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FM 6-77

DEPARTMENT OF THE ARMY FIELD MANUAL

105-mm HOWITZER M52 SELF-PROPELLED

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FIELD MANUAL
No. 6–77

DEPARTMENT OF THE ARMY
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105-mm HOWITZER M52, SELF-PROPELLED

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CHAPTER 1

INTRODUCTION

1. Purpose and Scope

This manual is a guide to assist commanders in developing the sections of 105-mm howitzer M52, self-propelled, firing batteries into efficient smooth-working teams that have a sense of discipline which will impel them to operate effectively under the stress of battle. This manual prescribes individual duties and section drills, inspection and maintenance drills, and tests and adjustments for sighting and fire control equipment, and provides instructions for the decontamination and destruction of equipment.

2. Definitions and Terms

a. Section. Tables of organization and equipment prescribe the *personnel* and *equipment* comprising each section of a battery (figs. 1 and 2). In this manual the term *section* is often used to designate *only the personnel* required to serve one piece and its equipment.

b. Front. The front of a section is the direction in which the muzzle of the howitzer points.

c. Right (Left). The direction right (left) is the right (left) of one facing the front.

d. In Battery. A howitzer is said to be in battery when the recoiling parts are in the normal firing position.

Figure 1. 105-mm howitzer M52, self-propelled, and section personnel.

3. Description of Equipment

To avoid accidents caused by exceeding the capabilities and limitations of the motor carriage, all members of the section should be familiar with the performance charcteristics shown in figure 3. For further details pertaining to full-track vehicle capabilities and combat driving, see TM 21–306.

4. References

Publications pertaining to the 105-mm howitzer M52, self-propelled, and auxiliary equipment, covering related matters which are not discussed in detail in this manual, are listed in the appendix.

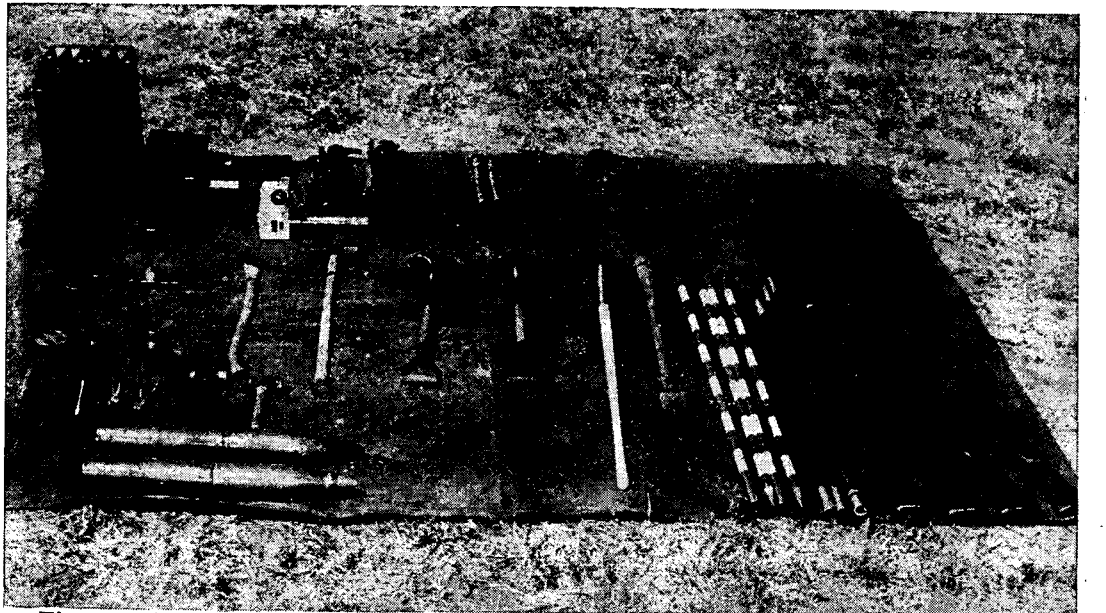

Figure 2. A method of displaying section equipment of the 105-mm howitzer M52, self-propelled.

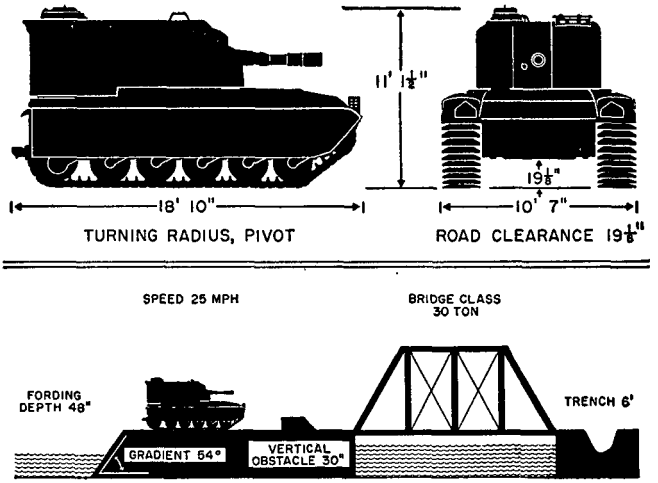

Figure 3. 105-mm howitzer M52, self-propelled performance characteristics.

CHAPTER 2

ORGANIZATION

5. Composition of Section

a. The section consists of section personnel, a 105-mm howitzer M52, self-propelled, and auxiliary equipment (fig. 1).

b. The personnel of the howitzer section are—

(1) A chief of section (CS).

(2) A gunner (G).

(3) An assistant gunner (No. 1).

(4) Four cannoneers, numbered from 2 through 5.

(5) A motor carriage driver (D).

c. Section equipment is listed in appropriate SNL and TOE 6–317R.

6. General Duties of Personnel

a. Chief of Section. The chief of section is the noncommissioned officer in command of the section and, as such, is responsible to the battery executive for—

(1) Training and efficiency of personnel.

(2) Performance of duties listed under section drill, duties in firing, tests and adjustment of sighting and fire control equipment, and inspection and maintenance of all section

equipment including the performance of scheduled preventive maintenance service on motor carriage.

(3) Observance of safety precautions.

(4) Preparation of field fortifications for protection of equipment, ammunition, and personnel.

(5) Camouflage discipline; local security; and chemical, biological, and radiological security discipline.

(6) Maintenance of the weapon record book.

(7) Police of the section area.

b. Gunner. The gunner is the assistant to the section chief in carrying out the duties specified in *a* above. The gunner's specific duties are prescribed in the appropriate chapters of this manual.

c. Cannoneers. Cannoneers perform duties as listed in this manual and any other duties that the chief of section prescribes.

d. Driver. The driver's primary duty is driving the motor carriage (TM 21–306) and performing preventive maintenance on the vehicle. He also performs such other duties as prescribed by this manual, by TM 9–717A, or as may be assigned by the chief of section. These duties can include substituting for any member of the section in firing.

CHAPTER 3

SECTION DRILL

Section I. GENERAL

7. Objective

The objective of section drill is the attainment of efficiency: maximum precision coupled with high speed.

8. Instructions

a. Adherence to the drills prescribed is necessary to develop maximum efficiency and to prevent injury to personnel and damage to equipment. Section drill must be conducted in silence except for commands and reports. The section must be drilled until reactions to commands are automatic, rapid, and efficient.

b. Errors are corrected immediately. Each member of the section must be impressed with the importance of reporting promptly to the chief of section any errors discovered before or after the command to fire has been given. The chief of section will report errors immediately to the executive.

c. Battery officers supervise the drill to insure that instructions are carried out and that maximum efficiency is obtained.

d. Personnel should be rotated during training so that each member of the section can perform all the

duties within the section. In addition, battery overhead personnel not assigned specific duties during drill periods should be trained in the fundamentals of section drill in order that they will be capable of functioning efficiently with a howitzer section if required.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

9. To Form Section

a. To Fall In. The chief of section takes his post. On the command of execution the section forms in a single rank at close interval, centered on and facing the chief of section at a distance of 3 paces (fig. 4). Higher numbered cannoneers, if present, form in order between No. 5 and the driver. The chief of section may indicate in his preparatory command the place and direction in which the section is to form. At the first formation for drill or exercise the caution, "As section(s)," precedes the command. The commands are FALL IN, or 1. IN FRONT (REAR) OF YOUR PIECE(S), 2. FALL IN, or 1. ON THE ROAD FACING THE PARK, 2. FALL IN. Execution is as follows: The section moves at double time and forms at close interval, at attention, guiding on the gunner (fig. 4).

b. To Call Off. The section being in formation, the command is CALL OFF. At the command, all personnel in ranks, except the gunner, execute eyes right. The section then calls off in sequence, "Gunner," "1," "2," "3," "4," "5," "Driver." As each man calls out his designation he turns his head smartly to the front.

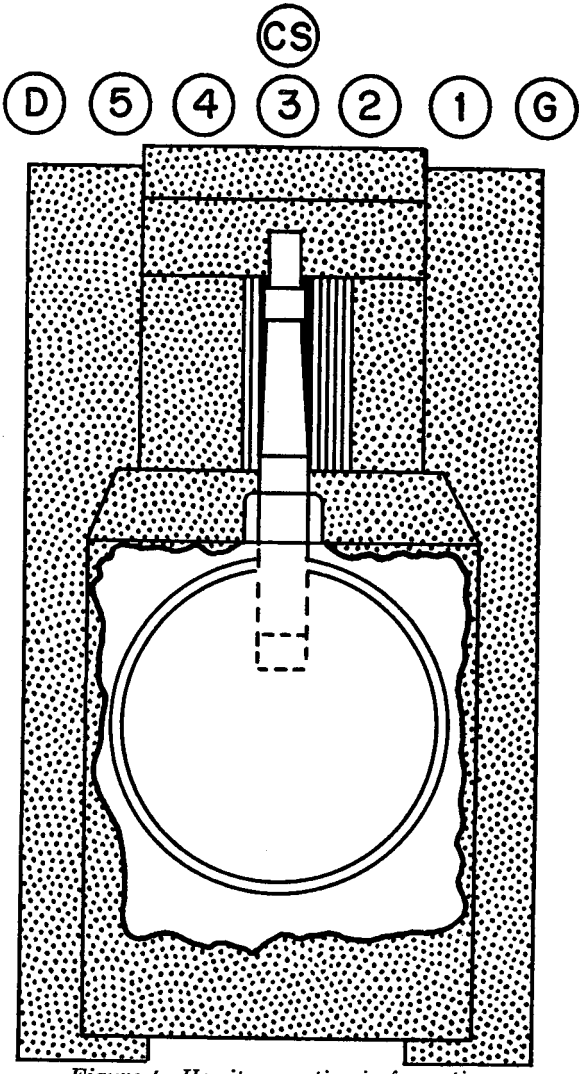

Figure 4. Howitzer section in formation.

10. Posts of Section

The command is 1. CANNONEERS, 2. POSTS. The command is general and is applicable whether the section is in or out of ranks, at a halt, or marching. All movements are executed at double time and are terminated at the position of attention. Higher numbered cannoneers, if present, take posts as prescribed by the chief of section.

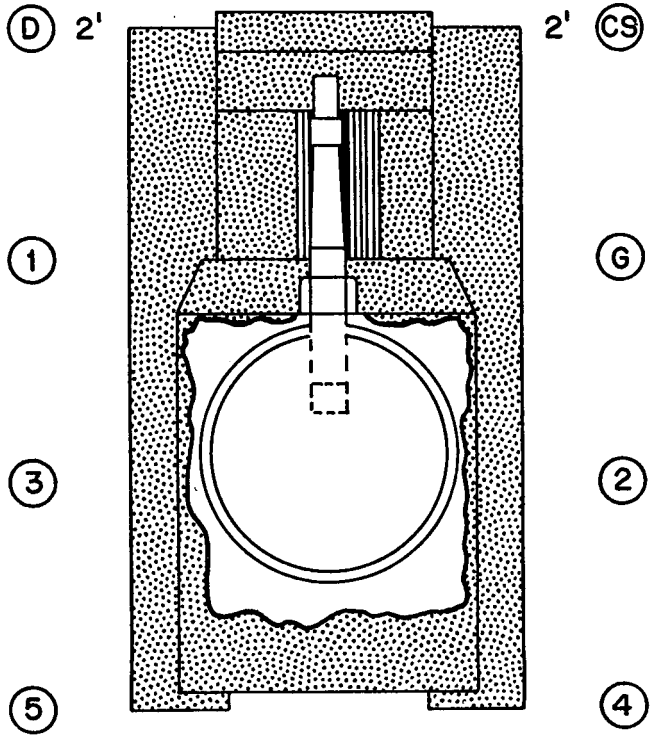

Figure 5. Posts of section, dismounted.

a. Dismounted. The section moves to posts as shown in figure 5. All personnel are 2 feet outside the tracks and facing to the front.

b. Prepared for Action. The piece having been prepared for action, posts are taken as shown in figure 6.

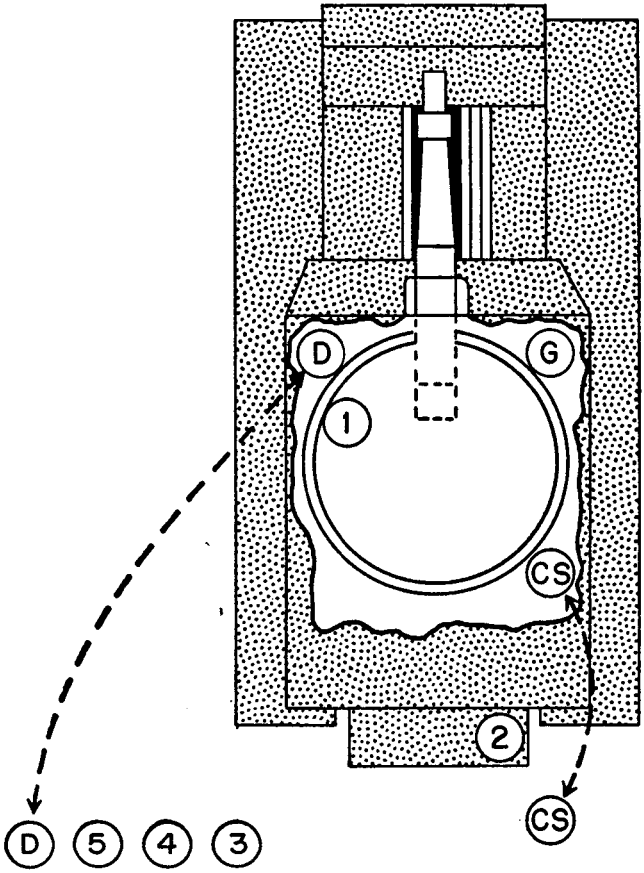

Figure 6. Posts of section, prepared for action.

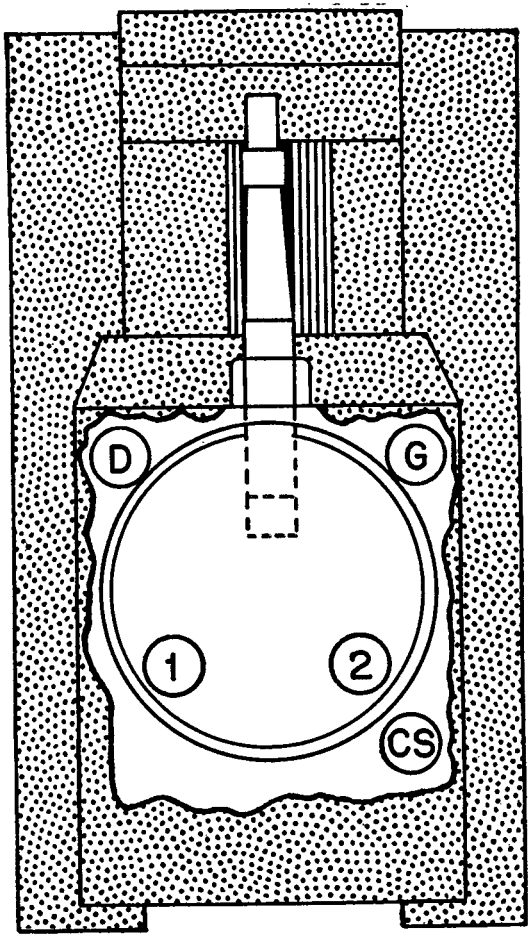

Figure 7. Section mounted.

c. Mounted, Not Prepared for Action. The section moves to posts as shown in figure 7. Nos. 3, 4, and 5 ride in another designated vehicle.

11. To Change Posts

To acquaint the members of the section with all duties and to lend variety to drill, posts should be changed frequently. The section being *in formation,* the commands are 1. CHANGE POSTS, 2. MARCH, or 1. SECTION CHANGE POSTS, 2. MARCH.

a. At the command 1. CHANGE POSTS, 2. MARCH, all number cannoneers except No. 5 (or the highest numbered cannoneer) take two left steps, taking the position of the next higher numbered cannoneer. No. 5 moves at double time in rear of the section to the post of No. 1. All other members of the section stand fast.

b. At the command 1. SECTION CHANGE POSTS, 2. MARCH, the driver (or the leftmost man) moves at double time in rear of the section to the post of the gunner. The gunner and all the other men in line take two left steps as in *a* above.

