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**155-MM HOWITZER M109
SELF-PROPELLED**



**HEADQUARTERS, DEPARTMENT OF THE ARMY
DECEMBER 1962**



FIELD MANUAL

No. 6-88

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 20 December 1962

155-MM HOWITZER M109, SELF-PROPELLED

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CHAPTER 1

GENERAL

1. Purpose and Scope

a. This manual is a guide to assist commanders and chiefs of sections in developing 155-mm howitzer M109, self-propelled sections into teams that will operate effectively in battle.

b. This manual prescribes the duties of the section personnel in —

- (1) Section drill.
- (2) Preparation for firing and traveling.
- (3) Firing.
- (4) Tests and adjustments.
- (5) Maintenance and inspections.
- (6) Decontamination of equipment.
- (7) Destruction of equipment.

c. This manual is applicable to both nuclear and nonnuclear warfare without modification.

d. To improve this manual, users are encouraged to submit recommended changes and comments. The procedure is as follows:

- (1) Key comments to the specific page, paragraph, and line.
- (2) Include supporting reasons with each comment.
- (3) Send direct to U. S. Army Artillery and Missile School, ATTN: AKPSIPL, Fort Sill, Okla.

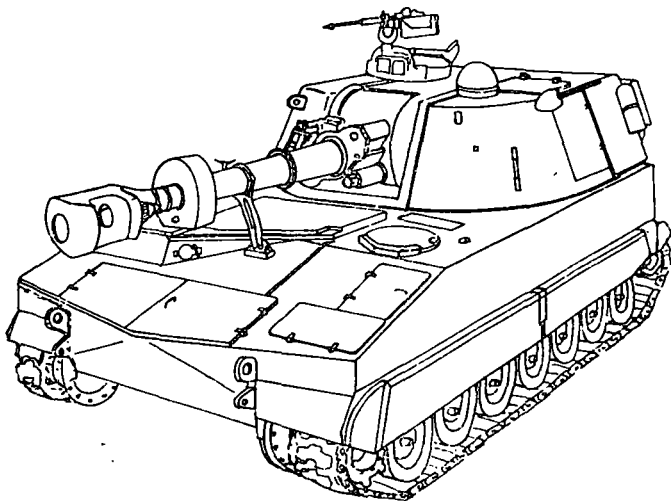


Figure 1. 155-mm howitzer M109, self-propelled.

2. Composition of the Howitzer Section

The personnel of the howitzer section are the —

- a. Chief of Section (CS).
- b. Gunner (G).
- c. Assistant Gunner (AG).
- d. Six cannoneers, numbered 1 through 6.
- e. Motor Carriage Driver (D).

3. Duties of the Chief of Section

The chief of section is the noncommissioned officer in command of the section. He is responsible for the —

- a. Training and efficiency of personnel.
- b. Performance of duties in drill, firing, tests and adjustments, inspection, and maintenance.

- c.* Observance of safety precautions.
- d.* Preparation of field fortifications.
- e.* Camouflage discipline; local security; and chemical, biological, and radiological security discipline.
- f.* Maintenance of equipment Log Book (TM 38-750).
- g.* Police and improvement of the section area.

4. Equipment

- a.* Capabilities and limitations of the howitzer are shown in figure 2.
- b.* Section equipment is shown in figure 3.

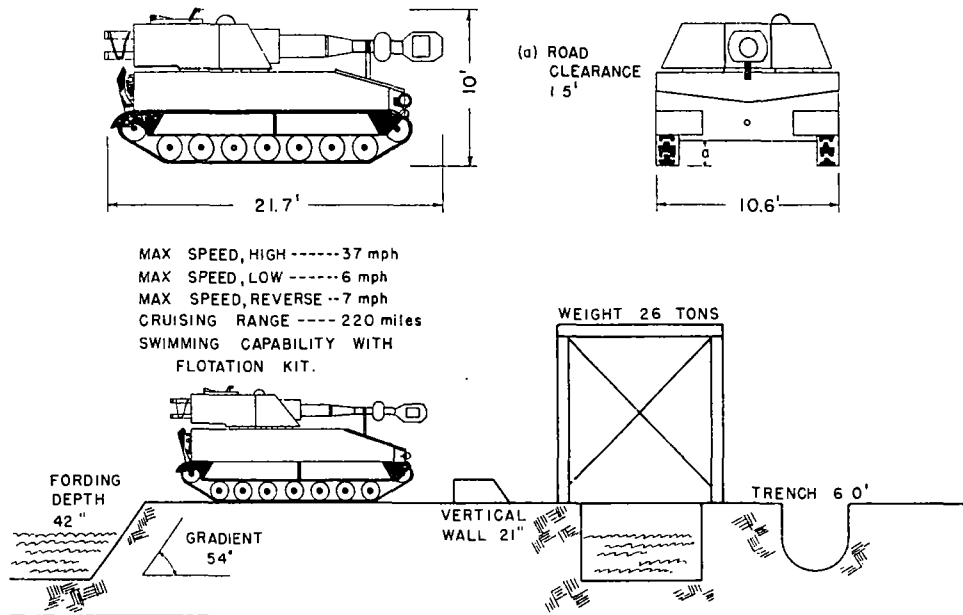


Figure 2. Performance characteristics.

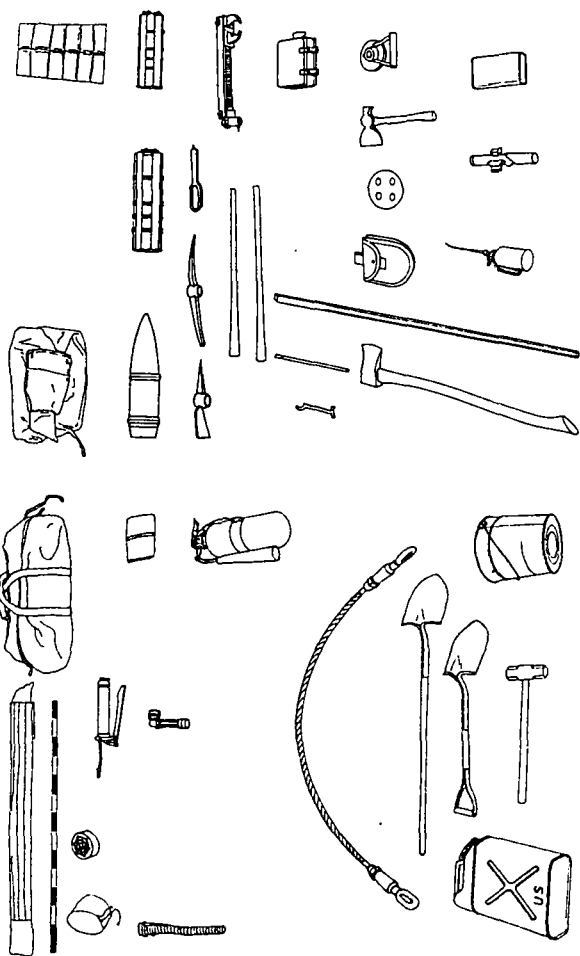


Figure 3. Section equipment.

5. References

Publications applicable to the 155-mm howitzer M109, self-propelled are listed in the appendix.

CHAPTER 2

SECTION DRILL

Section I. GENERAL

6. Purpose

This chapter prescribes the —

- a. Objectives and instructions for section drill.
- b. Commands and formations for section drill.

7. Objectives

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

8. Instructions

Section drill will be —

- a. Conducted in silence except for commands and reports.
- b. Repeated until reactions are automatic, rapid, and efficient.
- c. Supervised so that mistakes are discovered, reported, and corrected immediately.
- d. Supervised by battery officers to insure uniformity and efficiency.
- e. Conducted so that each member of the section can perform all duties within the section.

Section II. COMMANDS AND FORMATIONS

9. Forming the Section

To form the section, the chief of section takes his post and gives one of the following commands:

- a. To form the section the command is FALL IN. The section —

- (1) Moves at double time.
- (2) Forms in single rank at close interval, with the gunner on the right, the assistant gunner, the cannoneers in numerical order, and the driver at the left of the rank.
- (3) Centers on the chief of section at a distance of 3 paces (fig. 4).

b. To form section in a particular place, the commands may be 1. IN FRONT (REAR) OF YOUR PIECE, 2. FALL IN. The section —

- (1) Moves and forms a single rank as in *a* above.
- (2) Faces the direction of fire.

c. To form the section in a particular direction the commands may be 1. ON THE ROAD FACING THE PARK, 2. FALL IN. The section —

- (1) Moves and forms a single rank as in *a* above.
- (2) Faces the direction indicated in the command.

d. At the first formation for a drill or exercise, the caution "as a section" precedes the command.

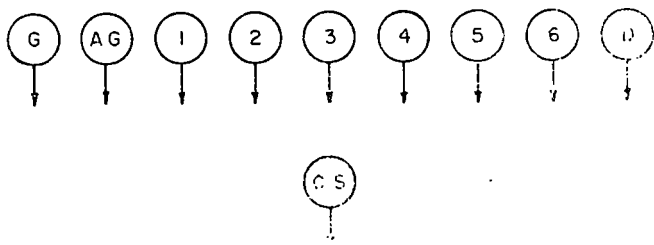


Figure 4. Section in formation.

10. To Call Off

With the section in formation, the command is **CALL OFF**.

a. All personnel except the gunner execute eyes right.

b. The section calls off in sequence: "Gunner, Assistant Gunner, 1, 2, 3, 4, 5, 6, Driver."

c. As each man calls out, he turns his head smartly to the front.

11. To Take Posts

The command is 1. **CANNONEERS**, 2. **POSTS**.

a. The command is general and may be given in or out of ranks, at a halt, or marching.

b. All movements are executed at double time and are terminated at the position of attention.

c. The section moves to posts as shown in —

(1) Figure 5, dismounted.

(2) Figure 6, mounted.

(3) Figure 7, prepared for action.

12. To Change Posts

To train all members of the section in all duties, posts should be changed frequently. With the section in *formation*, the commands are —

a. 1. **CHANGE POSTS**, 2. **MARCH**.

(1) Number 6 moves at double time to the post of the assistant gunner.

(2) The assistant gunner and numbers 1 through 5 take two left steps, each cannoneer taking the position of the next higher numbered cannoneer.

b. 1. SECTION CHANGE POSTS, 2. MARCH.

- (1) The leftmost man moves at double time to the post of gunner.
- (2) All other men move as in *a* above.

13. To Mount

To mount, the following commands may be given:

a. 1. PREPARE TO MOUNT. 2. MOUNT.

- (1) At the preparatory command, the section moves at double time to positions shown in figure 5.
- (2) At the command of execution, personnel mount and take positions as shown in figure 6.
- (3) If any member of the section is not to mount, he is designated and cautioned to stand fast. 1. PREPARE TO MOUNT, DRIVER STAND FAST, 2. MOUNT.

b. MOUNT. The section moves directly to the positions shown in figure 6.

Note. Transportation must be provided for cannoneers not mounted in the motor carriage.

14. To Dismount

To dismount the following commands may be given:

a. 1. PREPARE TO DISMOUNT, 2. DISMOUNT

- (1) At the preparatory command, compartment doors are opened, and personnel assume a crouched position in order to dismount rapidly.
- (2) At the command of execution, personnel take positions as shown in figure 5.

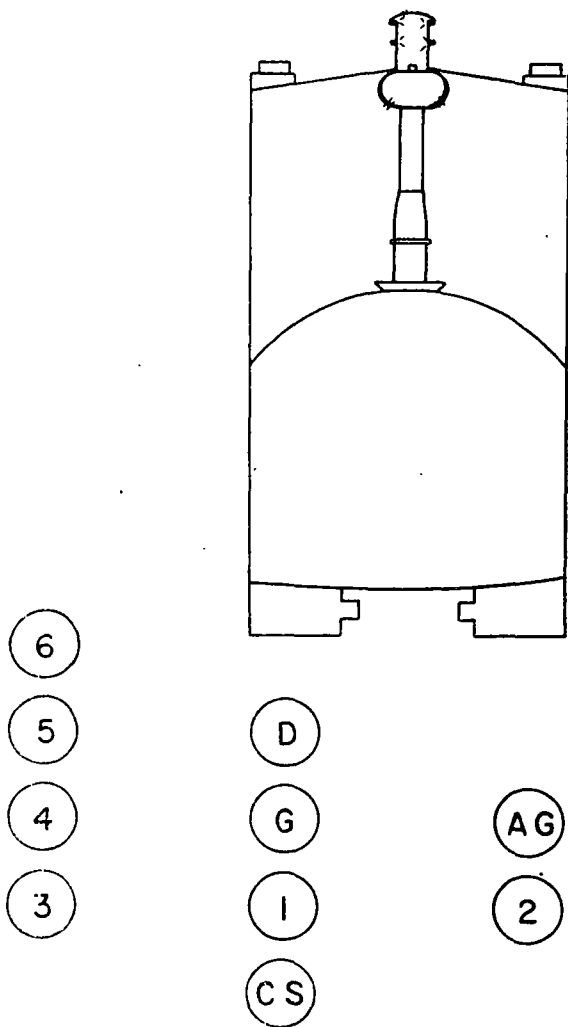


Figure 5. Posts, dismounted.

