CHAPTER 1
INTRODUCTION

This chapter gives the uses of the MK 19, 40-mm Grenade Machine Gun, MOD 3 (Figure l-l); it describes the MK 19; and it includes lists of equipment data and operational characteristics.

NOTE: The MK 19, 40-mm Grenade Machine Gun, MOD 3, is referred to in this FM as the MK (Mark) 19.

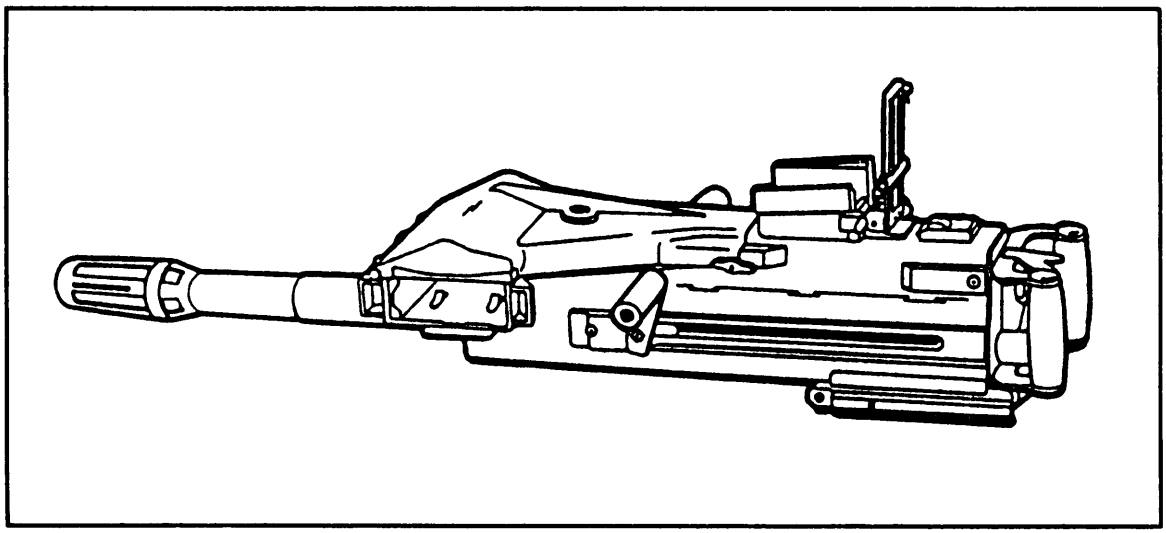


Figure 1-1. 40-mm grenade machine gun, MOD 3, MK 19.

1-1. APPLICATIONS OF THE MK 19

The MK 19 supports the soldier in both the offense and defense. It gives the unit a heavy volume of close, accurate, and continuous fire.

a. Protect motor movements, assembly areas, and supply trains in bivouac.

b. Defend against hovering rotary aircraft.

c. Destroy lightly armored vehicles.

d. Fire on suspected enemy positions.

e. Provide high volumes of fire into an engagement area.

f. Cover obstacles.

g. Provide indirect fires from defilade positions.

1-2. TRAINING STRATEGY

Training strategy refers to the overall concept of integrating resources with the instruction and training of individual and collective skills needed tp carry out a unit's wartime mission. Training strategies for the MK 19 are implemented in TRADOC institutions such as NCOES, Basic and Advanced Officers Courses, and in units. This overall training strategy is multi-faceted and includes the specific strategies used in institution and unit programs, as well as the supporting strategies for use of resources such as publications, ranges, ammunitions, training aids, devices, simulators, and simulations. These strategies are focused on the development of both critical soldier skills and training tasks, as well as well as leader skills that are required to support the overall intended outcome.

a. Training strategies are made up of two primary components: initial training and sustainment training. Both of these may include individual and collective skills. Initial training is critical. A task that is taught correctly, and that is learned well initially, will be retained longer; performance can be more quickly regained or sustained. This means that initial training must be right. Standard, common and current procedures are used. Over time, individual and unit skills decay. The amount of decay depends on many factors that include the difficulty and complexity of the tasks. Personnel turnover is a primary factor in decay of collective skills, because the loss of critical team or crew members normally causes a need for retraining to restore unit proficiency. If too much time passes between initial and sustainment training periods, or if the established training doctrine is altered, skills will be seriously eroded and complete retraining may be required.

b. The training strategy for the MK 19 begins with leader training and continues with unit training. An example of this overall process is found in Appendix D.

c. Bcause MK 19 Gunner is a skill level 2 position, personnel will be trained primarily within the unit. The institution will provide a soldier trained in the basics of the MK 19, with an emphasis on "Train the Trainer". There is no training planned for IET soldiers in this system.

d. Training continues in units where basic gunnery skills are taught and gunners are qualified. Once individual and

crew skills are learned, these skills must be sustained in the unit. To accomplish this, leaders must follow the annual gunnery training program outlined in Appendix D. In addition to the sustainment of skills, the unit must incorporate the system into collective training exercises such as platoon and squad live-fire STXs.

e. The strategy for sustaining basic MK 19 gunnery skills includes annual or semiannual instructional and qualification range firing. However, the unit must set up a year-round program to be able to accomplish sustainment. Key elements include training of the trainers, refresher training of preliminary skills, and use of devices for remedial training of soldiers who have trouble attaining qualification standards.

f. Additional skills trained in the unit include night firing, MOPP firing, and moving target training. Related soldier skills--camouflage, cover and concealment, fire and maneuver, and preparataion or selection of a fighting position--are addressed in this FM and must be integrated into tactical training. Tactical references are shown in the glossary.

g. In the unit, individual and leader MK 19 tasks are integrated into collective training including squad, section, and platoon drills and STXs, and company LFXs and FTXs. The tasks, conditions and standards for the collective tasks in these exercises as well as the way they are planned and conducted are found in the MTP and Drill books for the organization. Force-on-force exercises using MILES are discussed in TC 25-6. Based on the type of organization, these collective exercises are evaluated to standard leader and trainer after-action reviews. Objective evaluations of both individual and unit proficiency provide both readiness indicators and future training requirements.

h. A critical step in Army's overall MK 19 training strategy is to train-the-trainers and leaders first. Leader courses and unit publications are designed to develop the officer and NCO proficiencies necessary to plan and conduct marksmanship training and evaluate the effectiveness of unit marksmanship programs. Training support materials are provided by the proponent schools. They include: field manuals, training aids, devices, simulators and programs which serve as the doctrinal foundations and guidance for training the force.

i. FM 23-27 is organized to lead the trainer in a progressive manner through the material needed to aid him in training units. Information is presented beginning with preliminary subjects. These include mechanical training, knowledge of the gun's capabilities, and the principles and fundamentals of MK 19 gunnery. Live-fire applications are scheduled after the soldier has demonstrated these preliminary skills. Initial firing will be an instructional exercise, which ultimately leads to the soldier's ability to target the MK 19. Once the soldier understands the gun and has demonstrated sufficient skills necessary to target the gun, additional live-fire training and target-detection exercises at various ranges are conducted. Targets and target scenarios of increasing difficulty are mastered to develop proficiency. This progression and the targets are outlined in Appendix C. This initial individual training of several skills will culminate in the soldier's skill assessment, conducted on the qualification fire range. IAW the procedures specified in Appendix C, this evaluation also provides a partial view of overall unit skill and training effectiveness.

1-3. DESCRIPTION OF THE MK 19

The MK 19 is an air-cooled. blowback-operated machine gun, with five major assemblies (Figure 1-2) . It uses ammunition

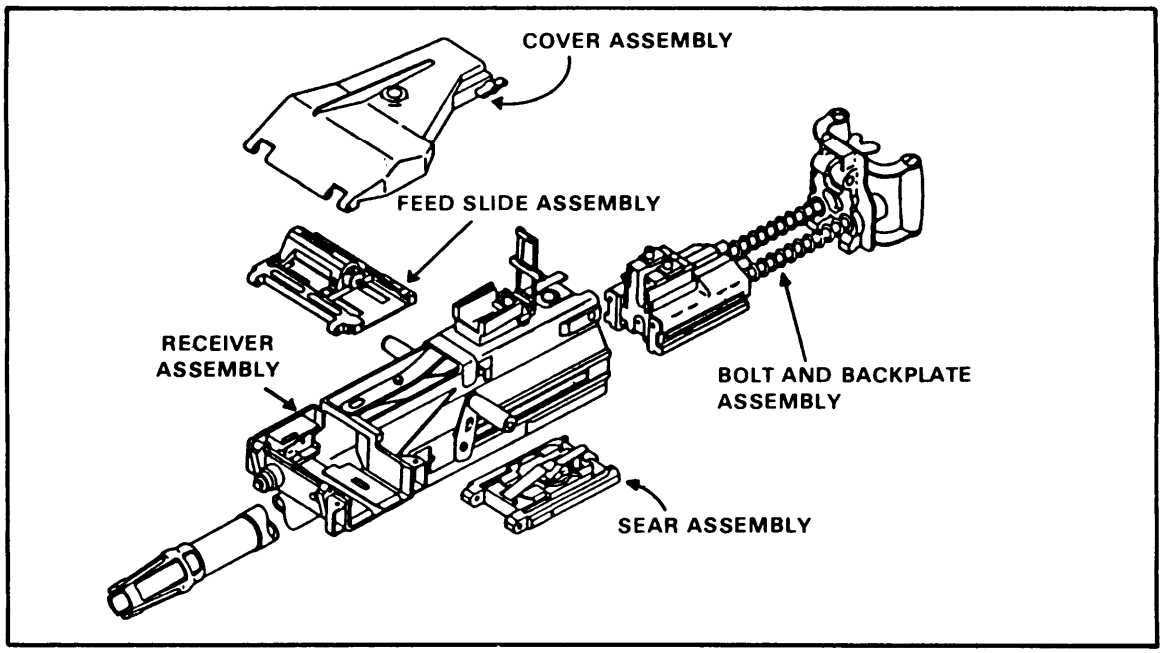


Figure 1-2. Five major assemblies.

that is belt-fed through the left side of the weapon by a disintegrating metallic link belt. Tables 1-1 and 1-2 give MK 19 equipment data and operational characteristics, respectively.

a. The MK 19 features a barrel which does not overheat, even after prolonged firing.

b. It has a blade-type front sight attached to the top cover assembly (Figure-1-3).

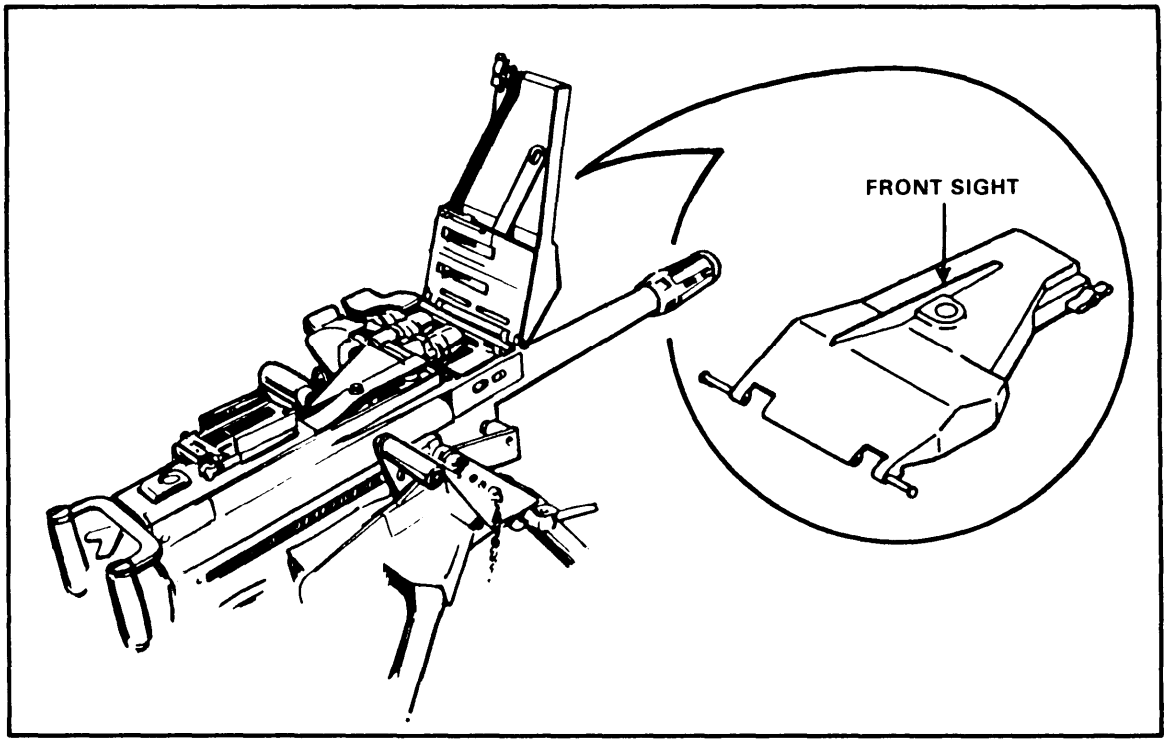


Figure 1-3. Front sight on top cover assembly.

c. The MK 19 has a leaf-type rear sight (with an adjustable range plate) mounted on a spring dovetail base, which should be folded forward to a horizontal position when the weapon is moved, and which has, on the sight leaf, a range plate incremented in 100-meter intervals from 300 to 1500 meters. Range changes may be made using either the slide release or the elevation wheel: the slide release is used for making major changes in elevation; the elevation wheel is used for making fine adjustments (Figure 1-4). The rear sight is adjustable for windage: turning the windage screw clockwise moves the sight to the right; turning it counterclockwise moves the sight to the left. One click equals a l-mil change.

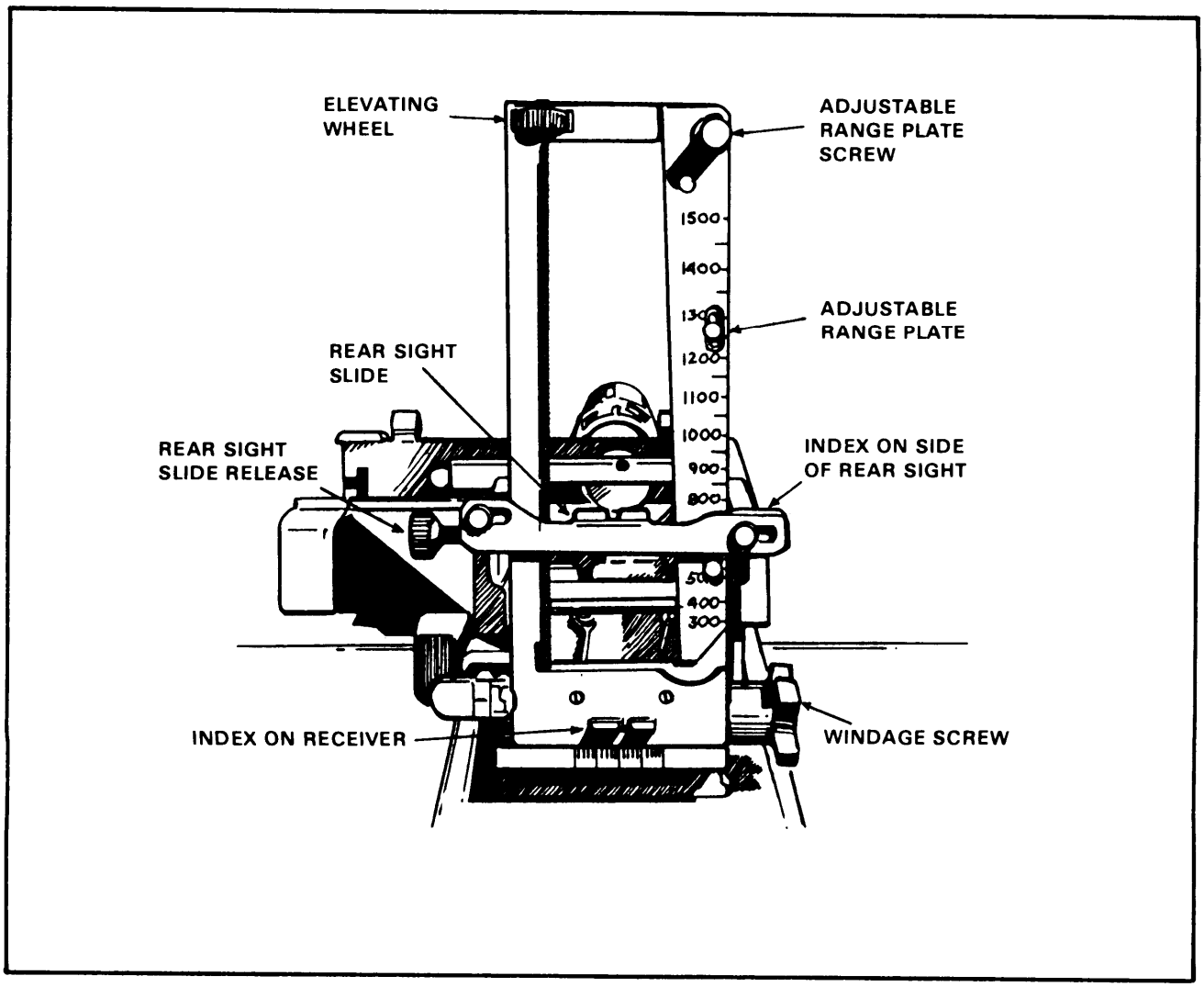


Figure 1-4. Rear sight.

Ammunition	M430 (HEDP), M383 (HE), M918 (TP), M922 (dummy).
MK 19 (MOD 3):	
Weight	75.6 pounds.
Length	43.1 inches.
Width	13.4 inches.
Height	8.8 inches.
MK 64 (MOD 7) gun cradle:	
Weight	21 pounds.
Length	17.5 inches.
Height	9.5 inches.
Tripod (M3) weight	44 pounds.
Total weight, weapon and cradle	96.6 pounds.
Total system weight (gun, cradle, and tripod)	140.6 pounds.
Mounts	M3 tripod, M4 pedestal, M66 ring, HMMWV weapon platform, M113 APC commander's cupola.

Table 1-1. Equipment data.

Maximum range	2,212 meters.
Maximum effective range	1,500 meters (point target) 2,212 meters (area target).
Rates of fire:	
Sustained	40 rounds each minute.
Rapid	60 rounds each minute.
Cyclic	325-375 rounds each minute.
Weapon life	50,000 rounds.
Elevation, tripod controlled	100 mils.
Depression, tripod controlled	250 mils.
Traverse, tripod controlled	800 mils (400 left and right).
Planned operating load	400 rounds for HMMWV and all others as prescribed by local commanders.
Weight of 48 rounds in M548 metal container	62 pounds.
Muzzle velocity	790 feet each second.
Angle of fire	Capable of automatic fire at any angle between 0 and 70 degrees elevation, based on the mounting arrangements.
Recoil forces (average)	500 pounds recoil.

Table 1-2. Operational characteristics.

d. The MK 19 uses 40-mm cartridges (Figure 1-5):

> WARNING
> USE ONLY PRESCRIBED AMMUNITION. DO NOT MIX TYPES OF AMMUNITION. TO DO SO COULD RESULT IN INJURY.

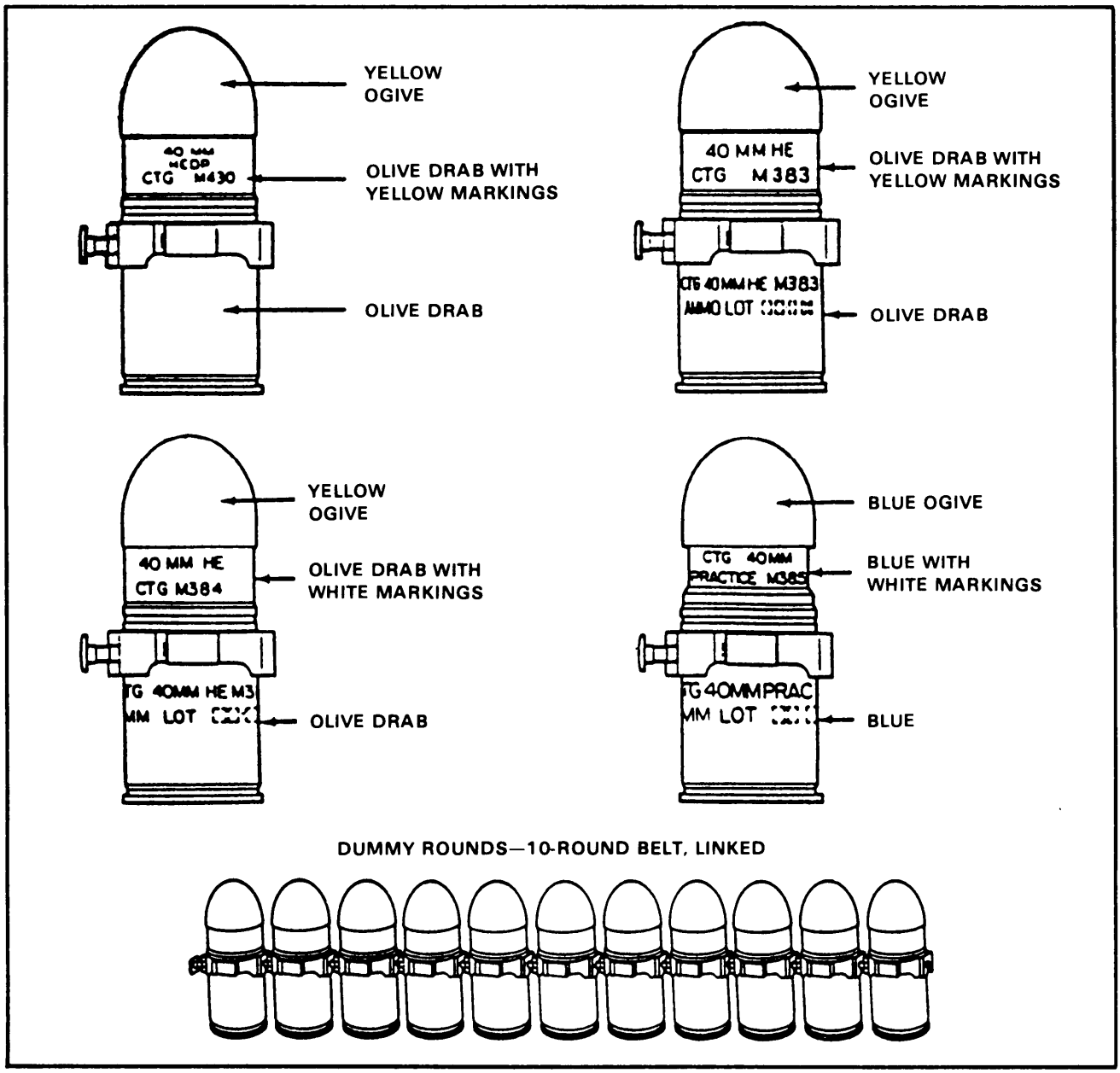


Figure 1-5. 40-mm cartridges.

(1) The HEDP (high-explosive, dual-purpose) M43Ø cartridge, joined with M16A2 links, is the standard round for the MK 19. The impact-type round penetrates 2 inches of steel armor at Ø-degree obliquity and inflicts personnel casualties in the target area. This round is packed in an M548 ammunition container (48 rounds, linked, in each container). It is olive drab with a yellow ogive and yellow markings. It has a PIBD, M549 fuze, and Comp B filler. It arms between 18 to 3Ø meters and has a casualty radius of 15 meters.

(2) The two HE (high-explosive) cartridges inflict personnel casualties in the target area with ground burst effects. Their fillers and body materials differ although performance traits are the same. Neither has the armor penetrating ability of the HEDP M43Ø round. They are both in wooden boxes, 5Ø rounds to a box.

(a) HE M383 or M383E1. These rounds are linked with M16A2 links, DODAC B571.

(b) HE M384. These rounds are linked with M16A2 links, DODAC B47Ø.

(3) The M385 practice rounds are joined with either M16A1 OR M16A2 links, B49Ø. They are packed the same as the HE rounds, in wooden boxes, 5Ø rounds to a box.

(4) The M922 dummy cartridges are joined with M16A2 links. Each MK 19 is allowed one 1Ø-round belt (DODAC B472), which is packed in an M2A1 metal box. These inert cartridges are used to check weapon function and for crew training.

CHAPTER 2
OPERATION AND FUNCTION

This chapter includes clearing, disassembly and assembly, loading, operating precautions, and cycle of operation.

2-1. CLEARING

Clear the MK 19 differently in a firing situation than in a nonfiring situation:

a. Firing Situation. In a firing situation, use the following procedures to clear the MK 19.

(1) Move the safety switch to SAFE ("S") (Figure 2-1). If all the ammunition has NOT been fired, the bolt is to the rear and a round is on the bolt face.

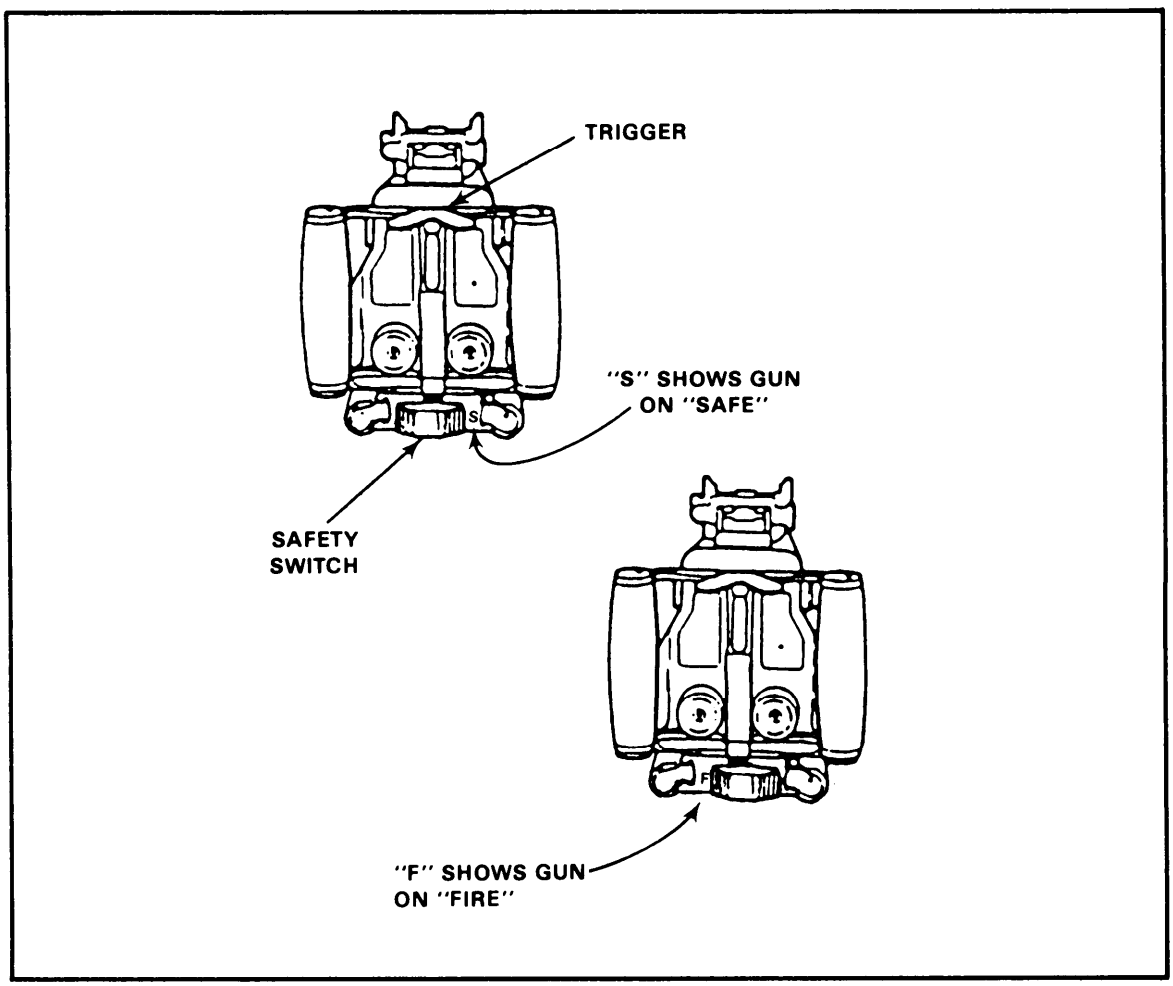


Figure 2-1. SAFE ("S") position.

(2) Open the top cover assembly (Figure 2-2).

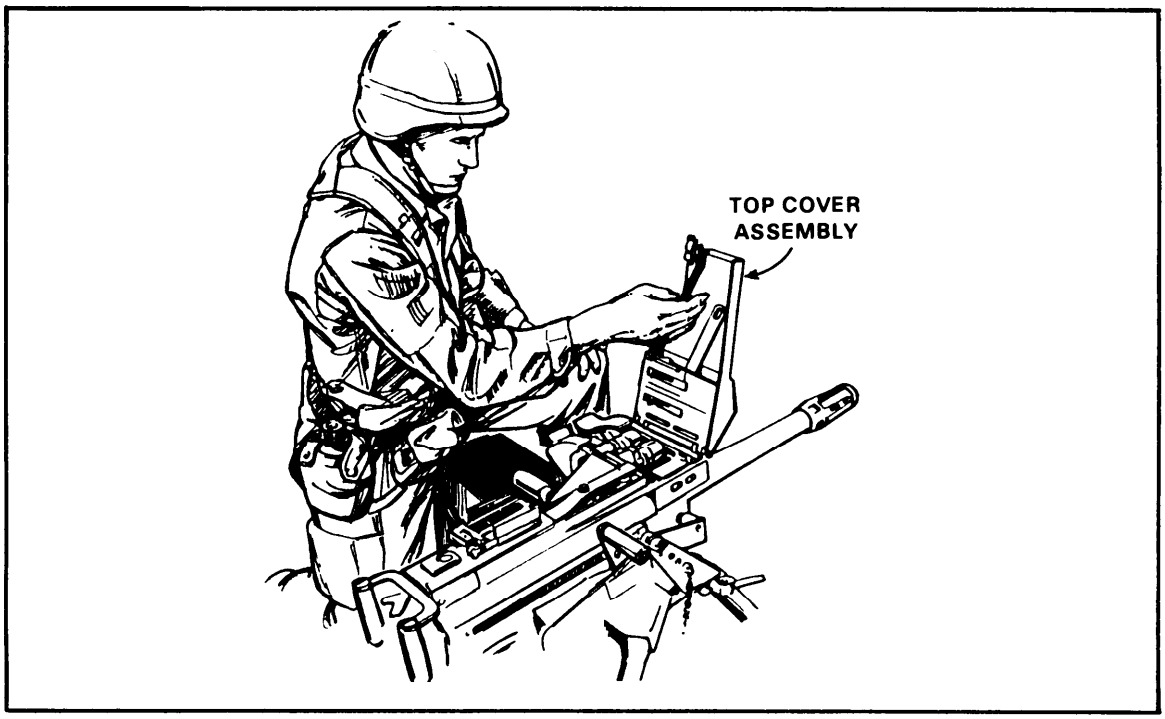


Figure 2-2. Top cover assembly.

(3) Take the ammunition from the feed tray by reaching beneath the feedtray and pressing the primary and secondary positioning pawls. At the same time, slide the linked rounds out of the MK 19 through the feed throat (Figure 2-3).

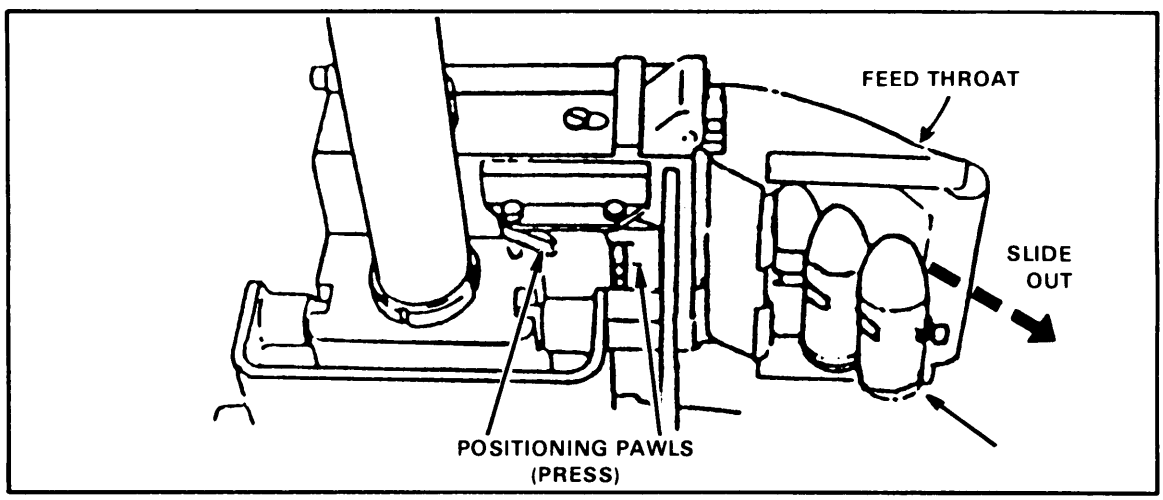


Figure 2-3. Removal of linked rounds from feeder.

(4) Insert a section of the cleaning rod or bayonet through either side of the receiver rail. Place it on top of the live round or cartridge case, as close to the bolt face as possilbe, and push down. This action forces the round out of the MK 19.

WARNING

USE EXTREME CARE WHEN TAKING OUT A LIVE ROUND WITH A BAYONET. ONCE THE ROUND IS FREE, CATCH IT IN ONE HAND--DO NOT ALLOW IT TO HIT THE GROUND.

(5) Lower and pull both charger handles to the rear (Figure 2-4).

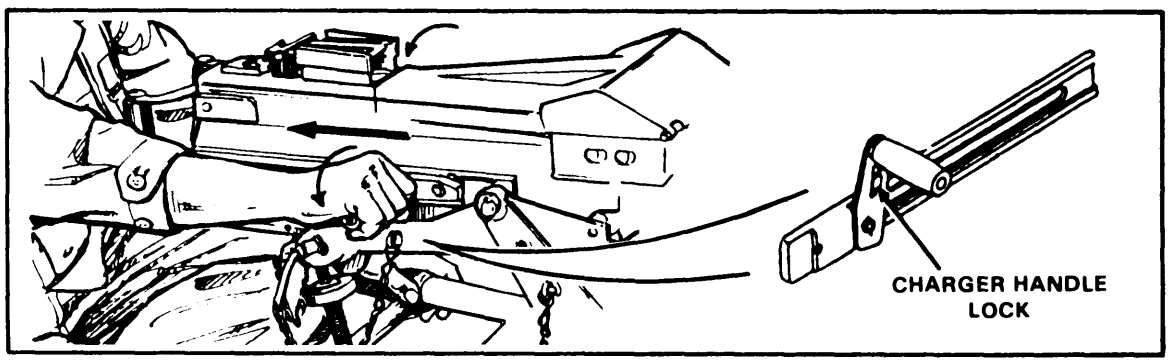


Figure 2-4. Charger handles.

(6) Inspect the chamber and bolt face again to ensure that no live rounds are in the weapon.

(7) Place the safety switch on FIRE (“F”) (Figure 2-1).

(8) While maintaining rearward pressure on the charging press the trigger and ease the bolt forward.

(9) Place the safety switch on SAFE.

b. Nonfiring Situation. In a nonfiring situation, use the following procedures to clear the MK 19:

(1) Place the safety switch on SAFE (Figure 2-1).

(2) Open the top cover assembly.

(3) Lower one charger handle.

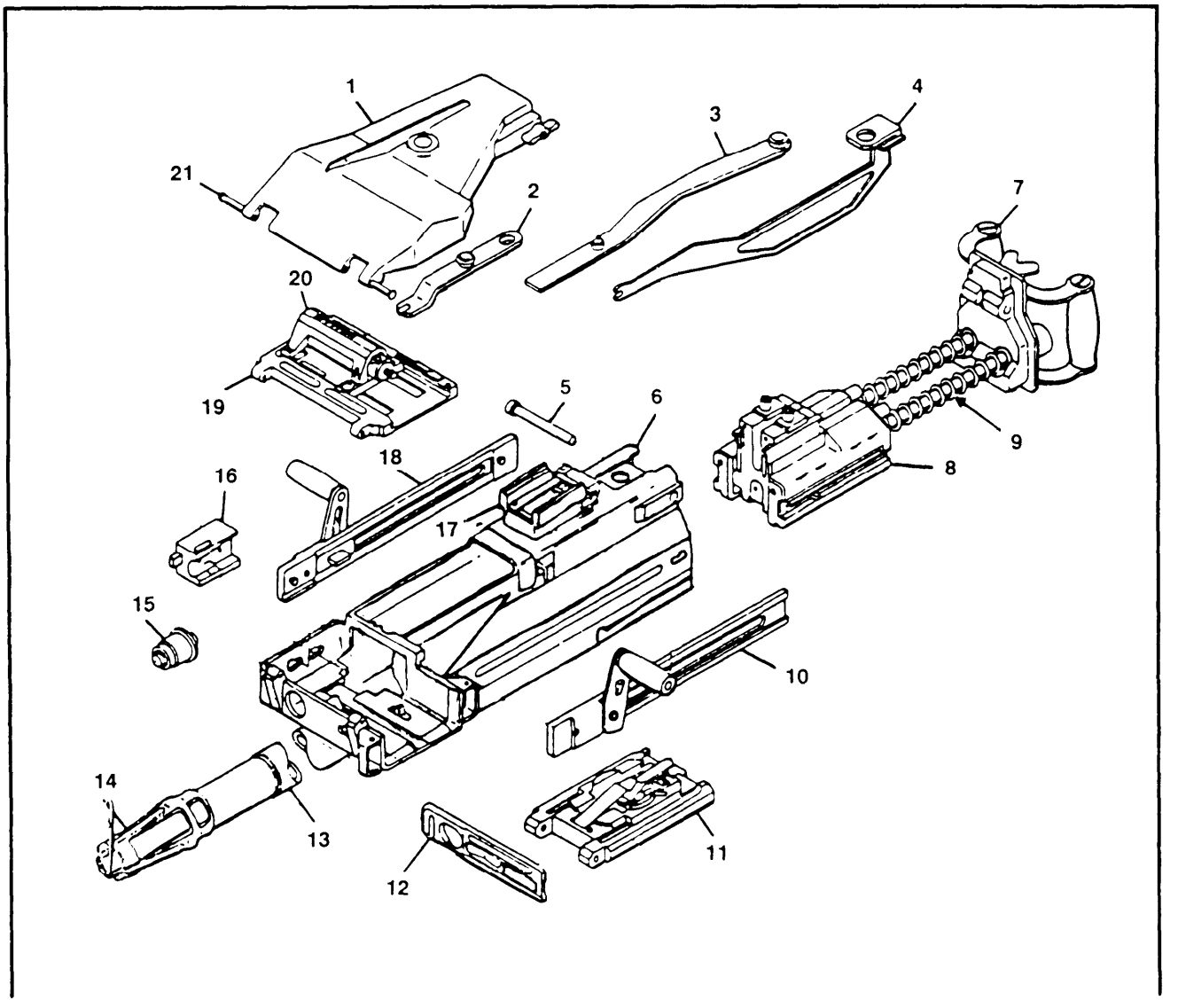
(4) Pull the charger handle slightly to the rear, allowing sufficient space between the face of the bolt and the chamber to see both. Check for live ammunition.

(5) Ride the bolt forward.

(6) Return the charger handle to its original upright position.

2-2. DISASSEMBLY AND ASSEMBLY

Only qualified ordnance personnel should disassemble the MK 19 beyond the steps detailed in this pragraph (Figure 2-5).



1. TOP COVER ASSEMBLY.
2. SECONDARY DRIVE LEVER ASSEMBLY.
3. PRIMARY DRIVE LEVER.
4. VERTICAL CAM ASSEMBLY.
5. BACKPLATE PIN ASSEMBLY.
6. RECEIVER ASSEMBLY.
7. CONTROL GRIP ASSEMBLY.
8. BOLT AND BACKPLATE ASSEMBLY.
9. GUIDE ROD AND SPRING.
10. CHARGER ASSEMBLY, LEFT.
11. SEAR ASSEMBLY.
12. ALIGNMENT GUIDE ASSEMBLY.
13. BARREL.
14. FLASH SUPPRESSOR.
15. ROUND POSITIONING BLOCK.
15. OGIVE PLUNGER ASSEMBLY.
16. ROUND POSITIONING BLOCK.
17. REAR SIGHT ASSEMBLY.
18. CHARGER ASSEMBLY, RIGHT.
19. FEED TRAY.
20. FEED SLIDE ASSEMBLY.
21. COVER PINS.

Figure 2-5. MK 19 disassembled.

a. Disassembly. Disassembly includes removal of parts to the extent explained in this chapter. To ensure that parts are not lost and are replaced properly, place them (in the order in which they are taken off) on a clean flat surface. A spent cartridge casing, a section of the cleaning rod, and a cartridge link may be used as removal and replacement tools. To disassemble--

(1) Clear the weapon.

(2) Take out the secondary drive lever:

(a) Raise the top cover assembly and push the secondary drive lever pivot post from the outside of the top cover assembly. Separate the secondary drive lever from the top cover assembly (Figure 2-6).

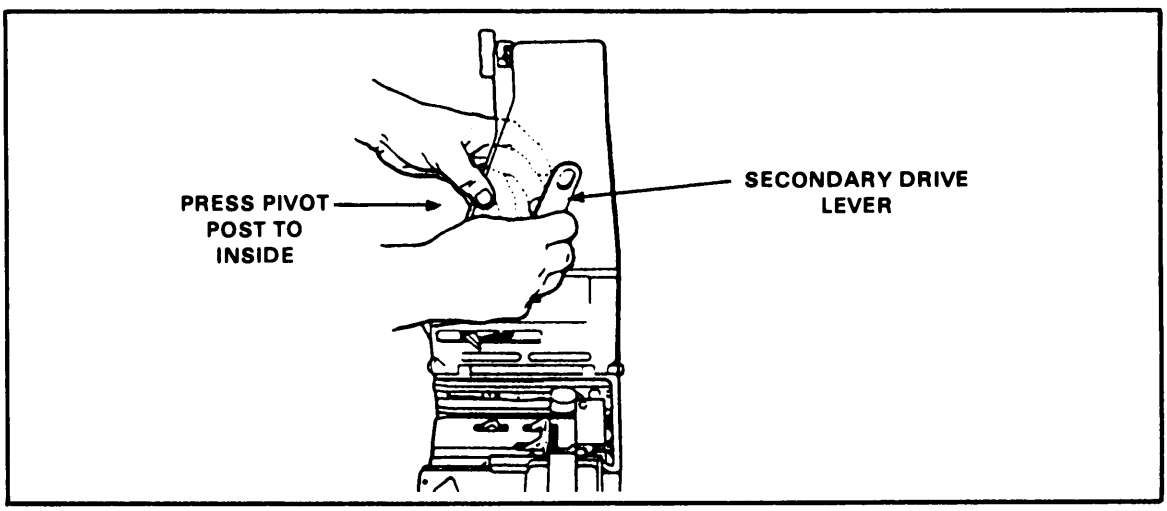


Figure 2-6. Secondary drive lever removal.

(b) Take the secondary drive lever from the slide assembly, and allow the feed slide and tray assembly to close.

(3) Take off the top cover assembly. Hold it straight up with one hand and pull the top cover pins from both sides (Figure 2-7). Lift the top cover assembly straight up and off.

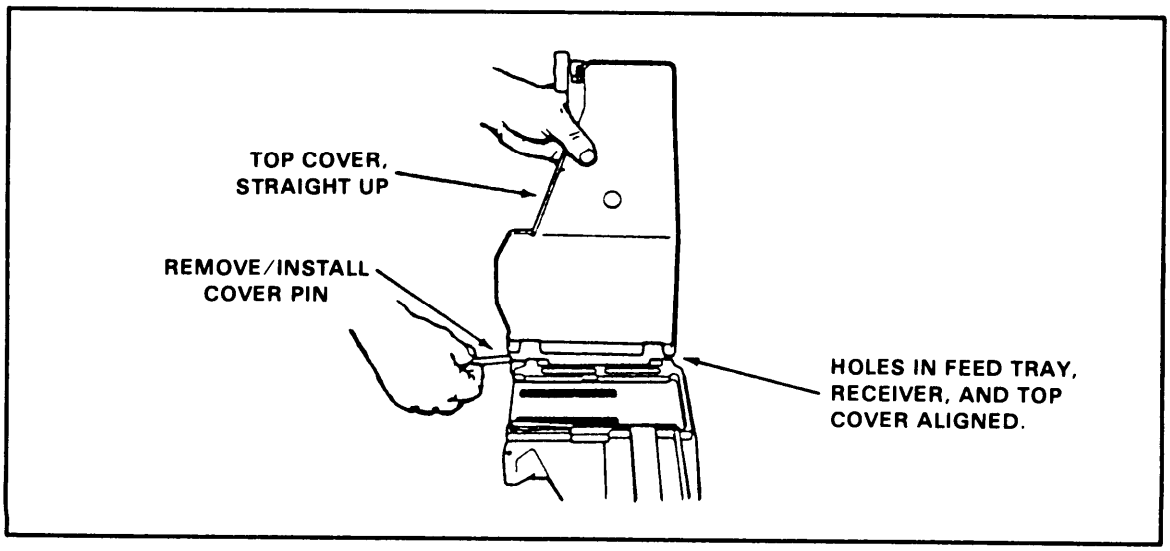


Figure 2-7. Top cover assembly.

(4) Take out the feed slide assembly and feed tray:

(a) Align the tabs on the feed slide assembly with the slots in the feed tray and lift them straight up (Figure 2-8).

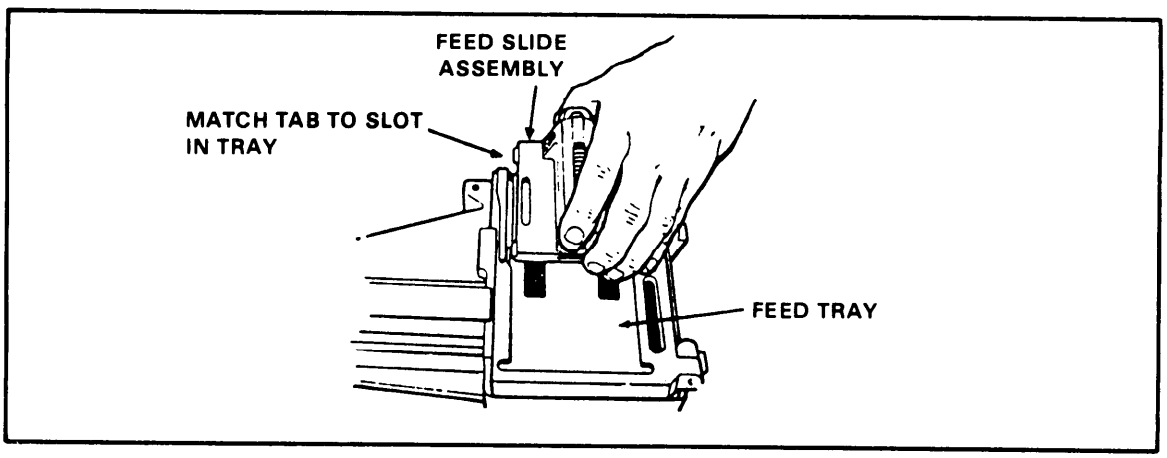


Figure 2-8. Feed slide assembly.

(b) Take out the feed tray by lifting it straight up (Figure 2-9).

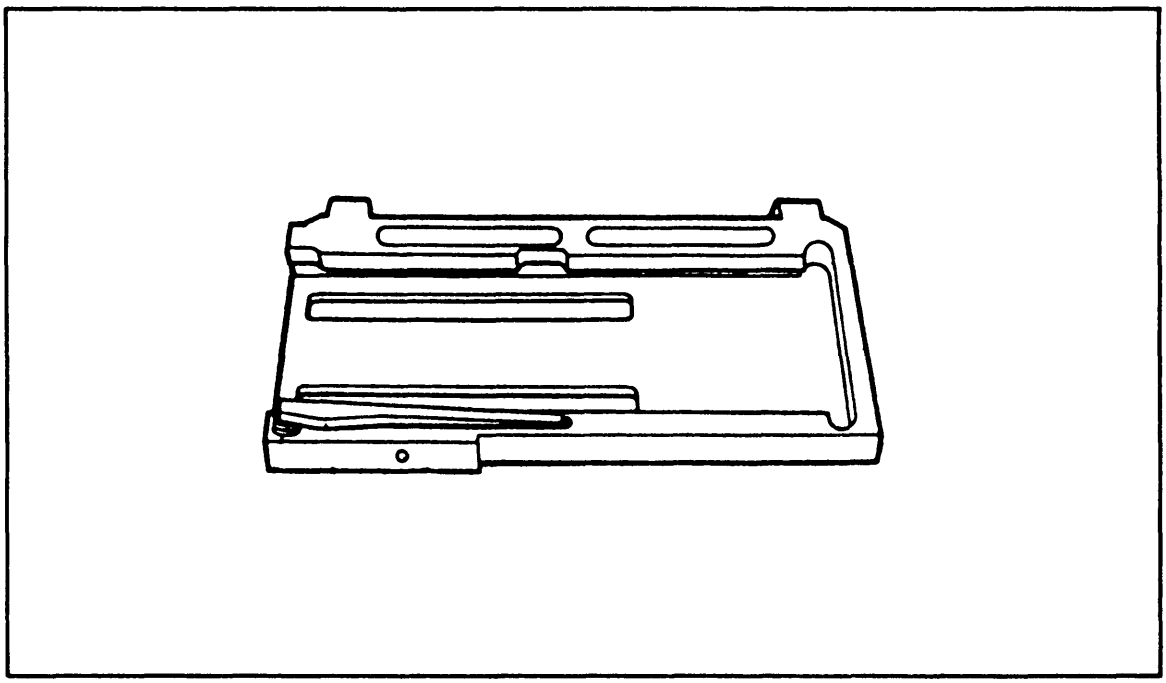


Figure 2-9. Feed tray.

(5) Take out the bolt and backplate assembly:

(a) Place the safety switch in the FIRE position.

(b) Take out the backplate pin using the rim of a spent cartridge case or metal link. Pry outward on the pin lip and remove the pin with the fingers (Figure 2-10).

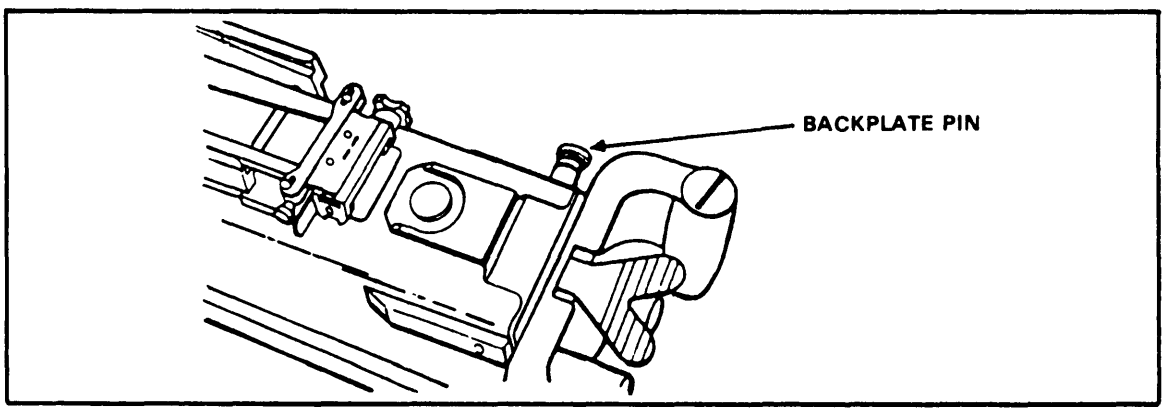


Figure 2-10. Backplate pin.

CAUTION
PRIOR TO TAKING OUT THE BACKPLATE PIN, ENSURE THAT THE BOLT IS IN THE FORWARD POSITION.

(c) Grasp the control grips with both hands and lift up slightly to disengage the backplate from the locking lugs in the receiver. Pull the bolt and backplate assembly to the rear. Once the bolt clears the sear, catch the bolt in one hand to prevent damage to the backplate assembly (Figure 2-11).

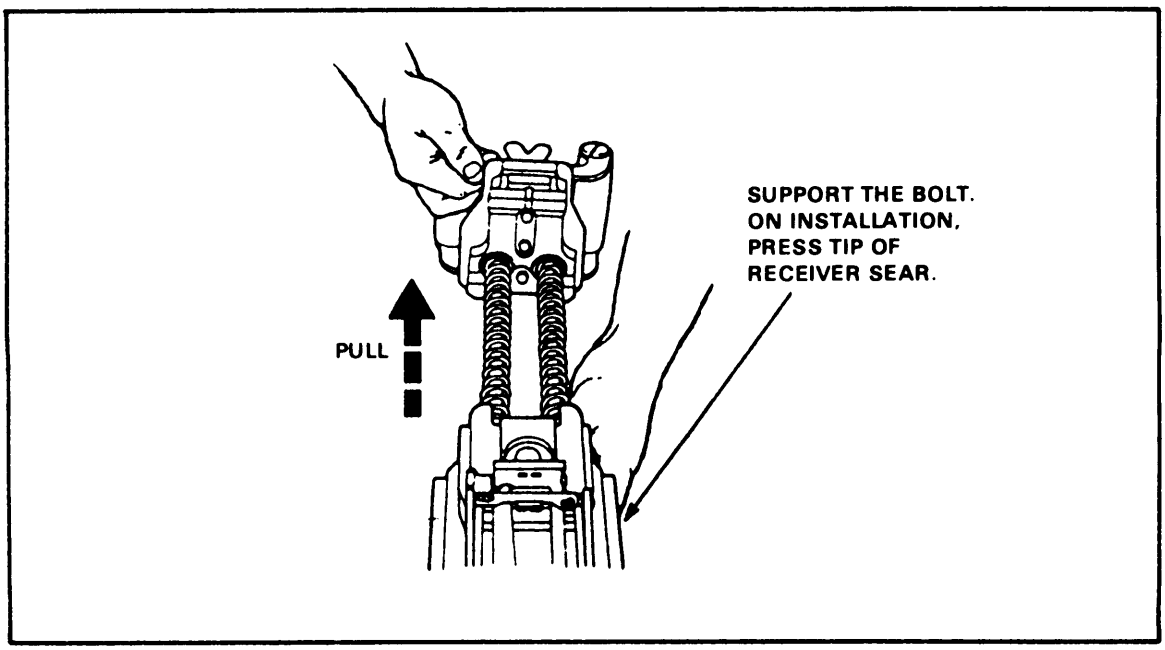


Figure 2-11. Removal of bolt and backplate assembly.

(6) Take off the primary drive lever and vertical cam:

(a) Reach under the top of the receiver and locate the drive lever lock. Slide the lock a quarter inch to the rear.

(b) Press down on the primary drive lever pivot post, which releases both the primary drive and vertical cam.

(c) Pull the primary drive lever from the front of the weapon and the vertical cam from the back (Figure 2-12).

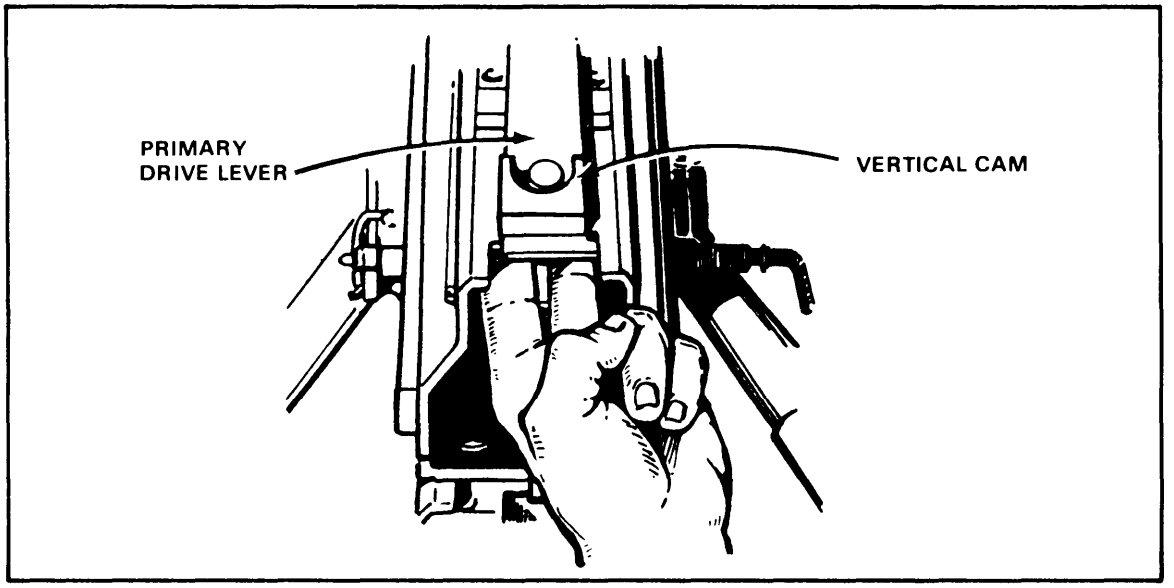


Figure 2-12. Primary drive lever and vertical cam.

(7) Take off the sear assembly:

(a) Turn the MK 19 on its side or upside down and use the rim of a spent cartridge case to lift up the sear lock plunger. At the same time, squeeze the sear and rotate the assembly 90 degrees to the right or left (Figure 2-13). Take off the sear assembly by pulling it away from the weapon. Keep pressure on the sear until the assembly comes off.

(b) Place the safety switch in the SAFE position.

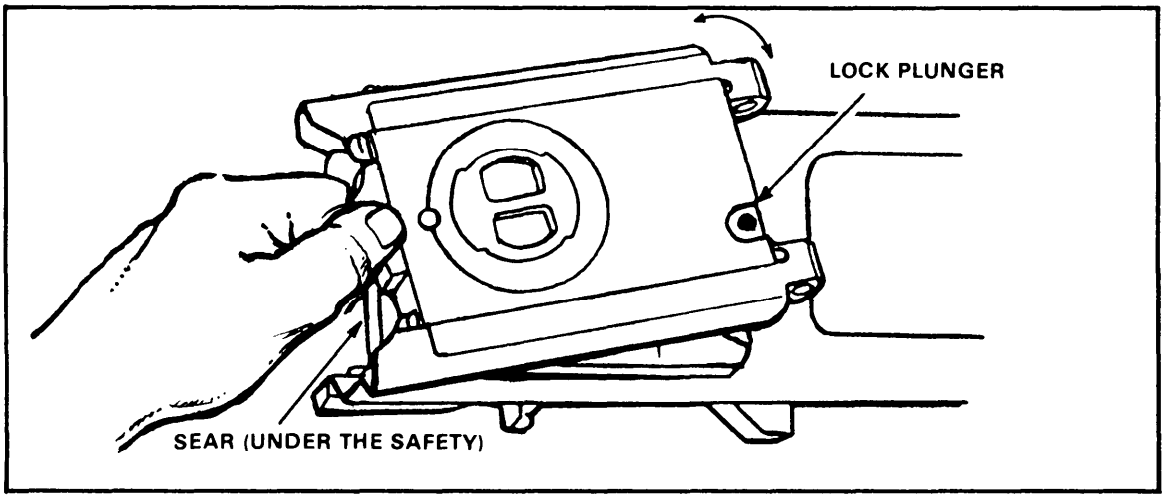


Figure 2-13. Sear assembly.

(8) Take off the alignment guide:

(a) Depress the tip of the alignment guide spring with the finger.

(b) Slide the alignment guide out of the receiver, pulling the assembly slightly rearward (Figure 2-14).

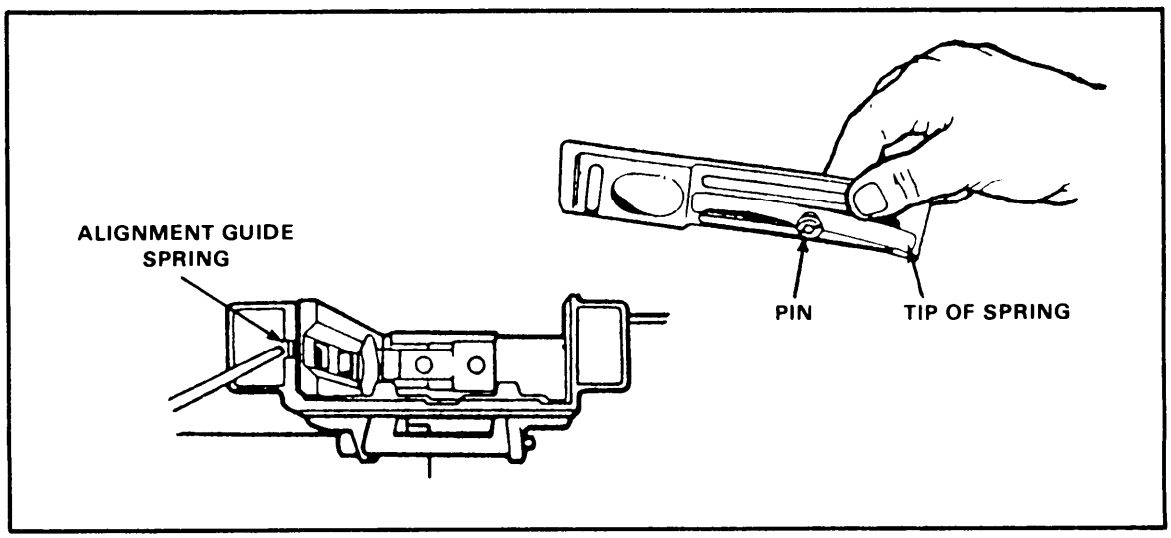


Figure 2-14. Alignment guide.

(9) Take out the ogive plunger, by pulling the ogive plunger assembly out through the inside wall of the receiver (Figure 2-15).

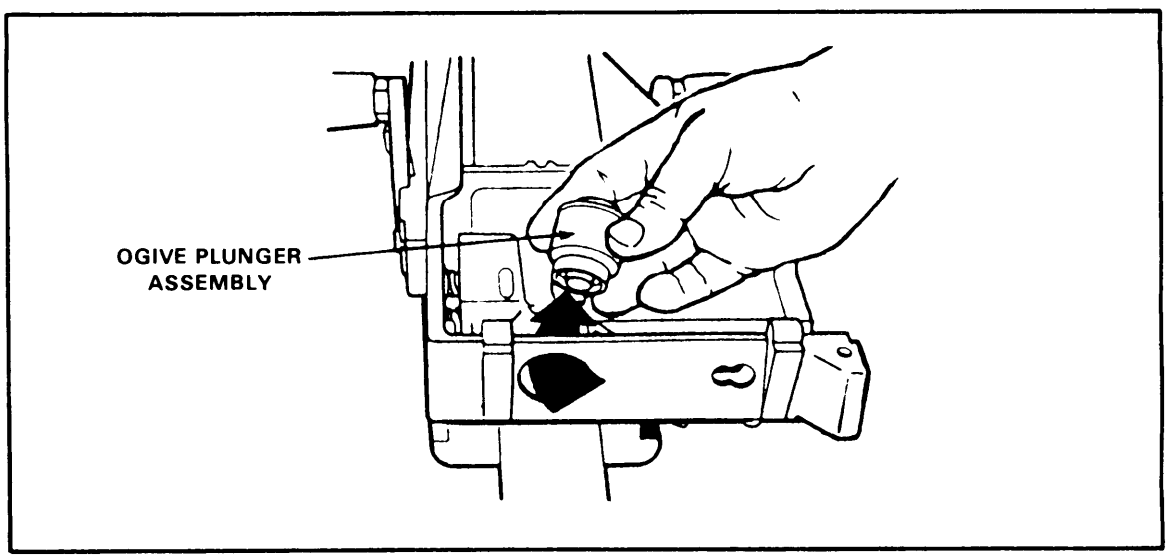


Figure 2-15. Ogive plunger

(10) Take off the round-positioning block by pushing it into the side of the gun, sliding it forward, and releasing it from the keyslots in the receiver wall (Figure 2-16).

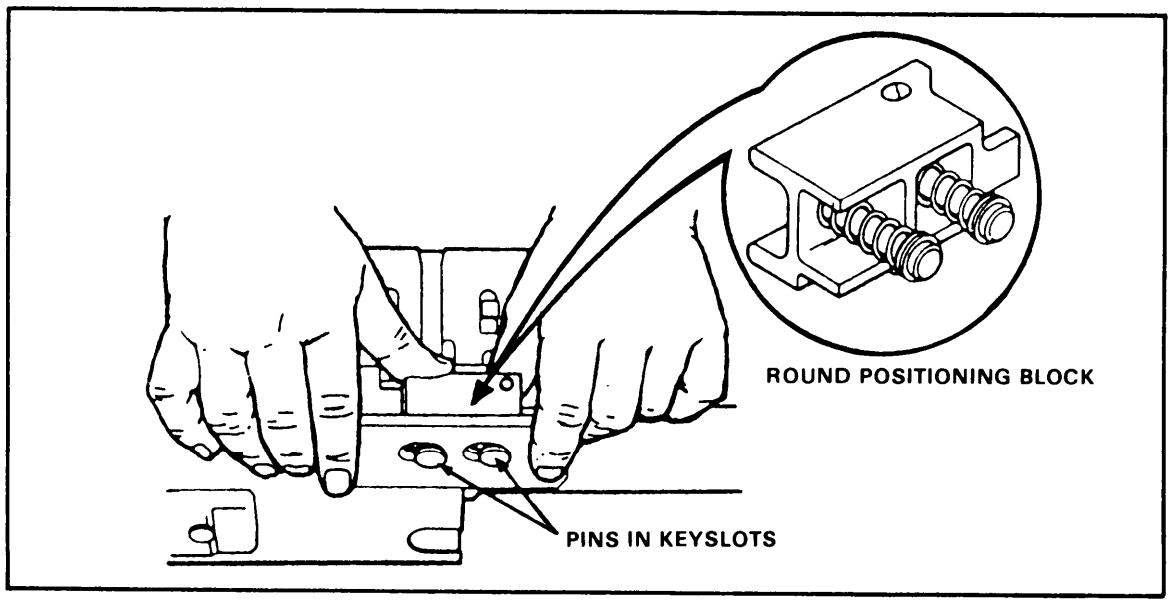


Figure 2-16. Round-positioning block.

(11) Take out the charger assemblies from both sides. Place the charger assemblies in the upright position. Using a metal link or spent cartridge case, retract the lock plunger at the base of the charger arm. Slide the charger housing rearward to disengage the lugs from the keyslots in the receiver. Lift the charger assembly away from the receiver (Figure 2-17).

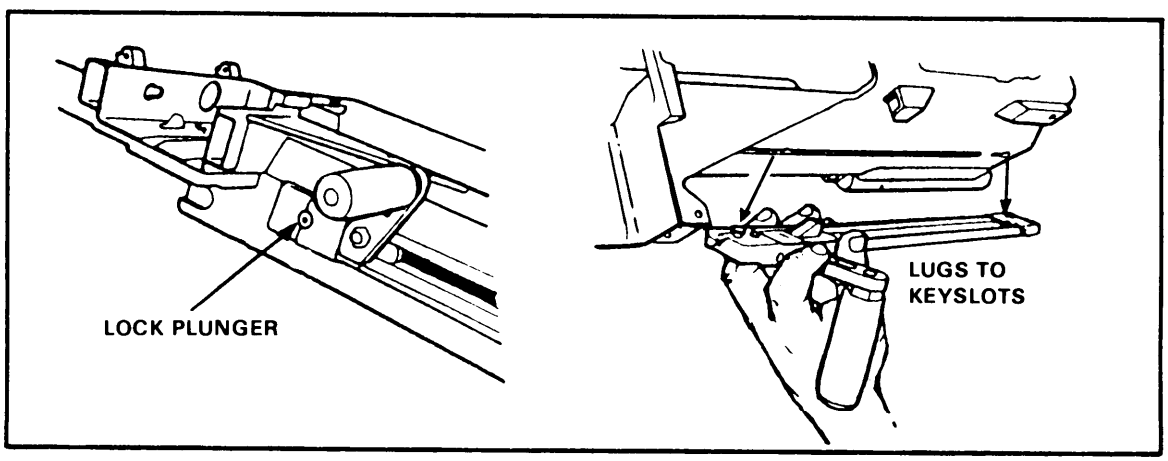
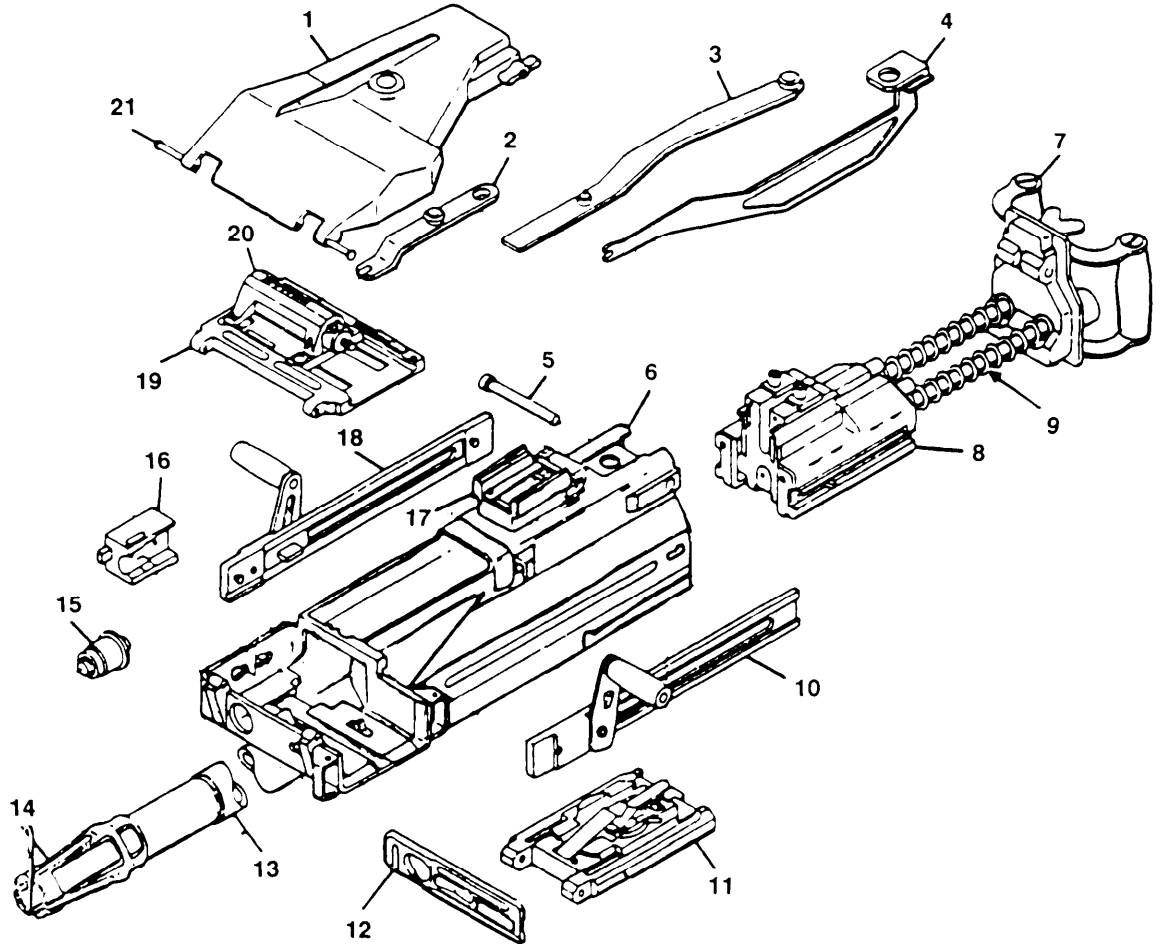


Figure 2-17. Charger assemblies.