12. To Mount

The commands are 1. PREPARE TO MOUNT, 2. MOUNT, or MOUNT.

a. At the preparatory command, the section moves at double time to positions shown in figure 5. At the command of execution, all personnel mount. All personnel, except Nos. 3, 4, and 5, hasten to positions as shown in figure 7. Nos. 3, 4, and 5 do not mount the motor carriage. They move at

double time to the vicinity of a designated vehicle and mount it at the command of the driver.

b. If any members of the section are to remain dismounted, their designation is announced with the caution, "Stand fast" given between the preparatory command and the command of execution. For example: 1. PREPARE TO MOUNT, "Driver stand fast," 2. MOUNT.

c. If the command is MOUNT, the section executes, without pausing, all that has been prescribed for the command 1. PREPARE TO MOUNT, 2. MOUNT.

13. To Dismount

The commands are 1. PREPARE TO DISMOUNT, 2. DISMOUNT, or DISMOUNT.

a. At the preparatory command, all members of the section mounted in the motor carriage place themselves in a position from which they may dismount easily. At the command of execution, members of the section dismount in inverse order of mounting and quickly take posts as shown in figure 5.

b. At the command DISMOUNT, the section executes without pausing all that has been prescribed for the command 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

14. To Fall Out

a. At Drill. When it is desired to give the personnel a rest from drill or relieve them temporarily from a *formation* or *post,* the command FALL OUT

is given. The command may be given at any time and means that the section is to remain in the vicinity of the drill area.

b. When Firing. When firing has been suspended temporarily, but it is desired to have the section remain in the vicinity of the motor carriage, the command FALL OUT is given. Men stand clear of the piece to insure that settings and laying remain undisturbed. During these periods the chief of section may direct the men to improve the position, to replenish ammunition, or to do other necessary work.

CHAPTER 4

PREPARING HOWITZER FOR FIRING AND TRAVELING

Section I. PREPARATIONS FOR FIRING

15. General

The howitzers of a battery will ordinarily be put into position individually under the direction of the executive and chiefs of section. A stake should be driven into the ground at a point where the center of each carriage is to be placed. Another stake should be placed in the direction of fire 50 to 100 yards from the first stake, so that the driver of the motor carriage can point the tube at the far stake as he drives the vehicle into position over the first stake. Each vehicle is halted at its proper place by the chief of section. Hand signals for guiding the vehicle are found in FM 21–60 and FM 25–10 and are discussed in paragraph 108, this manual.

16. To Prepare for Action

a. The motor carriage being in position or approaching it, the command is PREPARE FOR ACTION. Duties of individuals are given in table I. Each man takes his post (fig. 6) upon completion of his duties.

b. The howitzer normally will be partially prepared for action before reaching the firing position.

The duties of the cannoneers in preparing for action are the same whether the howitzer is moving or halted, but only such operations as are practicable are carried out while moving. Immediately after the howitzer is established in position, preparation for action is completed without further command.

c. If PREPARE FOR ACTION has not been ordered before the howitzer is established in position, the command is habitually given by the chief of section as soon as the vehicle is halted in position. If preparation for action is not desired, the caution, "Do not prepare for action" must be given.

Section II. PREPARATIONS FOR TRAVELING

17. March Order

To prepare to resume travel, the command is MARCH ORDER. Duties of individuals are listed in table II. Each man takes his post (fig. 7) upon completion of his duties.

18. To Resume Firing in Another Position

a. If firing is to be resumed shortly in another position in which the howitzer must be immediately ready to fire, the command MARCH ORDER is not given. When a displacement is ordered, only those operations necessary for the movement of the motor carriage and the security of equipment are performed.

b. If the command MARCH ORDER is given while the equipment is partially prepared for travel as described in *a* above, the remaining operations pertaining to march order are completed.

Table II. Duties in Preparing for Traveling

Sequence	Chief of section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver
1	Commands MARCH ORDER. Inspects chamber to see that weapon is not loaded. Supervises work of all members of the section throughout all sequences.	Removes and stows panoramic telescope. Installs travel insert in telescope mount T179.	Inspects chamber to see that weapon is not loaded and closes breech after chamber is inspected by chief of section.	Closes rear turret doors.	Obtains breech cover and places it on top of ammunition stowage compartment.			Starts engine if it is not running and checks gages.
2		Places piece in center of traverse. Operates traversing handwheel to assist driver in engaging turret traveling lock.	Take breech cover from top of ammunition stowage compartment and place it on the breech.		Replace powder increments of prepared rounds in cartridge cases, return ammunition to containers, and load ammunition.			Engages turret traveling lock, when directed by gunner.
3			Checks ammunition stowage rack for security.	Inspects caliber .50 MG and clamps it in traveling position.	Folds paulin assisted by No. 4.	Recovers, disassembles, and secures the rammer staff and rammer head in traveling position, and assists No. 3 in folding paulin.	Recovers, disassembles, and secures aiming posts.	
4	Verifies that weapon is prepared for traveling. Reports to the executive, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.	Inspects section area to insure that no section equipment is being left.			Closes ammunition compartment door.	Rewinds telephone wire. Stows communication equipment.	Replaces muzzle cover and direct fire telescope cover.	

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Table I. Duties in Preparing for Action

Sequence	Chief of section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver, motor carriage
1	Commands PREPARE FOR ACTION. Supervises work of all members of the section throughout all sequences.	Installs panoramic telescope and crosslevels mount. Stows travel insert in storage box for Panoramic telescope T149E1.	Unfasten and remove breech cover. No. 2 opens rear turret doors and hands breech cover to No. 3.		Lowers ammunition compartment door to horizontal position. Receives breech cover from No. 2 and places it to left rear of motor carriage.	Lays wire for intra-battery communication system from motor carriage to executive's post.	Assembles aiming posts and places them near right front of motor carriage.	Positions vehicle as directed by chief of section.
2	Checks recoil system for proper amount of oil.	Lays for direction if required.	Operates breech mechanism and examines breechblock, chamber, and bore, cleaning as necessary (assisted by No. 2 when so directed).	Clamps caliber .50 MG in direction of probable area of responsibility for position defense.	Places fuze setter on paulin to left rear of motor carriage.	Spreads paulin to left rear of motor carriage.	Removes muzzle cover and cover for direct fire telescope.	Disengages turret traveling lock.
3		Boresights weapon, if time permits.		When so directed, assists No. 1 in cleaning breech mechanism, chamber, and bore.	Lays out section equipment on paulin.	Assembles rammer staff to rammer head and lays it over rear of motor carriage.	Sets out aiming posts, if so directed by gunner.	Keeps engine running until it is determined that carriage shifts are not required or until chief of section commands CUT ENGINE.
4	Verifies that weapon is prepared for action. Reports to executive, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.		Assists gunner in boresighting, if time permits.	Assists gunner and No. 1 in boresighting if time permits.	Prepare ammunition for firing.			

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Table III. Duties in Firing

Sequence	Chief of section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver
1	Directs work of section personnel throughout all sequences.	Sets commanded deflection on azimuth counter. Lays on commanded deflection.	Opens breech. Wipes bore and chamber dry for first round. Inspects bore; if clear, announces, "Bore clear."	Checks setting of fuze. Hands prepared round to No. 1. Assists No. 1 in wiping bore dry.	Fuzes projectiles and sets fuzes. Hands prepared round to No. 2.	Prepares commanded charge, reassembles round, and passes the round to No. 3.	Unpack ammunition from containers and place it conveniently near No. 4.	
2		Sets commanded elevation on elevation counter. Lays piece on commanded elevation. Announces or signals "Ready," after No. 1 announces "Set."	On command ELEVATION—loads weapon, announces "Set," stands clear of path of recoil, faces chief of section, and grasps lanyard.					Shifts carriage as directed by the chief of section.
3	Insures that weapon is ready to fire. Indicates to executive that weapon is ready to fire by raising arm or announcing orally.							
4	On command of executive, commands FIRE to No. 1 and/or lowers arm.		Fires weapon on command of chief of section. Inspects bore; if clear, announces, "Bore clear." Throws expended cartridge case out left side of vehicle.					

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CHAPTER 5

DUTIES IN FIRING, INDIRECT LAYING

Section I. GENERAL

19. Instructions

The general instructions in paragraphs 7 and 8 on the conduct of section drill apply equally to section drill in duties in firing by indirect laying. For duties of the battery executive, see FM 6–40 and FM 6–140.

20. Duties of Individuals

(table III)

In general, the duties of individuals in the section in indirect fire are as follows:

a. The chief of section supervises and commands his section and is responsible that all duties of the section are performed properly, all commands executed, and all safety precautions observed.

b. The gunner sets the commanded elevation and deflection, lays the piece, and refers the piece.

c. No. 1 opens the breech, loads the piece, and fires the piece.

d. No. 2 receives prepared rounds from No. 3 and passes them to No. 1.

e. No. 3 fuzes projectiles and sets fuzes.

f. No. 4 prepares charges.

g. No. 5 removes ammunition from containers.

h. The driver shifts carriage as directed by the chief of section and assists No. 5 in removing ammunition from containers.

Section II. DUTIES OF CHIEF OF SECTION

21. List of Duties

(Detailed description of duties, pars. 22–36.)

a. Indicates the aiming point to the gunner.

b. Measures the site to the mask.

c. Follows fire commands.

d. Indicates when the piece is ready to fire.

e. Gives the command to fire.

f. Lays the piece for elevation when the gunner's quadrant is used.

g. Reports errors and other unusual incidents of firing to the executive.

h. Conducts prearranged fires.

i. Records basic data.

j. Observes and checks frequently the functioning of the materiel.

k. Assigns duties when firing with reduced personnel.

l. Verifies the adjustment of the fire control equipment.

m. Checks, before they are replaced in their containers, all rounds not fired which have been prepared for firing.

n. Controls the movement of the motor carriage.

o. Supervises use of ammunition.

22. Indicates Aiming Point to Gunner

When an aiming point is designated by the executive, the chief of section insures that he has properly identified the point in question. The chief of section then indicates it to the gunner. If there is any possibility of misunderstanding, the chief of section will turn the panoramic telescope until the horizontal and vertical cross hairs are on the point designated.

23. Measures Site to Mask

The command is MEASURE THE SITE TO THE MASK. The chief of section, looking through the bore, directs the gunner in placing the tube in such a position that the lowest element of the bore just clears the crest at its highest point in the probable field of fire. The gunner then turns the elevation counter knob in the appropriate direction until the three elevation verniers line up. The chief of section reads the elevation from elevation counter and reports to the executive, "Sir, No. (so-and-so), site (so much)."

24. Follows Fire Commands

The chief of section follows fire commands. He repeats the commands as required.

25. Indicates When Piece is Ready to Fire

When the executive can see arm signals made by the chief of section, the chief of section will extend

his right arm vertically upward as a signal that the piece is ready to fire. He gives the signal as soon as the gunner calls, "Ready." When arm signals cannot be seen, the chief of section reports orally to the executive, "Sir, No. (so-and-so) ready."

26. Gives Command to Fire

When No. 1 can see arm signals made by the chief of section, the chief of section will give the command to fire by dropping his right arm sharply to his side. When his arm signals cannot be seen, he commands orally, FIRE or NO. (SO-AND-SO), FIRE. The chief of section will not give the signal or command to fire until all cannoneers are in their proper places.

27. Lays Piece for Elevation When Gunner's Quadrant is Used

a. The command QUADRANT (SO MUCH) indicates that the gunner's quadrant is to be used. In laying for elevation, the gunner's quadrant is employed only when the elevation counter is inoperative or known to be inaccurate. The gunner's quadrant may be specified for use with assault fire or on certain destruction missions.

b. Quadrant 361.8, for example, is set on the gunner's quadrant as follows: The upper edge of the index plate is set opposite the 360 mark of the graduated arc on the quadrant frame, and the micrometer on the index arm is turned to read 1.8. Care must be taken to use the same side of the quadrant in setting both the index plate and the micrometer knob.

c. The announced quadrant having been set on the gunner's quadrant, the piece loaded, and the breechlock closed, the gunner's quadrant is set on the quadrant seat on top of the breech. The words *line of fire* must be at the bottom of the quadrant with the arrow pointing toward the muzzle. The chief of section must be sure to use the arrow which appears on the same side of the quadrant as the scale which he is using. He stands squarely opposite the side of the quadrant and holds it firmly on the quadrant seat, parallel to the axis of the bore. *It is important that he take the same position and hold the quadrant in the same manner for each subsequent setting, so that in each case he will view the quadrant bubble from the same angle.*

d. The chief of section then directs the gunner to elevate or depress the tube until the bubble is centered, being careful that the last motion is in the direction in which it is more difficult to turn the handwheel. He cautions the gunner when the bubble is approaching the center, in order that the final centering may be performed accurately.

e. Special and calibration corrections will be added algebraically at the battery fire direction center and commanded as NO. (SO-AND-SO), QUADRANT (SO MUCH).

28. Reports Errors and Other Unusual Incidents of Firing to Executive

If, for any reason, the piece cannot be fired, the chief of section promptly reports that fact to the executive and the reasons therefor; for example,

"Sir, No. (so-and-so) out, misfire." Whenever it is discovered that the piece has been fired with an error in laying, the chief of section reports that fact at once; for example, "Sir, No. (so-and-so) fired 40 mils right." Whenever the gunner reports that the aiming posts are out of alinement with the sight and that the misalinement is due to the displacement of the carriage, the chief of section reports that fact to the executive and requests permission to realine them. Likewise, he promptly reports other unusual incidents that affect the service of the piece.

29. Conducts Prearranged Fires

Whenever the execution of prearranged fires is ordered, the chief of section conducts the fire of his section in conformity with the prescribed data.

30. Records Basic Data

The chief of section records data of a semipermanent nature in a notebook. This data includes such information as minimum elevation; aiming points used and their deflections; prearranged fires when section data sheets are not furnished; safety limits in elevation and deflection; number of rounds fired, with the date and hour; and calibration and special corrections when appropriate.

31. Observes and Checks Frequently Functioning of Materiel

The chief of section closely observes the functioning of all parts of the materiel during firing. Before the piece is fired, he makes sure that the recoil mechanism contains the proper amount of oil; there-

after, he carefully observes the functioning of the recoil system. He promptly reports to the executive any evidence of malfunctioning (TM 9–717A). If the piece returns to battery with a shock, an oversupply of recoil oil is indicated; if the piece overrecoils or does not return to battery, an insufficient amount of recoil oil is indicated. Whenever the amount of reserve oil is less than that prescribed, the index on the indicator rod of the replenisher will indicate "fill."

32. Assigns Duties When Firing With Reduced Personnel

Whenever the number of personnel serving the howitzer is temporarily reduced to below that indicated in this manual, the chief of section makes such redistribution of duties as will best facilitate the service of the piece. Loss of cadremen, various details, and casualties will necessitate the sections operating with a reduced number of personnel to the extent that it is almost normal for section members to double up on duties. Around-the-clock firing requires the chief of section to divide the section into shifts to provide for relief.

33. Verifies Adjustment of Fire Control Equipment

See TM 9–324A for detailed instructions on testing and adjusting sighting and fire control equipment.

34. Checks, Before They are Replaced in Their Containers, All Rounds Not Fired Which Have Been Prepared for Firing

The chief of section personally checks all rounds

not fired that have been prepared for firing before they are replaced in their containers, to see that all seven powder increments are present in proper condition, that they are assembled in proper numerical order, and that they are of the same lot number. He also checks to see that the lot number on the projectile and cartridge case corresponds to the lot number on the container.

35. Controls Movement of Motor Carriage

When it is necessary to move the motor carriage, the chief of section instructs the driver to start the engine. He then controls the displacement of the motor carriage by voice, interphone, or hand signals.

36. Supervises Use of Ammunition

The chief of section supervises control and use of proper lot numbers of ammunition as directed by the battery executive.

Section III. DUTIES OF GUNNER

37. List of Duties

(Detailed description of duties, pars. 38–46.)

a. Centers the level bubbles on the panoramic telescope mount.

b. Lays the piece for direction.

c. Alines the aiming posts, assisted by No. 5.

d. Lays the piece for elevation.

e. Sets a common deflection to a common aiming point after the piece has been laid.

f. Sets or changes the deflection.

g. Signals and/or calls "Ready."

h. Refers the piece.

i. Makes corrections for aiming post displacement.

38. Centers Level Bubbles on Panoramic Telescope Mount (fig. 8)

The gunner centers the level bubbles on the telescope mount by operating the leveling knobs as part of preparing the sight for action. Once the bubbles are leveled, it should not be necessary to make further adjustments during firing. However, the level of the mount is verified before calling "Ready."