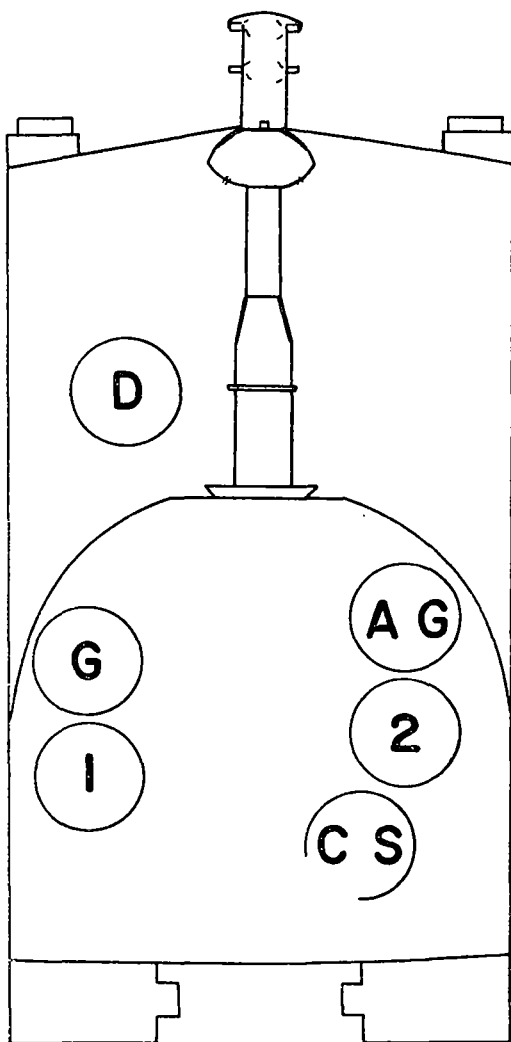


Figure 6. Posts, mounted.

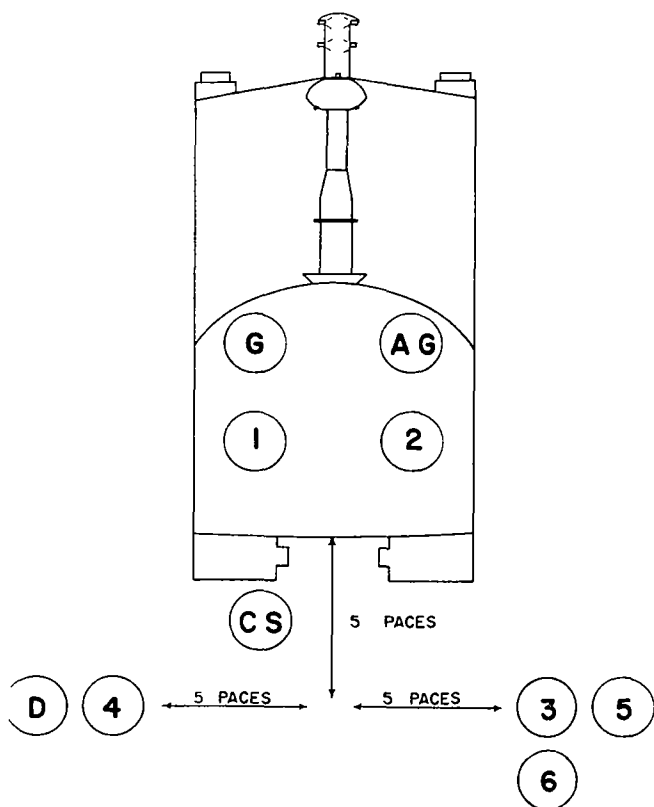


Figure 7. Posts, prepared for action.

b. DISMOUNT. The section moves without delay to positions as shown in figure 5.

15. To Fall Out

The command FALL OUT is given to provide rest and relief during drill or firing.

a. During Drill.

- (1) The command may be given at any time.
- (2) The section remains in vicinity of drill area.

b. When Firing.

- (1) The command may be given when firing is temporarily suspended.
- (2) The section remains in vicinity of, but clear of the piece.
- (3) The settings and layings are not disturbed.

CHAPTER 3

DUTIES OF THE HOWITZER SECTION

Section I. PREPARATIONS FOR FIRING

16. Purpose

This chapter prescribes duties for —

- a. Preparing the howitzer for firing (table I).
- b. Firing by indirect laying (table II).
- c. Firing by direct laying (table III).
- d. Preparing the howitzer for traveling (table IV).

(Tables I, II, III, and IV are located in back of the manual.)

17. At the Position

a. The howitzer is emplaced under direct supervision of the chief of section.

b. Preparation of the firing position prior to occupation is governed by time factors and unit SOP. The following preparation will, however, facilitate the occupation.

- (1) Mark the position with a stake to indicate where the center of the carriage is to be placed.
 - (2) Place another stake at a distance of 50 to 100 meters, in the approximate direction of fire, at which the driver can point the tube.
- c. Hand signals are used for guiding the driver.

18. To Prepare for Action

a. The command is **PREPARE FOR ACTION**.

(1) The command may be given with the howitzer in position or approaching the position.

(2) Duties of individuals are given in table I.

(3) Each man takes his post (fig. 7) when he has completed his duties.

b. Normally the howitzer is partially prepared for action before arriving at the firing position.

c. All duties are conducted at double time.

d. If the howitzer is not to be prepared for action at the firing position, a supplementary command **DO NOT PREPARE FOR ACTION** must be given.

Section II. FIRING

19. Firing by Indirect Laying

The vast majority of targets will be attacked by indirect laying. Indirect laying is a method of taking targets under fire by placing the line of sight of the panoramic telescope on an aiming point other than the target (aiming posts). To provide timely and accurate fire, the section must be indoctrinated with a sense of urgency. Every effort must be made to execute the timely and effective delivery of fire. A detailed list of duties is contained in table II.

20. Firing by Direct Laying

Some targets may be attacked by direct laying. This is a method of taking the target under fire by sighting directly on the target. Since such targets

are usually capable of returning fire, the following factors must be emphasized:

- a. Speed and accuracy in laying.
- b. High standards of training.
- c. Section operation as an independent unit.

21. Methods of Direct Laying

a. *Sighting System.* The two-man, two-sight system is the principal sighting system to be used with the weapon.

- (1) The gunner establishes lead with the panoramic telescope.
- (2) The assistant gunner establishes range with the direct fire telescope.

b. *One-Man, One-Sight System.* The one-man, one-sight system in which the gunner lays for both deflection and elevation may be used if required. However, the two-man, two-sight system provides faster laying, better accuracy, and a greater assurance of first round hits.

c. *Laying Method.* Central laying is used in conjunction with click sights.

- (1) The gunner sets the lead on the azimuth counter.
- (2) Traverses the tube until the vertical reticle is on the center of the target.
- (3) Subsequent changes in lead are made in 5-mil increments by sound (clicks) and feel when turning the azimuth knob.

d. *Tracking the Target.* After lead and range are laid on the target, continuous tracking is maintained during the firing sequence.

c. Specific Duties in Firing. Specific duties in firing by direct laying are shown in table III.

22. Range Card

a. The chief of section is responsible for the defense of his assigned sector. He should also be prepared to deliver fire in all sectors (directions).

b. During reconnaissance of the position and shortly after occupation of position, the chief of section will —

- (1) Measure or estimate the ranges to prominent terrain features and likely avenues of approach.
- (2) Establish reference points as required.
- (3) Prepare a range card (fig. 8).
- (4) As time permits, replace estimated ranges with more accurate ranges obtained by, pacing, taping, speedometer, maps or survey.

c. The executive officer will assign numbers to certain prominent terrain features to facilitate target location. For example, the executive commands, TARGET, TANKS POINT NUMBER 2, FIRE AT WILL.

d. As time permits, a deflection and a quadrant for each numbered point should be added to the range card to expedite and increase accuracy in firing.

e. The field of fire of the section should, if possible, be cleared of obstructions that might hinder fields of fire or observation. Care must be taken not to expose the location of the position.

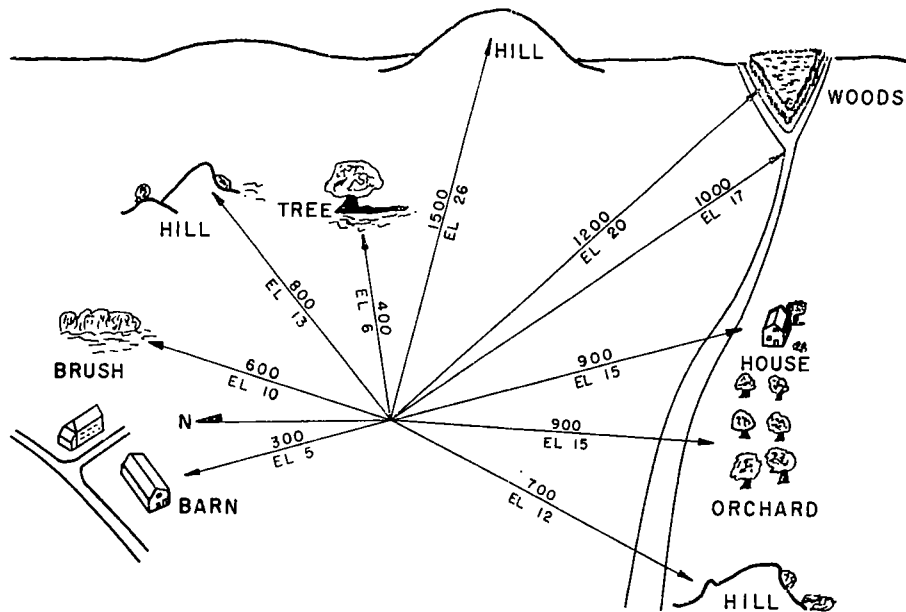


Figure 8. Range card for direct laying.

23. Trajectory Characteristics

Trajectory characteristics for different ranges must be considered prior to taking a target under fire. Information contained in table V provides data covering the effective direct fire ranges of the weapon.

24. Preparations for Traveling

The command is MARCH ORDER.

a. Duties of individuals are given in table IV.

b. Each man takes his post (fig. 5), when he has completed his duties.

Table V. Trajectory Characteristics, Shell HE, Charge 7

Range (meters)	Elevation (mils)	Trajectory characteristics	Firing data
100 200 300	2 3 5	For ranges from 0 to 400 meters, the trajectory is flat enough to prevent an 8-foot tank from passing under it: A range of 400 meters is ideal for opening fire, because fire can be conducted for the maximum time without misses, if deflection is correct.	Start firing with the estimated range at the closest 100-meter range line.
400 500 600 700 800 900 1,000 1,100 1,200	6 8 10 12 13 15 17 18 20	For ranges from 400 to 1,500 meters, the trajectory is sufficiently flat to permit direct estimate of range without bracketing the target. If a hit is obtained at the bottom of an 8-foot tank, while firing at the upper range limit, the addition of a 100-meter range change will result in a round that will just brush the top of the tank. Range changes	<ol style="list-style-type: none"> 1. Start firing with the estimated range at the closest 100-meter range line. 2. Make range changes with 50- or 100-meter increments. 3. Bracket adjustment of the target (overs and shorts) is not required.

1,300	22	will seldom be more than 100 meters, and 50-meter changes will frequently be sufficient. A range of 1,500 meters is the maximum range at which a tank should be fired on, unless tactical conditions require otherwise.	
1,400	24		
1,500	26		
1,600	20	For ranges from 1,500 to 2,500 meters, hits are only reasonably possible. Bracket adjustment of the target is normally required.	<ol style="list-style-type: none"> 1. Start firing with the estimated range at the closest 100-meter range line. 2. Adjustment on the target by bracketing (overs and shorts) is required. 3. Surprise effect on the target must not be important.
1,700	30		
1,800	32		
1,900	34		
2,000	36		
2,100	38		
2,200	40		
2,300	42		
2,400	44		
2,500	46		

CHAPTER 4

TECHNIQUES AND SITUATIONS THAT REQUIRE SPECIAL ATTENTION

25. Precision in Laying

a. Fire control instruments, fuze setters, and elevation and traverse mechanisms must be operated to reduce the effects of lost motion.

b. The gunner and assistant gunner will verify the laying after the breach has been closed.

c. For uniformity and accuracy —

(1) The line of sight for setting and reading a scale or centering a bubble should be at a right angle to the scale or level vial to prevent parallax errors.

(2) The vertical reticle of the panoramic telescope is aligned with the left edge of the aiming posts.

26. Aiming Points

After the howitzer has been laid for direction, it is referred to a primary aiming point, normally the aiming posts and alternate aiming points (distant aiming points) as required.

a. An aiming point must be a sharply defined point or a clearly visible vertical line.

b. Alternate aiming points (distant aiming points) must be at least 2,000 meters distant. This distance prevents displacement in firing or traverse from causing more than a $\frac{1}{2}$ mil horizontal change in direction with the same settings on the scales:

c. The aiming posts are placed in alinement with the vertical reticle of the panoramic telescope as directed by the gunner.

- (1) The *far* aiming post is placed at least 100 meters from the piece. This distance is the most desirable for accuracy, visibility, and control of the aiming post lights.
- (2) The *near* aiming post must be set up half-way between the far post and the piece. Equal spacing is accomplished either by pacing, or by measuring with the panoramic telescope and using the aiming post as a stadia rod, or by using a wire or cord with the appropriate distances marked in a convenient manner.
- (3) If the aiming post is used as a stadia rod, the procedure is as follows:
 - (a) Number 4 stands at the far aiming post and holds the upper section of an aiming post parallel to the ground and perpendicular to the line of sight.
 - (b) The gunner measures the length of the aiming post in mils on the reticle of the panoramic telescope.
 - (c) The gunner directs number 4 to move toward the piece and to emplace the near aiming post at a point where the upper section measures twice the number of mils it measured at the far aiming post.
- (4) For night use, the light on the far aiming post should be placed so that it appears several feet above the light on the

near aiming post. The lights placed in this manner establish a vertical line for laying the howitzer.

