-meter, double, E-type silhouettes are exposed for 45 seconds.
- The gunner determines the range, places the proper setting on the rear sight, assumes the proper position, obtains correct sight alignment and sight picture, and fires a 5- to 7-round burst at each target.
- If the gunner fails to hit the target, they fire another 5- to 7-round burst at each target using the adjusted, aiming point method of fire adjustment.

## TRANSITION CONDUCT OF FIRE WITH TRIPOD, QUALIFICATION

F-89. Gunners fire tasks 2 through 8 to qualify. The conduct of fire, ammunition, and targets are the same as for practice fire.

## TRANSITION FIRE, LIMITED VISIBILITY

F-90. Night or limited visibility firing requires the Soldier to apply gunner marksmanship while using night sights. Limited visibility training instills confidence in the machine gunner. Each Soldier learns how to engage targets using a night sight. They learn to mount the sight, boresight the weapon at 10-meters, and zero the vision devices at 10-meters using a 25-meter (M16A2) zero target. Finally, they learn to detect and engage a series of undetermined targets at various ranges with the aided vision device. Night firing exercises can be conducted during daylight with the TWS. The exercises are for instructional, practice, and qualification purposes. One point is given for each target hit, whether hit on the first or second burst. The total possible points are 11. Conduct of fire is identical to that in Firing Table II, except for target ranges and exposure times. Stoppage criteria from Firing Table II is used also. Firing Table III (see table F-7) provides ammunition requirements.

**Table F-7. Firing Table III, all weapons, transition fire, limited visibility**

| *FIRING TABLE III—ALL WEAPONS*<br>*Transition Fire, Limited Visibility, Machine Gun Role* | | | | | | |
|---|---|---|---|---|---|---|
| *TASK* | *TIME* | *ROUNDS* | | *TARGET* | *RANGE (M)* | *TYPE FIRE* |
| | | *QTY* | *TYPE* | | | |
| 1 | No Limit | 6 | 4:1[b] | 25-meter zero | 10 | 6 single rounds |
| 2[a] | No Limit | 18 | 4:1[b] | 25-meter zero | 10 | 18 single rounds |
| 3[a] | No Limit | 28 | 4:1[b] | Double E | 500 | 28 single rounds |
| 4[a] | 10 sec | 14 | 4:1[b] | Single E | 200 | 14 single rounds |
| 5[a] | 10 sec | 14 | 4:1[b] | Single E | 400 | Fixed, 5- to 7-round burst |
| 6[a] | 10 sec | 14 | 4:1[b] | Single E | 100 | Fixed, 5- to 7-round burst |
| 7[a] | 15 sec | 14 | 4:1[b] | Single E | 300 | Fixed, 5- to 7-round burst |
| 8[a] | 25 sec | 28 | 4:1[b] | Single E<br>Single E | 200<br>400 | Fixed, 5- to 7-round burst<br>Fixed, 5- to 7-round burst |
| 9[a] | 25 sec | 28 | 4:1[b] | Single E<br>Single E | 100<br>300 | Fixed, 5- to 7-round burst<br>Fixed, 5- to 7-round burst |
| 10[a] | 30 sec | 42 | 4:1[b] | Single E<br>Single E<br>Single E | 100<br>200<br>400 | Fixed, 5- to 7-round burst |
| ***Notes.*** The unit commander determines the position.<br>[a]Qualification task.<br>[b]Four ball rounds to one tracer round mix. | | | | | | |

## SCORES

F-91. Rather than points, the gunner receives only a hit or a miss when they hit the target on the first or second hit. Gunners must hit 6 out of 11 targets to qualify. The gunner must have qualified on both the 10-meter and transition in order to advance to this step. The scorer can record the number of hits on DA Form 85, which is the scorecard for the M249 and M240 machine guns. The form is available for downloading at http://www.apd.army.mil.

## CONDITIONS

F-92. Firing Table III (table F-7) is used for engaging targets out to 400 meters in ideal moonlight or daylight. Commanders may use field-expedient means to identify targets in the absence of ambient light.

## TARGETS

F-93. Firers use single and double E-type silhouette targets.

## POSITION

F-94. For the limited visibility transition firing table, the firers use the tripod, unless the commander directs that they use the bipod.