39. Lays Piece for Direction (fig. 9)

The piece being in position, tube in center of traverse, and not laid for direction, the executive commands NO. (SO-AND-SO) ADJUST, AIMING POINT THIS INSTRUMENT. After the gunner has reported "Sir, No. (so-and-so) aiming point identified," the executive commands NO. (SO-AND-SO) DEFLECTION (SO MUCH). The gunner sets the commanded deflection on the coarse azimuth scale, as viewed through the window, and the micrometer scale. He then directs the driver to move the motor carriage until the vertical line of the sight reticle is approximately on the executive's aiming circle. The gunner then traverses the tube until the vertical line of sight is exactly on the executive's aiming circle. He checks to insure that the

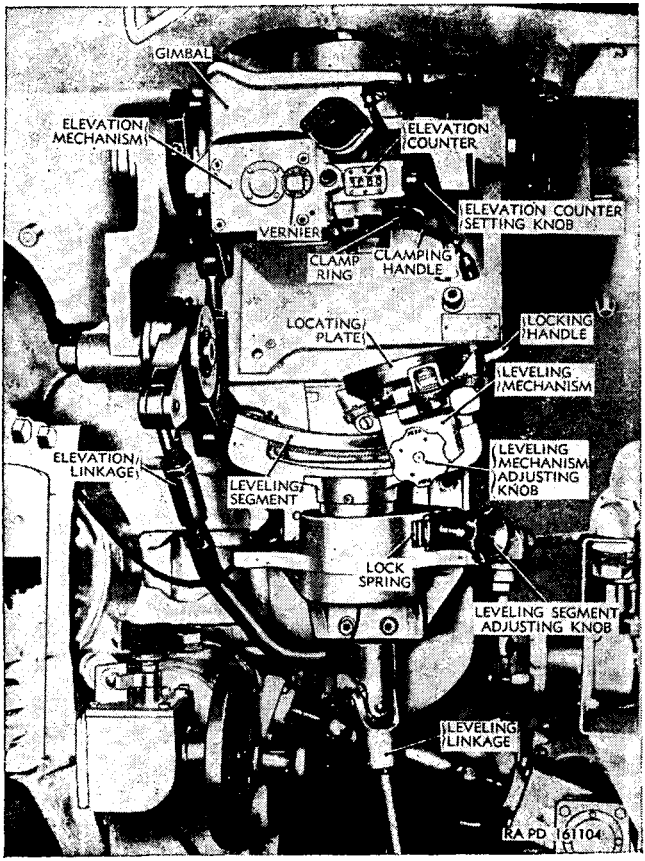


Figure 8. Telescope mount T179.

bubbles are level and announces, "Sir, No. (so-and-so) ready for recheck." As additional deflections are announced by the executive, he sets them on the coarse azimuth and the micrometer scales and traverses the tube so that the vertical line of sight is on

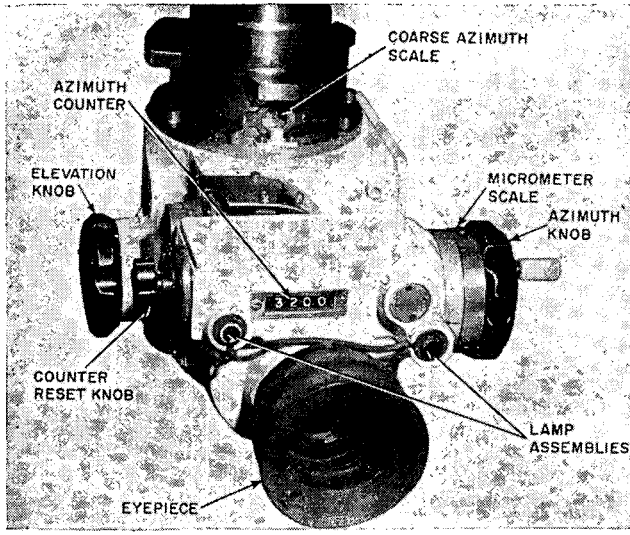


Figure 9. Panoramic telescope T149E1.

the aiming circle. When the executive announces "No. (so-and-so) is laid," the tube is oriented and should not be traversed except on order of the executive.

40. Alines Aiming Posts, Assisted by No. 5

The piece having been laid as in paragraph 39, the executive may command AIMING POINT, AIMING POSTS, DEFLECTION 800, REFER. At this command the gunner sets 8 on the coarse azimuth scale and 0 on the micrometer scale and, with hand signals, directs No. 5 in the alinement of the aiming posts with the vertical line of the sight reticle. If, because of the nature of the terrain, the aiming posts cannot be set out at deflection 800, the

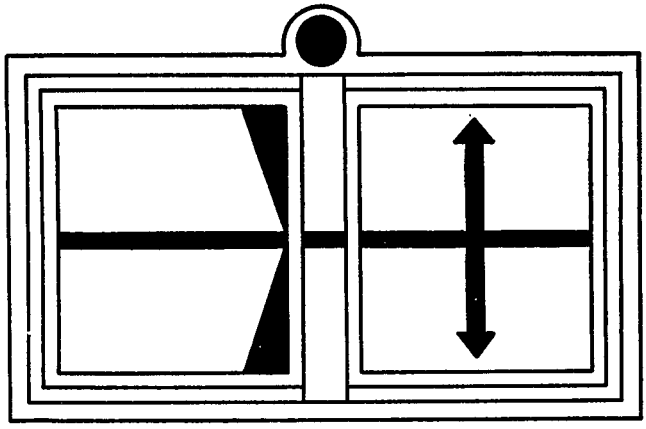
gunner turns the azimuth micrometer knob until the coarse azimuth and micrometer scales are on another even-hundred-mil graduation. He alines the aiming posts at this new deflection. The chief of section reports the altered deflection to the executive "Sir, No. (so-and-so) 800 in canyon (or other reason), laid on deflection 700." The executive will then command NO. (SO-AND-SO) LAID, RESET COUNTER TO 3200. The gunner resets azimuth counter to 3200. All subsequent deflection changes must be set on the azimuth counter. The tube is oriented and should not be traversed except on order of the executive.

41. Lays Piece for Elevation (fig. 10)

The gunner sets the announced elevation on the elevation counter, then clamps the elevation counter setting knob in position with the clamping knob. He then elevates or depresses the tube in the direction indicated by the arrows in the elevation vernier until the indexes in the elevation vernier are alined. Final adjustment will be made in the direction of increasing resistance.

42. Sets Common Deflection to Common Aiming Point After Piece Has Been Laid

The battery having been laid, the executive may command AIMING POINT, CHURCH STEEPLE, REFER. At this command, without moving the tube, each gunner turns his sight to the aiming point designated and reports the deflection to the executive. The executive then commands, COM-



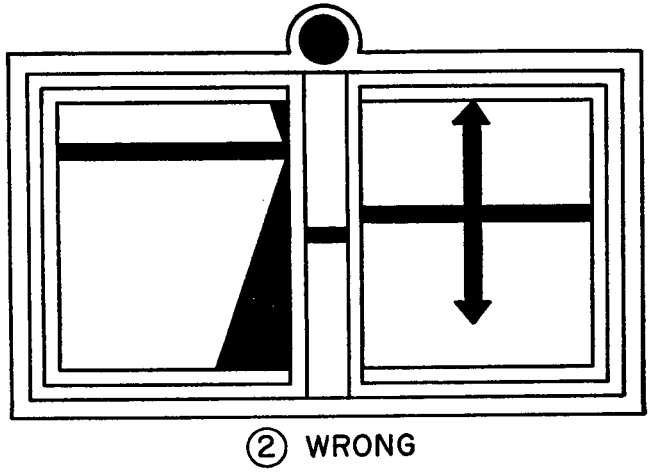


Figure 10. Alining elevation vernier indexes.

MON DEFLECTION 3200. At this command each gunner pushes in on the azimuth counter reset knob and rotates it until 3200 is read on the scale of the azimuth counter. All subsequent deflection changes must be set on azimuth counter. He makes a final check to verify that the line of sight is still on the aiming point.

43. Sets or Changes Deflection

The command is DEFLECTION (SO MUCH). If, for example, the command is DEFLECTION 3300, the gunner rotates the azimuth knob in the appropriate direction until 3300 is read on the azimuth counter. The gunner then traverses the piece until the vertical hair of the reticle is on the left edge of the aiming posts or on a designated aiming point. Final motion for traversing is from left to right.

44. Signals and/or Calls "Ready"

After the piece has been loaded and laid both in direction and elevation and is ready to fire, the gunner will call and/or signal "Ready," by shouting or by raising his right arm, to signify that the piece is ready to fire.

45. Refers Piece

The command from the executive is AIMING POINT THIS INSTRUMENT (OR OTHER POINT), REFER. Without disturbing the laying of the piece, the gunner turns only the sight until, with bubbles level, the vertical cross hair of the

reticle is on the point designated. He then reports the deflection, as read from the coarse azimuth and the micrometer scales, to the executive, "Sir, No. (so-and-so) deflection (so much)."

46. Makes Corrections for Aiming Post Displacement

For details of correcting for aiming post displacement, see paragraph 101.

Section IV. DUTIES OF CANNONEERS AND DRIVER

47. No. 1, List of Duties

(Detailed description of duties, pars. 48–53.)

a. Opens the breech prior to firing the first round.

b. Wipes the bore dry prior to firing the first round, assisted by No. 2.

c. Loads the piece.

d. Fires the piece.

e. Throws expended cartridge cases out the left side of the turret.

f. Closes the breech at the completion of firing.

48. Opens Breech Prior to Firing First Round

No. 1 grasps the breech operating handle with his right hand and releases the breech operating handle catch. He then pushes down on the handle until the breechblock locks in position.

49. Wipes Bore Dry Prior to Firing First Round

Before firing the first round, No. 1, assisted by No. 2, thoroughly dries the bore and chamber to insure that no oil or water is present.

50. Loads Piece

No. 1 grasps the round with his right hand at the base of the cartridge case and his left hand in front of the rotating band. He then faces the breech and, after an elevation has been announced, inserts the round in the breech and *pushes it home* with his right fist and announces "Set." It is extremely important that he use his fist, to guard against getting his fingers crushed by the closing breechblock. No. 1 will be particularly careful to avoid striking the fuze against any portion of the howitzer. A round to be loaded will be held well out of the path of the recoil until the tube is again in battery.

51. Fires Piece

At the command FIRE by the chief of section, No. 1 grasps the lanyard and pulls it to the rear, being careful to stay out of the path of recoil.

52. Throws Expended Cartridge Cases Out Left Side of Turret

After the piece has been fired, No. 1 recovers the expended cartridge case and throws it out the expended ammunition hatch located on the left side of the turret.

53. Closes Breech at Completion of Firing

After firing is completed or when directed by the chief of section, No. 1 closes the breech by tripping the extractors with the base of an expended cartridge case or other appropriate materiel. The extractors should never be tripped by hand because of

the possibility of the hand being crushed by the closing breechblock.

54. No. 2, List of Duties

(Detailed description of duties, pars. 55 and 56.)

a. Passes prepared rounds to No. 1.

b. Inspects and insures that fuze setting is correct.

55. Passes Prepared Rounds to No. 1

No. 2 receives prepared rounds from No. 3 and passes them to No. 1. He positions himself during firing on the door of the ammunition stowage compartment. As he passes the round to No. 1, he checks to make sure that there are no nicks or burrs on the rotating band. He hands the round to No. 1 in such a position that No. 1 may readily receive it as prescribed in paragraph 50.

56. Inspects and Insures That Fuze Setting Is Correct

No. 2 checks the prepared round as he passes it to insure that the fuze setting commanded is actually set on the projectile.

57. No. 3, List of Duties

(Detailed description of duties, pars. 58–61.)

a. Fuzes projectiles or changes fuze.

b. Sets the fuze setter M26 or M28.

c. Sets fuzes.

d. Passes prepared round to No. 2.

58. Fuzes Projectiles or Changes Fuze

No. 3 removes the fuze or closing plug from the projectile; removes (or replaces) the supplementary charge, if necessary; and screws in the designated fuze. In assembling fuzes to, or removing fuzes from projectiles, only the authorized fuze wrench should be used. Variable time (VT) fuzes should be screwed in by hand and tightened with fuze wrench M18, using only manual force. Do not hammer on the wrench or use an extension handle. On fuzes so equipped, No. 3 removes the safety pull wire from the fuze.

59. Sets Fuze Setter M26 or M28

No. 3 releases the time scale clamping screw marked "T" and, grasping the handle, turns the body until the index on the body is opposite the announced time on the time scale. He then locks the time scale clamping screw, being careful not to disturb the setting. For accuracy, he looks squarely at the scales and indexes in the same manner each time.

60. Sets Fuzes

a. Selective Superquick and Delay Fuzes. When fuze quick is commanded, No. 3 will verify the superquick setting. (The slot on the setting sleeve should be alined with the letters SQ.) When fuze delay is commanded, No. 3 will turn the setting sleeve until the slot is alined with the word DELAY.

b. Combination Time and Superquick Fuzes. The combination time and superquick fuze may be set

for time action. After fuzing the projectile, No. 3 removes the safety pull wire from the fuze. For percussion action, the command is FUZE QUICK. For time fuzes, No. 3 verifies that the S on the setting ring is alined with the index on the fixed ring; if not, he sets it at S.

c. Setting Time Fuzes.

(1) *Using fuze setter M26 or M28.* After making the announced setting on the fuze setter M26 or M28, No. 3 carefully places the setter over the fuze and turns the setter in the direction of increasing readings until the notch on the time ring of the fuze engages the stop on the setting ring of the fuze setter. He places the handle in the most convenient position, pushes down on the fuze setter until the notch fully engages the stop, and continues to turn it in the direction of increasing readings until the pawl in the adjusting ring assembly drops into the notch of the fixed fuze ring. This action prevents further turning and indicates that the fuze is set. He then lifts the fuze setter from the fuze and makes a visual check to see if the fuze is properly set. If the fuze is not properly set, he sets the fuze to S by turning the setter in the direction of increasing readings and then resets the fuze.

(2) *Using fuze setter M14 or M27.* Fuze setters M14 and M27 are wrench-type setters in which the time scale on the fuze

is used in setting the fuze. With M500-series fuzes, No. 3 engages the key of the fuze setter in the notch on the setting ring of the fuze and rotates the lower cap in the direction of increasing readings until the announced time setting is opposite the index mark on the fuze.

d. VT Fuzes. The older type VT fuzes (M97) operate and function in such a manner as to require no setting by personnel. The new type VT fuzes (M513-series) have a time setting ring and are set by using the fuze setter M28 in the same manner as the M54-series time fuzes are set by using the fuze setter M26. However, if the fuze setter M28 is not available, the wrench-type fuze setter is used to set the new type VT fuzes. VT fuzes of certain lots are issued with a wax coating on the plastic ogive. This wax coating is necessary for the proper functioning of the fuze and should not be removed. VT fuzes should be used as issued; that is, with the wax coating on the ogive, if so issued, or without a wax coating, if so issued.

61. Passes Prepared Round to No. 2

No. 3 positions himself on the ground as near as possible to the rear of the turret. After No. 3 completes the setting of the fuze, he passes the prepared round to No. 2.

62. No. 4, List of Duties

(Detailed description of duties, pars. 63–65.)

a. Prepares charges.

b. Replaces increments in the cartridge case before rounds are replaced in the container.

c. Assists No. 5 and driver in replacing ammunition in containers as directed by chief of section.

63. Prepares Charges

The fire command will include the designation of the charge. No. 4 verifies the number of increments and removes those increments numbered higher than the charge designated. He then replaces the remaining increments in the cartridge case in their original numerical order. After No. 4 has prepared the charge, he fits the projectile in the cartridge case. Care is taken to prevent damage to the lip of the cartridge case.

64. Replaces Increments in Cartridge Case Before Rounds Are Replaced in Container

Under the personal supervision of the chief of section, No. 4 replaces increments in cartridge cases for all ammunition prepared for firing, but not fired. He checks carefully to see that all seven increments are present, in the proper condition, assembled in the proper numerical order, and of the proper lot number.

65. Assists No. 5 and Driver in Replacing Ammunition in Containers as Directed by Chief of Section

See paragraph 69 for details of replacing ammunition in containers.

66. No. 5, List of Duties

(Detailed description of duties, pars. 67–70.)

a. Sets out aiming posts.

b. Removes ammunition from containers.

c. Replaces unused ammunition in containers.

d. Assists No. 4 in preparing charges as directed by the chief of section.

67. Sets Out Aiming Posts

No. 5 sets out the aiming posts as described in paragraph 100.

68. Removes Ammuniton from Containers

No. 5 removes the taped end from the cartridge case portion of the ammunition container and tilts the container so that the cartridge case can be taken by No. 4 or the driver when available. He then reverses the ends of the container and repeats the process so that the projectile is received by No. 4 or the driver when available.

69. Replaces Unused Ammunition in Containers

Under the personal supervision of the chief of section and assisted by No. 4 or the driver as available, No. 5 replaces unused ammunition in containers. He checks carefully to insure that the lot number on the projectile and cartridge case corresponds to the lot number on the container. He insures that the ammunition is in good condition and complete.

70. Assists No. 4 in Preparing Charges as Directed by Chief of Section

See paragraph 63 for details of preparing charges.

71. Driver, List of Duties

(Detailed description of duties, pars. 72 and 73.)

a. Moves the motor carriage if large deflection shifts are necessary.

b. Assists No. 5 in handling ammunition and performs such other duties as directed by the chief of section.

72. Moves Motor Carriage if Large Deflection Shifts Are Necessary

At the direction of the chief of section, the driver shifts the motor carriage to permit a large deflection shift to fall within the on-carriage traverse limits.

73. Assists No. 5 in Handling Ammunition

When No. 5 is unable to keep up with the ammunition requirements, the chief of section may direct the driver to assist in the handling of ammunition. See paragraphs 68 and 69 for details of handling ammunition.

CHAPTER 6

FIRING BY DIRECT LAYING

Section I. TECHNIQUE OF FIRE

74. General

a. Firing by direct laying is a technique that demands special training. The section must operate as an independent unit. Targets taken under fire by the section in direct laying are usually capable of returning fire on the section at pointblank range; therefore, speed and accuracy are extremely important in direct laying missions.

b. For additional information on firing by direct laying, see FM 6–140.