- (5) Unit SOP will specify the deflection at which to place the aiming posts; however, placing the aiming posts at a deflection of 2,400 to 2,600 reduces misalignment and allows for maximum visibility.
- (6) Correction for displacement of the aiming posts from the vertical reticle of the panoramic telescope is discussed in table II.

27. Changes in Data During Firing

If it is necessary to change any element of firing data, the executive commands CORRECTION.

a. Piece Unloaded. Set off new data and resume firing when the quadrant is announced.

b. Piece Loaded. Set off new data and resume firing when the quadrant is announced if no change is required in the fuze, time setting, or charge.

- (1) If the data requires a change in the fuze, time setting, or charge, the chief of section will suspend firing and report to the executive "Number 2 loaded, charge (), fuze (), time ()," stating the elements that are changed.
- (2) In continuous fire, changes in data are applied without stopping the fire or breaking its continuity.

28. To Unload the Howitzer

a. Once a complete round is loaded, it should be

fired. However, if unloading is required, the command is UNLOAD.

b. If the howitzer has been fired repeatedly and the tube is heated, it should be fired if possible; or if necessary, unload the weapon as quickly as possible.

c. Unloading will be supervised by an officer and the procedure is as follows:

- (1) Number 2 slides the block assembly on the firing mechanism to the right and ejects the primer.

Warning: Take care that the primer does not strike anything that would cause it to activate.

- (2) Assistant gunner depresses the tube to zero elevation.
- (3) Number 2 opens the breech and removes the powder charge.
- (4) Number 1 fills the powder chamber with waste, and number 2 closes the breech-block.
- (5) The officer inspects the rammer head to insure it is free from obstructions and thoroughly clean.
- (6) Number 3 assisted by number 4, inserts the rammer head into the muzzle until the head incloses the fuze and contacts the projectile.
- (7) Numbers 3 and 4 push on the rammer and, if necessary, tap the end of the staff lightly with a wooden block to dislodge the projectile.

- (8) Number 2 opens the breech, removes the waste, and positions the loading tray of the automatic rammer in the breech.
- (9) Numbers 3 and 4 push the projectile slowly out of the breech and on to the loading tray.
- (10) Number 1 removes the projectile from the loading tray.
- (11) The projectile is then disposed of as directed by the chief of section.

29. Care of Ammunition

To insure uniform results in firing, to prolong the life of the tube, and to avoid accidents, great care must be exercised in handling and storing ammunition. The following requirements should be met.

a. Information contained in TM 9-1900 that is applicable to field service should be followed.

b. Protect the projectile from damage.

- (1) Remove eyebolts only when the fuze is to be inserted.
- (2) Use tarpaulins and dunnage to protect ammunition against weather, dirt, and sun.
- (3) Raise projectiles stacked in the open 6 inches off the ground, and dig drainage ditches around the stacks.
- (4) Use dunnage liberally between ammunition layers, and allow a 6-inch air space between the top of the stack and the covering tarpaulin.

c. Propellant charges are —

- (1) Protected from direct rays of the sun and moisture.
- (2) Left in containers until just prior to firing.

Note. Uniform propellant temperatures must be maintained to provide accurate firing.

d. Explosive elements in primers and fuzes are particularly sensitive to shock and high temperature. The precautions to be observed are as follows:

- (1) Protect from weather, direct sunlight, and rough handling.
- (2) Remove protection and safety devices from fuzes just prior to their use.
- (3) Do not attempt to disassemble a fuze.

e. Protection against hostile fire may be accomplished by —

- (1) Dispersing ammunition in small stacks.
- (2) Storing ammunition in trenches or dug-outs.
- (3) Insuring that each stack of ammunition does not contain more than 50 rounds and is not more than three layers high.
- (4) Placing stacks of ammunition at least 10 meters apart.

f. Projectile and powder charges should be sorted into lot numbers as they are stored.

g. For further information on care of ammunition, see FM 6-40, TM 9-1300-203, TM 9-1900, and TM 9-2350-217-10.

30. Amphibious Operation

a. General. The howitzer can be equipped with a flotation device which will enable the vehicle to navigate rivers, lakes, and other water obstacles (fig. 9).

b. Equipment. The flotation device consists of the following:

- (1) *Bags.* Four bag-retainer assemblies will be installed on each side of the vehicle, and one bag on the front of the vehicle.
- (2) *Water Barriers.* Barriers will be installed on each forward side and across the front of the vehicle to reduce water seepage to the power plant compartment.
- (3) *Auxiliary Equipment.* Auxiliary equipment includes the necessary valves, blowers, hoses, and fittings to inflate the bags.

c. Preparation. Approximately 5 minutes is required to prepare the howitzer for amphibious operation. A detailed list of duties is contained in table VI.

Table VI. Duties in Amphibious Operation
(Located in back of manual)

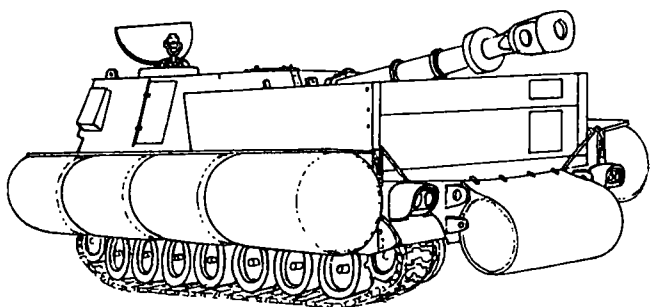


Figure 9. Howitzer prepared for amphibious operation.

CHAPTER 5

BORESIGHTING

Section I. GENERAL

31. Description

Boresighting is —

a. The process to *verify*, and *aline* if required, that the optical axis of the panoramic telescope and the direct fire telescope is parallel to the axis of the tube in deflection and elevation.

b. Conducted prior to firing and, when necessary, during lulls in firing.

c. Performed to insure accuracy in laying for elevation and direction.

32. Methods of Boresighting

a. The two methods for boresighting the 155-mm M109 self-propelled are the —

(1) Testing target method (par. 35-37).

(2) Distant aiming point method (par. 38-40).

b. The method of boresighting to be used will be determined by the unit SOP and the time available.

33. Equipment

The equipment that is needed for boresighting is described below:

a. *Front and Rear Boresights.*

- (1) Front and rear boresights are used to align the tube on the testing target or distant aiming point.
- (2) If boresights are not available, crosshairs are fastened to the muzzle and the obturator spindle vent is used as a rear sighting guide.

b. Testing Target. The testing target provides accurate aiming diagrams for the tube, the panoramic telescope, and the direct fire telescope in boresighting and testing. The testing target is prepared as follows:

- (1) Mount the testing target on a flat piece of material and fasten it to a stand to provide stability (fig. 10).
- (2) Install a plumb line and mil scale for use in leveling or canting the target (fig. 10).
- (3) Draw vertical reference lines for use when the trunnions are not level. The testing target must be canted an equal amount and in the same direction (fig. 10).
- (4) To facilitate boresighting in darkness, bore $\frac{1}{16}$ -inch hole through the center of each aiming diagram and cover each hole with a piece of heavy cloth. A flashlight is held against the material to provide an aiming point for blackout conditions.

c. Tools. Section equipment includes all necessary tools for boresighting and testing.

Caution: Use the proper tools to prevent damage to fire control equipment.

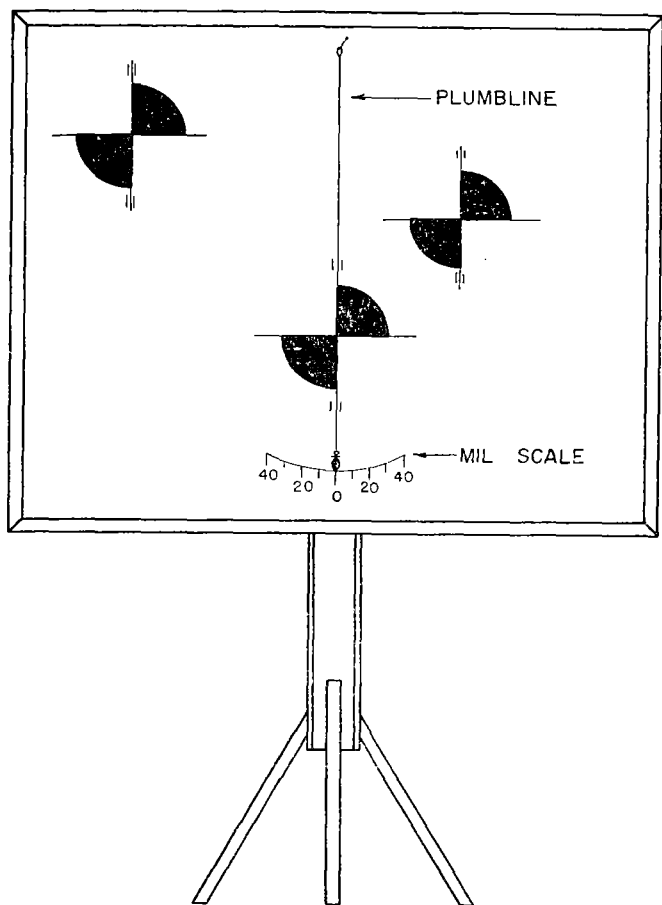


Figure 10. Testing target.

d. Plumb Line. The plumb line is used to level the trunnions for testing and to boresight the howitzer if time is not a factor. The plumb line is prepared as follows:

- (1) Suspend the line from any convenient location so that the muzzle of the howitzer can be placed at a distance of approximately 5 feet from the line. For a more complete test, insure that the line is long enough to allow for the highest possible tube elevation.
- (2) Attach a weight to the end of the line for tautness and, to prevent the line from swinging, place the weight in a liquid filled container.

34. Requirements for On-Carriage Fire Control Alinement

Correct alinement exists when —

a. The mounts and instruments are securely attached, and when no binding or excessive backlash exists in the gears.

b. The line of sight of the panoramic telescope is parallel to the axis of the bore throughout elevation limits.

c. The line of sight of the direct fire telescope is parallel to the axis of the bore.

d. The azimuth counter reads 3200.

e. The gunner's aid counter reads zero.

f. The elevation and azimuth slip scales on the direct fire telescope mount read 4.

g. All bubbles are centered.

Section II. TESTING TARGET METHOD

35. General

The testing target consists of alining the line of sight of the tube, the panoramic telescope, and the direct fire telescope with the aiming diagrams on the testing target.

36. Preparations for Boresighting

Preparations for boresighting are as follows:

- a. Place the howitzer on level ground.
- b. Place the tube in the center of traverse.
- c. Install the front and rear boresights (par. 33a).

d. Level the trunnions by using a plumb line or a gunner's quadrant. The plumb line method is preferable, and the procedure is as follows:

- (1) Install a plumb line (par. 33d).
- (2) Manually traverse the cab until the plumb line is alined with the front and rear boresights.
- (3) Elevate and depress the tube throughout its limits. The vertical hairline of the front boresight should remain in coincidence with the plumb line.
- (4) If coincidence is not maintained, build up the low track or shift the howitzer slightly.
- (5) Perform steps in (3) and (4) above until coincidence is maintained throughout the elevation limits.

- e. The gunner's quadrant will normally be used

to level the trunnions under field conditions when time is critical. The procedure is as follows:

- (1) Use gunner's quadrant that has been checked by the end-for-end test (par. 44).
- (2) Set the index arm and the micrometer scale on the quadrant at zero.
- (3) Place the quadrant on the breech block on the leveling pads that are perpendicular to the long axis of the tube.
- (4) Shift the howitzer slightly or build up the low track until the bubble on the gunner's quadrant is centered.

f. Set the tube at zero elevation by using a gunner's quadrant and applying corrections, as determined from the end-for-end test.

g. Center the bubbles in the pitch-level vial and cross-level vials of the panoramic telescope mount.

37. Boresighting Procedures with Testing Target

With the weapon prepared as in paragraph 36, boresight as follows:

a. Testing Target Location. Locate testing target at least 50 meters in front of the howitzer.

b. Testing Target Alinement. Without moving the tube, aline the center aiming diagram of the testing target with the line of sight through the tube (fig. 10). The testing target must be placed perpendicular to the axis of the bore. *The testing target must then be made secure.*

c. Panoramic Telescope Alinement.

- (1) Set the gunner's aid counter to zero.
- (2) Adjust the azimuth and elevation knobs

on the panoramic telescope to lay the reticle precisely on the left of the aiming diagram.

(3) Check that —

(a) The muzzle crosshairs are centered on the center aiming diagram.

(b) The telescope mount is level.

(4) The azimuth counter of the panoramic telescope should read 3,200 mils. If the reading is not 3,200 mils, turn the bore-sight adjustment shaft until 3,200 appears in the counter window.

d. Direct Fire Telescope Alinement.

(1) Rotate the azimuth and elevation knobs on the direct fire telescope to lay the reticle precisely on the right aiming diagram.

(2) Set the telescope mount slip scales to elevation 4, azimuth 4.

Note. Do not move the elevation or azimuth knobs when setting slip scales.