## FIRERS

F-95. Both the gunner and the assistant gunner fire the limited visibility transition table.

# QUALIFICATION STANDARDS

F-96. Qualification with the M249 or M240 machine gun requires the achievement of minimum standards for 10-meter and transition day firing tables.

## FIRING TABLE I

F-97. Allow 1 point for each round that impacts within the scoring space up to a maximum of 7 points for each space. The firer must score between 63 and 91 points to qualify.

## FIRING TABLE II

F-98. For each hit, place an X in the HIT column; for a miss, place an O in the MISS column. Allow 10 points for each target hit, whether the firer hits it with the first or second burst. The firer must score between 70 and 110 points to qualify.

## FIRING TABLE III

F-99. For each hit, place an X in the HIT column; for each miss, place an O in the MISS column. The firer must score between 6 and 11 hits to qualify.

## ALL TABLES

F-100. The firer must earn a total (combined) score (all firing tables added together) for each weapon as follows and as shown in table F-8.

**Table F-8. Machine gunner ratings**

| *QUALIFICATION* | *POINTS* |
|---|---|
| EXPERT | 186 TO 212 |
| GUNNER 1st CLASS | 157 TO 185 |
| GUNNER 2d CLASS | 139 TO 156 |
| UNQUALIFIED | 0 TO 126 |