75. Preparation of Range Card

a. The chief of section is responsible for defense in his assigned sector and should be prepared to fire on targets in other sectors.

b. As soon as possible after occupation of position, the chief of section measures or estimates the ranges to critical points in likely avenues of approach for enemy tanks and vehicles. For quick reference, he prepares a range card (fig. 11) upon which he notes these ranges.

c. If there are no prominent terrain features, stakes may be driven into the ground at critical

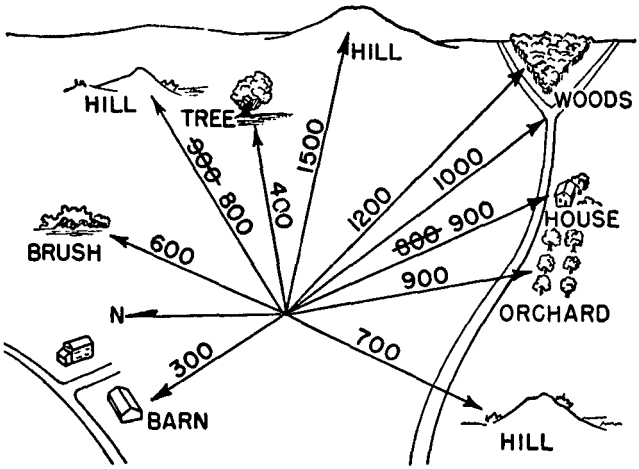


Figure 11. Range card for direct laying.

points for reference. As time permits, the range card should be improved by replacing estimated ranges with more accurate ranges obtained by firing, pacing, taping, vehicular speedometer readings, map measurements, or survey.

76. Field of Fire

The sector of fire for the howitzer should, if possible, be cleared of all obstructions that might endanger battery personnel when the howitzer is fired or that might hinder observation. Care should be taken not to disclose the location of the position.

77. Priority of Targets

Targets for firing by direct laying usually consist of tanks, vehicles, and personnel threatening the battery. Personnel will seldom present themselves

as a clearly defined target. Normally, attacking infantry, using all available cover, reveal themselves only fleetingly. Fire should be conducted on the area containing the attackers rather than on individuals. Tanks usually attack in groups and may be accompanied by infantry. First priority is given to attack of targets within the assigned sector of the howitzer and second priority to targets in other sectors. Priority within the assigned zone is given to—

a. Tanks at short ranges, threatening to overrun the position.

b. Hull down stationary tanks covering the advance of other tanks.

78. Ammunition and Fuzes

a. General. For close-in fires, a variety of fuzes and shells are available. When high explosive shells are used, charge 7 is habitually used for speed, ease in adjustment, imparting forward motion to fragments, and more effective fuze action. The flat trajectory resulting from use of charge 7, coupled with dug-in howitzers, may make extremely close-in fire impossible owing to projectiles skipping without detonating on impact. At ranges of 200 to 400 yards, fuzes may fail to function on hard, flat ground; however, preparation of sectors of fire will remedy this situation. The terrain may be prepared for direct fire by placing mounds of sandbags, dirt, or logs in the sector of fire. When direct fire is placed on these points as they are approached by an attacking force, the necessity for adjusting fire is reduced.

b. Ammunition. Ammunition may be high explosive (HE), high explosive antitank (HEAT), or white phosphorus (WP). HEAT is designed for, and is highly effective in, antitank and antivehicle fires. HE is ideally suited for antipersonnel fire and is effective against vehicles and tanks. WP may be used to set immobile tanks and vehicles on fire, to restrict defiles, and to produce casualties. However, consideration must be given to the effect of the resulting smoke screen on the defense of the howitzer position.

c. Fuzes. HEAT projectiles contain base detonating fuzes. WP projectiles are fuzed with a superquick-delay fuze. HE projectiles may be fuzed with superquick-delay or time fuzes.

(1) Fuze quick is the most desirable fuze to use with HE shell on close-in targets. It is highly effective and, since no fuze setting is required, is much faster to use.

(2) The time required to set the fuze and to adjust the point of impact for maximum ricochet effect makes fuze delay less desirable than fuze quick for close-in targets. When fuze delay is used to gain ricochet effect, the point of impact is adjusted from 10 to 30 yards in front of the target. If less than 50 percent of the bursts are ricochet, the fuze should be changed to quick.

(3) Fuze time is the least desirable fuze for close-in targets. At short fuze settings, variations in timing action give wide range

dispersion of bursts. Hence, this fuze should be used only for ranges of more than 1,000 yards. The areas covered effectively by air and ricochet bursts are similar.

79. Trajectories

Trajectory characteristics change with the type of ammunition and the charge fired. The following trajectory characteristics govern the conduct of fire by direct laying:

a. Ranges from 0 to 400 Yards Using HEAT or Ranges from 0 to 600 Yards Using HE, Charge 7. Within range limits of 0 to 400 yards using HEAT or 0 to 600 yards using HE, charge 7, the trajectory will be flat enough to prevent an 8-foot high tank from passing safely under it. If fields of fire and terrain allow, the upper range limits for the ammunition and charge used are the ideal at which to open fire by direct laying. Direct fire can then be conducted over the maximum time without misses if deflection is correct. Also, there is less risk of obscuring the target with the smoke from a short burst.

b. Ranges from 400 to 700 Yards Using HEAT or Ranges from 600 to 1,000 Yards Using HE, Charge 7. Range limits of 400 to 700 yards using HEAT or 600 to 1,000 yards using HE, charge 7 include the zone in which the trajectory is sufficiently flat to permit direct estimation of range without actually bracketing the target. Assuming little dispersion, if a hit is obtained at the bottom of

an 8-foot high tank firing at the upper range limit, 700 yards, for example, with HEAT, a 100-yard range increase will result in a round that will just brush the top of the tank. During adjustment within this zone, range changes should seldom be more than 100 yards, and frequently range changes of 50 yards will be sufficient. The upper limits mentioned herein are the greatest ranges at which direct fire should be opened unless tactical conditions require otherwise. A trained crew should obtain a hit by the second shot.

c. Ranges from 700 to 1,300 Yards Using HEAT or Ranges from 1,000 to 1,800 Yards Using HE, Charge 7. The zone of 700 to 1,300 yards using HEAT or 1,000 to 1,800 yards using HE, charge 7 includes the ranges at which hits by direct fire are only reasonably possible. Bracket methods are normally used to obtain adjustment in this zone. There is more dispersion in this zone, and direct fire should not be opened at these ranges unless surprise is not important.

d. Ranges Over 1,300 Yards Using HEAT or Ranges Over 1,800 Yards Using HE, Charge 7. At ranges over 1,300 yards using HEAT or over 1,800 yards using HE, charge 7, firing by direct laying is not advisable against moving targets. Dispersion is the controlling factor. Ranges must be known accurately or determined by bracketing. At these ranges the slope of fall of the projectile becomes so great that a hit on a moving target is very difficult to obtain.

80. Vertical Displacement Table

Vertical displacement is the change in the point of burst (up or down) between two rounds fired with different range settings at an upright target. Table IV shows the vertical displacement for a 100-yard range change at various ranges, firing shell HEAT and shell HE, charge 7. The use of vertical displacement in direct fire is explained in FM 6–140.

Table IV. Vertical Displacement (Feet) per 100-Yard Range Change

Range (yards)	Displacement, feet, shell HEAT	Remarks	Displacement, feet, shell HE, charge 7	Range (yards)
100	1	Start firing, using 400-yard range setting.	0.5	100
200	2		1.5	200
300	3		2	300
			2.5	400
			3.5	500
400	4	Start firing, using estimated range. Increase or de-	4	600
500	5.5	crease by multiple of 50 or 100 yards. Bracketing	5	700
600	6	not necessary.	5.5	800
700	8		6	900
			7	1,000
800	9	Bracket target (get bursts over and short) to obtain	8	1,100
900	10.5	hit.	9	1,200
1,000	11.5		10	1,300
1,100	13		10.5	1,400
1,200	14.5		11.5	1,500
1,300	16		13	1,600

Table IV. Vertical Displacement (Feet) per 100-Yard Change—Continued

Range (yards)	Displacement, feet, shell HEAT	Remarks	Displacement, feet, shell HE, charge 7	Range (yards)
			14	1,700
			14.5	1,800
Over 1,300	---------	At ranges over 1,300 yards using HEAT or ranges over 1,800 yards using HE, charge 7, direct fire is too inaccurate to be used against moving targets (par. 79*d*).	---------	Over 1,800

Note. Computed from data obtained from FT 105–H–4.

81. Direct Laying, Using Telescope T150E1

The telescope T150E1 is normally the only sighting instrument used for direct laying. Paragraphs 83 through 97 apply to use of the telescope T150E1 only. The reticle pattern of the telescope is correct when using shell, HEAT. The cross in the pattern represents zero range and deflection for boresighting the broken vertical line in the vertical center of the reticle. The broken lines below the cross represent 400-, 800-, 1,200-, 1,600-, 2,000-, and 2,400-yard ranges. Each horizontal line in the reticle represents a deflection of 5 mils. A cant correction knob and leveling vial are provided on the elbow section of the telescope which permits correction for up to 15° of cant.

82. Direct Laying, Using Panoramic Telescope T149E1

The panoramic telescope T149E1 is used for direct laying in case of emergency only. Direct laying with the panoramic telescope T149E1 is much slower and less accurate than with the telescope T150E1. For a detailed discussion of the use of the panoramic telescope T149E1 in direct laying, see TM 9–717A.

Section II. DUTIES OF CHIEF OF SECTION

83. List of Duties

(Detailed description of duties, pars. 84–91.)

a. Conducts the fire of his howitzer.

b. Alerts his section.

c. Identifies or selects the target.

d. Selects the charge, fuze, and projectile.

e. Determines the direction of movement of the target.

f. Determines the lead in mils.

g. Gives the command for range.

h. Gives subsequent commands based on observed effect.

84. Conducts Fire of His Howitzer

The chief of section conducts the fire of his howitzer when the executive officer commands TARGET (IDENTIFICATION), FIRE AT WILL, or simply FIRE AT WILL.

85. Alerts His Section

The command to alert the section is 1. CANNONEERS, 2. POSTS. At the command, members of the section move to their posts to be ready for the initial fire command. If the target is outside the maximum traverse of the howitzer, the alert is followed by the necessary signals to the driver to get the carriage pointed in the approximate direction of the target.

86. Identifies or Selects Target

If the executive officer designates an object as the target, the chief of section must identify the target correctly. If the target is a group of tanks or other objects, the chief of section selects the target which is the greatest threat to his own position or the position of the supported troops. He repeats the identification to his section, using the minimum

number of words, such as TANK or INFANTRY (OR OTHER TARGET).

87. Selects Charge, Fuze, and Projectile

The chief of section commands the appropriate items in sequence, such as SHELL HE, CHARGE 7, FUZE ____, or SHELL HEAT. He selects the charge, fuze, and projectile in accordance with paragraph 78.

88. Determines Direction of Movement of Target

The chief of section determines the direction of movement of the target and commands TRAVERSE RIGHT (LEFT), STEADY—ON. While giving these commands he looks along the tube or through the periscope M15A1.

89. Determines Lead in Mils

The amount of lead in mils for moving targets is determined by considering the speed of the target, the range, the course, and the ammunition being fired. Figure 12 shows approximate initial leads that should be used for various target speeds and courses in firing HEAT and HE, charge 7. The initial command for lead is LEAD (SO MUCH). During adjustment the lead is changed by the command RIGHT (LEFT) (SO MUCH).

90. Gives Command for Range

The command is RANGE (SO MUCH). The range commanded by the chief of section is that range to be set on the sight reticle. During the ad-

SPEED	LEAD (MILS)			
	Target traveling perpendicular to line of fire		Target traveling 45° to line of fire	
	HEAT	Charge 7	HEAT	Charge 7
Slow (0-10 MPH)	5	5	5	5
Medium (10-20 MPH)	20	15	15	10
Fast (over 20 MPH)	30	25	20	20

Figure 12. Approximate leads.

justment of fire, range is corrected by the command ADD (DROP) (SO MUCH).

91. Gives Subsequent Commands Based on Observed Effect

The chief of section observes each round and gives the necessary commands for changes in lead and range to adjust the burst to the target.

Section III. DUTIES OF REMAINDER OF SECTION

92. Gunner, List of Duties

(Detailed description of certain duties, pars. 93–95.)

a. Corrects for cant of the howitzer.

b. Lays on the target with the announced lead and range.

c. Tracks the target.

d. Commands FIRE.

e. Follows subsequent commands.

93. Corrects for Cant of Howitzer

The gunner checks the leveling vial on the elbow section of the telescope and rotates the cant cor-

rector knob until the bubble is centered. This operation corrects for up to 15° of cant.

94. Lays on Target with Announced Lead and Range and Tracks Target

The lead and range are measured on the horizontal reticle scale of the telescope. The cross in the reticle pattern represents zero range and deflection. The horizontal lines below the cross represent 400-, 800-, 1,200-, 1,600-, 2,000-, and 2,400-yard ranges. Each segment and space represents 5 mils of deflection. The gunner then tracks the target by using the traverse and elevating handwheels, keeping the proper sight picture on the center of the target. See figure 13 for proper sight picture.

95. Commands Fire

After No. 1 has called "Set," the gunner commands FIRE, when ready.

96. No. 1

The duties of No. 1 during direct fire are to open the breech on the first round, to load the howitzer, to call "Set" when the howitzer is loaded, and to fire the howitzer at the gunner's command FIRE.

97. Remainder of Section

The remaining cannoneers perform their duties as prescribed for firing by indirect laying.

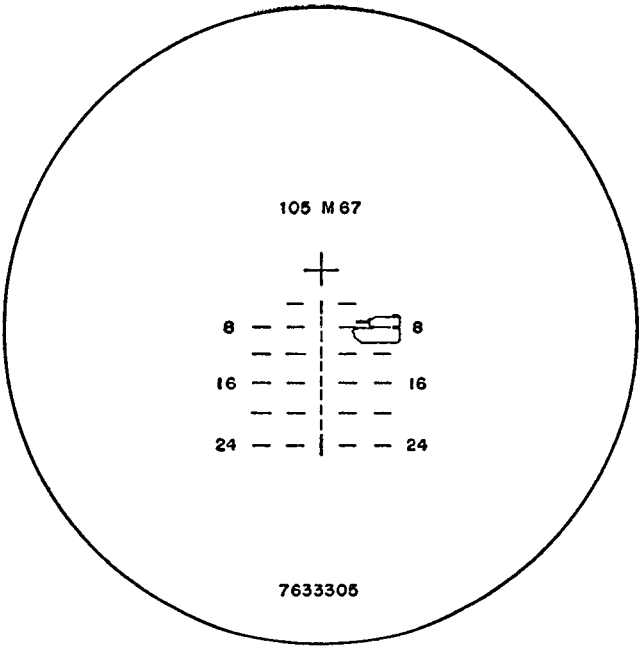


Figure 13. Gunner's sight picture, telescope T150E1, shell HEAT (lead 15 mils, range 800 yards).

CHAPTER 7

TECHNIQUES AND SITUATIONS THAT REQUIRE ATTENTION

98. Precision in Laying

a. Sighting and laying instruments, fuze setters, and elevating and traversing mechanisms must be properly operated to reduce the effects of lost motion. For uniformity and accuracy, the last motion in setting instruments and in laying should be in the direction prescribed in this manual. To insure accurate laying, personnel who lay the howitzer must be required to verify the laying after the breech has been closed.

b. The line of sight when setting and reading a scale or centering a bubble must be at a right angle to the scale or level vial to prevent parallax errors. Bubbles must be centered exactly.

c. For uniformity and accuracy in laying on aiming posts, the vertical cross hair in the reticle of the panoramic telescope must be alined with the left edges of the aiming posts.

99. Aiming Points

a. General. After the howitzer has been laid initially for direction, it is referred to the aiming posts and usually to one or more distant aiming points. An aiming point must have a sharply defined point

or vertical line which is clearly visible from the howitzer so that the vertical cross hair of the panoramic telescope can be alined on exactly the same place each time the howitzer is relaid.

b. Distant Aiming Point. A distant aiming point is one at sufficient distance (at least 2,000 yards) so that normal displacements of the howitzer in firing or traverse will not cause a horizontal angular change in direction (with the same settings on the azimuth scales) of more than one-half mil. The executive officer usually designates the distant aiming point or points to be used.

100. Aiming Posts

a. Two aiming posts are used for each howitzer. Each aiming post is equipped with a light for use at night. The most desirable distance from the howitzer to the far aiming post is 100 yards, considering accuracy of laying, visibility, and ability to control the aiming post lights. First, the far aiming post is set up and alined. The near aiming post is then set up and alined halfway between the far aiming post and the howitzer. The vertical cross hair of the panoramic telescope must be on the left edge of the aiming posts for proper alinement. To insure equal spacing of aiming posts, the distance to both the near and the far aiming post should be paced by the same man. If ground conditions make pacing inaccurate, the distance from the howitzer to the aiming posts may be measured by using the panoramic telescope and the aiming post as measuring devices (*d* below).

b. For night use, the aiming post lights should be adjusted so that the far light will appear several feet above the near light. On flat terrain this may be accomplished by using only the lower half of the near aiming post. The two lights placed in this way will establish a vertical line for laying the howitzer.

c. Since the panoramic telescope is mounted at considerable distance from the center of rotation of the top carriage, large changes in deflection will cause misalinement of the aiming posts.

d. To measure the distance from howitzer to aiming posts, the stadia method may be employed by using the panoramic telescope and the aiming post as measuring devices. No. 5 cannoneer, in setting out the aiming posts, holds the upper section of one of the aiming posts in a horizontal position, perpendicular to the line of sighting. The gunner measures the length of this section in mils on the horizontal cross hair of the panoramic telescope. For example, the upper section of the aiming post is 4½ feet long and measures 15 mils when it is 100 yards from the howitzer. The proper location for the near aiming post, in this case, would be at the point at which the 4½-foot section measures 30 mils. In many cases, the ideal spacing of 50 and 100 yards cannot be obtained, but the aiming posts will be properly spaced when the near aiming post is set at a point where one section of the aiming post (4½ ft) held horizontally measures twice the number of mils on the horizontal cross hair that it measured at the far aiming post location. This measurement may be performed at night by attaching the night lighting

devices on the ends of one section of an aiming post and holding it horizontally.