Section III. DISTANT AIMING POINT METHOD

38. General

The distant aiming point method consists of alining the line of sight of the tube, the panoramic telescope, and the direct fire telescope on an aiming point at a distance of at least 2,000 meters.

39. Preparations for Boresighting

a. Select a well-defined point at a distance of not less than 2,000 meters.

b. Preparations prescribed for the testing target method apply (par. 36) except that accurate leveling of the trunnions is not required.

40. Boresighting Procedures with Distant Aiming Point

a. Lay the line of sight of the tube on the distant aiming point.

b. Lay the reticle of the panoramic telescope and the direct fire telescope on the distant aiming point with the same sight picture observed through the tube.

c. Adjust the telescopes as required (par. 37*c* and *d*).

CHAPTER 6

BASIC PERIODIC TESTS

Section I. GENERAL

41. Purpose

Basic periodic tests are performed —

a. To determine whether the on-carriage sighting equipment, the gunner's quadrant, and the fuze setter are in correct adjustment.

b. By the section and the artillery mechanic under the supervision of the battery executive.

c. At the discretion of the unit commander. Suggested times are —

(1) Once each year if howitzer is used for nonfiring training.

(2) Every 3 months if the howitzer is fired.

(3) As soon as possible after intensive use, accidents, or travel in extremely rough terrain.

(4) When fire is inaccurate for no apparent reason.

42. Preparations for Basic Periodic Tests

The following conditions must be established prior to conducting the tests:

a. Drive the motor carriage to a site that is as near level as possible.

b. Suspend a plumb line (par. 33*d*).

c. Level the trunnions by using the plumb line.

d. Boresight the howitzer by using the testing target.

Section II. TESTS OF GUNNER'S QUADRANT

43. General

The gunner's quadrant *must* be in proper adjustment to conduct the tests and adjustments on other sighting and fire control equipment.

44. End-for-End Test

The end-for-end test is conducted as follows :

a. Inspect the shoes on the gunner's quadrant for dirt, nicks, and burrs.

b. Inspect the quadrant seats on the breech for dirt, nicks, and burrs.

c. Zero the scales on the gunner's quadrant.

d. Place the quadrant on the quadrant seats. Depress and elevate the tube until the bubble in the gunner's quadrant is centered.

e. Reverse the quadrant on the seats and check the bubble. If the bubble recenters, the quadrant is in adjustment, and the test is complete.

f. If the bubble does not center, turn micrometer knob and try to center the bubble.

(1) If bubble centers, read the black figures on the micrometer scale and divide by 2. *This is the correction for the gunner's quadrant.*

(2) Place this correction on the micrometer scale, and level the tube.

(3) Reverse the quadrant. The bubble should center.

g. If the bubble does not center as in *f* above, move the gunner's quadrant arm down one graduation (10 mils).

- (1) Turn the micrometer knob until the bubble centers.
- (2) Take the reading on micrometer scale, add 10 to it and divide the sum by 2. Place the result on the micrometer scale.
- (3) With the quadrant arm set at minus 10 and the above result on the micrometer scale, place the quadrant on the quadrant seats and level the tube.
- (4) Reverse the quadrant. The bubble should center.
- (5) Subtract the reading on the micrometer scale from 10 to obtain the error.

Note. If an error is determined during the end-for-end test, it will be used only during the sighting tests and adjustments and will not be carried in fire missions. If the error exceeds 0.4 mil, the quadrant must be sent to ordnance.

45. Micrometer Test

The micrometer test is performed as follows:

- a.* Set the radial arm to read 10 mils on the elevation scale, and set the micrometer at zero.
- b.* Place the quadrant on the leveling plates 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 zero, and set the micrometer at 10 mils.

d. Reverse the quadrant; the bubbles should center.

Note. Do not disturb the lay of the tube.

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

46. Comparison Test

The comparison test is conducted in the following manner:

a. Compare the readings as follows:

(1) Take readings at low, medium, and high elevations.

(2) Use each gunner's quadrant in the battery.

(3) Use the leveling plates of a *single* piece.

b. Compute the average reading at each elevation.

c. Compare *each* quadrant reading with the average.

d. Any quadrant differing more than 0.4 mil from the average must be adjusted by ordnance personnel.

Section III. TESTS OF ON-CARRIAGE FIRE CONTROL EQUIPMENT

47. Panoramic Telescope Mount

For tests and adjustment of the panoramic tele-

scope mount M145 and linkage, see TM 9-2350-217-10, Operator's Manual.

48. Elevation Quadrant

For the orientation check of the elevation quadrant M15, see TM 9-2350-217-10, Operator's Manual.

Section IV. TEST OF FUZE SETTERS

49. General

Examine the fuze setters as follows:

a. Check for burred or dented edges —

(1) The stop that fits into the slot of the movable time ring.

(2) The adjusting pawl which engages the notch in the fixed fuze ring.

b. Depress the adjustable pawl against its spring to determine that the movement of the pawl is free.

c. Test the fuze setter with the fuze for which it was designed; the time scale on the fuze setter must have the same graduation as the time ring on the fuze.

50. Time Scale Test

The time scale test is performed to verify that the time set on the fuze agrees, within prescribed tolerances, with the time setting on the fuze setter. This test may be conducted during firing or as a separate test.

Warning: Never use a fuze from a dud.

a. The time set on the fuze should agree with the time setting on the fuze setter within one-

fourth of the smallest graduation on the fuze time ring. The tolerances are —

- (1) 0.05 second for fuzes having 0.2 second graduations.
- (2) 0.125 second for fuzes having 0.5 second graduations.

b. If a fuze setting doesn't agree with the time set on the fuze setter, proceed as follows:

- (1) Repeat the test as a check with a different setting.
- (2) If the fuzes and the fuze setter still don't agree refer the instrument to ordnance.

c. Do not set any one live fuze more than twice.

d. When tests are complete, reset all fuzes to SAFE and replace the safety wire or cotter pin.

CHAPTER 7

MAINTENANCE AND INSPECTIONS

51. General

Systematic maintenance and inspection are essential to insure that —

a. The howitzer section is prepared to carry out its mission immediately.

b. Unexpected breakdowns are not experienced at a critical time when maximum performance is essential.

c. Expensive and time-consuming repairs are reduced to a minimum.

52. Disassembly, Assembly, and Adjustment

Authorized adjustments and disassemblies to be performed by battery personnel are prescribed in TM 9-2350-217-10, Operator's Manual, and appropriate Department of the Army supply manuals. Deviation from these procedures is not authorized, except as permitted by the responsible ordnance officer.

53. Records

The principal records pertaining to the weapon are the Equipment Log Book, DA Form 2404, Equipment Inspection and Maintenance Worksheet, and DA Form 2407, Maintenance Request. For detailed information on the use of these forms, see TM 38-750.

54. Maintenance

Detailed instructions for maintaining the howitzer and the carriage are contained in TM 9-2350-217-10, Operator's Manual.

55. Inspections

a. *The chief of section* should inspect his equipment *daily* and take immediate action to correct any deficiencies found.

b. *The executive*, accompanied by the artillery mechanic, should make a *daily informal command inspection* on different parts of the weapon and carriage.

c. *The executive* should make a thorough mechanical inspection *at least once a month* of the weapons, auxiliary equipment, tools, and spare parts.

d. Detailed instructions for inspecting the howitzer and the carriage are contained in TM 9-2350-217-10, Operator's Manual.

56. Operational Services

A daily service is performed by the driver and the crew *each day* the vehicle is *operated*. This service is divided into three parts.

a. *Before-operation service* is a brief service to determine if the vehicle is ready for operation. At this time the chief of section verifies that sufficient ammunition, rations, tools, and equipment are available and secured. A detailed list of duties is contained in table VII.

Table VII. Duties in Before Operation Service
(Located in back of manual)

b. During-operation service consists of detecting any unsatisfactory performance of the vehicle. A detailed list of duties is contained in table VIII.

Table VIII. Duties in During Operations Service

(Located in back of manual)

c. After-operation service prepares the vehicle to operate again on a moment's notice. This is the basic daily service for the vehicle, and it is particularly important to detect deficiencies that developed during operation. All defects that the driver and crew cannot remedy must be reported at this time. The chief of section will resupply, as required, ammunition and rations and verify that all equipment is present. Procedures for daily preventive-maintenance services are contained in TM 9-2350-217-10, Operator's Manual. A detailed list of duties is contained in table IX.

Table IX. Duties in After Operation Service

(Located in back of manual)

CHAPTER 8

DECONTAMINATION OF EQUIPMENT

57. General

a. Equipment that has been contaminated with the following agents constitutes a hazard to personnel and must be removed or neutralized:

- (1) Chemical.
- (2) Biological.
- (3) Radiological.

b. Decontamination is the process of covering, removing, destroying, or changing the contamination agent or agents into harmless substances.

c. Decontamination must be started as soon as possible in order to reduce hazards, and allow safe operation of equipment.

58. Decontamination of Toxic Chemical Agents

Table X prescribes the methods for decontaminating for toxic chemical agents.

59. Decontamination of Biological Agents

Decontaminants and decontamination procedures for toxic chemical agents are usually effective against biological agents.

60. Decontamination of Radiological Agents

a. *Radioactive contaminants* cannot be made safe by chemical action. They must be removed or shielded if it is impracticable to wait for natural decay.

b. *Decontamination* is the process of *reducing* the hazard by removing the contaminant or shielding against radiation. Methods are given in table XI.

Table X. Decontamination for Toxic Chemical Agents

Contaminated object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Canvas	Boil in soapy water for 1 hour. Use 5 percent solution of household bleach for V-agents. Use 5 percent solution washing soda for G-agents.	Immerse in boiling water for 1 hour. Launder by standard methods. Use DANC ¹ solution for DS2 ¹ . Use slurry ² .	Aerate (except for V-agents).
Clothing	Immerse in boiling water for 1 hour, stir, add 1 pound of soap to each 10 gallons of water. Use 5 percent solution of bleach for V-agents. Use 5 percent solution of washing soda for G-agents.	Launder by standard methods. Dry clean. Use DS2 for cotton items only.	Rub M5 ointment on small contaminated areas. Aerate (except for V-agents).
Unpainted metals	Use DS2 or DANC, then rinse or wipe with organic solvent ³ , and dry.	Wash with cool soapy water ³ and rinse.	Aerate.

Painted metals	Spray with DS2 or DANC solution.	Wash with hot soapy water and rinse. (Slurry may be used if it is removed within 1 hour and the surface is oiled.)	Aerate. Weather.
Instruments	Clean with alcohol (or gasoline) and apply a thin coat of oil.	Wipe with rag dampened with DANC or DS2, dry with clean rag, and oil.	Weather.

¹ These decontaminants are injurious to plastic and hard rubber and should not be used in the bore.

² Equal weights of water and chloride of lime.

³ Organic solvents (petroleum products) and water do not neutralize contaminants. Precautions must be taken to dispose of these solvents as contaminated material.

Table XI. Decontamination for Radiological Agents

Method	Contaminated object	Technique	Remarks
Wash and scrub with water.	All nonporous surfaces (metal, paint, plastics).	Work from top to bottom and up wind.	Drainage must be controlled — water is contaminated.
Detergent (soap) solution.	All nonporous surfaces.	Heat water if possible. Rub surface and wipe dry. (Moist application is all that is desired, do not let drip.)	Rags and runoff require disposal.
Organic solvents. (Petroleum products).	All nonporous surfaces.	Immerse or wash with solvent, then wash in hot soapy water and rinse with clear water.	Vapors are toxic. Fire precautions are required.
Brushing	Porous and nonporous surfaces.	Brush, sweep, dust from equipment or clothing.	Limited control of contaminated dust. Wear protective mask.

Hot spots may be reduced by sanding, filing, or grinding. These methods are not practicable for large areas — a protective mask and gloves must be worn.

Launder	Clothing.	Use hot soapy water and rinse with clear water.	Water requires disposal.
Bathing and scrubbing.	Personnel.	Use brushes, running water, and soap.	Continue scrubbing until contamination level is safe.

CHAPTER 9

DESTRUCTION OF EQUIPMENT

61. General

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

b. Equipment will be destroyed only on the authority delegated by a division or higher commander.

62. Plans

A plan will be prepared by each battery to expedite destruction of equipment. The principles are as follows:

a. The plan must be adequate, uniform, easily executed.

b. Destroy essential parts first.

c. Destruction must be as complete as possible.

d. Destroy the *same* essential parts throughout the battery.

e. Destroy spare parts and accessories with the same priority as those installed on equipment.

63. Methods

a. The most generally applicable methods of destruction are —

- (1) *Mechanical* — Requires ax, pick, sledge or similar equipment.

- (2) *Burning*—Requires gasoline, oil, or other flammables.
- (3) *Demolition*—Requires ammunition or explosives.
- (4) *Gunfire* — R e q u i r e s artillery, rocket launcher, rifle grenades.

b. In general, destruction of essential parts, followed by burning is sufficient to render the weapon useless.

64. Reference

Detailed information on destruction of the equipment is contained in TM 9-2350-217-10, Operator's Manual.

CHAPTER 10

SAFETY PRECAUTIONS

65. General

Safety precautions to be observed in training are prescribed in AR 385-63. Additional information is given in FM 6-40, FM 6-140, TM 9-2350-217-10, and TM 9-1900. The more important safety precautions are summarized in this chapter.