NOTE: Further disassembly must be don by qualified ordnance personnel.

b. Assembly. To assemble the gun, replace the groups in the reverse order from the order in which they were taken off (Figure 2-18).



1. TOP COVER ASSEMBLY.
2. SECONDARY DRIVE LEVER ASSEMBLY.
3. PRIMARY DRIVE LEVER.
4. VERTICAL CAM ASSEMBLY.
5. BACKPLATE PIN ASSEMBLY.
6. RECEIVER ASSEMBLY.
7. CONTROL GRIP ASSEMBLY.
8. BOLT AND BACKPLATE ASSEMBLY.
9. GUIDE ROD AND SPRING.
10. CHARGER ASSEMBLY, LEFT.
11. SEAR ASSEMBLY.
12. ALIGNMENT GUIDE ASSEMBLY.
13. BARREL.
14. FLASH SUPPRESSOR.
15. OGIVE PLUNGER ASSEMBLY.
16. ROUND POSITIONING BLOCK.
17. REAR SIGHT ASSEMBLY.
18. CHARGER ASSEMBLY, RIGHT.
19. FEED TRAY.
20. FEED SLIDE ASSEMBLY.
21. COVER PINS.

Figure 2-18. MK 19 disassembled.

(1) Replace the charger assemblies.

(2) Replace the round-positioning block.

(3) Replace the ogive plunger.

(4) Replace the alignment guide.

(5) Replace the primary drive lever and vertical cam.

(6) Attach the sear assembly: depress the sear spring and turn the assembly 90 degrees toward the barrel's center line until the assembly locks into position.

(7) Insert the bolt and backplate assembly.

(a) Ensure that the cocking lever is forward and insert the bolt and backplate assembly into the receiver (Figure 2-19) .

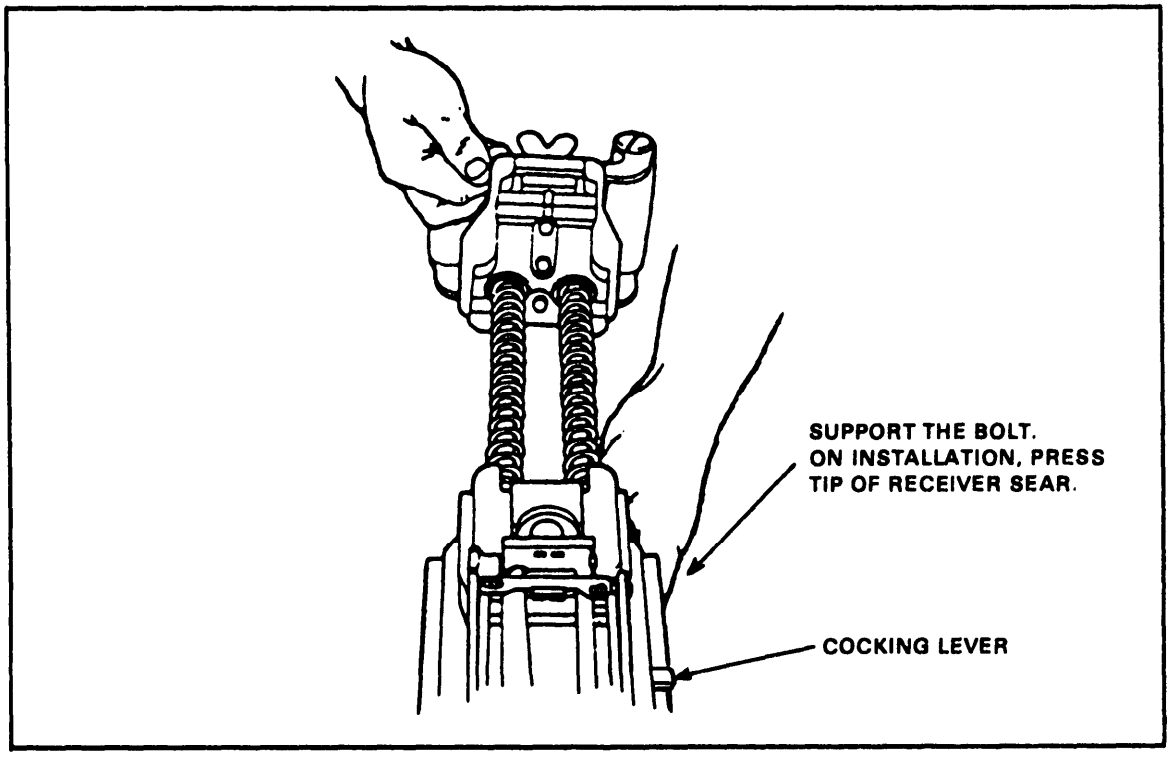


Figure 2-19. Insertion of bolt and backplate assembly.

NOTE: Before inserting the assembly, place the cocking lever in the forward position. Ensure that the safety switch is in the FIRE position so the sear can easily be depressed.

(b) Press the receiver sear and slide the bolt assembly forward until the retainer pin holes in the backplate and receiver are aligned.

(c) Insert the backplate retainer pin to lock the assembly into position.

(8) Place the feed tray assembly on the receiver. Place the feed slide assembly into the cutout slots on the feed tray.

(9) Attach the top cover assembly:

(a) Align the pinholes in the top cover assembly with the pinholes in the feed tray.

(b) Hold the cover straight up and insert the pins into both sides of the cover.

CAUTION
INSERT THE TOP COVER PINS USING ONLY THE HAND. FORCING THE PIN WILL BREAK THE WELDED CROSSPIN.

(10) Replace the secondary drive lever:

(a) Lift the feed slide assembly and feed tray.

(b) Place the forked end of the secondary drive lever on the inner feed slide pin (Figure 2-20).

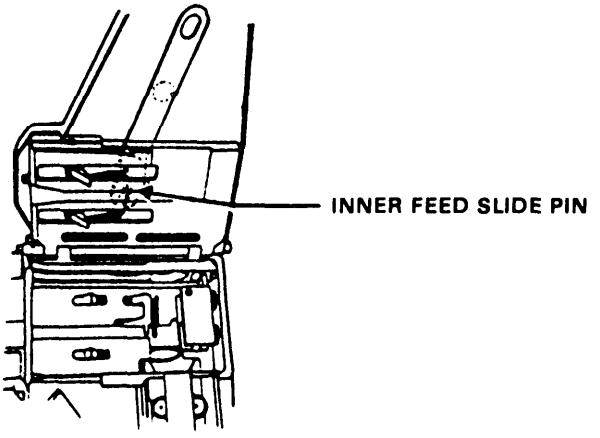


Figure 2-20. Replacement of secondary drive lever.

CAUTION
IF THE SECONDARY DRIVE LEVER IS NOT PROPERLY ENGAGED WITH THE INNER FEED SLIDE PIN, THE WEAPON WILL NOT FIRE PROPERLY AND WEAPON DAMAGE MAY RESULT.

(c) Press the raised pivot post through he hold in the top cover assembly. Press the secondary drive lever firmly against the top cover assembly.

2-3. LOADING

Before loading, the gunner shold ensure that the MK 19 is on SAFE, the bolt is in the forward position, and the feed throat is attached to the weapon.

Before loading, attach the feed throat (Figure 2-21) by squeezing the spring-loaded pins on the feed throat (l); insert the feed throat on both sides of the feeder (2). Make sure that the feed throat points down.

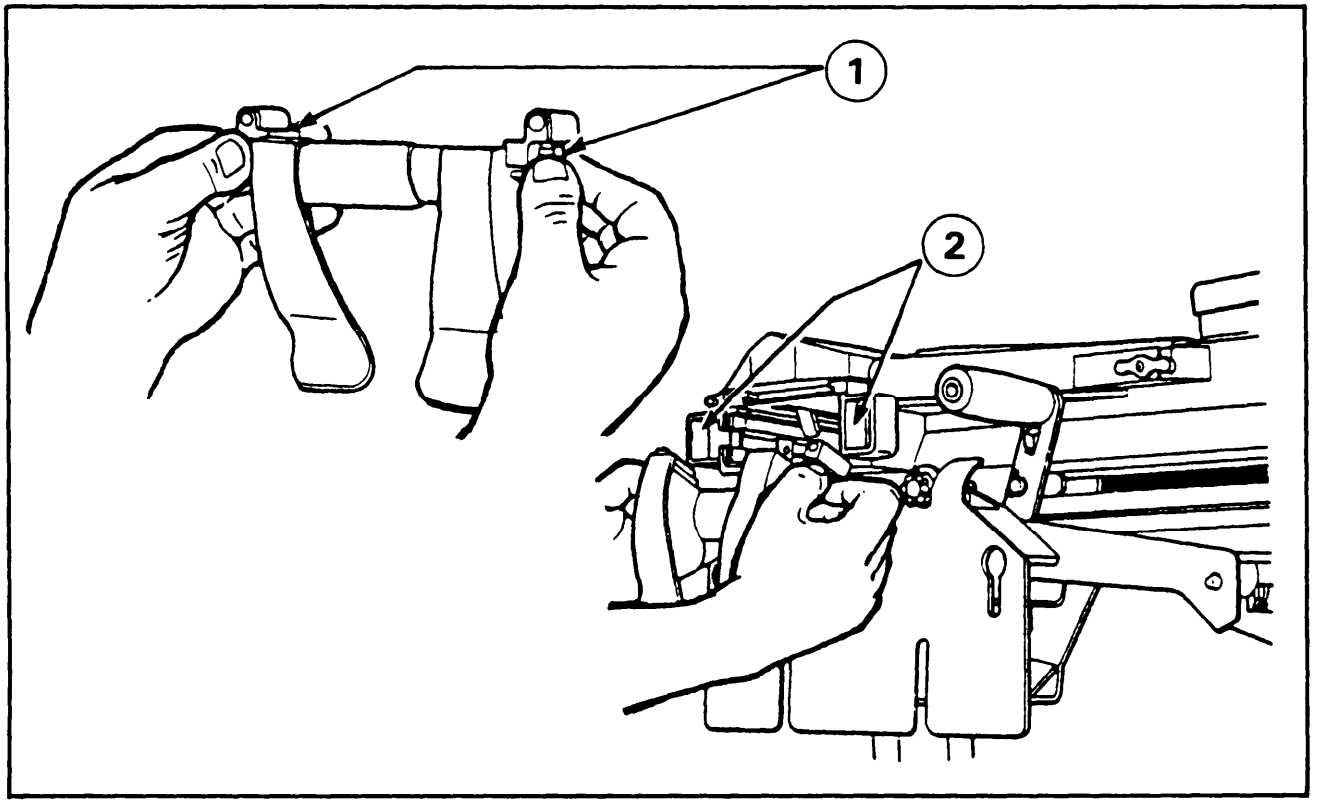


Figure 2-21. Attachment of feed throat.

b. When loading, use the following procedures:

(1) Insert the first round into the feeder (female link first) (Figure 2-22).

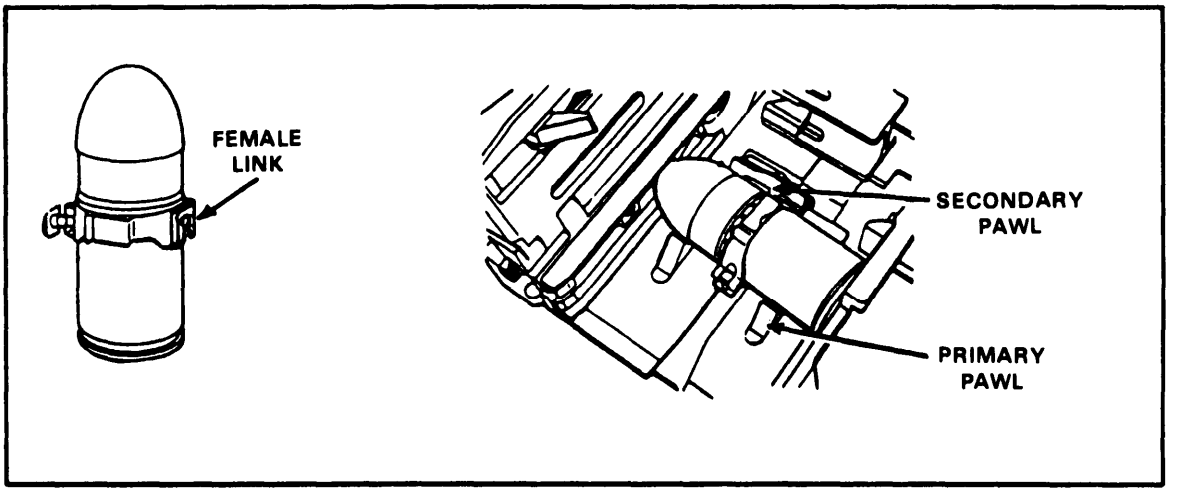


Figure 2-22. Loading of first round.

(2) Push the round across the secondary feed pawl. To move the feed slide assembly to the left (Figure 2-23, push the secondary drive lever to the right. Close the cover.

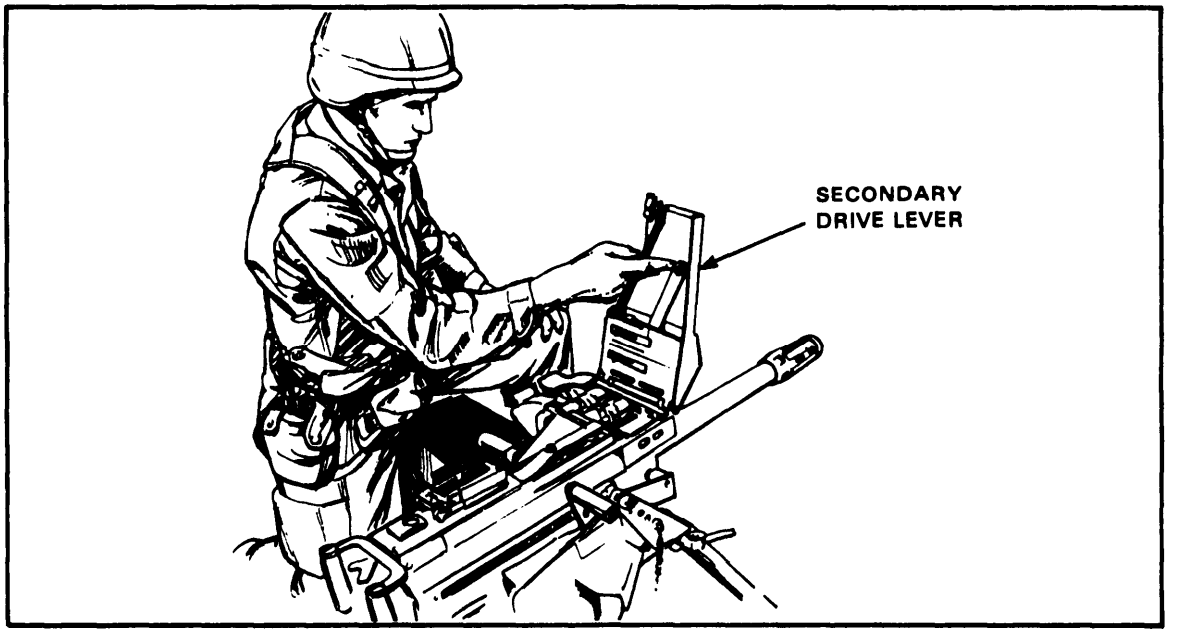


Figure 2-23. Positioning of feed slide assembly.

(3) Grasp the charger handles with the palms down (Figure 2-24). Press in on the charger handle locks. Rotate the handles down and pull them sharply to the rear (A). After locking the blot to the rear, return the charger handles forward to their original upright position (B).

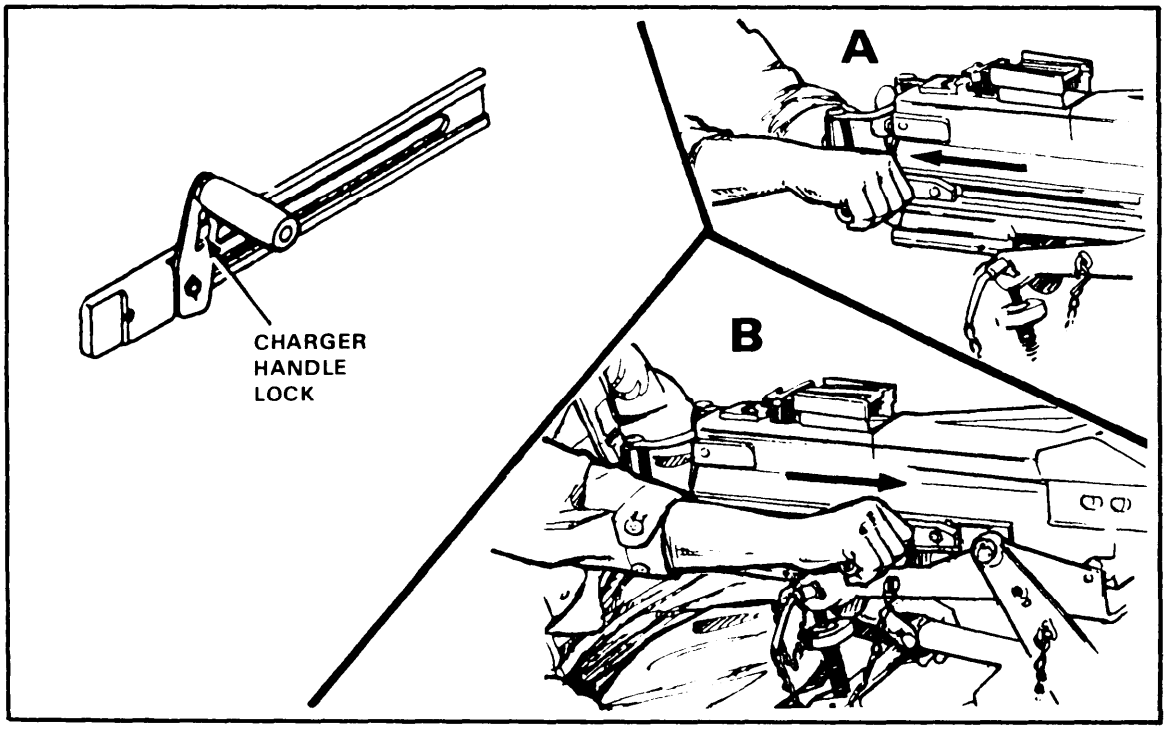


Figure 2-24. Charging the weapon.

CAUTION
FAILURE TO COMPLETELY PULL THE BOLT TO THE REAR MAY RESULT IN THE MISALIGNMENT OF THE M16A2 LINKS ON THE ROUND, CAUSING THE ROUND TO FEED IMPROPERLY.

(4) Place the safety switch on FIRE and press the trigger. The bolt slams forward and grasps the first round in the bolt extractors.

(5) Grasp, unlock, and turn downward the charger handles, and lock the bolt to the rear again.

(6) Ensure the safety switch is on SAFE.

(7) Return the charger handles to their original upright position .

(8) The MK 19 is ready to fire.

2-4. OPERATING PRECAUTIONS

Precautions are taken before, during, and after firing.

a. Before firing--

(1) Ensure that the correct ammunition is on hand.

(2) Ensure that the ammunition is clean and dent-free.

(3) Ensure that all ogives on the cartridges are tight.

(4) Ensure that the line of fire is clear of obstructions.

b. While firing--

(1) Ensure that the top cover is closed.

(2) Ensure that the muzzle of the MK 19 is pointed downrange at all times. In the event of a runaway gun, lower one of the charging handles.

(3) Use the suggested three- to five-round bursts.

c. After firing--

(1) Unload and clear the MK 19.

(2) Note weapon discrepancies and report them to the armorer.

(3) Clean and lubricate the MK 19 before storage.

2-5. CYCLE OF OPERATION

The MK 19 cycle of operation includes six steps: charging, extracting (delinking), cocking, firing, blowback, and automatic feeding. More than one step may be done at the same time.

a. Charging. The charger handles (Figure 2-25) are to pull the bolt (1) to the rear, aligning the round the bolt extractors. The rearward movement of the bolt

causes the primary drive lever (2) to move to the left, which moves the secondary drive lever (3) to the right. The forked end of the secondary drive lever, which rests on the inner feed slide assembly pin (4), move the feed slide assembly (5) to the right. The feed pawls (6) on the feed slide assembly move the linked rounds (7) over one place in the ammunition-feed area of the receiver. The leading round (8) lines up with the bolt extractor (9).

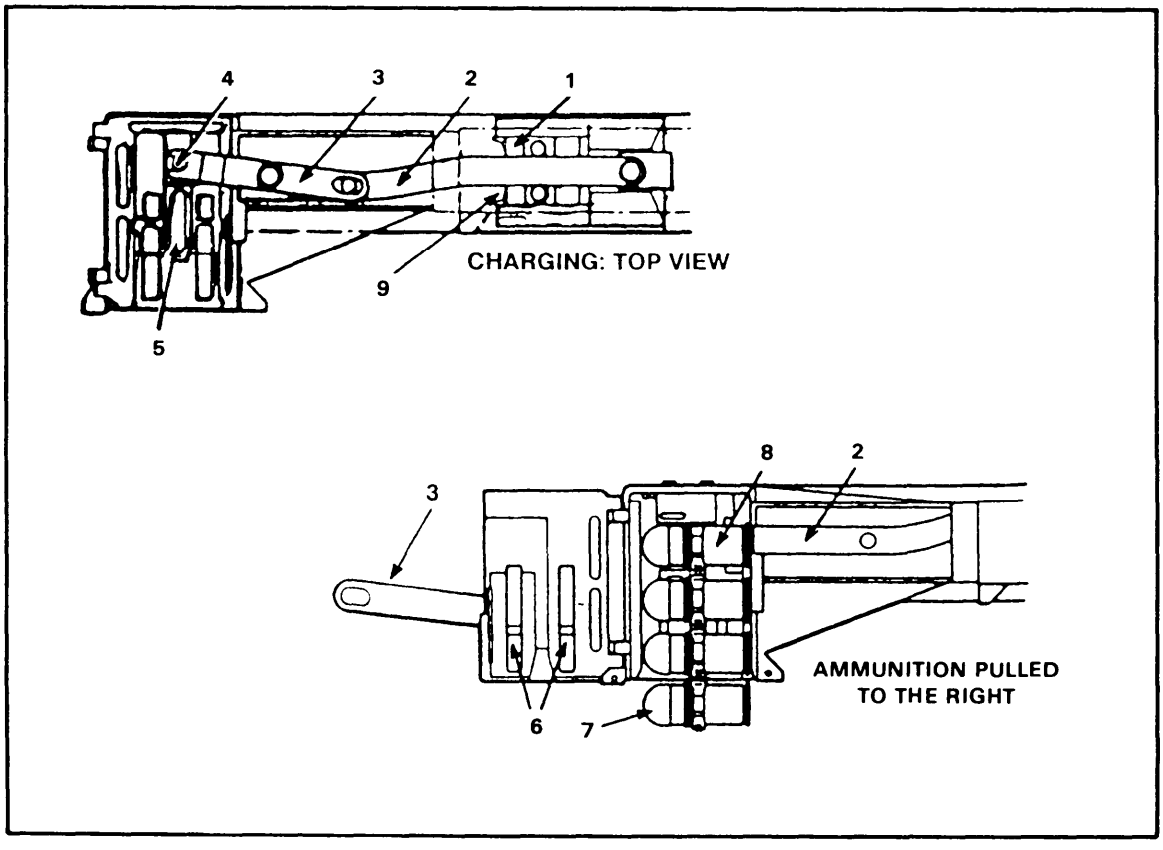


Figure 2-25. Charging cycle.

b. Extracting (Delinking). When a round is stripped from the belt, it is extracted or "delinked". This happens, after the MK 19 has been charged once, when the trigger (10) is pressed. The bolt slams forward and the bolt's extractors (11) snap over the rim of the cartridge case. When the MK 19 is charged again, the extractor pulls the leading round to the rear and separates the male and female links. The curved edge of the vertical cam (12) forces the lead round out of the extractors and into the bolt fingers (13). With the bolt completely to the rear, the round lines up with the chamber (14), and is ready to

fire. As the original leading round chambers, the next round aligns with the bolt extractors (Figure 2-26).

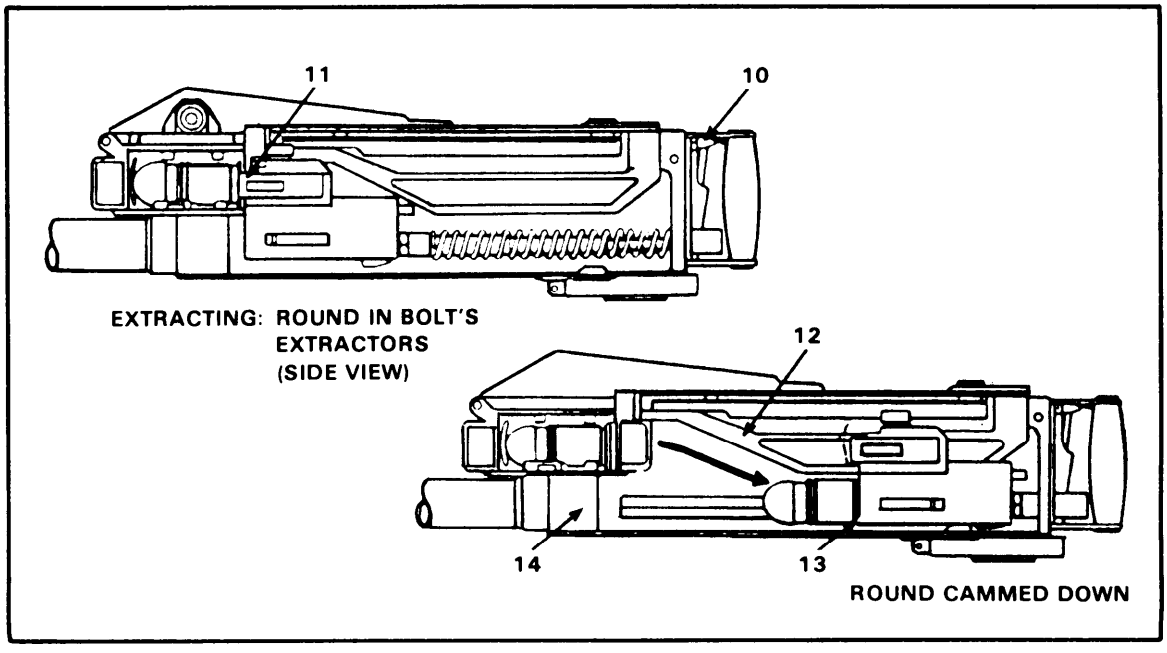


Figure 2-26. Extracting (delinking) round.

c. Cocking. The rearward movement of the bolt (Figure 2-27) causes the cocking lever (15) to retract the firing pin (16). When the cocking lever hits the rear end of the left receiver rail slot (17), the cocking lever is forced forward. The cocking lever retracts the firing pin, which the firing pin sear holds to the rear (18).

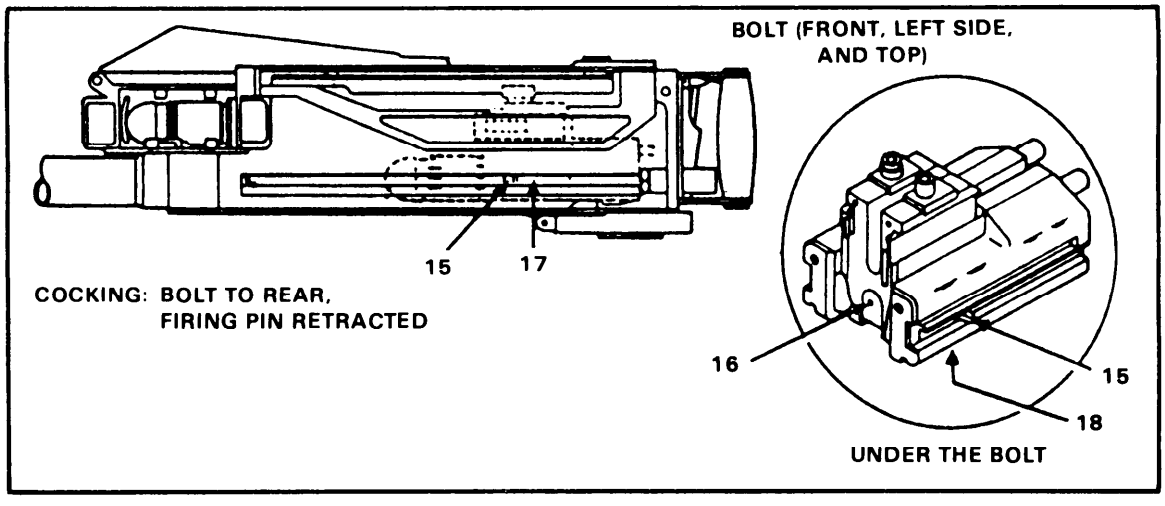


Figure 2-27. Cocking the MK 19.

d. Firing Cycle. Pressing the trigger depresses the tip of the receiver sear (21). The receiver sear disengages the bolt sear (22), which releases the bolt forward under spring pressure with a round in the blot fingers. The cocking lever hits the forward end of the left receiver rail slot, forcing the lever to the rear. The bolt sear hits a plate in the bottom of the receiver, which pushes the firing pin sear up to release the firing pin. A combination of the bolt's inertia and pressure from the firing pin spring drive the the firing pin forward. The tip of the firing pin detonates the primer. The round is not completely inside the chamber at the moment the weapon is fired. The cartridge case, held by the bolt fingers, protrudes from the chamber (23). The explosion forces the projectile down the bore (Figure 2-28).

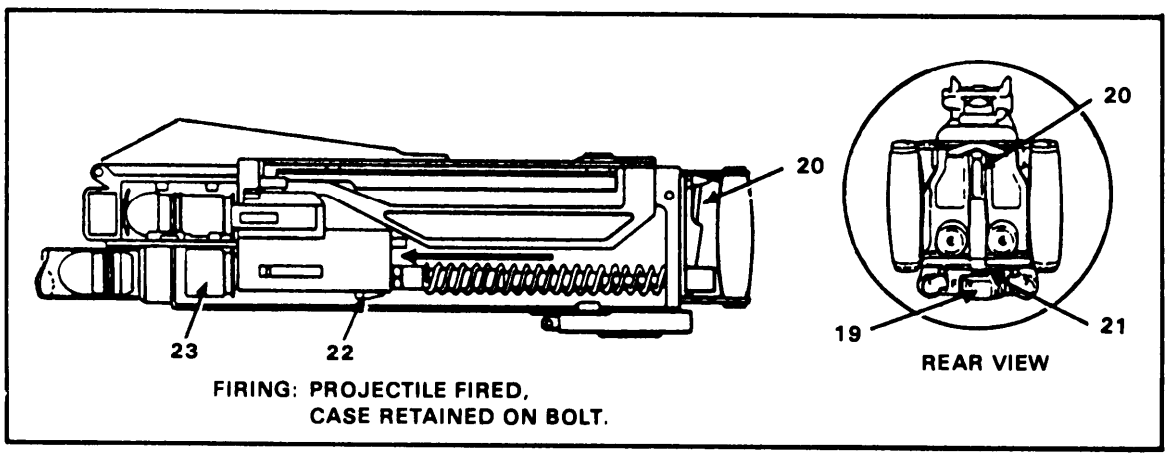


Figure 2-28. Firing cycle.

e. Blowback and Automatic Feeding Cycle. The gases from the burning powder force the bolt, with a new round in its extractors, to the rear. During this blowback, several things happen at once: the curved rail of the vertical cam delinks and forces down the new round on top of the spent case, forcing the spent case out of the bolt fingers and ejecting it out the bottom of the gun; the feed slide assembly pulls the rounds to the right in the receiver ammunition-feed area, where a new round is ready to pick up (automatic feed). During the bolt's travel to the rear, the cocking lever is pushed forward, which cocks the firing pin. When the bolt reaches the limit of its rearward travel, the recoil springs (24) are completely compressed. The bolt buffers (25) absorb over-travel, reducing trunnion load (recoil force) at the gun-mount attaching points. The bolt sear will not engage the receiver sear if the trigger is still depressed, and

another firing cycle occurs. Release of the trigger causes the bolt sear to engage the receiver sear, which prevents the bolt from going forward, and firing stops (Figure 2-29).

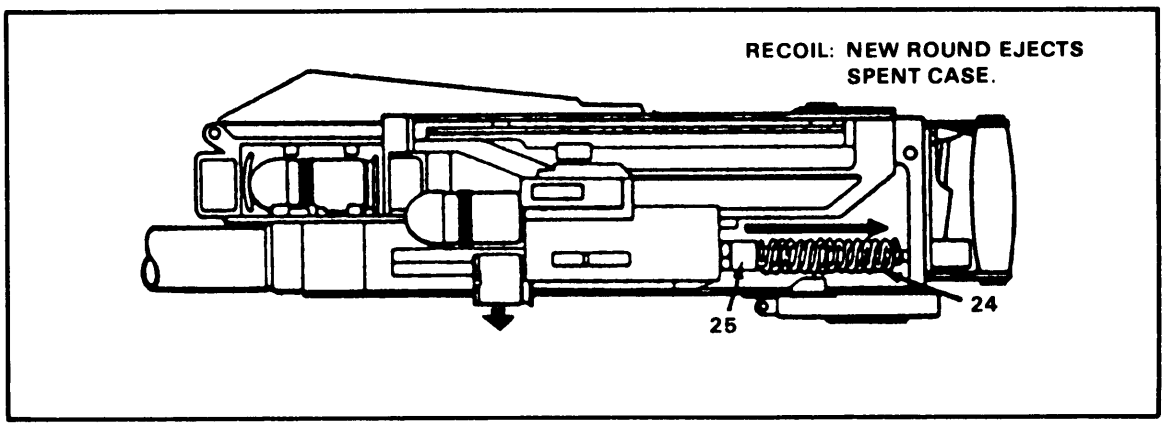


Figure 2-29. Blowback and automatic feed.

2-6. MALFUNCTIONS AND CORRECTIONS

A malfunction is a failure of the weapon to function properly. Neither defective ammunition nor improper operation of the gun by a crew member is considered a malfunction of the MK 19. The two most common MK 19 malfunctions are sluggish action and runaway gun.

a. Sluggish Gun. Excessive friction from dirt, carbon buildup, lack of lubrication, or burred parts usually cause sluggish action. Inspect the MK 19 for worn and damaged parts, and replace them as necessary.

b. Runaway Gun. A runaway weapon continues to fire after the trigger has been released. Worn parts or short recoil of the bolt assembly may cause runaway gun. Consider the amount of ammunition left and the type of MK 19 mount used when finding the best way to stop the weapon.

(1) If ammunition is not low and the MK 19 is used in the free gun mode, keep rounds on target until the all the rounds on the belt have been fired.

(2) If the MK 19 is mounted on either the M3 tripod or on a vehicle with the T&E (traversing and elevating) mechanism attached, hold the grip with one hand. At the same time, press the charger handle locks and lower one charger handle. This action interrupts the cycle of causing the MK 19 to cease firing.

CAUTION
DO NOT TRY TO BREAK THE AMMUNITION BELT.

c. Immediate Action. In the event of a stoppage in the MK 19, take immediate action: recharge it and try to fire once.

d. Remedial Actions. A stoppage is any interruption in the cycle of operation caused by faulty action of the weapon or ammunition. Take remedial action if immediate action does not end the stoppage:

(1) Unload and clear the MK 19.

(2) Inspect the weapon and ammunition to find the cause of the stoppage.

e. Corrective Actions. Take corrective action to correct the stoppage once the cause has been found (Table 2-l):

(1) If possible, correct the cause of the stoppage. reload, and try to fire the weapon.

(2) If the MK 19 stil does not fire, or cannot be repaired at the user level, contact the unit armorer.

PROBLEM	CHECK FOR	CORRECTIVE ACTION
	WARNING FOR SAFETY, KEEP BOLT IN FORWARD POSITION, UNLESS DIRECTED OTHERWISE.	
Gun will not fire.	Misfire.	Follow instructions for immediate action.
	Ammo jammed? Rounds aligned straight?	Clear jam. Align rounds.
	Is female link first?	If male-end of link is first, remove link rounds. Replace ammo with other end of belt, female link first.
	Any links broken?	If links are broken, replace with new linked ammo.
	Bad ammo?	
	-Remove round from bolt face. (If bolt is forward, pull back on one charging handle as you remove the round from the bolt.)	
	-Examine the round. Primer deeply indented? Round is defective.	Dispose of bad round as directed by current procedures and attempt to fire next round. If same problem occurs, replace ammo belt.
	-Primer not indented at all? Could be bad firing pin.	Pin must be replaced by a combat arms specialist.
	Short recoil? (Round is deformed and/or partially chambered.)	Immediate action: Slide belted rounds out of feeder. Remove deformed round from chamber. Pull bolt to rear. Now check for:
	-Carbon buildup in chamber.	Clean bore and chamber with bore cleaner and brush.
	-Receiver rails dry or obstructed.	Lubricate or clear obstruction.
	-Gun dirty.	Field strip gun. Then clean, inspect, lube.

Table 2-1. Corrective action for stoppages.

PROBLEM	CHECK FOR	CORRECTIVE ACTION
Gun will not fire (continued).	CAUTION BEFORE YOU GO ON, RELEASE BOLT TO FORWARD POSITION SLOWLY!	
	-Feeder or feed slide assembly parts loose, broken, or burred?	All worn, burred, or defective parts must be repaired by a combat arms specialist.
	-Bolt assembly parts loose, broken, or burred? NOTE: First, remove bolt and backplate assembly.	All worn, burred, or defective parts must be repaired by a combat arms specialist.
	-Timing bad?	Have a combat arms specialist adjust timing.
	Bad firing pin?	If the primer on the round is not indented, check the firing pin:
	-Firing pin fails to spring forward?	Report defect to a combat arms specialist.
	-Firing pin dirty?	Clean and lube bolt face.
	-Firing pin chipped or broken?	Report defects to a combat arms specialist.
	Defective feeder or feed slide assembly?	
	-Press pawls. Weak or broken?	Report defects to a combat arms specialist.
	-Feed slide assembly binding?	Remove feed slide assembly and tray. Clean, inspect, lube.
	-Link guide badly worn?	Report defects to a combat arms specialist.
	Bolt won't pick up round?	
	-Spent case in chamber?	Remove it. Then:
	-Check extractors.	
	(1) Dirty, clogged?	Scrape out dirt, especially on sides. Clean and lube.

Table 2-1. Continued.

PROBLEM	CHECK FOR	CORRECTIVE ACTION
Gun will not fire (continued).	(2) Extractors weak or damaged?	Report defects to a combat arms specialist.
	Bolt drops round before firing?	Dispose of dropped live round as required by current directives.
	-Bolt fingers or extractors weak or damaged?	Report defects to a combat arms specialist.
	Receiver rails binding?	Test by pulling the bolt to the rear. Ease it forward (hold on to one charging handle while you press the trigger).
	Binding rails?	Remove chargers. Inspect receiver rails for dirt or burrs. Report burrs or bent rails to a combat arms specialist.
	Bad cocking lever?	Remove bolt and backplate assembly.
	-Examine cocking lever (left side of bolt) for wear or damage.	Report defects to a combat arms specialist.
	CAUTION REASSEMBLE BOLT AND BACKPLATE WITH COCKING LEVER IN FORWARD POSITION.	
Sluggish or erratic fire.	Dirty bore or chamber?	Clean bore and chamber.
	Weak recoil springs?	Report weak springs to a combat arms specialist.
	Bent guide rods? (1) Pull out bolt and backplate assembly until it clicks. (2) Push against springs to test for weakness. Note if rods are bent.	Report bent guide rods to a combat arms specialist.
Runaway gun.	Timing need adjustment?	If you checked items 1 and 2 (above) with no luck, let a combat arms specialist test the timing mechanism.

Table 2-1. Continued.

PROBLEM	CHECK FOR	CORRECTIVE ACTION
Runaway gun. (continued).	Damaged sear?	If weapon is mounted on a tripod, hold the weapon on target while lowering one charging handle. The gun will stop firing.
	-Remove receiver sear housing and check sear components.	A combat arms specialist must repair any defects.
Gun fires too soon.	WARNING DO NOT OPERATE WEAPON UNTIL IT HAS BEEN CHECKED OUT AND REPAIRED BY A COMBAT ARMS SPECIALIST. THE WEAPON COULD BE DANGEROUS.	

Table 2-1. Continued.

2-7. DESTRUCTION

Only the commander can direct the destruction of the MK 19. There are several ways to destroy it. Methods include destruction by mechanical means, burning, gunfire, demolition or disposal, Use the same methods to destroy equipment. Handle ammunition differently, however. The best way to destroy ammunition is fire it. Otherwise, dispose of it by burial, by dumping it in a body of water, or by using the-demolition-method.

> WARNING
> AMMUNITION MUST NEVER BE SCATTERED (THIS MAY RESULT IN A HAZARD TO FRIENDLY SOLDIERS), BURNED (HE AND HEDP ROUNDS MAY EXPLODE), OR DESTROYED MECHANICALLY.

a. Mechanical Method. If possible, use the mechanical method to destroy MK 19s and equipment. There are three ways to do this:

(1) Smash them. Use a sledge hammer or some other tool. Damage all parts enough that they are not reusable.

(2) Bend the MK 19 guide rods over the receivers.

(3) Take off (or out) the same part from each of the MK 19s. If a different part is taken from each gun, new MK 19s may be pieced together.

b. Burning Method. To burn equipment or MK 19s, use a fuel source that burns hot enough to take the temper from the metal. Use, for example, JP-4, oil, or gas. All friendly soldiers in the area are warned before equipment or MK 19s are burned, because a fire will reveal the positions of friendly forces.

c. Gunfire Method. This is the least reliable way to destroy MK 19s or euipment. Pile up all of the equipment and MK 19s; use MK 19s, grenades, or rifles to fire on them. They will scatter, so check after shooting to see that they are all destroyed.

d. Demolition Method. Use an explosive charge such as C4 or any type of HE round. Place the charges so they will completely destroy all the MK 19s or equipment.

e. Disposal Method. To dispose of equipment and MK 19s, break them down and either scatter the parts into swamps or marshes, or bury them.

CHAPTER 3
GROUND AND VEHICLE MOUNTS

The MK 19 is used in either the ground- or vehicle-mount mode. The most often used ground mount is the M3 tripod. The M3 serves as a stable platform when the weapon is from any angle. The Mk 19 may be mounted on any vehicle equipped for the M2 caliber .50 machine gun. Vehicles include the l/4-ton utility vehicle (the M151 series), cargo trucks (2 1/2-ton to 5-ton), HMMWV, M113-series APC, and others. The MK 64 MOD 7 gun cradle, issued with the MK 19, gives the MK 19 its mounting flexibility. This chapter outlines the ground- and vehicle-mounting procedures.

3-1. MK 64, MOD 7, GUN CRADLE

Use the MK 67 MOD 7 gun cradle to mount the MK 19 to the machine gun pedestal, stand, ring or tripod mount. Attach the ammunition container bracket to the side plate of the cradle. In the center of the cradle is a pintle bushing and lock in which the M2 caliber .50 and M60 machine guns may be mounted. The front of the MK 19 is mounted on the two forward lugs of the gun cradle. The rear is secured by the retainer pin. Insert the cradle stow pin to hold the cradle in a horizontal position during travel (Figure 3-l).

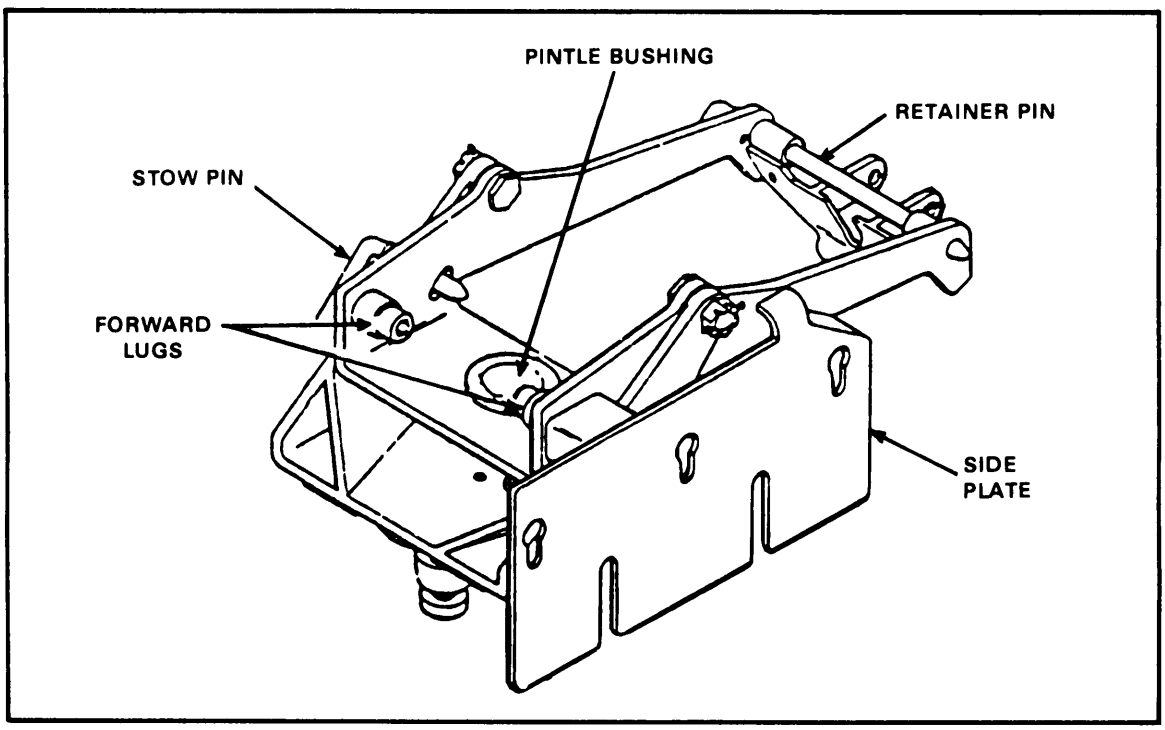


Figure 3-1. MK 67 MOD 7 gun cradle.

3-2. GROUND-MOUNTING THE MK 19 USING THE M3 TRIPOD

Mount the MK 19 as close to the ground as possible and lock the tripod's trail legs open. Set the adjustable front tripod leg to an angle of about 60 degrees to the ground. In flat terrain with the extensions closed, for example, use the following method to place the MK 19 about 12 inches above the ground.

a. Set the tripod trail legs (Figure 3-2):

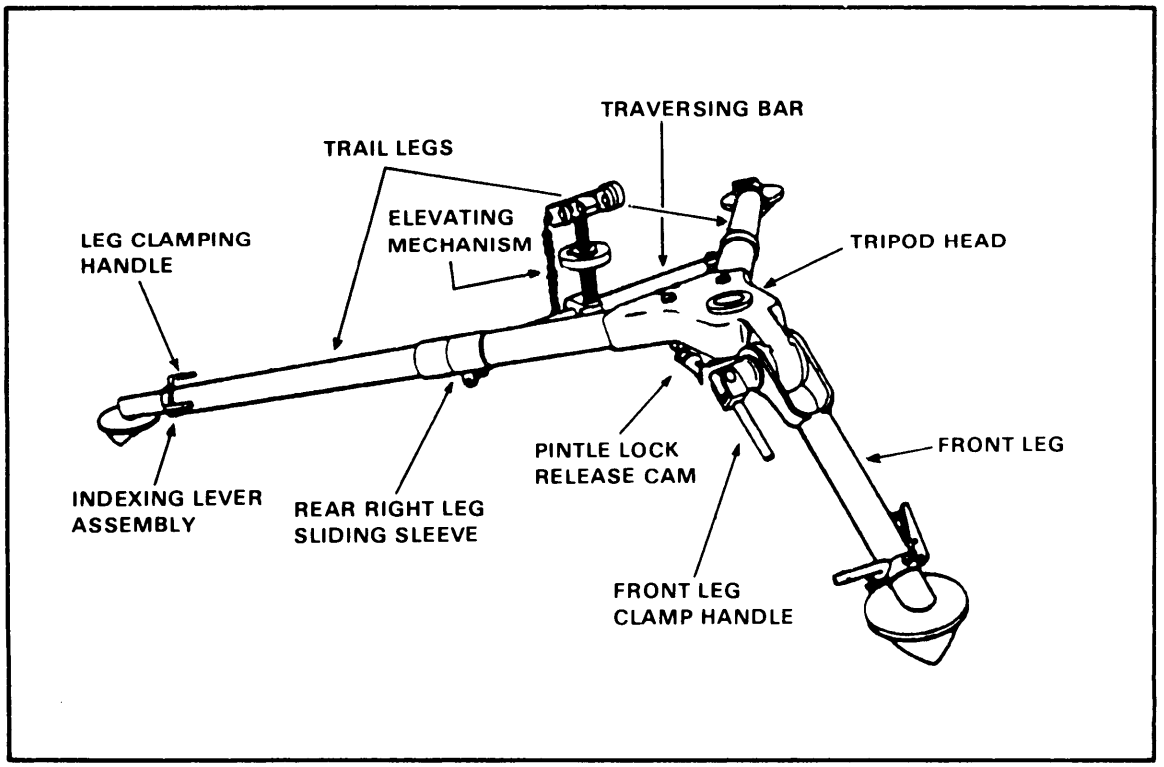


Figure 3-2. M3 tripod.

(1) Unscrew the leg-clamping handle; press down on the indexing lever, and extend the leg to the desired length.

(2) Align the indexing lever stud with one of the holes in the tripod leg extension.

(3) Release pressure on the indexing lever allowing the stud to fit the desired hole. Tighten the leg-clamping handle.

b. Set the front leg of the tripod:

(1) Turn the front leg clamp handle counterclockwise to loosen the front leg.

(2) Adjust the leg to the desired angle and tighten the front leg clamp.

c. Secure the tripod legs to the desired angle and tighten the each tripod leg into the ground. Sandbag each leg to stabilize the MK 19 for firing.

d. Mount the M64 MOD 7 gun cradle onto the M3 tripod:

(1) Unlock the tripod pintle lock release cam.

(2) Insert the gun cradle's pintle into the tripod pintle bushing (Figure 3-3).

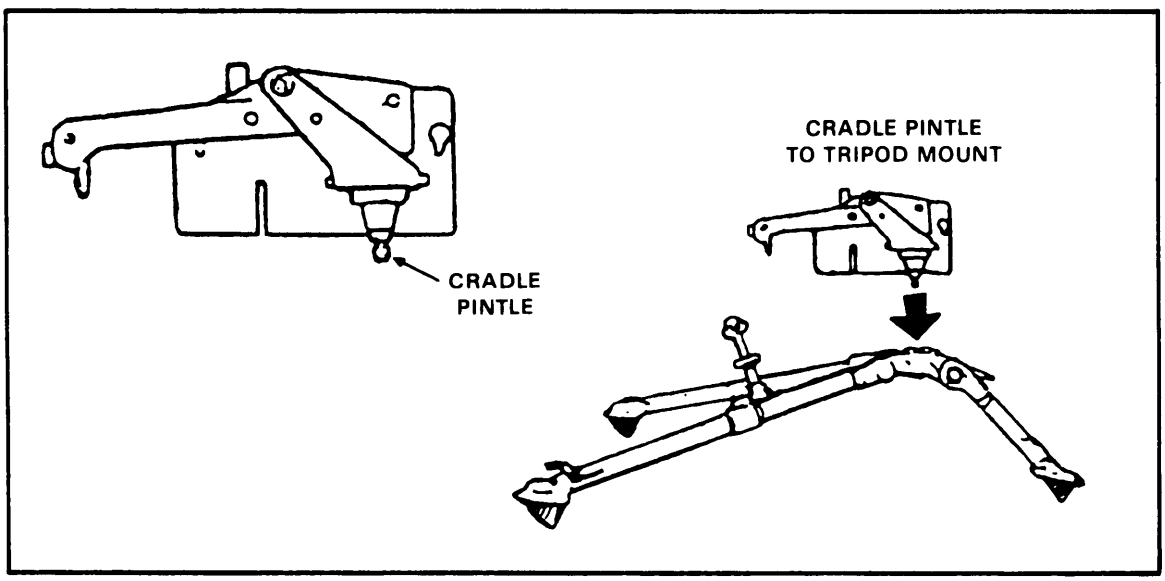


Figure 3-3. Insertion of pintle into pintle bushing.

Lock the pintle lock release cam to secure the gun cradle. Check the gun cradle, by pulling up on it slightly, to ensure that it is seated and locked.

e. Attach the T&E mechanism (Figure 3-4):

(1) Center the elevating handwheel between the upper and lower elevating screws.

(2) Center the traversing handwheel on the upper elevating screw yoke.

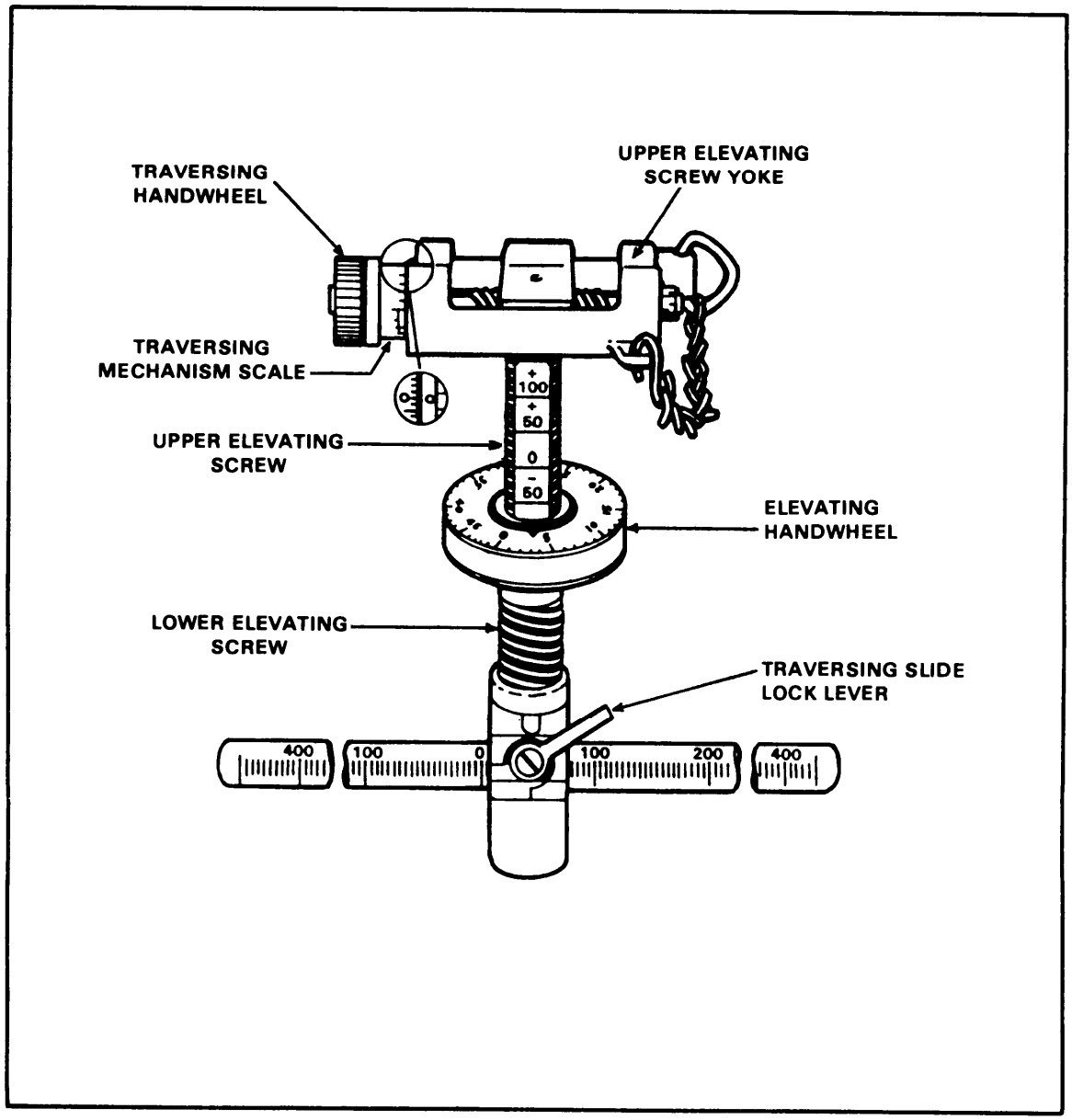


Figure 3-4. T&E mechanism.

(3) Remove the stow pin from the gun cradle (Figure 3-5).

(4) Align the holes in the upper elevating screw yoke of the T&E mechanism with the rear hols in the gun cradle (Figure 3-6).

NOTE : The stow pin locks the cradle in a horizontal position, preventing it from depressing or elevating.

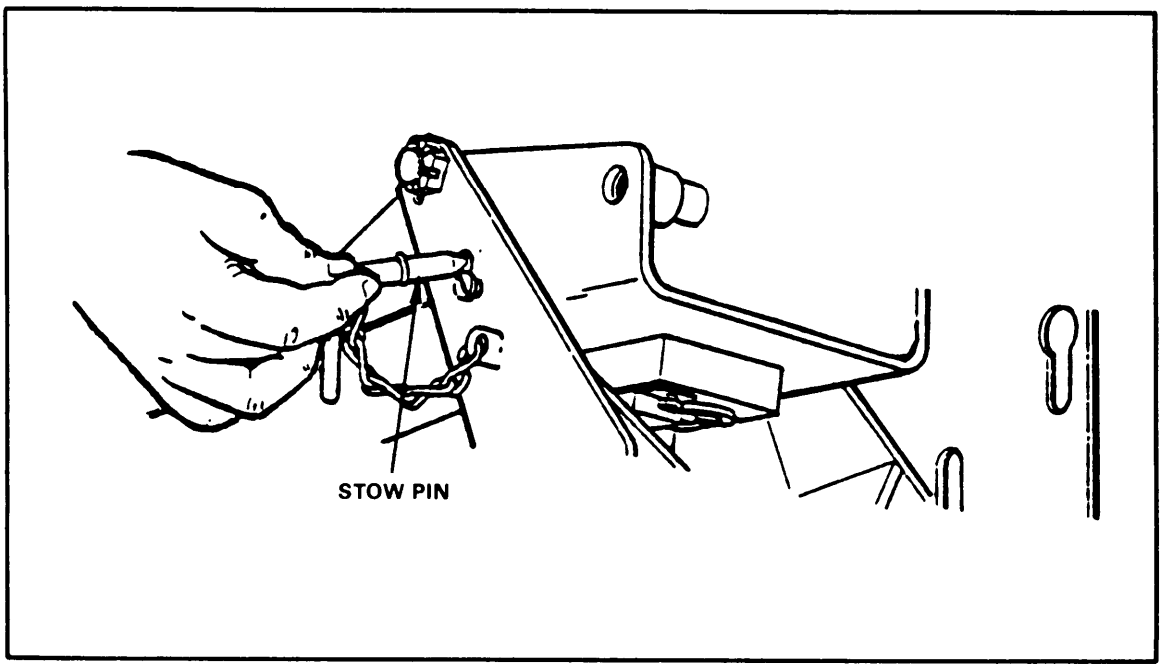


Figure 3-5. Stow pin.

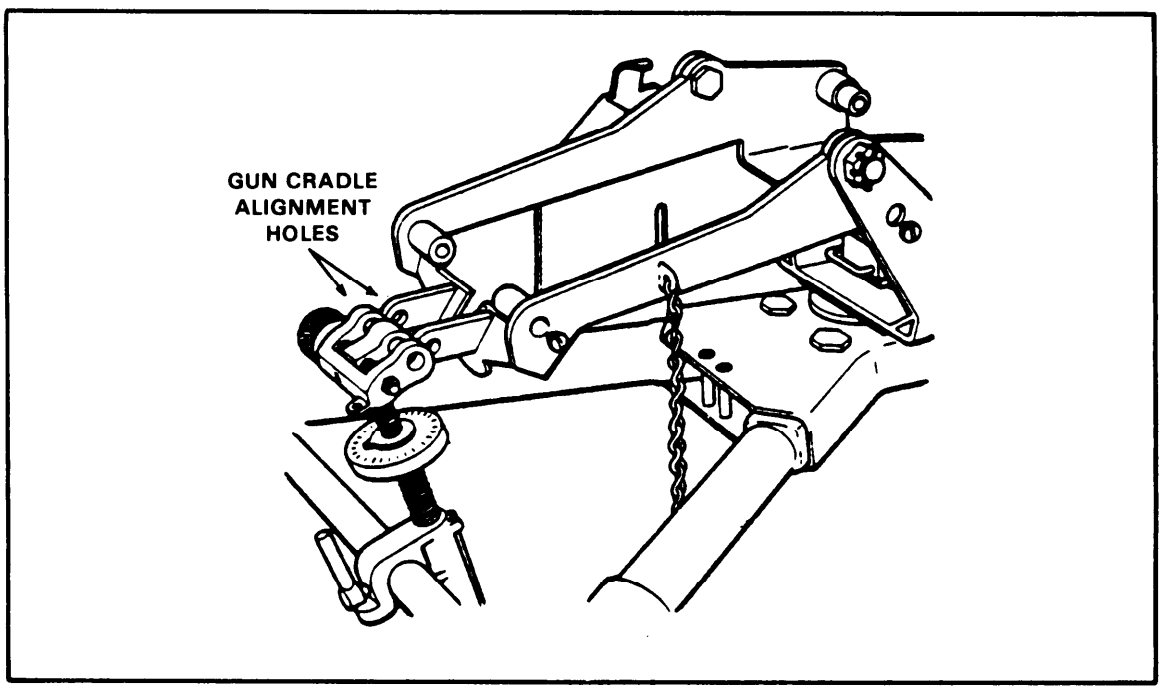


Figure 3-6. Alignment of gun cradle to T&E.

(5) Lock the elevating sleeve mechanism onto the center of the traversing bar.

(6) Insert the quick-release pin from the right (Figure 3-7).

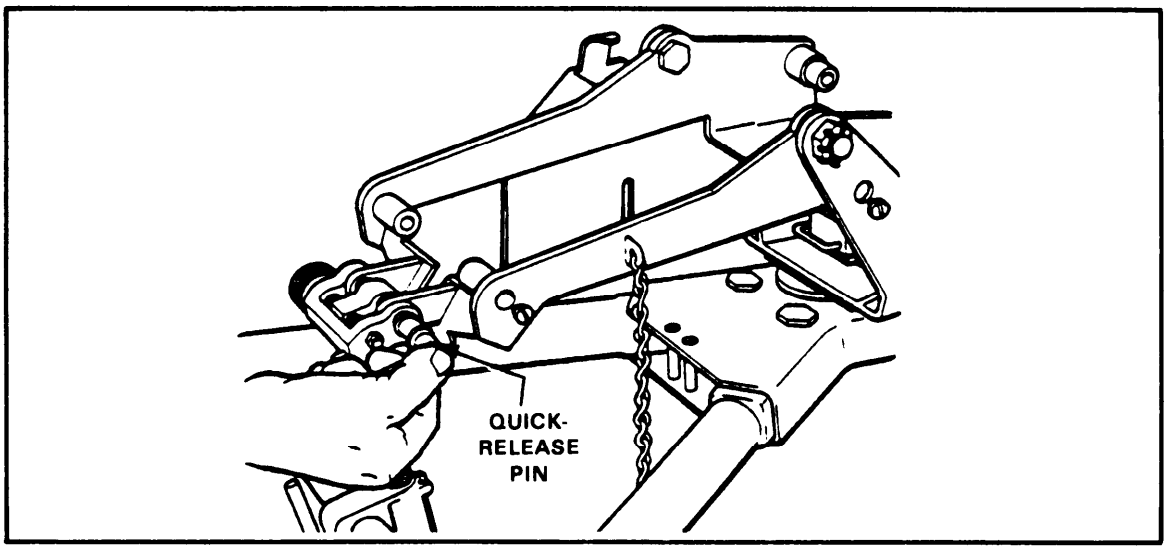


Figure 3-7. Quick release pin.

f. Mount the MK 19:

(1) Lift the MK 19 into the gun cradle. One soldier holds the barrel while another holds the control grips. The one holding the grips stands between the trail legs of the tripod; the other straddles the front leg. The soldiers lift the MK 19, barrel first, onto the cradle.

(2) Align the grooves on the receiver with the lugs in the gun cradle, and slide the receiver forward (Figure 3-8) .

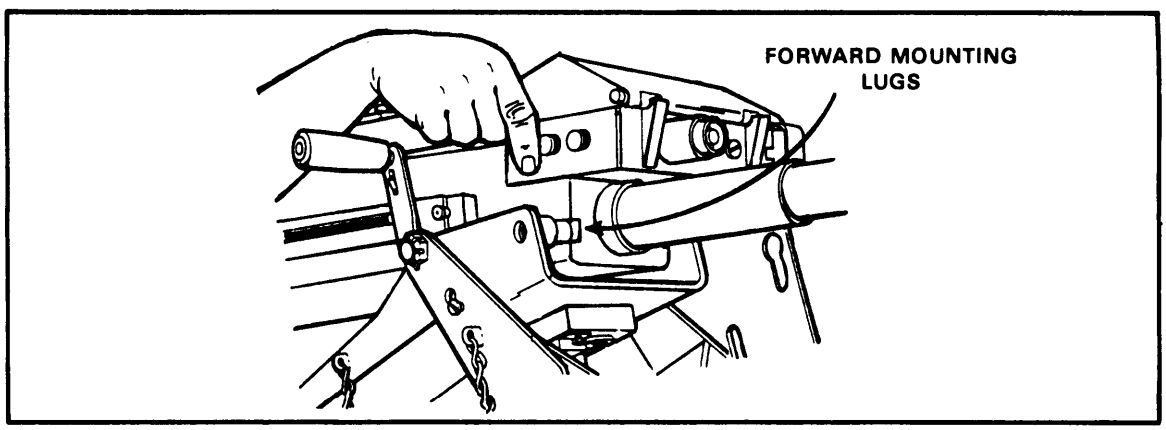


Figure 3-8. Mounting lugs.

(3) Align the sear mounting holes with the gun cradle mounting holes Figure 3-9. Secure the rear of the weapon by inserting the retaining pin through the cradle and sear assembly and rotate it until it locks in place (Figure 3-10. If a safety clip is attached, use it to secure the retaining pin.

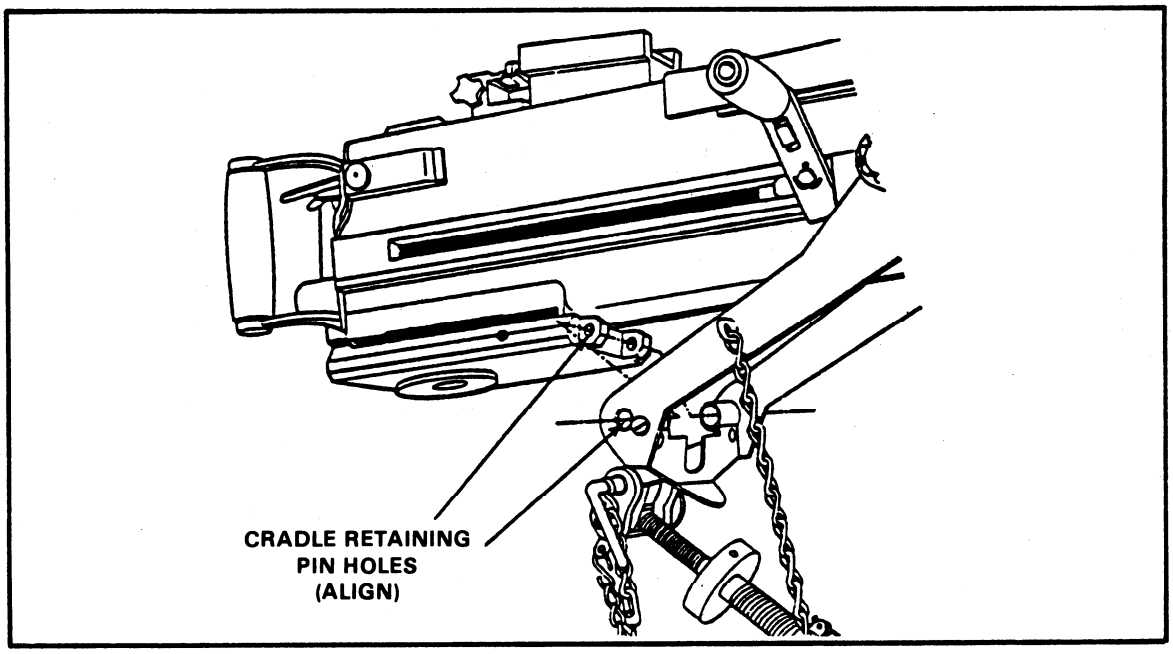


Figure 3-9. Alignment of the sear assembly and pin holes.