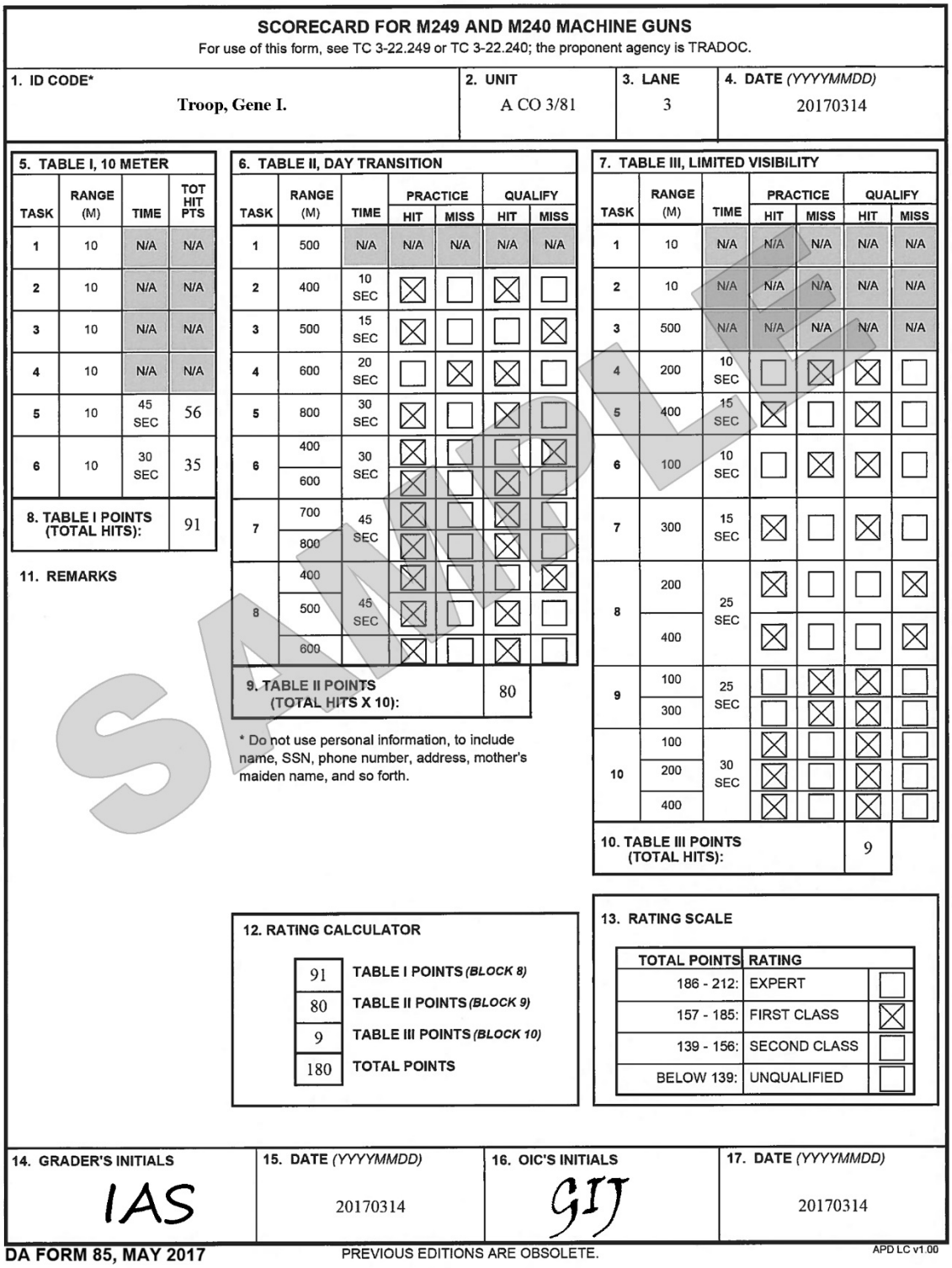
## SCORECARD

F-101. The trainer uses DA Form 85, to record the gunner's performance on the qualification range. The form is available for downloading at http:// www.apd.army.mil. Table F-9 shows ammunition requirements by table. DA Pam 350-38 provides the Standard in Training Commission (known as STRAC) ammunition requirements. Figure F-5, page F-28, shows an example of a completed form. Complete this form as follows (blocks 1 through 4, 11, and 14 through 17 are self-explanatory):

- Block 5, Table I, 10 Meter. Task 5 has eight target spaces; Task 6 has five. The firer may impact up to seven rounds per target space, so they can earn 56 points (8 x 7) for task 5 and 35 points (5 x 7) for task 6, for a maximum of 91 points for table I.
- Block 6, Table II, Day Transition. Mark each qualifying hit with an X, whether the firer hits the target on the first or second burst.
- Block 7, Table III, Limited Visibility. Mark each qualifying hit with an X whether the firer hits the target on the first or second burst.
- Block 8, Table I Points. Enter the sum of the points earned in Tasks 5 and 6.
- Block 9, Table II Points. Enter total qualifying hits multiplied by 10.
- Block 10, Table III Points. Enter total qualifying hits (no multiplication factor).
- Block 12. Enter the total from each table, and then add them to obtain the total points.
- Block 13. Using the total points in Block 12, determine the firer's rating.

**Table F-9. Ammunition requirements, all weapons, machine gun role**

| | ***ROUNDS (ALL WEAPONS)*** | |
|---|---|---|
| ***FIRING TABLE*** | ***QTY*** | ***TYPE*** |
| Table I, Practice | 131 | Ball |
| Table I, Record | 91 | X4:1 |
| Table II, Practice | 182 | X4:1 |
| Table II, Record | 154 | X4:1 |
| Table III, Practice | 52 | X4:1 |
| Table III, Record | 154 | X4:1 |



**SCORECARD FOR M249 AND M240 MACHINE GUNS**

For use of this form, see TC 3-22.249 or TC 3-22.240; the proponent agency is TRADOC.

| 1. ID CODE* | 2. UNIT | 3. LANE | 4. DATE *(YYYYMMDD)* |
|---|---|---|---|
| Troop, Gene I. | A CO 3/81 | 3 | 20170314 |

**5. TABLE I, 10 METER**

| TASK | RANGE (M) | TIME | TOT HIT PTS |
|---|---|---|---|
| 1 | 10 | N/A | N/A |
| 2 | 10 | N/A | N/A |
| 3 | 10 | N/A | N/A |
| 4 | 10 | N/A | N/A |
| 5 | 10 | 45 SEC | 56 |
| 6 | 10 | 30 SEC | 35 |
| 8. TABLE I POINTS (TOTAL HITS): | | | 91 |