66. Ammunition

The following precautions must be observed when handling ammunition:

a. Store ammunition in the firing area so that it is protected against accidental explosions.

b. Keep fire and flammables out of the area.

c. Protect ammunition from direct rays of the sun.

d. Do not disassemble fuzes.

e. All ammunition prepared for firing and not fired must be checked to insure that —

(1) Powder increments are present, in the proper order and in good condition; and that the proper lot numbers are placed in correspondingly marked containers.

(2) Time fuzes are reset to SAFE and the safety wires are replaced.

67. Failure to Fire

If the weapon fails to fire —

a. Keep the weapon trained on the target.

b. Clear unnecessary personnel from the vicinity of the howitzer.

c. Make two additional attempts to fire the weapon.

d. Wait 10 minutes after the last attempt to fire.

e. Eject the primer.

f. If the primer did not fire, replace the primer and attempt to fire.

g. If the primer did fire, open the breech; replace the propellant charge, and fire the weapon.

h. For detailed procedures, refer to TM 9-2350-217-10, Operator's Manual.

68. Drill and Firing

a. Load the weapon only when firing is imminent.

b. Personnel move in rear of the piece when going from side to side.

c. Personnel stay clear of recoil path.

d. Crew members should use ear plugs or cotton to protect ear drums.

e. A safety officer will be present during all firings in training exercises. Specific duties for the safety officer are listed in FM 6-40.

CHAPTER 11

TRAINING

Section I. GENERAL

69. Purpose

The purpose of this chapter is to present the minimum requirements for training the howitzer section. It includes —

- a. Information for conduct of training.
- b. Minimum training schedule.
- c. Gunner's qualification tests.

70. Conduct of Training

Section training is *conducted* by the section chief. Battery officers are responsible for preparing the training plans and for supervising their execution. The chief of section —

a. Trains *each* member of his section to function smoothly and efficiently in *all duties* in the section.

b. Welds the section into an effective, coordinated team, capable of functioning efficiently in combat.

c. Emphasizes the application of prior instruction to current training.

d. Maintains a progress card on each man to show —

- (1) Instruction attended.
- (2) Tests taken.
- (3) Remarks pertaining to progress.

e. References: AR 611-201, ATP 6-100, FM 21-5, and FM 6-125.

Section II. MINIMUM TRAINING SCHEDULE

71. Training Periods

a. The principles that should be followed in scheduling and preparing training periods are listed below:

- (1) Arrange periods in service of the piece drill along with other battery training to provide a balanced training program.
- (2) Section drill should not exceed thirty minutes and be conducted in a vigorous manner.
- (3) Precede and follow howitzer drill with logically related subjects. For example, precede the drill period with tests and adjustments and follow with inspection and maintenance.

b. Army Subject Schedule 6-3 provides uniform guidance for cannoneer training.

c. Operational and maintenance characteristics of the weapon are referenced in TM 9-2350-217-10.

d. The training schedule outlined in paragraph 72 is a guide to meet minimum training requirements.

§ 72. Schedule

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW.	1	Organization and composition of howitzer section, general duties of individuals, and formation of howitzer section.	Par. 2, 3, 9.	Howitzer and motor carriage.
C, D, PW.	1	Posts and posting, changing posts, and mounting and dismounting.	Par. 9-15.	Do.
C, D, PW.	2 (1-hour periods).	Prepare for action. March order.	Par. 18. Par. 24.	Do.
C, D, PW.	24 (½-hour periods).	Howitzer drill, duties in firing by indirect laying.	Par. 19.	TOE equipment.
C, D, PW.	9 (½-hour periods).	Howitzer drill, duties in firing by direct laying.	Par. 20-23.	Do.
C, D, PW.	6 (1-hour and ½-hour periods).	Tests and adjustment of sighting and fire control equipment.	Par. 30-49.	Do.

C, D, PW.	2 (½-hour periods).	Aiming post displacement correction.	Par. 26.	TOE equipment, blackboard, and chalk.
C, D, PW.	4 (1-hour periods).	Inspections and maintenance drills.	Par. 51-56.	TOE equipment.
C, D, PW.	1	Decontamination of materiel.	Par. 57-60.	Decontamination and TOE equipment.
C, D, PW.	1	Destruction of materiel to prevent use by the enemy.	Par. 61-64.	Demolition and TOE equipment.
C, D.	1	Safety precautions.	Par. 65-68.	TOE equipment.
PW.	16 (4-hour periods).	Service practice, firing by indirect laying.	Par. 19.	Do.
PW.	4	Service practice, firing by direct laying.	Par. 20-23.	Do.
C, PW.	6 (1-hour periods).	Review and tests of subjects previously covered.	All previous references.	Do.

Section III. GUNNER'S QUALIFICATION TESTS

73. Purpose and Scope

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

a. Determine the relative proficiency of the *artillery soldier* while performing the duties of gunner, 155-mm howitzer M109, self-propelled. *The tests are not a basis for determining the relative proficiency of batteries or higher units.*

b. Serve as an adjunct to training.

74. Standards of Precision

The following standards are required of the candidate:

a. Counter settings must be exact.

b. Leveling bubbles must be centered *exactly*.

c. Vertical reticle in the panoramic telescope must be alined on the left edge of the aiming post or on the same part of the aiming point or target each time the howitzer is laid.

d. *Final motions* must be made in appropriate direction.

(1) *Countersettings* are made from lower to higher numbers.

(2) *Elevation* should be in the direction of the more difficult movement.

(3) *Traverse* is from left to right.

(4) *Vertical reticle* of the panoramic telescope is moved from left to right.

75. Assistance

a. The candidate will receive no unauthorized assistance.

b. The candidate may select assistants as authorized in the tests.

c. If an assistant or the examiner causes the candidate to fail a test, the test will be disregarded and another test of the same nature will be administered.

76. Time

a. The time allowed for each test is from the last word of the command to the last word of the candidate's report.

b. The candidate may begin the test after the first word of the first command.

77. Scoring

a. Scoring will be in accordance with the subparagraphs *d* and *e* entitled "Penalties" and "Credit".

b. No penalty will be assessed in excess of the maximum credit allowed for each test.

78. Preparation for Tests

a. The howitzer will be prepared for action and the candidate will be posted in the position corresponding to the test or as indicated by the subparagraph *b* entitled "Special Instructions".

b. The examiner will insure that the candidate understands the requirements of the test.

c. Candidate reports "I am ready" before each test.

79. Qualification Scores

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

<i>Individual classification</i>	<i>Points</i>
Expert gunner	90
First-class gunner	80
Second-class gunner	70

§ 80. Outline of Tests

Paragraph	Subject	Number of tests	Points each	Maximum credit
81	Direct laying, panoramic telescope	4	2	8
82	Direct laying, direct fire telescope	4	2	8
83	Indirect laying, deflection only	18	2	36
84	Laying for quadrant with the elevation counter...	3	2	6
85	Laying for quadrant with the gunner's quadrant.	3	2	6
86	Displacement correction	2	—	4
	Part I	(1)	3	(3)
	Part II	(1)	1	(1)
87	Measuring site to the mask	1	4	4
88	Measuring quadrant	1	4	4
89	Measuring deflection	1	4	4
90	Tests and adjustments of sighting and fire control equipment.	5	—	10
	Tests 1 and 2	(2)	1	(2)
	Test 4	(1)	2	(2)
	Tests 3 and 5	(2)	3	(6)

91	Materiel	3	—	10
	Test 1	(1)	3	(3)
	Test 2	(1)	3	(3)
	Test 3	(1)	4	(4)

Total credit 100

81. Direct Laying Panoramic Telescope

a. Scope of Tests.

- (1) Four tests (two groups of two tests each) will be conducted.
- (2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

b. Special Instruction.

- (1) Place a stationary target approximately 600 meters from the howitzer.
- (2) Set azimuth counter to 3,200 mils, and set the gunner's aid counter to zero.
- (3) Point howitzer so that a 100-mil shift is required for tests 1 and 3.
- (4) Post the candidate as the gunner.
- (5) The laying of the piece will not be disturbed after tests 1 and 3.
- (6) The examiner will reverse the assumed direction of movement for test 3.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1 and 3	TARGET: THAT TANK, SHELL HE, CHARGE 7, FUZE QUICK, LEAD RIGHT 10, RANGE 800.	Sets lead on the azimuth counter. Traverses tube until vertical reticle is on the center of the target mass. Centers the pitch and cross-level bubbles. Commands FIRE and steps clear.

Test No.	Examiner commands	Action of candidate
2 and 4	RIGHT (LEFT) 10, ADD (DROP) 200.	Sets off change in lead by using click sights. Traverses the tube until the vertical reticle is on the center of the target. Commands FIRE and steps clear.

d. Penalties. No credit will be allowed if, after each test —

- (1) The incorrect lead is set on the azimuth counter.
- (2) The vertical reticle is not centered on the mass of the target.
- (3) The pitch and cross-level bubbles are not centered.

e. Credit.

Time in seconds, exactly or less than.	5	6	7
Credit	2.0	1.5	1.0

82. Direct Laying, Direct Fire Telescope

a. Scope of Tests.

- (1) Four tests (two groups of two tests each) will be conducted.
- (2) Test 1 and 2 (and tests 3 and 4) will be executed as one series of commands.
- (3) The candidate will be tested as the assistant gunner in the two-man, two-sight system.

b. Special Instructions

- (1) A stationary target will be placed approximately 600 meters from the howitzer.
- (2) For tests 1 and 3, the correct range line as viewed through the telescope will be placed more than 100 meters away from the target.
- (3) The laying of the piece will not be disturbed after tests 1 and 3.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1 and 3	TARGET: THAT TANK, SHELL HE, CHARGE 7, FUZE QUICK, LEAD LEFT 5, RANGE 600.	Places proper range line on the center of the visible mass of the tar- get. Checks and adjusts for cant as required. Calls "Set" and steps clear.
2 and 4	ADD (DROP) 200....	Same as test 1 above.

d. Penalties. No credit will be given if, after each test —

- (1) The correct range line is not on the center of the visible mass of the target.
- (2) The bubble in the cant-level vial is not centered.

e. Credit.

Time in seconds, exactly or less than.	2	2½	3
Credit	2	1.5	1.0

83. Indirect Laying, Deflection Only

a. Scope of Tests.

- (1) Eighteen tests (two groups of nine tests each) will be conducted.
- (2) Tests 1 through 9 (and tests 10 through 18) will be executed as one series of commands.

b. Special Instructions.

- (1) The examiner will identify an aiming point for the candidate.
- (2) Special corrections will be given *only* in the tests indicated in *c* below.
- (3) The deflection limits for each tests are as follows:

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

- (4) The howitzer will be laid with the correct deflection at the conclusion of each test.
- (5) Aiming posts will be set out at the deflection, as determined by unit SOP, and the far aiming post will be 100 meters from the sight.
- (6) The examiner will designate the section number and special corrections in deflection to be applied by the candidate.
- (7) The candidate will be posted as the gunner.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1 and 10.	SPECIAL CORRECTIONS, DEFLECTION 3200, NUMBER 1 LEFT 7.	Sets deflection and applies special correction. Centers cross level and pitch level bubbles. Traverses the piece until the vertical reticle is on the left edge of the aiming posts. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
2 and 11.	DEFLECTION 3050..	Sets deflection. Leaves correction on gunner's aid counter. Lays on aiming posts. Checks centering of bubbles. Relays if necessary. Calls "Ready" and steps clear.
3 and 12.	DEFLECTION 3130..	Same as test 2 above.
4 and 13.	NUMBER 1 RIGHT 4. CEASE FIRE, END OF MISSION (Operation is not timed.)	Same as test 2, except he sets <i>right 4</i> on the gunner's aid counter. Sets gunner's aid counter to zero.

Test No.	Examiner commands	Action of candidate
5 and 14.	AIMING POINT, CHURCH STEEPLE, REFER.	Refers telescope to church steeple. Uncovers azimuth counter. Reads deflection and calls "Number 1, deflection ()."
6 and 15.	DEFLECTION 3200 REFER.	Rotates azimuth knob until reset counter reads 3200. Verifies that the vertical reticle is on the church steeple. Calls "Number 1, deflection 3200 and steps clear."
7 and 16.	SPECIAL CORRECTIONS, DEFLECTION 3129 NUMBER 1 LEFT 6.	Same as test 1 above.
8 and 17.	DEFLECTION 3069..	Same as test 2 above.
9 and 18.	DEFLECTION 3071..	Same as test 2 above.

d. Penalties. No credit will be given if, after each test —

- (1) The deflection is not set correctly.
- (2) The cross-level and pitch-level bubbles are not centered.
- (3) The vertical reticle of the telescope is not

on the aiming point or on the left edge of the aiming post.

- (4) Last motion in traverse is not from left to right.

e. Credit.

Time in seconds, exactly or less than —

Tests 1, 10, 6, and 15.....	12	13	14
Other tests	8	9	10
Credit	2.0	1.5	1.0

84. Laying for Quadrant with the Elevation Counter

a. Scope of Tests. Three tests will be conducted.

b. Special Instructions.