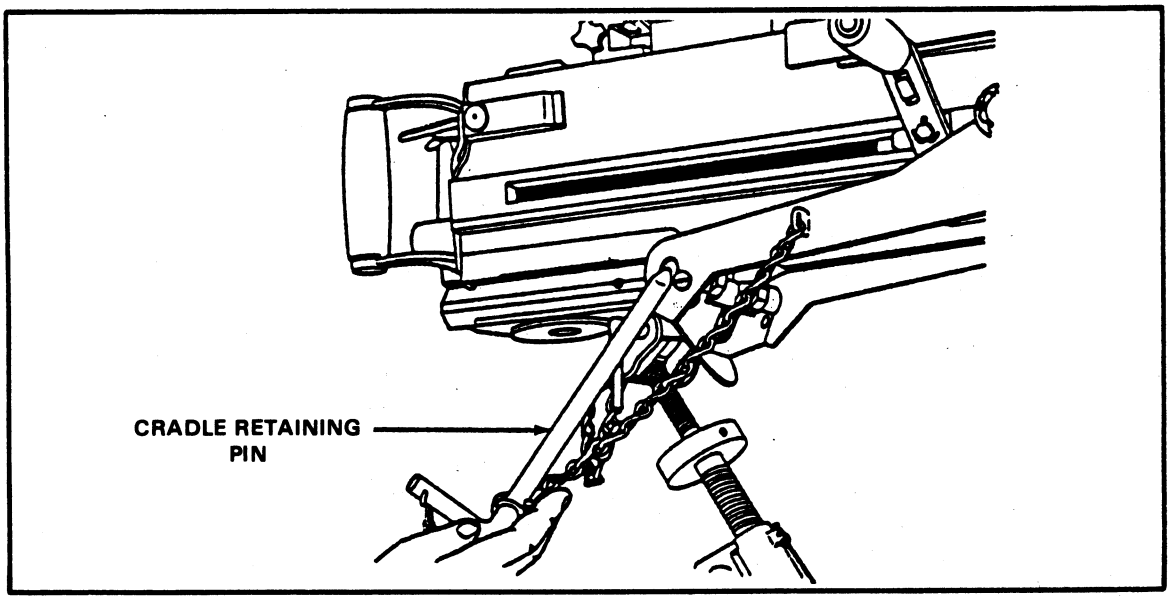


Figure 3-10. Insertion of the cradle retaining pin.

g. Attach the feed throat to the MK 19 by squeezing together each set of grip pins (Figure 3-11) and attaching the feed throat to the front left-hand side of the receiver assembly. The pins of the feed throat must line up with the pin holes in the receiver (Figure 3-12). Relax pressure on the spring-loaded grip pins so they will snap into place (Figure 3-13).

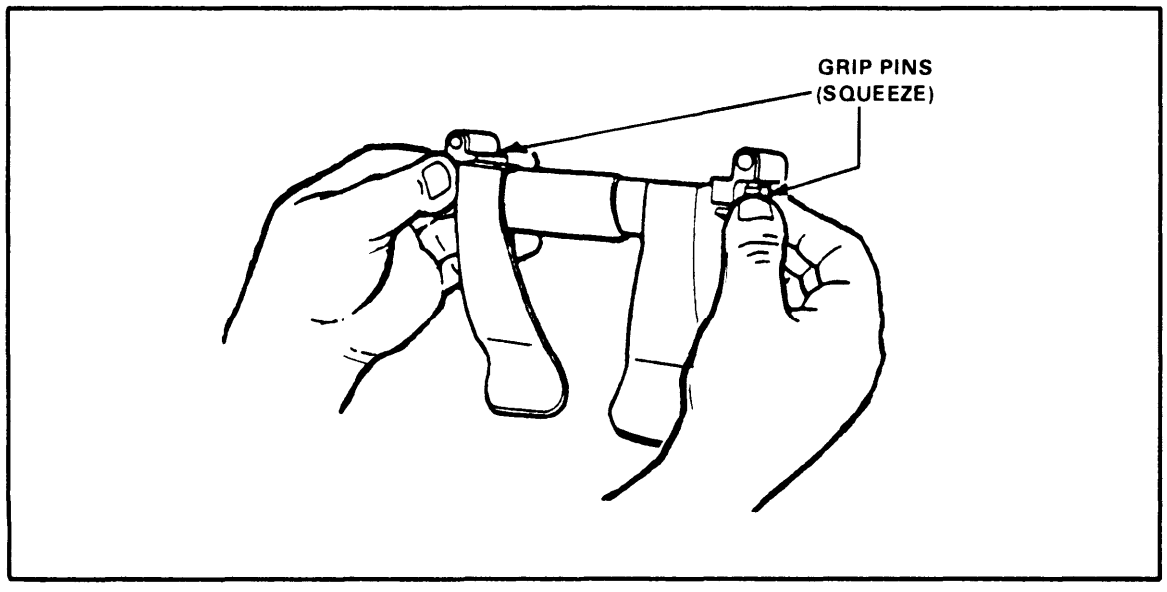


Figure 3-11. Grip pins.

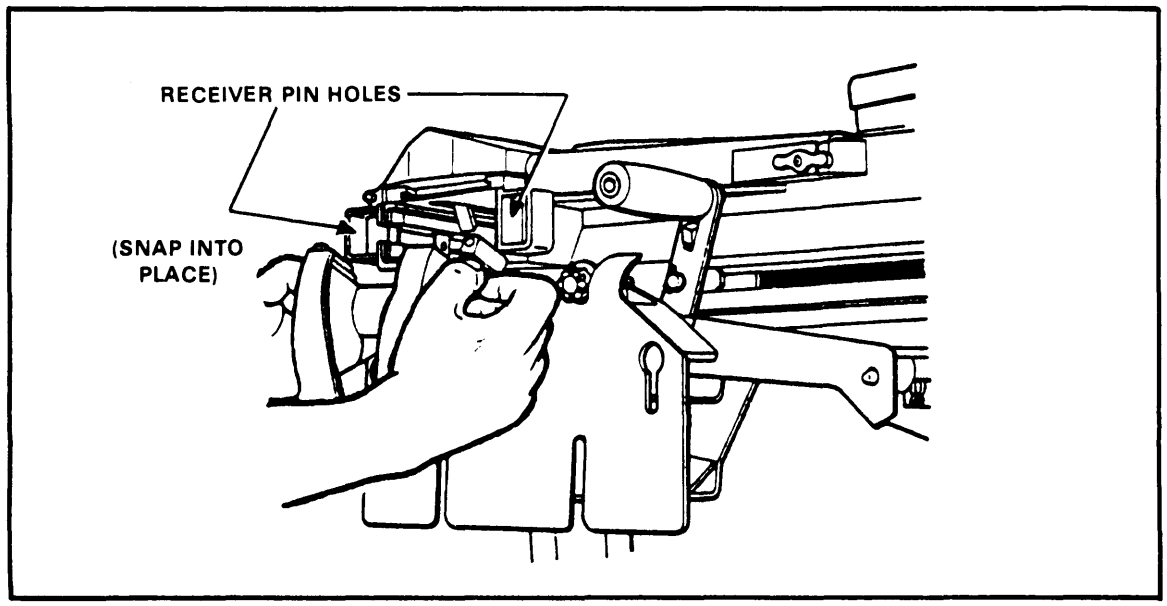


Figure 3-12. Feed throat alignment.

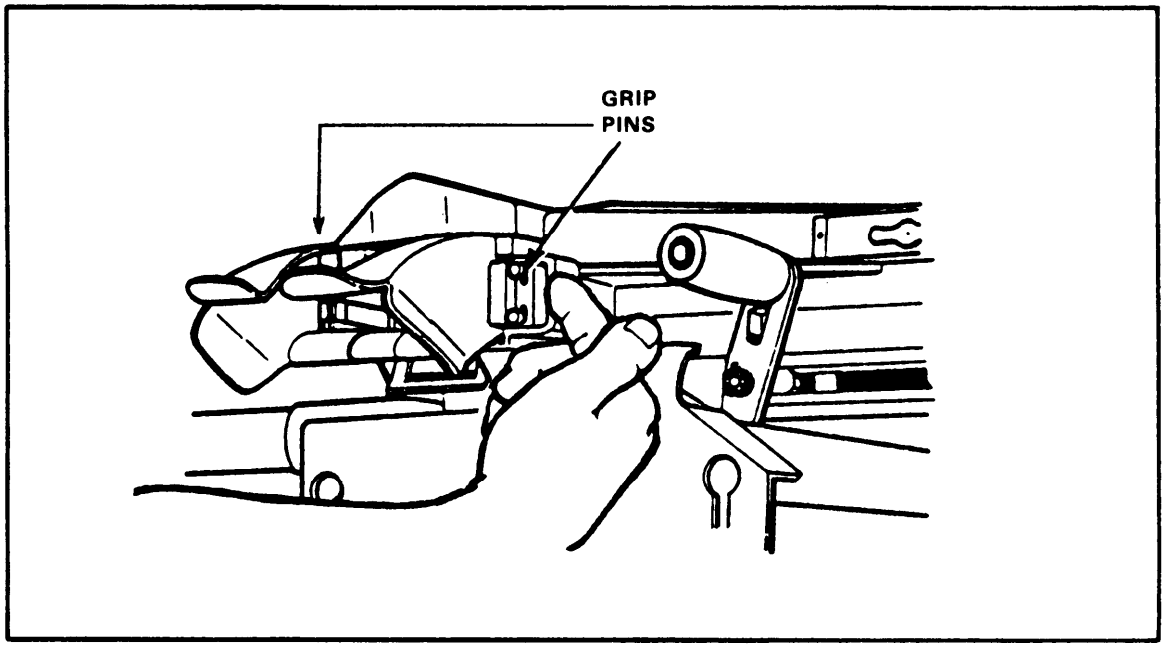


Figure 3-13. Feed throat installation.

NOTES: 1. When the MK 19 is mounted on the M3 tripod or any vehicle, it is called a weapon system.

2. The same procedure is used to mount the MK 19 to the gun cradle regardless of the types of mount used.

3-3. VEHICLE-MOUNTING THE MK 19

This paragraph lists the accessories used to mount the MK 19 to vehicles, and outlines the steps (by vehicle) that must be followed to do so. Since the mounting procedures are similar, they are explained completely for one type of vehicle. For the other types, the similarities are referenced and only the differences are explained in detail.

a. Accessories. Several accessories are used to mount the MK19 on vehicles. The MK 64 MOD 7 gun cradle is used to the mount the MK 19 in any mode. The pintle adapter is used to mount the MK 19 in all vehicular modes. Other accessories are used to mount the MK 19 to specific vehicles:

(1) Pintle adapter. This part is needed to mount the MK 19 to vehicles. The upper end accepts the gun cradle pinte, which is secured by a quick-release pin. Its lower end fits the mounting wells of the the M4 pedestal, the HMMWV weapon platform, the M36A2 ring

mount with the M66 ring, and the commander's cupola on the M113 APC (Figure 3-14).

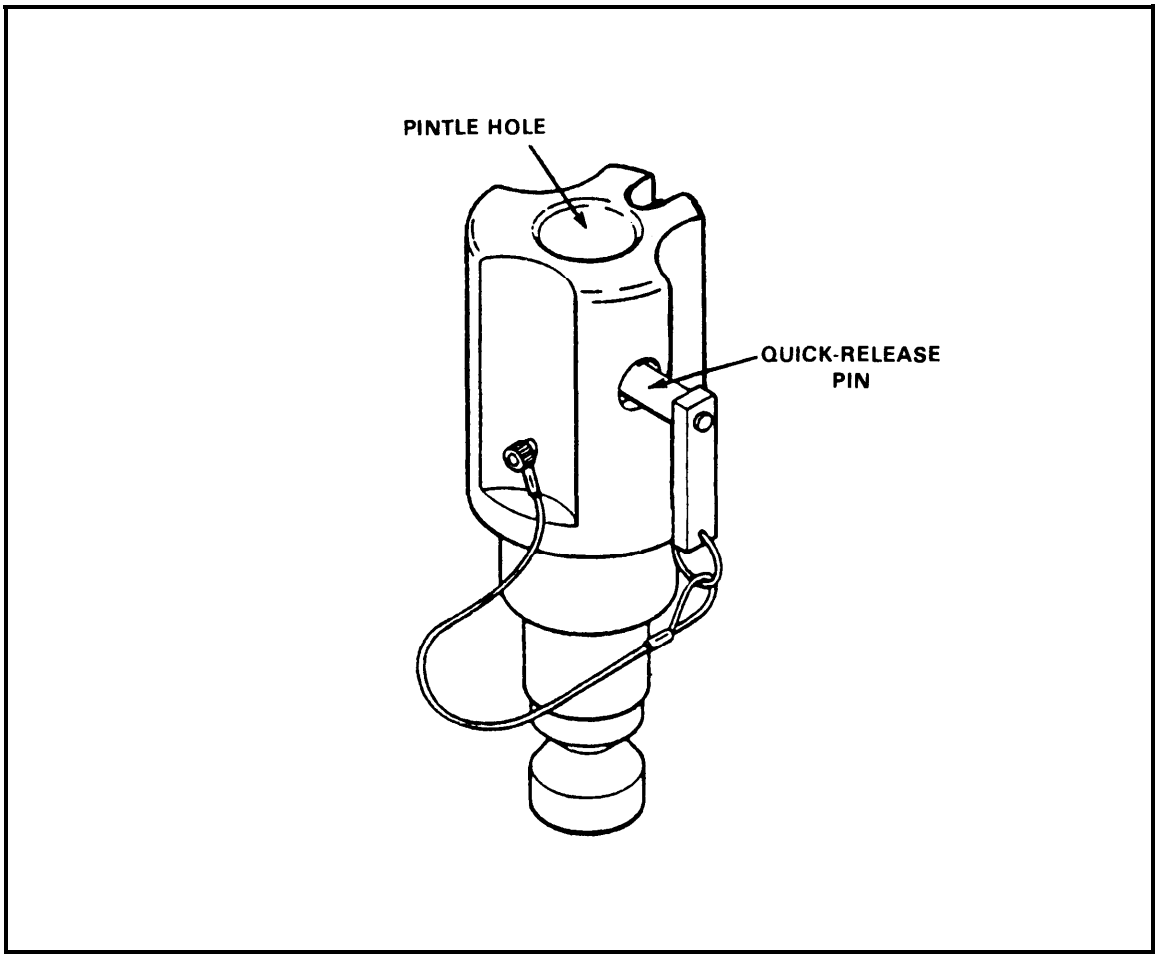


Figure 3-14. Pintle adapter.

(2) Train and elevating assembly. This assembly secures the MK 64 MOD 7 gun cradle to the M4 pedestal or HMMWV weapon platform pedestal and allows mechanical fire control adjustments. The lower end of the train and elevating assembly is attached to the pedestal by a train lock clamp. The clamp may be released or locked in possition by a train lock handle. Two positioning clamps are supplied to prevent vertical movement of the train lock clamp on the M4 pedestal. When used on the HMMWV weapon platform pedestal, only one clamp is needed above the train lock clamp. The upper end of the train and elevating assembly is a standard caliber .50 T&E mechanism. It is attached to the lower rear holes in the M4 cradle by a retaining pin (Figure 3-15).

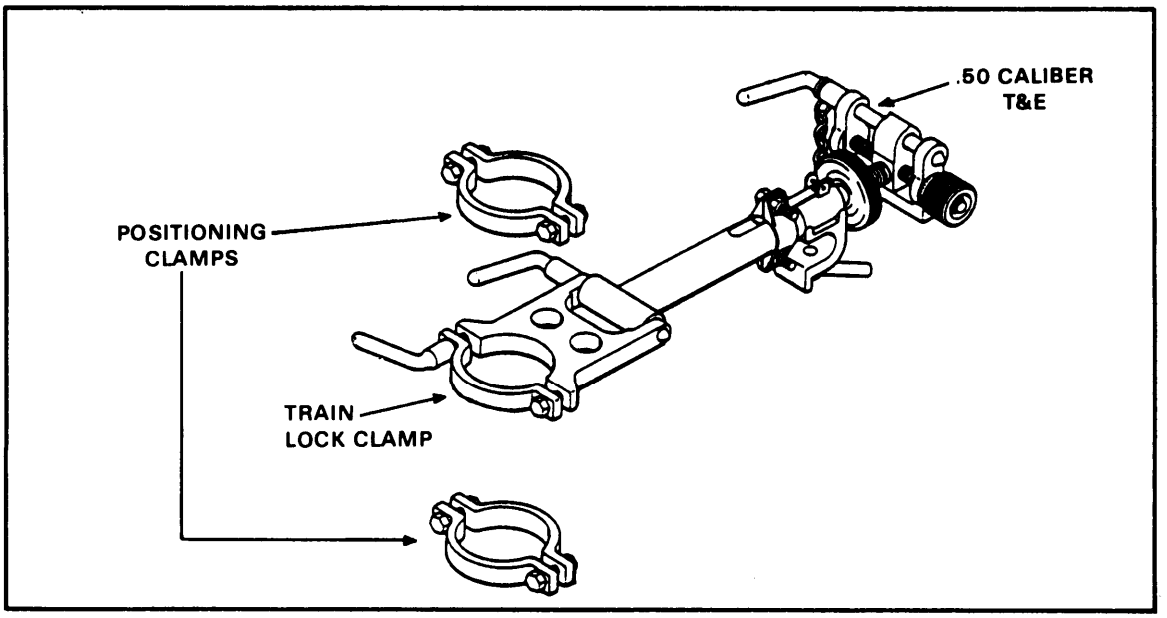


Figure 3-15. Train and elevating assembly.

(3) Travel lock adapter. This is used to hold the gun cradle securely during travel. It is attached to the gun cradle by a retaining pin, which is inserted through the gun cradle train and elevating mechanism mounting holes (Figure 3-16).

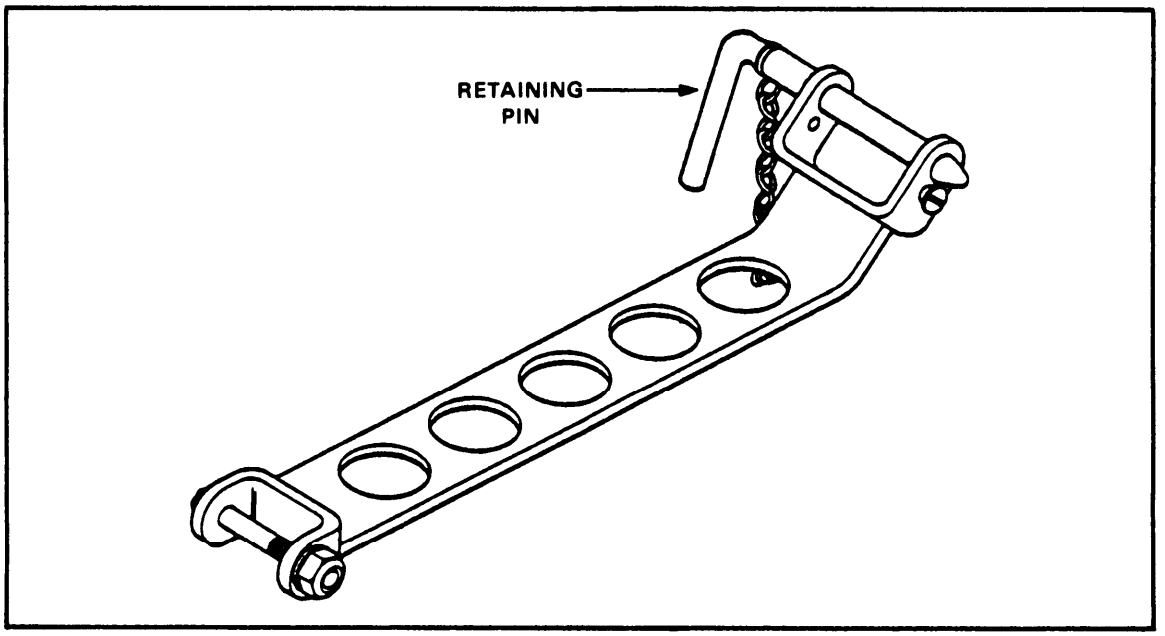


Figure 3-16. Travel lock adapter.

(4) Travel lock bracket. This bracket allows the travel lock adapter to be used with the M4 pedestal mount. It has two halves that are secured around the pedestal with nuts and bolts. The bracket is attached to the travel lock adapter by aligning their lower holes (Figure 3-17).

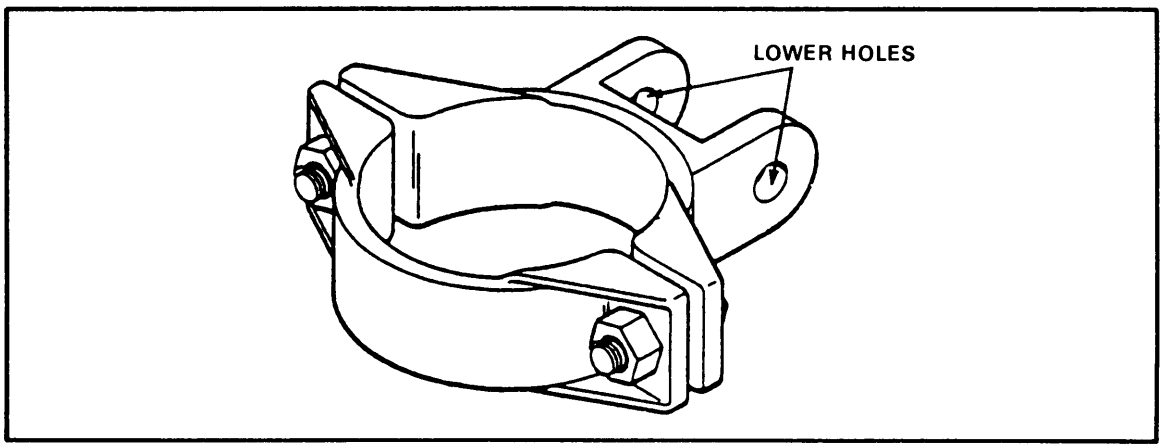


Figure 3-17. Travel lock bracket.

(5) Bracket mounting assembly. This assembly supplies a mount for the M548 metal ammunition container. It has a metal frame that attaches to the gun cradle, and a retaining pin that inserts through the top-inner end of the M548 ammunition container (Figure 3-18).

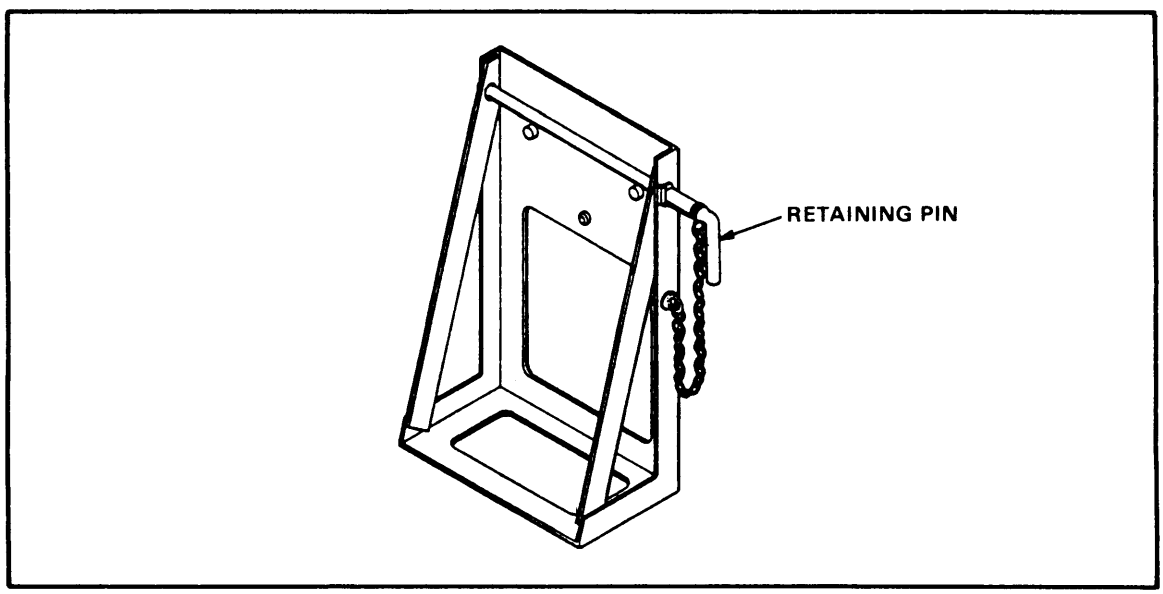


Figure 3-18. Bracket mounting assembly.

(6) Empty case catch bag. This bag catches empty cartridge cases as they are ejected. It is made of rubberized canvas. It is held in place by a metal rim, which attaches to the bottom of the cradle under the receiver by two hooks and a hanger (Figure 3-19).

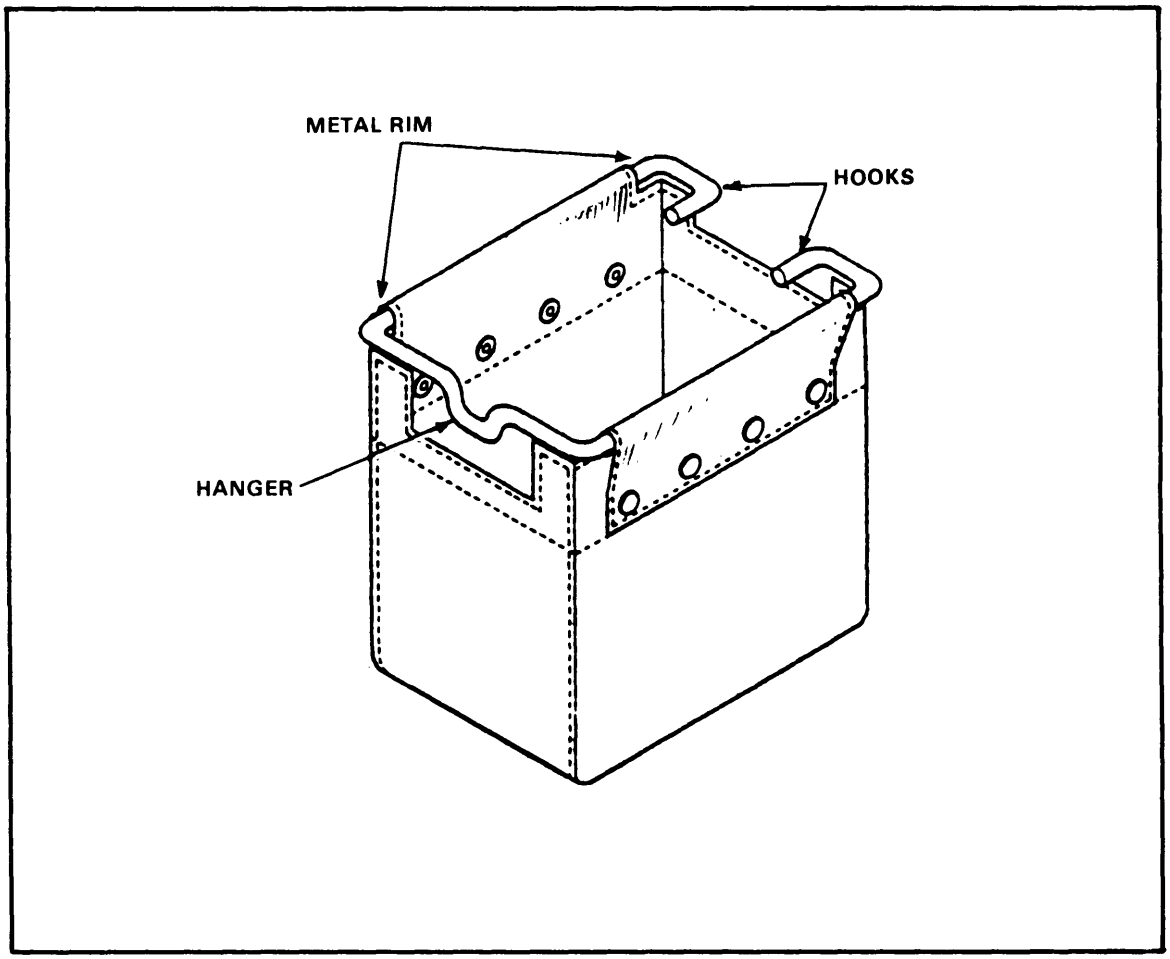


Figure 3-19. Empty case catch bag.

NOTE: The vehicular OVM are the only tools needed to mount the MK 19 on vehicles.

b. Vehicle Mounts.

(1) M4 pedestal (M151-series 1/4-ton utility vehicles. To mount the MK 19 on the M4 pedestal--

(a) Loosen the locking lever on the pedestal by turning the lever counterclockwise. Insert the lower end of the pintle adapter into the pedestal. Tighten

the lever by turning it clockwise (Figure 3-20). Pull up on the pintle adapter to ensure that it is secure.

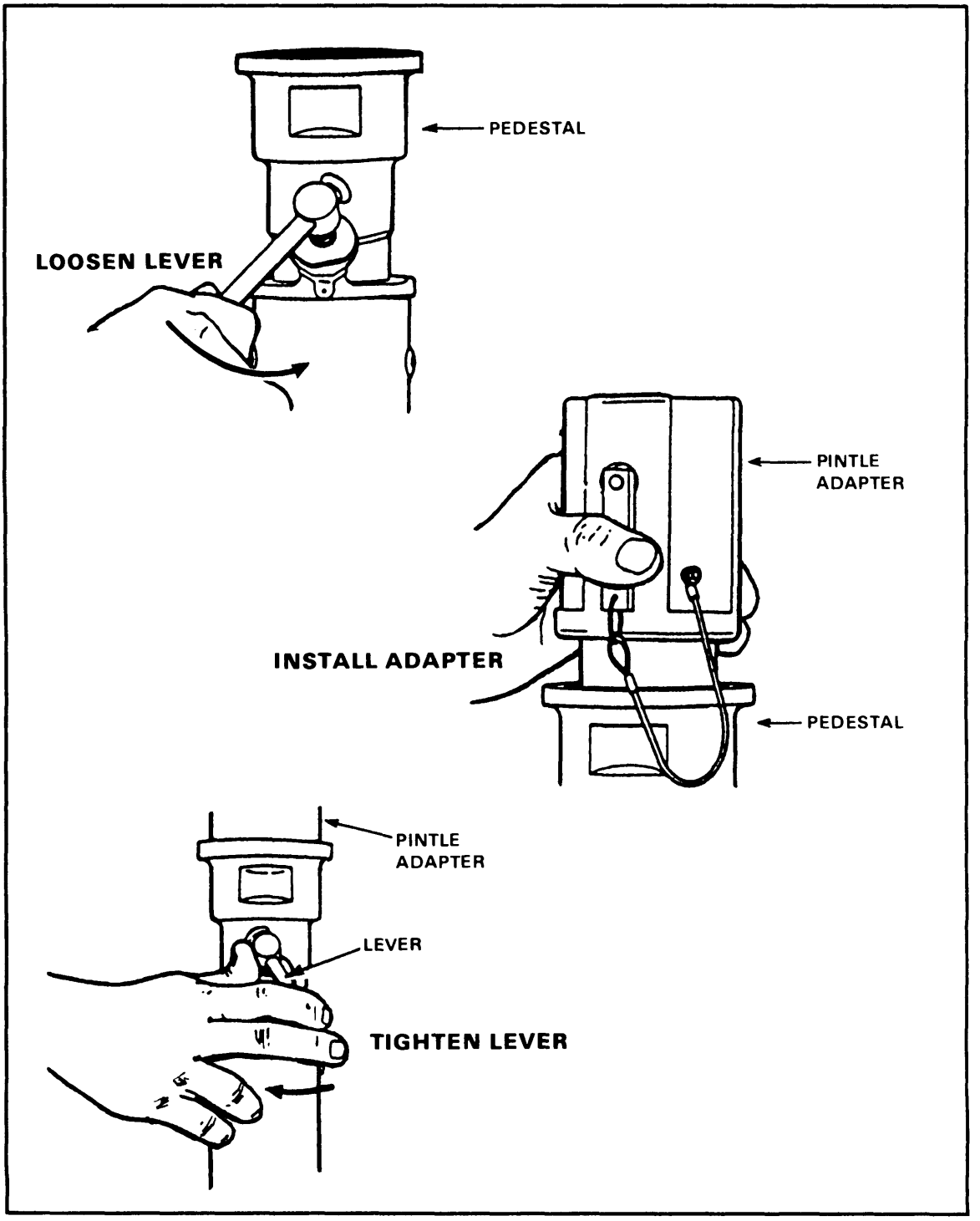


Figure 3-20. Pintle adapter installation.

(b) Take the quick-release pin from the pintle adapter. Insert the MK 64 gun cradle into the top of the pinte adapter. Replace the quick-release pin (Figure 3-21).

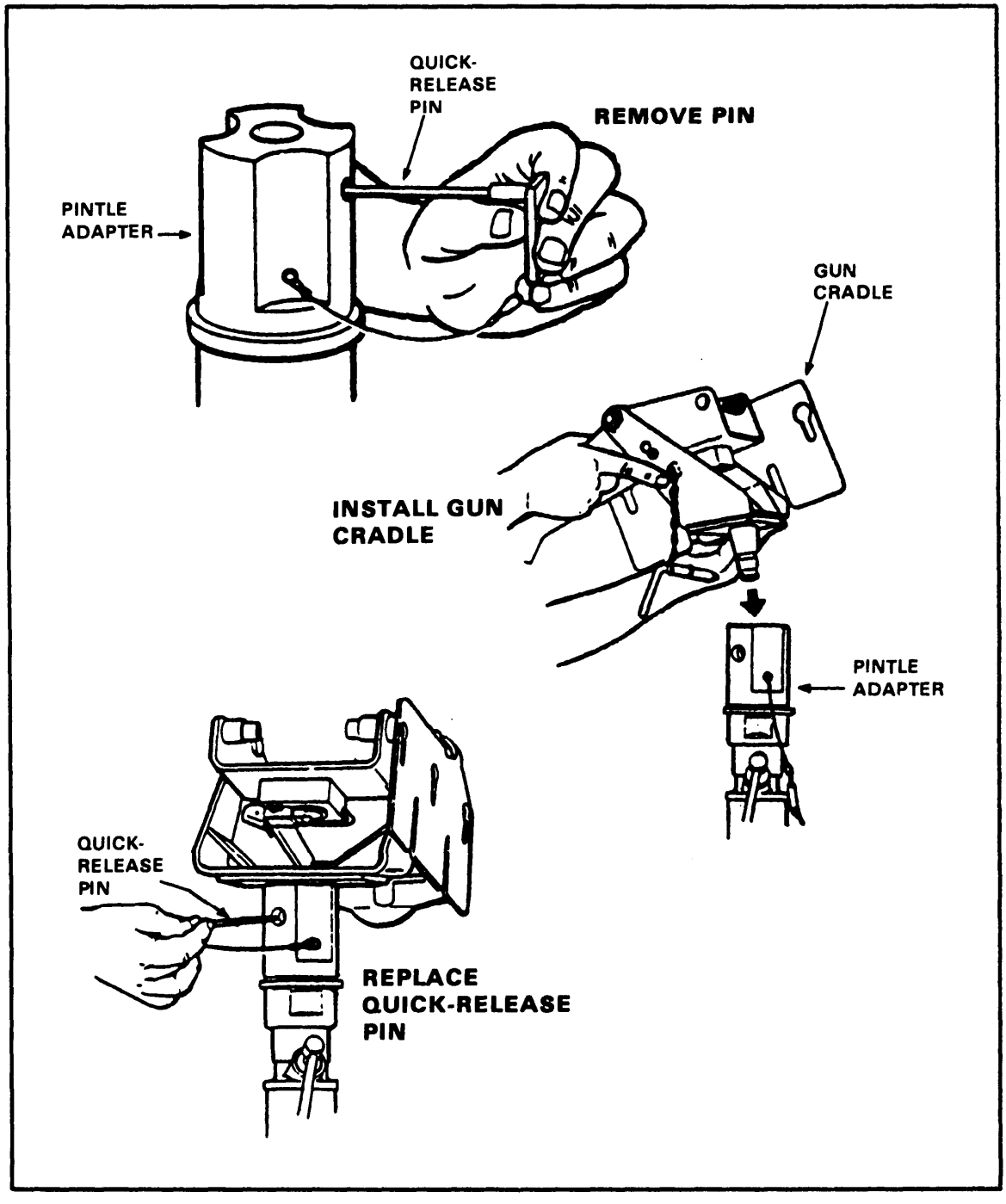


Figure 3-21. Gun cradle installation.

(c) Take out the train and elevating quick-release pin. Attach the train and elevating assembly to the holes in the rear of the gun cradle. Replace the quick-release pin and rotate it to the locked position (Figure 3-22).

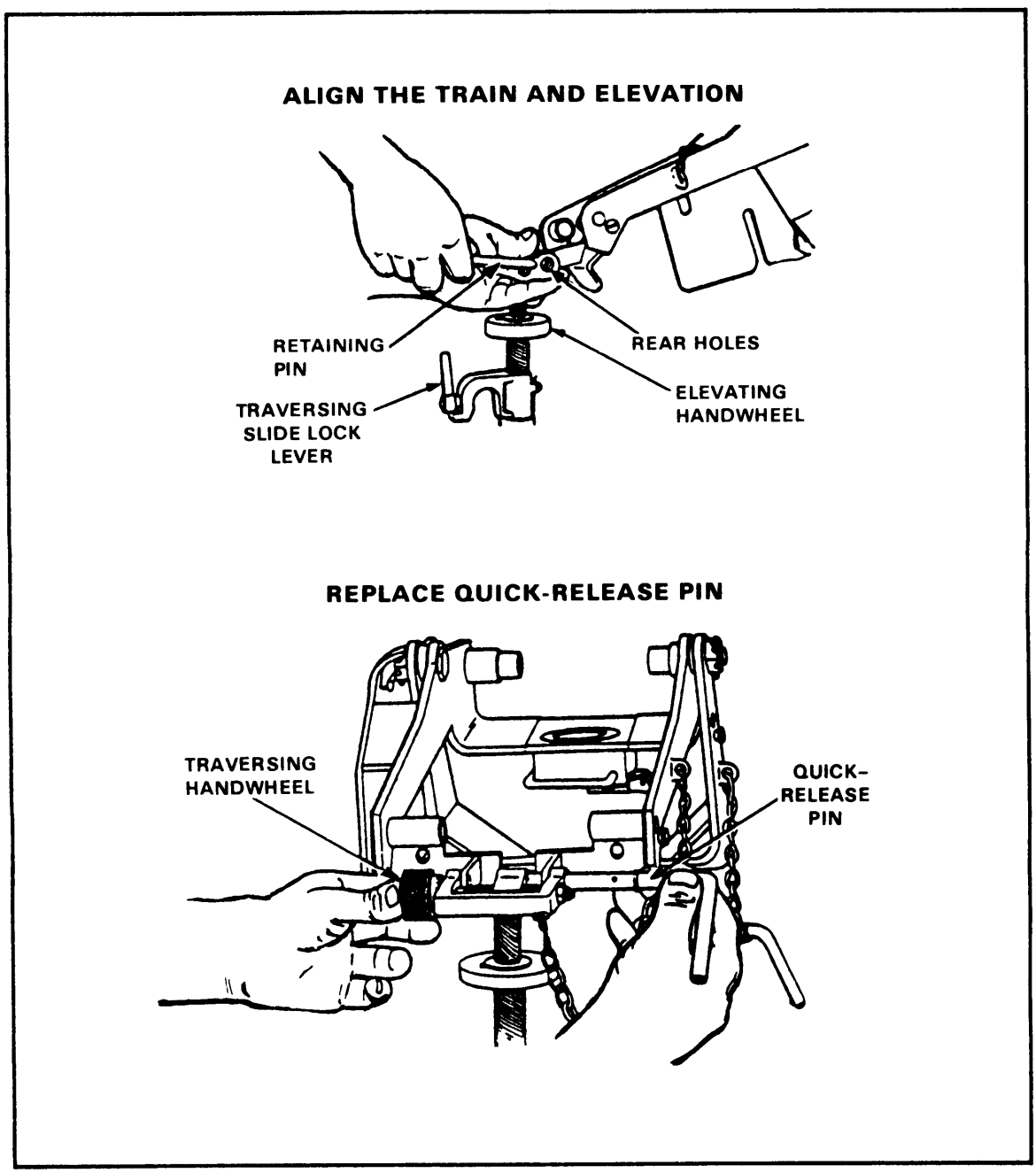


Figure 3-22. Train and elevating assembly installation upper part.

(d) Unscrew the train lock handle and hex bolt, separating the clamp into two parts. Place the two halves of the clamp around the MReplace the bolt and the train lock handle, and tighten them alternately. Tighten the train lock handle and the hex bolt (Figure 3-23).

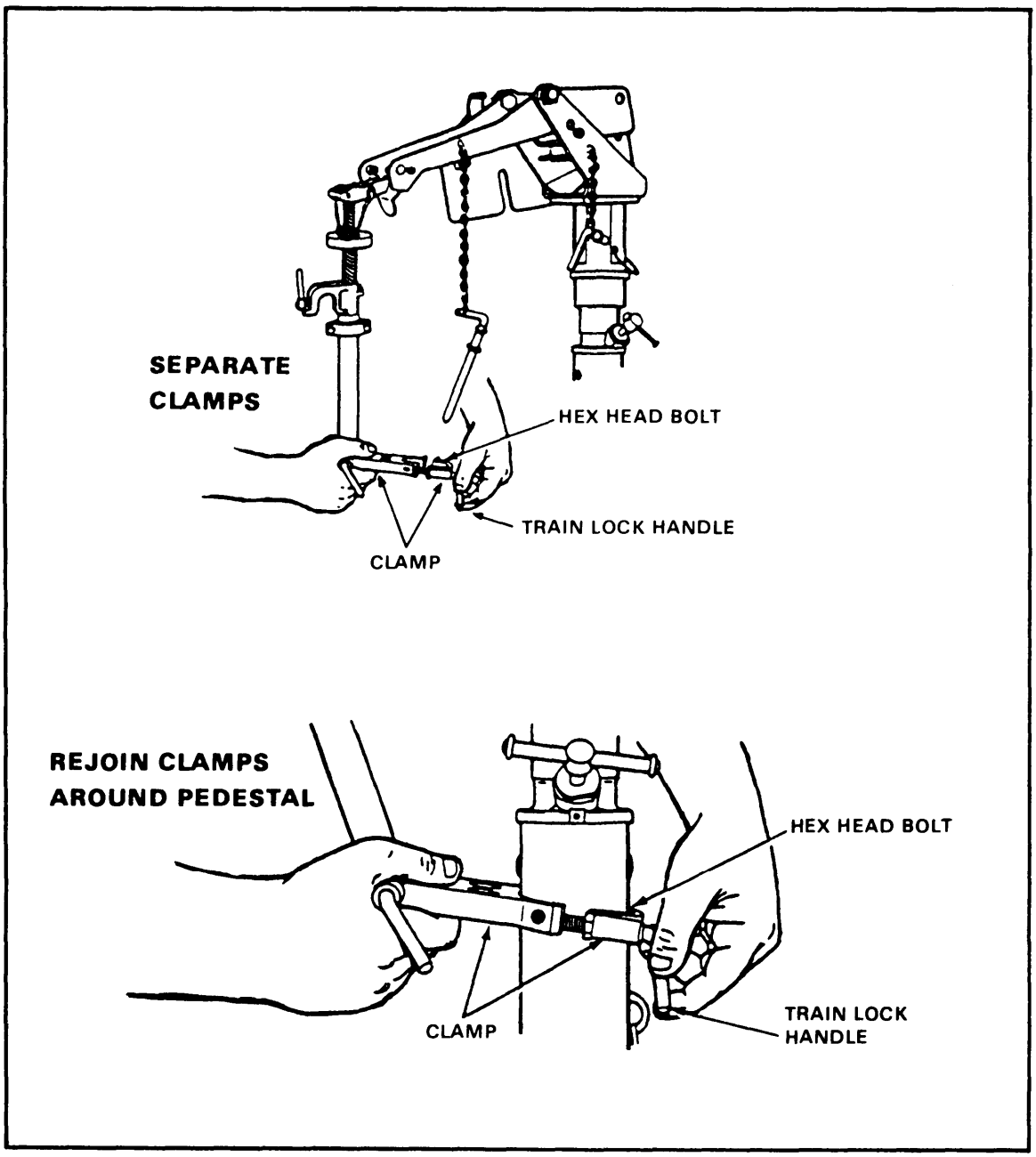


Figure 3-23. Train and elevating assembly installation, lower part.

(e) Take out the hex head bolts from the positioning clamp. Place both parts of the clamp around the M4 pedestal 1/4 inch below the train and elevating clamp. Insert the hex head bolts in the positioning clamp. Tighten the bolts to lock the clamp in place: it should not move up or down the pedestal. Fasten the second clamp 1/4 inch above the train and elevating clamp using the same method (Figure 3-24).

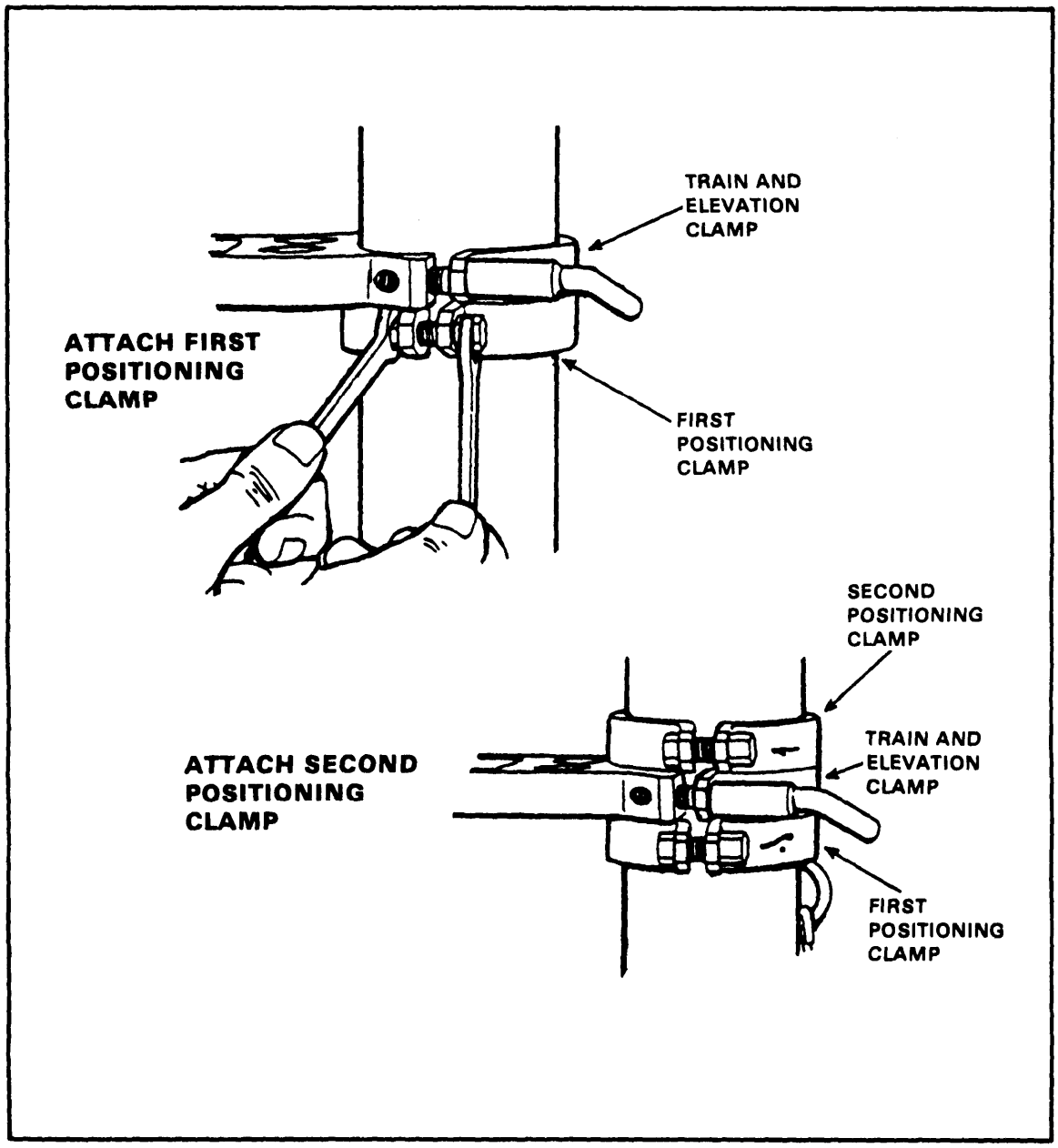


Figure 3-24. Attachment of positioning clamps.

(f) Mount the MK 19.

(g) Partly unscrew the wing nut on the threaded stud of the bracket mounting assembly. Align the stud with the forward groove in the side plate of the gun cradle. Push the bracket mounting assembly up until the heads of the two mounting pins align with the two forward keyholes. Push the heads of the two mounting pins into the keyholes and allow the bracket mounting assembly to slide down. Tighten the wing nut behind the side plate of the cradle (Figure 3-25).

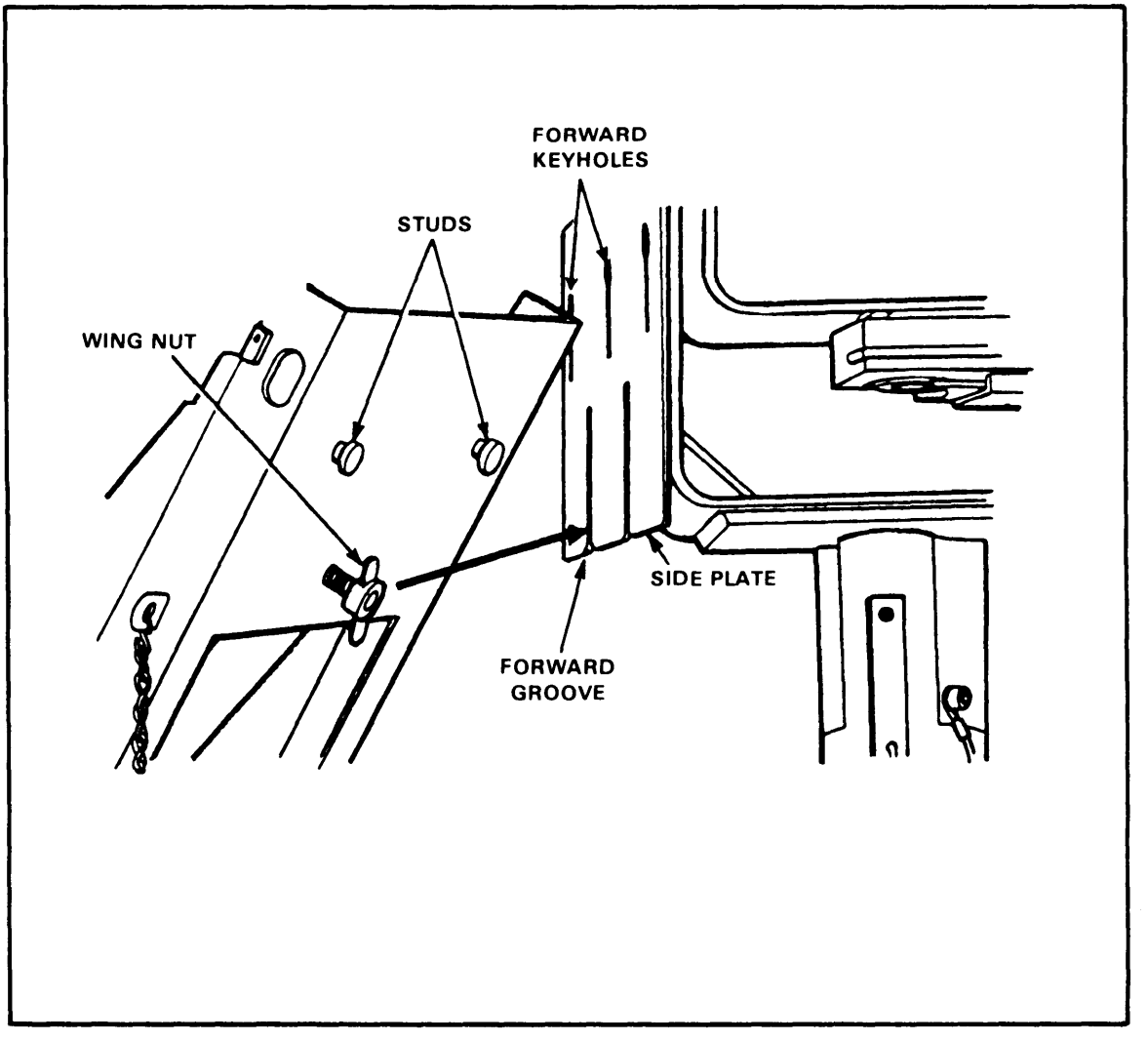


Figure 3-25. Attachment of bracket mounting assembly.

(h) Insert the two hooks on the empty case catch bag through the rear holes in the gun cradle. Engage the

single front hanger on the catch bag with the hook on the gun cradle (Figure 3-26).

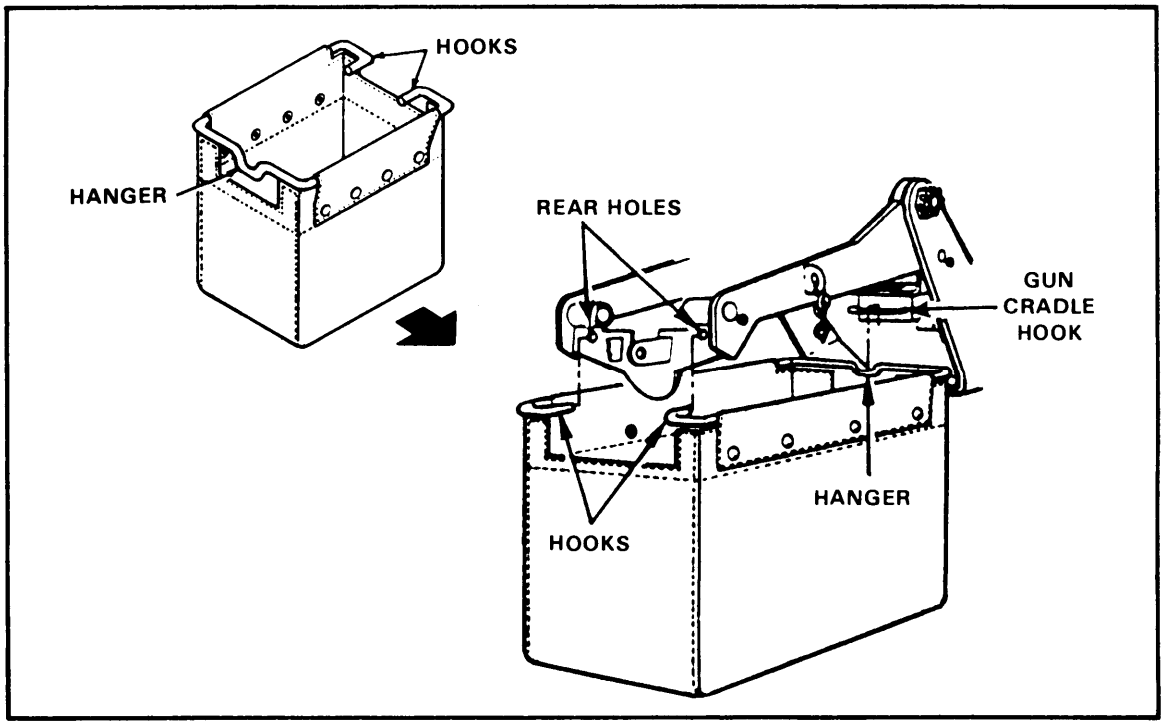


Figure 3-26. Attachment of empty case catch bag.

(2) HMMWV weapon platform (Figure 3-27). To mount the MK 19 on the HMMWV weapon platform, loosen the locking bolts on the side of the HMMWV PEDESTAL WITH A 9/16" wrench. Insert the pintle adapter into the pedestal and tighten the bolts with the wrench. Pull up on the pintle adapter to ensure it is installed securely. Attach the train and elevating assembly to the HMMWV pedestal. Mount the MK 19 and attach the bracket mounting assembly. Attach the empty case catch bag.

(3) M66 ring mount (2 1/2- to 5-ton cargo trucks). To mount the MK 19 on the M66 ring mount, insert the pintle adapter into the M36A2 ring mount with M66 ring receptacle. Install the gun cradle and mount the MK 19. Attach the bracket mounting assembly and the empty case catch bag.

(4) Commander's cupola (M113 APC). To mount the MK 19 on the commander's cupola, install the pintle adapter and the gun cradle. Mount the MK 19 and attach the bracket mounting assembly and the empty case catch bag.

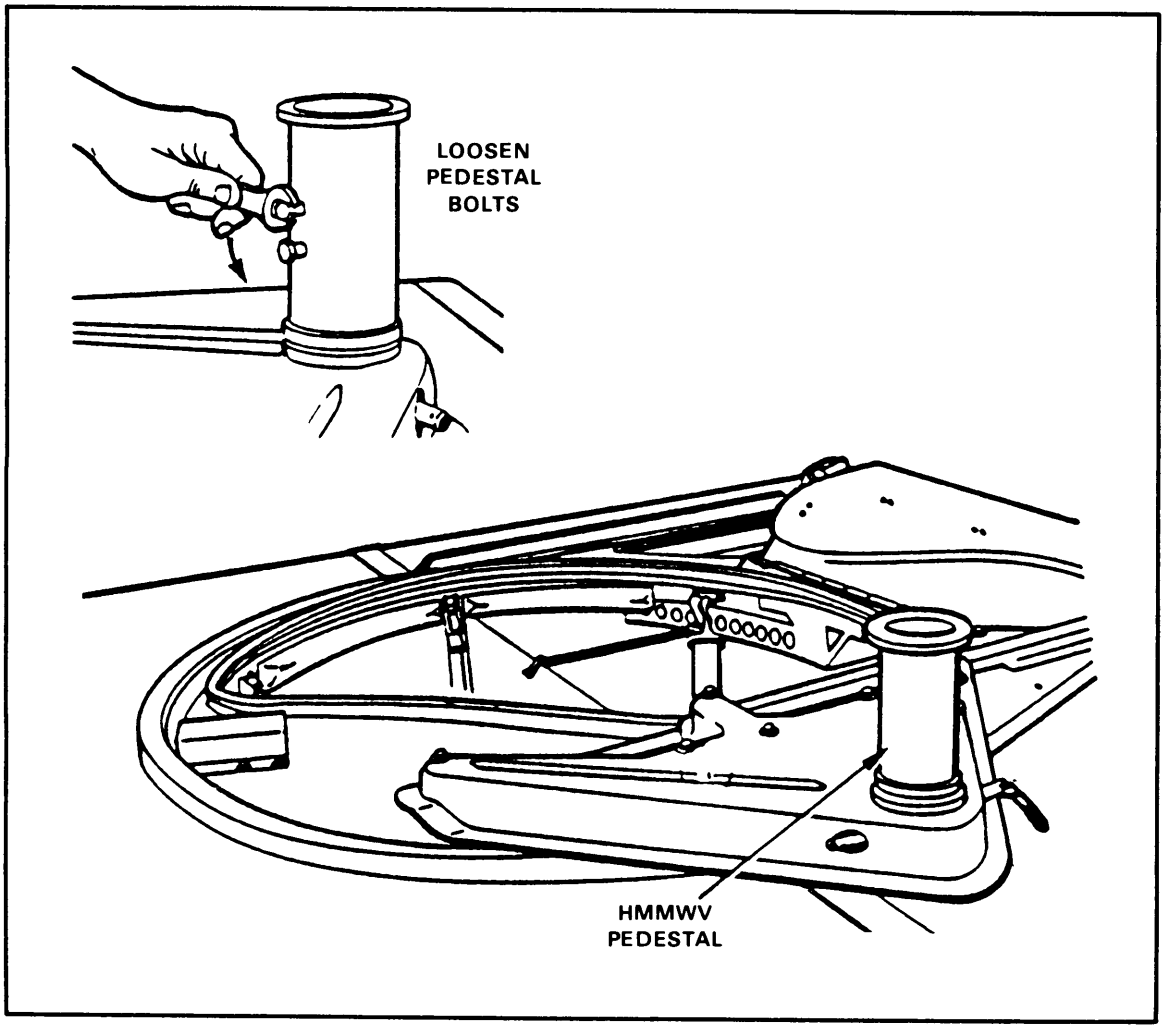


Figure 3-27. HMMWV pedestal.

NOTE: Firing from the cupola is commonly referred to as "free gun". The suggested position for firing free gun is standing with the elbows close to the body, the hands on the control grips, the thumbs on the trigger, and the MK 19 close to the chest.

CHAPTER 4
CREW DRILLS

The purpose of a crew drill is to build precision. speed, skill, and teamwork in checking equipment, placing the MK 19 into and taking it out of action, and moving it to a new position. Precision--the main goal--is achieved by following prescribed procedures. Speed, skill, and teamwork grow with practice. During the crew drill, all oral and visual signals are repeated. Once crew members can perform their duties well, they rotate to allow each member of the crew to learn the duties of the others. The ground-mounted MK 19 has three crew members: the gunner, the assistant gunner, and the ammunition bearer. The crew places the MK 19 into action and keeps the MK 19 supplied with ammunition. The crew will normally not be needed to carry the MK 19 and ammunition over long distances. A vehicle assigned to the crew carries the ammunition and equipment to the firing position. The terrain and the enemy situation dictate how close the vehicle may be brought to the firing position.

4-1. CREW EQUIPMENT

In addition to individual weapons and equipment, each crew member carries specific equipment used with the tripod-mounted MK 19 as listed below.

> WARNING
> Each soldier MUST wear a helmet and fragmentation vest during live-fire.

CREW MEMBER	SUGGESTED MINIMUM EQUIPMENT
Gunner.	MK 19, binoculars, and compass.
Assistant Gunner	M3 tripod, MK 64 gun cradle, with T&E attached.
Ammunition Bearer	One box of ammunition.

4-2. FORMATION FOR CREW DRILL

The leader commands FORM FOR CREW DRILL.

a. Task. Participate as a MK 19 crew member in the crew drill formation.

b. Condition. In a field environment, given a MK 19 gunner, assistant gunner, ammunition bearer, the weapon system, ammunition, and the command, FORM FOR CREW DRILL.

c. Standard. Upon hearing the leader's command, the crew forms in a column, five paces apart, in the following order: assistant gunner, gunner, and ammunition bearer (Figure 4-1).

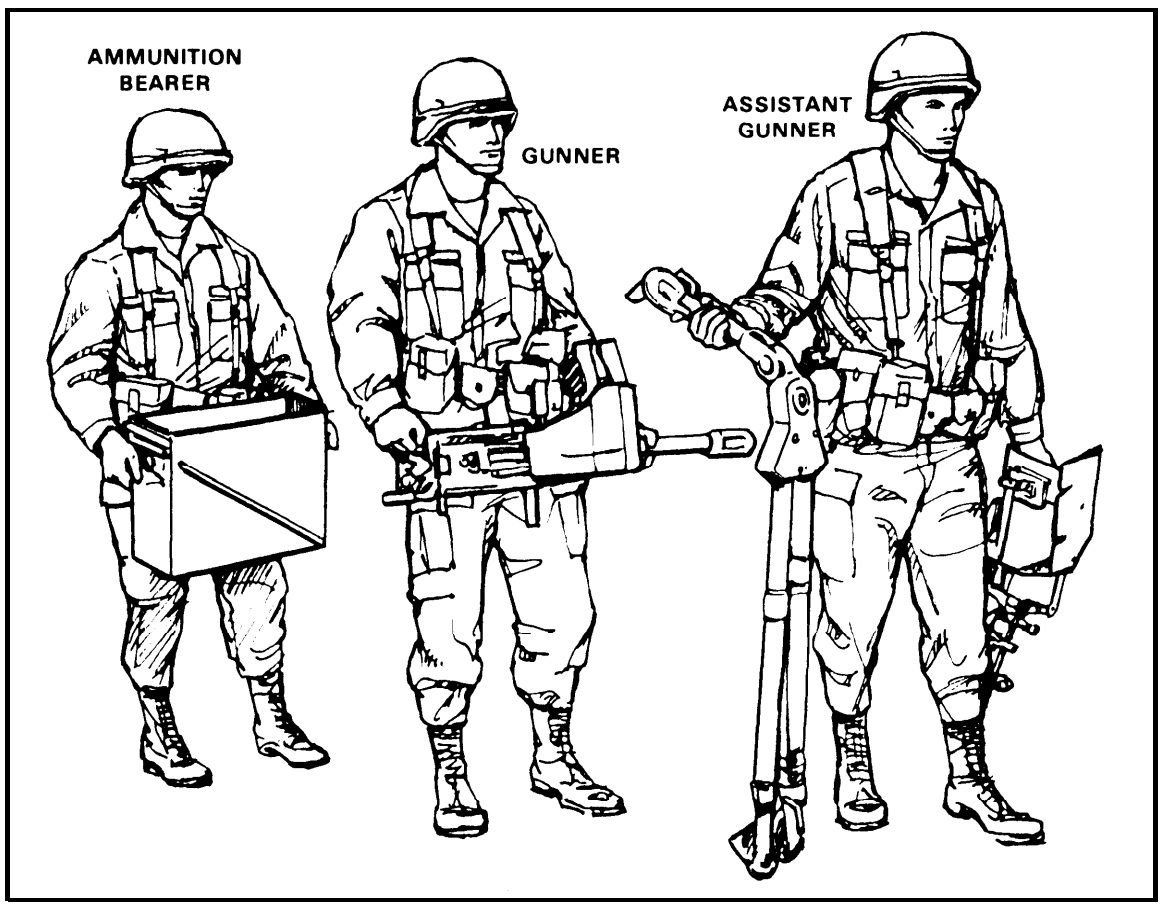


Figure 4-1. Three-man MK 19 crew.

(1) The assistant gunner carries the tripod, with the front leg positioned at a 60-degree angle and the trail legs collapsed, in one hand; he carries the gun cradle, with the T&E mechanism attached, in the other.

(2) The gunner carries the MK19, binoculats, and compass.

(3) The ammunition bearer carries one can of ammunition.

4-3. INSPECTION OF EQUIPMENT

The crew forms with equipment, inspects it, and makes a report.

a. Task. Inspect the MK 19 as a crew member.

b. Condition. In a field environment, given a MK 19 gunner, assistant gunner, ammunition bearer, the weapon system, ammunition, and the command, INSPECT EQUIPMENT BEFORE FIRING.

c. Standard. Upon hearing the leader's command, all crew members inspect the components.

(1) The leader commands INSPECT EQUIPMENT BEFORE FIRING.

(a) Assistant Gunner--Inspect the M3 tripod,gun cradle, and T&E mechanism.

- Ensure that the indexing levers and clamps on the front and trail legs work, and that the legs are in the short (low) position.
- Ensure the front leg is placed at a 60-degree angle and the trail legs are closely folded; and ensure that the front leg clamp is tight.
- Ensure the sleeve lock latch and pintle lock release cam work.
- Ensure the pintle bushing is clean has no burrs.
- Check the cradle to ensure the pintle is clean and that all pins and bolts are seated.
- Prepare the T&E by centering both handwheels.

(b) Gunner--Inspect the MK 19.

- Ensure that the weapon is clean.
- Ensure that the bolt is forward, the top cover is closed, and that the weapon is on SAFE.
- Ensure the charger handles are forward and locked in the up position.
- Ensure the binocular lenses are clean and that the focusing mechanism works.

- Check the compass to ensure that the magnetic arrow and bezel ring work freely.

(c) Ammunition Bearer--Inspect the ammunition, ensuring that the correct type of ammunition is on hand, and that the ammunition can is dent-free. Ensure that all ogives are tight and that the ammunition is clean.

(2) Crew members report when the inspections are finished.

(a) Ammunition bearer--Report, AMMUNITION CORRECT, or any defects.

(b) Gunner--Report, GUN AND AMMUNITION CORRECT, or any defects.

(c) Assistant gunner--Report, ALL CORRECT, or any defects.

4-4. PLACING THE MK 19 INTO ACTION

The leader commands and signals GUN TO BE MOUNTED, and points to the position where the gun is to be mounted: FRONT, and points in the direction of fire: ACTION, and indicates with his fist the MK 19s direction in the chosen position.

a. Task. As a crew member, place the MK 19 into operation.

b. Condition. In a field environment, given a MK 19 gunner, assistant gunner, ammunition bearer, the weapon system, ammunition, and the command, GUN TO BE MOUNTED, ACTION.

(c.) Standard. Crew members place the gun into operation.

(1) At the command or signal ACTION, the assistant gunner drags the tripod to the firing position by its front leg with his right hand, and carries the gun cradle, T&E mechanism attached, in his left hand. When he arrives at the firing position, he aligns the front tripod legs for direction and, with one quick motion, snaps the trail legs apart. This action makes the sleeve lock-latch snap in place (Figure 4-2) . He stamps each leg into the ground. He secures the gun cradle, with T&E attached, to the tripod, using the pintle lock

release cam (Figure 4-3). He secures the T&E mechanism to the tripod, by locking the traversing slide lock lever (Figure 4-4. He helps the gunner mount and load the MK 19.