101. Correction for Displacement of Aiming Posts

When the gunner notes that the vertical cross hair of the panoramic telescope is displaced from the line formed by the two aiming posts (or aiming post lights), he lays the howitzer so that the far aiming post (light) appears exactly midway between the near aiming post (light) and the vertical cross hair (fig. 14). If the displacement is due to traversing the howitzer, the gunner continues to lay as described above. If the displacement is due to progressive shifting of the carriage from shock of firing or other cause, the gunner will notify the chief of section, who, at the first lull in firing, will notify the executive and request permission to realine the aiming posts. To realine, the howitzer is laid with the far aiming post midway between the near aiming post and the vertical cross hair (fig. 14). The far aiming post is moved into alinement with the vertical cross hair of the telescope and then the near aiming post is alined. If terrain conditions make it impossible to move 1 of the 2 aiming posts, the howitzer is laid for direction and both aiming posts are alined to the right rear of the howitzer at the commanded deflection.

102. Testing Target

a. If the regular testing target or a visible distant aiming point is not available, a testing target may be improvised either by drafting the aiming

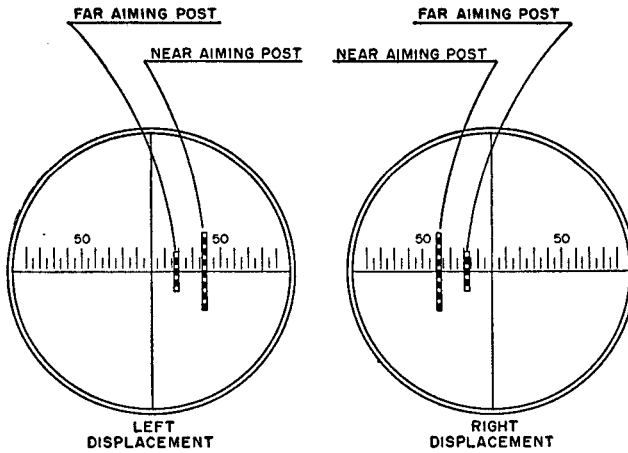


Figure 14. Gunner's sight picture of aiming posts in proper relationship when correcting for displacement.

diagrams to the correct measurements (TM 9–324A) or by the following technique:

(1) Carefully boresight the howitzer on a distant aiming point.

(2) Place a flat piece of masonite, wallboard, or similar material covered with a sheet of weather-resistant paper 50 yards in front of the howitzer so that its face is perpendicular to the line of sight through the tube. To render the testing target stable, the target may be fastened to a stand constructed for that purpose.

(3) Without disturbing the relationship of the telescopes to the tube, mark on the paper the centers of the lines of sight through the telescopes and the tube.

(4) From the centers marked, construct aiming diagrams such as those found on standard testing targets.

b. For use in either leveling or canting the testing target, a mil scale may be drawn at the bottom of the target. A small nail at the top marks the center from which the arc was drawn and provides a hook from which to suspend the plumb line (fig. 15).

c. Vertical reference lines may be drawn through the centers of each of the diagrams (fig. 15). These lines may be used when the trunnions cannot be leveled by setting the testing target with the cant angle of the howitzer. The target is tilted until the line of sight through the tube tracks the tube reference line when the tube is elevated or depressed. Then, the panoramic telescope should be adjusted so that its vertical cross hair tracks between the appropriate reference lines when the tube is elevated or depressed.

103. Cease Firing

The command CEASE FIRING is normally given to the howitzer section by the chief of section, but in emergencies anyone present may give the command. At this command, regardless of its source, firing will cease immediately. If the howitzer is loaded, the chief of section will report that fact to the executive. The executive acknowledges this announcement by saying "No. (so-and-so) loaded." If CEASE FIRING came from the fire direction center, firing is resumed at the announcement of the elevation. If CEASE FIRING came from within

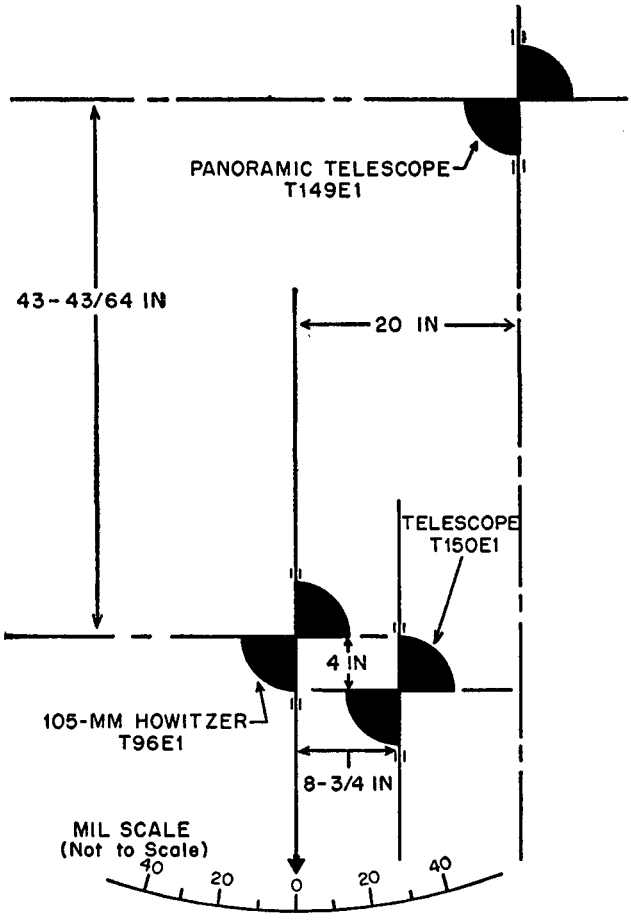


Figure 15. Vertical reference lines and mil scale drawn on testing target.

the firing battery, the executive will investigate the condition that caused the command to be given. When the condition is corrected, firing is resumed at the executive's announcement of the elevation.

104. Changes in Data During Firing

a. If a change in firing data is made before the howitzer is loaded, the corrected data is announced. The new data is then set off and firing is resumed at the announcement of the elevation.

b. If a change in firing data is made after the howitzer is loaded, the command CEASE FIRING is given. If no change in fuze setting is required, or if the howitzer is loaded with percussion-fuzed shell, the new data is set off and firing is resumed at the announcement of the elevation. If the howitzer is loaded with time-fuzed shell and the data requires a change in fuze setting, the chief of section will suspend firing and that fact will be reported to the executive; for example, "No. 2 loaded, time (so much)." The howitzer will not be unloaded unless directed by the executive. In continuous fire, changes in data are so applied as not to stop the fire or break its continuity.

105. To Unload Piece

a. A complete round, once loaded, should always be fired in preference to being unloaded, but military necessity may dictate otherwise.

b. When the command UNLOAD is given, No. 1 opens the breech slowly; No. 2, standing at the breech, receives the ejected round or cartridge case.

c. Should the extractor fail to extract the complete round, the staff and unloading rammer (head) is used. Unloading will be done only under the immediate supervision of an officer. The officer inspects the recess in the head of the rammer to assure that it is free from obstructions. No. 1 then inserts the rammer in the bore until the head incloses the fuze and comes into contact with the projectile. He pushes and, if necessary, taps the rammer staff slightly or operates the spring-operated rammer until the round is dislodged. He then pushes the round out of the breech and No. 2 receives it.

d. If the cartridge case is extracted but not the projectile, No. 1 fills the chamber with waste and closes the breechblock. He dislodges the projectile as in *c* above. No. 2 then opens the breech, removes the waste, and receives the projectile as No. 1 pushes it to the rear.

e. For further information on unloading, see FM 6–140 and TM 9–324A.

f. In case of a misfire, the instruction in paragraph 142 will be followed.

106. Care of Ammunition

a. To insure uniform results in firing, to prolong the life of the tube, and to avoid accidents, care must be exercised in the storage and handling of ammunition at the battery. Provisions of TM 9–1900 applicable to field service should be followed carefully. In the field, conditions existing in each

position will determine the amount of time, labor, and materials required to store and preserve the ammunition adequately. If the position is to be occupied for only a few hours, a tarpaulin spread on the ground may be sufficient; for longer periods of time, more elaborate facilities should be provided.

b. Ammunition must be protected from damage. When ammunition is received, it should be sorted into lots and placed in the best available storage. Powder temperature should be kept as uniform as possible. Ammunition data cards should be kept until after all ammunition for that lot is expended. Ammunition should be left in containers until its early use is expected. Protection should be provided against moisture, dirt, direct rays of sun and, as far as practicable, artillery fire and bombing. Protection from weather, dirt, and sun may be obtained by the use of tarpaulins below and above ammunition and dunnage between the layers. Projectiles stacked in the open should be raised off the ground by at least 6 inches. If drainage is not good, ditches should be dug around the stacks. A liberal use of dunnage should be made between layers, and covering tarpaulins should be raised at least 6 inches from the stack to insure adequate ventilation. Each stack should contain not more than 75 rounds and should be not more than 4 layers high. Stacks should be at least 10 yards apart.

c. For further information on care of ammunition, see FM 6–140, TM 9–324A, TM 9–1900, and TM 9–1901.

107. Section Data Board

When positions are occupied for more than a few hours, data boards may be used by each section for recording such items as deflections to aiming points, calibration corrections when appropriate, minimum elevations, data for barrages and counterpreparations, and other data which may be needed quickly. If such information assumes a standard pattern, the section may paint a form on the inside of the hull and chalk in the various items of information in the appropriate spaces.

108. Hand Signals

Standard hand signals are used to indicate to the driver the proper movement of the motor carriage. Dismounted signals are given facing the driver and are as illustrated in FM 21–60 and FM 25–10.

CHAPTER 8

BORESIGHTING AND BASIC PERIODIC TESTS

Section I. GENERAL

109. Purpose and Scope

The purpose of this chapter is to outline the procedures for boresighting and for making basic periodic tests of on-carriage fire control equipment. The procedures covered will include only those that may be accomplished at battery level.

110. Equipment

The equipment listed in *a* through *d* below is needed for performing boresighting and periodic tests.

a. Boresights. Front and rear boresights or improvised substitutes are necessary for boresighting and testing. If boresights are not available, cross hairs may be fastened on the muzzle and the firing pin hole in the breechblock bushing may be used as a rear sighting guide by removing the firing lock from the closed breechblock.

b. Testing Target. A testing target (par. 102) or suitable substitute is needed for both boresighting and testing. If the testing target is not available, a clearly defined aiming point 2,000 yards or more from the gun may be used for boresighting.

c. Tools. The section equipment includes all the necessary tools for boresighting and testing. Care must be taken in using the screwdrivers and wrenches to insure that damage to fastenings does not result through carelessness or the use of inappropriate tools.

d. Plumb Line. Although not essential for boresighting, it is necessary that a plumb line be used in the basic periodic test in order to obtain maximum accuracy. The farther from the gun that the plumb line is placed, the longer the line must be. To keep a long plumb line taut it may be necessary to add weight to the line. Wrenches or rocks may be used. The tendency of the weight to swing may be decreased by placing a bucket containing water or other liquid under the plumb line so that the plumb bob is partially immersed in the liquid. A plumb line strung from a building or tree is desirable and should be used if possible. Units in garrison may find it convenient to rig a plumb line on a building. The line may then be nailed in place so that it can be used permanently.

Section II. BORESIGHTING

111. General

a. Description. Boresighting consists of alining the line of sight through on-carriage fire control instruments parallel to the line of sight through the center of the tube. Boresighting is conducted by section personnel before firing and during lulls in firing.

b. Methods. The three general methods of boresighting the weapon are the—

(1) Testing target method.

(2) Distant aiming point method.

(3) Standard angle method.

c. Leveling. Prior to starting the tests, the howitzer should be placed in the center of traverse. The vehicle should be placed upon ground as level as possible, since no means are provided on the carriage for cross-leveling the trunnions. The ground may be built up under one track to assist in approximately leveling the trunnions. There should be no more than 20 mils of cant in the trunnions during any boresighting operation.

112. Conditions

The on-carriage sighting equipment of the weapon is in correct adjustment and "boresighted" when the conditions in *a* through *d* below exist.

a. Mounts and instruments are securely attached and there is no binding or excessive backlash between the gears.

b. The lines of sight of on-carriage sighting equipment are parallel to the axis of the bore.

c. All scales and indexes read zero.

d. All bubbles are leveled.

113. Testing Target Method

a. General. It is essential that the proper testing target be used for the weapon being boresighted. If a testing target is not available, a substitute may

be constructed as explained in paragraph 102. The testing target method consists of boresighting by using the aiming diagrams on the testing target as aiming points. The steps to be followed are as follows:

(1) *Trunnions.* Although it is not absolutely necessary to level the trunnions for boresighting, it is advisable to do so whenever possible. Accurate results can be obtained more readily if the trunnions are level, because then a corresponding tilt does not have to be introduced in the mounts and testing target. In no case should there be more than 20 mils cant.

(2) *Tube.* Level the tube by using the gunner's quadrant on the leveling plates of the breech ring. Make certain that the shoes on the gunner's quadrant are positioned between the engraved lines on the leveling plates.

(3) *Boresights.* Open the breech and insert the breech boresight in the chamber. Attach the muzzle boresight, stretching linen cords across witness marks on the muzzle and securing the ends by placing a strap around the end of the muzzle over the cords.

(4) *Panoramic telescope mount level.* The level of the locating plate is checked by insuring that the bubbles in the leveling segment level vials and the leveling mechanism level vials are accurately centered.

b. Elevation Counter. To make the elevation counter reading agree with the tube elevation, place the gunner's quadrant on the breech pads and, by elevating or depressing, bring the tube to *0* elevation. Rotate the elevation counter setting knob until the elevation vernier indexes are alined. If the counter reading does not agree with the gunner's quadrant reading within plus or minus one-half mil, zero the elevation counter, loosen the lock setscrew in the side of the bellcrank (fig. 16) and, with a $\frac{5}{32}$-inch hex setscrew wrench, turn the bellcrank adjusting screw until the elevation vernier indexes are alined. Tighten the lock setscrew while making certain that the adjustment does not change.

Note. Some T179 mounts will have a setscrew or capscrew on top of the bellcrank adjusting screw. This screw must be removed before the bellcrank adjustment can be made.

c. Testing Target Alinement. Place the testing target at least 50 yards in front of the howitzer with the face of the target perpendicular to the line of sight through the tube. Position the target so that the bore diagram is alined with the boresight. While elevating and depressing the tube, tilt the target until the intersection of the muzzle boresight cords tracks between the vertical reference lines on the bore diagram without deviation. Fix the target in this position. Elevate or depress the tube to aline the intersection of the muzzle boresight cords with the center of the bore diagram.

d. Panoramic Telescope Alinement. Rotate the elevation and azimuth knob until the horizontal and

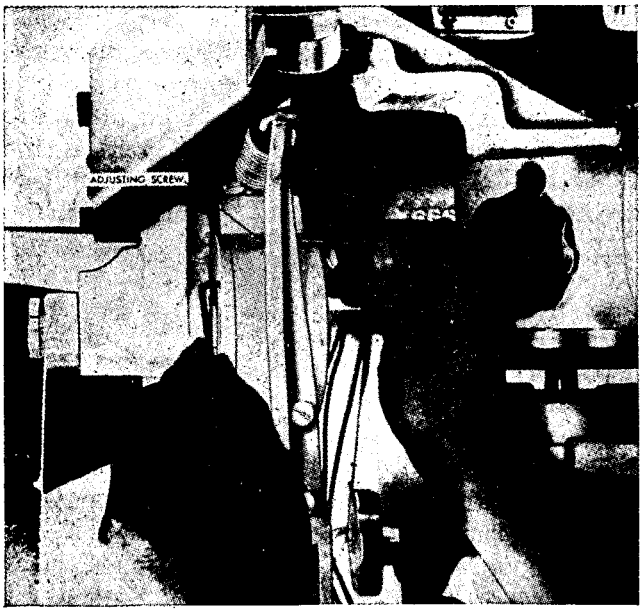


Figure 16. Bellcrank adjustment.

vertical lines of the reticle pattern are alined with the horizontal and vertical lines respectively on the panoramic telescope diagram on the testing target. The coarse azimuth scale and the micrometer scale of the panoramic telescope should now read 0; if they do not, loosen the locking screws on the micrometer scale and slip the micrometer scale to 0. Then tighten the locking screws, being careful not to disturb the setting of the telescope or scales.

e. Direct Fire Telescope Alinement. After procedures prescribed in *c* above are performed, rotate the cant correction knob to level the cant correction

level vial. Unlock the boresight knob locking levers. Rotate the azimuth and elevation boresight knobs until the cross hairs at zero range on the reticle pattern are alined with the center of the direct fire telescope diagram on the testing target. If the cross hairs of the telescope cannot be brought into coincidence with the lines on the aiming diagram by using the boresight knobs, notify ordnance maintenance personnel.