- (1) Each test will require a change from 20 to 40 mils.
- (2) Commands in tests 2 and 3 will not be in multiples of 5.
- (3) Candidate will be posted as assistant gunner.
- (4) The setting on the elevation counter will be within 40 mils of the initial elevation.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	QUADRANT 375.....	Sets quadrant on the elevation counter. Centers pitch and cross-level bubbles. Calls "Ready" and steps clear.
2	QUADRANT 342	Same as test 1 above.
3	SPECIAL COR- RECTIONS, NUMBER 1 UP 2, QUADRANT 363.	Same as test 1 above, except he sets up 2 on the gunner's aid counter.

d. Penalties. No credit will be allowed if, after each test —

- (1) The quadrant is not set accurately.
- (2) The cross-level and pitch-level bubbles are not centered.
- (3) The last movement of the tube is not in the direction in which it is more difficult to elevate.

e. Credit.

Time in seconds, exactly or less than.	4	5%	6%
Credit	2.0	1.5	1.0

85. Laying for Quadrant with the Gunner's Quadrant

a. Scope of Tests. Three tests will be conducted.

b. Special Instructions.

- (1) Gunner's quadrant will be set at zero for the first test.
- (2) Tests 2 and 3 will require changes from 30 to 60 mils.
- (3) Candidate will be posted to the left of and facing the breech and will be holding the gunner's quadrant.
- (4) An assistant will elevate or depress the tube as directed by the candidate.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	QUADRANT 210	Sets quadrant elevation on the gunner's quadrant. Seats the quadrant. Directs his assistant to elevate or depress the tube until the quadrant bubble is centered. Calls "Ready" and awaits verification of the laying.
2	QUADRANT 257	Same as test 1 above.
3	QUADRANT 193	Same as test 1 above.

d. *Penalties.* No credit will be allowed if, after each test —

- (1) Quadrant elevation is not set correctly.
- (2) Quadrant is not properly seated.
- (3) Quadrant bubble is not properly centered.
- (4) Last movement of the tube was not in the direction in which it is more difficult to elevate.

e. *Credit.*

Time in seconds, exactly or less than.	6	6 $\frac{3}{4}$	7
Credit	2.0	1.5	1.0

86. Displacement Correction

a. *Scope of Test.* One test, consisting of two parts, is conducted.

b. Special Instructions.

- (1) Aiming posts will be set out at prescribed distances.
- (2) An assistant will be stationed by the far aiming post.
- (3) The examiner will require the candidate to lay the piece on an announced deflection and report "I am ready."
- (4) The motor carriage will be moved so that a 5- to 10-mil aiming post displacement occurs.
- (5) The lay of the howitzer at the end of part I will not be disturbed for part II.

c. Outline of Test.

(1) Part I.

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

(2) Part II.

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

d. Penalties.

(1) *Part I.* No credit will be allowed if —

(a) The far aiming post does not appear midway between the near aiming post and the vertical reticle of the telescope.

(b) Cross-level and pitch-level bubbles are not centered.

(c) Final motion of traverse was not from left to right.

(2) *Part II.* No credit will be allowed if —

(a) Deflection is other than the announced deflection.

(b) Aiming posts are not properly alined.

(c) Vertical reticle of the telescope is not on the left edge of the aiming posts.

e. Credit.

Part I, time in seconds	3	3½	3¾	4
exactly or less than."				
Credit	3	2.0	1.5	1.0
Part II, no time limit				
Credit	1.0

87. Measuring Site to the Mask

a. Scope of Test. One test will be conducted.

b. Special Instructions.

(1) The howitzer, prepared for action, will be placed 200 to 400 meters from a mask of reasonable height.

(2) The tube will be pointed 100 to 150 mils above the crest and 100 to 150 mils to the right or left of the highest point on the crest.

- (3) The candidate will be posted at the rear of the breach.
- (4) An assistant will traverse and elevate the tube as directed by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE SITE TO MASK.	<p>Sights along lowest element of the bore and directs the movement of the tube until the line of sight just clears the highest point of the crest.</p> <p>Centers the cross-level and pitch-level bubbles.</p> <p>Reads the elevation from the elevation counter.</p> <p>Reports "Number (), sight to mask ()."</p>

d. Penalties. No credit will be allowed if —

- (1) The line of sight along the lowest element of the bore does not just clear the highest point of the crest.
- (2) The cross-level and pitch-level bubbles are not properly centered.
- (3) Site is not announced correctly.
- (4) Last movement of the tube was not in the direction in which it is more difficult to elevate.

e. Credit.

Time in seconds, exactly	14	15	16	17
or less than.				
Credit	4.0	3.0	2.0	1.5

88. Measuring Quadrant

a. *Scope of Test.* One test is conducted.

b. *Special Instructions.* Prior to the test the examiner will lay the tube at a selected quadrant and will set the gunner's quadrant to zero.

c. *Outline of Test.*

Examiner commands	Action of candidate
MEASURE THE QUADRANT.	Places gunner's quadrant on the quadrant seats on the breech ring. Levels the bubble on the gunner's quadrant by raising the index arm and turning the micrometer knob. Announces "Number () quadrant ()" and hands quadrant to examiner.

d. *Penalties.* No credit will be allowed if —

(1) The quadrant bubble is not centered when the quadrant is properly seated.

(2) The quadrant is not announced correctly.

e. *Credit.*

Time in seconds, exactly or less than.	8	9%	10%
-------------------------------------------	---	----	-----

Credit	4.0	3.0	2.0
--------------	-----	-----	-----

89. Measure Deflection

a. *Scope of Test.* One test is conducted.

b. *Special Instructions.*

(1) The piece will be laid on the aiming posts.

(2) An aiming point within 200 mils left or right of the aiming posts will be designated and will be identified by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
NUMBER 1, AIMING POINT THAT (MARKER) REFER.	Centers the cross-level and pitch-level bubbles. Refers to aiming point. Reads deflection from the azimuth counter and reports "Number 1, deflection ()," and steps clear.

d. Penalties. No credit will be allowed if —

- (1) The cross-level and pitch-level bubbles are not centered properly.
- (2) Vertical reticle of the telescope is not on the aiming point.
- (3) Deflection is not announced correctly.
- (4) The weapon is traversed.

e. Credit.

Time in seconds, exactly or less than.	5	5%	6	6%
Credit	4	3	2.0	1.5

90. Tests and Adjustments of Sighting and Fire Control Equipment

a. Scope of Tests. Five tests will be conducted in which the candidate will be required to —

- (1) Demonstrate the testing methods and authorized adjustments of sighting and fire control equipment.
- (2) Describe the action taken (send to ordnance) if adjustment is not authorized by the user.

b. Special Instructions.

- (1) The piece will be prepared for tests as indicated in paragraph 42 of this manual.
- (2) Necessary items of equipment are bore-sights, testing target, gunner's quadrant, and plumb line.
- (3) An assistant will elevate or depress the tube at the direction of the candidate during tests 1 and 2 and will align the testing target for test 5.
- (4) Tests will be conducted in numerical order.
- (5) The gunner's quadrant used for tests 1 and 2 will be used for tests 3 and 4, with the correction determined in test 1, provided the correction does not exceed 0.4 mil.
- (6) Adjustments on the telescope mount M145 and linkage are as prescribed in TM 9-2350-217-10.
- (7) Tube will be leveled after test 2 and will not be disturbed thereafter.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON THE GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 44. Calls "Correction () mils, quadrant serviceable, (unserviceable)" and hands the quadrant to the examiner.

Test No.	Examiner commands	Action of candidate
2	<p>PERFORM MICROMETER TEST ON THE GUNNER'S QUADRANT.</p> <p><i>Note.</i> Level the tube at conclusion of test 2.</p>	<p>Performs test as pre- scribed in paragraph 45.</p> <p>Calls "Quadrant microm- eter is (is not) in error."</p>
3	<p>TEST PANORA- MIC TELESCOPE MOUNT AND LINKAGE.</p>	<p>Performs tests and makes adjustments as prescribed in TM 9- 2350-217-10.</p> <p>Calls "Ready" when tests and adjustments are complete.</p>
4	<p>PERFORM ORIEN- TATION CHECK ON THE ELEVA- TION QUAD- RANT M15.</p>	<p>Performs check as pre- scribed in TM 9-2350- 217-10.</p> <p>Calls "Ready" when check is complete.</p>
5	<p>BORESIGHT THE HOWITZER.</p>	<p>Performs tests and makes adjustments as prescribed in para- graphs 35-37.</p> <p>Calls "Ready" and steps clear.</p>

d. Penalties. The tests are not essentially speed tests. The prescribed times are to insure that the candidate performs the tests without wasted effort.

(1) *Test 1.* No credit will be allowed if —

(a) The bubble in the gunner's quadrant does not center when checked by the examiner.

- (b) The error (one-half of the angle that was indicated when the quadrant was first reversed and the bubble was centered, using the index arm and the micrometer knob) is not announced correctly by the candidate.
 - (c) The candidate fails to declare the quadrant unserviceable if the error exceeds 0.4 mil or fails to declare the quadrant serviceable if the error is 0.4 mil or less.
 - (d) The time to complete the test exceeds 2 minutes.
- (2) *Test 2.* No credit will be allowed if —
- (a) The procedure is not followed correctly.
 - (b) The time to complete the test exceeds 1 minute.
- (3) *Test 3.* No credit will be allowed if —
- (a) The procedure is not followed correctly.
 - (b) The checks and adjustments are not accomplished at quadrants 416,858 and 1,300 mils in sequence.
 - (c) The candidate does not declare the telescope mount unserviceable if the readings disagree more than 0.5 mil.
 - (d) The candidate does not adjust linkage within prescribed limits.
 - (e) No time is prescribed for this test.

- (4) *Test 4.* No credit will be allowed if —
- (a) The procedure is not followed correctly.
 - (b) Candidate fails to notify the examiner if the reading on the gunner's quadrant disagrees more than 0.5 mil with the elevation quadrant.
 - (c) No time is prescribed for this test.
- (5) *Test 5.* No credit will be allowed if —
- (a) The candidate fails to make indicated adjustments.
 - (b) The candidate does not adjust azimuth counter to read exactly 3,200.
 - (c) The direct fire telescope mount slip scales are not set at elevation 4, azimuth 4.
 - (d) The time to complete tests and adjustments exceeds 4½ minutes.

e. Credit. If tests and adjustments are within prescribed limits, maximum credit will be given as follows:

<i>Test</i>	<i>Points</i>
1	1
2	1
3	3
4	2
5	3
Maximum credit	<hr/> 10

91. Materiel

- a. Scope of Tests.* Three tests are performed.
- b. Special Instructions.*

- (1) *Tests 1 and 2.* A paulin will be placed on the compartment floor for layout of disassembled parts. The candidate will be allowed to select the tools prior to the test. The candidate may have an assistant to aid him in moving the breechblock.
- (2) *Test 3.* A complete set of lubrication equipment and lubricants authorized for use by battery personnel will be made available. Lubricants will be clearly marked.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	DISASSEMBLE BREECHBLOCK ASSEMBLY.	Performs operation as prescribed in TM 9-2350-217-10. Identifies all parts to the examiner.
2	ASSEMBLE BREECHBLOCK.	Performs operation as prescribed in TM 9-2350-217-10.
3	PERFORM DAILY AND QUARTERLY LUBRICATION.	Selects proper lubricants and equipment. Shows <i>how, when,</i> and with which lubricant is used at each point. (Actual lubrication is not performed.) Checks <i>all</i> lubricant levels.

d. Penalties.

- (1) The tests are not speed tests; however, times are prescribed to insure that the candidate performs the tests without wasted effort.
- (2) No credit will be given if the following time limits are exceeded:

<i>Test</i>	<i>Time (minutes)</i>
1	8
2	12
3	5

- (3) One-half point will be assessed for each component incorrectly identified in test 1. There are no prescribed times for identifying the components. However, the examiner may reduce the grade if the candidate demonstrates obvious unfamiliarity with the components.
- (4) One-half point will be assessed for each lubrication point missed, each lubricant improperly selected, and each lubricating device improperly selected.

e. Credit.

<i>Test</i>	<i>Points</i>
1	3
2	3
3	4
Maximum credit	<hr/> 10

APPENDIX

REFERENCES

AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 385-63	Regulations for Firing Ammunition for Training Target Practice, and Combat.
AR 611-201	Manual of Enlisted Military Occupational Specialties.
AR 672-5-1	Awards.
AR 750-5	Organization, Policies, and Responsibilities for Maintenance Operation.
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides and Phono-Recordings.
DA Pam 310-series	Index of Military Publications.
FM 5-15	Field Fortifications.
FM 5-20	Camouflage, Basic Principles and Field Camouflage.
FM 5-25	Explosives and Demolitions.
FM 6-20-2	Field Artillery Techniques.
FM 6-40	Field Artillery Cannon Gunnery.
FM 6-125	Qualification Tests for Specialists Field Artillery.

FM 6-140	The Field Artillery Battery.
FM 17-50	Armor Logistics.
FM 21-5	Military Training.
FM 21-30	Military Symbols.
FM 21-40	Small Unit Procedures in Nuclear, Biological and Chemical Warfare.
FM 21-60	Visual Signals.
FM 22-5	Drills and Ceremonies.
FM 31-70	Basic Cold Weather Manual.
ATP 6-100	Army Training Program for Field Artillery Units.
ATT 6-117	Training Test for Field Artillery Howitzer Battery, 105-mm or 155-mm.
FT 155-Q-3	Firing Tables for Howitzer, 155-mm.
TM 3-220	Chemical, Biological, and Radiological Decontamination.
TM 9-238	Deep Water Fording of Ordnance Materiel.
TM 9-575	Auxiliary Sighting and Fire Control Equipment.
TM 9-1527	Ordnance Maintenance: Gunner's Quadrants M1, M1918 and Machine Gun Clinometer M917.
TM 9-1590	Ordnance Maintenance: Fuze Setters, M14, M22, M23, M25, and M27.
TM 9-1900	Ammunition, General.