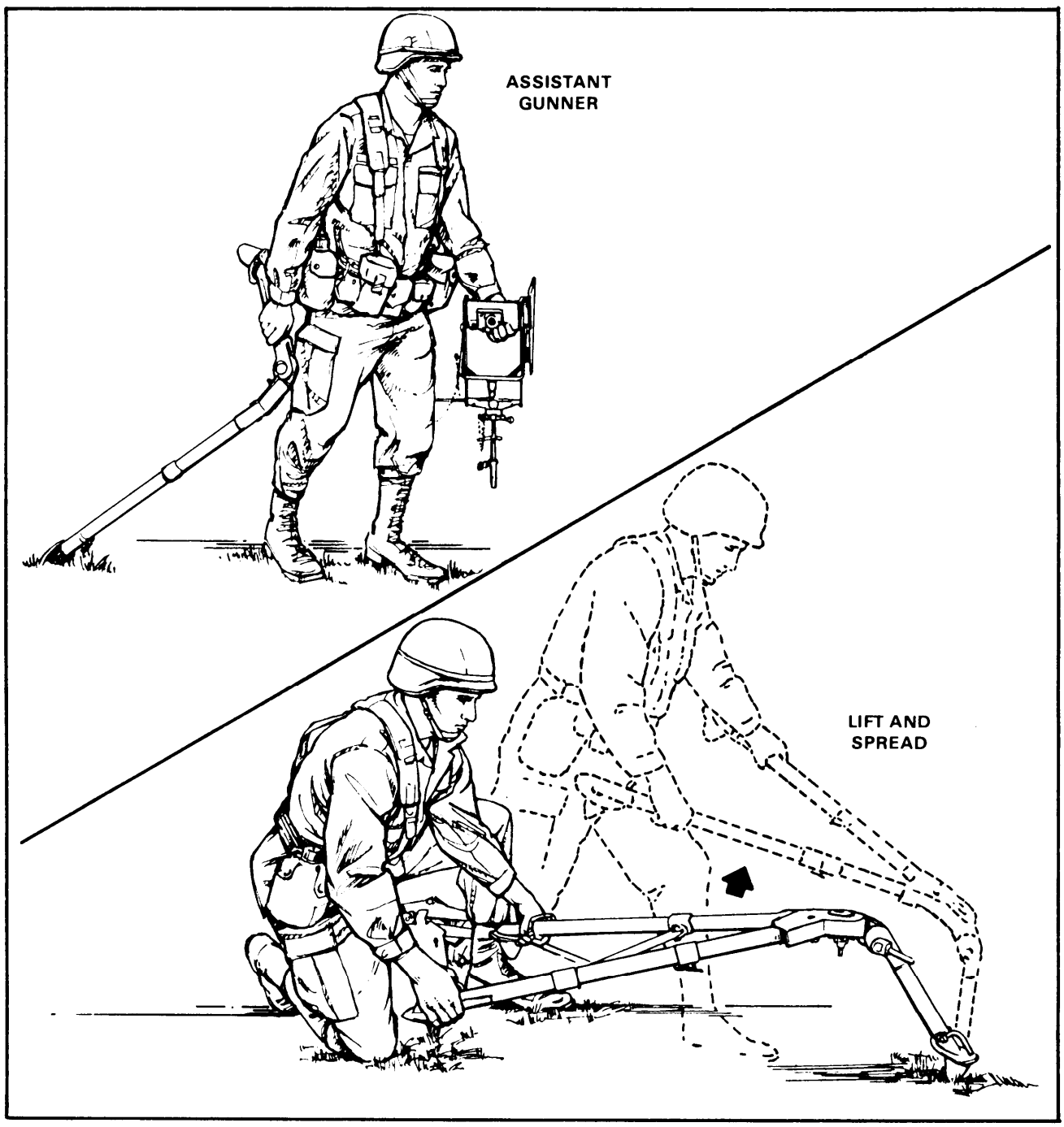


Figure 4-2. Positioning the tripod.

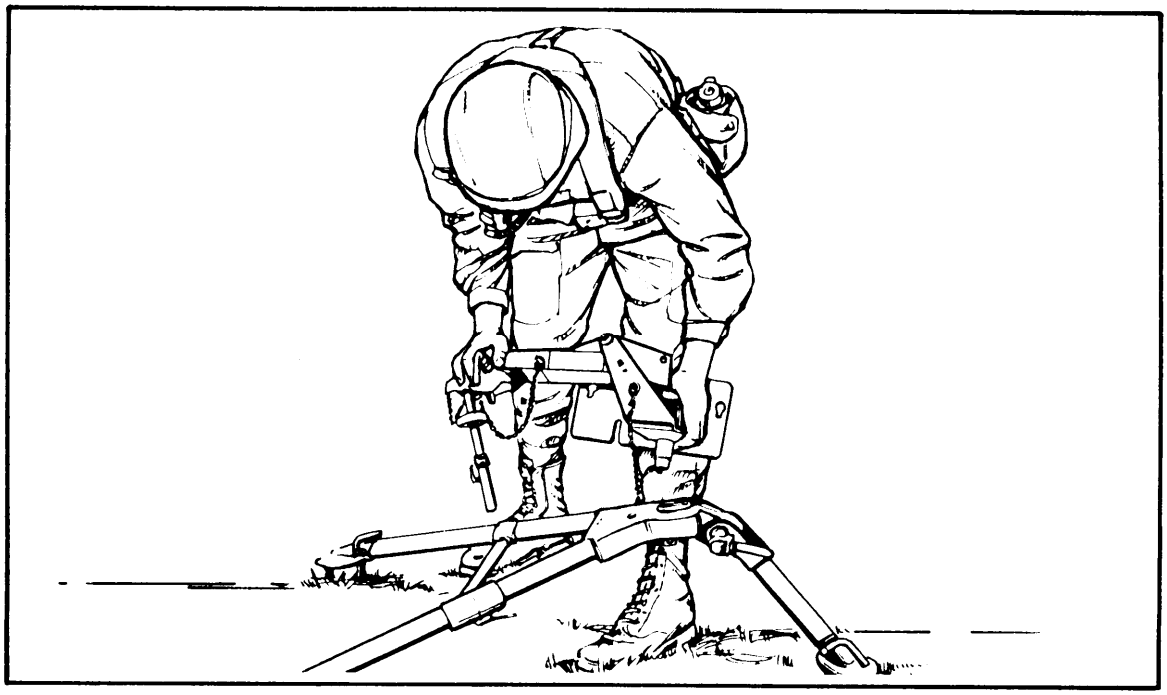


Figure 4-3. Mounting the MK 19 mount on the tripod.

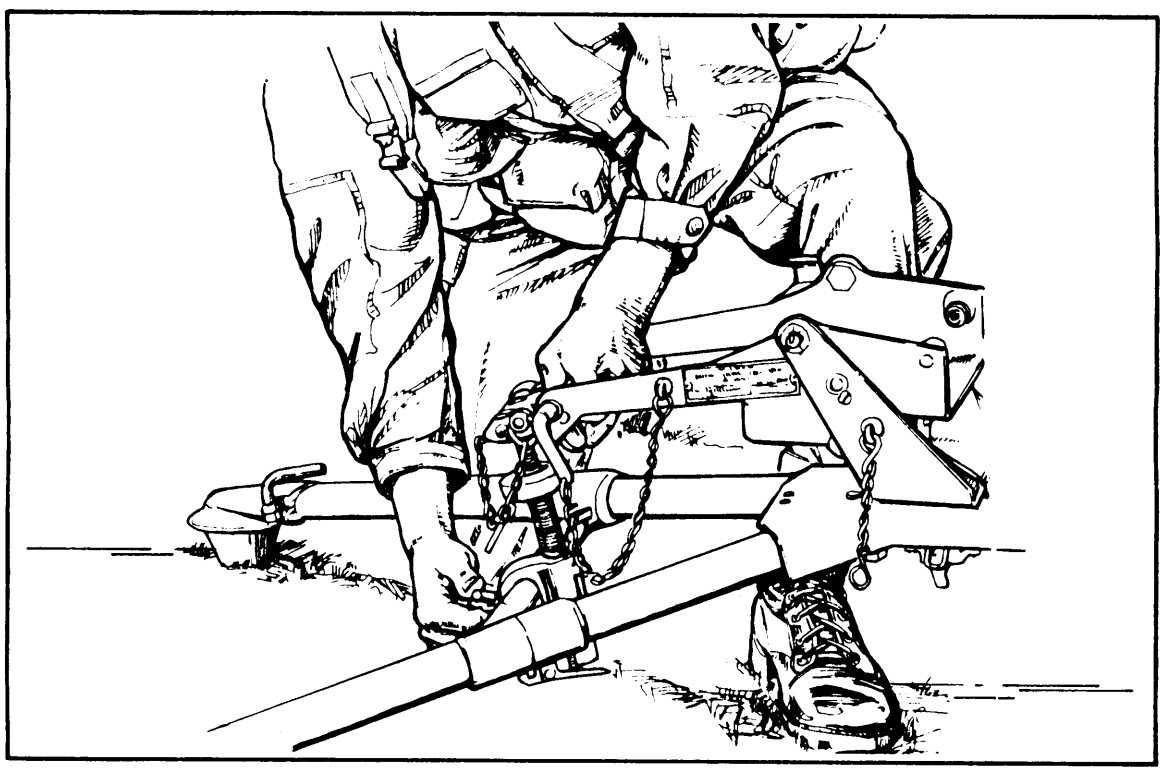


Figure 4-4. Securing the T&E mechanism.

(2) At the command or signal ACTION, the gunner carries the MK 19 receiver to the tripod, with the barrel in his left hand, and the in his right hand (Figure 4-5). The assistant gunner grasps the barrel while the gunner holds the grips. Together they align the grooves on the receiver with the lugs in the gun cradle, and slide the receiver forward (Figure 4-6). The gunner secures the rear of the weapon by inserting the retaining pin through the cradle and sear assembly (Figure 4-7).

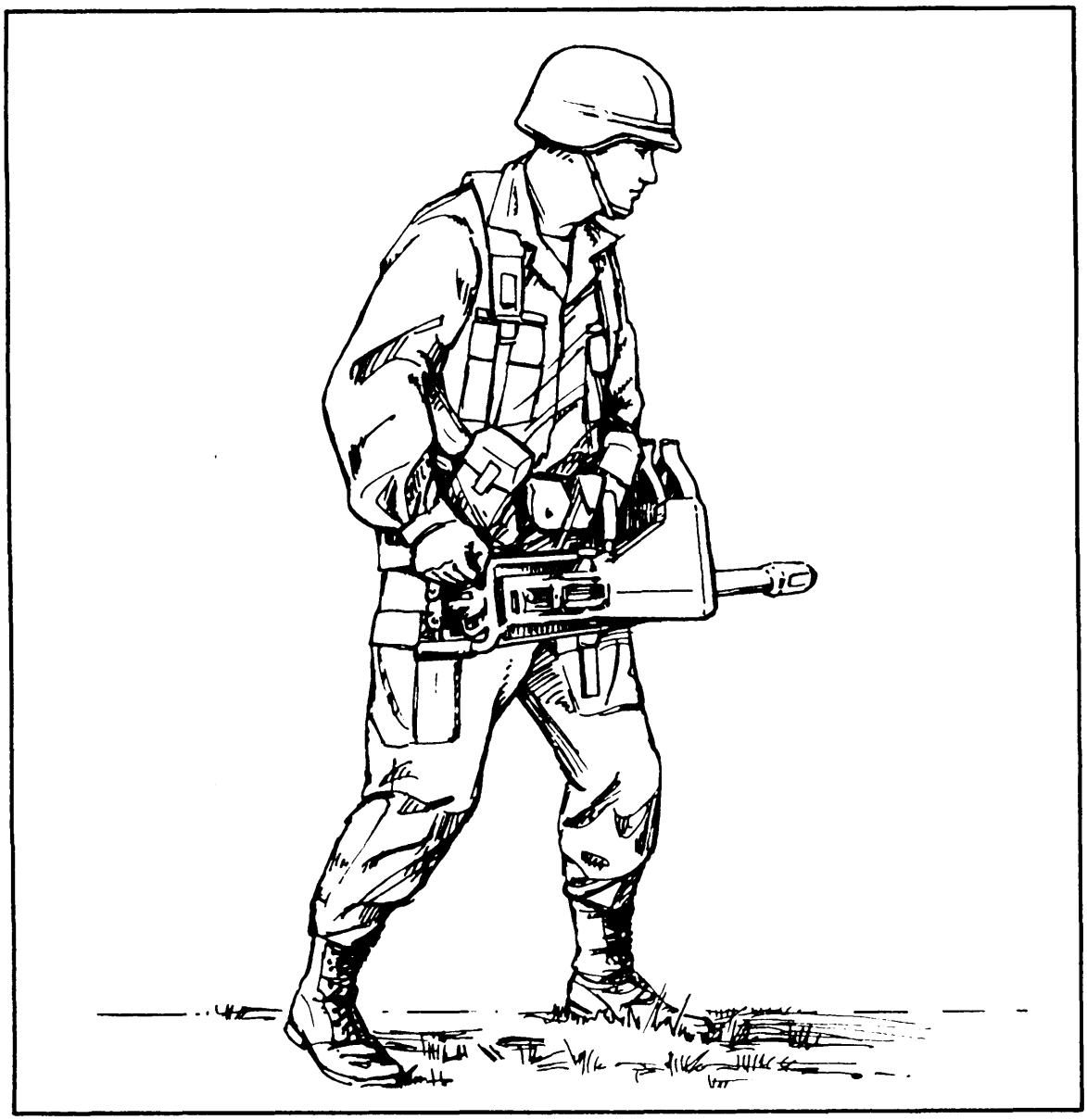


Figure 4-5. Gunner moving into position.

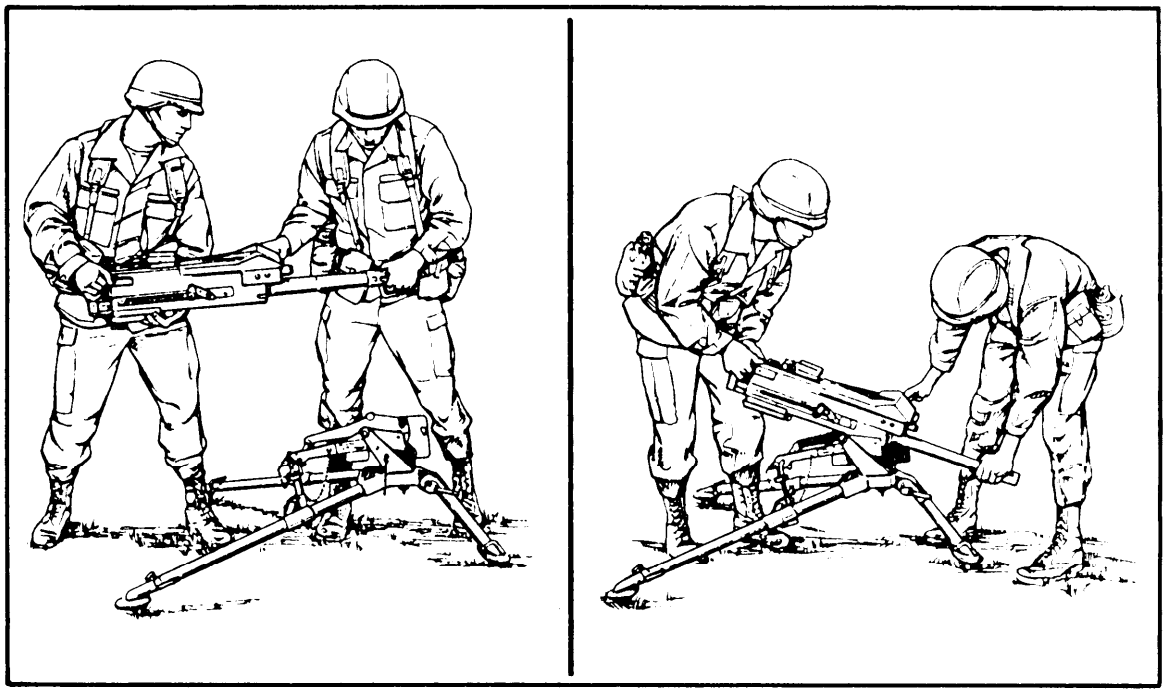


Figure 4-6. Placing the MK 19 in the cradle.

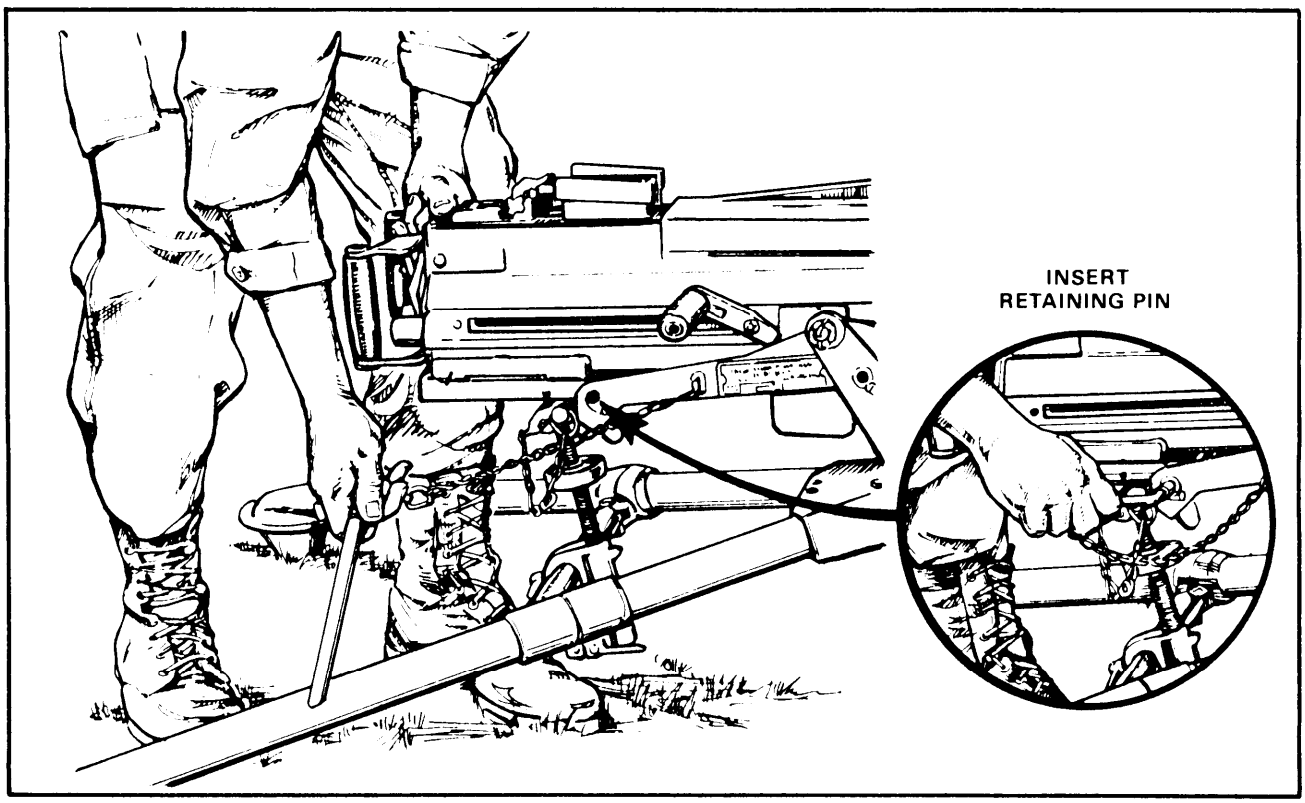


Figure 4-7. Securing the MK 19 to the cradle.

(3) The ammunition bearer carries the can of ammunition to the MK 19 position (Figure 4-8). He take the lid off and ensures the ogive ends of the rounds are pointed downrange (Figure 4-9). He gives the can to the assistant gunner. The ammunition bearer returns to the ammunition point and stands by to do whatever is needed to complete the mission.

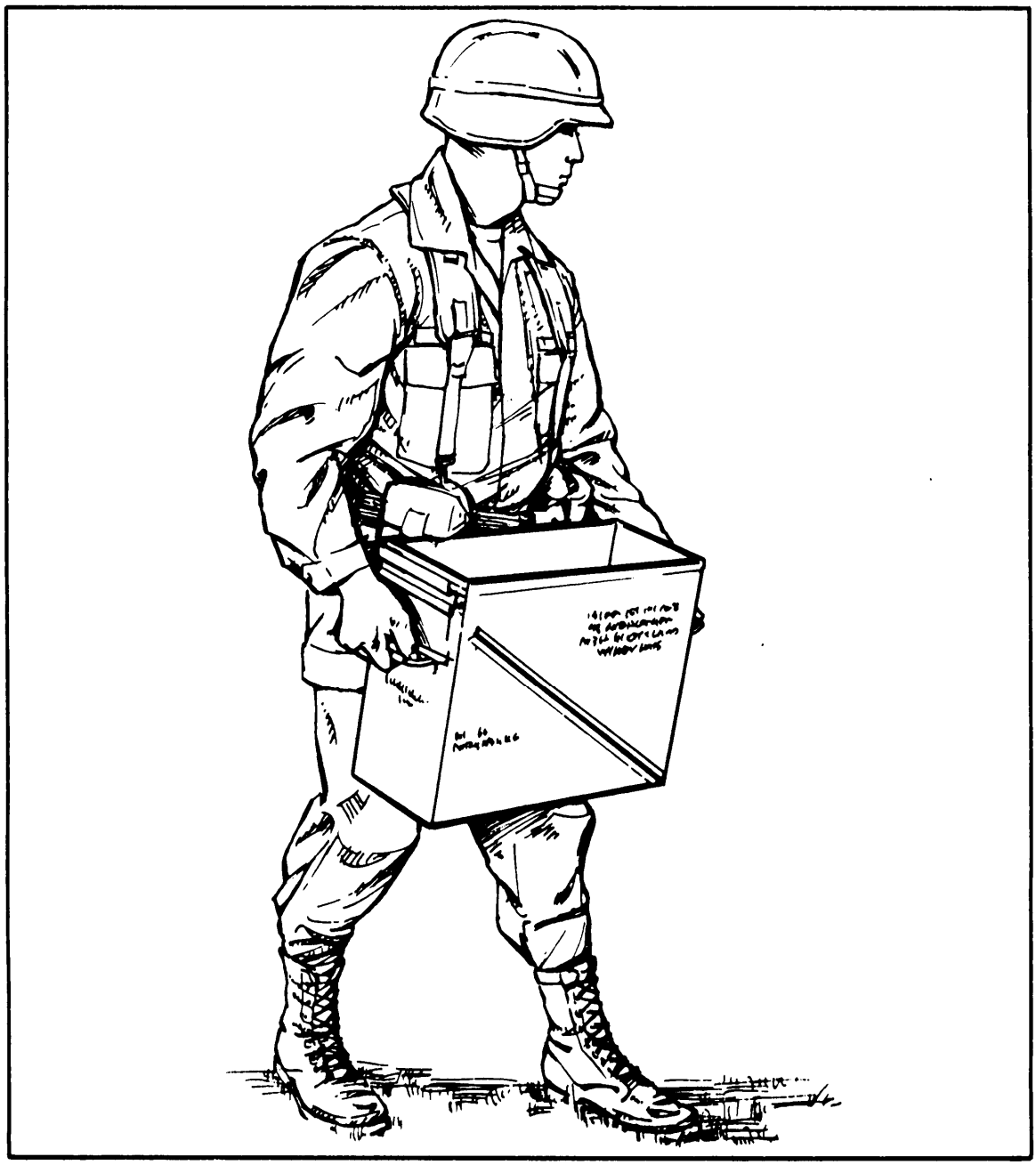


Figure 4-8. Ammunition bearer with ammunition can.

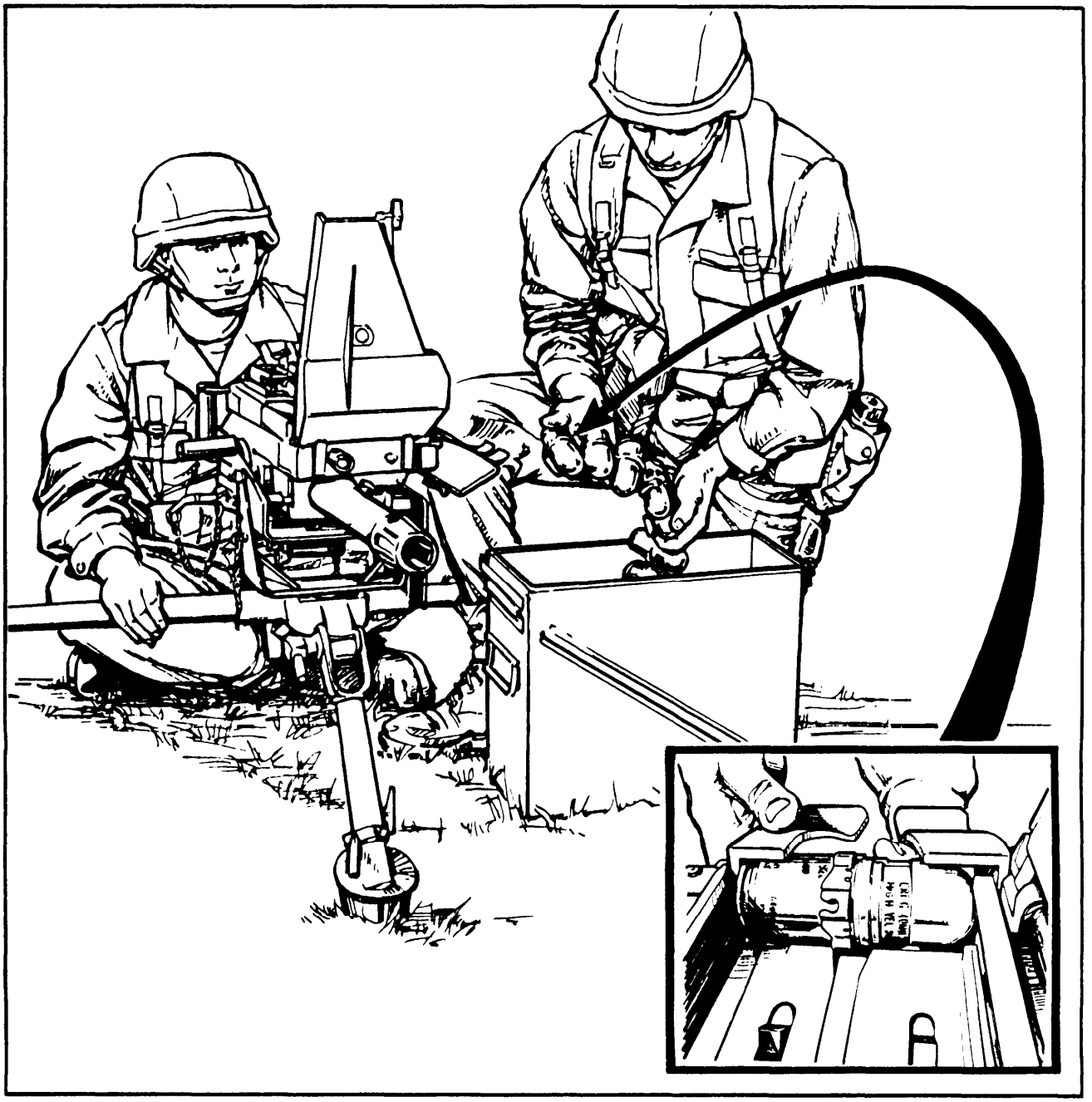


Figure 4-9. Alignment of ammunition belt.

(4) The gunner opens the top cover. The assistant gunner inserts the first round into the feeder, female link first, pushes the first round across the primary feed pawl (Figure 4-10), and moves the feed slide assembly to the left by pushing the secondary drive lever to the right (Figure 4-11).

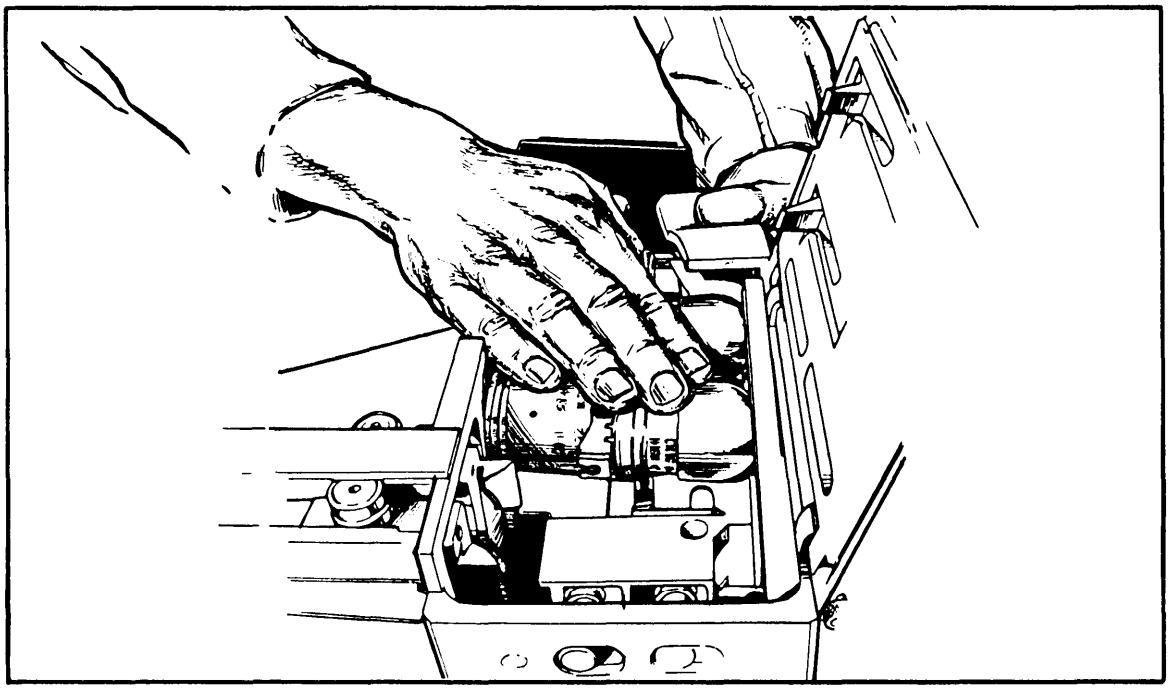


Figure 4-10. Placement of the round across the primary feed pawl.

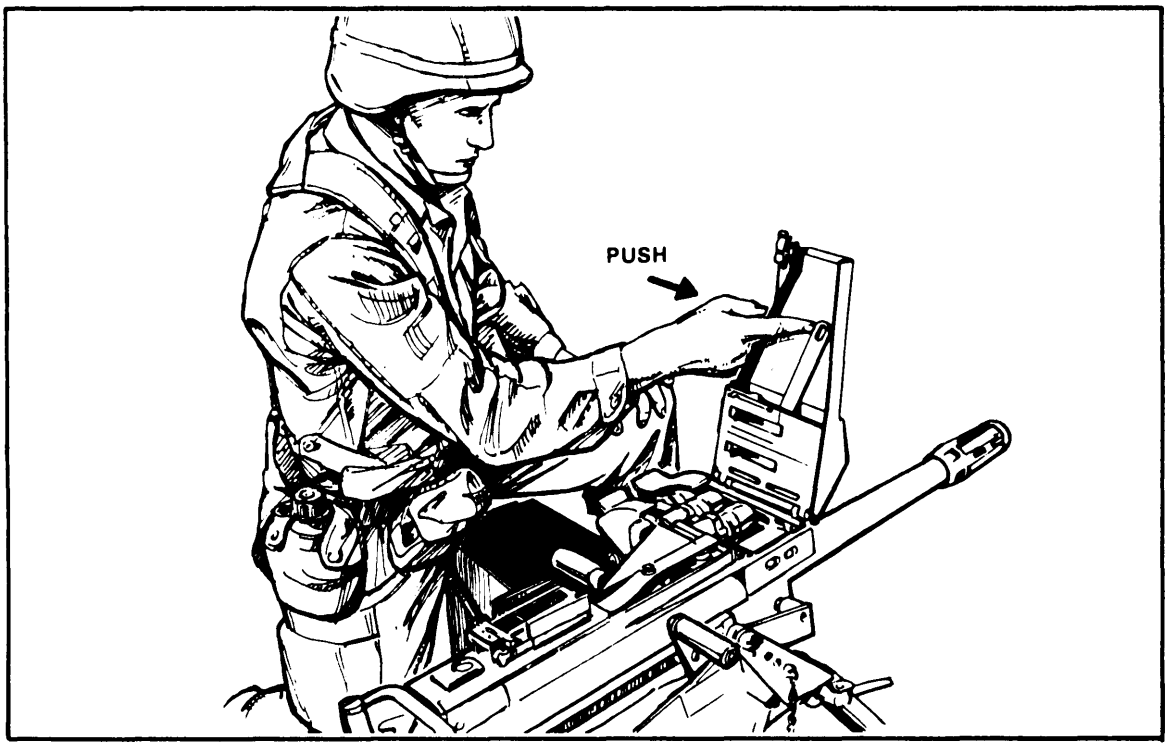


Figure 4-11. Feed slide assembly moved to the left.

(5) The gunner closes the top cover and charges the weapon (Figure 4-12). The gunner presses the trigger, which places the lead round in the bolt extractor. He charges the weapon a second time, forcing the lead round from the bolt extractors into the bolt fingers. The weapon is ready to fire. When the assistant gunner raises the rear sight, the gunner calls UP (Figure 4-13).

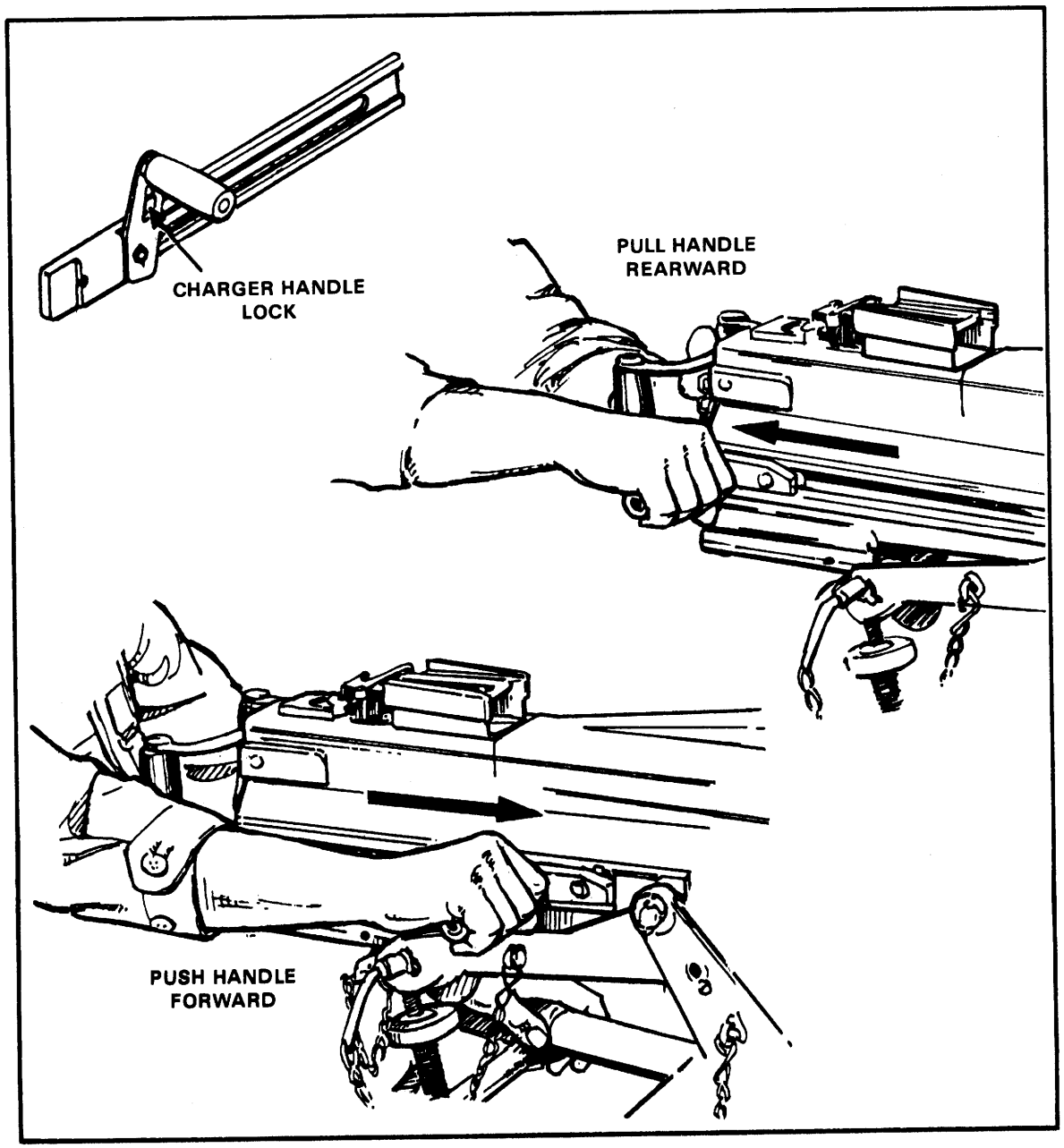


Figure 4-12. Gunner charging the MK 19.

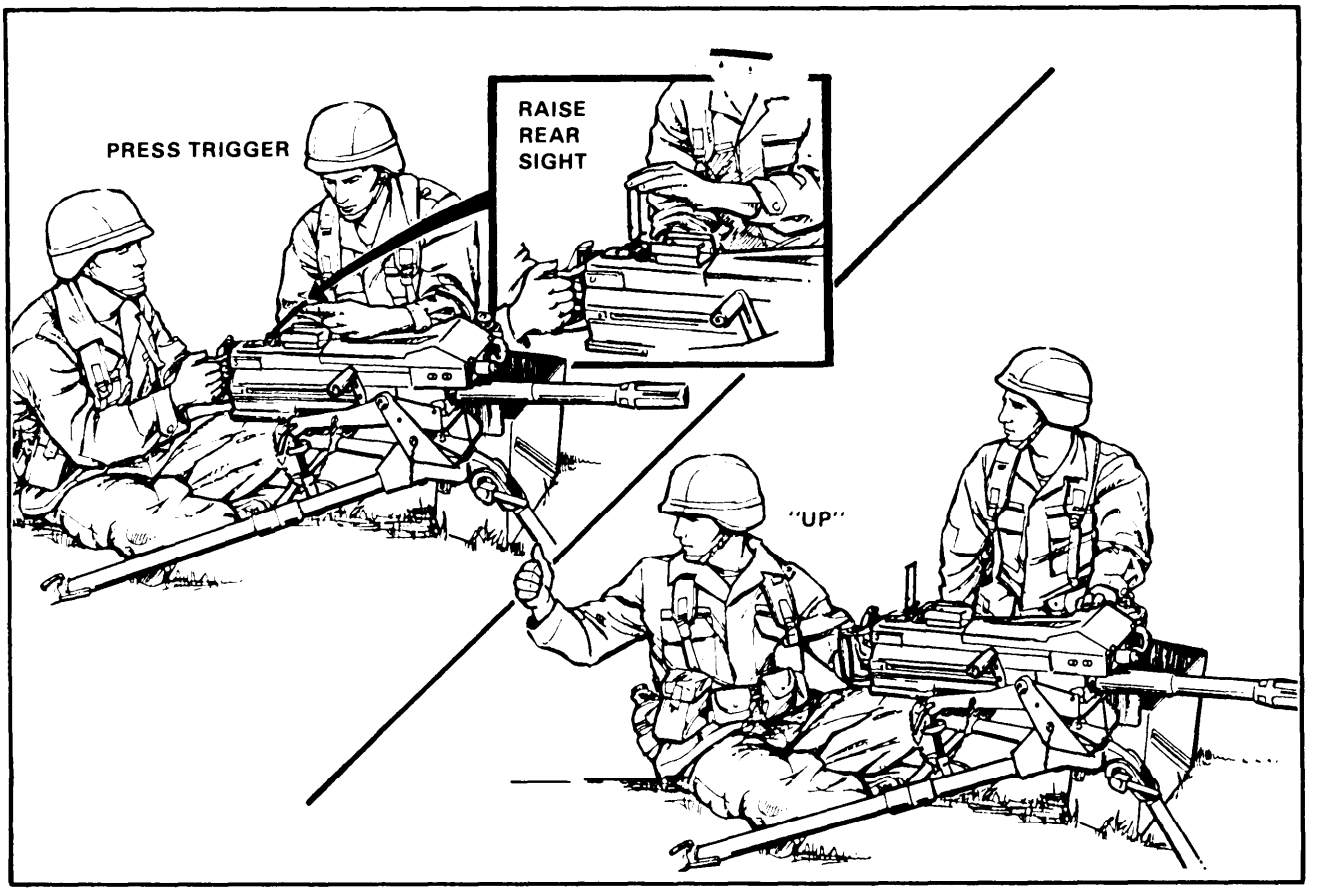


Figure 4-13. Raising the rear sight.

4-5. TAKING THE MK 19 OUT OF ACTION

To take the gun out of action, the leader commands OUT OF ACTION.

a. Task. As a crew member, take the MK 19 out of action.

b. Condition. In a field environment given a MK 19 gunner, assistant gunner, ammunition bearer, the weapon system, ammunition, and the command, OUT OF ACTION.

c. Standard. Each crew member will accomplish the following in sequence:

(1) The gunner raises the top cover of the MK 19; the assistant gunner releases the ammunition belt from the feed tray and places it in the ammunition can. The gunner takes the round or spent cartridge case from the bolt fingers, places it in the ammunition can, and closes the top cover.

(2) The assistant gunner releases the MK 19 from the gun cradle. The gunner lifts the MK 19 off the mount and moves to a position ten paces behind the tripod. He places the MK 19 on the ground in front of him with the flash suppressor to the left and with the sights on the top.

(3) Once the gunner has moved away from the tripod, the assistant gunner releases the T&E mechanism, takes off the gun cradle/T&E mechanism. He releases the sleeve lock latch. He grasps the front leg and rotates the tripod to a vertical position. He releases the sleeve latch, and collapses the trail legs. He loosens the front leg clamp, folds down the front leg, and tightens the clamp. He returns, with tripod and gun cradle, to a position five paces behind the gunner.

(4) The ammunition bearer comes forward and gets the ammunition can(s) or any other loose equipment, and returns to a position five paces behind the assistant gunner. The gunner announces UP.

4-6. CARRYING THE TRIPOD-MOUNTED MK 19

To move the MK 19 and equipment a short distance, the gunner commands SECURE EQUIPMENT, FOLLOW ME.

a. Task. Move the tripod-mounted MK 19.

b. Condition. In a field environment, given a MK 19 mounted on an M3 tripod.

c. Standard. The MK 19 must be moved using one of three methods-- dragging, two-man carry, or three-man carry.

(1) Dragging. The gunner grasps the front leg and pulls the MK 19 to the new position, and the assistant gunner secures any loose equipment.

(2) Two-man carry. The gunner stands behind the tripod with a trail leg in each hand. The assistant gunner grasps the front leg and avoids touching the barrel if it is hot. The gunner and assistant gunner carry the mounted MK 19. The assistant gunner returns to secure any loose equipment.

(3) Three-man carry. The gunner and assistant gunner each holds a trail leg just above the traversing bar. The ammunition bearer grasps the front leg and avoids

touching the barrel if it is hot. The crew moves to the new position. The ammunition bearer and the assistant gunner go back and get the ammunition or loose equipment, and return to the new position.

CHAPTER 5
MARKSMANSHIP

This chapter gives guidance for instruction and development of MK 19 gunnery skills. It provides data needed to develop training programs, plans, and lessons used to build the gunners' confidence and skill in firing the MK 19. Marksmanship training ensures that each soldier keeps his combat firing skills at a level consistent with the unit's mission. During war, skills that have been maintained supply a base for MK 19 training (see Appendix B).

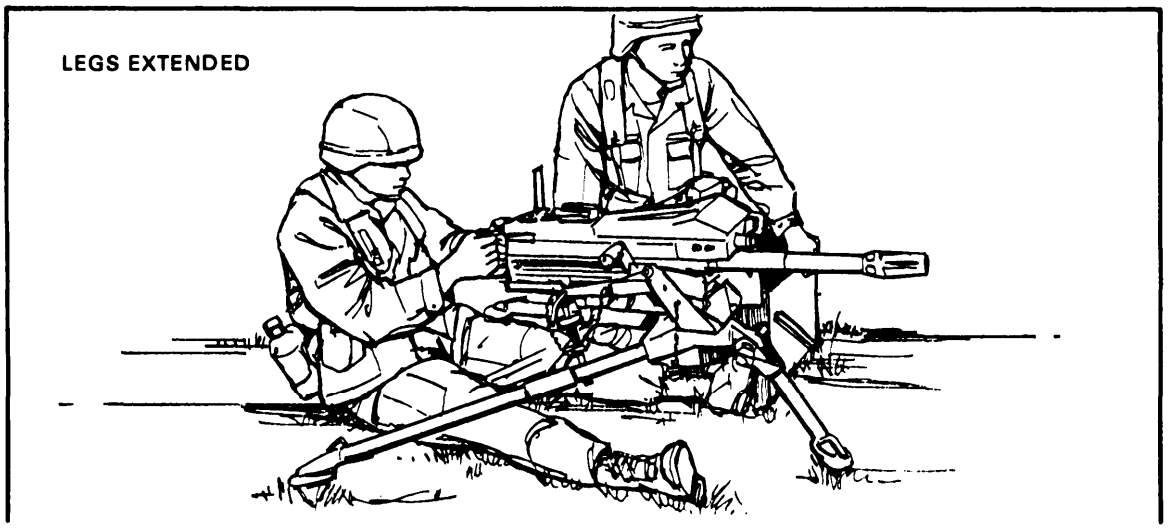
Section I. PREPARATORY MARKSMANSHIP TRAINING

Preparatory marksmanship training for the MK 19 covers the firing positions, the MK 19 fighting position, use of the T&E mechanism and manipulation exercises. Thorough instruction during the preparatory training and exercises helps ensure efficient use of time and ammunition during range firing. Both the diagnostic and intermediate tests are in Appendix B.

5-1. FIRING POSITIONS

Use the basic positions as follows during training and range firing of the MK 19:

a. Sitting. When the tripod is used in the low or high position, sit directly behind the gun between the trail legs of the tripod. Extend the legs under the tripod, cross them, or brace the feet on the tripod (Figure 5-1). Place the elbows on the inside of the thighs for support when crossing the legs or bracing the feet on the tripod.



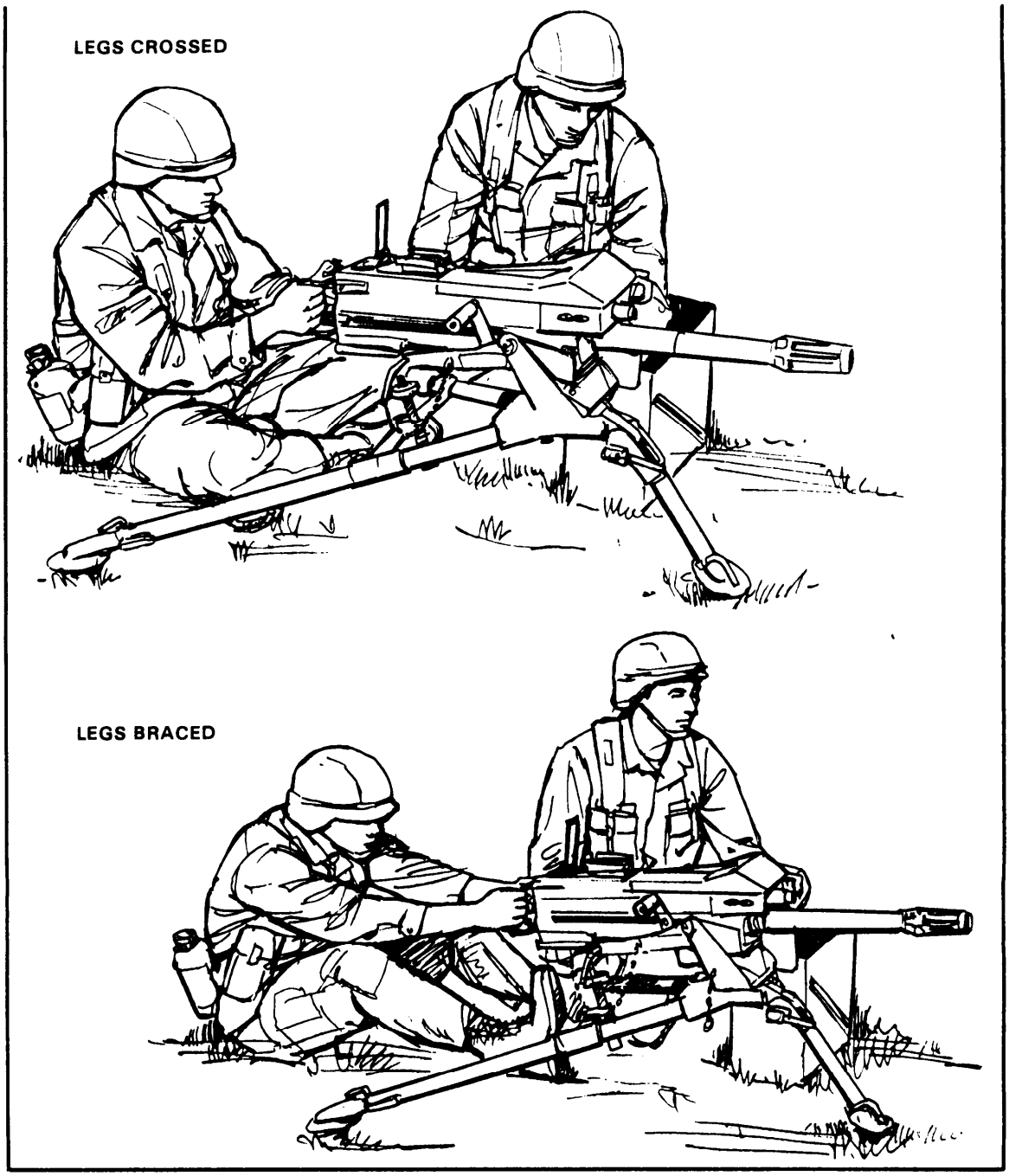


Figure 5-1. Seated firing positions.

b. Standing. When the MK 19 is mounted on a vehicle, stand with both hands on the control grips and the thumbs resting on the trigger. Keep the elbows against the body, the body forward, and the chest against the hands to brace the gun (Figure 5-2).

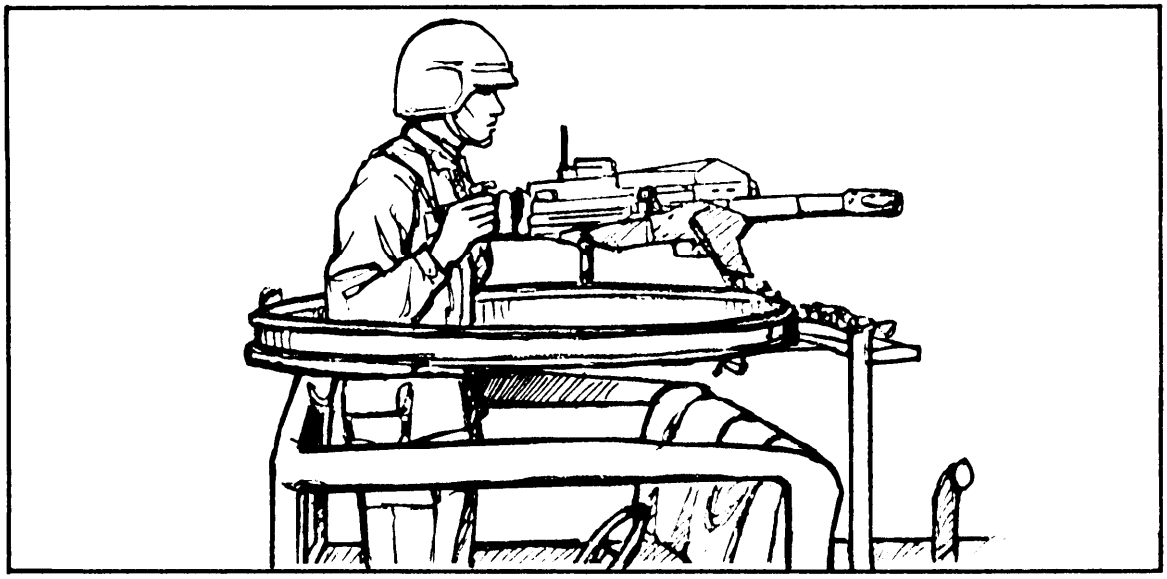


Figure 5-2. Standing position.

c. Kneeling. When the MK 19 is in a fighting or hasty tripod-mounted position (Figure 5-3), kneel and grasp the control grips with thumbs on the trigger.

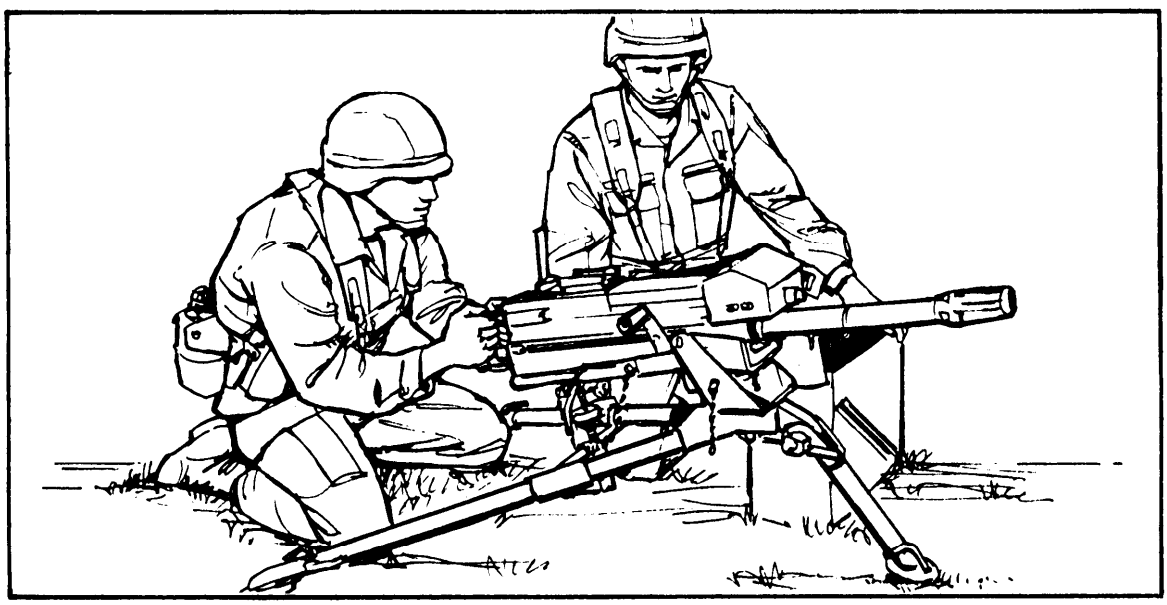


Figure 5-3. Hasty tripod position.

5-2. FIGHTING POSITION

A fighting position is dug when the unit has time to prepare it or is in a defensive position. Make the fighting position as follows (Figure 5-4):

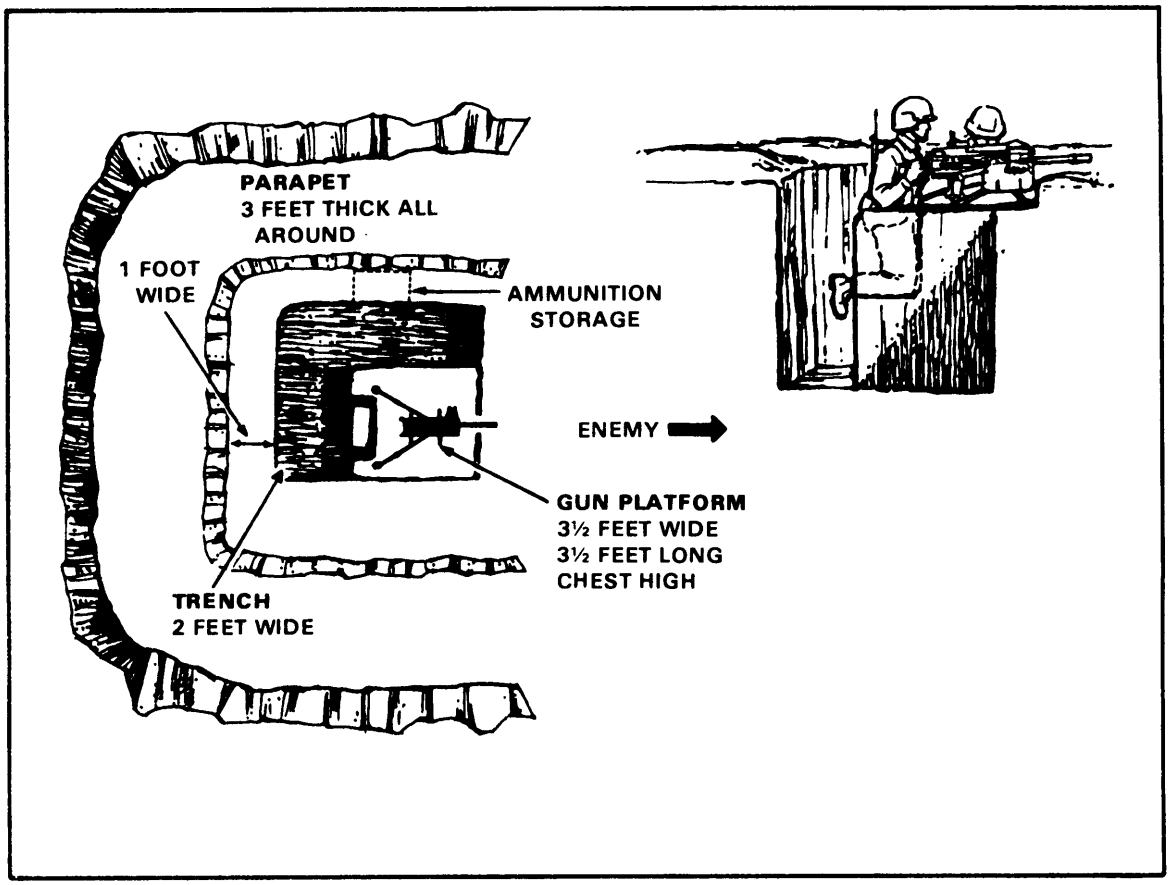


Figure 5-4. Dug-in position.

a. Position the MK 19 so it is oriented on the center of the assigned sector of fire. Mark the position of the tripod legs and trace the outline of the firing platform, which will be dug about 3 inches deep.

b. Dig the position in the shape of an L around the firing platform. The position should be chest-deep and wide enough to allow the MK 19 crew to load, operate, and place effective fire on assigned sector of fire. The position can be made so that the gunner can fire from the kneeling position by digging the desired depth directly behind the gun.

c. Use dirt from the hole to build flank parapets 18 inches thick. Dig the ammunition storage area into the left wall of the "L" and close to the ground.

d. Make sure the wall behind the firing platform is sloped to allow for entrance to and exit from the fighting position.

e. Build overhead cover:

(1) Put flank support logs, 4 to 6 inches in diameter, on top of each other along the entire length of the flank parapets.

(2) Put logs, 4 to 6 inches in diameter, side by side across the support logs as the base for the overhead cover.

(3) Put a waterproof layer over the base logs.

(4) Put 18 inches of dirt on top of the waterproofing material.

(5) Mold and camouflage the cover to blend with the terrain.

f. Camouflage the position with natural materials such as rocks, logs, live bushes, and grass.

5-3. TRAVERSING BAR AND T&E MECHANISM

Use the T&E mechanism to engage preselected target areas at night or during degraded conditions. Record direction and elevation readings from the traversing bar and T&E mechanism. Record all readings in mils.

a. Zero the T&E. Before the T&E can be used effectively to engage targets, it must be zeroed (Figure 5-5). Zeroing is a simple process if the following method is used:

(1) To zero the traversing handwheel, hold the T&E so the traversing handwheel is on your left as you look at it. Turn the traversing handwheel toward you until it stops. Loosen the locking nut slightly. Align the 0 on the scale with the 0 on the elevating screw yoke. Hold the scale with the 0’s aligned, and tighten the locking nut. Make sure the 0’s stay aligned. Turn the traversing handwheel two complete revolutions away from you. If doing this at night, count 50 “clicks” away from you.

(2) To zero the elevating handwheel to the upper elevating screw, align the two 0's. Rotate the elevating handwheel up or down until a 0 with a line below it is visible on the upper elevating screw. Position the elevating handwheel so the indicator is pointing at the 0 on the handwheel.

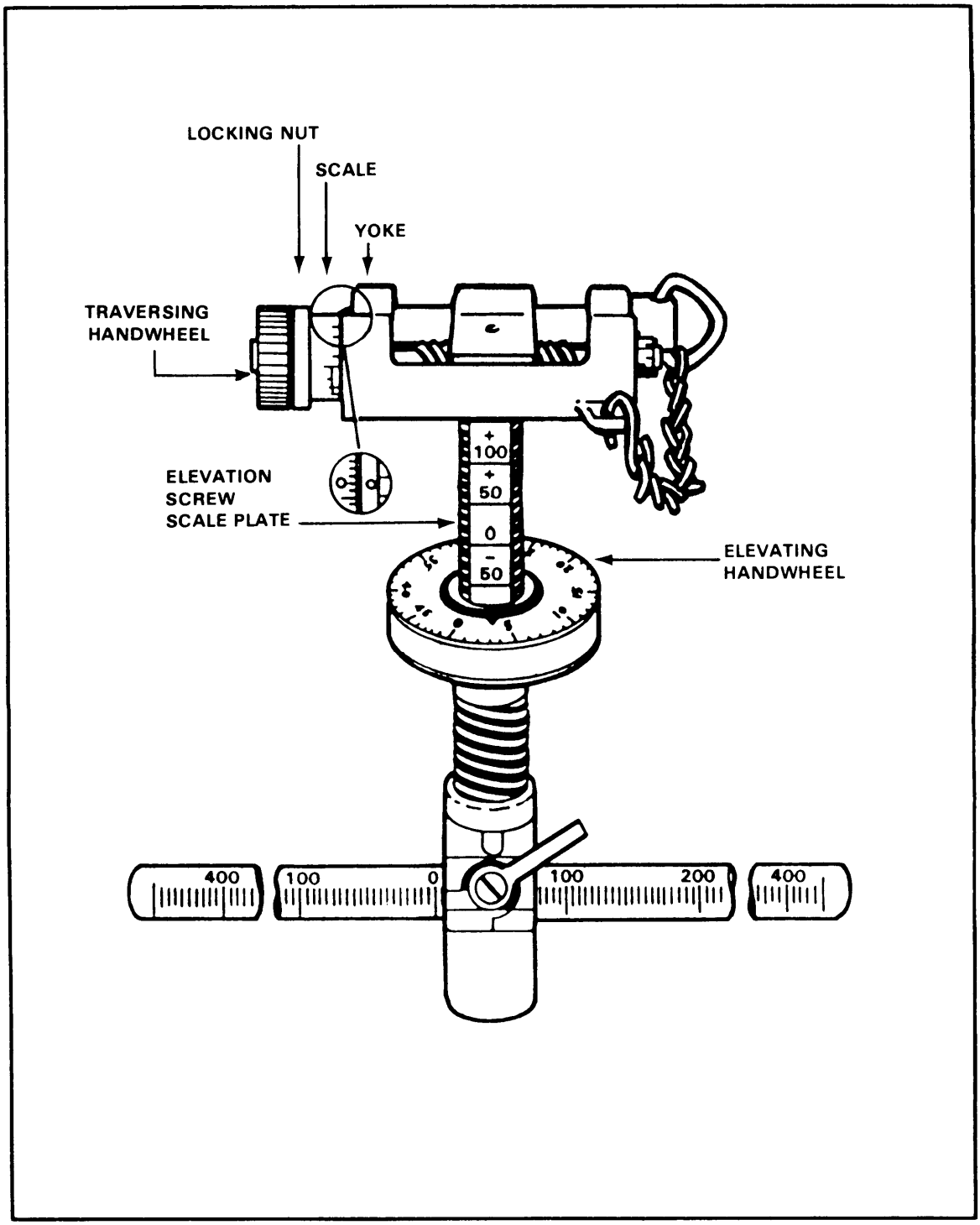


Figure 5-5. Zeroing the T&E mechanism.

(3) Zero the elevating mechanism sleeve to the lower elevating screw. Rotate the elevating mechanism sleeve

all the way up; rotate it down until it stops; note the number of complete turns. Rotate the elevating mechanism sleeve up half that many turns. Position the slide lock lever to face you. Attach the T&E to the tripod and gun.

b. Lay the gun for direction. When a sector of fire has been assigned, pick up the rear legs of the tripod and shift the tripod until the muzzle of the weapon points to the center of the sector of fire. Once the MK 19 is laid for direction, firmly stamp in the tripod shoes and place sandbags on the legs. This aids stability and may prevent accidental movement.

c. Obtain and record direction readings to all targets within the sector of fire (Figure 5-6). Loosen the traversing slide lock lever and move the slide along the traversing bar until the MK 19 is laid on the center of a point target or on either flank of a linear target. Lock the traversing bar and read the direction from the scale on the traversing bar. If the left edge of the traversing slide does not fall exactly on a 5-roil tickmark, move the left edge of the traversing bar slide back to the next smaller mil reading. Use the traversing handwheel to complete the initial lay. Obtain a reading to the target by the direction of the MK 19 barrel. If the barrel is moved to the right, record a right reading. Read the number on the traversing bart from the left side of the

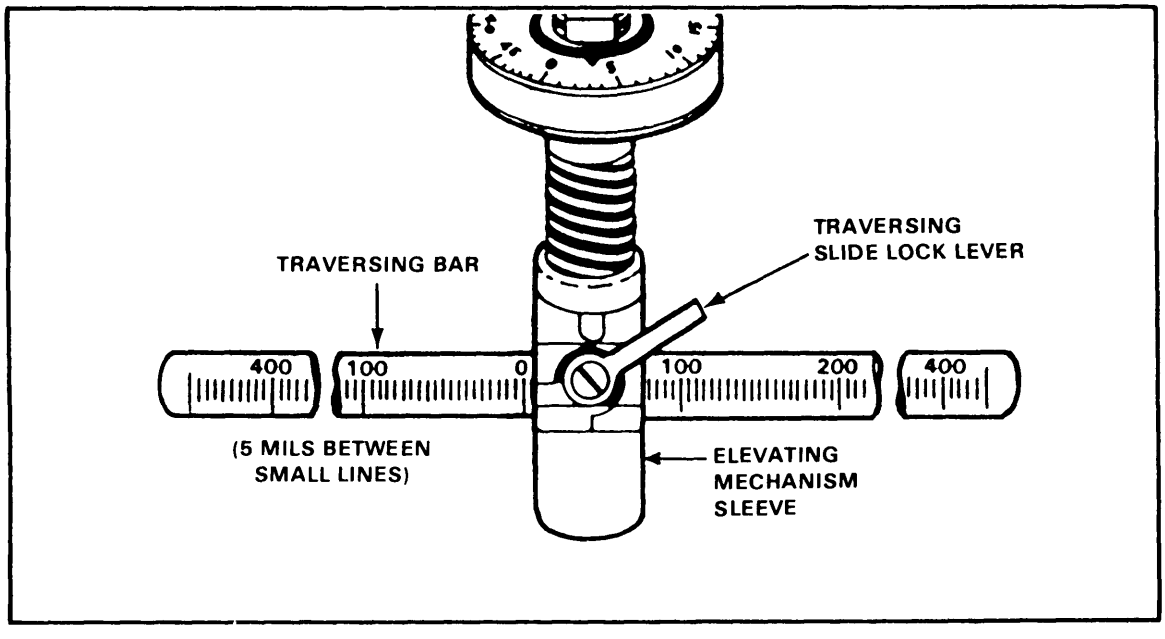


Figure 5-6. Direction reading.

traversing slide lock. If the barrel is moved to the left and the traversing slide lock is on the right side of the zero, record a left reading. After taking a direction reading for a target, measure the width of the target in mils using the traversing handwheel to move across the target. Reposition the traversing mechanism before moving to another target.

d. Obtain elevation readings. Ensure the MK 19 is laid on the center base of the target. Read the elevation from two scale: the first, or major, part from the elevating screw plate scale; the second, or minor, part from the elevating handwheel. Separate the two part from the elevation reading with a slash "/", for example, -50/3. An elevation reading may not be valid on any other T&E than the one from which it was read. If the number of threads is increased or decreased after the data is recorded, accurate fire cannot be placed on the target. For example, if a weapon is freed to engage a secondary sector, and the base of the T&E mechanism is rotated, the data is wrong unless the same number of thread are exposed before and after the move.

(1) Major reading. The elevating scale plate is graduated in 50-mil increments from -250 to +100. Except for the zero, each number has a plus or minus sign above it. All numbers, including zero, have an index line below them. To get the major elevation reading, hold the T&E so that your eyes are even with the top of the elevating handwheel. The major reading (for example, -50) is the first number,with an index line, that is visible above the handwheel (Figure 5-7).

(2) Minor reading. The elevating handwheel scale is marked in fifty increments of 1 mil each (Figure 5-7). The minor reading, which has no plus or minus sign, is the number that lines up with the pointer. The minor reading represents the number of mils the gun is laid below the major reading, for example, 3.

(3) Verify a direction elevation reading by firing and adjusting on the target.