114. Distant Aiming Point Method

The distant aiming point method of boresighting consists of alining the lines of sight of on-carriage fire control equipment and the line of sight through the axis of the tube on a common point at least 2,000 yards away from the howitzer. A distant aiming point may be used if a testing target is not available or if its use is impractical. The steps prescribed for the testing target method apply except that both the boresights and the optical sights are alined on the same point instead of on separate diagrams of a testing target. Accurate leveling of the trunnions is unnecessary.

115. Standard Angle Method

a. General. Conditions may exist when the boresighting methods previously described are impractical. Under such circumstances, the howitzer may be boresighted by referring to a selected point on the muzzle. The deflection and elevation angles necessary to refer the line of sight of the panoramic telescope to the selected point on the muzzle are referred to as the standard angles. Once the stand-

ard horizontal and vertical angles are determined, they may be used for quick boresighting when more precise methods cannot be used. Correction of misalinement as a result of this test should be verified by a more accurate method at the earliest opportunity. In using the standard angle method of boresighting, be sure that the position of the recoiling parts with respect to the nonrecoiling parts is the same as when the standard angles are determined.

b. Preliminary Operations. The ideal time to determine the standard angles for later use is after performing basic periodic tests when the trunnions are level (par. 111*c*) and the panoramic telescope mount is known to be in correct alinement (par. 113*d*). The procedure for determining standard angles is as outlined in (1) through (8) below.

(1) With the tube in battery, scribe lines in the paint to mark the normal position of the parts that move in recoil with respect to the parts which do not move in recoil.

(2) Boresight the howitzer by using a testing target.

(3) With adhesive tape, fasten a bright common pin in the right horizontal witness mark at the muzzle of the tube. Allow the pin to project to the right of the muzzle (fig. 17).

(4) Fasten the telescope parallax shield in place over the eyepiece.

(5) By turning the azimuth micrometer scale and elevating or depressing the tube as

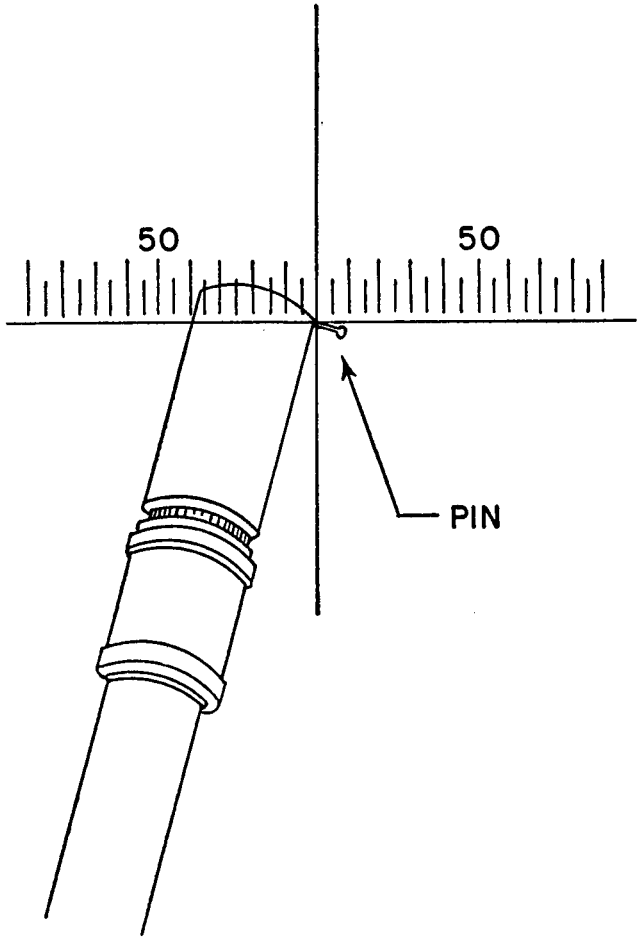


Figure 17. Sight picture of projecting pin.

necessary, place the horizontal cross hairs of the panoramic sight on the metal pin in the right horizontal witness mark of the tube.

(6) Verify that the sight mount is level and that the intersection of the horizontal and vertical cross hairs of the panoramic telescope are exactly on the junction of the pin with the muzzle.

(7) Read and record the deflection from the panoramic telescope, estimating to the nearest one-fourth mil. This is the standard azimuth angle for the howitzer tested.

(8) With the gunner's quadrant seated on the quadrant seats, measure and record the elevation of the tube to the nearest one-fourth mil. This is the standard elevation angle for the howitzer tested.

c. Performance of Standard Angle Method. Once the standard angles have been determined and recorded, the steps in performing the standard angle method of boresighting are as outlined in (1) through (5) below.

(1) Verify that the parts that move in recoil are in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined.

(2) Fasten a pin in the right horizontal witness mark of the muzzle so that the pin projects out to the right of the muzzle.

(3) Place the parallax shield on the eyepiece of the telescope.

(4) Set off the standard elevation and azimuth angles (*b*(6) and (8) above).

(5) If the intersection of the cross hairs of the panoramic telescope is not exactly on the junction of the pin and the muzzle, the sight is out of adjustment. If the azimuth angle is in error, it may be corrected by battery personnel by slipping the azimuth micrometer scale. If the elevation angle is in error by more than one-half mil, bellcrank adjustment (par. 113*b*) must be performed.

Section III. BASIC PERIODIC TESTS

116. General

Basic periodic tests are performed by the section under the supervision of the battery executive and the artillery mechanic. These tests are performed at the discretion of the unit commander. Suggested times for performance of the tests are once each year if the howitzer is used only for nonfiring training; once every 3 months if the howitzer is fired; as soon as possible after intensive use, accidents, or traversing extremely rough terrain; and whenever the howitzer fires inaccurately for no readily apparent reason. The tests reveal whether or not the on-carriage sighting equipment, the gunner's quadrant, and the fuze setter are in correct adjustment. Preparation for the tests includes—

a. Boresighting the howitzer.

b. Placing the motor carriage on a site that is as near level as possible.

c. Preparing parallax shields for the panoramic telescope T149E1 and telescope T150E1 for it will be necessary to eliminate parallax in viewing a plumb line or testing target at close range. The shield should be the same diameter as the eyepiece lens housing. The shield should be made of stiff cardboard or brass shim stock and should have a vertical and horizontal centered slot $\frac{1}{16}$-inch wide by $\frac{1}{4}$-inch long. The shield should be placed in front of the eyepiece with the slot in the vertical position.

d. Establishing a suitable plumb line for the tests (par. 110*d*).

117. Test of Cross-Level Setting, Telescope Mount T179

For test of cross-level setting, telescope mount T179, see TM 9–324A.

118. Test of Longitudinal-Level Setting, Telescope Mount T179

For test of longitudinal-level setting, telescope mount T179, see TM 9–324A.

119. Test of Elevation Counter Synchronization

With the gunner's quadrant placed on the breech pads, take elevation readings at 0, 225, 625, 1,025, and 1,155 mils, and if the elevation counter and the gunner's quadrant do not agree within $\frac{1}{2}$ mil at *0* elevation and *1* mil at each of the other readings, the synchronization adjustment must be made by qualified ordnance maintenance personnel.

120. Test of Plumb of Reticles in Telescopes T149E1 and T150E1

For test of plumb reticles T149E1 and T150E1, see paragraph 87*c*(6), TM 9–324A.

121. Test of Gunner's Quadrant

The gunner's quadrant must be in proper adjustment before conducting tests and adjustments of other sighting and fire control equipment. Inspect the shoes of the gunner's quadrant for dirt, nicks, or burs. Similarly, inspect the leveling plates on the upper surface of the breech ring. Dirt, nicks, or burs on these surfaces will cause the instrument to give inaccurate readings. For detailed testing of the gunner's quadrant, see paragraphs 122 through 124.

122. End-For-End Test, Gunner's Quadrant

a. Set both the index arm and the micrometer scale of the gunner's quadrant at zero, making sure that the auxiliary indexes match.

b. Place the quadrant on the leveling plates of the breech ring with the "line of fire" arrow on the quadrant pointing toward the muzzle and center the quadrant bubble by turning the elevating handwheel.

c. Reverse the quadrant on the leveling plates (turn it end-for-end). If the bubble recenters, the quadrant is in adjustment and the test is completed.

d. If the bubble does not recenter, try to center it by turning the micrometer knob. If the bubble centers, read the black figures on the micrometer scale

and divide by 2. This result is the correction. Set this correction on the micrometer and level the tube by using the elevation handwheel. Check again by turning the quadrant end-for-end. The bubble should recenter when the quadrant is reversed. If the correction of error is more than plus or minus 0.4 mil, the quadrant must be adjusted by ordnance maintenance personnel.

e. If the bubble does not center as in *d* above, move the radial arm down 1 graduation (10 mils) and perform the following operations: Turn the micrometer until the bubble centers; take the reading on the micrometer, add 10 to it, and divide the sum by 2; place this result on the micrometer, leaving the radial arm at minus 10; center the bubble with the elevation handwheel; and check by turning quadrant end-for-end. The bubble should recenter. If the correction of error is more than plus or minus 0.4 mil, the quadrant must be adjusted by ordnance maintenance personnel.

123. Micrometer Test, Gunner's Quadrant

a. Set the radial arm to read 10 mils on the elevation scale, and set the micrometer at 0.

b. Place the quadrant on the leveling plates on the breech ring with the "line of fire" arrow pointing toward the muzzle, and center the quadrant bubble by elevating the tube.

c. Set the radial arm at 0 on the elevation scale, and set the micrometer at 10 mils.

d. Without disturbing the laying of the tube, reseat the quadrant on the leveling plates. The bubble should center.

e. If the bubble does not center, the micrometer is in error and must be adjusted by ordnance maintenance personnel.

124. Comparison Test, Gunner's Quadrant

Compare readings taken at low, medium, and high elevations with all of the gunner's quadrants of a battery on the leveling plates of a single *piece.* The trunnions of this piece should be level. Any quadrant differing from the average by more than 0.4 mil at any elevation should be sent to ordnance maintenance personnel for adjustment.

125. Application of Correcton, Gunner's Quadrant

When a gunner's quadrant requires a correction as determined by the end-for-end test, the correction is *not* applied during firing. The correction is recorded and applied only when tests are made.

126. Test of Fuze Setters

Examine the stop which fits into the slot in the movable time ring and the adjusting pawl which engages the notch in the fixed fuze ring to see that their edges are not burred or bent. Depress the adjustable pawl against its spring to see that the movement of the pawl is free. Test the fuze setter with fuzes for which it is designed; the time scale on the fuze setter must have the same graduations as the time ring on the fuze.

Table V. Maintenance and Inspection Duties Before Operation (March) (B) and During Halt (D)

Sequence	Chief of section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver
1	(B) (D) Supervises inspection of members of howitzer section in all sequences.	(B) (D) Inspects condition, functioning, and security of sighting and fire control equipment.	(B) Visually checks presence and condition of fire extinguisher.	(B) Removes the breech cover and muzzle cover, and checks for rips and tears.	(B) Inspects rammer staff sections and aiming posts for condition and completeness.	(B) (D) Inspects ammunition for amount and proper storage. Checks storage of extra fuzes.	(B) Inspects tracks visually.	(B) (D) Checks fuel, oil, and coolant levels and spare containers. Inspects for fuel leaks in engine compartment.
2	(B) (D) Checks recoil system for leaks. Checks replenisher indicator rod to see if system has proper level of recoil oil.	(B) Tests operation of elevating and traversing mechanism.	(B) Tests operation of breechblock and firing mechanisms.	(B) Visually inspects periscopes, hull, armor, towing connections, hatches, doors, and paulins.	(B) Checks storage and condition of pioneer tools, swab bucket, and other miscellaneous section equipment.	(B) Inspects communication equipment and wire.	(D) Inspects bumper springs, road wheel arm, shock absorber, and torsion bars to see if they have been damaged.	(B) (D) Observes instruments for normal readings during warmup of vehicle. Checks driving controls of vehicle for operation.
3	(B) Verifies proper supply of gasoline, oil, water, and emergency rations.	(B) Verifies completeness of section equipment and the presence of an adequate supply of cleaning materials.	(B) (D) Checks machine gun and mount for cleanliness, functioning, and security. Checks storage of machine gun ammunition.	(B) Assists gunner in checking completeness of section equipment.	(B) Inspects howitzer and mount for loose parts and for broken or cracked welds.	(B) Assists gunner in boresighting the howitzer.	(B) (D) Inspects under vehicle for leaks.	(B) Engages the turret traverse lock before march.
4	(B) Verifies presence of TM's, weapon record book, lubrication order, trip ticket, driver license, and accident report form.	(B) Checks night lighting devices.	Reports "No. 1 ready."	Reports "No. 2 ready."	Reports "No. 3 ready."	Reports "No. 4 ready."	(B) Checks presence, condition, and operation of lights. Driver operates switches.	Reports "Driver ready."
5	(B) Checks section equipment for loading and completeness.	(B) Boresights the howitzer. (Boresighting should be checked after displacement and prior to firing, if time permits.)					Reports "No. 5 ready."	
6	Reports to battery executive "Sir, No. (so-and-so) in order," or reports any defects which the section cannot remedy without delay.	Reports "Gunner ready."						

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Table VI. Duties in Inspection and Maintenance after Operation

Sequence	Chief of section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	Driver
1	Supervises maintenance and inspections by all members in all sequences.	Tests operation of elevating and traversing mechanisms and cleans and lubricates.	Cleans and lubricates breechblock, assisted by No. 2.	Assists No. 1 in cleaning breechlock.	Cleans bore of howitzer, assisted by No. 4.	Assists No. 3 in cleaning bore of howitzer.	Inspects and lubricates track and suspension system.	Notes engine operation and inspects instruments.
2	Cleans and tests gunner's quadrant.	Inspects condition and operation of sighting and fire control equipment.	Inspects, cleans, and lubricates .50 caliber machine gun, assisted by No. 2.	Assists No. 1 in cleaning .50 caliber machine gun.	Inspects and cleans rammer staff, aiming posts, and pioneer tools.	Inspects condition of ammunition storage and ready rack, and cleans as required.	Assists driver in cleaning suspension system and outside of carriage.	Checks fuel, oil, and coolant levels, and replenishes, if necessary.
3	Posts weapon record book entries and verifies presence of other forms and manuals.	Boresights the weapon.	Cleans and tests firing mechanism.	Cleans inside of turret.	Inspects and cleans contents of section's tool compartment.	Inspects and cleans communications equipment.	Observes ground underneath carriage for evidence of leaks.	Checks all driving controls for proper operation.
4	Inspects recoil system; directs No. 1 to service, if necessary.	Cleans and tests night lighting device.	Checks presence and condition of fire extinguishers.			Assists gunner in boresighting the howitzer.		Assisted by No. 5, cleans suspension system and outside of carriage.
5	Reports to executive "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay or assistance.							

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CHAPTER 9

MAINTENANCE AND INSPECTIONS

127. General

Maintenance and inspection are essential to insure that the section is prepared to carry out its mission immediately. Systematic maintenance and inspection drills provide the best insurance against unexpected breakdown at the critical moment when maximum performance is essential.

128. Disassembly, Adjustment, and Assembly

Disassemblies and adjustments of the weapon authorized to be performed by battery personnel are prescribed in TM 9–717A and TM 9–324A, supplemented by instructions in Department of the Army supply manuals. No deviations from these procedures is permitted unless authorized by the responsible ordnance officer.

129. Records

a. The principal records pertaining to the weapon are the weapon record book (DA Form 9–13 and DA Form 9–13–1), a field report of accidents (AR 385–63), and the unsatisfactory equipment report (DA Form 468). Information on the purpose and use of these records may be found in the records themselves.

b. The principal records pertaining to the motor carriage are the vehicle technical manual, lubrication order, accident report (DA Form 285), and vehicle and equipment operational record (DD Form 110). Information on the purpose and use of these records may be found in the records themselves.

c. The chiefs of sections and the battery executive also should keep semipermanent records on the weapons and vehicles for information and guidance.

130. Maintenance

For detailed instructions concerning maintenance of the howitzer and carriage, see TM 9–324A and TM 9–717A.

131. Inspections

Regular inspections are required to insure that materiel is maintained in serviceable condition.

a. The chief of section is responsible for all of the equipment in his section. He should inspect it thoroughly each day. If he sees the need for repair or adjustment that the section cannot remedy, he notifies the executive immediately so that the necessary action may be taken.

b. The battery executive, accompanied by the artillery mechanic, should make a daily spot check inspection. He inspects different parts of the weapons and carriages each day to insure complete coverage every few days. At least once a month the battery executive makes a thorough mechanical inspection of weapons, motor carriages, auxiliary equipment, tools, and spare parts.

c. Battery, battalion, and higher commanders should make frequent command inspections to assure themselves that the equipment in their commands is being maintained at prescribed standards of appearance, condition, and completeness.

d. For details on inspecting the howitzer and carriage, see TM 9–324A and TM 9–717A.

e. Duties of individuals in performing the necessary inspection and maintenance of the weapon and carriage are given in tables V and VI.