TM 9-2300	Artillery Materiel and Associated Equipment.
TM 9-2350-217-10	Part I. Operator's Manual for Howitzer, Light, Self-Propelled: 105-mm, T195E1 and Howitzer, Medium, Self Propelled: 155-mm, M109.
TM 9-2350-217-20	Part II. Organizational Maintenance for Howitzer, Light, Self-Propelled 105-mm T195E1, and Howitzer, Medium, Self-Propelled: 155-mm, M109.
TM 9-2810	Preventive Maintenance, Supply Inspection, and Training Procedures Tactical Motor Vehicle.
TM 11-206	Interphone Controls C-980/U and C-981/U and Intercommunication Set Control C-980 A/U.
TM 11-2643	Intercommunication Sets AN/UIC-1, and AN/UIC-1X.
TM 21-301	Driver Selection, Training and Supervision; Tracked Vehicles.
TM 21-306	Manual for the Tracked Vehicle Driver.
TM 38-750	The Army Equipment Record System and Procedures.

LO 9-2350-217-10	Part IV. Lubrication Instructions.
SM 9-5-1315	Ammunition, 75-mm Through 125-mm.
SM 9-5-1390	Ammunition and Explosives, Fuzes and Primers.

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Regt/Gp (1)	6-357 (5)
Inf BG (1)	6-425 (5)
Ft Carson (2)	6-427 (5)
Ft Devens (2)	17-22 (1)

NG: State AG (3).

USAR: Same as Active Army except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-50.

1

2

3

4

5

CHANGE

No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 20 February 1968

155-MM HOWITZER, M109, SELF-PROPELLED

FM 6-88, 20 December 1962, is changed as follows:

Paragraphs 44g(5), 45e, 46d, 50b(2), 52, and 90a(2). Wherever the term "ordnance" appears, it is changed to read "support maintenance".

Page 16, paragraphs 17b(1) and (2).

- (1) (As superseded by C 2, 27 Aug 64)
Mark the howitzer positions with stakes and engineer tape in the direction of fire to indicate the place along which the edge of the left track is to be driven.
- (2) (As superseded by C 2, 27 Aug 64)
Camouflage, fortifications, and other position preparations are initiated based on available time and the tactical situation.

Page 14, figure 7, (as superseded by C 2, 27 Aug 64) follows:

*This change supersedes C 2, 27 August 1964.

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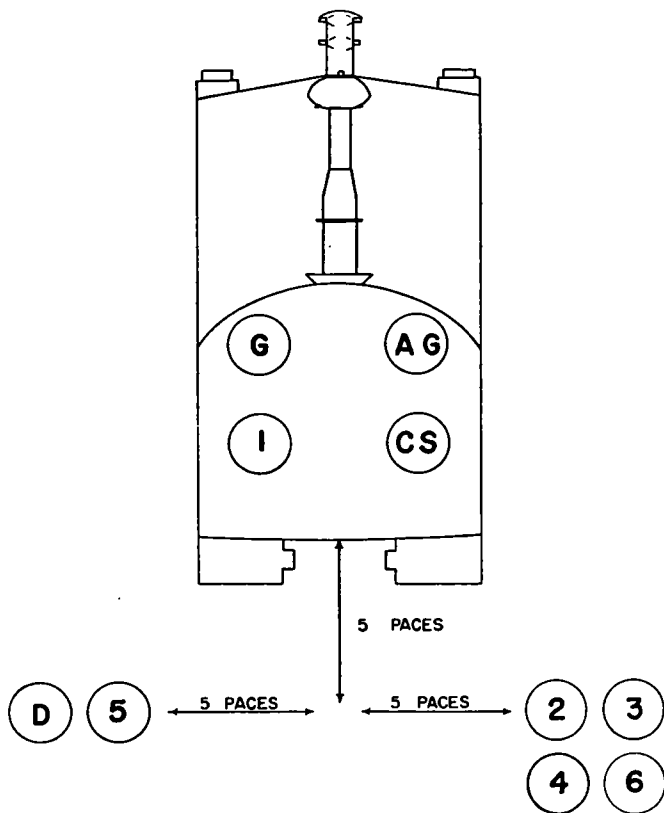


Figure 7. Posts prepared for action.

Page 17, paragraph 19. In line 5, "(aiming posts)" is changed to read "(infinity-aiming reference collimator, aiming posts, or distant aiming points)," and to the end of line 9 add "(fig. 7.1)."

Page 17. Figure 7.1 is added as follows:

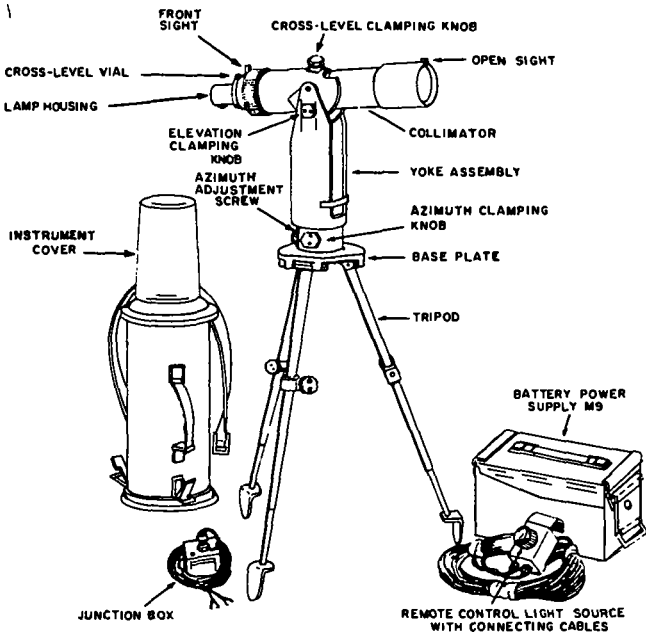


Figure 7.1. Infinity-aiming reference collimator and auxiliary equipment.

Pages 22 and 23. Table V is superseded as follows:

Table V. Direct Fire Table, 155-MM Howitzer, M109, SHELL HE, Chrage 7

Range meters	Elevation mils	Vertical displacement feet	Trajectory characteristics	Firing data
100	2	0	Within these ranges the trajectory is flat enough to prevent an 8-foot tank from passing safely beneath it. Fields of fire and terrain allowing, the upper range limit is ideal at which to open fire. This allows maximum time for conduct of fire. Range shifts of 100 meters are usually sufficient to bring the rounds on target.	1. Start firing at estimated range or 400 meters, whichever is greater. 2. Make 100 meter range changes until the round is brought on target.
200	3	.5		
300	5	1.0		
400	6	1.5		
500	8	2.0		
600	10	3.0		
700	12	3.5	Within these range limits it is necessary to establish a bracket. This is necessary due to the flat trajectory and the difficulty in estimating the correct range change in meters necessary to place rounds on target. A round that misses the target due to height of trajectory will land	1. Start firing at the estimated range. 2. Adjustment with the use of a bracket (overs and shorts) is required. 3. Make 200 meter range changes until a bracket is established. 4. Split the bracket until a
800	13	4.0		
900	15	4.5		
1000	17	5.0		
1100	19	6.0		
1200	20	6.5		
1300	22	7.0		
1400	24	8.0		

			<p>behind the target in range. Bracketing enables a more rapid adjustment on target. Range shifts of 200 meters should be made until a bracket is obtained.</p> <p>Within these ranges a hit on a moving target must be considered only reasonably possible. A bracket should be established using 400 meter range changes. Firing should be done at these ranges only when surprise is not important.</p> <p>At ranges greater than 2200 meters, direct laying is not advisable against moving targets. Increasing angle of fall of the projectile, difficulties in range estimation and the size of the target in the sight combine to make a target hit difficult and unlikely.</p>	<p>target hit is obtained.</p> <ol style="list-style-type: none"> 1. Start firing at the estimated range. 2. Adjustment with the use of a bracket (overs and shorts) is required. 3. Make 400 meter range changes until a bracket is established. 4. Split the bracket until a target hit is obtained.
1500	26	8.5		
1600	28	9.5		
1700	30	10.0		
1800	32	10.5		
1900	34	11.5		
2000	36	12.0		
2100	38	13.0		
2200	40	13.5		

Page 24, paragraph 26. In line 3 "aiming posts" is changed to read "aiming posts or collimator."

Page 26, paragraph 26c(5).

- (5) (As superseded by C 1, 22 Aug 63)
Unit SOP will specify the deflection at which to place the aiming posts; however, weapon design permits placement of the aiming posts at any desired deflection.

Page 26. Paragraph 26d and figure 8.1 are added after paragraph 26c(6).

d. If the collimator is used as the primary aiming point it is alined with the vertical reticle of the panoramic telescope as directed by the gunner. The infinity-aiming reference collimator is an optical instrument which simulates an azimuth reference target at infinity.

- (1) The collimator may be emplaced in any convenient position, from 4 to 15 meters from the left side of the weapon. Best results are obtained between 5 to 11 meters.
- (2) While the howitzer is being laid, number 4 alines the optical system of the collimator on the center of the telescope rotating head and cross-levels the reticle pattern.
- (3) After the howitzer is laid the gunner directs number 4 in alining the 0 line of the collimator reticle with the vertical reticle of the panoramic telescope.

- (4) To lay for direction during firing, the gunner sets the announced deflection on the panoramic telescope and alines any number on the panoramic telescope reticle with the same number of the collimator reticle with the vertical line of the reticle of the panoramic sight on the low side of the displayed collimator pattern. This procedure for laying compensates for weapon displacement (fig. 8.1).

Note. For positive location, an area at least 7 mils in diameter must be seen at all times on the collimator reticle.

Page 27, paragraph 28c(1), (3), (4), and (8).

- (1) (As superseded by C 2, 27 Aug 64) Number 1 slides the block assembly on the firing mechanism to the right and ejects the primer.
- (3) (As superseded by C 2, 27 Aug 64) The assistant gunner opens the breech and Number 1 removes the propellant charge.
- (4) (As superseded by C 2, 27 Aug 64) Number 1 fills the powder chamber with waste and the assistant gunner closes the breechblock.
- (8) (As superseded by C 2, 27 Aug 64) The assistant gunner opens the breech. Number 1 removes the waste, and positions the loading tray of the automatic rammer in the breech.

Page 30. Paragraph 30.1 is added after paragraph 30.

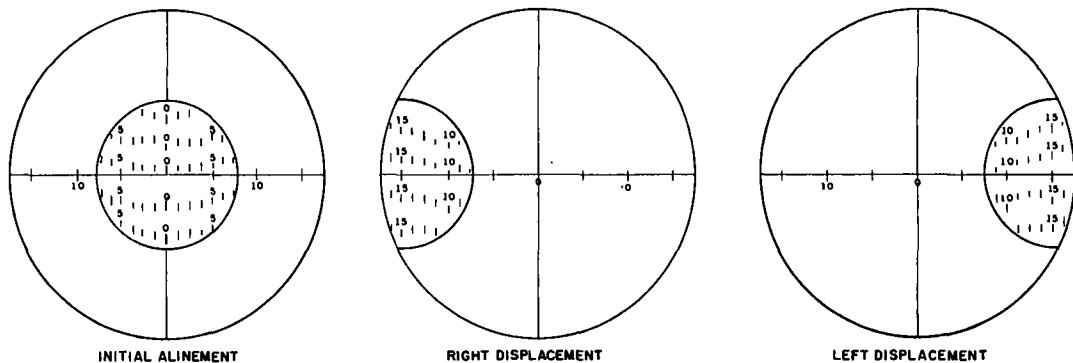


Figure 8.1. Gunner's sight picture of the collimator when correcting for displacement.

30.1. Explosive Projectiles in Heated Tubes

Explosive projectiles in heated tubes presents an extremely hazardous situation. The precautions to be observed are as follows:

a. Do not chamber the round in a weapon until immediately prior to firing.

b. A round that has been chambered in a weapon should be fired or removed from the weapon within 5 minutes.

c. If the round in a heated tube cannot be fired or removed within the 5 minute period, the following actions should be taken:

- (1) Where a misfire *is not* involved and in the event the round can not be fired or removed within 5 minutes the primer and propelling charge or cartridge case should be removed immediately then elevate the cannon tube approximately 30° and evacuate all personnel to safe distance. Allow the projectile and weapon to cool for 2 hours.
- (2) After the 2 hours waiting period one or more go the methods indicated in (*a*), (*b*), and (*c*) below should be attempted to clear the projectile from the tube. The weapon may be carefully moved or relocated to a remote position if necessary. If relocating is necessary the cannon tube should be lowered and locked in the traveling position. Waste will be placed in the chamber to cushion the

projectile and to protect the face of the breech block while the weapon is being moved.

- (a) Reload the weapon with the lowest propelling charge possible (Charge 1) and fire the weapon remotely.

Warning: It must be anticipated that the projectile may detonate in the cannon tube or along its trajectory upon firing, therefore all personnel must be evacuated to a safe distance or placed under adequate protective cover.