(4) Use the dry-fire method to get data to targets without live firing and adjusting. Set the rear sight on the range to the target, lay the gun on the center base of the target, and take direction and elevation readings. Use the dry-fire method only when firing is not feasible.

NOTE: Correct range setting is critical because any discrepancy will cause and error in the elevation when the target is engaged.

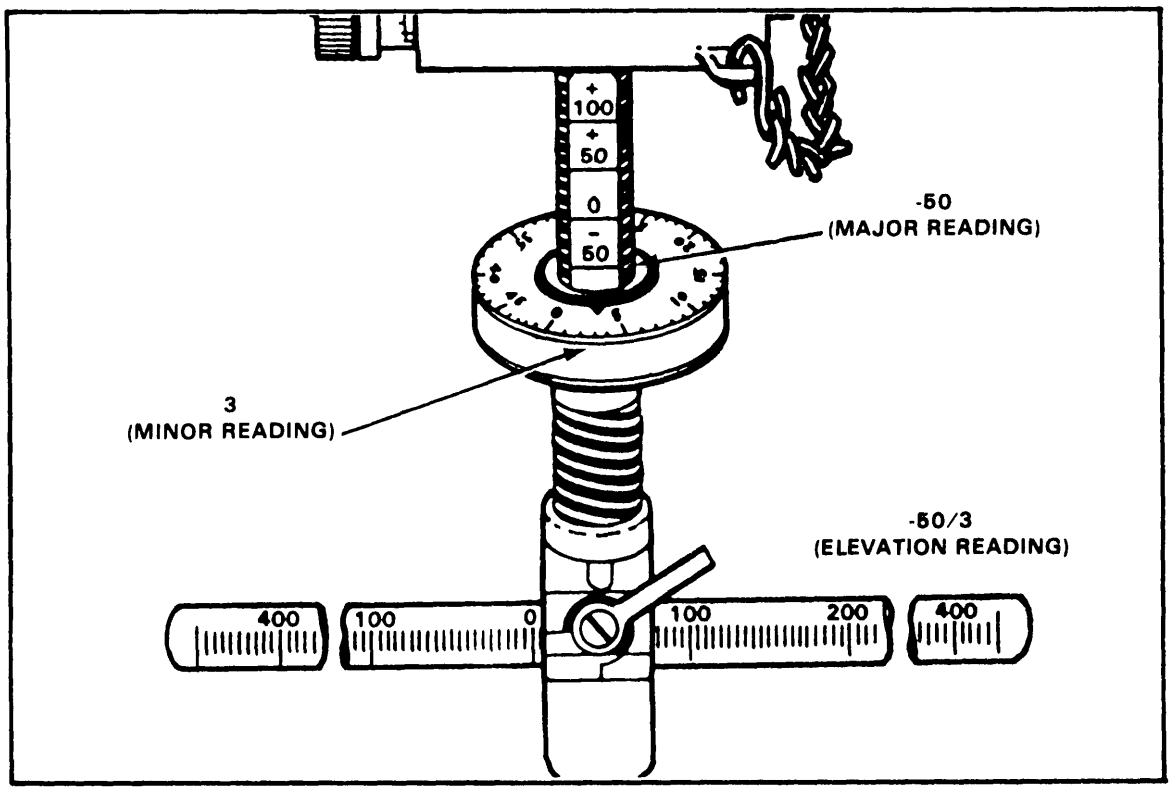


Figure 5-7. Elevation readings.

5-4. EXERCISES

The exercises include sighting and aiming, sight setting and laying, manipulating, determining the range, and preparing a range card.

a. Sighting and Aiming Exercises. There are two sighting and aiming exercises. The first calls for the use of the sighting bar:

(1) This exercise teaches how to get the correct sight picture, and also teaches alignment methods. Sight alignment means lining up the front and rear sights, with the top center of the front sight blade appearing in the center of the rear sight. Sight picture means lining up the front sight, the front sight blade just target, with the tip of the front sight, and the touching the bottom center of the target. Gunners must show skill in aligningsights correctly and in getting

the correct sight picture, using a sighting bar Figure 5-8). Gunners must correctly show the point of aim, after sight alignment, 8 out of 10 times.

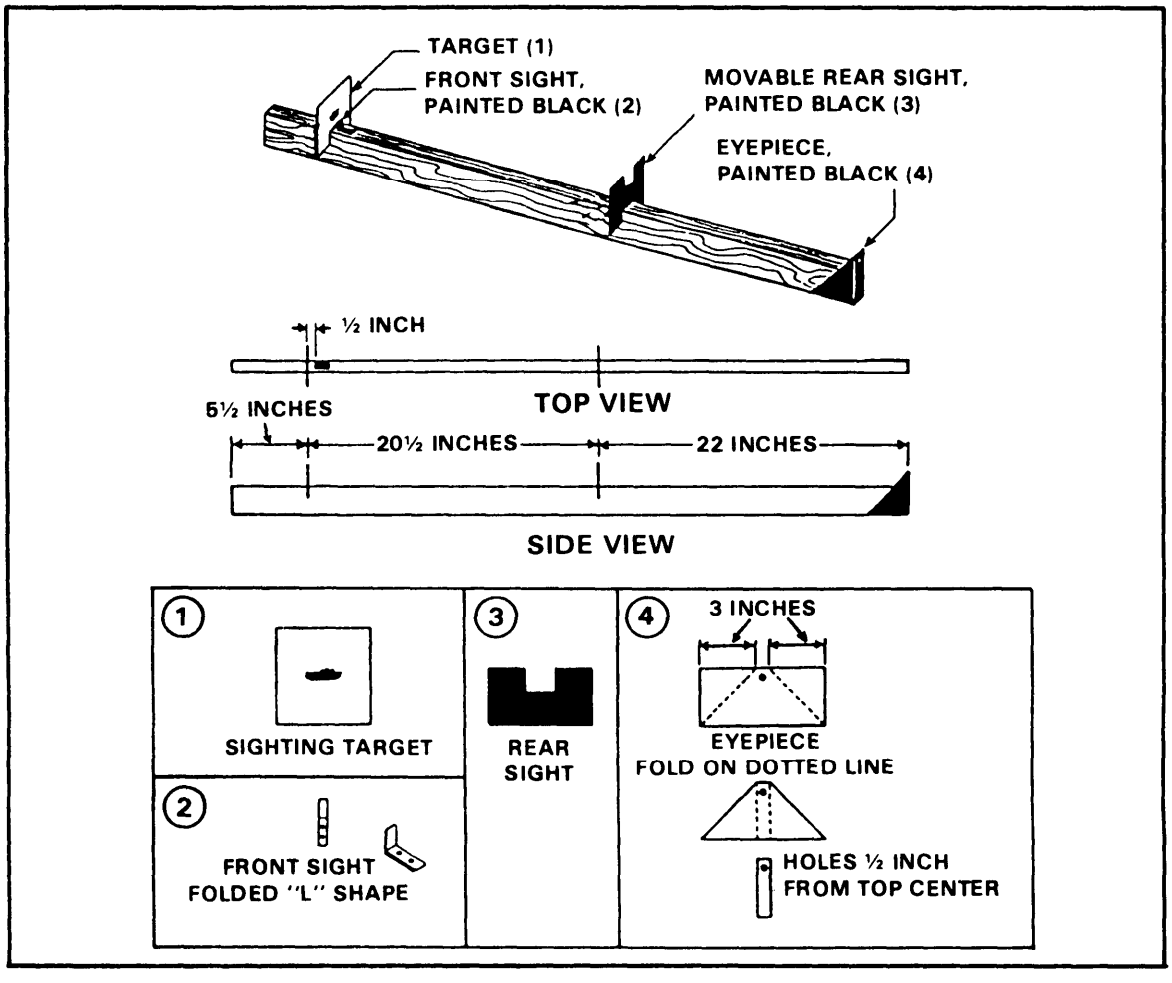


Figure 5-8. Sighting bar.

(2) The second sighting and aiming exercise, used with the MK 19 and target board, gives the gunner a chance to apply lessons learned during the first exercise. Place the target board (Figure 5-9) 10 meters from the muzzle of the MK 19. Use the T&E mechanism to get the correct sight picture on each target that is called out. the gunner feels he can sight and aim, the coach checks and critiques the gunner's ability to change from the start point on the target board to any new target called by the coach.

NOTE: This exercise will continue until the gunner is skilled in sighting and aiming.

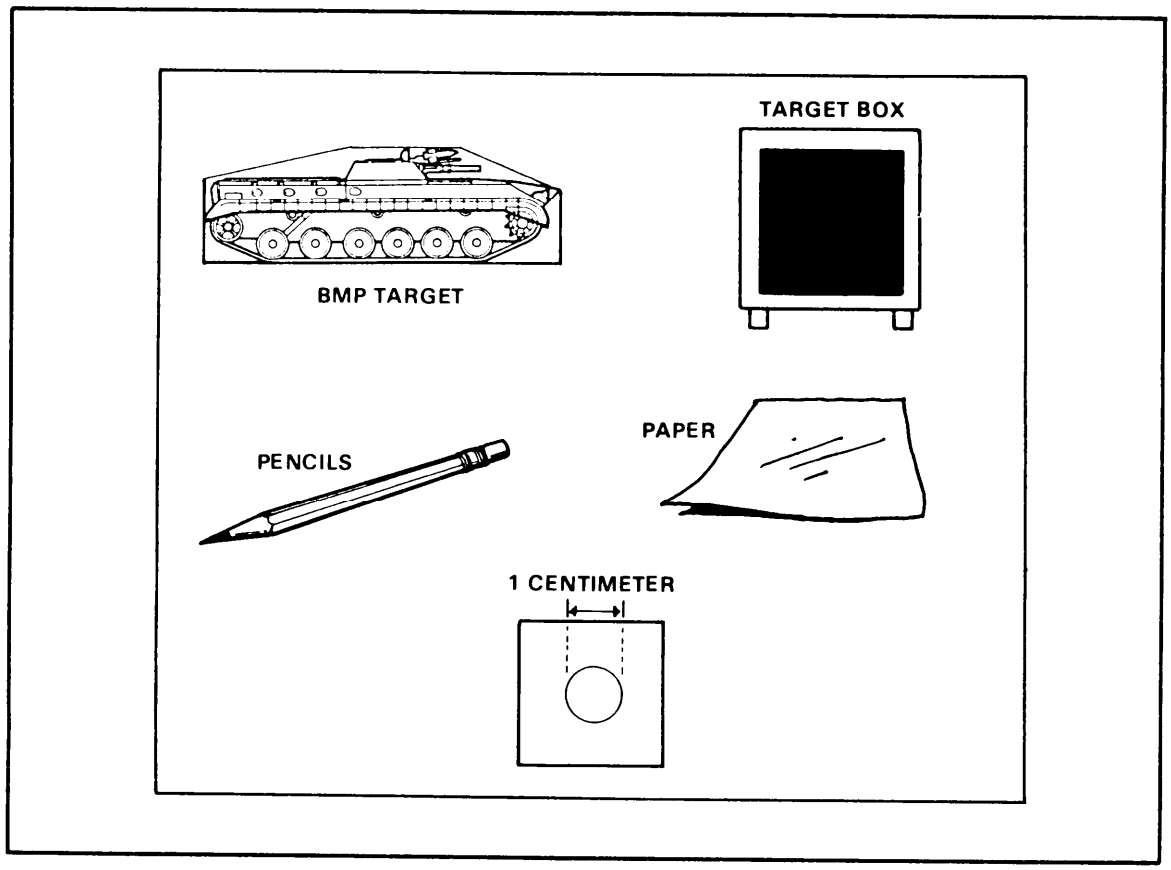


Figure 5-9. MK 19 target board.

b. Sight Setting and Laying Exercises. The first exercise teaches the soldier how to set the rear sight quickly and correctly (Figure 5-10). The second builds accuracy and speed in laying the gun on an aiming point, and allows extra practice in sight setting. Explain and show each exercise before beginning instruction.

(1) Sight setting exercise. Explain that, by turning the elevating screw knob, the soldier can make minor adjustments in elevation. All major adjustments will be made with the slide release. Have one soldier act as gunner and another act as coach. Announce the range, for example, EIGHT HUNDRED; have the soldier in the gunner's position repeat the range, set the sight at the announced range, assume the correct gunner's position and announce UP. The soldier acting as coach checks the setting of the slide and points out any errors. soldiers work in pairs, change roles, and go through the exercise until each one can correctly and rapidly set the sight.

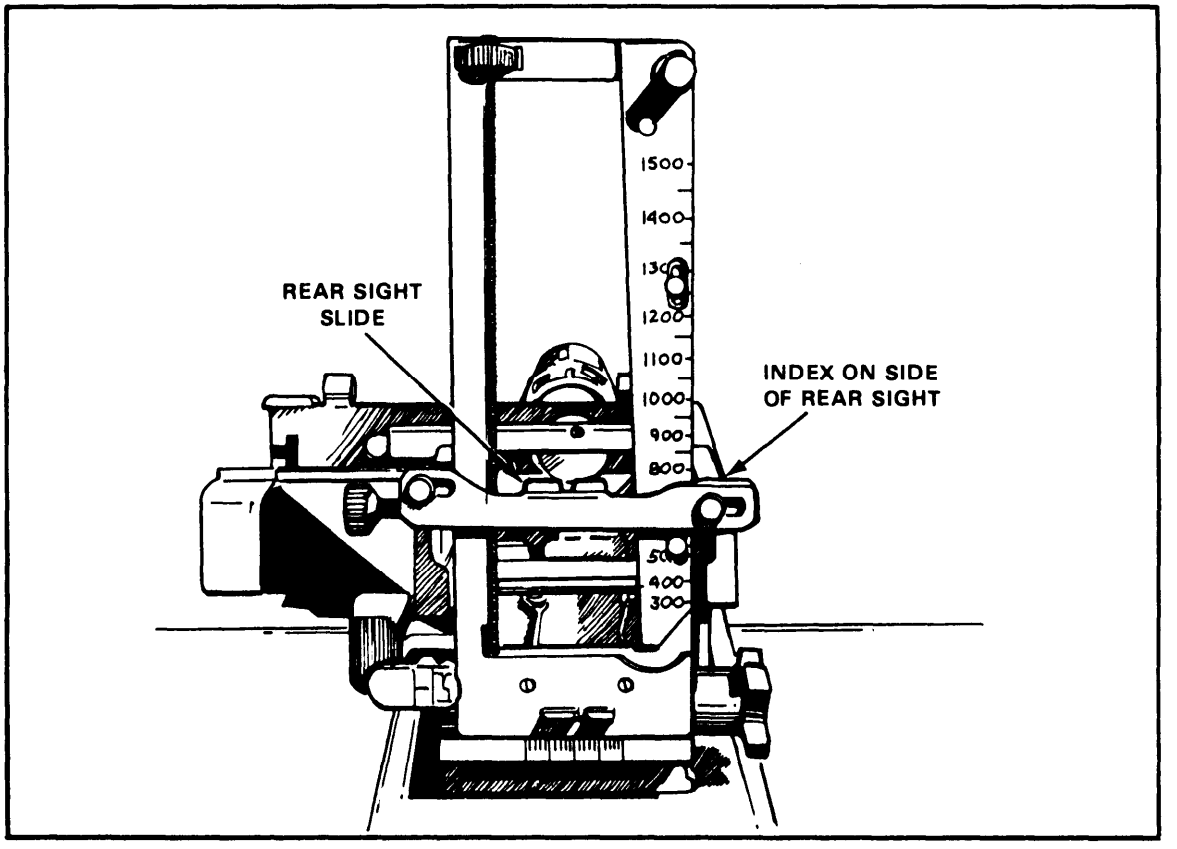


Figure 5-10. Rear sight adjustments.

(2) Sight setting and laying exercise. The MK 19 target board is used in this exercise. Explain that the exercise starts with the sight leaf down and the sight slide at 500 meters. Ranges of less than 400 meters or greater than 1,500 meters will not be announced. Have one soldier acts as gunnerand another as coach at the gun. Announce an aiming point and range ; for example, TARGET NUMBER ONE, ONE TWO HUNDRED. pause after each element to allow the gunner time to repeat it. After the gunner repeats each element, have the gunner: set the sights; manipulate the gun by turning the T&E handwheels until the sights are aligned on the chosen aiming point; assume the correct gunner's position; and report UP. The soldier acting as coach checks the sight setting and lay of the gun. The soldiers work in pairs, changing roles until each is skilled in doing the exercise.

c. Manipulation Exercise. Manuipulation means shifting the direction of the gun from one point to another. There are two manipulation exercises:

(1) The first exercise gives the gunner practice in manipulation. The coach stands ten paces in front the gun and uses hand signals to show the direction in which the gunner is to move the muzzle (figure 5-11). The gunner works the handwheel to manipulate the gun. The coach observes and makes needed corrections. When the gunner reacts quickly and can manipulate the gun as he has been shown, his instruction may continue.

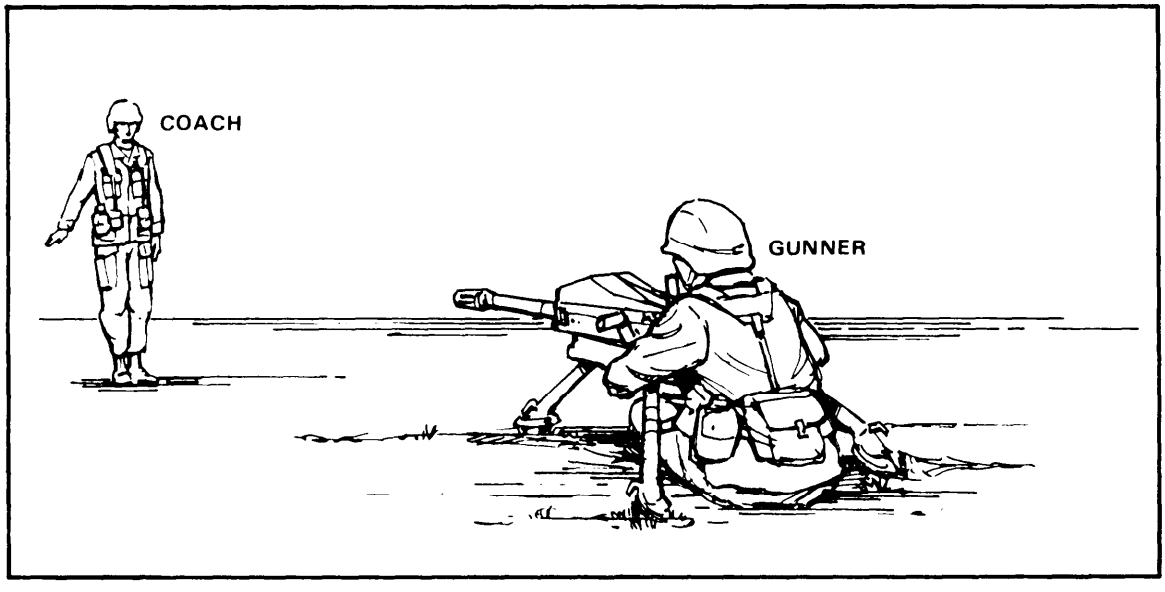


Figure 5-11. Coach and gunner exercise.

NOTE: This exercise continues until the gunner is skilled in sighting and aiming.

(2) Once the soldier knows the basics of sighting and aiming, and can assume a good firing position give him the second manipulation exercise. Show how to manipulate the weapon to get a correct initial lay and how to skillfully shift the direction of the weapon to successive points. Ensure the instructions are known and followed:

(a) Place the MK 19 target board 10 meters from the muzzle of the gun.

(b) Make large shifts in direction by releasing the traversing slide lock lever and moving the slide to the right or left. Make small changes in direction by turning the traversing handwheel with the left hand. One click on either T&E handwheel moves the strike 1 mil (1 centimeter on the target).

(c) Manipulate for elevation by rotating the elevating handwheel with the left hand (Figure 5-12).

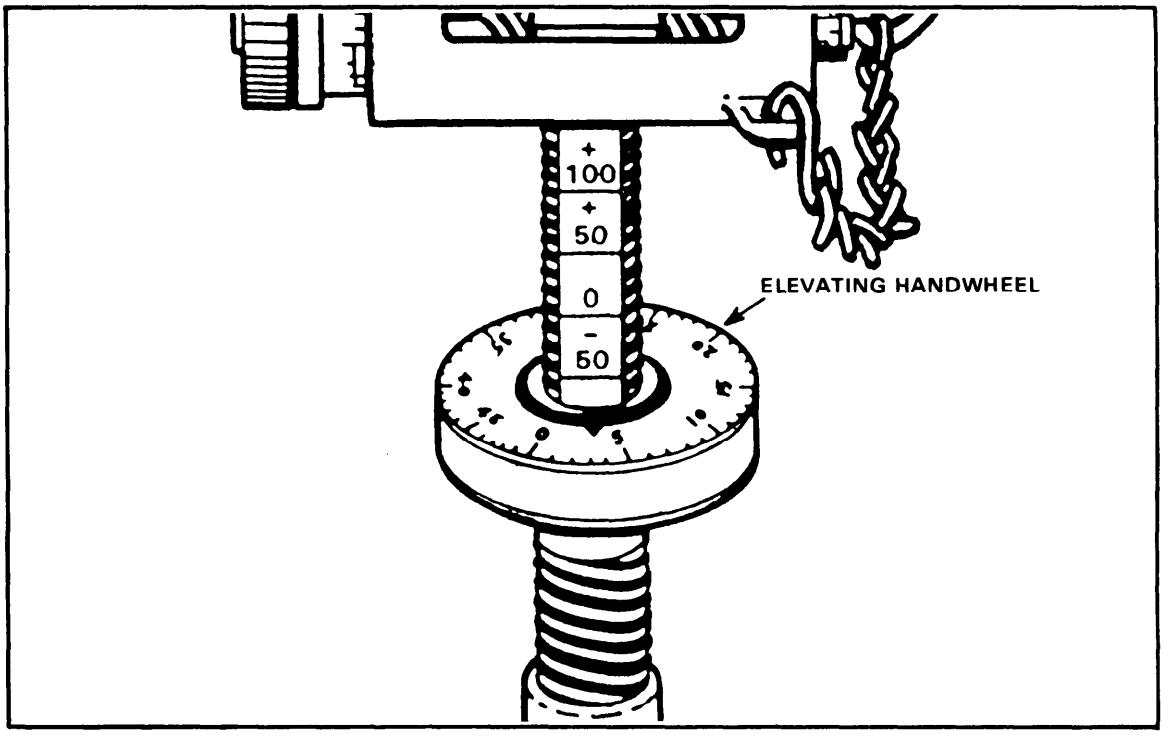


Figure 5-12. Elevating handwheel.

d. Range Determination Exercise. Range determination means finding the distance between the gunner's position and his target. The gunner's ability to engage a depends on his ability to correctly find the range to the target. Under combat conditions, ranges may not be known in advance; the effectiveness of fire depends largely on the accuracy of the range used. There are several methods for finding range. Some of these are: estimating visually, firing the weapon, measuring range from a map or aerial photograph, and pacing the distance. Binoculars or laser range finders may be used--see Chapter 6, Section II, Range Determination.

e. Range Card Exercise. A range card is a record of the firing data needed to engage predetermined targets within a sector (s) of fire at night or during degraded conditions. The range card may also be used to aid in target engagement during good visibility. It aids the leader in preparing his defense plan. Predetermined targets in the secondary sector are engaged by use of field expedients. A range card has two parts: a sketch section and a data

section. Although the sketch is not drawn to scale, the data referring to the targets must be correct. DA Form 5517-R is standard range card to be used Figure 5-13).

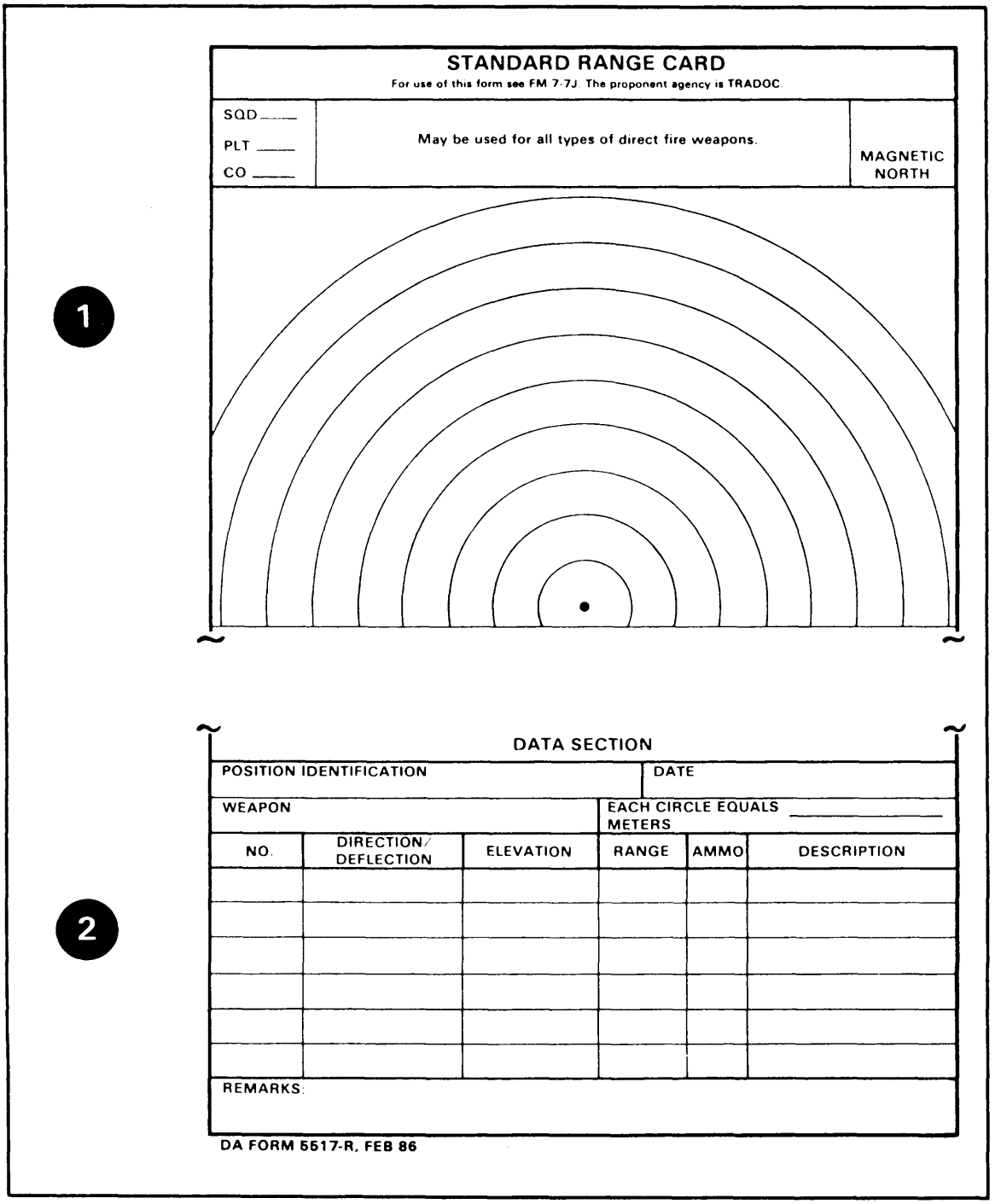


Figure 5-13. Range card sketch (1) and data sections (2).

(1) Range cards are prepared in duplicate. One copy stays at the gun position, and the other is sent to platoon headquarters. Complete range cards are prepared for primary position, and partially complete range cards are prepared for alternate and supplementary positions. Range cards are prepared on arrival in a position, regardless of the planned length of stay. The gunner, aided by the assistant gunner, prepares the range card(s). Range cards are revised often during occupation of a position.

(2) Once the leader has decided where the firing position will be, the gunner prepares the range card(s).

(3) The range card is prepared as follows:

(a) Draw a sector sketch, covering the entire sector. Make the sketchas large as possible, not to exceed the largest circle. For a large area covered by trees or woods, draw only the outline and label the area "woods" or "orchard" (Figure 5-14).

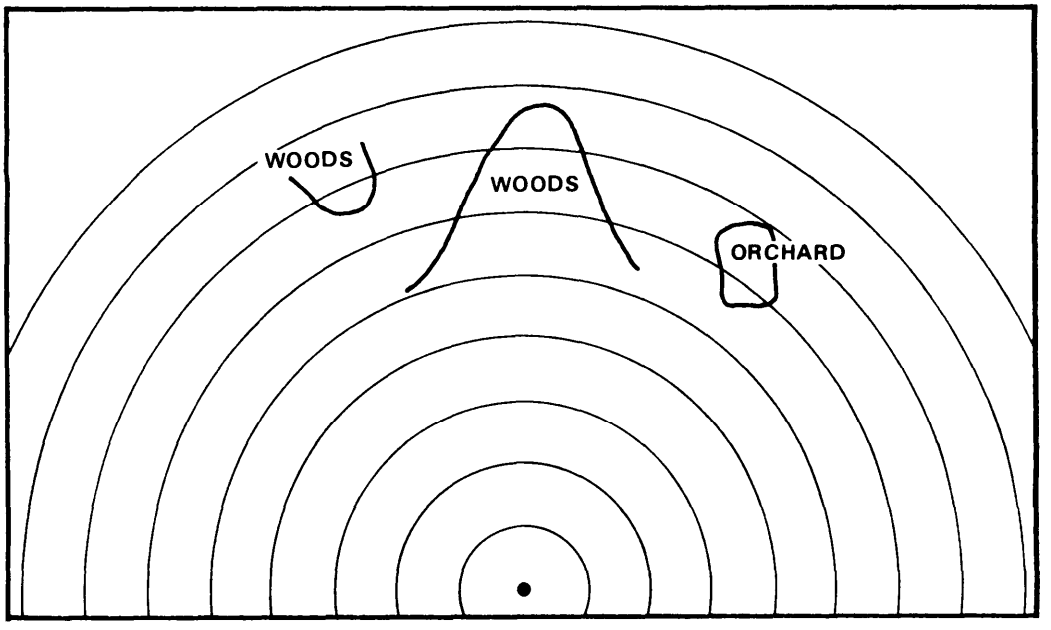


Figure 5-14. Sketch of area on range card.

(b) In the lower center of the sketch section, show the firing position by drawing the symbol for the weapon (Figure 5-15).

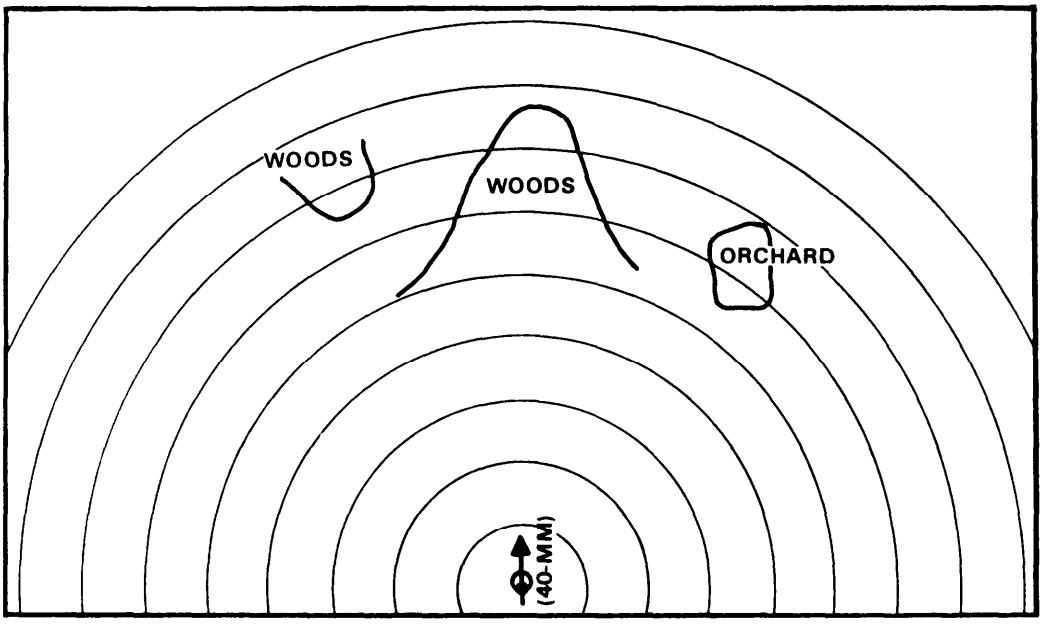


Figure 5-15. MK 19 symbol on range card.

(c) Show the location of the firing position by drawing a sketch of a nearby recognizable terrain feature. Label it and draw an arrow to the weapon symbol. Add the distance and azimuth from the terrain feature to the firing position (Figure 5-16).

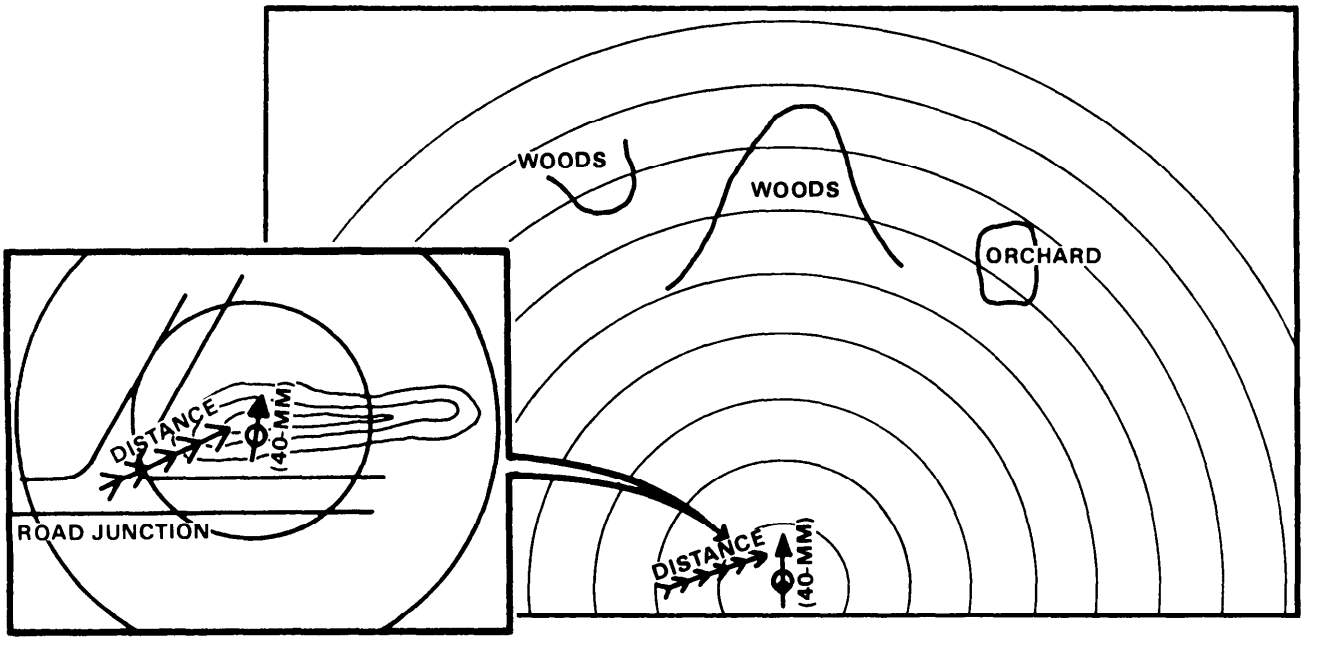


Figure 5-16. Distance and azimuth to terrain feature.

(d) Draw lines from the weapon symbol to reflect the left and right limits (Figure 5-17).

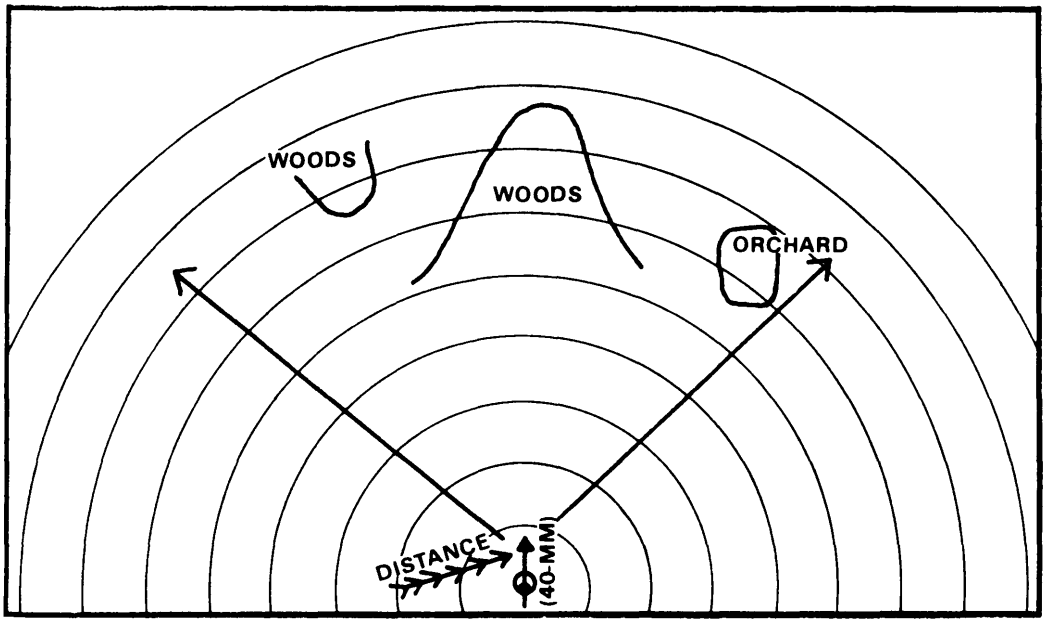


Figure 5-17. Sector of fire.

(e) Number the planned target engagement locations from left to right, and write them on the range card (Figure 5-18).

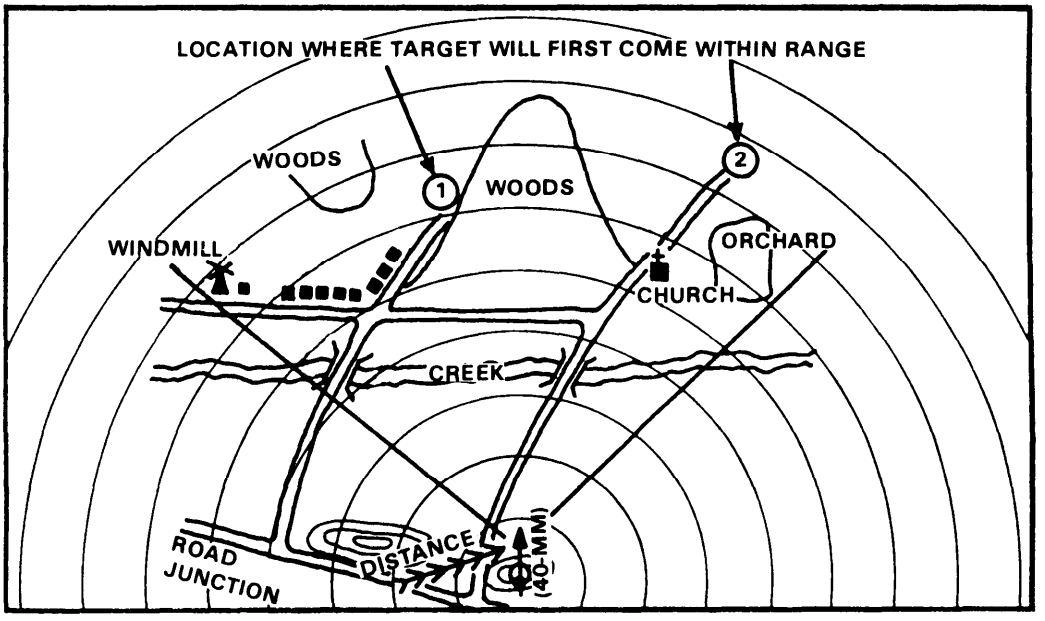


Figure 5-18. Planned target engagement areas.

(f) Number the target reference points (TRPs) from left to right, and write them on the range card (Figure 5-19).

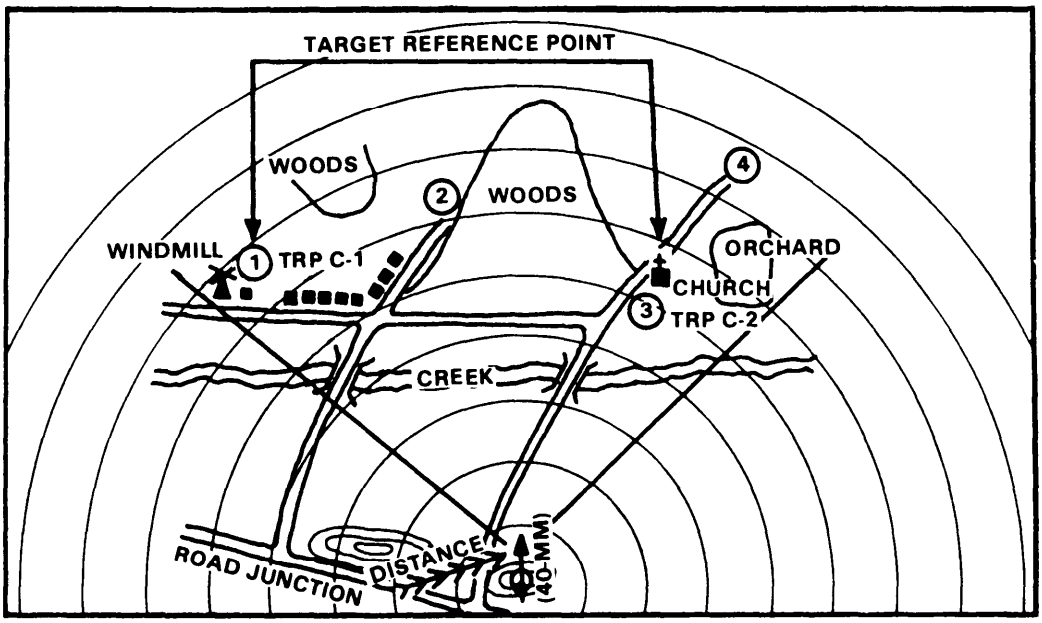


Figure 5-19. Target reference points.

(g) If no limiting factors exist, the maximum engagement line curves and joins the left and right sector-of-fire boundaries at the maximum engagement range (Figure 5-20). If limiting factors exist, draw the

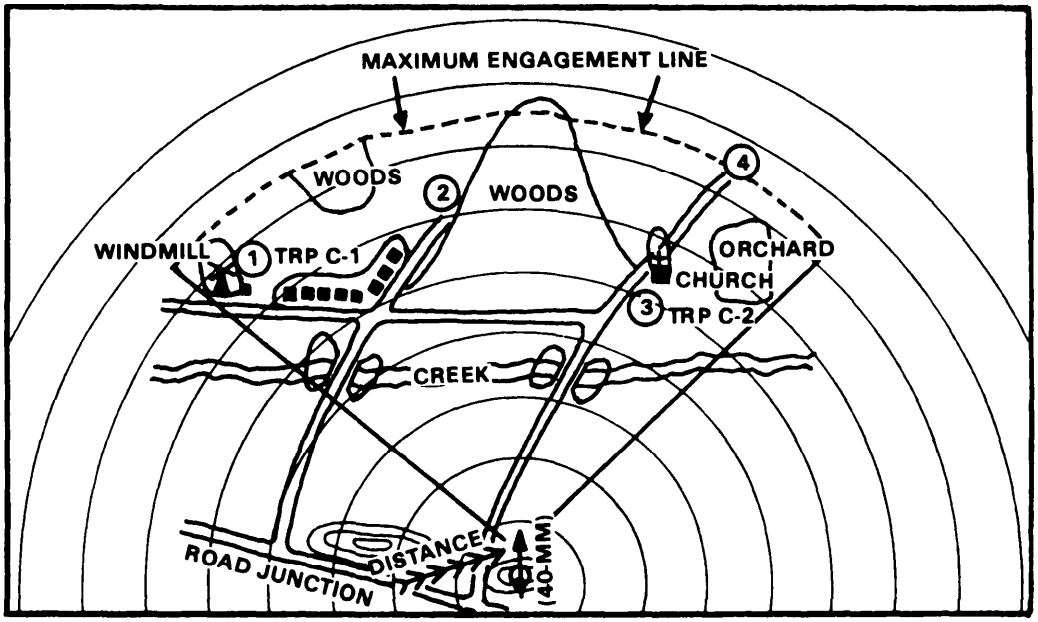


Figure 5-20. Maximum engagement line.

maximum engagement line in front of the limiting terrain features (Figure 5-21).

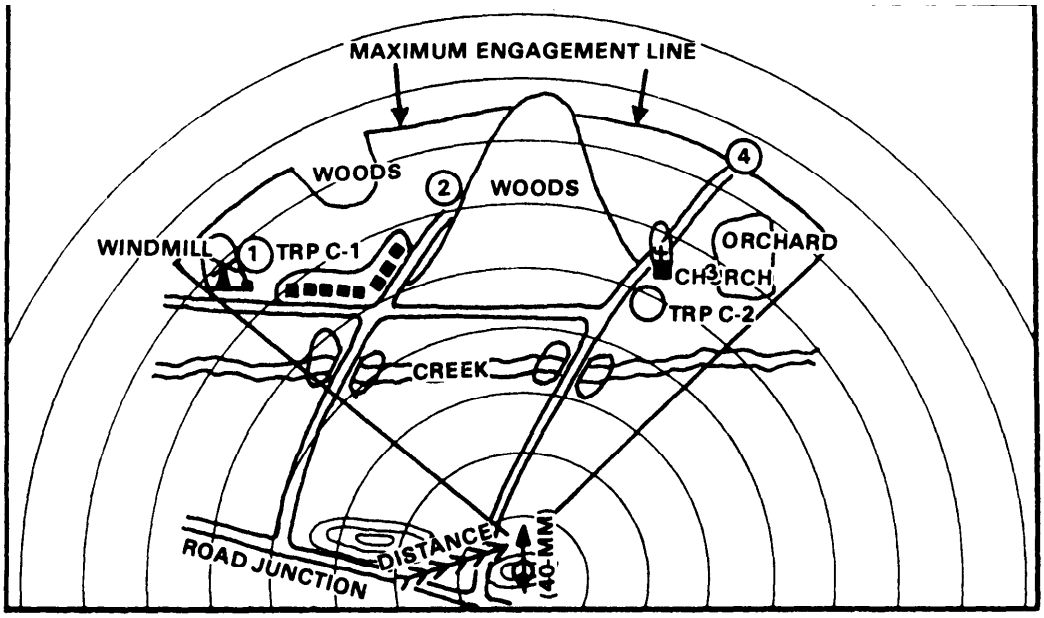


Figure 5-21. Limiting factors on maximum engagement line.

(h) Fill in the marginal information at the top of the card (Figure 5-22):

STANDARD RANGE CARD For use of this form see FM 7-7J. The proponent agency is TRADOC.		
SQD 1 PLT 2 CO A	May be used for all types of direct fire weapons.	MAGNETIC NORTH

Figure 5-22. Marginal information.

- Unit description--never show unit higher than company level.
- Magnetic north--orient the range card with the terrain and find the direction of magnetic north with a compass. Draw a magnetic north arrow using the straight edge of the compass.

(i) Fill in the data section (Figure 5-23):

- Position identification--write primary, alternate, or secondary.
- Weapon--MK 19, grenade machine gun.

- Date--write the day and month.

POSITION IDENTIFICATION: PRIMARY			DATE: 16 DEC		
WEAPON: MK19			EACH CIRCLE EQUALS _____ METERS		
NO.	DIRECTION/ DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
1	L200 MIL	+140/35	2050	M450	WINDMILL/TRP C-1
2	L30 MIL	+160/35	1750	M430	ROAD
3	R25 MIL	+140/35	1600	M430	CHURCH/TRP C-2
4	R100 MIL	+150/10	1400	M430	ROAD
REMARKS:					

Figure 5-23. Data section information.

- Each circle equals 294 meters--write in the distance in meters between the circles. To find the distance, count the intervals from the weapon to the maximum engagement line. Divide the number of intervals into the range. This gives the distance between circles (Figure 5-24). For example:

$$\frac{\text{2,212 meters}}{\text{7.5 intervals}} = \text{294 meters between circles}$$

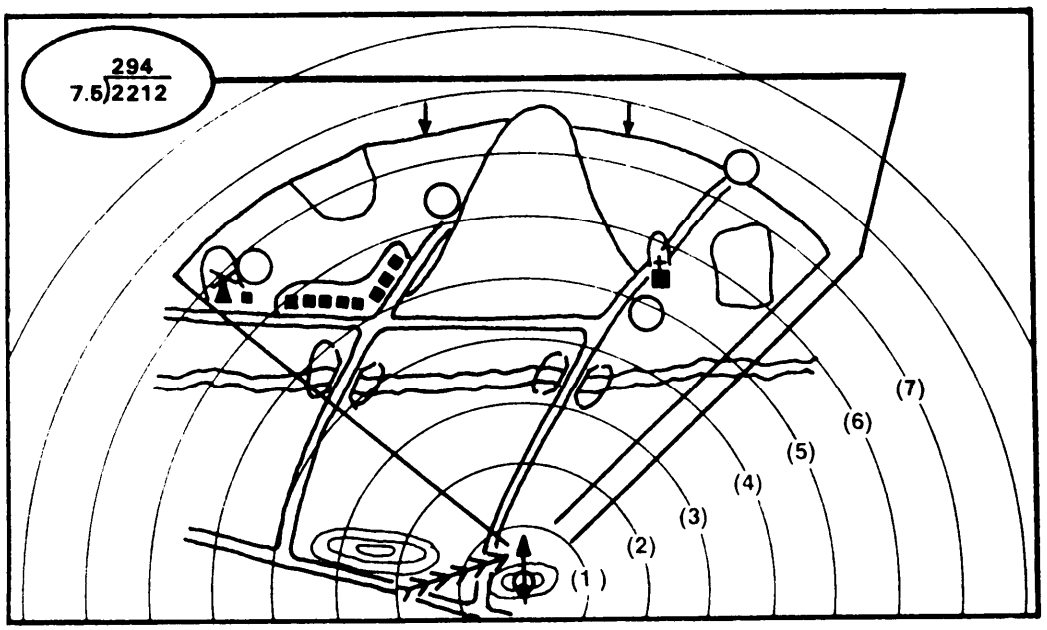


Figure 5-24. Determination of range the circles represent.

- Number-- starting with number 1, write the numbers as listed for TRPs and target engagement locations.

- Direction/deflection--write the mils from the traversing bar and handwheel.

- Elevation--write the elevation from the elevating screw plate scale and the elevating handwheel.

- Range--distance in meters from the weapon to the TRP or target engagement area.

- Ammunition--write the type of round issued for the mission.

- Description--list the name of the object, for example: road, windmill, or church. If the item is a TRP, list the TRP number also.

Section II. RANGE FIRING

Range firing gives hands-on MK 19 firing experience to the soldier who has completed the Intermediate Gunnery Test. Use the procedures in this section to set up and conduct range firing. Range firing includes zeroing procedures, observation and adjustment for fire, instructional firing, and qualification firing.

5-5. DESCRIPTION

There are three types of ranges which may be used for MK 19 live fire training. Regardless of which range is used, the MK 19 may be fired from either a tripod or a vehicle.

a. 40-mm Grenade Machine Gun Range. This range is designed for the conduct of individual firing exercises and qualifications. Details about this range may be found in FM 25-7.

b. MK 19 Crew Gunnery Range. When an MPRC is not available, a MK 19 range may be used. The MK 19 range (Figure 5-25) is designed only for 40-mm machine gun firing--individual, squad, or platoon exercises and qualifications may be conducted on this range.

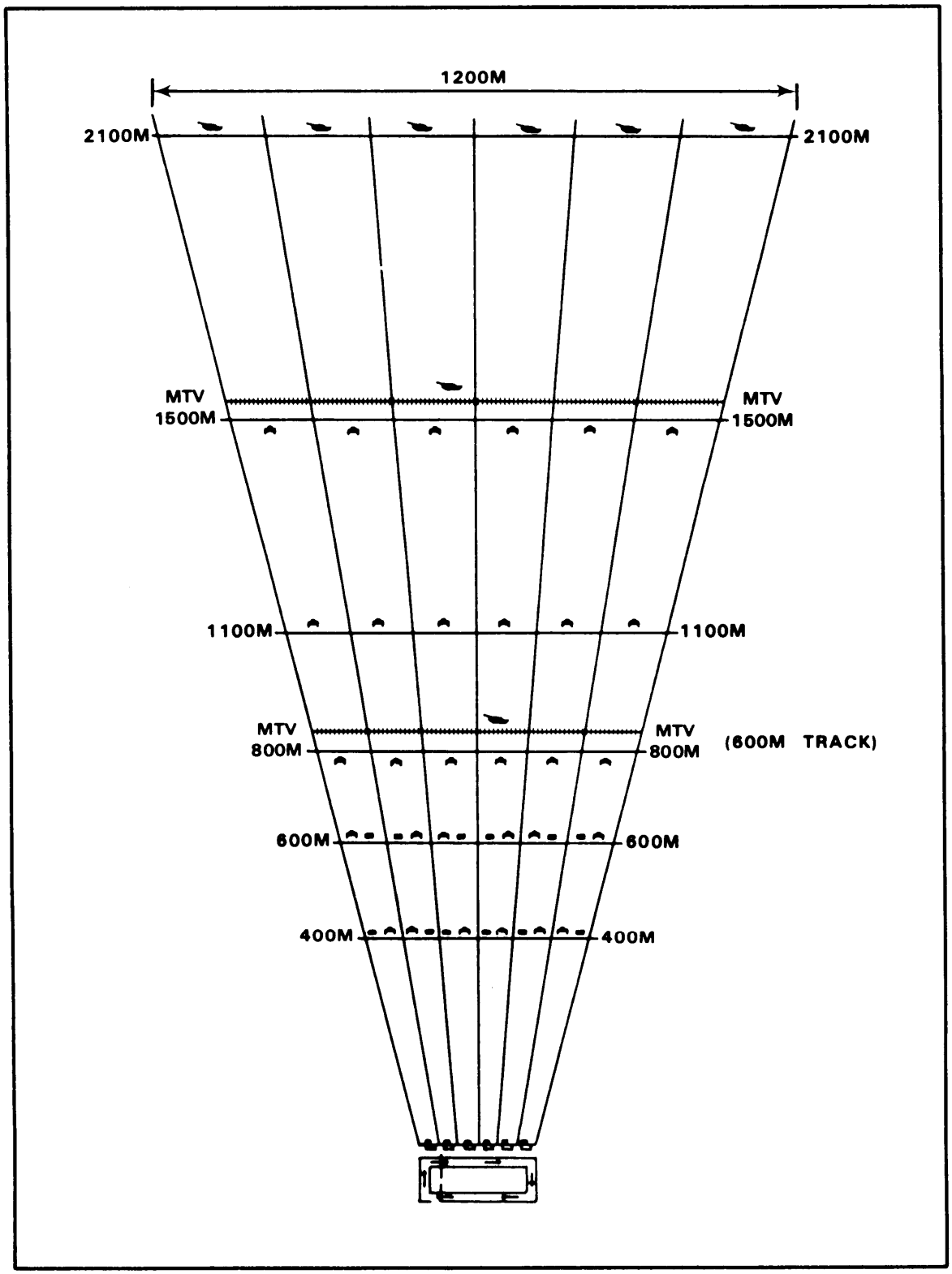


Figure 5-25. MK 19 crew gunnery range.

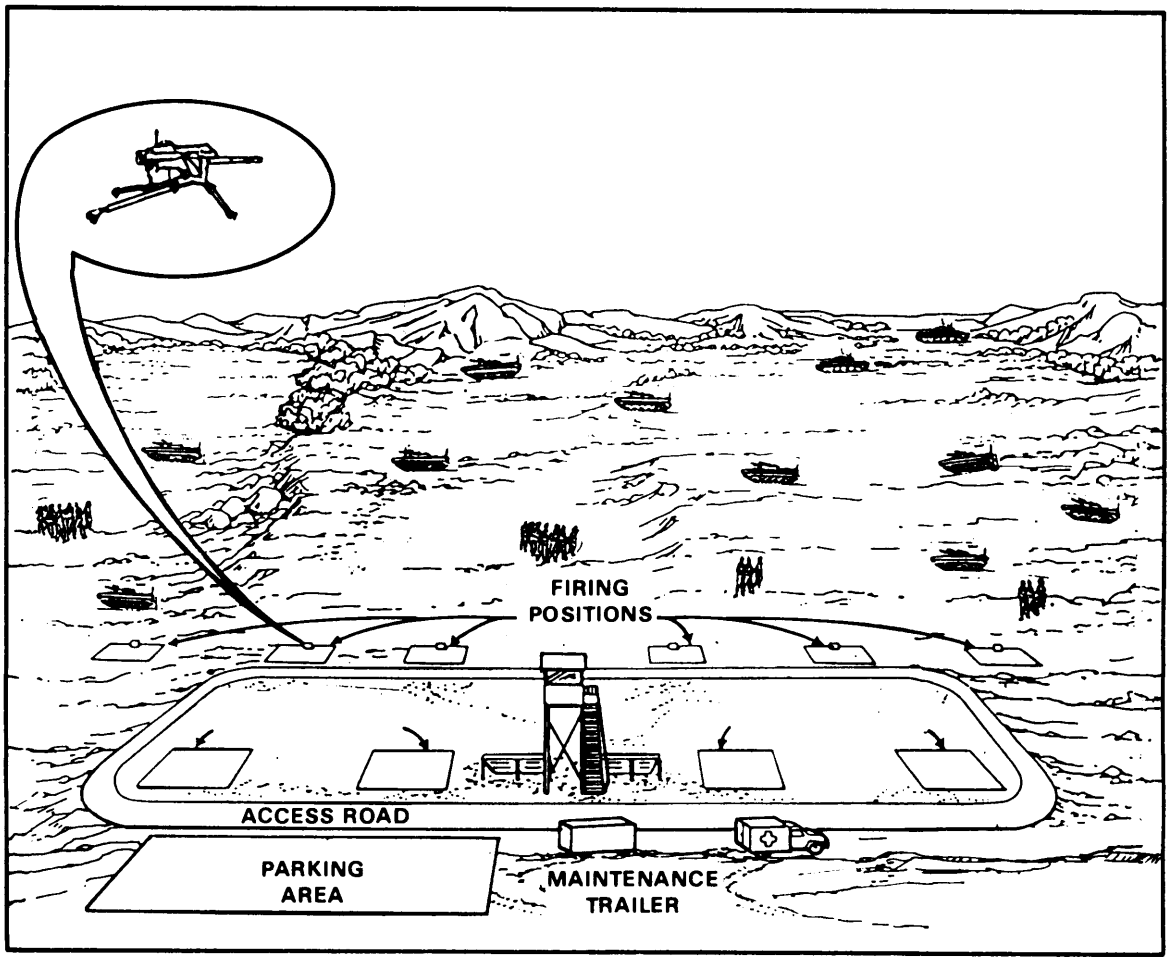


Figure 5-25. Continued.

(1) The MK 19 target engagement area should have uniformly level or upward-sloping terrain, with targets such as BMPs, thin-skinned vehicles, or dismounted troops. The firing line has six positions, which are 50 meters apart. The control tower is 20 meters behind the firing line so tower control personnel can observe the entire firing line. The ammunition point is at least 75 meters behind the firing line, and 50 meters from all weapons. The concurrent training area is at least 100 meters from the firing line in an area that will not interfere with range firing.

(2) The two types of targets on the range will be area and point targets. Point targets include troop targets with four or less silhouettes or BMP targets at less than 1,100 meters. Area targets include troop targets with more than four silhouettes or BMPs at greater than 1,100 meters.

c. MPRC. The multipurpose range complex (MPRC) is the range suggested for MK 19 live fire training. It is used to train mechanized, motorized, combat support, and combat service support units. The design and traits of this type of range are described in FM 25-7. Only the M385 or the M918 practice round is used on this range.

5-6. OPERATION

Use range operation procedures any time live fire is conducted on the range. These procedures are the same for all range firing exercises.

a. Send gun crews to the bleachers. Brief them on range setup, fire commands, and safety procedures. Explain exercise needs as defined by the unit commander, or as they are to be done per the firing tables (Appendix C).

b. Divide the crews into groups and assign each group a firing point and an AI (assistant instructor). Ensure they are directed to their firing points and are shown their assigned sectors of fire. Have the AIs ensure that all crews have the equipment needed to perform the task.

c. Conduct the exercise. For example: GUNNER, WHEN I SAY BEGIN, PLACE THE MK 19 INTO OPERATION ON THE TRIPOD (ORGANIC CARRIER) WITHIN __ MINUTES. ARE THERE ANY QUESTIONS? (PAUSE) BEGIN. At the end of the given time period, direct: STOP. AIs, CRITIQUE YOUR CREWS AND GIVE ME YOUR “UP” SIGNAL WHEN YOU HAVE FINISHED.

5-7. COACHES

The instructor may arrange for a coach to be present at each gun during following prepartory training, exercises, and instructional firing. Successful marksmanship training depends greatly on the coaches. Well-trained and well-rehearsed gunners or crew members may be assigned as coaches. The coaches--

a. Require the gunner to inspect his gun and equipment.

b. Help the gunner place the gun on target.

c. Require the gunner to explain the exercise which he is about to perform.

d. Observe the gunner's position, grip, and manipulation during simulated firing.

5-8. FIRING

Firing the MK 19 is not hard. However, to be effective, the gunner must be able to skillfully manipulate the trigger and T&E. The following steps are simple, but the gunner must remember: to estimate the distance to the target, to set the sights for the distance, to manipulate the T&E, to press the trigger, and to fire a single round. (Since the MK 19 is a fully automatic weapon, this can only be done by "popping" the trigger once.) He must spot the impact of the first round and adjust to the target before firing a second round. If the impact is in the target area, he should begin firing three- to five-round bursts. This whole process can be done in a matter of seconds, the longest part being the flight time of the round. To fire the weapon:

a. Place the safety on FIRE.

b. Endure the charger handles are in the forward and up-right position.

c. Place the hands on the control grips, and the thumb (s) on the trigger.

d. Press the trigger to fire.

> WARNING
> THE FIRST BURST IS THE HARDEST TO CONTROL. ENSURE THAT THE GUN'S RECOIL DOES NOT CAUSE THE BARREL OF THE WEAPON TO DROP. KEEP IT ELEVATED.

5-9. ZEROING PROCEDURES

Zeroing is important in gunnery of the MK 19 and is curcial for hitting targets at ranges of 600 meters or more. The following is the correct way to zero the MK 19 to the gunner:

a. Loosen the range plate screw. Move the leaf sight plate to the midpoint between the two studs. Tighten the range plate screw. Move the rear sight slide to the meter mark that represents the distance to the target. For example, move to the 400-meter mark to zero on a target known to be 400 meters away. Set the windage knob at the zero index line.

b. Align the sights on the base of the target using the T&E mechanism.

c. Fire a single round and spot the impact of the round. If it is on target, fire another short burst to confirm the zero. If the round is not on target, go on to the next step.

d. To adjust for a round that is not on target, do the following:

(1) If the round is short or long, adjust the elevation knob. Estimate how short or long the round is. If the round is short, use this estimate to adjust the elevation knob clockwise, which moves the sights up onto the target. To adjust for a long round, turn the elevation knob counterclockwise to bring the sights down to the target. For example, if the rounds impact 10 mils short, adjust the elevation knob 10 mils up by turnig it clockwise. Realgn the sights and adjust the gun back on target using the T&E before the next round is fired.

NOTES: 1. If the adjustment was correct, the second round should be on target. If so, fire the rest of the rounds to confirm the zero. If not, repeat the previous step.

2. If the impacts are not observed, bold adjust ments may be needed.

(2) If the round is to the right or left, adjust the windage knob. Estimate how far to the right or left the sight needs to move to bring the rounds on target. To adjust to the right, turn the windage knob clockwise; to adjust to the left, turn it counterclockwise. For example, if the rounds impact 10 mils to the right, adjust the sight 10 mils to the left by turning the windage knob counterclockwise. Realign and adjust the sights back on target using the T&E before the next round is fired.

(3) Once the zero is completed, align the range plate scale at the exact range of the zero, and tighten it.

e. Point out errors and explain their effect.

5-10. OBSERVATION AND ADJUSTMENT FOR FIRE

Observation and adjustment gives the soldier a chance to practice adjustment of fire by observing trajectory and impact or by re-laying often on the target using the sights. Live fire training is held on the firing range after the methods are explained in the classroom.

a. When firing on targets, adjust by moving the burst into the target. Base on the strike of the rounds, adjust the number of clicks for elevation and direction needed to move the center of impact onto the target. This does not call for the use of sights. For example, fire at a target 500 meters away; the rounds impact 20 meters short and 50 meters right. Use the T&E handwheels, moving the muzzle left and up the proper number of clicks, to manipulate the gun onto the target.

b. Another procedure is the adjusted aiming point method. Use the sights and select an aiming point calculated to place the second burst on target. For example, fire at a 500-meter target; the rounds impact 20 meters short and 10 meters right. Rapidly select another aiming point about 20 meters beyond and 10 meters to the left of the target, lay on that aiming point, and fire.

5-11. LIVE FIRE

The live fire gunnery exercise train and qualify MK 19 gunners. There are seven firing tables, four for practice and three for qualification. See Appendix C for the firing tables. Sample scorecards may be seen in Figure 5-26.

PRACTICE LIVE FIRE

NAME	SSAN	UNIT	DATE	RANGE	LANE
ROANE, GARY	212-00-1234	C 2BN 29TH INF	18 AUG 88	MK 19	2

TABLE 1

RD	RANGE (M)	TIME (SEC)	HIT	MISS	SCORE	POINTS
4	400	1 MIN	✓			
8	1100	2 MIN	✓			
8	1500	2 MIN	✓			
6	600	1 MIN 30 SEC	✓			
		TOTAL	4			

TABLE 2

RD	RANGE (M)	TIME (SEC)	HIT	MISS	SCORE	POINTS
4	600	1 MIN		✓		
8	1100	2 MIN	✓			
6	600	1 MIN 30 SEC		✓		
8	1500	2 MIN	✓			
12	1100	3 MIN	✓			
	600			✓		
		TOTAL	3	3		

TABLE 3

RD	RANGE (M)	TIME (SEC)	HIT	MISS	SCORE	POINTS
4	400	1 MIN	✓			
8	800	1 MIN 30 SEC	✓			
6	600	1 MIN 30 SEC	✓			
8	1100	2 MIN		✓		
		TOTAL	3	1		

TABLE 4

RD	RANGE (M)	TIME (SEC)	HIT	MISS	SCORE	POINTS
6	600	1 MIN	✓			
8	800	2 MIN	✓			
8	800	2 MIN	✓			
		TOTAL	3			

TABLE	SCORE	POINTS
1		
2		
3		
4		
5		
6		
7		

FIRER'S QUALIFICATION SCORE _____

SSG Larry Jackson
SCORER'S SIGNATURE

QUALIFICATION SCORES AND RATING:

DISTINGUISHED ☐
QUALIFIED ☑
UNQUALIFIED ☐

1LT David P. Annis
OFFICER'S SIGNATURE

Figure 5-26. Sample of firing table scorecards.

QUALIFICATION LIVE FIRE

NAME	SSAN	UNIT	DATE	RANGE	LANE
ROANE, GARY	212-00-1234	C 2BN 29TH INF	18 AUG 88	MK 19	2

TABLE 5

RD	RANGE (M)	TIME (SEC)	HIT	MISS	SCORE	POINTS
4	400	1MIN	✓			
4	600	1MIN	✓			
8	1100	2MIN	✓			
6	600	1MIN 30SEC	✓			
8	1500	2MIN	✓			
12	1100	3MIN	✓			
	600		✓			
			7			

TABLE 6

RD	RANGE (M)	TIME (SEC)	HIT	MISS	SCORE	POINTS
4	400	1MIN	✓			
8	800	1MIN 30SEC	✓			
6	600	1MIN 30SEC	✓			
8	1100	2MIN	✓			
			4			

TABLE 7

RD	RANGE (M)	TIME (SEC)	HIT	MISS	SCORE	POINTS
6	400	1MIN	✓			
8	600	2MIN	✓			
8	800	2MIN		✓		
			2	1		

TABLE	SCORE	POINTS
1		
2		
3		
4		
5	7	
6	4	
7	2	1

SSG Larry Jackson
SCORER'S SIGNATURE

QUALIFICATION SCORES AND RATING:

DISTINGUISHED ☑
QUALIFIED ☐
UNQUALIFIED ☐

FIRER'S QUALIFICATION SCORE _____

1LT Walter L. Parker
OFFICER'S SIGNATURE

Figure 5-26. Continued.

CHAPTER 6
TECHNIQUES OF FIRE

Firing techniques allow the gunner to deliver controlled, effective fire on target. Direct lay is the most effective technique that may be used with the MK 19. The five fundamentals of fire are:

- Characteristics and classes of fire.
- Range determination.
- Application of fire.
- Degraded conditions.
- Predetermined fires.

Section I. CHARACTERISTICS AND CLASSES OF FIRE

Gunners must understand the actions and effects of the MK 19 to effectively employ it. This section discusses characteristics and classes of fire.

6-1. CHARACTERISTICS OF FIRE

The following are definitions of the characteristics of fire which will be discussed in this section:

a. Trajectory. This is the path of the projectile in flight. The path is curved due to gravity and elevation of the sights. The trajectory increases as the sights are elevated for far targets.

b. Line of Sight. This is an imaginary line from the gun to the target, as seen through properly adjusted sights.

c. Ordinate. This is the vertical distance that occurs anywhere between the line of sight and the trajectory.

d. Maximum Ordinate. This is the highest point of trajectory, at which the vertical distance between the trajectory and line of sight is greatest.

e. Danger Space. This is the area in which the impact of the round or the dispersal of shrapnel causes injuries to personnel or destruction of the target.

f. Dead Space. This is the area(s) in which personnel or targets are safe from the gun’s fire. Dead spaces can be, for example, ditches, depressions, or ravines.

g. Cone of Fire. This is the dispersion of the rounds as they leave the gun.

h.Beaten Zone. This is the area in which the cone of fire strikes the ground or target. Terrain slope and range to the target affect the beaten zone. If the cone of fire falls on upward-sloping ground, the beaten zone is shortened, and vice versa. As range increases, the beaten zone is shortened and widened.

i. Center of Impact. This is where the heaviest concentration of fire impacts.