CHAPTER 10

DECONTAMINATION OF EQUIPMENT

132. General

Equipment which has been contaminated by biological, chemical, or radiological agents constitutes a danger to personnel. *Contamination* means the spreading of an injurious agent in any form and by any means. Persons, objects, or terrain can be contaminated. *Decontamination* is the process of making any contaminated place or thing safe for unprotected personnel. This can be done by covering, destroying, removing, or changing into harmless substances the contaminating agent or agents. Generally, only equipment contaminated by persistent agents need be decontaminated.

133. Decontamination for Chemical Agents

a. Ammunition. With rags, wipe off visible contaminant from projectiles. Apply DANC (decontamination agent, noncorrosive, M4), wipe with solvent-soaked rag, and then dry. If DANC is not available, scrub with soap and cool water. Slurry (equal weights of water and chloride of lime) can be used on contaminated ammunition containers, but it must not be allowed to penetrate into the ammunition itself.

b. Instruments. If instruments are exposed to corrosive gases, clean them as soon as possible with

solvent, allow them to aerate, and apply a thin coat of light machine oil. A rag dampened with DANC may be used, followed by drying with a clean rag and then applying a coat of machine oil. DANC injures clear plastic or hard rubber surfaces.

c. Weapons. Remove dirt, dust, grease, and oil from weapons. Do not apply wet mix but allow surfaces to air after oil and dirt have been removed. DANC can be used on all metal surfaces except the bore. Also effective on metal are hot water and soap or cleaning solvent. After decontamination, weapons are dried and oiled.

d. Automotive Equipment. Light contamination from spray can be decontaminated by aeration alone. For heavier contamination, use DANC on exterior or interior surfaces which personnel are likely to touch. For larger area decontamination, wash vehicle with water and scrub painted surfaces with soap and water.

134. Decontamination for Biological and Radiological Agents

a. General. After a contaminating attack, recovery of equipment may be achieved either by waiting, to permit the decay of contamination, or by active decontamination to reduce the danger to a level where it is no longer a significant hazard to operating personnel. Decontamination may be either rough or detailed, depending on the urgency of the military situation. The procedure adopted will be a command decision.

b. Rough Decontamination. Rough decontamination is performed when urgency is the main factor. Its purpose is to reduce contamination sufficiently to permit personnel to work with, or close to, equipment for limited periods. Rough decontamination may be achieved by means of water or steam, if available. Soap or other detergent used in conjunction with water or steam aids in decontamination.

c. Detailed Decontamination. Detailed decontamination, in which the emphasis is on thoroughness, will be carried out in rear areas and repair bases and include procedures of surface decontamination, aging, sealing, and disposal.

135. References

For further information on decontamination, see FM 21–40 and TM 3–220.

CHAPTER 11

DESTRUCTION OF EQUIPMENT

136. General

a. Tactical situations may arise in which it is necessary to abandon equipment in the combat zone. In such a situation all abandoned equipment must be destroyed to prevent its use by the enemy.

b. The destruction of equipment subject to capture or abandonment in the combat zone will be undertaken only upon authority delegated by a division or higher commander.

137. Plans

All batteries will prepare plans for destroying their equipment in order to reduce the time required should destruction become necessary. The principles to be followed are—

a. Plans for destruction of equipment must be adequate, uniform, and easily carried out in the field.

b. Destruction must be as complete as the available time, equipment, and personnel will permit. Since complete destruction requires considerable time, priorities must be established so that the more essential parts are destroyed first.

c. The same essential parts must be destroyed on all like units to prevent the enemy from constructing a complete unit from undamaged parts.

d. Spare parts and accessories must be given the same priorities as the parts installed on the equipment.

138. Methods

To destroy equipment adequately and uniformly, all personnel of the unit must know the plan and priority of destruction and be trained in the methods of destruction.

139. References

For detailed information on destruction of the 105-mm howitzer M52, self-propelled, complete with fire control equipment and spare parts, see TM 9–717A. For destruction of ammunition, see TM 9–1901.

CHAPTER 12

SAFETY PRECAUTIONS

140. General

Safety precautions to be observed in training are prescribed in AR 385–63. Additional information is found in FM 6–140, TM 9–324A, TM 9–717A, TM 9–1900, and TM 9–1901. The more important safety precautions are summarized in paragraphs 141 through 143.

141. Ammunition

a. All ammunition on the ground at the firing position must be so placed that it is protected against explosion in case of accident at the position. Fire and explosive or flammable materials must be kept away from ammunition. Ammunition should be protected from direct rays of the sun by use of a tarpaulin or other suitable covering.

b. Battery personnel must not attempt to disassemble fuzes.

c. If for any reason a round is not fired after the time fuze has been set, the fuze must be reset to SAFE before it is restowed.

d. All rounds not fired which have been prepared for firing must be checked by the chief of section to insure that all seven powder increments are present in proper order and condition and that they are of

the proper lot number. The chief of section also verifies that the lot number on the projectile and the cartridge case corresponds to the lot number on the container. For ammunition that is to be returned to ordnance, a battery officer must certify that it has been properly reassembled (FM 6–140).

142. Misfires

a. In the event of a misfire, two more attempts are made to fire the howitzer. Wait 2 minutes before breach is opened.

Caution: The howitzer should remain as laid and all personnel must stay clear of the muzzle and path of recoil. All personnel not required for the operation should be cleared from the vicinity.

b. After the third attempt to fire the howitzer has been made, the command to unload (par. 105) is given. The breach is opened to extract the cartridge case. Should the complete round be extracted, the projectile is separated from the cartridge case. The primer in the base of the cartridge case is immediately inspected to determine whether the indent is normal. If there is normal indentation, the cartridge case is thrown clear of all personnel to prevent injury in case of a hangfire. The projectile is reloaded with another cartridge case and firing is resumed.

c. See TM 9–324A for action to be taken in case the indent on the primer is light or there is no indent, which indicates that the firing lock is not functioning properly.

d. See TM 9–324A for safety regulations pertaining to misfires.

143. General Safety Precautions During Drill and Firing

a. The howitzer is kept unloaded except when firing is imminent.

b. Members of the section on the ground will pass in rear of the carriage when they go from side to side.

c. Personnel should stay a safe distance from the breech to prevent injury when the gun recoils.

d. During firing, personnel should use cotton in their ears to protect eardrums against injury.

e. In training, there must always be a safety officer for each artillery unit firing. For duties of the safety officer, see FM 6–40.

CHAPTER 13

TRAINING

Section I. GENERAL

144. Purpose and Scope

The purpose of this chapter is to present the absolute minimum requirements for training the personnel of a howitzer section in the performance of their duties in service of the howitzer. It includes general information on the conduct of training, a minimum training schedule, and tests to be given for the qualification of gunners.

145. Objectives

The objectives of training are to speed the attainment of proficiency by cannoneers in their individual duties and, through drill, to weld them into an effective, coordinated team that is able to function efficiently in combat. During training, supervisors should keep in mind the proficiency sought by the appropriate Army Training Tests. Maximum efficiency is attained through regular drills.

146. Conduct of Training

a. Training will be conducted in accordance with the principles set forth in FM 21–5. The goal of training should be the standards set forth in FM 6–125 and AR 611-201.

b. In general, individual training is conducted by noncommissioned officers as far as practicable. Officers are responsible for preparing training plans, for conducting unit training, and for supervising and testing individual training.

c. Throughout training, the application of prior instruction to current training must be emphasized.

d. A record of the training received by each individual should be kept on a progress card which may be maintained by each chief of section for each man in his section. This card should show each period of instruction attended, tests taken, and remarks pertaining to progress. Progress cards should be inspected frequently by the battery executive to make sure they are being kept properly and to determine the state of training. *Requiring the chief of section to keep these records emphasizes his responsibility toward his section.*

e. The necessity for developing leadership and initiative in noncommissioned officers must be emphasized constantly throughout training.

147. Standards To Be Attained

A satisfactory trained howitzer section is one in which each member knows the duties of all other members of the section and is able to perform efficiently in all positions. See chapter 14 for tests to be given for the qualification of gunners.

Section II. MINIMUM TRAINING SCHEDULE

148. General

The training schedule given in paragraph 150 is a guide to meet the minimum training requirements in subjects covered in this manual for personnel of a howitzer section.

149. Individual Periods

a. Individual periods of training in service of the piece should be arranged along with other battery training into a balanced training program, taking into consideration the basic principles of training.

b. In general, except for service practice, periods on any subject should not be longer than 1 hour. Howitzer drill periods should be for ½ hour only and should be conducted in a vigorous manner.

c. Periods of howitzer drills should be preceded and followed by periods on subjects that will be logically related to the drill. For example, a period of howitzer drill should be preceded by a period of testing and adjustment of sighting and fire control equipment and followed by a period on inspection and maintenance drills. A period on aiming post displacement correction may be presented between two periods of howitzer drill.

d. TM 9–324A provides information on which to base periods of instruction on description, characteristics, and functioning of the howitzer; familiarization with the howitzer, including breech and firing mechanism, tube assembly and top carriage,

recoil mechanism, elevating mechanism, and sighting and fire control equipment; and field assembly and malfunction. These periods of instruction should be included in the battery training schedule, closely allied with the training in service of the piece given in paragraph 150. Approximately 8 hours should be devoted to this instruction.

e. Additional service of the piece training may be performed during battery training exercises.

150. Schedule

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW	1	Organization and composition of howitzer section; general duties of individuals; formation of howitzer section.	Pars. 5–8.	Weapon and section vehicles.
C, D, PW	1	Posts and posting of cannoneers; changing posts; mounting and dismounting.	Pars. 9–14, 108.	Do.
C, D, PW	20 (2-hour periods).	Prepare for action and march order.	Pars. 15–18.	TOE equipment.
C, D, PW	24 (½-hour periods).	Howitzer drill, duties in firing by indirect laying.	Pars. 19–73, 99–101, 103–107.	Do.
C, D, PW	9 (½-hour periods).	Howitzer drill, duties in firing by direct laying.	Pars. 74–97.	Do.
C, D, PW	6 (1-hour and ½-hour periods).	Tests and adjustment of sighting and fire control equipment.	Pars. 102, 109–126.	Do.

C, D, PW	1 (½-hour periods).	Aiming post displacement correction.	Pars. 98–101.	TOE equipment, blackboard, and chalk.
C, D, PW	4 (1-hour periods).	Inspection and maintenance drills.	Pars. 127–131.	TOE equipment.
C, D, PW	1	Decontamination of materiel.	Pars. 132–135.	Decontamination and TOE equipment.
C, D, PW	1	Destruction of materiel to prevent use by the enemy.	Pars. 136–139.	Demolition and TOE equipment.
C, D	1	Safety precautions.	Pars. 140–143.	TOE equipment.
PW	16 (4-hour periods).	Service practice, firing by indirect laying.	Pars. 19–73.	Do.
PW	4 (4-hour periods).	Service practice, firing by direct laying.	Pars. 74–97.	Do.
C, PW	6 (1-hour periods).	Review and tests of subjects previously covered.	All previous references.	Do.

CHAPTER 14

TESTS FOR QUALIFICATION OF GUNNERS

Section I. GENERAL

151. Purpose and Scope

This section prescribes the tests to be given in the qualification of gunners. The purpose of the tests is twofold:

a. To provide a means of determining the relative proficiency of the individual artillery soldier in the performance of the duties of the gunner, 105-mm howitzer M52, self-propelled. The tests will not be a basis for determining the relative proficiency of batteries or higher units.

b. To serve as an adjunct to training.

152. Standards of Precision

The candidate will be required to perform the tests in accordance with the standards in *a* through *d* below.

a. Scale settings must be exact, and matching indexes must be brought into coincidence.

b. Level bubbles must be exactly centered.

c. The vertical cross hair in the reticle of the panoramic telescope must be alined on the left edge of the aiming post or on exactly the same part of the aiming point each time the howitzer is laid.

d. Final motions of azimuth and elevation setting knobs, as well as traversing and elevating handwheels, must be made in the appropriate direction. For elevating, the final motion of the handwheel should be in the direction of the more difficult movement. Final motion for traversing is from left to right. Final movement of the vertical cross hair of the telescope is from left to right.

153. Assistance

The candidate will receive no unauthorized assistance. Each candidate may select authorized assistants as indicated in the tests. In the event a candidate fails any test through the fault of the examiner or any assistant, the test will be disregarded, and the candidate will be given another test of the same nature.

154. Time

The time for any test will be the time from the last word of the command to the last word of the candidate's report. The candidate may begin any test after the first word of the first command.

155. Scoring

Scoring will be accordance with the two paragraphs, *Penalties* and *Credit,* under each subject. If a test is performed correctly, credit will be given in accordance with the paragraph *Credit* under each subject. No credit will be allowed if conditions exist as specified in paragraph titled *Penalties.*

156. Preparation for Tests

The howitzer will be prepared for action and the candidate posted at the proper position corresponding to the test being conducted or as indicated in paragraph entitled *Special Instructions.* The examiner will insure that the candidate understands the requirements of each test and will require the candidate to report "I am ready," before each test.

157. Qualification Scores

Minimum scores required for qualification in the courses are as follows:

Individual classification	*Points*
Expert gunner	90
First-class gunner	80
Second-class gunner	70

158. Outline of Tests

Section No.	Subject	Number of tests	Points each	Maximum credit
II	Direct laying, direct fire telescope.	4	2	8
III	Indirect firing, deflection only.	18	2	36
IV	Displacement correction—	1		4
	Part I		(3)	(3)
	Part II		(1)	(1)
V	Measuring deflection.	2	4	8
VI	Laying for elevation, elevation counter.	3	2	6
VII	Laying for elevation, gunner's quadrant.	3	2	6
VIII	Measuring the elevation.	1	5	5
IX	Measuring site to mask.	1	4	4

Section No.	Subject	Number of tests	Points each	Maximum credit
X	Tests and adjustment of sighting and fire control equipment.	2	4	8
XI	Materiel.	3	5	15
	Total credit			100

Section II. TEST, DIRECT LAYING, DIRECT FIRE TELESCOPE

159. Scope of Tests

a. Four tests (2 groups of 2 tests each) will be conducted in which the candidate will be required to execute commands similar to those in paragraph 161.

b. Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

c. The candidate will be tested in the duties of the gunner.

160. Special Instructions

a. A stationary target will be placed approximately 600 yards from the howitzer.

b. Coarse azimuth and micrometer scale will be set at zero, and indexes will be matched.

c. Candidate will be posted as the gunner.

d. Howitzer will be pointed so that a shift of approximately 100 mils will be required for tests 1 and

3, and it will not be necessary to shift the motor carriage for any of the 4 tests.

e. Laying at the termination of tests 1 and 3 will not be disturbed prior to beginning tests 2 and 4.

f. Examiner will announce the assumed direction of the movement of the target at the beginning of tests 1 and 3. The assumed direction of the movement of the target in test 3 will be opposite to that in test 1.

161. Outline of Test

Test No.	Examiner commands (for example)	Action of candidate
1 and 3	TARGET, THAT TANK; FROM LEFT TO RIGHT, LEAD 5, RANGE 600.	Centers cant corrector bubbles. Traverses tube until proper lead has been set. Places proper range line of reticle on the center of the visible mass of the target. Gives the command, FIRE, when ready and steps clear.
2 and 4	RIGHT (LEFT) 10, ADD (DROP) 200.	Same as test 1 above.

162. Penalties

No credit will be allowed if, after each test—

a. Azimuth scale has been moved from zero.

b. Indexes on the azimuth micrometer have been moved from zero.

c. Cant corrector bubbles on the telescope mount are not centered.

d. Lead in mils is not set properly.

e. Proper range line of the reticle is not on the center of the visible mass of the target.

163. Credit

Time in seconds, exactly or less than	4	4⅔	5
Credit	2.0	1.5	1.0

Section III. TEST, INDIRECT FIRING, DEFLECTION ONLY

164. Scope of Tests

Eighteen tests will be conducted in which the candidate will be required to execute commands similar to those in paragraph 166. Tests 1 through 4 (and test 5 through 9, 10 through 13, and 14 through 18) will be executed as one series of commands.

165. Special Instructions

a. Commands will not necessitate manual shifting of the howitzer beyond the limits of on-carriage traverse.

b. Examiner will select a suitable aiming point and identify it to the candidate.

c. Commands for special corrections will be given *only* in the tests indicated in paragraph 166.

d. Command for new deflections for each test will be within the following prescribed limits:

Test No.	Maximum change (mils)	Minimum change (mils)
2 and 11	180	140
3 and 12	90	70
4 and 13	40	20
7 and 16	100	60
8 and 17	50	30
9 and 18	20	10

e. Piece will be laid with correct settings at the conclusion of each test before proceeding with the next test.

f. Aiming posts will be set out at prescribed deflection and distances for these tests.

g. Examiner will designate the numbered section to be used. The examiner will announce special corrections in deflection to be applied by the candidate.

h. Candidate will be posted as the gunner.

166. Outline of Test

Test No.	Examiner commands (for example)	Action of candidate
1 and 10	SPECIAL CORRECTIONS, DEFLECTION 3190, NO. 1, LEFT 7.	Levels the leveling mechanism bubbles of the telescope. Sets deflection and special corrections. Traverses tube until vertical cross hair is on left edge of aiming posts. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
2 and 11	DEFLECTION 3345.	Sets deflection change. Lays on aiming posts. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
3 and 12	DEFLECTION 3255.	Same as test 2 above.
4 and 13	No. 1, RIGHT 4. At conclusion of test 4 (13) give CEASE FIRE, END OF MISSION. (No time considered for this operation.)	Same as test 2 above.