**6. TABLE II, DAY TRANSITION**

| TASK | RANGE (M) | TIME | PRACTICE HIT | PRACTICE MISS | QUALIFY HIT | QUALIFY MISS |
|---|---|---|---|---|---|---|
| 1 | 500 | N/A | N/A | N/A | N/A | N/A |
| 2 | 400 | 10 SEC | X | | X | |
| 3 | 500 | 15 SEC | X | | | X |
| 4 | 600 | 20 SEC | | X | X | |
| 5 | 800 | 30 SEC | X | | X | |
| 6 | 400 | 30 SEC | X | | | X |
| | 600 | | X | | X | |
| 7 | 700 | 45 SEC | X | | X | |
| | 800 | | X | | X | |
| 8 | 400 | 45 SEC | X | | | X |
| | 500 | | X | | X | |
| | 600 | | X | | X | |
| 9. TABLE II POINTS (TOTAL HITS X 10): | | | | | | 80 |

**7. TABLE III, LIMITED VISIBILITY**

| TASK | RANGE (M) | TIME | PRACTICE HIT | PRACTICE MISS | QUALIFY HIT | QUALIFY MISS |
|---|---|---|---|---|---|---|
| 1 | 10 | N/A | N/A | N/A | N/A | N/A |
| 2 | 10 | N/A | N/A | N/A | N/A | N/A |
| 3 | 500 | N/A | N/A | N/A | N/A | N/A |
| 4 | 200 | 10 SEC | | X | X | |
| 5 | 400 | 15 SEC | X | | X | |
| 6 | 100 | 10 SEC | | X | X | |
| 7 | 300 | 15 SEC | X | | X | |
| 8 | 200 | 25 SEC | X | | | X |
| | 400 | | X | | | X |
| 9 | 100 | 25 SEC | | X | X | |
| | 300 | | | X | X | |
| 10 | 100 | 30 SEC | X | | X | |
| | 200 | | X | | X | |
| | 400 | | X | | X | |
| 10. TABLE III POINTS (TOTAL HITS): | | | | | | 9 |

**11. REMARKS**

* Do not use personal information, to include name, SSN, phone number, address, mother's maiden name, and so forth.

**12. RATING CALCULATOR**

| | |
|---|---|
| 91 | TABLE I POINTS *(BLOCK 8)* |
| 80 | TABLE II POINTS *(BLOCK 9)* |
| 9 | TABLE III POINTS *(BLOCK 10)* |
| 180 | TOTAL POINTS |

**13. RATING SCALE**

| TOTAL POINTS | RATING | |
|---|---|---|
| 186 - 212: | EXPERT | |
| 157 - 185: | FIRST CLASS | X |
| 139 - 156: | SECOND CLASS | |
| BELOW 139: | UNQUALIFIED | |

| 14. GRADER'S INITIALS | 15. DATE *(YYYYMMDD)* | 16. OIC'S INITIALS | 17. DATE *(YYYYMMDD)* |
|---|---|---|---|
| IAS | 20170314 | GIJ | 20170314 |

DA FORM 85, MAY 2017 PREVIOUS EDITIONS ARE OBSOLETE. APD LC v1.00

SAMPLE

**Figure F-5. Completed DA Form 85, example**

# Glossary

The glossary lists acronyms and terms with Army or joint definitions. Where Army and joint definitions differ, (Army) precedes the definition. Terms for which TC 3-22.XX is the proponent are marked with an asterisk. The proponent manual for other terms is listed in parentheses after the definition.

## SECTION I – ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **ARS** | adaptive rail system |
| **ATP** | Army tactics and procedures |
| **ATPIAL** | Advanced Target Pointer/Illuminator/Aiming Light |
| **CBRN** | chemical, biological, radiological, and nuclear |
| **CoVM** | center of visible mass |
| **I2** | image intensifiers |
| **JP** | joint publication |
| **LCD** | liquid crystal display |
| **LMG** | light machine gun |
| **LOS** | line of sight |
| **MIL** | milliradians |
| **MIL-STD** | military standard |
| **MGO** | machine gun optic |
| **MOA** | minute of angle |
| **SOP** | standard operating procedure |
| **T&E** | traversing and elevating |
| **TC** | training circular |
| **TM** | technical manual |
| **TWS** | thermal weapon sight |

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**TC 3-22.249**
**16 May 2017**

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*Active Army, Army National Guard, and United States Army Reserve:* To be distributed in accordance with the initial distrubution number (IDN) 115879, requirements for TC 3-22.249.

**PIN: 201601-000**