6-2. CLASSES OF FIRE

There are three ways in which fire is classified.

a. Respect to the Ground. Normally, this means either ing or grazing fire. However, since grazing fire is not practical for use with the MK 19, only plunging fire will be considered. Plunging fire strikes the target from a high angle and confines the danger space to the beaten zone. For example, when fired from the top of a hill, projectiles follow an arcing trajectory and land in the valley. Though there are many forms of plunging fire, this is the most often used (Figure 6-1).

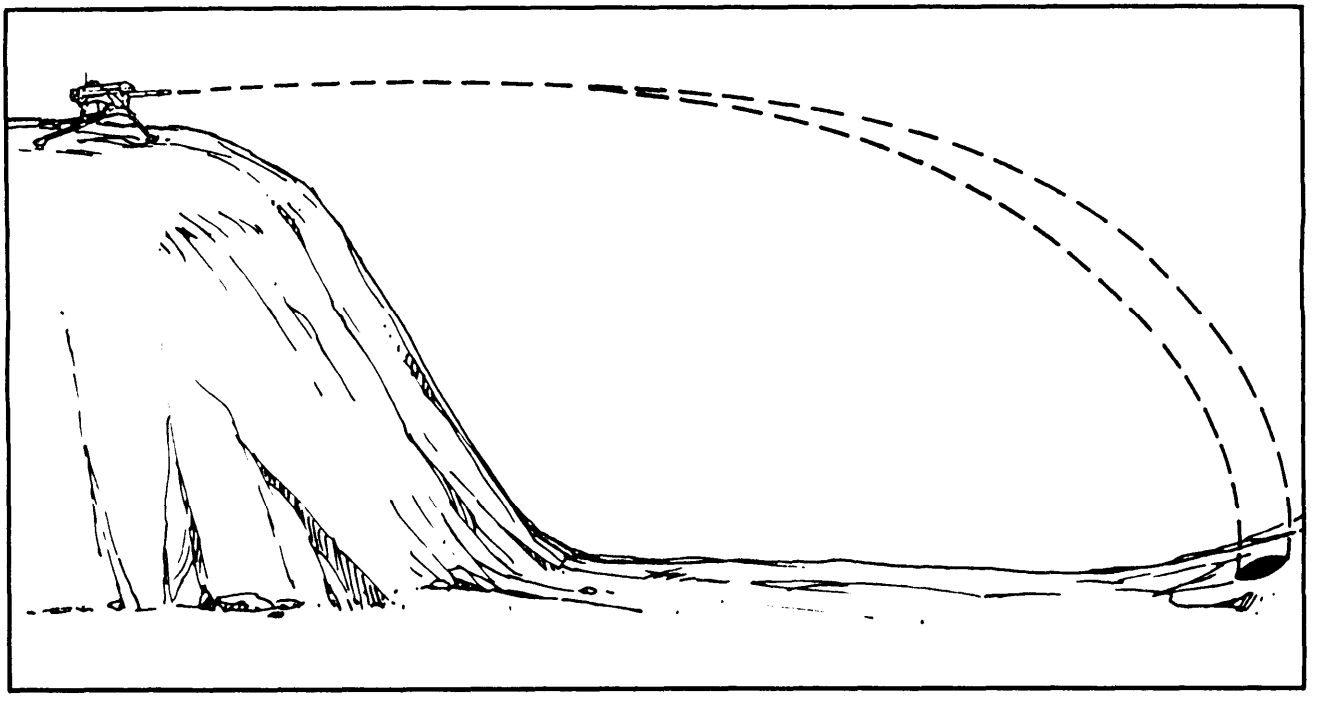


Figure 6-1. Plunging fire.

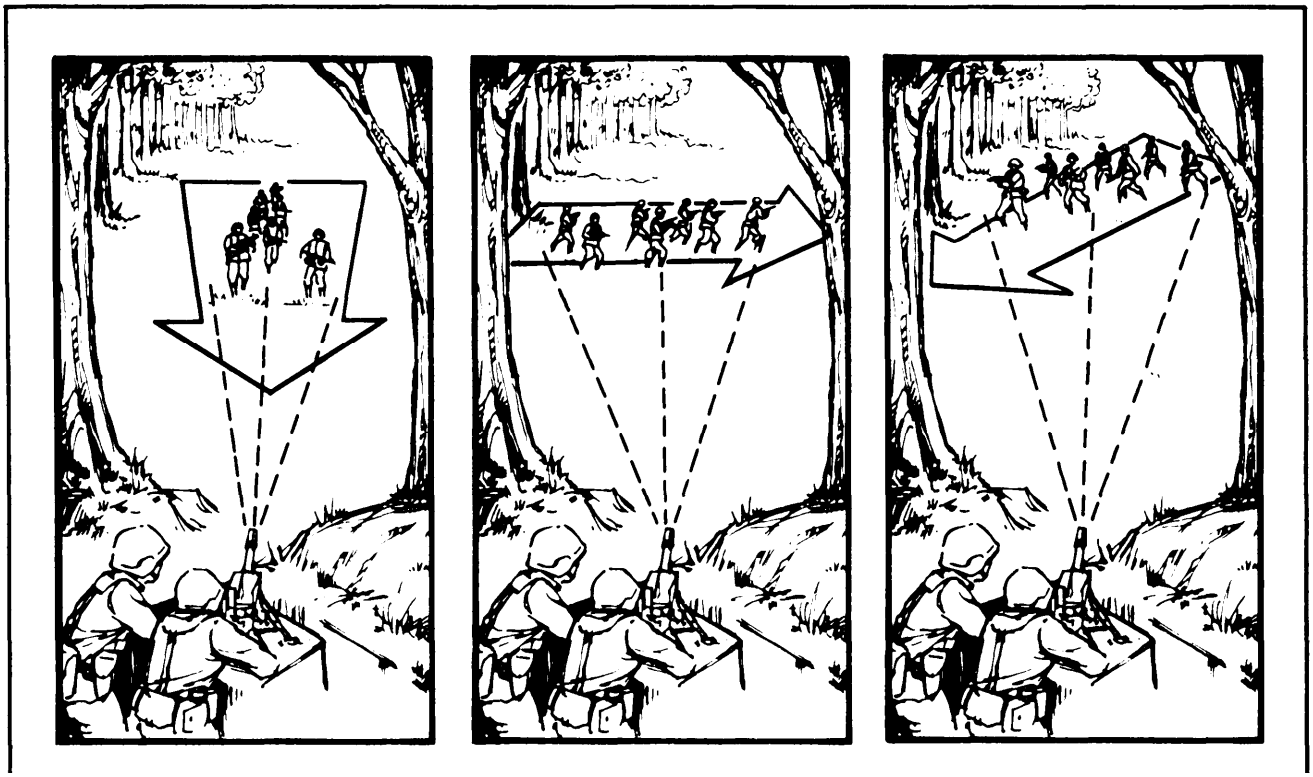
b. Respect to the Target. This class of fire is divided into four types of fire (Figure 6-2):

(1) Frontal. This type of fire is delivered against a target's front, with the target moving toward the firing position.

(2) Flanking. This type is delivered against the flank of the target.

(3) Oblique. This is fire directed at a target moving at any angle other than directly toward or perpendicular to the gun.

(4) Enfilade. This type of fire occurs when the long axis of the beaten zone coincides with the long axis of the target. Enfilade fire may be frontal or flanking, depending on which way the target is facing. For example, frontal enfilade occurs if the MK 19 is in the middle of a road and the target is approaching on the same road. Flanking enfilade occurs if the target is moving either way, left or right, yet is still in a long axis configuration away from the MK 19 .



FRONTAL FLANKING OBLIQUE

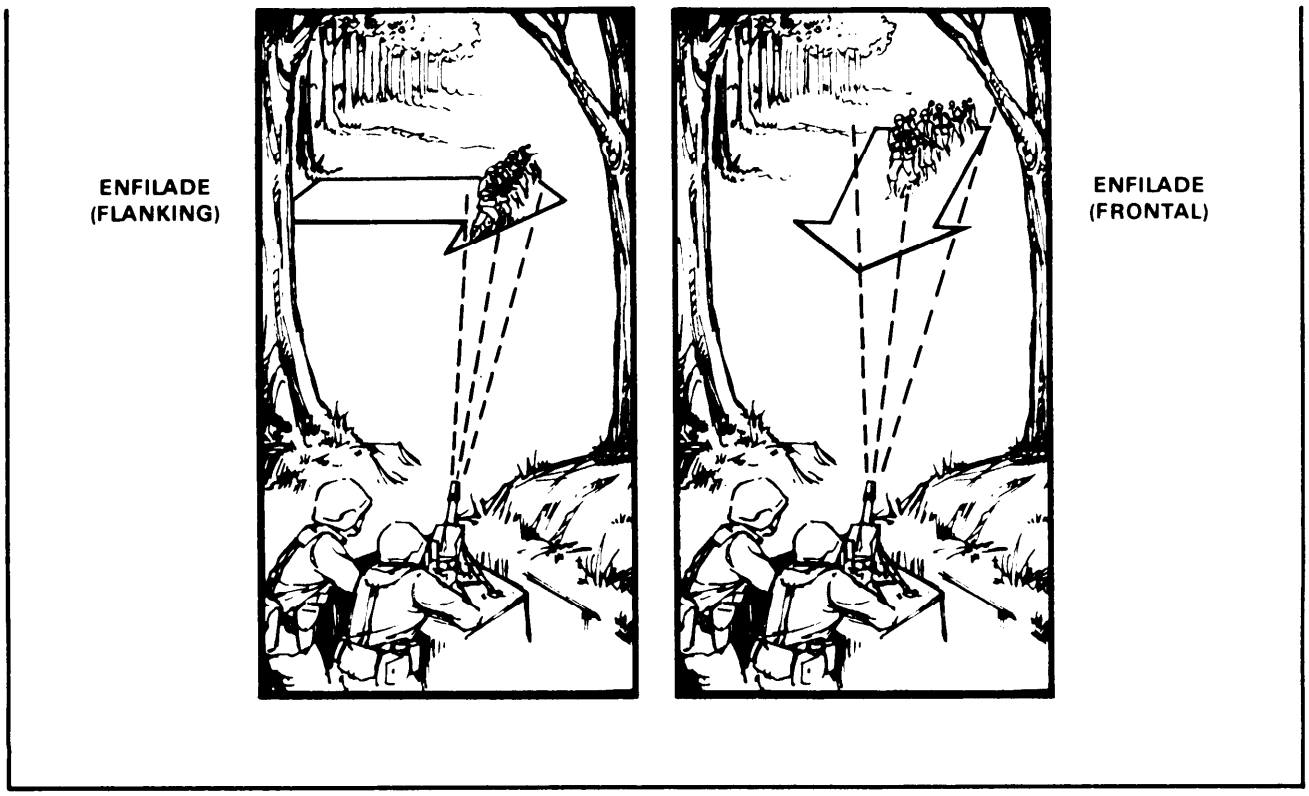


Figure 6-2. Classes of fire with respect to the target.

c. Respect to the MK 19. This includes six ways in which fire may be manipulated (Figure 6-3).

(1) Fixed. This is fire delivered against a target with one aim point, which concentrates the beaten zone.

(2) Traversing. This is fire moved from left to right or right to left, with no range change. It may be used against frontal or flanking targets.

(3) Searching. This is fire directed against a deep changes are not. Searching fire is used against enfilade targets.

(4) Traversing and searching. This is a combination of traversing and searching fires used against a target with depth and width (most likely an oblique target).

(5) Swinging traverse. This fire is slightly different from traversing and searching. Although it is delivered

against a wide target, with major changes in direction, no elevation changes are made. To deliver fire using a swinging traverse, the gunner releases the traversing slide lock, allowing the gun to travel freely across the traversing bar.

(6) Free gun. This is fire delivered with the T&E removed, when quick changes in direction and depth are needed to fire on moving targets.

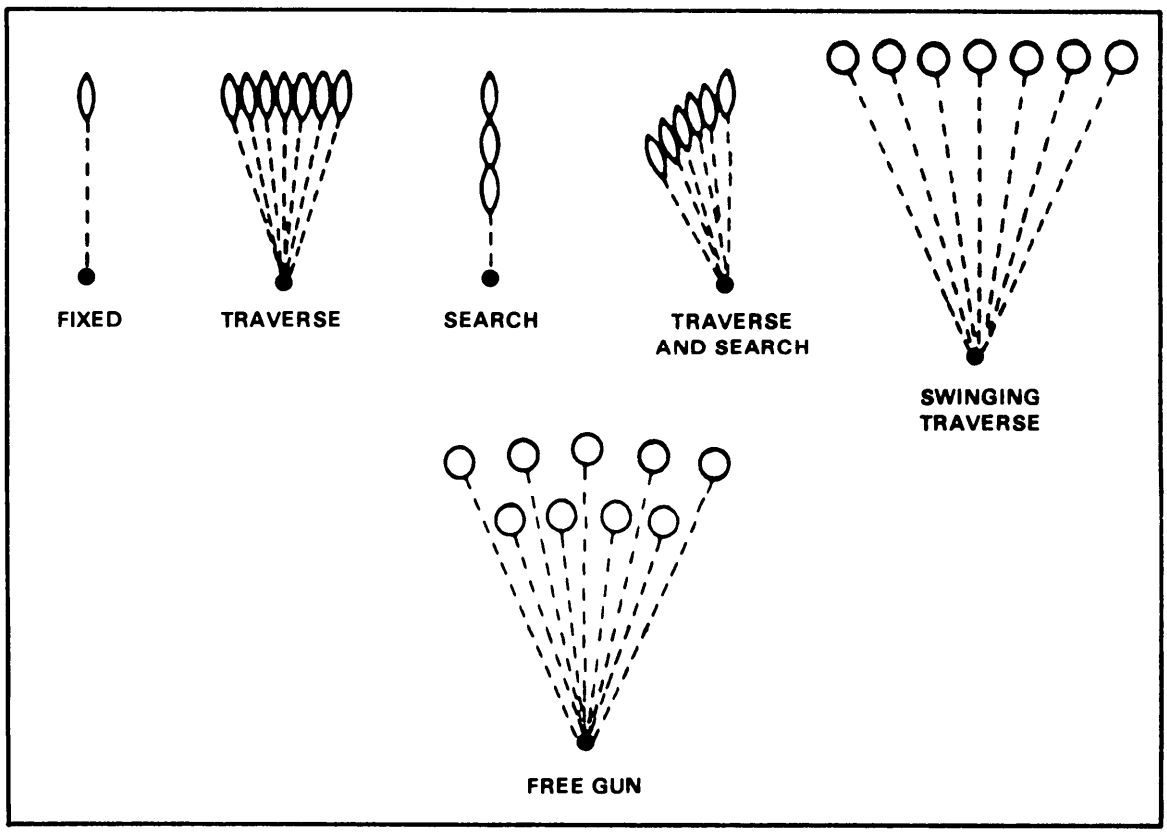


Figure 6-3. Classes of fire with respect to the MK 19.

Section II. RANGE DETERMINATION

Range determination is the process of finding the distance between the gunner's position and his target. The gunner's ability to engage a target effectively depends on determining the correct range to the target.

6-3. MEASUREMENT BY VISUAL ESTIMATION

Range is often determined by this method. There are two ways to estimate range visually.

a. Using the 100-meter unit-of-measure method, visualize 100 meters on the ground (this takes practice) and determine how many units of 100 meters there are to the target (Figure 6-4). For targets more than 500 meters (5 units) away, pick a point about halfway, estimate the range to that point, and double it (Figure 6-5).

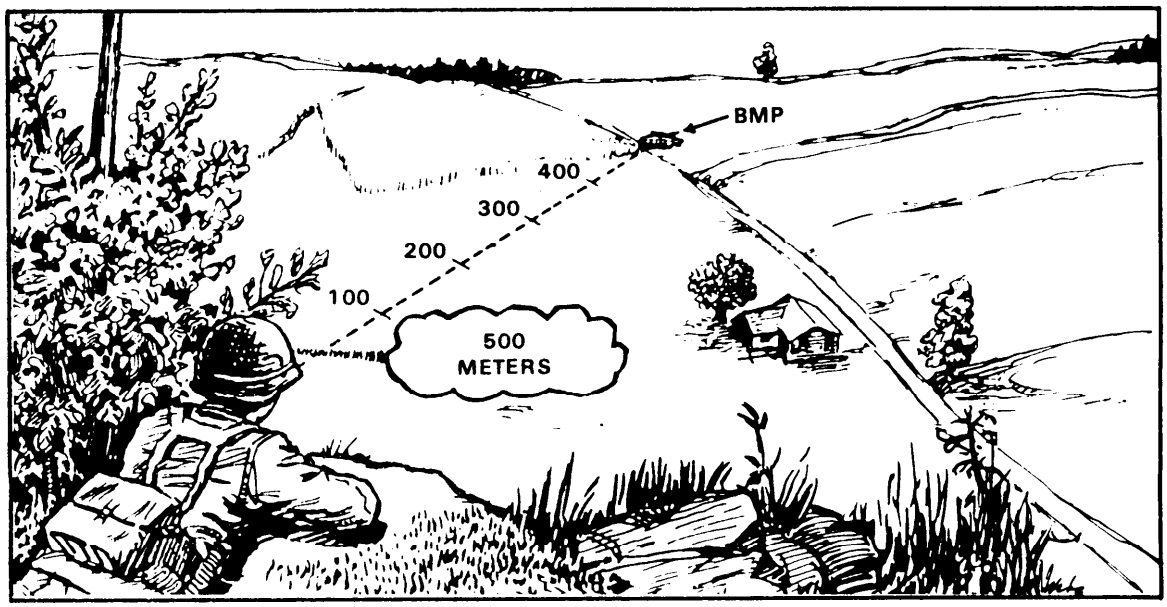


Figure 6-4. Application of the 100-meter unit-of-measure method for ranges up to 500 meters.

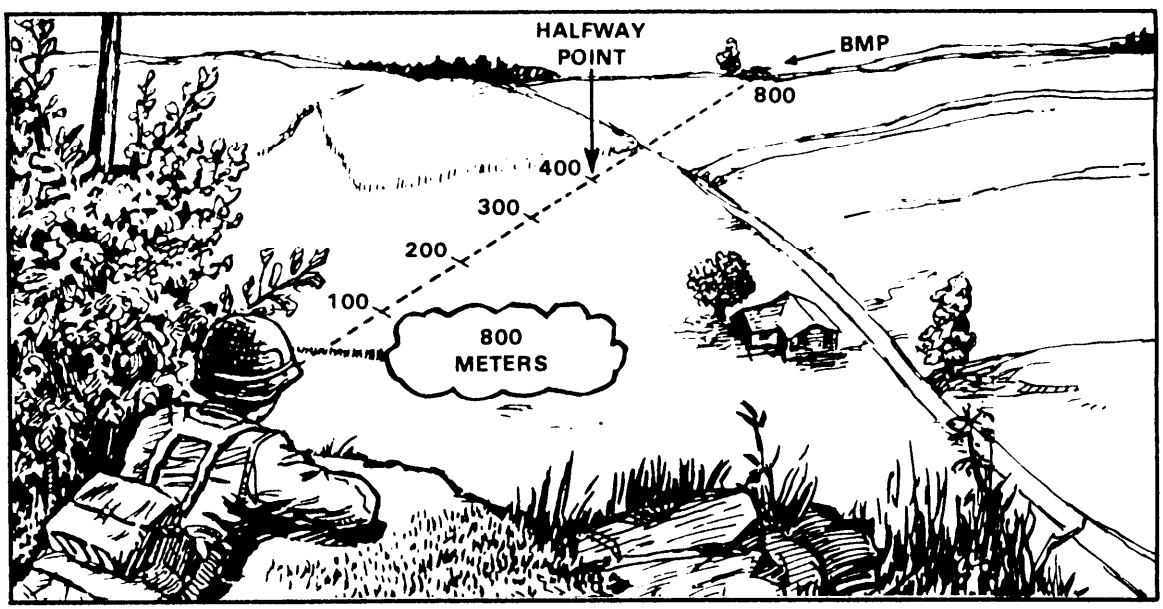


Figure 6-5. Application of the 100-meter unit-of-measure method for ranges greater than 500 meters.

b. Use the appearance-of-objects method, which is fairly reliable, to determine range (this also takes practice). Memorize the sizes and shapes of familiar objects at different ranges. Consider the factors in Table 6-1, which affect the appearance of objects.

FACTORS AFFECTING RANGE ESTIMATION	FACTORS CAUSING UNDERESTIMATION OF RANGE	FACTORS CAUSING OVERESTIMATION OF RANGE
The clarity of outline and details of the target.	When most of the target is visible and a clear outline can be seen.	When only a small part of the target can be seen or the target is small in relation to its surroundings.
Nature of terrain or position of the observer.	When looking across a depression that is mostly hidden from view.	When looking across a depression that is totally visible.
	When looking downward from high ground.	When looking from low ground toward high ground.
	When looking down a straight, open road or along a railroad.	When vision is narrowly confined as in streets, draws, or forest trails.
	When looking over uniform surfaces like water, snow, desert, or grain fields.	
Light and atmosphere.	In bright light or when the sun is shining from behind the observer.	In poor light such as dawn and dusk; in rain, snow, fog; or when the sun is in the observer's eyes.

FACTORS AFFECTING RANGE ESTIMATION	FACTORS CAUSING UNDERESTIMATION OF RANGE	FACTORS CAUSING OVERESTIMATION OF RANGE
	When the target is in sharp contrast with the background or is silhouetted because of its size, shape, or color. When seen in the clear air of high altitudes.	When the target blends into the background or terrain.

Table 6-1. Factors affecting visual range estimation.

6-4. MEASUREMENT FROM A MAP

Another way range may be determined is by using a military map. The gunner locates his positionand the target's position on the map. He mesures the distance and uses the legend scale at the bottom of the map to find the range.

6-5. MEASUREMENT BY PACING

When using this method, the leader ensures there is no immediate danger to the gun's crew. The crew sets up its position, and the gunner selects the target. The assistant gunner walks to the target in a straight line, counting the number of paces it takes to reach the target. As the distance is paced off, the gunner can determine dead space (when the assistant gunner’s belt goes below the line of the gunner’s sight).

6-6. MEASUREMENT USING BINOCULARS

Binoculars can be used to determine range. The recently adopted M19 binocular, unlike other models, is a lightweight, compact instrument intended for use in general field observation and fire direction. The binocular's left telescope includes horizontal and vertical retitles graduated in

10-mil increments (Figure 6-6). When using binoculars to determine range, the soldier must understand the mil relation (Figure 6-7).

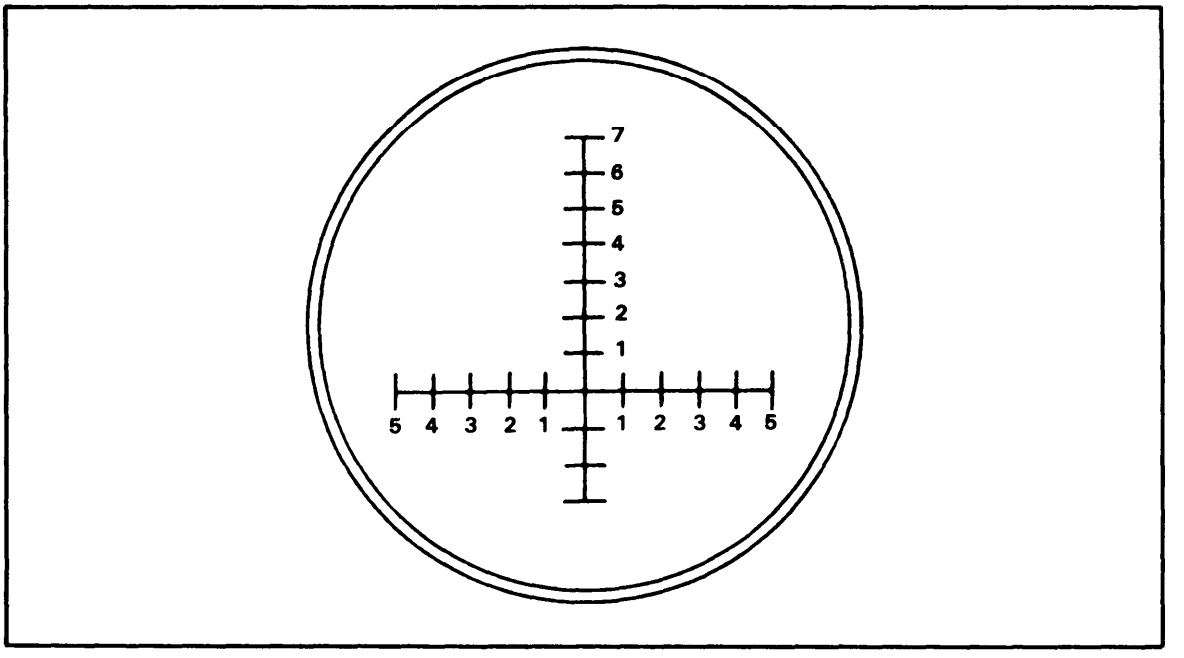


Figure 6-6. M19 binocular reticle.

a. The mil(m) is the unit of angular measurement used in adjusting fire. A circle has 6,400 mils. At a distance of 1,000 meters, an object 1 meter wide measures 1 mil. Change mils to meters by multiplying the number of mils times the range (distance) in thousands of meters. Obtain the unknown width or range to an object (Figure 6-7) using a similar method.

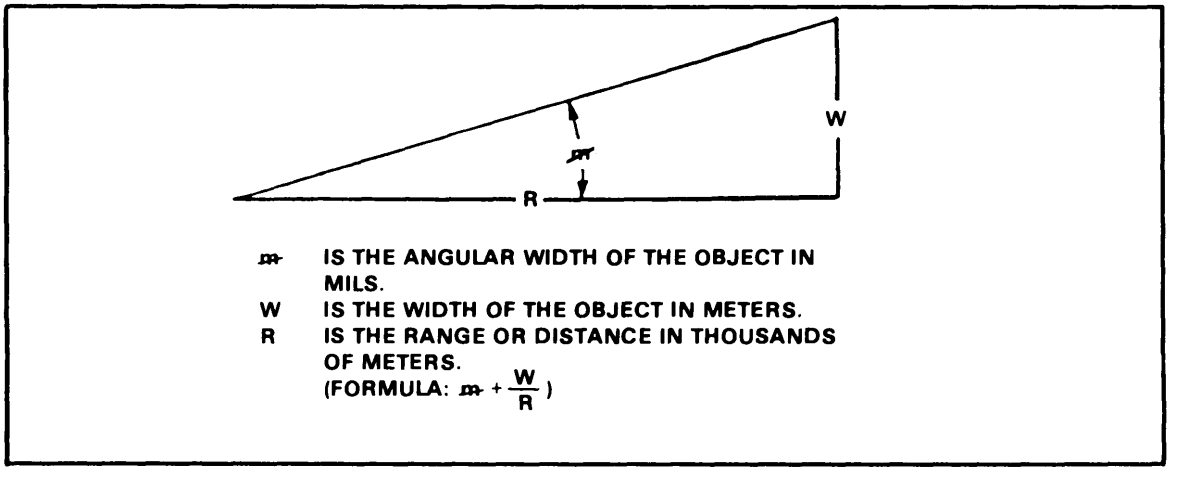


Figure 6-7. Mil relation.

b. The mil relation, as shown in Figure 6-7, is $\mu = \frac{W}{R}$; when μ is the angular width of the object in mils, W is the width of the object in meters, and R is the range or distance in thousands of meters.

(1) To find Width when the known Range is 4,000 meters and the object is 15μ wide, multiply (R x μ) 4 (range in thousands) times 15 (mils). The answer is 60 (meters), or 4 x 15 = 60 meters.

$$W = R \text{ (in thousands)} \times \mu$$
$$W = 4 \times 15$$
$$W = 60$$

(2) To find Range when the known Width in meters (between two bursts or two objects) is 60 and the angular measurement for the same width, when measured with binoculars, is known to be 15 mils, divide (W + m) 60 (meters) by 15 (mils). The answer is 4 (thousand meters).

$$R = \frac{W}{\mu}$$
$$R = \frac{60}{15}$$
$$R = 4 \text{ (in thousands)}$$

(3) To find μ when the known Width in meters between a reference point and the target is 60 meters and the known Range to the target is 4,000 meters, divide (W + R) 60 (meters) by 4 (range in thousands) and the answer is 15 (mils) or 60 + 4 = 15 mils.

$$\mu = \frac{W}{R}$$
$$\mu = \frac{60}{4}$$
$$\mu = 15$$

c. The observer uses the mil relatin in computing direction shifts as indicated in Figure 6-8.

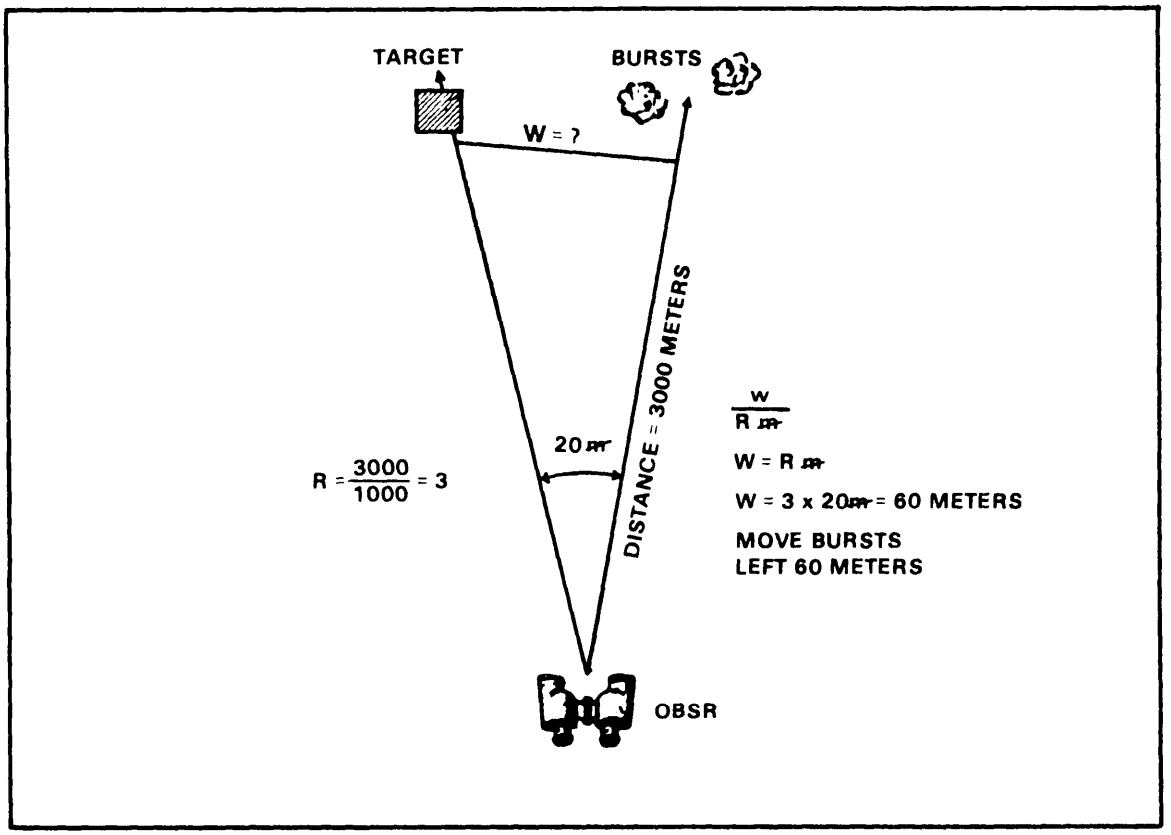


Figure 6-8. Computation of direction shift.

6-7. MEASUREMENT USING AN/GVS- LASER RANGE FINDER

The hand-held AN/GVS-5 laser range finder provides observers and small unit leaders the ability to more accurately determine range to targets and other known points. This range finder allows first-round fire for effect, which results in increased enemy casualties and saves ammunition. Friendly units can use the range finder to precisely locate themselves using intersection and modified resection techniques. The range finder aids in the determination of sector depth, range to suspected enemy locations, distance to targets along avenues of approach, and information for overlapping fires. When an AN/GVS-5 is available, it should be used to construct range cards. Information about placing the AN/GVS-5 into action can be found in TM 11-5860-201-30.

6-8. MEASUREMENT BY FIRING

The gunner can determine range by firing a zeroed MK 19. The gunner fires a burst and uses the T&E mechanism to "walk" the rounds on target. The gunner sets and reads the

sights on the target, and notes the range. This measurement method is used frequently in combat situations.

6-9. MEASUREMENT BY LATERAL DISTANCE

The gunner can use the four-finger method to find distance. He measures the distance from one point to another with the T&E mechanism. He extends his arm toward the target, palm out, elbow locked, one eye closed, and index finger raised (Figure 6-9). He sights along the edge of the finger, adding extra fingers to fill in the space (the average finger is 30 mils wide). One finger equals 30 mils, two equal 70 mils, three equal 100 mils (Figure 6-10).

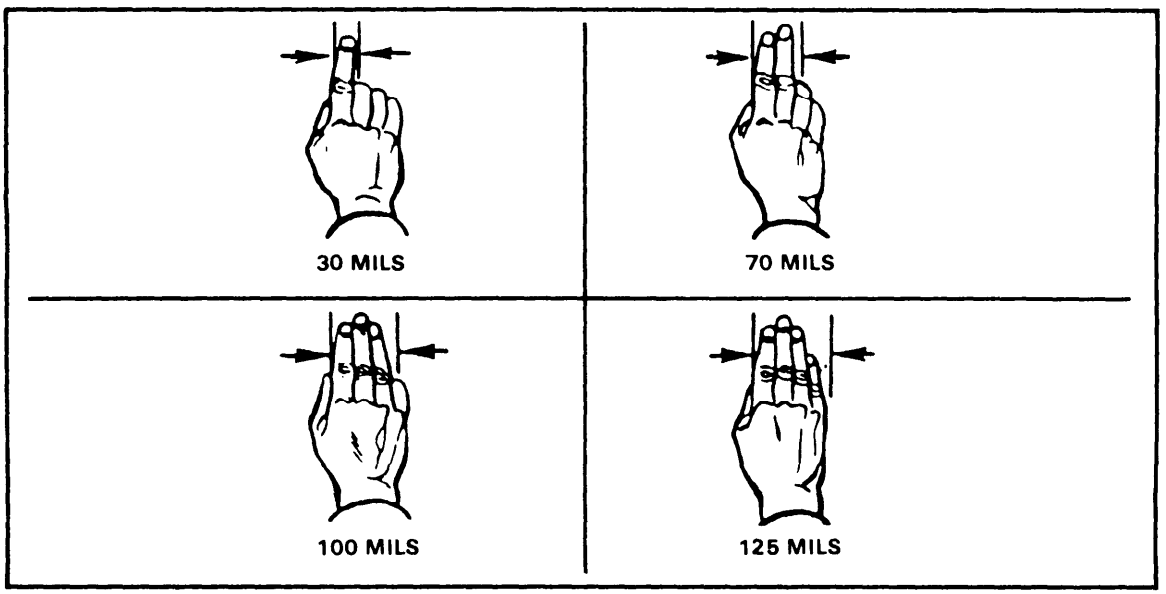


Figure 6-9. Hand-and-finger value estimates.

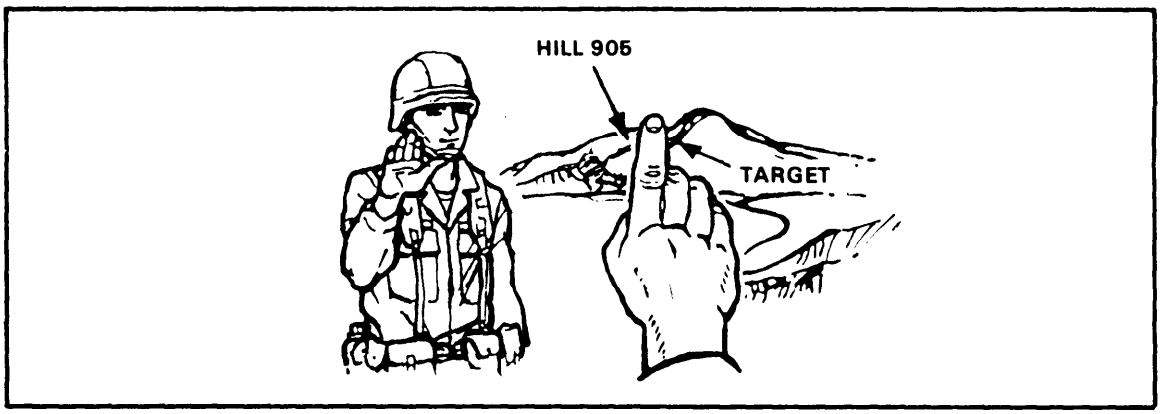


Figure 6-10. Use of fingers to measure deviation

Section III. APPLICATION OF FIRE

This section includes information about MK 19 fire control and target engagement. Fire control includes all operations connected with the preparation and application of fire to a target.

6-10. FIRE CONTROL

To correctly exercise fire control, the gunner must be able to open fire at the instant desird; to adjust fire on the target; to regulate the rate of fire; to shift fire from one target to another; and to cease fire. Failure to exercise correct fire control results in danger to friendly troops, loss of surprise, premature disclosure of position, misuse of fire on unimportant targets, loss of time in securing adjustments, and waste of ammunition. The main factors to consider for effective fire control are:

a. Sector of Fire. This is an area of terrain that an assigned unit will cover. It has specific, designated boundaries. Sectors of fire vary in size but are generally limited areas that can be engaged without movement of the tripod.

b. Rate of Fire. Surprise and shock effect may be obtained by firing all MK 19s at the same time, using the rapid rate for at least the first few bursts. Engage fleeing targets as soon as possible, and with all available fire. Use the rapid rate for the initial delivery of fire to make adjustment of fire easier. Also, whenever the rate of fire is not stated, use the rapid rate. In all cases, unless otherwise ordered, fire the first few bursts at the rapid rate; thereafter, use the prescribed rate.

c. Adjustment of Fire. Adjustments may be made before or after firing.

(1) Initial adjustment. Set the sights on the range to the target, lay on the target, fire an aimed burst, and observe the impact. When the initial burst is correct, continue to fire (manipulating if necessary) until the target is covered. When the initial burst is not correct, determine from the impact the amount of traverse and search required to place the next burst on the target. Manipulate the gun with the T&E handwheels making large range corrections by resetting the sights and re-laying on the target.

(2)Subsequent correction and adjustment. Observation and adjustment of fire is the most important element of fire control. It is continuous throughout the action. The gunner is trained to observe and adjust fire without command and to check the lay of the gun frequently. The gunner is also trained to foresee the action of the enemy after fire is open,and to shift fire to cover any changes in the formation or location of the target. If the gunner fails to do these things, the leader promptly corrects him by announcing or signaling subsequent fire commands. This responsibility to adjust fire continues up through the chain of command. When subsequent fire commands are issued, the gunner makes the required adjustments. When the gun is fired from the tripod mount, subsequent commands are given as adjustments to the elevation or deflection at which the last burst was fired. The adjustments are given in mils and are announced or signaled as: ADD, DROP, RIGHT, or LEFT so many mils. Changes in deflections and elevation such as RIGHT 2 or ADD 5 are made with the T&E handwheels.

6-11. FIRE COMMANDS

Fire commands are the means by which leaders control fires. A fire command is a set of instructions, given in a prescribed format, that enables the gun crew to properly engage the desired targets. There are two types of fire commands--initial and subsequent. Initial fire commands are used for engagement of targets and the shifting of fire to new targets. Subsequent fire commands are used to adjust fire, change the rate of fire, and cease fire. The explanation below is based on two gun crews. A good fire command is brief and clear, and in the proper sequence. It is given clearly at a rate that is easily understood by the gunner. Gunners repeat each element to ensure understanding. It is unlikely for a complete initial fire command to be issued during a fire fight. The leader determines which elements of a fire command are obvious to the gunners and which elements must be given to them. Some targets may be engaged with only the alert, range, and command to fire. For example: FIRE MISSION, SEVEN HUNDRED, FIRE. The procedures outlined below are used to accustom gunners to issuing and executing instructions in a logical sequence. The use of complete fire commands in training prepares the gunners to receive fragmentary fire commands in combat.

a. Initial Fire Command. This contains the following elements:

ALERT.
DIRECTION (as needed).

DESCRIPTION (as needed).
RANGE.
ASSIGNMENT/METHOD (division, manipulation, rate; all only as needed).
CONTROL.

(1) Alert. The alert is the first element of the initial fire command. Its purpose is to choose the gun crews and ready them to receive and execute the fire command. FIRE MISSION is announced for all targets When two or more guns are to fire, the leader announces, FIRE MISSION. If only one gun is to fire, then NUMBER 1 (2) FIRE MISSION is given. When alert all guns, but only wants one gun to fire, the announcement is FIRE MISSION, NUMBER 1 (2).

(2) Direction. There are several ways to designate target direction:

(a) Oral. When the target is not obvious, the leader must tell the gunners where to look. The leader gives direction as FRONT, RIGHT FRONT, LEFT FLANK, and so on. The leader may identify an indistinct terrain the use of a reference point. The selected RP, announced as REFERENCE, must be a distinctive terrain feature or object in or near the target area. The word TARGET precedes the target description when an RP is used.

- When the RP is within the target area, the leader may describe the target as extending so many mils, meters, or fingers from that point. He announces range to the RP. Examples of direction, if the RPs are within the target area:

  REFERENCE: BUNKER, FIVE ZERO ZERO.
  TARGET: TROOPS EXTENDING RIGHT TWO FIVE, LEFT TWO FIVE.

- If the selected RP is outside the target area, the leader announces the range to the target:

  REFERENCE: LONE TREE.
  TARGET: MACHINE GUN IN EDGE OF WOODS; FIVE ZERO ZERO.

- The leader may get the direction to a target that is not obvious by selecting an obvious feature and, by naming successive RPs, leading the gunner to the target step by step.

REFERENCE:RED-ROOFED HOUSE, RIGHT OF HOUSE,
HEDGE, CENTER OF HEDGE, GATE, ABOVE GATE.
TARGET: MACHINE GUN.

- For a tripod-mounted MK 19, the interval between the reference and the target is measured by laying the gun on the RP and manipulating the gun a given number of mils to the target.

(b) Firing a MK 19. Pointing out an obscure target by firing a MK 19 is simple, fast, and accurate. However, it may cause loss of surprise or premature disclosure of the gun's position. The leader announces the general direction of fire, if it is not obvious; lays one gun on the target, commands WATCH MY BURSTS, and fires one or more on the target. The leader completes the designation orally using the target's midpoint or extremes: RIGHT FLANK, MIDPOINT or NEAR END. Firing rifle tracers at the target makes it easier for the gunners to find.

(c) Laying a MK 19. Laying the gun on a target is a simple and accurate method that does not sacrifice surprise. The leader goes to each gun, lays it on the target, and has the gunners check the lay. The gunners open fire simultaneously on command.

(3) Description. The leader gives a brief target description to inform the gunners of the nature of the target. Example of target descriptions include: TROOPS, which refers to any dismounted enemy personnel; MACHINE GUN, which refers to any automatic gun; TANK, which refers to any armored vehicle. If several targets are in view, the leader may describe the target or part of a target to be engaged as LEADING TRUCK, RIGHT BUILDING, FAR END, HALTED COLUMN, and so on. If the target is obvious, no description is necessary.

(4) Range. This element follows the target description. The leader announces it in even digits, hundreds or thousands. For example: FOUR FIVE ZERO; THREE HUNDRED; ONE ONE HUNDRED; ONE THOUSAND.

(5) Assignment/method. This element is used only when specific assignments are required to divide or subdivide the target, assign class of fire, or announce a rate of fire.

(a)Division (or subdivision). The leader gives this element only when it is required (see paragraph 6-12). Division may be announced as follows:

NUMBER 1 RIGHT HALF, NUMBER 2 LEFT HALF.
NUMBER 1 HT TWO-THIRDS, NUMBER 2 LEFT TWO-THIRDS.
NUMBER 1 RIGHT TWO-THIRDS, NUMBER 2 LEFT ONE-THIRD.

(b) Manipulation. The leader gives this element to prescribe the class of fire with respect to the gun, and gives it only if the required manipulation is not obvious. For example:

FIXED.
TRAVERSE.
SEARCH.
TRAVERSE AND SEARCH.
SWINGING TRAVERSE.

(c)Rate. The greatest effect results from having two guns open fire at the rapid rate, at the same time. Regardless of the rate announced, gunners open and adjust fire at the rapid rate, and use the announced rate--sustained, rapid, or cyclic--thereafter. Size of target, type of target, and ammunition supply are the factors which influence selection of a rate of fire. Rates of fire are distinguished as follows:

- Sustained. This rate of fire is measured in rounds per minute and is the rate at which a MK 19 may be fired indefinitely without damage from overheating. The leader announces, SUSTAINED.

- Rapid. This rate is measured in rounds per minute and is the rate at which a MK 19 may be fired for a limited time without danger of overheating. The rapid rate permits a high volume of fire to be delivered for a short, set time. Gunners will use the rapid rate unless another rate is announced.

- Cyclic. This is the rate at which a MK 19 can be fired, for a limited time ONLY, at the fastest rate the gun will fire. This rate may be used when the target or area needs the greatest possible suppression. The leader announces, CYCLIC.

(6) Control. The leader uses this element to give the command to open fire. For immediate engagement of the target, the leader gives the command FIRE or the arm-and-hand signal to fire without pause. Fire is often withheld for surprise and effect, and both guns open fire at the same time. To ensure this, the leader may preface the command or signal to fire with the words, AT

MY COMMAND or ON MY SIGNAL. When the gunners are ready to engage the target, they report UP or announce NUMBER 1 (2) UP, READY, and the leader gives the command or signal to fire.

b. Subsequent Fire Commands. The leader uses these to repeat or correct a fire command, to adjust fire, to cease or commence fire, or to terminate the alert. The deflection correction must always be given first.

- Repeat fire command. If the gunner fails to understand any element of the fire command, a repetition of the element may be requested by announcing the misunderstood element with rising inflection to denote a question. When repeating any portion of the fire command, the leader will preface it with the words, THE COMMAND WAS.

- Correct fire command. The leader changes or corrects a portion of the fire command by announcing CORRECTION and giving the command. For example, to change an incorrect range command of 500 meters to 600 meters, the command is CORRECTION, SIX HUNDRED.

- Adjust fire. The leader adjusts fire if the initial burst was not on target. The leader does this by announcing the direction and elevation needed to get on he target: ADD 100, RIGHT 20; or DROP 200, LEFT 50.

- Cease and commence fire. CEASE FIRE is announced if the leader wishes to interrupt fire for any reason This type of subsequent fire command informs the MK 19 crew that it will remain on the alert and that more instructions will follow. Firing is renewed by announcing a subsequent fire command or by announcing a new fire command. Firing is resumed with the same data by using the command FIRE.

- Terminate the alert. To allow the MK 19 crew to relax between fire missions, the termination of the alert is announced as CEASE FIRING, END OF MISSION.

6-12. TARGET ENGAGEMENT

The method chosen depends on terrain, target presentation, type of target, and tactical situation.

a. Distribution of Fire. To be effective, fire must be distributed over an entire target. Improper distribution results in gaps between beaten zones and allows some of

the enemy to escape or to use guns without effective opposition.

(1) Factors affecting distribution of fire. No fix rule can be given as to the widest target that a single MK 19 may effectively engage. Ideally, the target should be no more than 100 mils wide. The traversing screw on the T&E mechanism limits the gun's traverse unless the traversing slide lock lever is unlocked. Wider targets require more traversing time, which prevents the gunner from placing a continuous volume of fire on the whole target. The engagement of a wide target by a single MK 19 requires excessive ammunition.

(2) The fire unit. This consists of a pair of MK 19s. If possible, at least two guns should be assigned to the same mission, although sometimes a single MK 19 may be effective. The assignment of a pair to a single mission ensures continuous fire in case either gun is put out of action. Two guns can provide a great volume of fire on the target, and can reduce the time require to cover it.

(3) Manipulation of the tripod-mounted MK 19. Traversing fire is moved in 5-mil increments. The MK 19s are fired after each manipulation to ensure the beaten zone overlap. Searching fire is often used on level or evenly sloping ground. When the ground is irregular, however, the amount of search to apply between bursts in order to ensure overlap of the beaten zones is determined by observation.

b. Engagement of Point Target. Any target no larger than the beaten zone is a point target, and is engaged by fixed fire. The command is FIXED. MK 19 crews are trained to follow any movement or change in formation made by the enemy after the initial burst of fire. An example of a fire command for a point target is as follows:

FIRE MISSION.
FRONT.
MACHINE GUN.
SIX HUNDRED.
FIXED.
RAPID.
FIRE.

c. Engagement of Linear Target. There are several ways to engage a linear target. THe method used is chosen based on the number of MK 19s available and whether or not the entire target is visible to the gunner.

(1) Linear engagement--one MK 19. A single MK 19 engages the target the same as either one of a pair. The MK 19 is laid just outside either flank (or on a reference point within the target area) and the gunner adjusts fire on the flank (or point). The gunner traverses back and forth across the entire area until told to cease firing. The leader may designate where he wants initial fire. For example, if he directs a single gunner to engage a target with width:

FIRE MISSION.
FRONT.
TROOPS EXTENDING FROM DEAD TREE RIGHT 20 MILS.
FIVE HUNDRED.
TRAVERSE.
RAPID.
AT MY COMMAND.
FIRE (given after the gunners announce UP.)

(2) Linear engagement--two MK 19s. A linear target may be engaged two ways when a pair of MK 19s is used, depending on the width of the target in mils. For either method to be used, the target must be less than the length of the beaten zone in depth.

(a) Target 100 mils or less in width. the normal traversing method is used in this case. Each MK 19 delivers the initial burst of fire on its corresponding flank of the target. Fire is adjusted on that point. Each MK 19 is traversed across the target to the other flank, covering the entire target, until the gunners are told to cease firing (Figure 6-11). The command for this type of fire is TRAVERSE. An example of a fire command used for this situation follows:

FIRE MISSION.
RIGHT FRONT.
TROOPS, EXTENDING FROM DEAD TREE RIGHT TO CLEARING.
SEVEN FIVE ZERO.
TRAVERSE.
RAPID.
AT MY SIGNAL.
FIRE (given after the gunner announces UP).

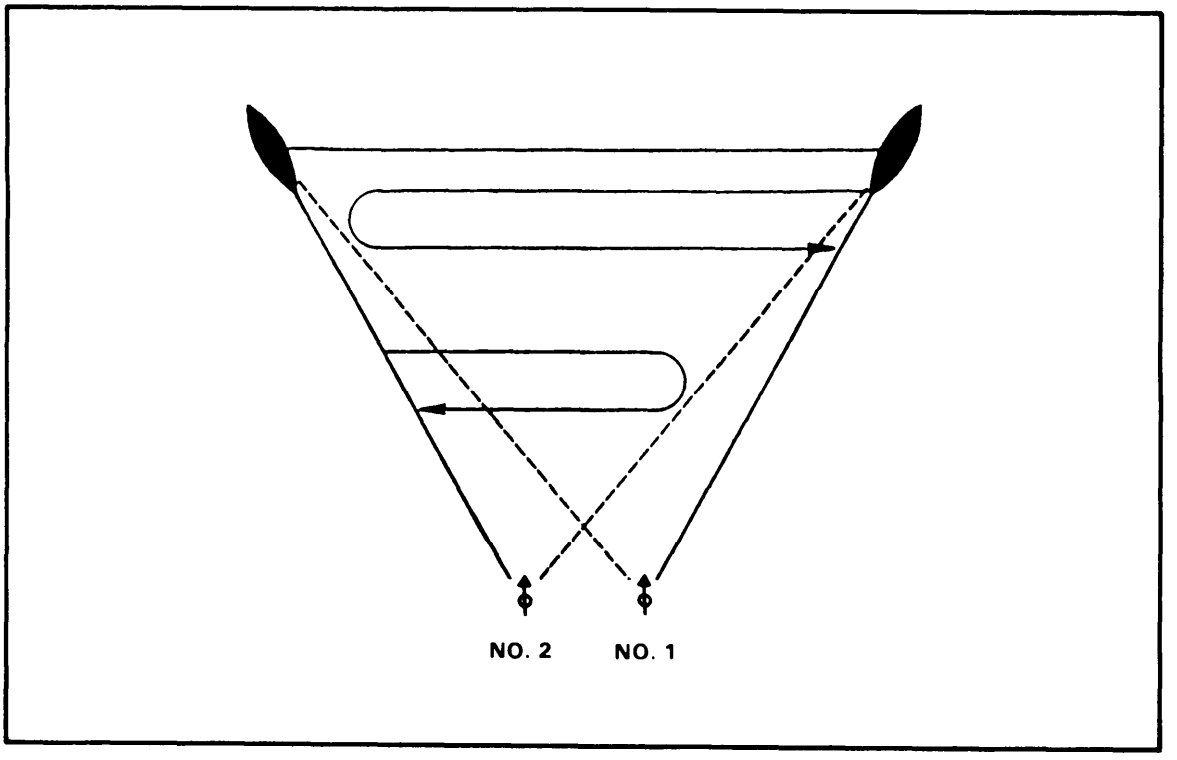


Figure 6-11.Traversing method, pair of MK 19s, targets 100 mils or less in width, both flanks visible.

(b) Target more than 100 mils in width. In this case, the leader assigns part of the target to each MK 19 (Figure 6-12). One part may be smaller than the other to ensure it receives a heavier concentration of fire. Each gun fires an initial burst on its respective flank, and covers its assigned part of the target as described in (a). An example of a fire command follows:

FIRE MISSION.
RIGHT FRONT.
TROOPS, EXTENDING FROM DEAD TREE RIGHT TO CLEARING, ROW.
EIGHT HUNDRED.
NUMBER 1, RIGHT ONE-THIRD; NUMBER 2, LEFT TWO-THIRDS.
TRAVERSE.
RAPID.
AT MY COMMAND.
FIRE (given after the gunners announce UP).

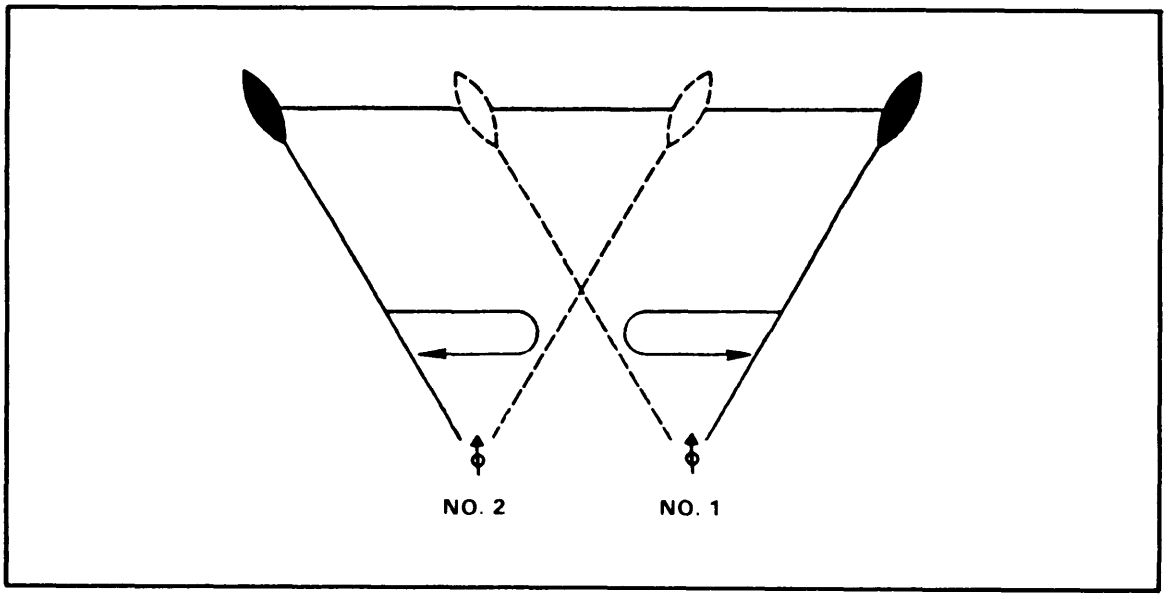


Figure 6-12. Traversing method, pair of MK 19s, target more than 100 mils in width.

(3) Linear engagement--four MK 19s. Four guns may be needed to concentrate a heavy volume of fire into a wide target area. Methods used are similar to the ones described for a pair of MK 19s. The width of the target in mils determines which type of linear engagement is used.

(a) Target 100 to 200 mils in width:

- Each pair of MK 19s engages the whole target (Figure 6-13).

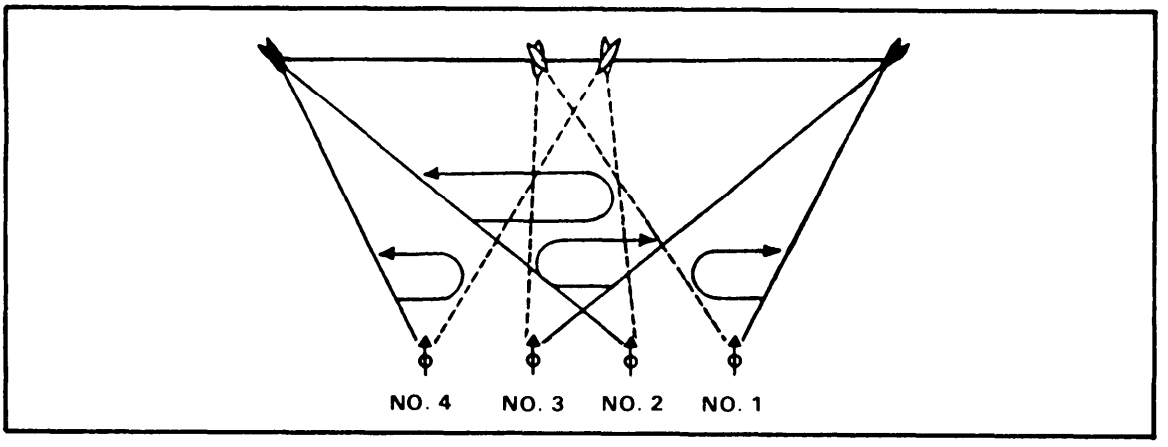


Figure 6-13. Four MK 19s, target 100 to 200 mils in width.

- Each pair of MK 19s engages half the target (Figure 6-14).

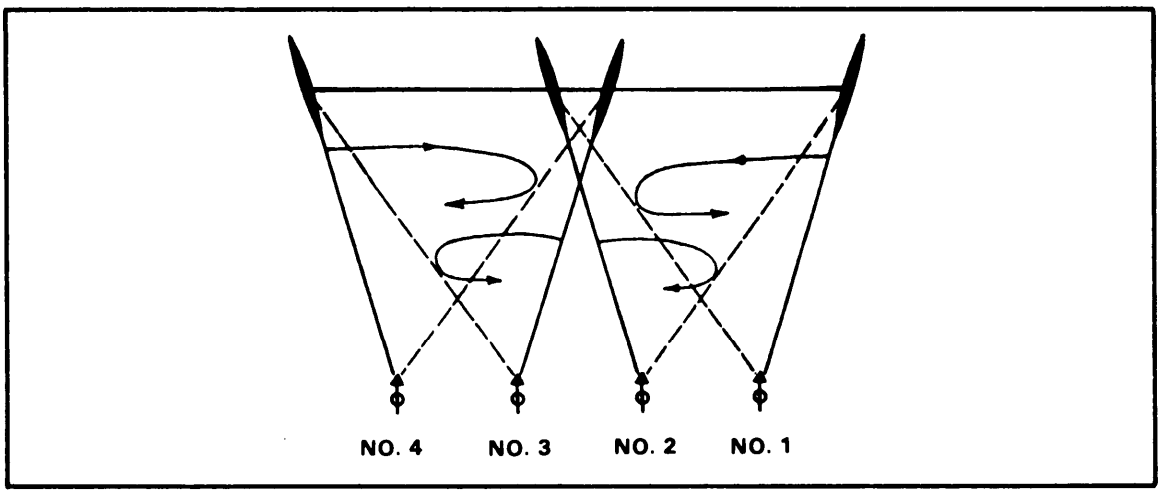


Figure 6-14. Pair of MK 19s engaging each half of a target 100 to 200 mils in width.

(b) Target greater than 200 mils in width. The leader may assign part of the target to each gun in this case. The target may be divided in half for each fire unit or in four parts, one for each MK 19 (Figure 6-15) .

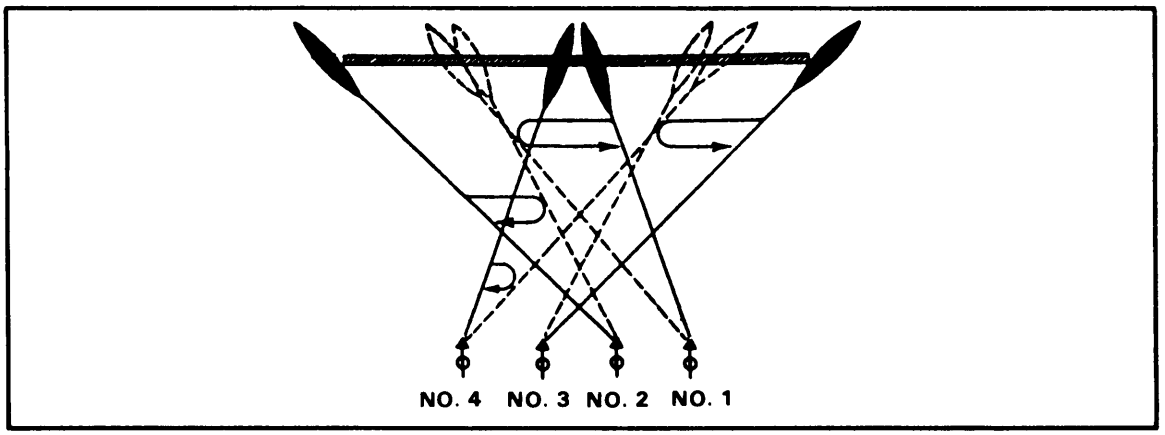


Figure 6-15. Four MK 19s, each pair engaging part of target with extreme width.

(4) Linear engagement--flanks of target not identifiable. The target may be located by firing tracers from an observer's gun; by laying MK 19s, or by using a

reference point. The RP may be in or near the target area.

(a) When an RP is outside the target area, the leader may direct the gunner to it by announcing the interval (right or left--long or short) between the RP and the target. With the MK 19 on a tripod mount, the gunner measures the interval right or left between the RP and the flank of the target by laying on the RP, with the sights set at the range to the target, and then shifting the MK 19 the designated number of mils. The interval long or short may be measured in mils using the computed search method, or it may be estimated in meters. When the gunners lay each MK 19 on its respective flank, they adjust fire and engage the target.

(b) When an RP is in the target area, the leader may identify the flanks of an obscure target as extending so many mils from the RP. In this case, gunners use the swinging traverse: each MK 19 is laid on the announced RP (initial aiming point); adjusted for fire; and traversed the given distance to its corresponding flank and back, firing after each manipulation (Figure 6-16). Each gunner continues traversing back and forth across the entire target until told to cease firing. Each gunner stops firing while traversing past the RP. Examples of fire commands that may be used follow:

- The leader designates the target by firing one gun:

```
FIRE MISSION.
LEFT FLANK.
WATCH MY BURSTS (OR TRACERS).
 (Lays and fires MK 19 at left flank)
   LEFT FLANK.
 (Lays and fires MK 19 at right flank)
   RIGHT FLANK.
TROOPS.
NINE HUNDRED.
TRAVERSE.
RAPID.
AT MY COMMAND.
FIRE (given after gunners announce UP).
```

- The leader designates the target by using a reference point outside the target area (MK 19s on tripod mounts):

FIRE MISSION.
RIGHT FRONT.
REFERENCE: DEAD TREE.
RIGHT SIX ZERO MILS; DROP THREE FIVE ZERO METERS (or drop so many mils, if using computed search).
TARGET: TROOPS EXTENDING RIGHT FIVE ZERO MILS.
SIX HUNDRED.
TRAVERSE.
RAPID.
AT MY COMMAND.
FIRE (given after the gunners announce UP).

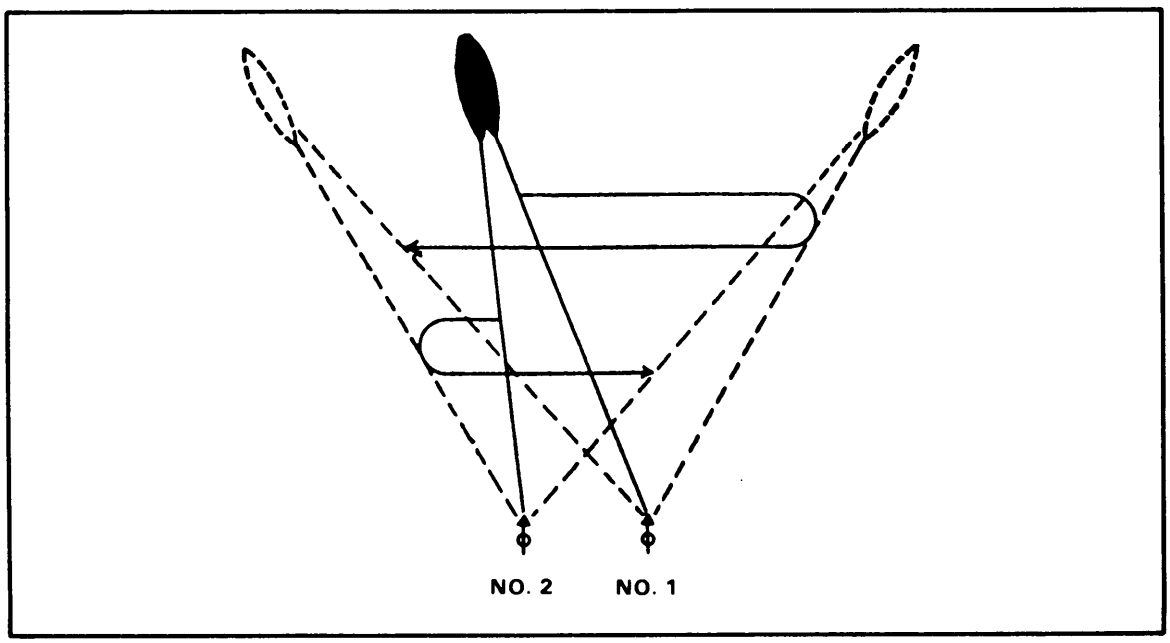


Figure 6-16. Two MK 19s, deep enfilade target, ends not visible.

The leader designates the target by using a reference point within the target area (MK 19s on tripod mounts):

FIRE MISSION.
FRONT.
REFERENCE: LONE TREE.
TARGET: TROOPS EXTENDING RIGHT TWO ZERO MILS, LEFT, ZERO MILS.
SEVEN HUNDRED.
TRAVERSE.
RAPID.

AT MY COMMAND.
FIRE (given after the gunners announce UP).

(5) Linear engagement--swining traverse. As previous ly described, a single gun uses this method against massed or rapidly moving targets at short ranges. The leader's fire command for a swinging traverse may be, for example:

FIRE MISSION.
LEFT FRONT.
TRUCKS .
SWINGING TRAVERSE.
FIRE.

d. Engagement of Deep Targets Using Searching Fire. There are several ways for leaders to use two guns to engage a stationary deep target, depending on whether the ends of the target are visible to the gunner. If the target location is unknown, the computed search method may be used to engage the target. A deep target that is stationary or that has limited mobility may be engaged with searching fire.

(1) Target ends visible to gunner. The Number 1 gun is adjusted first on the near end and the Number 2 gun on the far end. Each gunner searches to the opposite end and back again repeatedly, until told to cease firing (Figure 6-17). Target depth is considered in determining sight settings. The command is SEARCH.

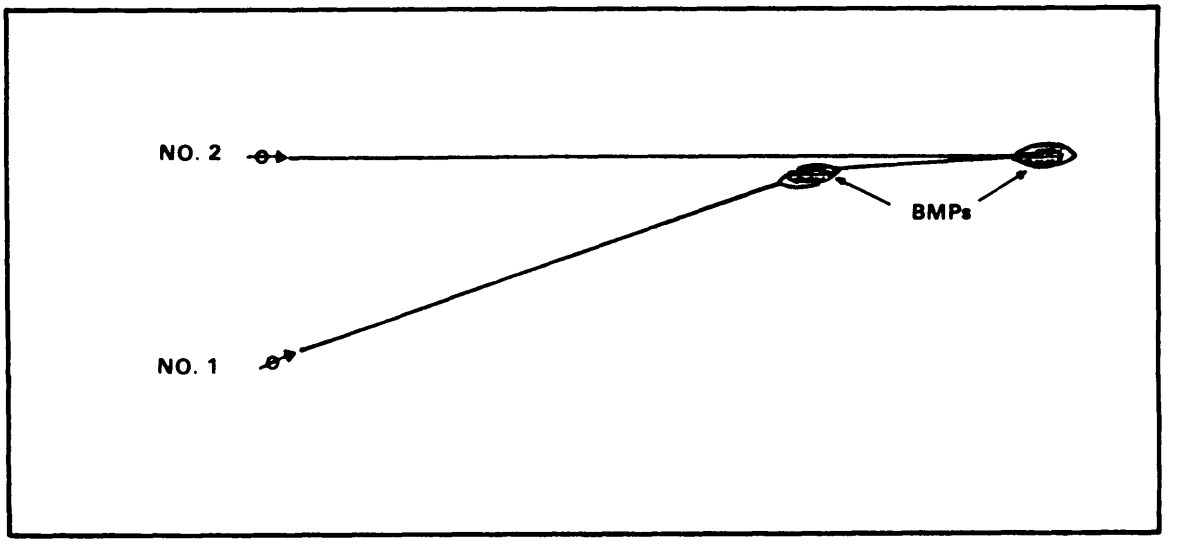


Figure 6-17. Two MK 19s, deep enfilade target, ends visible.