Test No.	Examiner commands (for example)	Action of candidate
5 and 14	AIMING POINT, CHURCH STEEPLE, REFER.	Refers telescope to church steeple. Reads deflection and calls "No. 1, deflection (so much)."
6 and 15	DEFLECTION 3000, REFER.	Sets deflection on azimuth counter. Verifies that vertical cross hair of the reticle is on church steeple. Calls "No. 1, deflection 3000."
7 and 16	SPECIAL CORRECTIONS, DEFLECTION 3083, NO. 1, RIGHT 9.	Same as test 1 above.
8 and 17	DEFLECTION 3100.	Same as test 2 above.
9 and 18	DEFLECTION 3094.	Same as test 2 above.

167. Penalties

No credit will be allowed if, after each test—

a. Deflection is not set correctly.

b. Leveling mechanism bubbles are not centered.

c. Vertical cross hair of the telescope is not on the aiming point or left edge of aiming posts, as the case may be.

d. Last motion of the traverse was not made to the right.

168. Credit

Time in seconds, exactly or less than—			
Tests 1, 10, 6, and 15 each	12	13	14
Other tests, each	8	9	10
Credit	2.0	1.5	1.0

Section IV. TEST, DISPLACEMENT CORRECTION

169. Scope of Test

One test, consisting of two parts, will be conducted in which the candidate will be required to execute the commands given in paragraph 171.

170. Special Instructions

a. Aiming posts will be set out at the prescribed distances.

b. An assistant, selected by the candidate, will be stationed close to the far aiming post.

c. Examiner will require the candidate to lay the howitzer on an announced deflection and report, "I am ready."

d. The far aiming post or the howitzer will then be moved so that a displacement of 5 to 10 mils occurs.

e. Laying of the howitzer at the termination of part I will not be disturbed for part II.

171. Outline of Tests

a. Part I.

Examiner commands	Action of candidate
CORRECT FOR DISPLACEMENT.	Lays the howitzer so that the far aiming post appears midway between the near aiming post and the vertical cross hair of the reticle of the telescope. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.

b. Part II.

Examiner commands	Action of candidate
ALINE AIMING POSTS.	Records deflection on breech and announces "Deflection (so much) recorded." Directs assistant in alining aiming posts. Calls "Ready" and steps clear.

172. Penalties

No credit will be allowed for either part if—

a. Part I.

(1) Far aiming post does not appear midway

betweeen the near aiming post and the vertical cross hair of the telescope.

(2) Level bubbles are not centered.

(3) Last motion of traverse was not made to the right.

b. Part II.

(1) Deflection is not the announced deflection.

(2) Aiming posts are not properly alined.

(3) Vertical cross hair of the telescope is not on the left edge of the aiming posts.

173. Credit

Part I, time in seconds, exactly or less than.	3	3⅓	3⅔	4
Credit	3.0	2.0	1.5	1.0
Part II, no time limit				
Credit	1.0			

Section V. TEST, MEASURING DEFLECTION

174. Scope of Test

Two tests will be conducted in which the candidate will be required to measure and report a deflection in accordance with the commands in paragraph 176.

175. Special Instructions

a. Howitzer will be laid on aiming posts to the right front.

b. Examiner will select two aiming points. The aiming point for test 1 will be within 200 mils to the left or right of the aiming posts; and the aiming

point for test 2 will be within 200 mils on the opposite side of the aiming posts.

c. The appropriate aiming point will be designated by the examiner and identified by the candidate prior to the start of each test.

176. Outline of Test

Test No.	Examiner commands	Action of candidate
1	NO. 1, AIMING POINT, CHURCH STEEPLE TO LEFT FRONT, REFER.	Centers leveling mechanism bubbles. Refers to aiming point. Checks centering of bubbles and re-lays telescope if necessary. Reads deflection and reports "No. (so-and-so) deflection (so much)" and steps clear.
2	NO. 1, AIMING POINT, WATER TOWER, RIGHT FRONT, REFER.	Same as test 1 above.

177. Penalties

No credit will be allowed if—

a. Leveling mechanism bubbles are not centered properly.

b. Vertical cross hair of the telescope reticle is not on the aiming point.

c. Deflection is not announced correctly.

d. Traversing handwheel is turned.

178. Credit

Time in seconds, for each test, exactly or less than.	5	5⅝	6	6⅝
Credit	4.0	3.0	2.0	1.5

Section VI. TEST, LAYING FOR ELEVATION, ELEVATION COUNTER

179. Scope of Test

Three tests will be conducted in which the candidate will be required to execute commands similar to those in paragraph 181.

180. Special Instructions

a. Each test will require a change of settings and the accompanying laying of the tube in elevation. (All commands given will be within the limits of 200 to 400 mils on the elevation counter.)

b. Commands for elevation for tests 2 and 3 will not be made in multiple of 5 mils.

181. Outline of Test

Test No.	Examiner commands (for example)	Action of candidate
1	ELEVATION 290.	Sets announced elevation. Matches elevation counter vernier. Checks level bubbles. Calls "Ready."
2	ELEVATION 326.	Same as test 1 above.
3	ELEVATION 323.	Same as test 1 above.

182. Penalties

No credit will be allowed, if after each test—

a. Elevation counter is not set accurately.

b. Elevation counter vernier is not matched.

c. Last motion of the tube was not in the direction in which it is most difficult to turn the elevating handwheel.

183. Credit

Time in seconds, exactly or less than	6⅜	7⅜	8⅜
Credit	2.0	1.5	1.0

Section VII. TEST, LAYING FOR ELEVATION, GUNNER'S QUADRANT

184. Scope of Tests

Three tests will be conducted in which the candidate will be required to execute commands similar to those in paragraph 186.

185. Special Instructions

a. Gunner's quadrant will be set at zero for the first test.

b. Each succeeding test will require a change of quadrant setting within the limits of 30 to 60 mils.

c. Candidate will be posted to the left of and facing the breech, with the gunner's quadrant in his hand.

d. An assistant, selected by the candidate, will be posted to operate the elevating handwheel.

186. Outline of Tests

Test No.	Examiner commands (for example)	Action of candidate
1	QUADRANT 190.	Sets quadrant elevation on gunner's quadrant. Seats quadrant. Has assistant elevate or depress the tube until quadrant bubble is centered. Calls "Ready" and waits for examiner to verify laying.
2	QUADRANT 245.	Same as test 1 above.
3	QUADRANT 215.	Same as test 1 above.

187. Penalties

No credit will be allowed if, after each test—

a. Quadrant elevation is not set correctly.

b. Quadrant is not properly seated.

c. Quadrant bubble is not properly centered.

188. Credit

Time in seconds, exactly or less than	6	6⅔	7
Credit	2.0	1.5	1.0

Section VIII. TEST, MEASURING ELEVATION

189. Scope of Test

One test will be conducted in which the candidate will be required to measure the elevation by means of the gunner's quadrant.

190. Special Instructions

Prior to the test the examiner will lay the tube at a selected elevation, measure the elevation, and then set the gunner's quadrant at zero.

191. Outline of Test

Examiner commands	Action of candidate
MEASURE THE ELEVATION.	Places gunner's quadrant on the quadrant seats of the breech ring. Levels bubble by raising or lowering the index arm and turning the micrometer knob. Announces "No. (so-and-so), elevation (so much)," and hands quadrant to examiner.

192. Penalties

No credit will be allowed if—

a. Quadrant bubble is not centered when the quadrant is seated properly.

b. Elevation is not announced correctly.

193. Credit

Time in seconds, exactly or less than	8	9⅝	10⅝
Credit	5.0	3.5	2.0

Section IX. TEST, MEASURING SITE TO MASK

194. Scope of Test

One test will be conducted in which the candidate will be required to execute the command given in paragraph 196.

195. Special Instructions

a. The howitzer, prepared for action, will be placed 200 to 400 yards from a mask of reasonable height.

b. The tube will be pointed so that it is 100 to 150 mils above the crest and 100 to 150 mils right or left of the highest point of the crest.

c. An assistant, selected by the candidate, will be stationed as the gunner to elevate or depress the tube as required by the candidate.

d. The candidate will take post at the rear of the breech.

196. Outline of Test

Examiner commands	Action of candidate
MEASURE SITE TO MASK.	Sights along lowest element of bore and directs operation of the elevating and traversing mechanism until line of site just clears the crest. Rotates the elevation counter setting knob until the vernier is alined and elevation counter is set. Checks centering of level bubbles. Reads elevation from elevation counter. Reports "No. (so-and-so), site to mask (so much)."

197. Penalties

No credit will be allowed if—

a. Line of sight along the lowest element of the bore does not just clear crest.

b. Vernier is not accurately alined.

c. Site to mask is not announced correctly.

198. Credit

Time in seconds, exactly or less than	11	12	13	14
Credit	4.0	3.0	2.0	1.5

Section X. TESTS AND ADJUSTMENT OF SIGHTING AND FIRE CONTROL EQUIPMENT

199. Scope of Test

Two tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the prescribed tests and authorized adjustments or to describe the action to be taken (e.g., send to ordnance) if adjustment is not authorized to be made by using personnel.

200. Special Instructions

a. Howitzer will be prepared for the test by leveling the trunnions and centering the tube in traverse. Cross hairs will be installed on the muzzle, and either the breech boresight inserted or the firing mechanism removed.

b. Equipment required for the tests will include cross hairs for the muzzle (breech boresight optional), gunner's quadrant, plumb line or transit, and testing target.

c. Candidate will select an assistant who will operate the elevating handwheel and adjust and aline the testing target at the direction of the candidate.

d. Tests will be conducted in the chronological sequence indicated in paragraph 201. After completion of test 2, the gunner's quadrant used in tests 1 and 2 will be used for test 3, with the proper correction, as determined in test 1, carried on the quadrant, provided the correction does not exceed 0.4 mil.

e. Adjustments which the candidate may be required to accomplish will fall within the following limits:

(1) Reticle (zero cross) direct fire telescope within limits of boresight adjustment.

(2) Vertical line of reticle of panoramic telescope.

f. The tube will be leveled at the conclusion of test 2 and will not be disturbed thereafter.

201. Outline of Tests

Test No.	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 122. Calls "Error (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.
2	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 123. Calls "Quadrant micrometer is (is not) in error."

202. Penalties

The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that the candidate can perform the operation without wasted effort. No credit will be allowed for tests 1 and 2 if—

a. Test 1.

(1) Bubble of the gunner's quadrant does not center when verified by the examiner.

(2) The error (one-half of the amount of the angle which was indicated when the quadrant was first reversed and the bubble centered by moving the index arm and micrometer) is not announced correctly by the candidate.

(3) Candidate does not declare the quadrant unserviceable if the error (necessary correction) exceeds 0.4 mil.

(4) Time to complete the test exceeds 2 minutes.

b. Test 2.

(1) Procedure is not followed correctly.

(2) Time to complete the test exceeds 1 minute.

203. Credit

a. Candidate will be scored on the general merit of his work in addition to the specific requirements above.

b. If the tests are performed correctly within the

prescribed time limit, maximum credit will be given as follows:

Test 1	4
Test 2	4
Total	8

Section XI. TEST FOR MATERIEL

204. Scope of Test

Candidate will be required to perform three tests as outlined in paragraph 206.

205. Special Instructions

a. Tests 1 and 2. For tests 1 and 2, a paulin will be placed on the carriage for the convenience of the candidate in laying out the disassembled parts. The candidate will be allowed to select the tools and accessories necessary for the performance of the tests prior to the start of the tests.

b. Test 3. For test 3, a complete set of lubrication equipment authorized for use of battery personnel will be made conveniently available on a paulin adjacent to the howitzer. Every type of lubricant used on the howitzer will be placed conveniently on the paulin, each in a plainly labeled container, and the lubrication order for the howitzer will be made available for use of the candidate.

206. Outline of Tests

Test No.	Examiner commands	Action of candidate
1	PERFORM AUTHORIZED DISASSEMBLY OF BREECH MECHANISM AND FIRING LOCK.	Performs the operation as described in TM 9–324A, laying the parts on the paulin. After disassembly, identifies all parts to examiner.
2	ASSEMBLE BREECH MECHANISM AND FIRING LOCK.	Performs the operation as described in TM 9–324A.
3	DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.	Using the lubrication order as a guide, selects proper lubricating equipment and lubricant and shows *how* and with *which lubricant* each lubrication point is serviced. (Actual lubrication is not performed.)

207. Penalties

a. The tests are not essentially speed tests. The purpose of the maximum time limits is to insure that the candidate can perform the operations without wasted effort.

b. No credit will be given if the following time limits are exceeded:

Test 1 ---------- 1½ minutes
Test 2 ---------- 3 minutes
Test 3 ---------- 2 minutes

c. A penalty of one-half point will be assessed for each component part that is not correctly identified

or omitted in test 1. There is no time limit imposed on the identification of component parts. However, the examiner may reduce the grade if it becomes obvious that the candidate is not familiar with the nomenclature.

208. Credit

a. The candidate will be scored on the general merit of his work in addition to the specific requirements stated in paragraph 207.

b. If each test is performed correctly within the prescribed time limit, maximum credit will be given as follows:

Test 1	5
Test 2	5
Test 3	5
Total	15

APPENDIX

REFERENCES

1. Miscellaneous Publications

AR 385–63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
AR 600–70	Badges.
AR 611–201	Manual of Enlisted Military Occupational Specialties.
AR 700–38	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247 (R2)).
AR 750–5	Maintenance Responsibilities and Shop Operations.
ATP 6–300	Army Training Program for Field Artillery Unit (U).
ATT 6–1	Training Tests for Field Artillery Howitzer or Gun Battery.
ATT 6–2	Training Tests for Field Artillery Battalion Firing.
ATT 6–3	Training Tests for Field Artillery Rocket Battery and Battalion Tests.
DA Pam 108–1	Index of Army Motion Pictures, Television Recordings, and Filmstrips.

DA Pam 310-series	Index of Military Publications.
SR 320–5–1	Dictionary of United States Army Terms.
SR 320–50–1	Authorized Abbreviations.
TOE 6–317C	Armored Field Artillery Battery, 105-mm Howitzer, Self-Propelled or Howitzer Company, Armored Cavalry Reconnaissance Battalion.
FM 5–15	Field Fortifications.
FM 5–20	Camouflage, Basic Principles.
FM 5–20B	Camouflage of Vehicles.
FM 5–20D	Camouflage of Field Artillery.
FM 5–25	Explosives and Demolitions.
FM 6–40	Field Artillery Gunnery.
FM 6–101	The Field Artillery Battalion.
FM 6–125	Qualification Tests for Specialists, Field Artillery.
FM 6–140	The Field Artillery Battery.
FM 17–50	Logistics, Armored Division.
FM 21–5	Military Training.
FM 21–30	Military Symbols.
FM 21–40	Defense Against CBR Attack.
FM 21–60	Visual Signals.
FM 22–5	Drills and Ceremonies.
FM 23–65	Browning Machine Gun, Caliber .50 HB, M2.
FM 25–10	Motor Transportation, Operations.
LO 9–7204	Howitzer, 105-mm Self-Propelled, T98E1.

TM 3–220	Decontamination.
TM 6–605	Field Artillery Individual and Unit Training Standards.
TM 9–324A	105-mm Howitzer T96E1.
TM 9–575	Auxiliary Sighting and Fire Control Equipment.
TM 9–717A	Self-Propelled 105-mm Howitzer T98E1.
TM 9–850	Abrasive, Cleaning, Preserving, Sealing, Adhesive, and Related Materials Issued for Ordnance Materiel.
TM 9–1527	Gunner's Quadrants M1 and M1918 and Machine Gun Clinometer M1917.
TM 9–1590	Fuze Setters, M14, M22, M23, M25, and M27.
TM 9–1900	Ammunition, General.
TM 9–1901	Artillery Ammunition.
TM 9–2300	Artillery Materiel and Associated Equipment.
TM 9–2810	Tactical Motor Vehicle Inspections and Preventive Maintenance Services.
TM 9–2853	Preparation of Ordnance Materiel for Deep Water Fording.
TM 21–301	Driver Selection, Training and Supervision, Half-Track and Full-Track Vehicles.
TM 21–305	Driver's Manual.

TM 21–306	Manual for the Full-Track Vehicle Driver.
DA Form 9–13	Weapon Record Book.
DA Form 468	Unsatisfactory Equipment Report.

2. ORD Supply Manuals

ORD 9 SNL G–258	Howitzer, 105-mm, Self-Propelled, T98E1.
ORD 3 SNL K–1	Abrasives, Adhesives, Cleaners, Preservatives, Recoil Fluids, Special Oils and Related Items.
ORD 3 SNL R–1	Ammunition, Fixed and Semifixed, Including Subcaliber for Pack, Light and Medium Field, Aircraft, Tank, and Antitank Artillery, Including Complete Round Data.
ORD 3 SNL R–3	Ammunition, Service Fuses and Primers for Pack, Light and Medium Field, Aircraft, Tank, and Antitank Artillery.
SM 9–5–1375	Ammunition Explosives, Bulk Propellants, and Explosive Devices.

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By Order of *Wilber M. Brucker*, Secretary of the Army:

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