(a) Target less than 200 meters deep. The leader announces the range to the midpoint of the target for both MK 19s, using the length of the beaten zones to ensure the initial bursts impact on the target. An example of a fire command for this situation follows:

FIRE MISSION.
FRONT.
HALTED COLUMN.
SEVEN HUNDRED (midrange).
SEARCH.
RAPID.
AT MY COMMAND.
FIRE (given after gunners announce UP).

(b) Target depth greater than 200 meters. The leader announces the range to the near end for the Number 1 gun, and to the far end for the Number 2 gun. An example of a fire command for this situation follows:

FIRE MISSION.
LEFT FRONT.
TROOPS ALONG RIGHT EDGE OF WOODS.
NUMBER 1, SIX HUNDRED; NUMBER 2, NINE HUNDRED.
SEARCH.
RAPID.
AT MY COMMAND.
FIRE (given after gunners announce UP).

(2) Target ends not visible to gunner. The target may be located by having an observer fire tracers at the target, by laying the MK 19s, or by using a reference point. The reference point must be visible to the gunner and in the vicinity of the target. When a selected reference point is outside the target area, the leader may direct the gunner to the target and announce the interval to the right or left (long or short) between the reference point and the target. If the MK 19 is on a tripod, the gunner lays on the freference point with the sights set at the range to the midpoint of the target; he measures the interval in meters. When priate number of mils. The gunner may measure the long or short interval in mils, using the computed search method, or he may estimate the interval in meters. When the gunners lay their MK 19s on the right or left flank (near or far end), respectively, they adjust fire and engage the target. When the gunners lay their MK 19s on the announced RP (initial aiming point), they set their sights at the range to the RP, and adjust fire. The

gunner on the Number 1 gun searches down the designated number of meters (or mils), firing after each manipulation until the gun is set on the near end of the target. The gunner on the Number 2 gun searches up the designated number of meters (or mils), firing after each manipulatin, until the gun is set on the far end of the target. When each gun has reached the near or far end, respectively, the gunners reverse the direction and both search up and down between the two limits, covering the entire target, until told to cease firing.

e. Engagement of Deep Targets Using Computed Search Method. When the depth of a target must be described in roils (search), the leader may compute the depth from the RP using the computed search method. The leader determines the ranges to the near and far ends of the target and finds the required AE (angles of elevation) in mils for both ranges (Appendix E). The leader then computes the difference between the two--this is the amount of search required when the MK 19 and target are at the same elevation on level ground. If the fire is plunging, the amount of search should be increased. For example, a deep target has been sighted, the ends of which are not visible to the gunners; an RP is visible on the target at a range of 1,100 meters, the depth of the target is estimated at 200 meters, and the RP appears to be midway between the ends of the target:

$$\frac{200 \text{ meters}}{2} = 100 \text{ meters from RP to each end of target}$$

1,100 + 100 = 1,200 meters to far end of target
1,100 - 100 = 1,000 meters to near end of target

AE 1,200 meters	=	175 mils
-AE 1,000 meters	=	132 mils
depth of target		43 mils

$$\frac{43 \text{ mils}}{2} = 21.5 \text{ mils from RP to each end of target}$$

To search in 5-mil increments, the gunners cover the target by searching 25 roils long and 25 roils short of the reference point, or a total of 50 mils. The leader describes the target to the gunner as TARGET; TROOPS

EXTENDING LONG 25 MILS; SHORT 25 MILS. The following are examples of fire commands:

- RP in target area, ends of target not visible to the gunner:

FIRE MISSION.
RIGHT FRONT.
REFERENCE: LONE BUSH.
TARGET: TROOPS EXTENDING SHORT ONE HUNDRED YARDS, LONG TWO HUNDRED YARDS.
SIX HUNDRED (range to reference point).
SEARCH.
RAPID.
AT MY COMMAND.
FIRE (given after gunners announce UP).

- RP outside target area, gun on tripod.

FIRE MISSION.
LEFT FRONT.
REFERENCE: DEAD TREE.
RIGHT THREE ZERO MILS; ADD TWO HUNDRED METERS (or add so many mils, using computed search) .
TARGET: TROOPS EXTENDING OVER TWO HUNDRED METERS (or long so many mils, using computed search).
NINE HUNDRED.
SEARCH.
RAPID.
AT MY COMMAND.
FIRE (given after gunners announce UP).

f. Engagement of Moving targets. Due to the slow flight of the MK 19 round, it is not practical to engage moving targets using the track-and-lead methods of engaging moving targets. In order to effectively engage moving targets with the MK 19, use the trapping method of engaging targets. The gunner chooses an aiming point forward fo the target and on the target path, and presses the trigger before the target comes into the sights. After starting to fire, the gunner moves the MK 19 slowly toward the target. The target moves into the impact area, and is "trapped." The gunner must begin firing before the target is in the sights or in the impact area (Figure 6-18).

(1) Engagement of deep target movig away from the MK 19 position. If the target is moving rapidly away, both gunners lay their MK 19s on the far end of the target with the range set to that point, and search up.

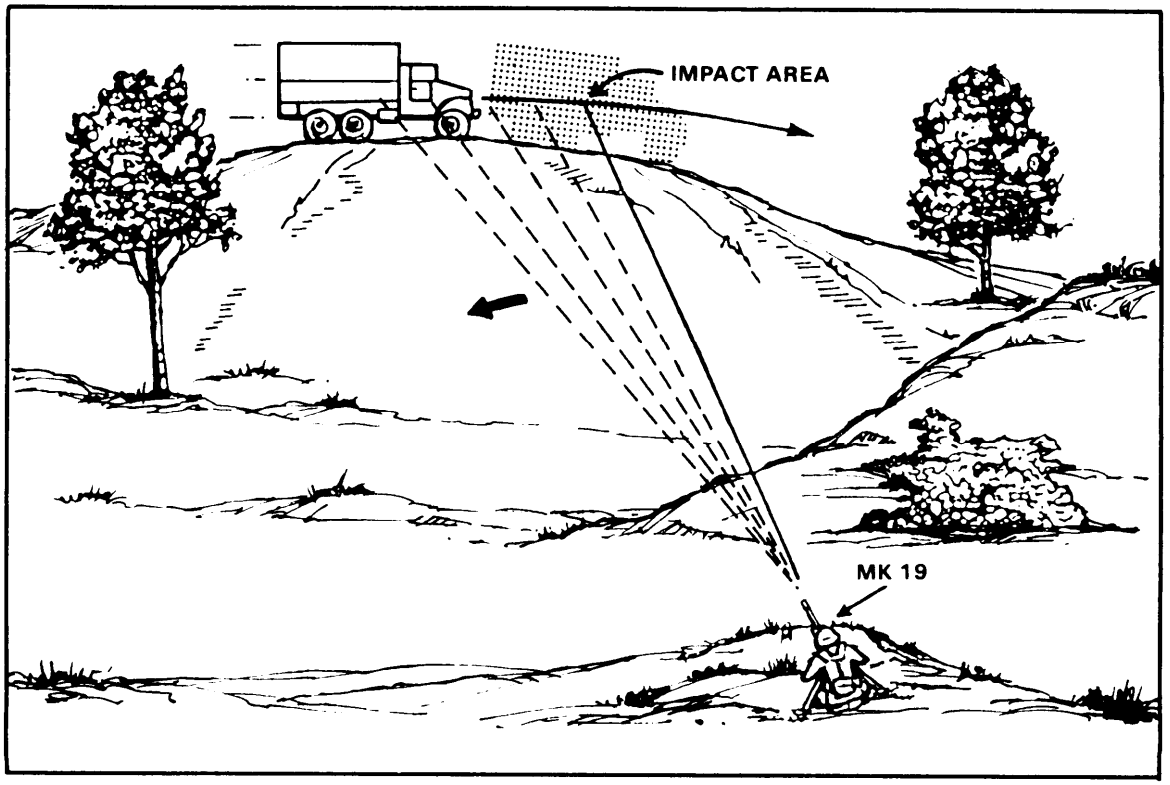


Figure 6-18. Target-trapping method.

(2) Engagement of deep target moving toward the MK 19 position. If the target is moving rapidly toward the MK 19 position:

(a) One MK 19. The gunner lays the MK 19, adjusts on the near end of the target with a range to the target's midpoint, and searches up and down the entire target. When an RP within the target area is announced, the gunner lays on it with the range to that point. The gunner adjusts fire and searches up and down the entire target, beginning with the near end, until told to cease firing.

(b) Pair of MK 19s. The gunners lay both guns on the near end of the target, set the sights on the range to that point, and search down. The manipulation element of the fire command for a rapidly approaching or receding target is BOTH WEAPONS; FAR (NEAR) END; SEARCH.

(c) Four MK 19s. Each pair of gunners engages the target as if they were acting alone. If one pair must be switched to a different target, the other pair

continues to cover the original target. A deep target need never be subdivided since the elevating mechanism on the M3 tripod allows enough search to cover any deep target within the maximum effective range for direct lay (1,500 meters).

g. Engagement of Linear Target with Depth Using Traversing and Searching Fire. The method used depends on the number of MK 19s available and whether the flanks of the target are visible to the gunner:

(1) One MK 19, flanks visible. The gunner lays initially on the near flank of the target with range set to the midpoint, adjusts fire on the near flank, and traverses and searches back and forth, covering the entire target, until told to cease firing.

(2) Pair of MK 19s , flanks visible. Gunners use the same method as for engagement of a deep linear target: they must search to keep the center of impact on the target. The leader determines the range for the initial fire command the same as for a deep target (Figure 6-19).

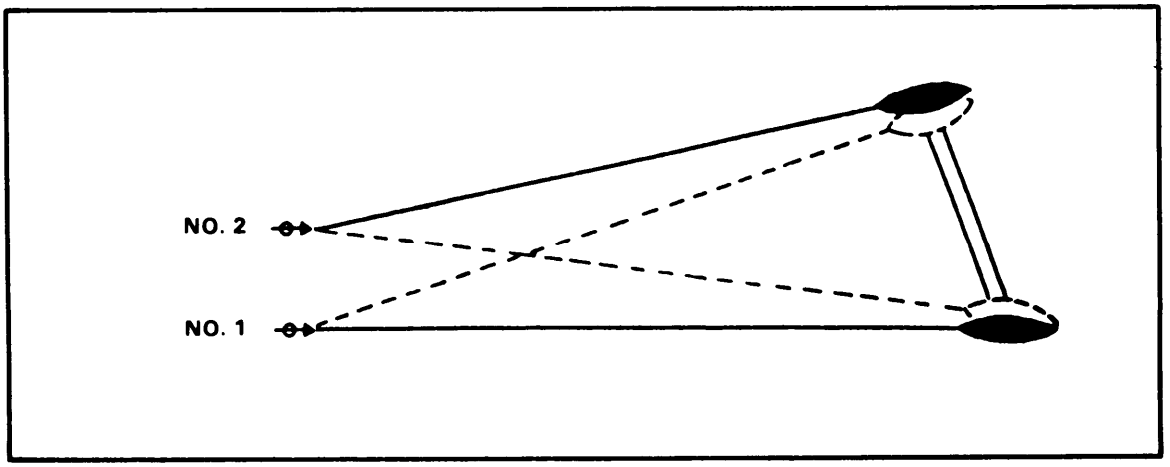


Figure 6-19. Two MK 19s, linear target with depth.

(3) Four MK 19s, flanks visible. Gunners use the same method for two pairs as is used for two guns. If one pair must be switched to another target, the other continues to cover the original target.

(4) Flanks invisible. The leader may designate the target using an RP. An RP in the target area is not used as an initial aiming point, however, because of the difficulty in describing an oblique target.

(5) Fire commands. The leader may use the following fire commands for linear targets with depth:

- When the target is not wide enough to require subdivision, is 200 meters or less in depth, and is to be engaged by either one or two MK 19s:

```
FIRE MISSION.
RIGHT FRONT.
TROOPS EXTENDING FROM BLACK STUMP RIGHT TO
  LONE PINE.
SEVEN HUNDRED (midrange)
TRAVERSE AND SEARCH.
RAPID.
AT MY SIGNAL.
FIRE (given after gunners announce UP).
```

- When the target is 100 mils wide or less, is 200 meters deep or less, and is to be engaged by four MK 19s:

```
FIRE UNIT, FIRE MISSION.
FRONT.
TROOPS TO THE RIGHT OF RED BANK.
SEVEN HUNDRED (midrange).
TRAVERSE AND SEARCH.
RAPID.
AT MY SIGNAL.
FIRE (given after gunners announce UP).
```

- When the target is wide enough to require subdividing, is more than 200 meters in depth, and is to be engaged by either two or four MK 19s:

```
FIRE MISSION.
FRONT.
TROOPS EXTENDING FROM TRUCK, RIGHT TO
  BRIDGE.
NUMBER 1 (and 3 if four MK 19s are
  engaging the target), SEVEN HUNDRED.
NUMBER 2 (and 4 if four MK 19s are
  engaging the target), ONE THOUSAND.
NUMBER 1 (and 3), RIGHT HALF.
NUMBER 2 (and 4), LEFT HALF.
TRAVERSE AND SEARCH.
RAPID.
AT MY SIGNAL.
FIRE (given after gunners announce UP).
```

h. Engagement of Target Using Combined Sights. Leaders may choose this expedient way to engage a linear target

with depth. They may lengthen the beaten zone of a two- to four-gun fire unit by having gunners set the sights differently on eachgun. The leader gives one gunner a setting 50 meters less than the range, the other 150 meters more other a setting 50 meters more than the estimated range. When four guns are used, one pair of gunners sets sights 150 meters less than the range, the other 150 meters more than the range. This technique sacrifices percision for speed, but may be necessary for fast-moving or fleeing targets. A sample fire command for the use of combined sights follows:

FIRE MISSION.
RIGHT FRONT.
TROOPS EXTENDING FROM CROSSROADS TO HOUSE.
1300 METERS (midrange).
COMBINED SIGHTS; NUMBER 1, 1,350 METERS;
  NUMBER 2, 1,250 METERS.
TRAVERSE.
RAPID.
FIRE (given after gunners announce UP).

i. Engagement of Area Target. This applies to a target that cannot be covered by either traversing fire, searching fire, or traversing and searching fire. Area target engagement requires that the leader mass fires from four to six guns. Examples of area targets include:

(1) Large troop or mechanized formations.

(2) Targets that must be suppressed, for which exact positions are unknown or which are not visible.

(3) Large kill zones or engagement areas for which predetermined fires have been planned.

j. Engagement of Target Using Massed Fires. Leaders can mass fires in both offensive and defensive operations, depending on the time available to plan and conduct the engagement.

(1) Defensive operations. There are two types of defensive operations.

- Defense, time not a factor. Massing fires into an EA (engagement area) has advantages over other types of area fire engagements. Onec TRPs are designatd, gunners may fire upon them to register or rehearse the MK 19s. After the target has been subdivided and TRPs registered, the gunners traverse, search up, traverse back, and search down through their assigned parts of

the target to assure full coverage of the target (Figure 6-20). The same method applies regardless of how many MK 19s are used. If four or six guns are used, the leader must subdivide the target and assign more TRPs than for a pair of MK 19s. An example of a fire command for this situation follows:

FIRE MISSION.
FRONT TRPs 1, 2, 3, 4
(MK 19s are laid on respective TRPs)
AREA: ENEMY COMPANY ENTERING EA GOLD.
(Range omitted, MK 19s on TRPs.)
TRAVERSE.
SEARCH UP 50 MILS.
RAPID.
AT MY COMMAND.
FIRE (given after the enemy is completely within the engagement area and the gunners announce UP).

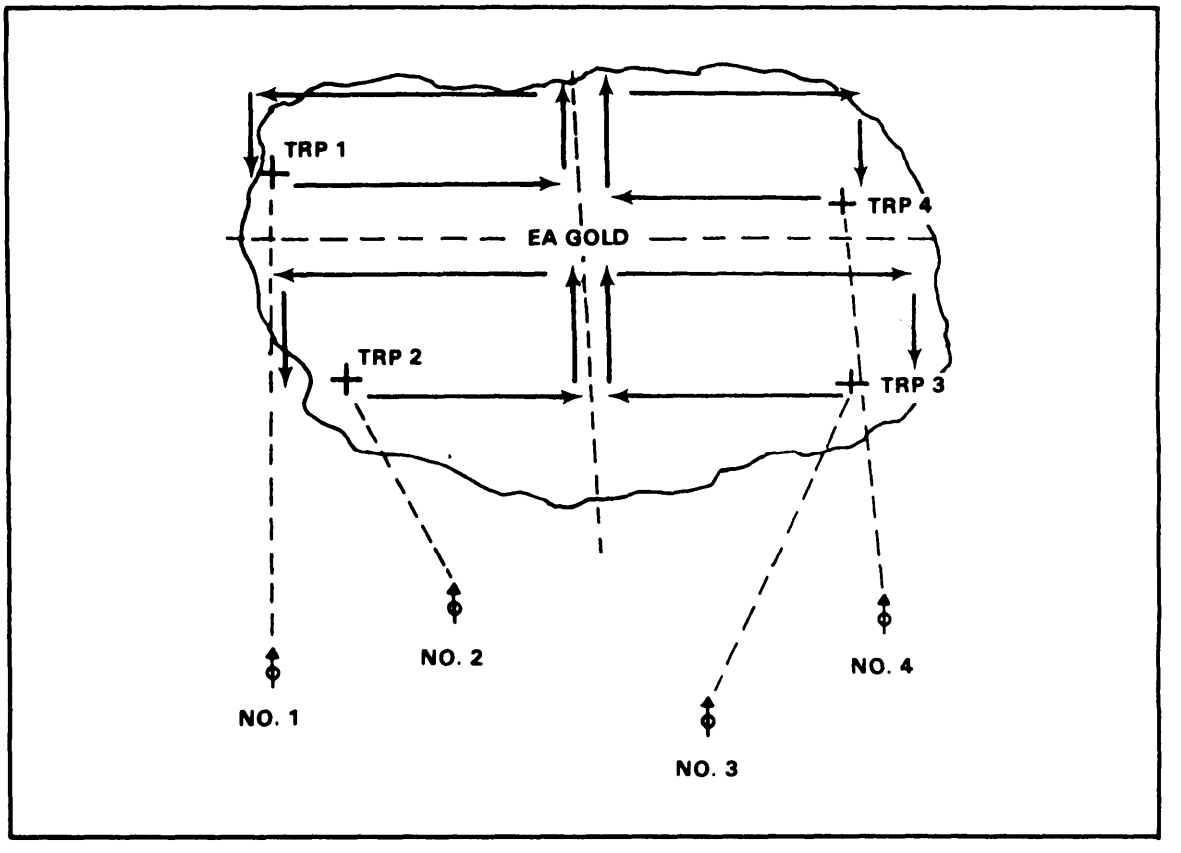


Figure 6-20. Use of massed fires, time not a factor.

o Defense, time a factor. Leaders may not have the luxury of registering their MK 19s on TRPs prior to

chance contacts due to time factors or the element of surprise. However, the lethal effect of massed MK 19 fire on an area target should not be overlooked. Units should develop and practice SOPs that enable them to engage large-area long targets on quick notice. For example, the leader may give each MK 19 a section or quadrant for all quick area engagements. He may assign the upper left side of the target to the Number 1 gun, the upper right to Number 2, and so on.

(2) Offensive operations. Massing fires into an area target can also be useful for offensive operations. During a movement to contact or an attack, time a factor, massed fires may be used to suppress a suspected or actual enemy position, allowing the unit to flank or bypass the enemy. Although fast target acquisition and volume of fire are primary goals, the leader should subdivide the target for control, and adjust fires for greatest effect. Massed fires are especially useful in support of an attack, time not a factor, which may require the use of overhead fire.

WARNING OVERHEAD FIRE SHOULD NOT BE USED UNLESS THE VERTICAL INTERVAL BETWEEN FRIENDLY SOLDIERS AND THE TARGET LINE IS GREAT ENOUGH TO ENSURE SAFETY.

6-13. DEFILADE POSITION

The MK 19 is most effective when laid directly on a target. Depending on the tactical situation, however, defilade could be the most desirable position.

a. Definition. A MK 19 is in defilade position when the gun and its crew are hidden, by a crest or mask, from enemy ground observation and small-arms fire (Figure 6-21). The position may be on the reverse slope of the mask, on the forward slope of the next high ground to the rear of the mask, or in a small fold in the ground. A defilade firing position does not necessarily reduce the effectiveness of fire against a stationary enemy target or preclude fire over the heads of friendly troops. Defilade may also be useful in providing predetermined fire into an EA.

b. Advantages. Some of the advantages of using defilade position are that the MK 19 and crew have cover and

concealment from direct fire guns; the crew has some freedom of movement near the MK 19 position; control and supply are facilitated; and /the characteristic smoke flash of the MK 19 are partially concealed from observation.

c. Disadvantages are that targets close to the mask usually cannot be engaged and, because adjustment of fire must be made through an observer, rapidly moving ground targets are not easily engaged.

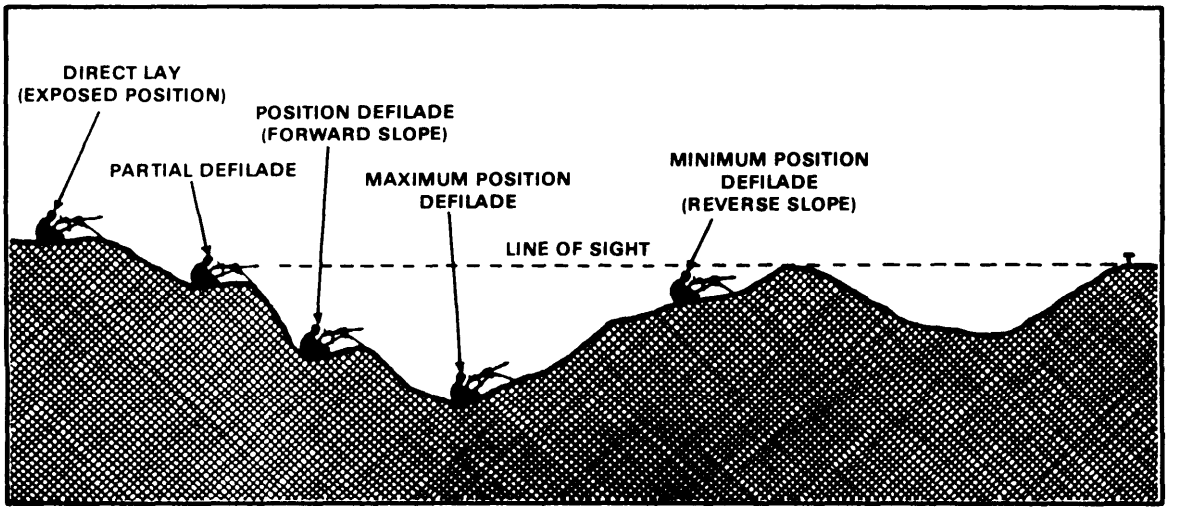


Figure 6-21 Defilade positions (and direct lay).

d. Options. A defilade position may be either on a forward or reverse slope.

(1) Reverse slope positions. These positions afford some protection from high-angle enemy fire and direct-fire cannon.

(a) Minimum defilade position. A MK 19 is in minimum defilade position when it is sited at the highest point on a slope on which it is defiladed. Minimum defilade position provides great flexibility in engagement of new targets, although it does not provide the best cover. A MK 19 crew positioned in minimum defilade may be grazed by enemy machine gun fire, but is concealed from enemy observation near the target area.

(b) Maximum defilade position. A MK 19 is in maximum defilade position when it is sited at the lowest point on a slope from which it can engage a target. A MK 19

crew positioned in maximum defilade has relatively good cover but lacks the flexibility to engage new targets.

(2) Forward slope position. A forward slope defilade position is not vulnerable to grazing fire from the target area, but it is open to attack or damage from mortar and artillery fire. A MK 19 is in partial defilade on a forward slope if the gun and gunner have some mask protection from direct fire, and if the gunner is able to engage the target using direct lay. Partial defilade is used only when a fire mission cannot be completed from defilade. A MK 19 may be held in defilade and moved into partial defilade to fire.

e. Considerations. There are four essential elements that must be considered when using the MK 19 in defilade position: direction, elevation, mask clearance, and adjustment of fire.

(1) Direction. There are four ways to lay the gun(s) for direction.

(a) Direct-alignment method. The observer selects a position on the gun-target line from which the target can be seen. The gunner lossens the traversing slide and, directed by the observer, moves the MK 19 right or left until it is aligned on the target.

(b) Aiming-point method. For and aiming point, the gunner selects a prominent landmark visible through the sights (Figure 6-22). An aiming point on the gun-target line and at an equal or greater range than the target is desirable; however, the gunner may use an aiming point on the mask.

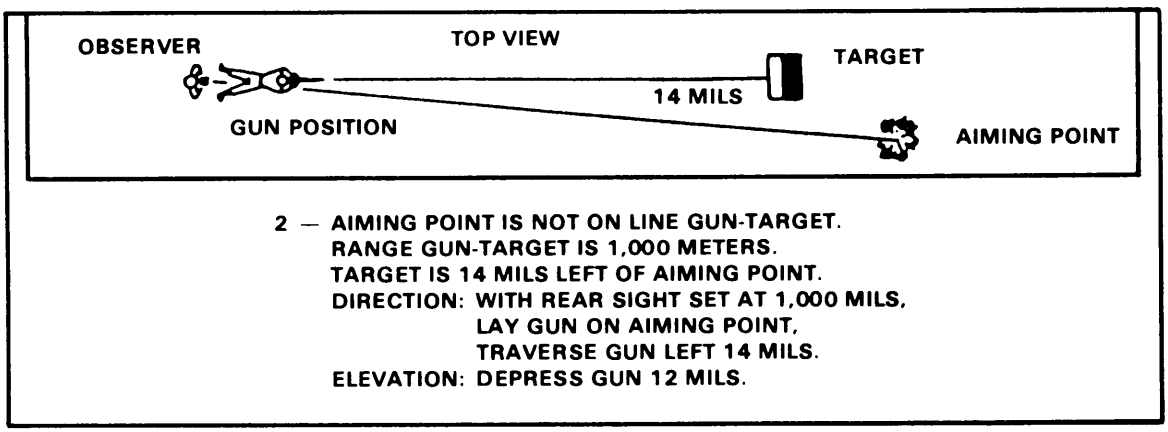


Figure 6-22. Aiming-point method.

- When the aiming point is on the gun-target line, the gunner lays the MK 19 on the aiming point, which aligns it on the target.

- When the aiming point is not on the gun-target line, the gunner measures the deflection with binoculars or compass, and adjusts the lay of the MK 19.

(c) Aiming-stake method. When no natural aiming point is available, the assistnt gunner sets out an aiming stake, and the gunner aligns the gun on the target.

(d) Map-and-compass method. The leader locates the MK 19 position and target on a map; draws a line between the two points; orients the map to the terrain; and places the line of sight on the compass along the gun-target line drawn on the map. The leader then announces the magnetic azimuth at the compass index to the gunner as the direction of lay (Figure 6-23). Using this method wiht terrain-profiling techniques permits the MK 19 to be used in various defilade positions.

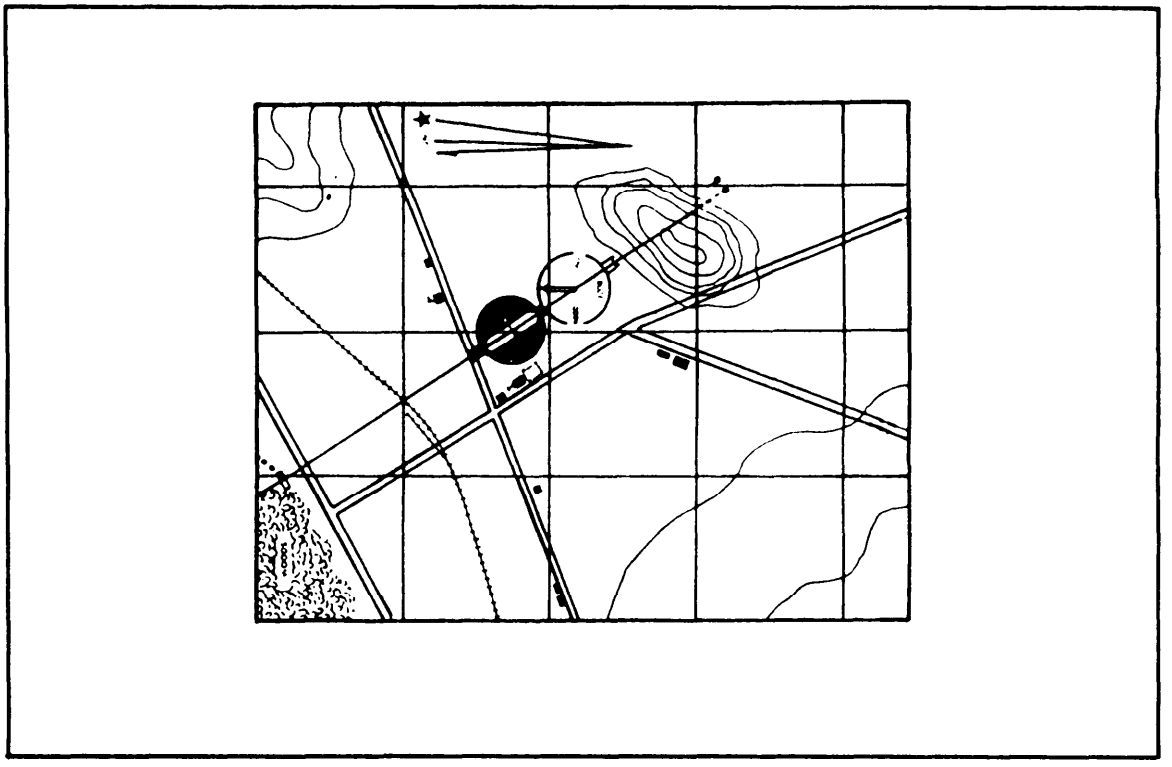


Figure 6-23. Map-and-compass method.

(2) Elevation. To lay the gun(s) for elevation when engaging targets from defilade, knowledge of the trajectories of 40-mm rounds and of indirect lay is necessary. The MK 19 mounted on the M3 tripod with the T&E mechanism is not is not equipped to deliver indirect fire in the traditional sense--like a mortar. Because the Mk 19 has a high-arc trajectory when in the direct-fire mode,it can be fired effectively from difilade if the gunner positions it properly with the help of a well-trained observer. Discussion of laying the MK 19 for elevation will include those techniques and procedures that do not require a lot of data and calculations.

The AE is the vertical angle between the bore line and the line of sight, when the gun and target are at the same elevation (1, Figure 6-24). The AE is always a positive (plus) and increases as the range increases. The AE for 40-mm ammunition, for each 100 meters of range up to 2,700 meters, is contained in Appendix E. For example, to hit a target at a range of 1,000 meters, the MK 19 must have an AE of +131.9 mils to the line of sight.

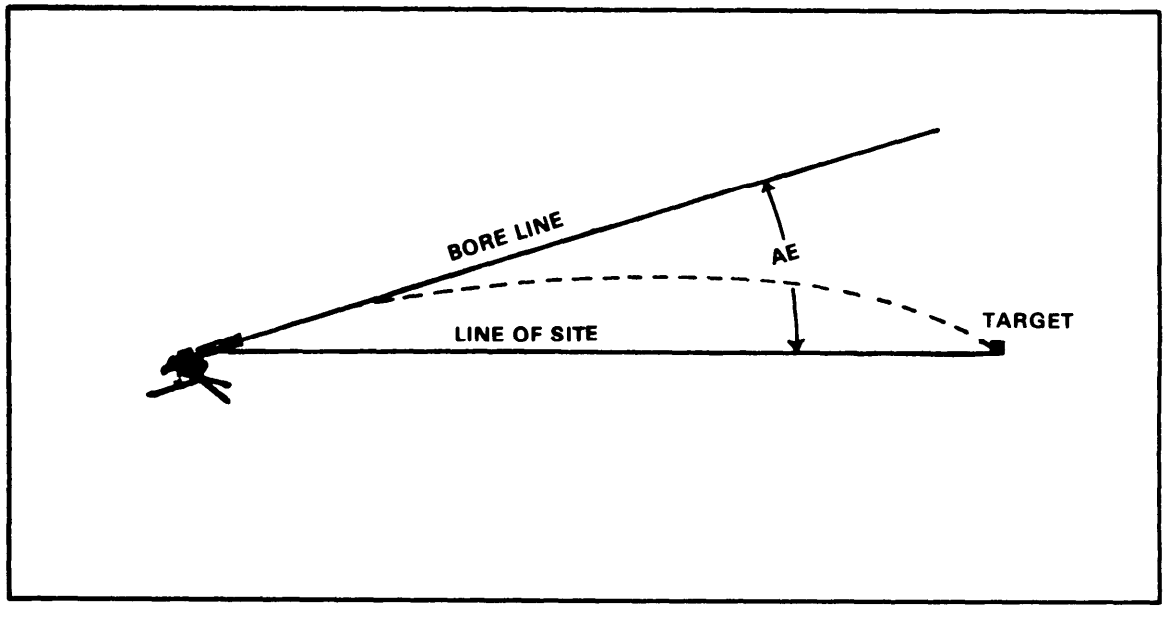


Figure 6-24. Angle of elevation.

When the MK 19 and target are not at the same elevation, an additional angle must be taken into consideration. The angle of sight is the vertical angle formed by the line of sight and a horizontal line from the base of the gun. When the target is at a higher elevation than the

gun, the AS is positive (plus) (Figure 6-25). When the target is lower than the gun, the AS is negative (minus).

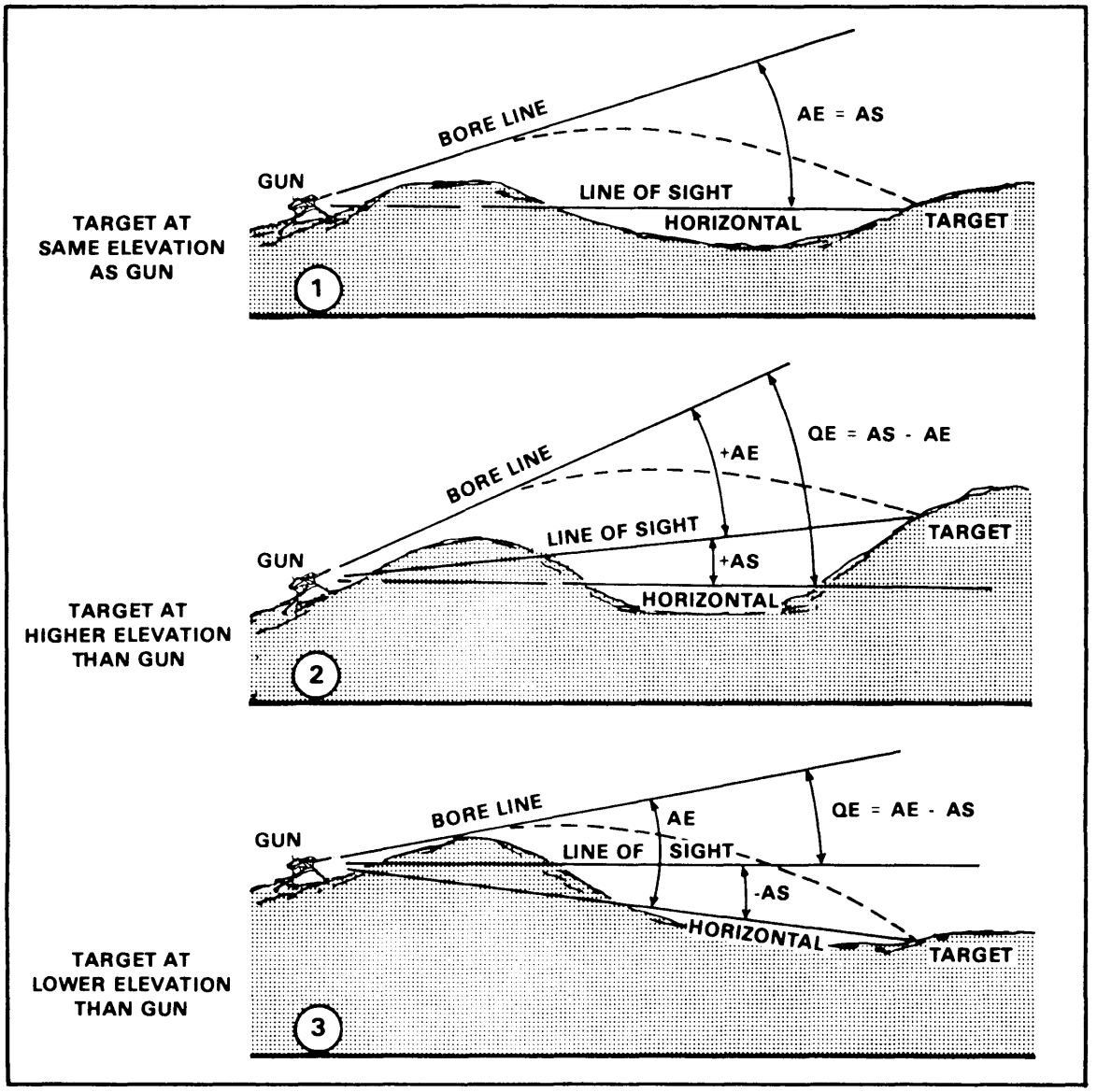


Figure 6-25. Angle of elevation, angle of sight, and quadrant elevation.

The angle quadrant elevation is formed between the bore line and the horizontal line through the base of the gun(Figure 6-25). The QE is positive (plus) whenever the gun is aimed above the horizontal, and negative (minus) whenever the gun is aimed below the horizontal. It is the algebraic sum of the angle of

elevation and the angle of sight; that is, if the angle of sight is positive, it is added to the angle of elevation; if the angle of sight is negative, it is subtracted from the angle of elevation.

QE = AE + AS (target above horizontal line)
QE = AE - AS (target below horizontal line)

(a) Computed quadrant elevation method. The leader must determine the correct range to the target. Using the range, the leader finds the corresponding AE from Appendix E. The leader must find the AS using binoculars, by measuring in mils the vertical interval between the target and the estimated horizontal. The leader may assume the distant horizon to be at a zero angle of sight, or at the same elevation as the MK 19 position. QE may be determined by algebraically adding this data as previously described.

(b) Measured quadrant elevation method. The gunner should locate the MK 19 in partial defilade and lay it on the target using direct-laying methods. The leader measure the QE with the M2 compass. The gunner moves the MK 19 into defilade position and places the measured QE on the gun. For each meter difference in elevation between the position in partial defilade and the firing position, the gunner adds 1 mils to the QE when firing at a range of 1,000; 1/2 mil when firing at 2,000 meters, and so on.

c)Aiming-point method. The gunner selects an aiming point visible from the MK 19 position-- preferably a point at a greater range than the target and at a higher elevation than the target-- and the leader finds the range to the target. Using binoculars, the leader measures the vertical angle in mils from the aiming point to the base of the target. The leader has the gunner lay the MK 19 on the aiming point, with the sight set to hit the target, and directs the gunner to manipulate the gun through the number of mils measured. For example (Figure 6-26), the range to the target is 1,000 meters. The angle read with the binoculars from the aiming point down to the base of the target is 12 mils. The sight should be set at 1,000 meters, the MK 19 laid on the aiming point, and the muzzle then depressed 12 mils.

(3) Mask clearance. After the gun(s) has been laid, the leader must determine whether or not the entire cone of fire will clear the mask, if mask clearance is not obvious. In order to ensure mask clearance, the leader

has the gunner sight on the crest of the mask and re-lay the MK 19 for elevation on the target. The gunner ensures that the difference in elevation from MK 19 to target and from MK 19 to mask is at least +10 mils. The gunner checks this by sighting along the bottom of th receiver and the barrel.

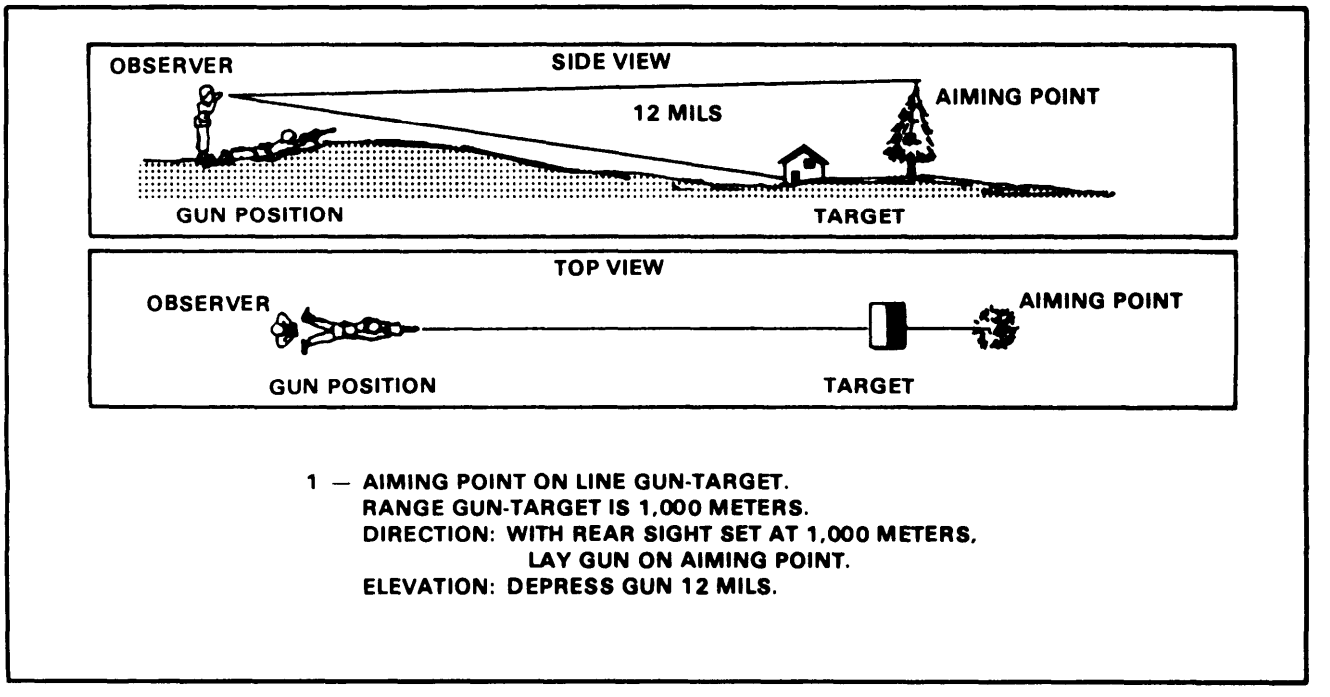


Figure 6-26. Aiming-point-method for elevation.

NOTE: The procedures already discussed will aid in the initial lay of the gun. The best tactical application of fire from the defilade position is defense, time not a factor, especially in a reverse slope defense. Leaders should try to register their MK 19s on selected TRPs, as previously discussed. Trial and error should be used to adjust for accurate fire from the defilade position. While the MK 19s are being registered, every precaution must be taken to guarantee troop safety.

(4) Adjustment of fire. Under field conditions, a MK 19 quickly laid on the target will seldom result in an initial impact directly on the target. Rapid adjustment of fire is essential. This is assured by thoroughly training the observer to estimatre range and lateral distance, and translate them into mils. The observer should be in a position to see the initial impact. To ensure this, the burst (three to five rounds) should be

long. Except for long ranges, or when for other reasons visual observation is hard, the observer does not ordinarily use binoculars for the initial burst. If the initial lay is incorrect, the binocular's limited field of view may cause the observer to miss the impact of the round. Adjustment of fire should be bold and aggressive. The observer should command large corrections and avoid creeping fire toward the target. When a burst is incorrect for deflection and elevation, the observer's next command should correct both.

f. Construction of a Terrain Profile. The leader may use a side view or cross section of the ground along a selected line or direction to determine where friendly and enemy forces can see each other. The leader can also use it to plan fires; that is, to locate dead space, to plan a defilade position, and so on. To construct a terrain profile, locate the gun position on the map and determine the direction of fire, or profile line (Figure 6-27).

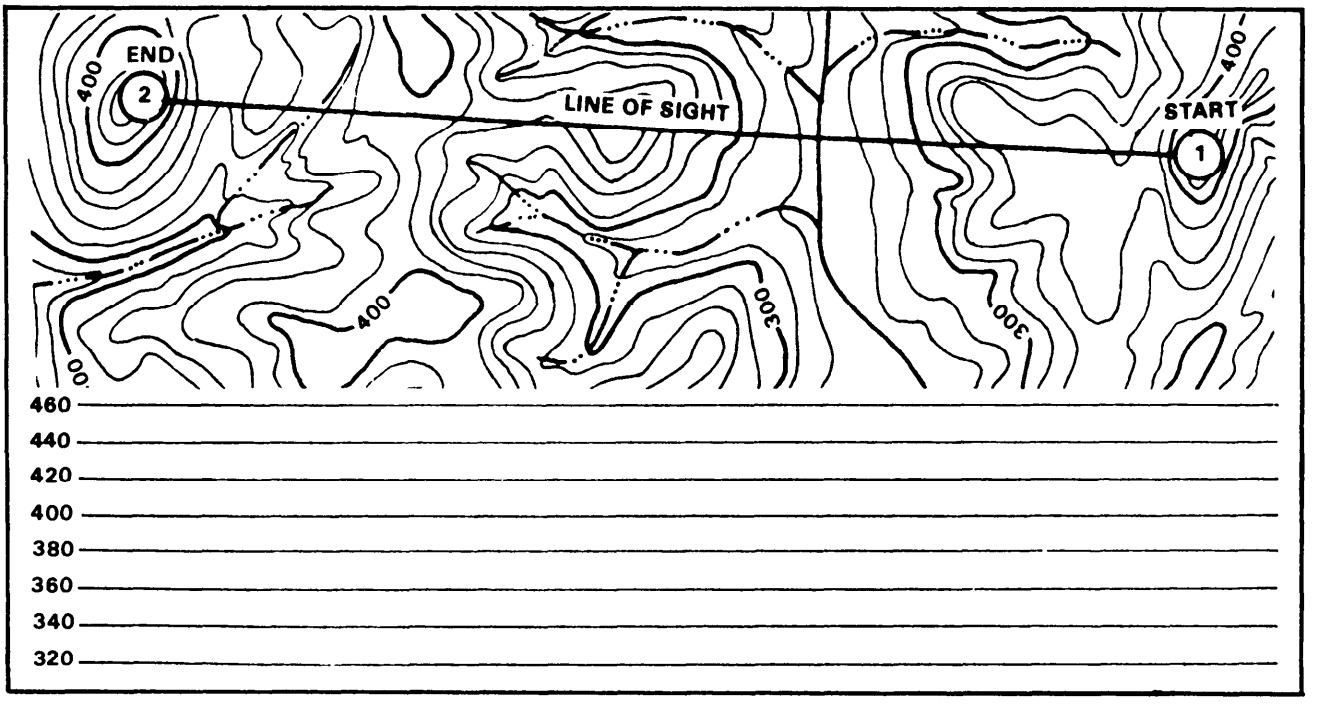


Figure 6-27. Profile line (map contour elevation 10 feet).

(1) Place the edge of a lined piece of paper along the profile line. Tick-mark all points of known elevation on the edge of the paper. These points are the contour lines. Any paper with evenly spaced horizontal lines, such as graph or notebook paper, may be used. The wider

the spacing of the lines, the graeater the vertical exaggeration in the profile; however this does not affect the information.

(2) Draw perpendiculars down across the horizontal lines for each marked point, and identify the high and low points along the profile (Figure 6-28).

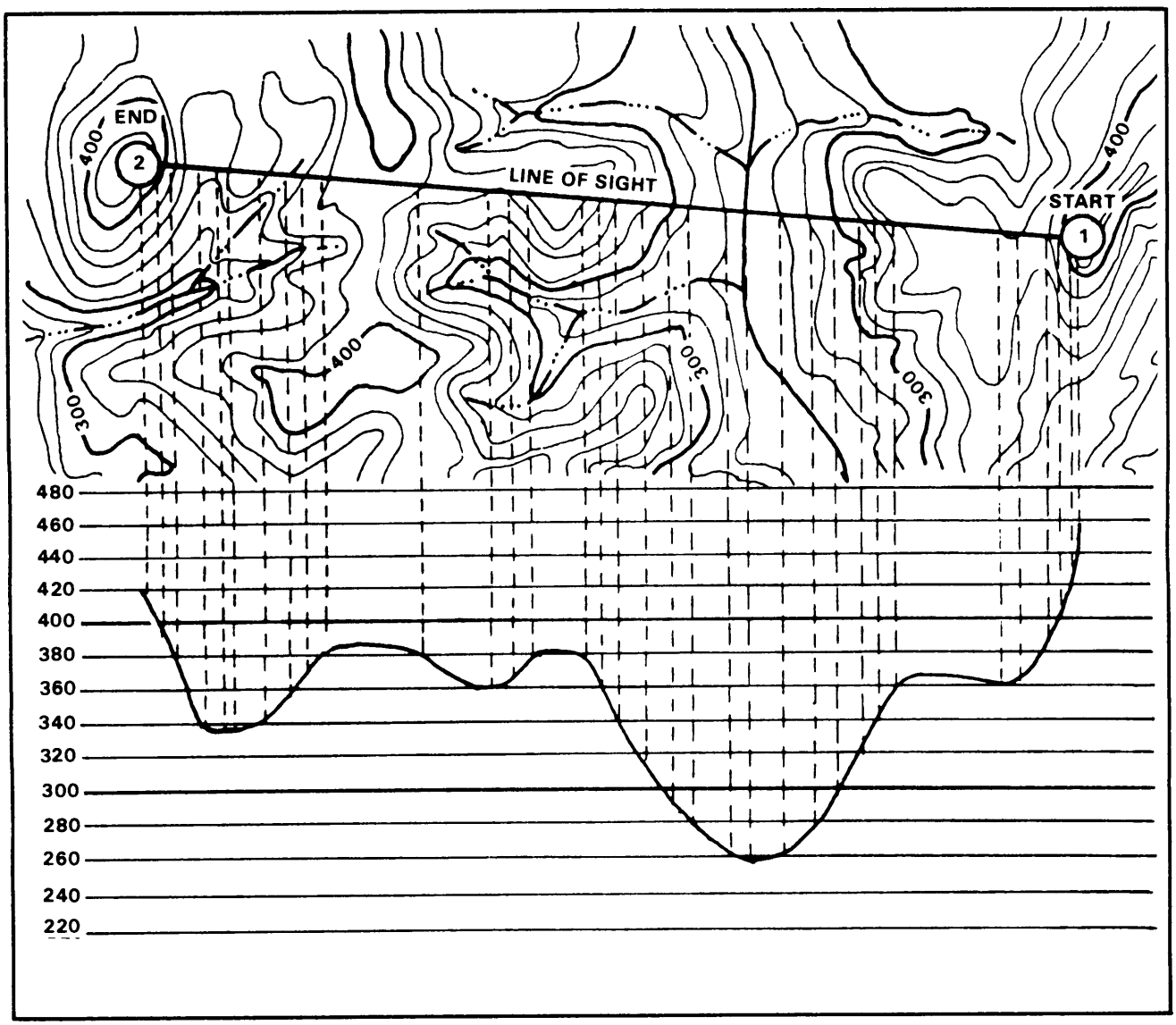


Figure 6-28. Marking of elevation.

(3) Connect all the points with a smooth curve (Figure 6-29).

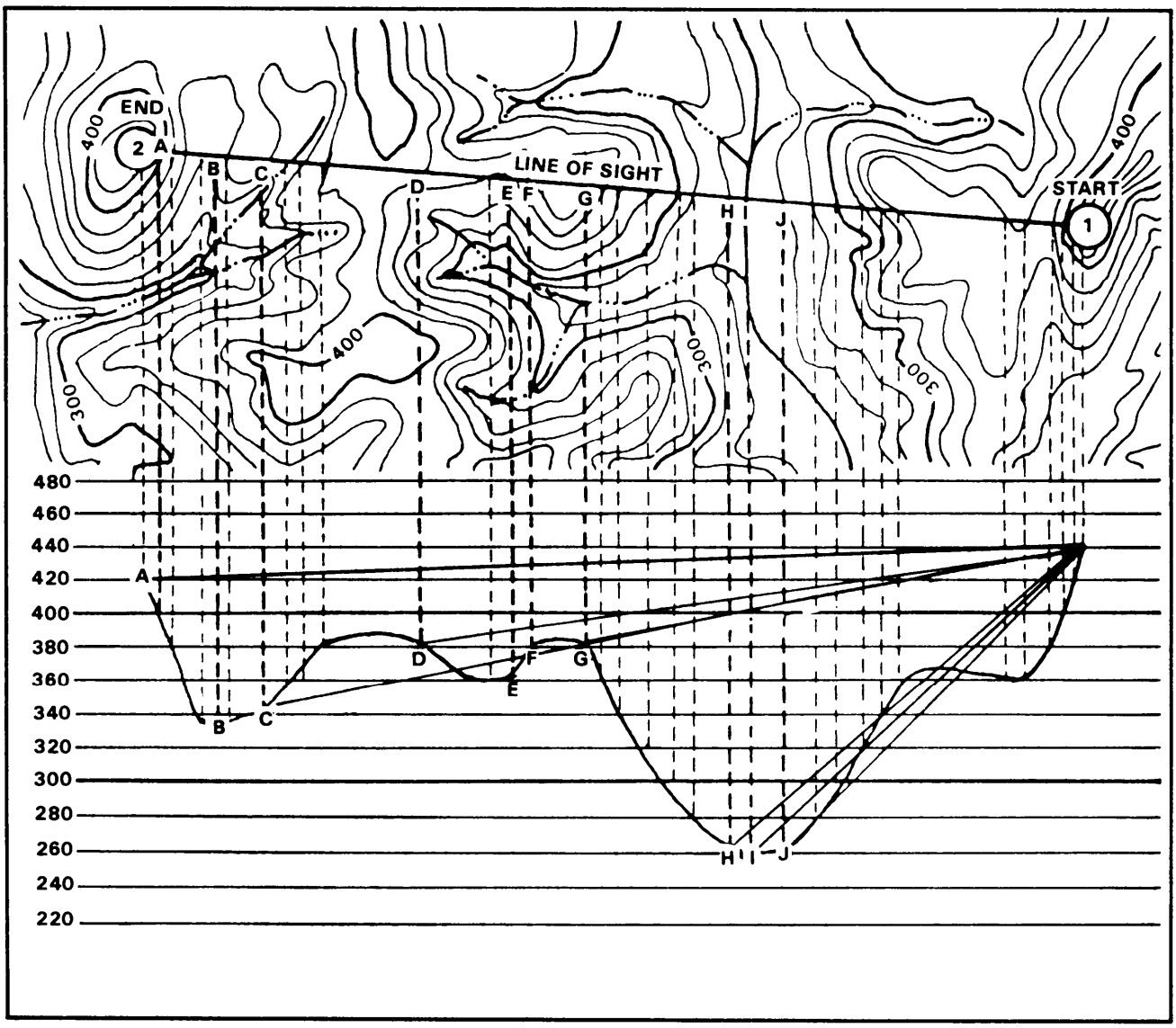


Figure 6-29. Terrain profile.

Section IV. DEGRADED CONDITIONS

The MK 19 is fired the same way under degraded conditions as it is fired under good conditions, except that degraded conditions limit the gunner's ability to observe the impact of rounds in relation to the target and to make adjustments.

6-14. NIGHT FIRING

The use of range cards and predetermined fires are important at night or during degraded conditions because the targets or engagement areas are chosen and marked in advance, which

enables the gunner to adjust onto targets quickly and easily ly. The gunner must know how to read his traversing slide bar and T&E mechanism. This task can be difficult at night or during degraded conditions. The gunner can mark targets on the slide bar with luminous tape, use mini-chemical lights, or use flashlights with red lens covers.

a. Firing with the use of illumination has proven to be much the same as firing during normal daylight conditions. Estimation of distances and adjustment of rounds are difficult at night or during degraded conditions. Gunners should be able, using illumination, to effectively engage targets out to 800 meters. Past this range, the elevation of daylight. Past this distance, visibliity is poor even with illumination, due to long shadows and dispersion of light.

b. The AN/TVS-5 can be mounted on the MK 19 and used effectively to spot and adjust rounds to target out to ranges of 800 meters. Past this range, the elevation of the scope on the gun is too high to see the impact of the rounds, so it can be hand-held by an observer who calls out adjustments to fire.

6-15. NBC FIRING

Firing the MK 19 during NBC conditions is no different than firing in normal conditions. Wearing the protective mask during firing does not change the way the gunner sights and aims the MK 19 to engage targets. The assistant gunner should take care to avoid catching his clothes or gloves while feeding ammunition. The gunner should also avoid contact with the hot barrel.

6-16. FIRING IN FOG OR SMOKE

Neither the degraded conditions of fog or smoke changes the way the gunner fires the MK 19. The only limitations are observation of rounds and adjustment onto targets. The use of predetermined fires, trip flares, PEWS, or forward observers can cut down on these limitations.

Section V. PREDETERMINED FIRES

Predetermined fires are fires planned to cover target areas such as enemy avenues of approach, likely sites for enemy guns, and probable enemy assault routes. Laying the MK 19 on predetermined targets by either of the following methods may be verified by firing the MK 19 and adjusting it on target.

6-17. T&E-MECHANISM METHOD OF LAYING THE MK 19

When the MK 19 is laid on target in the primary sector, the direction and elevation is taken from the traversing bar and the T&E mechanism. Both direction and elevation, as well as the range to each target, are recorded on the range card. Each target in the sector of fire must be numbered and laid on in sequence.

6-18. FIELD-EXPEDIENT METHOD OF LAYING THE MK 19

Another method for laying on predetermined targets is to use field expedients (Figure 6-30). Field expedients must be used in the secondary sector, ans consist of aiming and base stakes. They can be used in the primary sector to aid the gunner.

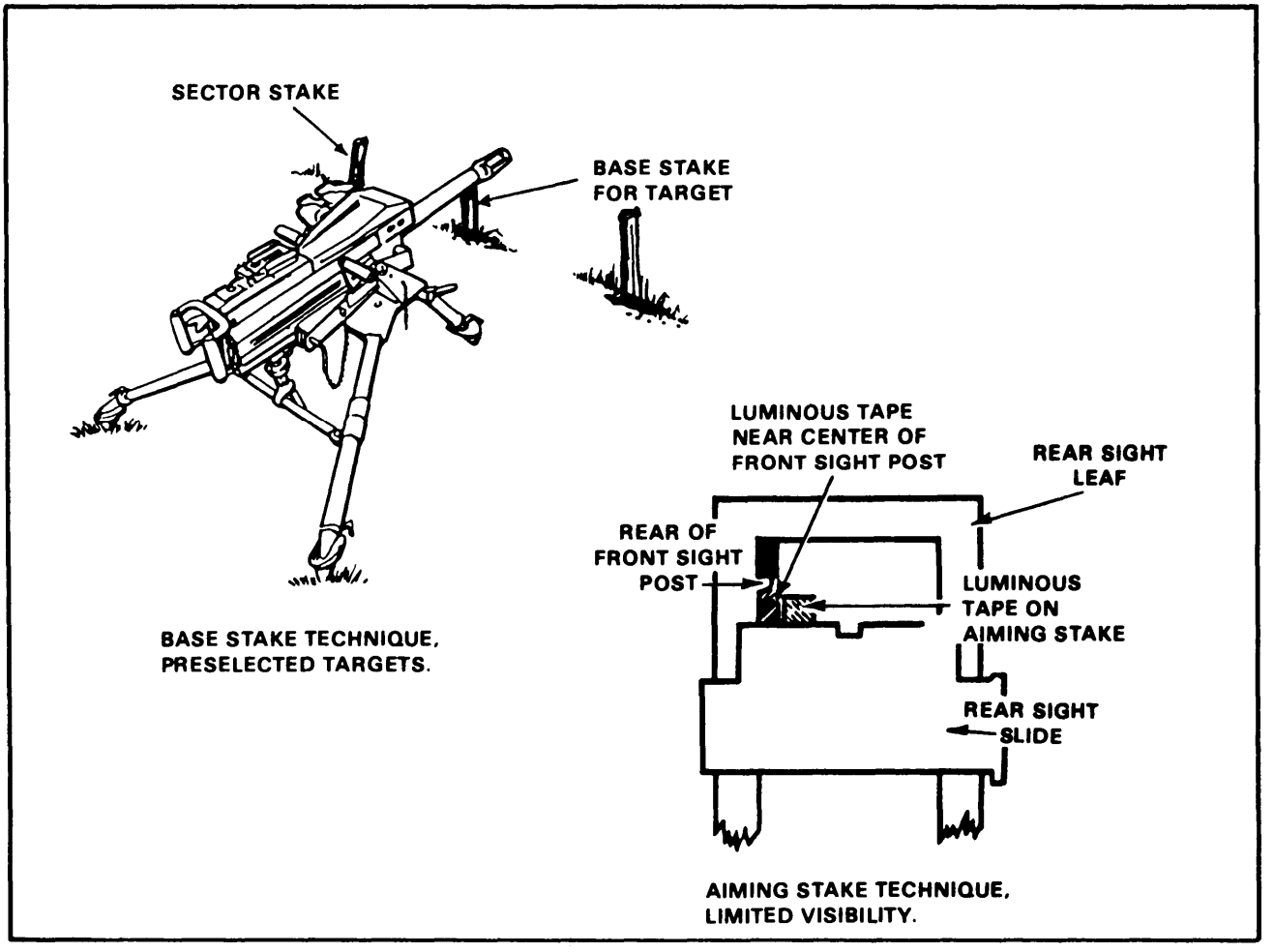


Figure 6-30. Techniques for laying the MK 19 using field-expedient method.

CHAPTER 7
INFORMATION FOR INSTRUCTORS

This chapter provides information to aid instructors in training MK 19 crews to become skilled teams.

7-1. PREPARATION

To present instruction in the time allotted, the instructor must be prepared and rehearsed. Assistant instructors and demonstrators must also be trained and rehearsed so that they can conduct demonstrations using training aids that clearly illustrate the information. Use public address sets if the group is larger than a platoon.

a. Orgainization. Divide the soldiers into groups of appropriate size, considering the phase of instruction and the facilities available. If enough assistant instructors are available, assign one to each crew. Otherwise, position the assistant instructors so that they can closely supervise the crew.

b. Presentation. Explain and demonstrate each portion of the instruction, following with closely supervised practical work. Emphasize practice throughout training in order to develop skill and teamwork. Secure and critique all MK 19 firing during training.

c. Examination. Ensure that soldires make good progress throughout each period of instruction. Those who do not progress well must receive more instruction under close supervision. Give a formal or informal participation-type examination following each phase of instruction to measure effectiveness of instruction.

7-2. MECHANICAL TRAINING

During this phase of training, the gun is mounted on the M3 mount, or installed on a table. Nomenclature charts (or mats) help the crew members learn the names of parts. If possible, assign one assistnat instructor for each crew. Present a brief history of the gun. Stress its combat role and assigned mission. Emphasize the purpose, scope, and importance of the instruction to be presented. Be sure to clearly define the term stoppage during the introduction, and emphasize the need for correct care and cleaning procedures.

a. Orgainization. Organize the class.

b. Presentation. The following table can be used as a guide in presenting instruction in stoppages and immediate action. Stress precision in detecting the cause and reducing stoppages. As the soldiers progress, concentrate on speed in applying immediate action and other methods of reducing a a stoppage. Train the crew to function as a team.

STOPPAGES	INSTRUCTION PREPARATION
Misfire due to defective primer.	Place a dummy cartridge in the belt.
Short round.	Place a short round in the belt.
Bulged round.	Insert a bulged round the belt.
Belt improperly loaded.	Pull a cartridge partially out of the belt.
Battered or thick-rimmed cartridge.	Place a battered or thick-rimmed cartridge in the belt.
Failure to remove a round from the chamber.	Place a dummy cartridge, with the rim filed off, in the chamber.
Separated case which is removed from the chamber by the new round when the bolt is pulled to the rear.	Drive the front portion of a cartridge securely on a dummy cartridge. Pull the bolt to the rear and place the cartridge properly on the face of the bolt. Ease the bolt forward.

Table 7-1. Preparation for instructing stoppages and immediate action.

7-3. CREW DRILLS

The demonstration crew must be well-trained and equipment must be complete. Issue equipment for each crew: use basic TOE equipment and disstinctive helmet liners that identify each crew member according to his duties, and normal individual equipment.

a. Organization. Present initial instruction and demonstration to one crew. For practical work, divide the class into crews of four men per MK 19. To aid in control and supervision, mark off equipment with engineer tape or wire, and line up the crew members behind their equipment.

b. Presentation. Stess the facts that the crew drill is the first step in developing teamwork, and that precision is required of every member for the crew to function smoothly. During initial practice periods, work on precision; talk each soldier through his duties as a crew member. Require the soldiers to do each operation when directed, and precisely as directed. Once they can, work on speed.

c. Advanced Training. In advance training, use a speed drill to create interest and stimulate competition. This also furthers teamwork and test individual crew performance. A well-trained crew should be able to place the gun into action, or take it out of action, in 25 seconds without error.

7-4. MARKSMANSHIP

The instructor will arrange for a demonstration crew, with gun and mount, to be available; he will have a sighting bar, an illustration of a correct sight picture, a sighting target (panel with holder), a stopwatch, control flags, cleaning rods, and patches.

a. Organization.

(1) Organize each crew with four members, if possible.

(2) Use a centralized area, preferably with bleachers, for conferences and demonstrations. The area should be fairly level, and large enough for the guns to be placed 10 meters from the targets.

b. Presentation.

(1) Make sure that the soldiers know that the marksmanship basics must be learned and practiced during the preparatory phase of marksmanship training, in order for the soldiers to be able to fire the marksmanship course satisfactorily.

(2) With the help of coaches and assistant instructors, ensure that steps are done correctly during the preparatory phase of marksmanship.

(3) Give a brief description of the operation, general data, and exterior nomenclature of the MK 19.

(4) Assistant instructors should disassemble and assemble the MK 19 as the instructor explains the procedure.

(5) Assistant instructors should disassemble and assemble the MK 19 as the instructor explains the procedure.

NOTE: When the crews can skillfully disassemble and assemble the gun, demonstrate this phase of instruction to them blindfolded, using an assistant. Doing this encourages crews to practice during their free time, and develops individual skill and initiative.

Stress that this is not done against time, because of the danger of damaging parts of the gun.

c. Operation. Each crew requires an MK 19 mounted on an M3 mount and a belt of five dummy rounds.

(1) Explain and demonstrate the proper method of loading, unloading, and clearing the MK 19. Stress the safety factors involved.

(2) Point out how the feed throat must be attached before loading the MK 19.

(3) Demonstrate the method of letting the bolt go forward.

d. Functioning. Training aids are useful if the class is platoon-sized; otherwise, training aids may be used for study and discussion during breaks. Use one gun per crew, as in previous mechanical training instruction.

(1) Divide functioning into six phases (Chapter 2).

(2) Explain and demonstrate each phase of functioning. Assistant instructors should duplicate each demonstration on the guns within each crew. With these setups at the guns, each crew member can see how the parts work. Setups may be used for each phase of functioning.

APPENDIX A
HISTORY OF THE MK 19

Although the MK 19 is a recent entry into the Army guns inventory, development began in 1963. The first version was a hand-cranked multiple grenade launcher called the MK 18. In 1966, the need for more fire power inspired the development of a self-powered 40-mm machine gun called the MK 19 MOD 0. This model was neither reliable enough nor safe enough for use as a military gun. Product improvemts begun in 1971 resulted in the 1972 MOD 1, of which only six were produced. The MOD 1 performed effectively in Navy riverine patrol craft, and broader applications for the MK 19 were found. In 1973, the Navy developed the MOD 2, which featured improved reliability, safety and maintainability. In 1976, a complete redesign resulted in the MK 19 MOD 3, which the Army adopted in 1983. The Army will use the MK 19 within the tactical environment for defense, retrograde, patrolling, rear area security, MOUT, and special operations.

APPENDIX B
GUNNERY TESTS

There are three gunnery tests: a diagnostic gunnery test, an intermediate gunnery test, and a gunnery skills test. The instructor is responsible for the conduct of all tests, and must ensure that sufficient scorecards or answer sheets are available.

B-1. DIAGNOSTIC GUNNERY TEST

This test is given before and during preparatory training. It is a written test that evaluates the trainees' knowledge of the MK 19 as well as the instruction given. Training units prescribe procedures for the test, and announce scores of those who satisfactorily complete the test. If this test is used, it should be given before range firing. It has a possible score of 100 points. To satisfactorily complete the test, 80 points are required.

		POINTS
1.	Name the five major assemblies of the MK 19.	5
2.	Explain how to clear and disassemble the MK 19.	15
3.	Explain how to assemble the MK 19.	15
4.	Explain how to perform a function check.	5
5.	Explain how to apply immediate action to a runaway gun.	5
6.	Explain how to apply immediate action when a malfunction occurs.	10
7.	Explain one phase of functioning (directed by the examining officer).	10
8.	Explain why the weapon should not be fired with the top cover assembly open.	10
9.	Explain how to inspect ammunition before loading (belt to have at least one each of the following: short round, bent round, loose bullet, broken link or round not pushed fully into its link).	10
10.	Explain how to load to half-load position.	5
11.	Explain and demonstrate sight alignment.	10
		100

B-2. INTERMEDIATE GUNNERY TEST

This a written test given at the end of preparatory marksmanship training. It is used to evaluate the instruction as well as the soldier's gunnery skills. This test has 21 questions--20 multiple-choice and 1 true or false. Each soldier must correctly answer 17 of the 21 in

order to move on to the next phase of training. The instructor is responsible for the conduct of the test.

1. What are the five major groups (field strip) of the MK 19?

a. Receiver assembly, top cover assembly, sear assembly, bolt assembly, and feed slide assembly.
b. Top cover assembly, receiver assembly, barrel, sear assembly and feed tray, and bolt and backplate assembly.
c. Receiver assembly, feed slide assembly and feed tray, top cover assembly, sear assembly, and bolt and backplate assembly.
d. Sear assembly with chargers, receiver assembly, feed tray assembly, top cover assembly, bolt and backplate assembly.

2. Where is the weapon safety located?

a. On the right side of the receiver assembly.
b. On the left side of the receiver assembly.
c. On top of the receiver assembly.
d. On the sear assembly at the bottom rear of the receiver assembly.

3. In a nonfiring situation to clear the weapon, in which order are the steps below taken?

a. 2, 4, 3, 1.
b. 1, 3, 4, 2.
c. 3, 1, 2, 4.
d. 1, 2, 4, 3.

1. Ensure that the safety switch is in the SAFE position, and the bolt is forward; open the top cover by rotating the top cover latch counter-clockwise. Lift the cover.
2. Return the bolt to the full forward position and rotate the charger handles upward.
3. Inspect the feed tray and extractors on the top of the bolt to ensure that a round is not in the “pickup” position.
4. Unlock and pull the charging handles to the rear two to three inches. Inspect the face of the bolt and the chamber.

4. In which substance(s) should the bolt and backplate assembly never be immersed?

a. Cleaning solvent.
b. Lubricant.
c. Bore cleaner.
d. All of the above.

5. Under which conditions should a generous second coat of lubricant be used when cleaning the weapon?

a. Hot, wet, salt air, sea spray.
b. Hot, dry, sandy, dusty.
c. Cold, icy, snow.
d. All of the above.

6. Under which conditions should a second coat of lubricant not be used?

a. Hot, wet, salt air, sea spray.
b. Hot, dry, sandy, dusty.
c. Cold, icy, snow.
d. All of the above.

7. During reassembly, what is the first major group to be placed back on the weapon?

a. Sear assembly.
b. Bolt and backplate assembly.
c. Top cover assembly.
d. Receiver assembly.

8. When closing the top cover, in what position must the feed slide assembly be; and in what position must the bolt be to ensure proper alignment of th primary and secondary drive levers?

a. Left; to the rear.
b. Right; to the rear.
c. Left; forward.
d. Right; forward.

9. What is the maximum range of the weapon, in meters?

a. 1,500.
b. 2,212.
c. 2,000.
d. 1,800.

10. What is the maximum effective range of the weapon, in meters, for point targets?

a. 1,500.
b. 2,212.
c. 2,000.
d. 1,800.

11. What is the cyclic rate of fire for the weapon, in rounds, each minute?

a. 225 to 275.
b. 275 to 325.
c. 325 to 375.
d. 375 to 425.

12. What is the main characteristic(s) of the MK 19?

a. Fully automatic.
b. Blowback operated.
c. Air-cooled.
d. All of the above.

13. Which mount(s) should the weapon not be attached to?

a. M3 tripod without the T&E mechanism.
b. M3 tripod with the T&E mechanism.
c. M4 pedestal.
d. All of the above.

14. How much armor plating, in inches, is the weapon capable of penetrating, whenfiring ammunition at zero degrees obliquity?

a. 1.
b. 2.
c. 3.
d. 4.

15. Within how many meters must the 40-mm HE round impact to cause casualties to exposed enemy personnel?

a. 5.
b. 10.
c. 15.
d. 20.

16. To stop a runaway weapon, what step(s) must be taken?

a. Release the trigger and step away from the weapon.
b. Grab and twist the ammunition belt to break it off.
c. Unlock and lower one charging handle while keeping control of the weapon.
d. None of the above.

17. When loading the weapon, place the female link end of the ammunition belt through the feed throat and draw the ammunition into the weapon feed area.

a. True.
b. False.

18. What is the term used to describe an interruption in the functioning cycle when it is caused by faulty action of the gun or faulty ammunition?

a. Blockage.
b. Breakage.
c. Malfunction.
d. Remedial action.

19. To perform corrective action, what step(s) must be taken?

a. Unload and clear the weapon.
b. Inspect the weapon and ammunition to find the cause of the problem.
c. Correct the problem, reload, and try to fire the weapon.
d. All of the above.

20. How many rounds should per burst should the gunner fire when engaging targets?

a. 3 to 5.
b. 5 to 8.
c. 7 to 10.
d. 9 to 12.

21. In which position(s) must both charger handles be for the weapon to fire?

a. Forward and down.
b. Forward and up.
c. To the rear and down.
d. None of the above.

B-3. GUNNERY SKILLS TEST

This is a test guide for unit commanders to standardize and maintain MK 19 gunnery skills. It is a nonfiring hands-on test given at the end of MK 19 training. It may be held indoors if facilities are available. Seven stations are used for the skill tests. The test is graded on a GO or NO-GO basis.

a. Instructions for the Gunner's Examination. The following is a guide for giving gunners the skill test.

(1) To organize for testing, assemble the entire unit in one area and orient them as follows:

DURING THE NEXT ____ HOURS YOU WILL TAKE PART IN A PERFORMANCE-TYPE EXAMINATION TO TEST YOUR KNOWLEDGE OF THE MK 19 MACHINE GUN. STAY WITH YOUR ASSIGNED GROUP DURING THE ENTIRE EXAMINATION. INITIALLY, EACH GROUP WILL BE ASSIGNED TO A SPECIFIC STATION. AT EACH STATION, AN ASSISTANT INSTRUCTOR WILL EXPLAIN EXACTLY WHAT TASK OR TASKS YOU ARE TO PERFORM. AFTER BEGINNING THE TASK, IF YOU DO NOT KNOW A STEP OR STEPS, ASK THE ASSISTANT INSTRUCTOR FOR HELP. HE WILL TELL YOU HOW TO PERFORM THE STEP, DEDUCT THE NECESSARY POINTS FROM YOUR GRADE, AND YOU MAY CONTINUE TO WORK. SEVENTY PERCENT IS THE PASSING SCORE.

(2) Organize the unit into seven equal groups that rotate from station to station until all individuals have been tested. Helmet and LBE will be worn for this test. Assign enough assistant instructors to each station to grade and critique each gunner’s performance. For ease in marking, give score sheets to each grader and collect the sheets immediately after the test.

(3) At the end of testing for each group, have each grader assemble the soldiers he graded and give them a thorough critique (five minutes).

b. Testing Stations. There are seven stations for gunnery skills testing. All stations except one, six, and seven have intermediate training objectives.

c. Scoring. For tasks at stations one, six, and seven score the soldier GO if all steps are passed (p). Score the soldier NO-GO if any steps are failed (f). If the soldier fails any steps, show what was done wrong and how to do it correctly. For stations two through five, score the soldier GO on a task if he receives no more than one intermediate training objective NO-GO.

STATION ONE

TASK: Identify the characteristics of the MK 19.

CONDITIONS: In any environment, the gunner is given a complete tripod-mounted MK 19.

STANDARDS: The gunner will know characteristics of the MK 19.

PERFORMANCE MEASURES:

		GO	NO-GO
1.	General description (nomenclature) .		
2.	Weapons sight.		
3.	Weight of gun.		
4.	Maximum effective range for a point target.		
5.	Maximum effective range for an area target.		
6.	Cyclic rate of fire.		
7.	Muzzle velocity.		
8.	Types of ammunition.		
9.	Weight of the MK 64 MOD 7 gun mount.		
10.	Types of mounts.		

STATION TWO

Station Two has seven intermediate training objectives.

TASK: Perform operator's maintenance on the MK 19.

CONDITIONS: In any environment, given a complete MK 19, cleaning equipment, tools, work space, and TM 9-1010-230-10.

STANDARDS: The gunner will disassemble the MK 19 within four minutes. The gunner will use the cleaning materials as required in the operator's TM to clean the MK 19. The gunner will inspect, lubricate, and assemble the MK 19 within four minutes, and perform a function check.

Intermediate Training Objective 1: Disassemble the MK 19.

CONDITIONS: Given a location in which to work, an assembled MK 19, weapon-cleaning equipment, lubricant, and TM 9-1010-230-10.

STANDARDS: The gunner will disassemble the MK 19 within four minutes.

PERFORMANCE MEASURES:

		NO-GO
1.	Clear the gun.	
2.	Remove the bolt and backplate assembly.	
3.	Remove the secondary drive lever.	
4.	Remove the feed slide assembly.	
5.	Remove the top cover assembly.	
6.	Remove the feed tray.	
7.	Remove the primary drive lever and vertical cam.	
8.	Remove the alignment guide assembly.	
9.	Remove the ogive plunger.	
10.	Remove the round-positioning block.	
11.	Remove the charger assemblies (LH, RH).	

PERFORMANCE MEASURES:

GO	NO-GO

12. Remove the sear assembly.

13. Complete within four minutes.

Intermediate Training Objective 2: Clean the MK 19

CONDITIONS: Given a disassembled MK 19, with the proper cleaning equipment.

STANDARDS: The gunner will clean the MK 19.

PERFORMANCE MEASURES:

GO	NO-GO

1. Receiver assembly:
   a. Wipe or brush away dirt from all parts, especially the interior of the receiver housing, receiver rails, and feeder area.
   b. Use a rag to apply the cleaning solvent.
   c. Swab out the bore and chamber using a bore brush and RBC.
   d. Wipe dry.

2. Sear assembly:
   a. Wipe or brush away dirt.
   b. Use a rag to apply the cleaning solvent.
   c. Wipe dry.

3. Alignment guide assembly:
   a. Wipe or brush away dirt.
   b. Soak assembly in cleaning solvent.
   c. Wipe dry.

4. Ogive plunger assembly:
   a. Wipe or brush away dirt.
   b. Use a rag apply the cleaning solvent.
   c. Wipe dry.

PERFORMANCE MEASURES:

GO	NO-GO

5. Round-positioning block:

   a. Wipe or brush away dirt.
   b. Soak in cleaning solvent.

6. Charger assemblies:

   a. Wipe or brush away dirt.
   b. Use a rag to apply cleaning solvent.
   c. Wipe dry.

7. Vertical cam assembly:

   a. Wipe or brush away dirt.
   b. Soak in cleaning solvent.
   c. Wipe dry.

8. Primary drive lever:

   a. Wipe or brush away dirt.
   b. Soak in cleaning solvent.
   c. Wipe dry.

9. Secondary drive lever:

   a. Wipe or brush away dirt.
   b. Soak in cleaning solvent.
   c. Wipe dry.

10. Feed slide assembly:

   a. Wipe or brush away dirt.
   b. Use a rag to apply the cleaning solvent.
   c. Wipe dry.

11. Feed tray:

   a. Wipe or brush away dirt.
   b. Soak in cleaning solvent.
   c. Wipe dry.

PERFORMANCE MEASURES:

GO	NO-GO

12. Top cover assembly:

    a. Wipe or brush away dirt.
    b. Use a rag to apply the cleaning solvent.
    c. Wipe dry.

13. Bolt and backplate assembly:

    a. Wipe or brush away dirt.
    b. Use a rag to apply the cleaning solvent.
    c. Wipe dry.

14. Use only authorized cleaning materials.

Intermediate Training Objective 3: Inspect the MK 19.

CONDITIONS: Given a disassembled and cleaned MK 19.

STANDARDS: The gunner will inspect the MK 19.

PERFORMANCE MEASURES:

GO	NO-GO

1. Receiver assembly:

    a. Inspect the receiver housing for cracks (even hairline) , rust, burrs.
    b. Inspect the receiver rails for burrs, deformity, or unusual wear.
    c. Inspect the feeder pawls for spring action, burrs, or broken pawls.
    d. Inspect the barrel for carbon building or pitting in the bore or chamber.
    e. Inspect the flash suppressor for dents, cracks, or loose pin.
    f. Inspect the rear sight for rust, and the sight scale for readability.

2. Sear assembly: Inspect for burrs, rust, or wear on sear face, or binding in the safety switch movement.

PERFORMANCE MEASURES:

GO	NO-GO

3. Alignment guide assembly:

   a. Inspect for deformed or cracked spring.
   b. Inspect for cracks around the pin.
   c. Inspect for loose pin.
   d. Inspect for burrs, dents, and cracks.

4. Ogive plunger assembly: Inspect for cracks in the housing.

5. Round-positioning block:

   a. Inspect for burrs, dents, or cracks.
   b. Inspect for broken, deformed, or missing springs.
   c. Inspect for bent, cracked, or broken parts.

6. Charger assemblies (LH, RH):

   a. Inspect for burrs on grooved edges.
   b. Inspect for chipped, cracked, broken, or missing handle assemblies.
   c. Inspect for spring tension in the lock charger handle lock.
   d. Inspect for spring tension in the lock plunger.
   e. Inspect for bent charger housing.

7. Vertical cam assembly:

   a. Inspect for burrs or buckling.
   b. Inspect scratches, chips, or aluminum buildup on the chromed edge.
   c. Inspect for lock binding.

8. Primary drive lever: Inspect for burrs around the pivot post.

9. Secondary drive lever:

   a. Inspect for burrs, cracks, chips, or buckling.
   b. Inspect for missing retaining pin.

PERFORMANCE MEASURES:

GO	NO-GO

10. Feed slide assembly:

    a. Inspect for burrs or cracks.
    b. Inspect for broken feed pawls, binding, or no spring action.
    c. Inspect for deformed shuttle-spring tip.
    d. Inspect for loose mounting screws.

11. Feed tray:

    a. Inspect for burrs or cracks.
    b. Inspect for lack of spring action.

12. Top cover assembly:

    a. Inspect for burrs, cracks, or rust.
    b. Inspect for loose or missing latch.
    c. Inspect for bent pins, and for missing or broken cross pins.

13. Bolt and backplate assembly:

    a. Inspect overall for burrs, rust, or cracks.
    b. Inspect handles for cracks.
    c. Inspect for broken or bent recoil springs.
    d. Inspect for bent or broken guide rods.
    e. Inspect for missing safety wire.
    f. Inspect for broken or worn cocking lever.
    g. Inspect for cracked or chipped bolt sear.
    h. Inspect for cracked or binding cam followers.
    i. Inspect for cracked or chipped bolt fingers.
    j. Inspect for chipped or broken firing pin tip.
    k. Inspect for chipped, cracked, or missing extractors.
    l. Inspect for bent or cracked backplate or missing retaining ring.

Intermediate Training Objective 4: Lubricate the MK 19.

CONDITIONS: Given a disassembled, cleaned, and inspected MK 19, and lubricant and brush.

STANDARDS: The gunner will lubricate the weapon.

PERFORMANCE MEASURES:

	GO	NO-GO
1. Receiver assembly: Apply a light coat of lubricant on the receiver rails, feeder, and feeder pawls.		
2. Sear assembly: Apply a light coat to all parts.		
3. Alignment guide assembly: Apply a light coat to all parts.		
4. Round-positioning block: Apply a light coat to the springs.		
5. Charger assemblies (LH,RH): Apply a light coat to all parts, especially the grooved edges of the rails.		
6. Vertical cam: Apply a light coat to all parts, especially the chromed edge.		
7. Primary drive lever: Apply a light coat to all parts, especially the pivot posts.		
8. Secondary drive lever: Apply a light coat to all parts, especially the pivot post and forked end.		
9. Feed slide assembly: Apply a light coat to all parts, especially the feed pawls.		
10. Feed tray: Apply a light coat to all parts, especially the feed pawls. rails.		
11. Top cover assembly: Apply a light coat to all parts, especially the latch, the pivot post hole, and the pin holes.		

PERFORMANCE MEASURES:

12. Bolt and backplate assembly: Apply a light coat to all parts, especially the bolt face, bolt sear, guide rods, recoil springs, bolt rails, cam followers, and cocking lever.

Intermediate Training Objective 5. Assemble the MK 19.

CONDITIONS: Given a disassembled, cleaned, inspected, and lubricated MK 19.

STANDARDS: The gunner will assemble the weapon in proper sequence within four minutes.

PERFORMANCE MEASURES:

	GO	NO-GO
1. Assemble the sear assembly.		
2. Assemble the charger assemblies (LH, RH).		
3. Assemble the round-positioning block.		
4. Insert the ogive plunger assembly.		
5. Insert the alignment guide assembly.		
6. Attach the vertical cam.		
7. Attach the primary drive lever.		
8. Attach the feed tray.		
9. Attach the feed slide assembly.		
10. Attach the top cover assembly.		
11. Attach and engage the secondary drive lever.		
12. Insert the bolt and backplate assembly.		
13. Complete within four minutes.		

Intermediate Training Objective 6: Perform a function check.

CONDITIONS: Given an assembled MK 19.

STANDARDS: The gunner will perform a function check on the weapon.

PERFORMANCE MEASURES:

	GO	NO-GO
1. Close the top cover.		
2. Charge the weapon.		
3. Lock the charging handles forward.		
4. Place the gun on SAFE.		
5. Press the trigger.		
6. If the weapon fires, notify the supervisor.		
7. If the weapon did not fire, continue.		
8. Move the safety to FIRE.		
9. Press th trigger. Bolt should spring forward.		
10. Open the top cover.		
11. Check the tip of the firing pin. It should be exposed.		
12. Move the feed slide to the left.		
13. Close the top cover.		
14. Move the safety to SAFE.		

Intermediate Training Objective 7: Clean, inspect, and lubricate the MK 64 MOD 7 gun cradle.

CONDITIONS: Given a gun cradle, TM 9-1010-231-13&P, and lubricant.

STANDARDS: The gunner will clean, inspect, and lubricate the gun cradle.

PERFORMANCE MEASURES:

GO	NO-GO

1. Clean the gun cradle.

   a. Brush or wipe away dirt.
   b. Use a rag to apply cleaning solvent.
   c. Wipe dry.

2. Inspect the gun cradle for--

   a. Bent or cracked retaining pins.
   b. Damaged threads on depression stop.
   c. Damage to mounting surface on the gun cradle.
   d. Loss of mounting hardware (nuts, bolts, pins, or chains).
   e. Depression stop in place (training use only).
   f. Frozen pintle lock.
   g. Missing cotter pins.

3. Lubricate the gun cradle. Apply a light coat to all pins and pivot points.

STATION THREE

Station Three has four intermediate training objectives.

TASK: Load, unload, and correct malfunctions; clear the MK 19.

CONDITIONS: Given a location in which to work, a complete M3 tripod-mounted Mk 19 and ten rounds of linked 40-mm ammunition (dummy).

STANDARDS: The gunner will load, unload, and clear the MK 19, and will take immediate and remedial action per TM 9-1010-230-10 and this training program.

Intermediate Training Objective 1: Clear the MK 19.

CONDITIONS: Given an M3 tripod-mounted weapon in a designated location, and ten rounds of linked 40-mm ammunition (dummy).

STANDARDS: The gunner will clear the MK 19.

PERFORMANCE MEASURES:

GO	NO-GO

NONFIRING: When the weapon has been in storage and is taken out for maintenance, a nonfiring situation exists.

1. Place the gun on SAFE.
2. Open the top cover.
3. Lower the charging handles.
4. Pull back on the charging handles slightly, allowing enough space between the face of the bolt and the chamber to allow both to be seen.
5. Inspect the bolt face, the chamber, and the feed area for ammunition.
6. Ride the bolt forward.
7. Return the charging handles to the original upright position.
8. Move the feed slide assembly to the left.

PERFORMANCE MEASURES:

GO	NO-GO

9. Close the top cover.

FIRING: A firing situation exists when the weapon has been fired or when it is in an environment in which ammunition has been used.

1. Place the gun on SAFE.
2. Lock the bolt to the rear.
3. Remove the live round or spent case from the bolt face.
4. Catch the live round as it falls out.
5. Open the top cover.
6. Remove the rounds from the feeder.
7. Move the safety to FIRE.
8. Ride the bolt forward.
9. Move the safety to SAFE.
10. Move the feed slide assembly to the left.
11. Close the top cover.

Intermediate Training Objective 2: Load the MK 19.

CONDITIONS: Given an M3 tripod-mounted weapon in a designated location, ten rounds of linked 40-mm ammunition (dummy).

STANADARD: The gunner will load the weapon.

PERFORMANCE MEASURES:

GO	NO-GO

1. Place the weapon on SAFE.
2. Ride the bolt forward.

PERFORMANCE MEASURES:

	GO	NO-GO
3. Return the charger assemblies to the original upright position.		
4. Open the top cover.		
5. Slide the rounds, female link first, through the feed throat.		
6. Insert the first round into the feeder and across the first pawl.		
7. Move the feed slide assembly to the left.		
8. Close the top cover.		
9. Charge the weapon.		
10. Lock the charger handles forward.		
11. Move the safety to FIRE.		
12. Press the trigger (bolt goes forward).		
13. Move the safety to SAFE.		
14. Charge the weapon (live round on bolt face).		
15. Lock the charger handles forward.		

Intermediate Training Objective 3: Correct malfunctions.

CONDITIONS: Given an M3 tripod-mounted weapon in a designated, ten rounds of linked 40-mm ammunition (dummy), and a simulated stoppage.

STANDARD: The gunner will correct the malfunction.

PERFORMANCE MEASURES:

	GO	NO-GO
1. In a training situation, wait ten seconds after any stoppage.		

PERFORMANCE MEASURES:

GO	NO-GO

2. Charge the weapon and try to fire.

3. If the weapon fails to fire, recharge and try to fire.

If the weapon fails to fire (or gunner is instructed that the gun did not fire) after the second attempt, the gunner will take remedial action:

4. Unload and clear the weapon.

5. Inspect the weapon and ammunition and try to find the cause of the stoppage.

6. If possible, correct the cause of the stoppage, reload, and try to fire the weapon.

Intermediate Training Objective 4: Stop a runaway gun.

CONDITIONS: Given an M3 tripod-mounted weapon in a designated location, ten rounds of linked 40-mm ammunition (dummy), and a simulated runaway gun.

STANADARDS: The gunner will stop the runaway gun.

PERFORMANCE MEASURES:

GO	NO-GO

Lower one of the charging handles.

STATION FOUR

Station Four has four intermediate training objectives.

TASK: Mount and dismount the MK 19 onto one of the following: M3 tripod, M4 pedestal on a 1/4-ton vehicle, HMMWV with weapon platform, or commander's cupola on an M113.

CONDITIONS: Given a complete MK 19, a complete MK 64 MOD 7 gun cradle, a location in which to work, TM 9-1010-231-13&P, and one or more of the following: M3 tripod, 1/4-ton vehicle with an M4 pedestal, HMMWV with weapon platform, or M113.

STANDARDS: The gunner will mount and dismount the MK 19 on the gun cradle, mount the gun on other mounts as directed. The time limit for moving the MK 19 from one mount to another is four minutes.

TRAINING NOTE: when the MK 19 is mounted on a unit's organic carrier or the M3 tripod, it is called a weapon system. The weapon system is mounted using the three-man concept. The gunner is responsible for ensuring that it is mounted correctly, with the aid of the other two team members. The steps for securing the MK 19 to the gun cradle are ght same. The MK 19 is moved from one mount ot another with the MK 64 MOD 7 gun cradle attached.

Intermediate Training Objective 1: Mont the MK 19 on the M3 tripod.

CONDITIONS: Given a location in which to work, an M3 tripod with T&E mechanism, the gun cradlem and TM 9-1010-231-13&P.

STANDARDS: The gunner will mount the gun cradle on the M3 tripod.

PERFORMANCE MEASURES:

GO	NO-GO

MONTING:

1. Set up the M3 tripod.
2. Secure the MK 64 MOD 7 gun cradle onto the M3 tripod.
3. Lift the gun into the gun cradle.

PERFORMANCE MEASURES:

GO	NO-GO

4. Slide the front portion of the receiver into the gun cradle.

5. Secure the rear of the gun to the gun cradle.

6. Attach the T&E mechanism the to the M3 tripod.

7. Attach the T&E mechanism to the gun cradle.

8. Attach the feed throat.

DISMOUNTING:

9. Remove the T&E mechanism retaining pin.

10. Insert the gun cradle stow pin (left side) .

11. Unlock the M3 tripod pintle lock release cam.

12. Lift the MK 19, with the MK 64 MOD 7 gun cradle attached, from the M3 tripod.

Intermediate Training Objective 2: Mount and dismount the MK 19 from the M4 pedestal.

CONDITIONS: Given a location in which to work, a vehicle with an M4 pedestal mount, an M3 tripod-mounted MK 19, the T&E mechanism, pintle adapter, ammunition container bracket, and tools.

STANDARDS: The gunner will remove the MK 19 from the M3 tripod, mount it on the M4 pedestal within four minutes, and dismount it from the M4 pedestal within four minutes.

PERFORMANCE MEASURES:

GO	NO-GO

MOUNTING:

1. Remove the T&E mechanism retaining pin.

PERFORMANCE MEASURES:

GO	NO-GO

2. Insert the cradle stow pin (left side).
3. Unlock the M3 tripod pintle lock lever.
4. Move the MK 19 to the M4 pedestal.
5. Loosen the locking lever on the M4 pedestal.
6. Insert the pintle adapter into the top part of the M4 pedestal.
7. Remove the quick-release pin from the pintle adapter.
8. Tighten the locking lever on the M4 pedestal.
9. Lift up the MK 19 and insert the gun cradle pintle into the top of the pintle adapter.
10. Insert the quick-release pin into the pintle adapter from either side.
11. Attach the train and elevation mechanism to the gun mount.
12. Center the elevation handwheel.
13. Remove the stow pin.
14. Attach the train and elevation mechanism clamp to the M4 pedestal.
15. Attach the two support clamps to the M4 pedestal.
16. Attach the ammunition container bracket (right side).
17. Attach the empty case catch bag.

DISMOUNTING:

18. Remove the ammunition container bracket (right side).

PERFORMANCE MEASURES:

GO	NO-GO

19. Remove the pin securing the train and elevation mechanism to the gun cradle.

20. Insert the gun cradle stow pin.

21. Remove the quick-release pin from the pintle adapter.

22. Lift the MK 19 from the M4 pedestal.

23. Loosen the locking lever on the M4 pedestal.

24. Lift the pintle adapter from the M4 pedestal.

Intermediate Training Objective 3: Mount and dismount the MK 19 from the HMMWV weapon platform.

CONDITIONS: Given a mounted MK 19, location in which to work, a HMMWV with weapon platform, pintle adapter assembly, train and elevating mechanism, and TM 9-1010-231-13&P.

STANDARDS: The gunner will remove the MK 19 from its mount and install it on the HMMWV weapon platform within four minutes.

PERFORMANCE MEASURES:

GO	NO-GO

MOUNTING

1. Remove the MK 19 from its mount.

2. Loosen the locking screws on the HMMWV pedestal.

3. Insert the pintle adapter into the HMMWV pedestal.

4. Tighten the locking screws.

5. Remove the quick-release pin from the pintle adapter.

PERFORMANCE MEASURES:

	GO	NO-GO
6. Lift the MK 19,with MK 64 MOD 7 gun cradle attached, to the pintle adapter and insert the gun cradle pintle into the pintle adapter.		
7. Insert the pintle adapter quick-release pin.		
8. Attach the train and elevating assembly to the gun cradle.		
9. Center the elevating handwheel.		
10. Remove the gun cradle stow pin.		
11. Attach the train and elevating mechanism to the HMMWV pedestal.		
12. Attach the ammunition container bracket.		
DISMOUNTING:		
13. Remove the ammunition container bracket.		
14. Remove the train and elevating mechanism from the HMMWV pedestal.		
15. Remove the train and elevating mechanism from the gun cradle.		
16. Insert the gun cradle stow pin.		
17. Remove the quick-release pin from the pintle adapter assembly.		
18. Lift the MK 19 from the HMMWV pedestal.		
19. Remove the pintle adapter from the HMMWV pedestal.		

Intermediate Training Objective 4: Mount and dismount the MK 19 from the commander’s cupola of an M113.

CONDITIONS: Given a mounted MK 19, a location in which to work, an M113 with the commander's cupola, pintle adapter, ammunition bracket, and TM 9-1010-231-13&P.

STANDARDS: The gunner will remove the MK 19 from its mount and install it on the commander’s cupola of the Ml13 within four minutes.

PERFORMANCE MEASURES:

G O	NO-GO

MOUNTING:

1. Insert the pintle adapter into the mount receptacle.
2. Remove the pintle adapter quick-release pin.
3. Lift the MK 19 to the pintle adapter and insert the cradle pintle into the pintle adapter.
4. Insert the pintle adapter quick-release pin.
5. Attach the ammunition bracket.

DISMOUNTING:

6. Insert the gun cradle stow pin.
7. Remove the ammunition bracket.
8. Remove the pintle adapter quick-release pin.
9. Lift the MK 19 from the commander's cupola.

STATION FIVE

TASK: Identify characteristics of a defensive position for the MK 19.

CONDITIONS: Given an M3 tripod, a complete Mk 19, a location tion in which to work, direction of fire, and a partially dug fighting position.

STANDARDS: The gunner will identify the actions needed to complete the fighting position.

PERFORMANCE MEASURES:

	G O	NO-GO
1. Check assigned direction of fire.		
2. Check gun traverse.		
3. Check overhead cover.		
4. Check fighting position camouflage.		
5. Check for protection against small-arms fire.		
6. Check for protection against indirect fire fragments.		
7. Check for protection from aerial observation.		
8. Check for mutual support with other fighting positions.		
9. Check for a good field of fire.		

STATION SIX

TASK: Prepare a range card for the MK 19.

CONDITIONS: Light, in a defensive position, given a tripod-mounted MK 19, a principal direction of fire and secondary sector of fire (both with recognizable targets), paper, pencil, and compass.

STANDARDS: Prepare range cards that include a data and sketch section for each sector of fire, with appropriate sketches and military symbols.

PERFORMANCE MEASURES:

GO	NO-GO

1. Orient the range card.
2. Sketch the terrain that is to the front of the position (prominent and man-made, including terrain features) .
3. Fill in or construct the marginal data section.
   a. Gun number.
   b. Unit designation.
   c. Date.
   d. Magnetic north arrow.
4. Sketch machine gun symbol.
5. Specify gun location in relation to prominent terrain feature or eight-digit grid coordinate.
   a. Determine azimuth in mils from the terrain feature to the gun.
   b. Determine distance between the terrain feature and the gun.
   c. Sketch and identify the terrain feature on the card.
   d. Connect the feature and gun with a barbed line.
   e. Write the distance in meters above the line.

PERFORMANCE MEASURES:

GO	NO-GO

f. Write the azimuth in mils below the line from the feature to the gun.

6. Sketch in the TRPs, if any.

7. Label TRPs, if any.

STATION SEVEN

TASK: Mount, place into operation, and dismount the AN/TVS-5 night vision device from the MK 19.

CONDITIONS: Given a mounted MK 19 and an AN/TVS-5.

STANDARDS: The gunner will mount the AN/TVS-5 on the MK 19, place the sight into operation, and dismount the AN/TVS-5 from the MK 19.

PERFORMANCE MEASURES:

	GO	NO-GO
1. Mount the M2 mounting bracket onto the MK 19.		
2. Mount the AN/TVS-5 onto the M2 bracket.		
3. Install the batteries in the device.		
4. Press your eye against the eye guard.		
5. Turn the ON-OFF/TUBE BRIGHTNESS control to ON.		
6. Adjust the ON-OFF/TUBE BRIGHTNESS control, as needed.		
7. Turn the ON-OFF/RETICLE BRIGHTNESS control to ON.		
8. Turn the diopter focus ring until the clearest image of the reticle pattern is obtained.		
9. Turn the objective focus ring until the target in the field og view is sharply defined.		
10. Turn the ON-OFF/RETICLE BRIGHTNESS control to OFF.		
11. Turn the ON-OFF/TUBE BRIGHTNESS control to OFF.		
12. Remove the batteries from the AN/TVS-5.		
13. Remove the AN/TVS-5 from the M2 bracket.		
14. Remove the M2 bracket from the MK 19.		

APPENDIX C

FIRING TABLES

There are ten exercises used to train MK 19 gunners and crews. Commanders dictate the level of mission-oriented protection posture (MOPP) used during MK 19 gunnery. The first seven exercises use individual gunnery firing The last three use collective gunnery tables. Active fighting force gunners qualify semiannually and participate in unit-level live fires quarterly. Active supporting force gunners qualify and participate on instructional fire annually. All reserve component gunners qualify annually.

C-1. INDIVIDUAL GUNNERY

The first four of these tables are used for gunnery practice. Five through seven are used for gunnery qualification.

a. Instructional Fire Exercise (TABLE C-1). The instructional firing exercise gives the soldier practice firing on a range before qualification firing.

b. Dismounted Range Card Exercise (TABLE C-2). The dismounted range card exercise is held after instructional fire and gives the gunner and crew a chance to test their skills against a time-and-hit exercise. It is held twice yearly, or as often as the commander feels is needed to maintain crew skills.

(1) Time the gunner and the crew while they place the tripod-mounted MK 19 into operation in a selected location.

(2) Time the gunner while he completed a range card with the the ranges of all targets within his sector of fire.

(3) Have the gunner suppress or kill single or multiple targets in his sector of fire, using his range card data.

(4) Time the gunner and the crew while they take the MK 19 out of operation.

c. Mounted Combat Exercise (TABLE C-3).The mounted combat exercise gives the gunner and the crew practice fighting from a vehicle. It is held twice yearly, or as often as the commander feels is needed to maintain crew skills.

(1) Time the gun crew while they place the MK 19 into operation on its organic carrier. (Carriers may be HMMWVs, 2 l/2-ton trucks, M151-series utility trucks, or M113-series APCs.)

(2) Using the time-and-hit standards set by the unit commander, give the gunner and the crew a series of single and multiple targets to suppress or kill in their sector of fire.

(3) Upon completion of mounted firing, time the gunner and the crew while they take the MK 19 out of operation.

EXERCISE

Distinguished	176/344
Qualified	97/175
Unqualified	96 and below

Practice qualification scores and rating.

d. Night Fire Exercise (TABLE C--4). This live-fire exercise develops and improves MK 19 gunnery skills at night or during degraded conditions. Hold this exercise as often as the commander feels is needed to maintain crew skills.

EXERCISE

Distinguished	176/344
Qualified	96/172
Unqualified	96 and below

Qualification scores and rating.

e. Dismounted Range Card Qualification (TABLE C-5). This live-fire exercise tests the skills practiced during the dismounted range card exercise. It is scored on the time taken and target hits made based on the firing table standards. Hold this exercise twice yearly, or as often as the commander feels is needed to maintain crew skills.

f. Dismounted Range Combat Qualification. (TABLE C-6). This live-fire exercise tests the practiced during the mounted combat exercise. It is scored on the time taken and target hits made based on the firing table standards Hold this exercise twice yearly, or as often as the commander feels is needed to maintain crew skills.

g. Night Fire Qualification (TABLE C-7). This live-fire exercise tests the skills practiced during the night fire exercise. It is scored within a time frame and on target hits made, based on the firing table standards. Hold this exercise twice yearly, or as often as the commander feels is needed to maintain crew skills.

C-2. COLLECTIVE GUNNERY

These three exercises test the application of fire from two or more guns against linear, deep, linear with depth, and area targets. They test collective individual skills, fire control, leader skills, adjustment of fire, methods of target engagement, and the control of one or more fire units. Tables C-8 through C-10 should be used with unit live-fire exercises and not as part of individual qualification. They can be held on any range or piece of terrain that supports the MK 19. Targets arrayed may be made up of 55-gallon drums, hulks of old vehicles, silhouettes, chalk, and panel markers or engineer tape.

TABLE 1

INSTRUCTIONAL FIRE EXERCISE

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Mount the MK 19 on the M3 tripod.	Given a MK 19, M3 tripod, T&E mechanism, MK 64 gun mount, and a selected firing position.	Gun crew must be able to mount the MK 19 in its tripod mode within 1 minute.	Ø	1 minute	
2. Prepare a range card.	Given a MK 19, T&E mechanism, selected firing position with a designated sector of fire, and BMP and dismounted troop targets at ranges of 400, 600, 1,100, and 1,500 meters.	Gunner must prepare a completed range card within 15 minutes.	Ø	15 minutes	
3. Zero the MK 19 using a 400-meter BMP target.	Given a tripod-mounted MK 19, 400-meter BMP target, selected firing position, and 4 rounds of 40-mm TP.	Gunner must impact on target with at least 2 of the 4 rounds on the BMP target.	4 rounds	N/A	
4. Engage BMP target at 1,100 meters using range card data (point target).	Given a tripod-mounted MK 19, completed range card, BMP target at 1,100 meters, selected firing position, and 8 rounds of 40-mm TP.	Gunner must impact on BMP target with at least 2 out of 8 rounds.	8 rounds	N/A	
5. Engage BMP target at 1,500 meters using range card data.	Given a tripod-mounted MK 19, completed range card, BMP target at 1,500 meters, selected firing position, and 8 rounds of 40-mm TP.	Gunner must impact within 15 meters of the BMP target area with at least 2 out of 8 rounds.	8 rounds	N/A	

Table C-1. Instrtuctional fire exercise.

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
6. Engage dismounted troops at 600 meters, using range card data (area target).	Given a tripod-mounted MK 19, completed range card, dismounted troop targets at 600 meters, selected firing position, and 6 rounds of 40-mm TP.	Gunner must impact at least 2 out of 6 rounds in the area of the target array, within 5 meters of a troop silhouette.	6 rounds	N/A	
7. Dismount the MK 19.	Given a MK 19, M3 tripod, and selected firing position.	Gun crew must dismount the MK 19 from the M3 tripod within 1 minute.	0	1 minute	
		TOTAL:	26 rounds		

Table C-1. Continued.

TABLE 2

DISMOUNTED RANGE CARD EXERCISE

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Mount a MK 19 on an M3 tripod.	Given a MK 19, M3 tripod, M64 gun mount, T&E mechanism, and selected firing position.	Gun crew must mount the MK 19 on the M3 tripod within 1 minute.	Ø	1 minute	
2. Prepare a range card.	Given a MK 19, T&E mechanism, selected firing position with an assigned sector of fire, and BMP and dismounted troop targets at ranges of 400, 600, 1,100, and 1,500 meters.	Gunner must prepare a completed range card with all targets in his sector of fire within 15 minutes.	Ø	15 minutes	
3. Zero the MK 19 while mounted on the M3 tripod, at a 400-meter BMP.	Given a tripod-mounted MK 19, selected firing position, 400-meter BMP target, and 4 rounds of 40-mm TP.	Gunner must impact at least 2 out of 4 rounds on the 400-meter BMP target.	4 rounds	N/A	
4. Engage 600-meter BMP target while tripod-mounted, using range card data (point target).	Given a tripod-mounted MK 19, selected firing position, 600-meter BMP target, and 4 rounds of 40-mm TP.	Gunner must impact at least 2 out of 4 rounds on the 600-meter BMP target.	4 rounds	1 minute	
5. Engage 1,100-meter BMP target using range card data.	Given a tripod-mounted MK 19, selected firing position, BMP target at 1,100 meters, completed range card, and 8 rounds of 40-mm TP.	Gunner must impact on BMP target with at least 2 out of 8 rounds.	8 rounds	2 minutes	

Table C-2. Dismounted range card exercise.

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
6. Engage 600-meter (area) troop target using range card data.	Given a tripod-mounted MK 19, 6 rounds of 40-mm TP, selected firing position, and troop target at 600 meters.	Gunner must impact at least 2 out of 6 rounds in the area of the target array, within 5 meters of a troop silhouette.	6 rounds	1 minute, 30 seconds	
7. Engage BMP target at 1,500 meters using range card data.	Given a tripod-mounted MK 19, 8 rounds of 40-mm TP, selected firing position, BMP target at 1,500 meters, and a completed range card.	Gunner must impact within 15 meters of the BMP target with at least 2 out of 8 rounds.	8 rounds	2 minutes	
8. Engage BMP target at 1,100 meters and dismounted troops at 600 meters using range card data.	Given a tripod-mounted MK 19, 12 rounds of 40-mm TP, BMP target at 1,100 meters, dismounted troop target at 600 meters, and completed range card.	Gunner must impact at least 2 out of 12 rounds on the BMP target, then shift to dismounted troop target and place at least 2 rounds in the area of target array, within 5 meters of troop silhouette.	12 rounds	3 minutes	
9. Dismount the MK 19 from the M3 tripod.	Given a mounted MK 19.	Gun crew must take the MK 19 out of operation from the tripod mount within 1 minute.	0	1 minute	
		TOTAL:	42 rounds		

Table C-2. Continued.

TABLE 3

MOUNTED COMBAT EXERCISE

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Mount a MK 19 on its organic carrier.	Given a MK 19, organic carrier, and selected firing position.	Gun crew must mount the MK 19 on its organic carrier within 2 minutes.	Ø	2 minutes	
2. Engage BMP target at 400 meters while mounted.	Given a MK 19, organic carrier, 4 rounds of 40-mm TP, and selected firing position.	Gunner must impact on BMP target with at least 2 out of 4 rounds at 400 meters.	4 rounds	1 minute	
3. Engage BMP target at 800 meters while mounted.	Given a MK 19, organic carrier, 8 rounds of 40-mm TP, and selected firing position.	Gunner must impact on BMP target at 800 meters with at least 2 out of 8 rounds.	8 rounds	1 minute, 30 seconds	
4. Engage 600-meter (area) troop target.	Given a MK 19, organic carrier, 6 rounds of 40-mm TP, and selected firing position.	Gunner must impact at least 2 out of 6 rounds in the area of the target array, within 5 meters of a troop silhouette at 600 meters.	6 rounds	1 minute, 30 seconds	
5. Engage 1,100-meter BMP target.	Given a MK 19, organic carrier, 8 rounds of 40-mm TP, and selected firing position.	Gunner must impact on the BMP target at 1,100 meters with at least 2 out of 8 rounds.	8 rounds	2 minutes	
6. Dismount the MK 19 from its organic carrier.	Given a MK 19 and organic carrier.	Gun crew must dismount the MK 19 from its organic carrier within 2 minutes.	Ø	2 minutes	
		TOTAL:	26 rounds		

Table C-3. Mounted combat exercise.

TABLE 4

NIGHT FIRE EXERCISE

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Mount the AN/TVS-5 to the MK 19.	Given AN/TVS-5 complete, MK 19, M3 tripod, and T&E mechanism.	Gunner must mount the AN/TVS-5 on the MK 19 within 2 minutes.	0	2 minutes	
2. Using a zeroed MK 19 with an AN/TVS-5 mounted for observation, engage a 400-meter BMP target.	Given AN/TVS-5 complete, MK 19, M3 tripod, 6 rounds of 40-mm TP, and 400-meter BMP target, during the hours of daylight.	Gunner must impact 2 out of 6 rounds on BMP target at 400 meters.	6 rounds	1 minute	
3. Engage BMP target at 600 meters.	Given a MK 19, 8 rounds of 40-mm TP, and a target at a distance of 600 meters.	Gunner must impact on BMP target at 600 meters.	8 rounds	2 minutes	
4. Engage dismounted troop target at 800 meters.	Given a MK 19, 8 rounds of 40-mm TP, and a target at a distance of 800 meters.	Gunner must impact within 5 meters of a silhouette target at 800 meters.	8 rounds	2 minutes	
5. Dismount the AN/TVS-5 from the MK 19.	Given a MK 19 and an AN/TVS-5.	Gun crew must take AN/TVS-5 out of operation within 2 minutes.	0	2 minutes	
		TOTAL:	22 rounds		

Table C-4. Night fire exercise.

TABLE 5

DISMOUNTED RANGE CARD QUALIFICATION

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Mount an MK 19 on an M3 tripod.	Given a MK 19, M3 tripod, M64 gun mount, T&E mechanism, and selected firing position.	Gun crew must mount the MK 19 on the M3 tripod within 1 minute.	Ø	1 minute	
2. Prepare a range card.	Given a MK 19, T&E mechanism, selected firing position with an assigned sector of fire, and BMP and dismounted troop targets at ranges of 400, 600, 1,100, and 1,500 meters.	Gunner must prepare a completed range card with all targets in his sector of fire within 15 minutes.	Ø	15 minutes	
3. Zero the MK 19 while mounted on the M3 tripod, at a 400-meter BMP.	Given a tripod-mounted MK 19, selected firing position, 400-meter BMP target, and 4 rounds of 40-mm TP.	Gunner must impact at least 2 out of 4 rounds on the 400-meter BMP target.	4 rounds	N/A	
4. Engage 600-meter BMP target while tripod-mounted, using range card data (point target).	Given a tripod-mounted MK 19, selected firing position, 600-meter BMP target, and 4 rounds of 40-mm TP.	Gunner must impact at least 2 out of 4 rounds on the 600-meter BMP target.	4 rounds	1 minute	
5. Engage 1,100-meter BMP target using range card data.	Given a tripod-mounted MK 19, 8 rounds of 40-mm TP, selected firing position, BMP target at 1,100 meters, and a completed range card.	Gunner must impact on BMP target with at least 2 out of 8 rounds.	8 rounds	2 minutes	

Table C-5. Dismounted range card qualification.

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
6. Engage 600-meter (area) troop target using range card data.	Given a tripod-mounted MK 19, 6 rounds of 40-mm TP, selected firing position, and troop target at 600 meters.	Gunner must impact at least 2 out of 6 rounds in the area of the target array, within 5 meters of a troop silhouette.	6 rounds	1 minute, 30 seconds	
7. Engage BMP target at 1,500 meters using range card data.	Given a tripod-mounted MK 19, 8 rounds of 40-mm TP, selected firing position, BMP target at 1,500 meters, and a completed range card.	Gunner must impact within 15 meters of the BMP target with at least 2 out of 8 rounds.	8 rounds	2 minutes	
8. Engage BMP target at 1,100 meters and dismounted troop target at 600 meters using range card data.	Given a tripod-mounted MK 19, 12 rounds of 40-mm TP, BMP target at 1,100 meters, dismounted troop target at 600 meters, and completed range card.	Gunner must impact at least 2 out of 12 rounds on the BMP target, then shift to dismounted troop target and place at least 2 rounds in the area of target array, within 5 meters of troop silhouette.	12 rounds	3 minutes	
9. Dismount the MK 19 from the M3 tripod.	Given a mounted MK 19.	Gun crew must take the MK 19 out of operation from tripod mount within 1 minute.	0	1 minute	
		TOTAL:	42 rounds		

Table C-5. Continued.

TABLE 6

MOUNTED COMBAT QUALIFICATIONS

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Mount the MK 19 on its organic carrier.	Given a MK 19, organic carrier, and selected firing position.	Gun crew must mount the MK 19 on its organic carrier within 2 minutes.	Ø	2 minutes	
2. Engage BMP target at 400 meters while mounted.	Given a MK 19, organic carrier, 6 rounds of 40-mm TP, and selected firing position.	Gunner must impact on BMP target with at least 2 out of 4 rounds at 400 meters.	4 rounds	1 minute	
3. Engage BMP target at 800 meters while mounted.	Given a MK 19, organic carrier, 8 rounds of 40-mm TP, and selected firing position.	Gunner must impact on BMP target at 800 meters with at least 2 out of 8 rounds.	8 rounds	1 minute, 30 seconds	
4. Engage 600-meter (area) troop target.	Given a MK 19, organic carrier, 6 rounds of 40-mm TP, and selected firing position.	Gunner must impact at least 2 out of 6 rounds in the area of the target array, within 5 meters of a troop silhouette at 600 meters.	6 rounds	1 minute, 30 seconds	
5. Engage 1,100-meter BMP target.	Given a MK 19, organic carrier, 8 rounds of 40-mm TP, and selected firing position.	Gunner must impact on the BMP target at 1,100 meters with at least 2 out of 8 rounds.	8 rounds	2 minutes	
6. Dismount the MK 19 from its organic carrier.	Given a MK 19 and organic carrier.	Gun crew must dismount the MK 19 from its organic carrier within 2 minutes.	Ø	2 minutes	
		TOTAL:	26 rounds		

Table C-6. Mounted combat qualification.

TABLE 7

NIGHT FIRE QUALIFICATION

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Mount the AN/TVS-5 to the MK 19.	Given AN/TVS-5 complete, MK 19, M3 tripod, and T&E mechanism.	Gunner must mount the AN/TVS-5 on the MK 19 within 2 minutes.	0	2 minutes	
2. Using a zeroed MK 19 with an AN/TVS-5 mounted for observation, engage a 400-meter BMP target.	Given AN/TVS-5 complete, MK 19, M3 tripod, 6 rounds of 40-mm TP, and 400-meter BMP target, during the hours of daylight.	Gunner must impact 2 out of 6 rounds on the BMP target at 400 meters.	6 rounds	1 minute	
3. Engage BMP target at 600 meters.	Given a MK 19, 8 rounds of 40-mm TP, and BMP target at a distance of 600 meters.	Gunner must impact on BMP target at 600 meters.	8 rounds	2 minutes	
4. Engage dismounted troop target at 800 meters.	Given a MK 19, 8 rounds of 40-mm TP, and dismounted troop target at a distance of 800 meters.	Gunner must impact within 5 meters of a silhouette target at 800 meters.	8 rounds	2 minutes	
5. Dismount the AN/TVS-5 from the MK 19.	Given a MK 19 and an AN/TVS-5.	Gun crew must take the AN/TVS-5 out of operation within 2 minutes.	0	2 minutes	
		TOTAL:	22 rounds		

Table C-7. Night fire qualification.

TABLE 8

LINEAR AND DEEP TARGETS

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Engage a linear target with a pair of MK 19s (two guns).	Given a linear target 100 meters wide at 800 to 1,200 meters, two MK 19s on tripods with T&E mechanisms, during the hours of daylight or under degraded conditions.	Gun crews must cover 90 percent of the linear target with effective fire while performing the following: 1. The leader lays the guns on their respective flanks. 2. The leader issues the fire command for engaging a linear target. 3. Gunners engage using traversing fire. 4. Observers ensure that fires remain on target and adjust appropriately.	40 rounds	2 minutes	
OR					
2. Engage a linear target with two pairs of MK 19s (four guns).	Given a linear target 200 meters wide at from 800 to 1,200 meters, four MK 19s on tripods with T&E mechanisms, during the hours of daylight or under degraded conditions.	Same as task 1, except the leader may have to subdivide the target.	80 rounds	3 minutes	

Table C-8. Linear and deep targets.

Table C-8. Continued.

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
3. Engage a deep target with a pair of MK 19s (two guns).	Given a deep target 100 meters long with midrange to target from 800 to 1,200 meters, two MK 19s on tripods with T&E mechanisms, during the hours of daylight or under degraded conditions.	Gun crews must cover 90 percent of the deep target with effective fire while performing the following: 1. The leader lays the guns on their respective ends of the target. 2. The leader issues the fire command for engaging a deep target. 3. Gunners engage using searching fire. 4. Observers ensure that fire remains on the target and adjust appropriately.	40 rounds	2 minutes	
4. Engage a deep target with two pairs of MK 19s (four guns).	Given a deep target 200 meters long with midrange to the target from 800 to 1,200 meters, four MK 19s on tripods with T&E mechanisms, during the hours of daylight or under degraded conditions.	Gun crews should cover 90 percent of the deep target with effective fire while performing the same steps in task 3, except the leader may have to subdivide the target.	80 rounds	3 minutes	
		TOTAL:	240 rounds		

TABLE 9

LINEAR TARGETS WITH DEPTH

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Engage a linear target with depth with a pair of MK 19s (two guns).	Given a target 100 meters wide and 50 meters long (or 50 meters wide and 100 meters long), at 800 to 1,200 meters, two MK 19s with tripods and T&E mechanisms, during daylight or under degraded conditions.	Gun crews must cover 80 percent of the linear with depth target with effective fire while performing the following: 1. The leader lays the guns on the gun crews' respective flanks (ends) of the target. 2. The leader issues the fire command for engaging a linear target with depth. 3. Gunners engage using traversing and searching fire. 4. Observers ensure that fire remains on the target and adjust appropriately.	40 rounds for each target	3 minutes	
2. Engage a linear target with depth with two pairs of MK 19s (four guns).	Given a target 200 meters wide and 50 meters long (or 50 meters wide and 200 meters long), at 800 to 1,200 meters, four MK 19s with tripods and T&E mechanisms, during daylight or under degraded conditions.	Same as task 1, except the leader may want to subdivide the target.	80 rounds for each target	4 minutes	
		TOTAL:	120 rounds		

Table C-9. Linear targets with depth.

TABLE 10

AREA TARGETS

TASK	CONDITION	STANDARD	AMMUNITION	TIME	REMARKS
1. Engage area target with two pairs of MK 19s (four guns).	Given an area target from 1,000 to 1,400 meters (midrange) extending over 200 meters in length and width, four MK 19s on tripods with T&E mechanisms, during the hours of daylight or under degraded conditions.	The combined gun crews must cover 70 percent of the area target with suppressive fire while performing the following: 1. The leader determines direction and elevation to the area target (midrange). 2. He divides the area target and ensures that each gun is laid on its portion, and assigns TRPs. 3. Each gun registers on its respective TRP. 4. The leader issues the fire command for an area target. 5. All MK 19s engage; gunners use traverse and search manipulations to adjust and distribute fires. 6. Observers ensure fires remain on target and adjust appropriately.	160 rounds	5 minutes	
2. Engage area target with three pairs of MK 19s (six guns).	Given an area target from 1,000 to 1,400 meters (midrange) extending over 300 meters in length and 200 meters in width, six MK 19s on tripods with T&E mechanisms, during the hours of daylight or under degraded conditions.	The combined gun crews must cover 70 percent of the area target with suppressive fire while performing the following: (Performance measures are the same as for task 1.)	240 rounds	8 minutes	
		TOTAL:	400 rounds		

Table C-10. Area targets.

APPENDIX D
ANNUAL GUNNERY TRAINING PROGRAM

This appendix contains four suggested annual training programs for the MK 19 MOD 3, one for each of the fighting and supporting active and reserve forces. Because of the high cost of M918TP and M430 HEDP rounds,live firing is kept to a minimum. Gunnery training programs have been prepared to adequately train gunners based on the mission profile of the unit. The firing tables that support these programs are in Appendix C. A definition of each force along with a summary of the annual gunnery training program designed for it, is included in this appendix.

D-1. FIGHTING FORCES ACTIVE COMPONENT

These forces consist of infantry, military police, and engineer units of the Active Army. The MK 19s will be used in both offensive and defensive roles. Gunners assigned to these units will qualify semiannually, and participate in unit level live fires quarterly. Each gunner assigned to this portion of the force will fire 300 rounds annually.

a. Every Quarter.

- Monthly Preliminary Marksmanship Instruction (PMI) and Crew Drills.
- Quarterly Gunnery Skills Test.

b. First Quarter Only.

- Semiiannual Qulification: Tables C-5 through C-7.
- Quarterly unit live-fire exercise: Table C-8.

c. Second Quarter Only. Quarterly unit live-fire exercise: Table C-9.

d. Third Quarter Only.

- Semiannual qualification: Tables C-5 through C-7.
- Quarterly unit live-fire exercise: Table C-10.

e. Fourth Quarter Only. Quarterly unit live-fire exercise: CALFEX--choice of tables C-8 through C-10.

D-2. SUPPORTING FORCES ACTIVE COMPONENT

These forces consist of all other units in the active component not identified as fighting forece units. These guns will be used primarily in defense of battalion, brigade, and division rear operations. Gunners from these forces will participate in instructional fire and qualification annually.

a. Every Quarter.

- Monthly Preliminary Marksmanship Instruction (PMI) and Crew Drills.
- Quarterly Gunnery Skills Test.

b. First Quarter Only. There is no additional training during this quarter.

c. Second Quarter Only. Live fire: Table C-1.

d. Third Quarter Only. There is no additional training during this quarter.

e. Fourth Quarter Only. Annual qualification: Tables C-5 through C-7.

D-3. FIGHTING FORCES RESERVE COMPONENTS

These forces consist of military police, engineer, and infantry units of the reserve component. forces must maintain a level of proficiency higher than that of the active support forces. At the same time, limited time and range resources must be considered. Gunners of these forces will conduct sustainment on the trainer at least quarterly. Live fires will consist of annual qualification and a unit level live-fire exercise. These forces will be allocated 114 rounds per year for live fire and qualification.

a. Every Quarter.

- Semiannual Preliminary Marksmanship Instruction (PMI) and Crew Drills.
- Quarterly Gunnery Skills Test.

b. First Quarter Only. There is no additional training during this quarter.

c. Second Quarter Only. There is no additional training during this quarter.

d. Third Quarter Only. Live-fire qualification: Tables C-1 and C-5 through C-7.

e. Fourth Quarter Only. There is no additional training during this quarter.

D-4. SUPPORTING FORCES RESERVE COMPONENT

These forces consist of all reserve units not specifically outlined under the paragraph on fighting forces. They will be allocated 78 rounds for each year to qualify.

a. Every Quarter.

- Semiannual Preliminary Marksmanship Instruction (PMI) and Crew Drills.
- Quarterly Gunnery Skills Test.

b. First Quarter Only. There is no additional training during this quarter.

c. Second Quarter Only. There is no additional training during this quarter.

d. Third Quarter Only. Live-fire qualification: Tables C-5 through C-7.

e. Fourth Quarter Only. There is no additional training during this quarter.

APPENDIX E
TRAJECTORY DATA

The table in this appendix provides information about the trajectory of MK 19 projectiles as they are influenced by various factors:

NOTE: 40-MM TP, XM918 is a reduced time-of-flight experimental ammunition.

RANGE, METERS	ELEVATION, MILS				FLIGHT TIME, SECONDS				REMAINING VELOCITY			
									M430		M385	
	M430	M385	M918	XM918*	M430	M385	M918	XM918*	FPS	MPS	FPS	MPS
0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	790	240.8	790	240.8
100	9.0	9.0	8.9	4.6	0.43	0.43	0.43	0.31	747	227.7	744	226.8
200	18.6	18.7	18.5	9.5	0.88	0.88	0.88	0.63	706	215.2	701	213.7
300	29.1	29.3	28.8	14.9	1.36	1.37	1.35	0.97	667	203.3	660	201.2
400	40.4	40.8	39.9	20.6	1.87	1.88	1.85	1.33	630	192.0	622	189.6
500	52.6	53.4	51.8	26.7	2.40	2.43	2.38	1.70	596	181.7	586	178.6
600	65.9	66.9	64.7	33.3	2.97	3.07	2.93	2.10	564	171.9	552	168.2
700	80.3	81.8	78.5	40.4	3.58	3.63	3.52	2.52	533	162.5	520	158.5
800	96.0	98.2	93.5	48.1	4.22	4.29	4.14	2.97	505	153.9	491	149.7
900	113.1	116.1	109.8	56.3	4.90	4.99	4.80	3.43	478	145.7	463	141.1
1000	131.9	135.8	127.5	65.2	5.63	5.74	5.50	3.93	453	138.1	438	133.5
1100	152.5	157.6	146.8	74.9	6.41	6.55	6.24	4.45	430	131.1	414	126.2
1200	175.2	181.9	167.8	85.3	7.24	7.42	7.03	5.00	409	124.7	393	119.8
1300	200.4	209.0	191.0	96.6	8.14	8.37	7.88	5.58	389	118.6	373	113.7
1400	228.6	239.6	216.6	108.9	9.11	9.40	8.79	6.19	372	113.4	356	108.5
1500	260.3	274.6	245.0	122.2	10.17	10/53	9.77	6.84	356	108.5	341	103.9
1600	296.7	315.3	277.1	136.7	11.34	10.53	10.84	7.53	343	104.5	329	100.3
1700	339.2	364.2	313.7	152.6	12.65	11.80	12.01	8.27	333	101.5	320	97.5
1800	390.8	426.4	356.5	169.9	14.17	13.25	13.34	9.05	325	99.1	314	95.7
1900	458.3	518.4	408.5	189.0	16.06	15.01	14.88	9.88	322	98.1	314	95.7
2000	570.1	–	477.2	210.0	18.97	17.44	16.82	10.77	324	98.8	–	–
2100	–	–	757.3	233.4	–	–	23.66	11.73	–	–	–	–
2200	–	–	–	259.6	–	–	–	12.77	–	–	–	–
2300	–	–	–	289.3	–	–	–	13.91	–	–	–	–
2400	–	–	–	323.4	–	–	–	15.18	–	–	–	–
2500	–	–	–	363.8	–	–	–	16.62	–	–	–	–
2600	–	–	–	413.8	–	–	–	18.32	–	–	–	–
2700	–	–	–	482.4	–	–	–	20.54	–	–	–	–
2800	–	–	–	–	–	–	–	–	–	–	–	–

*REDUCED TIME-OF-FLIGHT EXPERIMENTAL AMMUNITION.

Table E-1. Comparison of direct-fire aiming data.

RANGE, METERS	REMAINING VELOCITY				ANGLE OF FALL, DEGREES				MAXIMUM ORDINATE, FEET			
	M918		XM918*									
	FPS	MPS	FPS	MPS	M430	M385	M918	XM918*	M430	M385	M918	XM918*
0	790	240.8	1100	335.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100	750	228.6	1044	318.2	0.5	0.5	0.5	0.3	0.7	0.7	0.7	0.4
200	712	217.0	991	302.1	1.1	1.2	1.1	0.6	3.1	3.1	3.1	1.6
300	675	205.7	940	286.5	1.8	1.9	1.8	0.9	7.4	7.5	7.3	3.8
400	641	195.4	892	271.9	2.6	2.7	2.6	1.3	14.0	14.2	13.8	7.1
500	608	185.3	847	258.2	3.6	3.7	3.5	1.8	23.3	23.7	22.8	11.7
600	578	176.2	804	245.1	4.7	4.8	4.5	2.3	35.7	36.5	34.7	17.9
700	549	167.3	763	232.6	5.9	6.1	5.6	2.9	51.7	53.1	50.1	25.7
800	521	158.8	724	220.7	7.3	7.6	6.9	3.6	72.0	74.4	69.4	35.6
900	496	151.2	688	209.7	8.9	9.3	8.4	4.3	97.4	101.0	93.4	47.7
1000	471	143.6	653	199.0	10.7	11.3	10.1	5.2	128.7	134.1	122.7	62.5
1100	449	136.9	620	189.9	12.8	13.6	12.0	6.1	167.0	174.8	158.2	80.3
1200	428	130.5	590	179.8	15.2	16.2	14.1	7.2	213.6	224.9	201.2	101.6
1300	409	124.7	561	171.0	17.9	19.1	16.5	8.4	270.3	286.3	252.9	126.8
1400	391	119.2	534	162.8	21.0	22.5	19.2	9.8	339.3	361.8	315.0	156.6
1500	376	114.6	508	154.8	24.5	26.4	22.3	11.4	423.6	455.3	390.0	191.6
1600	362	110.3	484	147.5	28.4	30.9	25.8	13.1	527.6	527.9	480.8	232.7
1700	350	106.7	462	140.8	32.9	36.1	29.7	15.0	658.4	724.6	592.2	280.8
1800	341	103.9	442	134.7	38.2	42.2	34.1	17.2	828.4	931.6	731.6	337.0
1900	334	101.8	423	128.9	44.4	50.0	39.2	19.6	1065.6	1259.3	912.3	402.8
2000	332	101.2	406	123.7	53.2		45.3	22.4	1486.5		1166.1	479.9
2100	350	106.7	392	119.5			63.6	25.3			2298.7	570.7
2200			379	115.5				28.6				678.0
2300			368	112.2				32.3				806.2
2400			359	109.4				36.3				961.6
2500			354	107.9				40.8				1154.6
2600			351	107.0				45.8				1405.6
2700			352	107.3				52.0				1767.3
2800												

*REDUCED TIME-OF-FLIGHT EXPERIMENTAL AMMUNITION.

Table E-1. Continued.

APPENDIX F
OPERATIONS CHECKLIST

This appendix consists of an operations checklist of procedures (Table F-1) to be followed before, during, and after operation of the MK 19.

WEAPON PART	BEFORE	DURING	AFTER
1. Bore.	Ensure it is clear and clean.		Clean and oil lightly.
2. Moving parts.	Oil lightly and test for worn or broken parts. They should function without excessive friction.	Lubricate working parts. Observe the functioning of the gun to anticipate failures.	Inspect, clean, and oil lightly.
3. Ammunition.	a. Ensure correct type is used. b. Ensure it is clean and dent free. c. Ensure all ogives are tight. d. Have an adequate supply on hand.	Keep correctly aligned in the feedtray; check resupply; protect from sun, moisture, and dirt. Watch for link stoppage.	Clean, store carefully, and replenish supply.
4. Top cover.	Inspect for dents or damage.	Keep closed and locked down.	Lube properly after cleaning.
5. Line of fire.	Ensure line of fire is clear of all obstructions.	Cease fire if any obstruction appears in the line of fire.	

Table F-1. Operations checklist.

FM 23-27
27 DECEMBER 1988

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

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GLOSSARY

AE	angles of elevation
AI	assistant instructor
APC	armored personnel carrier
AS	angle of sight
BMP	(a Threat vehicle)
CALFEX	combined arms live-fire exercise
Comp	composition
DA	Department of the Army
deg	degrees
DODAC	Department of Defense Ammunition Code
EA	engagement area
elev	elevation
fps	feet per second
ft	feet
FM	field manual
FPF	final protection fires
FTX	field training exercise
HE	high explosive
HEDP	high-explosive dual-purpose
HMMWV	high mobility multipurpose wheeled vehicle
HQS	headquarters
IAW	in accordance with
IET	initial entry training
LAW	lubricant,arctic weather
LBE	load-bearing equipment
LFX	live-fire exercise
LH	left hand
MACS	Multipurpose Arcade Combat Simulator
max ord	maximum ordinate
MILES	multiple integrated laser engagement system
MK	Mark
mm	millimeter
MOD	model
MOPP	mission-oriented protection posture
MPRC	multipurpose range complex
mps	meters per second
NBC	nuclear, biological, chemical
NO	number

OVM	operator’s vehicle material
PDF	principal direction of fire
PEWS	platoon early warning system
PIBD	point initiating, base detonating
PMI	preliminary marksmanship instruction
QE	quadrant elevation
RBC	rifle bore cleaner
RH	right hand
sec	seconds
SOP	standard operating procedures
STX	situational training exercise
T&E	traverse and elevation
TESS	Tactical Engagement Simulator System
TOE	table of organization and equipment
TM	technical manual
TP	training practice
TRADOC	United States Army Training and Doctrine Command
TRP	target reference point
VDT	Video Disk Trainer

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PREFACE

The purpose of this manual is to provide MK 19 gunnery principles, methods, and techniques, and to provide standards and tests to measure individual, crew, and platoon MK 19 gunnery skills. Gunnery in this manual is unique to the MK 19, 4Ø-mm Grenade Machine Gun, MOD 3. Included is a description of system features, engagement techniques, preliminary gunnery, gunnery skills test, gunnery tables, and qualification. Features of the MK 19 system that do not affect gunnery doctrine and technique are covered in applicable operator's manuals. Because TMs have priority updates, in all cases where the procedures in this manual conflict with TM procedures, the TM will be followed. Units may have to modify the gunnery program to meet local training restraints. While the gunnery program to meet local for live fire, the Tactical Engagement Simulator System (TESS), Video Disc Trainer (VDT), or Multipurpose Arcade Combat Simulator (MACS) or other training devices may be used, except on qualification tables. In all cases, units must evaluate their training to ensure that it follows the building-block principle and adheres to sound training policy. A crew that cannot do well in preliminary gunnery exercises is not likely to do well in live-fire exercises.

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Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

REFERENCES

REQUIRED PUBLICATIONS

Required publications are sources that users must read in order to understand or to comply with this publication.

None.

RELATED PUBLICATIONS

Related publications are sources of additional information. They are not required in order to understand this publication.

Army Regulation (AR)

385-63	Policies and procedures for Firing Ammunition for Training, Target Practice, and Combat

Department of Defense Regulation

5100-76-M	Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives

Department of the Army Circular (DA Cir)

350-85-4	Standards in Weapons Training

Department of the Army Form (DA Form)

5517-R	Standard Range Cards (LRA)

Field Manuals (FM)

3-5	NBC Decontamination
5-25	Explosives and Demolitions
7-7J	The Mechanized Infantry Platoon and Squad (Bradley)
21-26	Map Reading and Land Navigation
21-60	Visual Signals
25-2	Unit Training Management
25-3	Training in Units

25-7	Training Ranges
31-70	Basic Cold Weather Manual
90-10	Military Operations on Urbanize Terrain (MOUT)

Soldier's Training Publication (STP)

21-1	Soldier’s Manual of Common Tasks (SMCT), Skill Level 1

Technical Manuals (TM)

9-1005-245-14	Operator’s, Organiztional, Direct Support and General Support Maintenance: Various Machine Gun Mounts and Combinations Used on Tactical and Armored Vehicles
9-1010-230-10	Operator’s Manual and Components List for Machine Gun, 40-mm, MK 19 MOD 3
9-1010-231-13&P	Operator, Organizational and Intermediate Maintenance Manual, for Gun Mount, MK 64 MOD 4/(1) MK 19 MOD 3, 40-mm Machine Gun, (2) M2 Caliber .50 HB Machine Gun, and (3) M60 7.62-mm Machine Gun
11-5855-214-10	Operator’s Manual for Night Vision Sight, Crew-Served Weapon, AN/TVS-5

Training Circulars (TC)

23-13	Crew-Served Weapon Night Vision Sight
25-6	Tactical Engagement Simulation Training with MILES
25-7	How to Develop Training Management Skills in the Unit
90-1	Military Operations on Urbanized Terrain Training

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MK 19, 40-MM GRENADE MACHINE GUN, MOD 3

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