- (b) Request Direct Support Maintenance personnel with the technical advise of EDD personnel regarding recognition of possible exuded explosive or other hazards to carefully remove the cannon tube (with stuck projectile) at a remote location away from buildings and occupied area. The cannon tube containing the stuck projectile should then be released to EOD personnel.
 - (c) Request assistance from EOD personnel.
- (3) For separate loading ammunition involved in a misfire—
- (a) Wait for 2 minutes from the last attempt to fire before removing the primer. If the primer has fired personnel should be evacuated to a safe distance for a 2-hour waiting period

without removing the propelling charge. After the 2 hours waiting period remove the propelling charge and follow the guidance outlined in (2) above.

- (b) If the primer has not fired after the 2-minute waiting period a new primer will be tried or the faulty firing mechanism corrected. Then should the weapon not fire within a total elapse time of 5 minutes the propelling charge will be removed and personnel should be evacuated to safe distance for a 2-hour waiting period. The guidance outlined in (2) above should then be followed.

CHAPTER 5

BORESIGHTING

31. General

a. Purpose. The purpose of boresighting is to insure accuracy in laying for elevation and direction. Boresighting is the process of alining the on-carriage sighting and fire control equipment so that the lines of sight of the telescopes are parallel to the axis of the bore of the weapon. Boresighting is conducted before firing and, when necessary, during lulls in firing.

b. Methods of Boresighting. There are two methods of boresighting the M109. They are the—

- (1) Testing target method.
- (2) Distant aiming point method.

32. Preparation for Boresighting

a. Regardless of the method used the weapon should be near its center of traverse and pointed in the general direction of the distant aiming point or testing target.

b. Accurate cross-leveling of the trunnions is unnecessary for boresighting on a distant aiming

point; however, they should be as level as possible.

c. The breech and muzzle boresights must be in their proper positions.

d. All instruments and mounts must be positioned securely without free play.

33. Testing Target Method

To boresight, using the testing target method, follow the steps in *a* through *f* below:

a. Level the trunnions as accurately as possible.

b. Using the gunner's quadrant and applying any correction determined by the end-for-end test (para 44) plus the reading stamped on the howitzer breech ring, set the tube to zero elevation.

c. Turn all numeral counters and corrector scales to zero on both the panoramic telescope mount M145 and the elevation quadrant M15, and cross level the bubbles. The longitudinal bubbles should now be centered within plus or minus 0.5 mil. If they are not, the mount should be referred to authorized support personnel.

d. Place the panoramic telescope in the telescope mount M145.

- (1) Check the gunner's aid to see that it has been set to zero, and adjust the azimuth and reset counters to read 3200.
- (2) Center the pitch level bubble by rotating the pitch level knob.

e. Place the testing target (fig. 10) 50 to 100 meters in front of the howitzer tube and position the target so that the bore diagram is alined in the boresights.

f. Adjust the panoramic telescope to the testing target (fig. 10).

- (1) By rotating the azimuth knob, adjust the vertical line in the reticle of the panoramic telescope on the testing target diagram. The azimuth counter should read 3200. If the azimuth counter does not read 3200, fully *depress* the boresight adjusting shaft and rotate the shaft until the azimuth counter reads 3200.

Caution: To prevent extensive damage to the panoramic telescope M117, the boresight adjustment shaft must be fully depressed before an attempt is made to rotate it.

- (2) Adjust the horizontal line of the panoramic telescope on the testing target diagram by means of the elevation knob on the telescope. The weapon is now boresighted for indirect fire.

34. Boresighting the Direct Fire Telescope

To boresight the direct fire telescope—

a. Rotate the azimuth and elevation knobs on the direct fire telescope by laying the reticle precisely on the right aiming diagram.

b. Set the telescope mount slip scales to elevation 4, azimuth 4.

Note. Do not move the elevation or azimuth knobs when setting slip scales.

35. Distant Aiming Point Method

A distant aiming point may be used for bore-sighting if a testing target is unavailable or if the tactical situation makes use of a testing target impractical. The aiming point selected should be a sharply defined point at least 1,500 meters from the howitzer and as near to howitzer zero elevation as possible. All steps prescribed for the testing target method (para 32 and 33) apply in the distant aiming point method, except that the boresights and the optical sights are alined on the same distant aiming point rather than on displaced points as on the testing target. Accurate leveling of the trunnions is unnecessary when a distant aiming point is used for bore-sighting.

Paragraphs 36 through 40 are not used.

Page 34. Figure 10 is superseded as follows:

Page 43, paragraph 45c. In line 2, after "mils" add "the bubble should center."

Page 43. Paragraph 45d is rescinded.

Page 45, paragraph 50a. In line 4, delete "the tolerances are."

Page 45. Paragraphs 50a(1), (2), and 50c are rescinded.

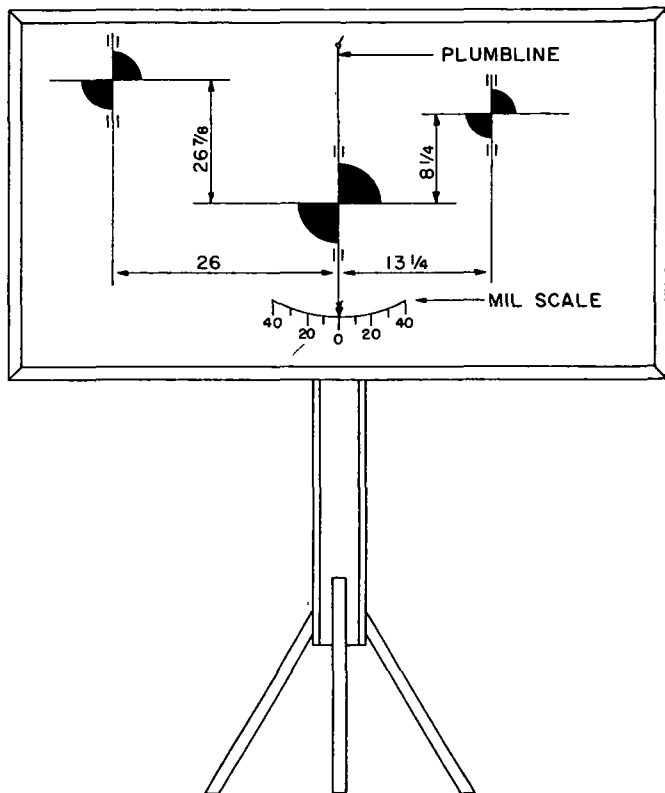


Figure 10. Testing target.

Page 57, paragraph 67d. In line 1, "10 minutes" is changed to read "2 minutes."

Page 57, paragraph 67e.

e. (As superseded by C 1, 22 Aug 63) Secure a

piece of wire and tie a loop in one end. Place the loop over the knob of the follower shaft on the block assembly. Stand clear of the breechblock, pull on the wire, and eject the primer. Secure the ejected primer.

Page 57. Paragraph 67g is superseded as follows:

g. If the primer did fire, wait an additional 8 minutes before opening the breech and replacing the propelling charge.

Page 61, paragraph 72. Subject item No. 7 "aiming post" is changed to read "aiming post or collimator."

Page 62. Paragraph 74d(2) is rescinded.

Page 62, paragraph 74e is added as follows:

e. This test may be performed with either aiming posts or the infinity-aiming reference collimator without modification of standards. Designation of aiming post or collimators for the test should be decided in favor of the system presently in use by the testing unit. If the collimator is used, substitute the applicable terms and procedures that appear in this change.

Page 69. Paragraph 83b(5) is superseded as follows:

- (5) Aiming posts or collimator will be set out at deflection as determined by unit SOP. Aiming posts will be emplaced so the near post is halfway between the far post and the sight. The far post is emplaced approximately 100 meters

from the sight. The collimator is placed 4 to 15 meters from the sight with best results between 5 to 11 meters.

Page 70, paragraph 83c. Test 1, action of candidate. In line 8 after "posts" add "or until the proper sight picture is read on the collimator."

Page 70, paragraph 83c. Test 2, action of candidate. In line 4 after "posts" add "or collimator."

Page 73. Paragraph 84d(3) is rescinded.

Page 74. Paragraph 85d(4) is rescinded.

Page 75, paragraph 86b(1). In line 1, "aiming posts" is changed to read "aiming posts or collimator."

Page 75, paragraph 86b(4). In line 2, "aiming post displacement occurs."

Page 75, paragraph 86c(1). Part I, action of candidate, add to line 4 "or until a proper sight picture on the collimator is read."

Page 75, paragraph 86c(2) Part II, examiner commands "aline aiming posts" is changed to read "aline aiming point."

Page 76, paragraph 86d(1)(a). In line 4, after "telescope" add "or incorrect sight picture is read on the collimator."

Page 76. Paragraph 86d(2)(b) is superseded as follows:

- (b) Aiming posts or collimator are not properly alined.

Page 76, paragraph 86d(2)(c). In line 2, after "posts" add "or incorrect sight picture is read on the collimator."

Page 77. Paragraph 87d(4) is rescinded.

Page 78, paragraph 89b(1). In line 1, after "posts" add "or collimator."

Page 78, paragraph 89b(2). In line 2, "the aiming posts will be" is changed to read "the aiming posts or collimator will be."

Page 86, appendix. The following publications are added:

ATT 6-117	Field Artillery Howitzer Battery, Light or Medium, Towed or Self-Propelled.
TM 10-500-53	Airdrop of Supplies and Equipment, Rigging Ammunition for Low and High Velocity Drop.
TM 11-5830-340-12	Intercommunications Set, AN/VIC-1(V).
TM 55-2350-200-12-1	Air Transport of Supplies and Equipment, Howitzer M-108 and M-109.
TA 23-100-Series	Ammunition Allowances.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-11
requirements for 155 mm Howitzer M109, Self-Propelled.

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SLS Ch 3

FIELD MANUAL

155-MM HOWITZER M109 SELF-
PROPELLED

CHANGE

HEADQUARTERS
DEPARTMENT OF THE ARMY

No. 2

WASHINGTON, D. C., 27 August 1964

FM 6-88, 20 December 1962, is changed as follows: In figure 2, change WEIGHT 26 TONS to WEIGHT 27 TONS.

17. At the Position

* * * * *

b. Preparation of the *** facilitate the occupation.

(1) (Superseded) Mark the howitzer position with stakes and engineers tape in the direction of fire to indicate the place along which the edge of the left track is to be driven.

(2) (Superseded) Camouflage, fortifications and other position preparations are initiated based on available time and the tactical situation.

* * * * *

* This change supersedes C 1, 22 August 1963.

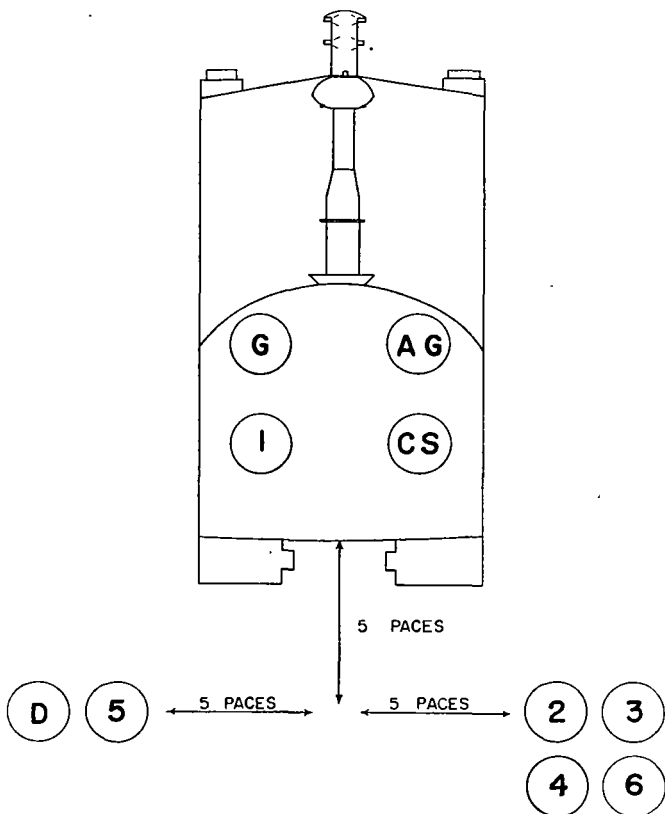


Figure 7. (Superseded) Posts, prepared for action.

26. Aiming Points

After the howitzer *** points) as required.

* * * * *

c. The aiming posts *** by the gunner.

* * * * *

- (5) (As superseded by C 1, 22 Aug 63)
Unit SOP will specify the deflection at which to place the aiming posts; however, weapon design permits placement of the aiming posts at any desired deflection.

* * * * *

28. To Unload the Howitzer

* * * * *

c. Unloading will be *** is as follows:

- (1) (Superseded) Number 1 slides the block assembly on the firing mechanism to the right and ejects the primer.

* * * * *

- (3) (Superseded) The assistant gunner opens the breech and number 1 removes the propellant charge.

- (4) (Superseded) Number 1 fills the powder chamber with waste and the assistant gunner closes the breechblock.

* * * * *

- (8) (Superseded) The assistant gunner opens the breech. Number 1 removes the waste, and positions the loading tray of the automatic rammer in the breech.

* * * * *

36. Preparations for Boresighting

Preparations for boresighting are as follows:

* * * * *

b. Rescinded.

* * * * *

e. The gunner's quadrant *** is as follows:

* * * * *

(3) (Superseded) Place the quadrant on the breech ring leveling pads that are perpendicular to the long axis of the tube.

* * * * *

f. (Superseded) Set the tube at zero elevation by using a gunner's quadrant applying the corrections determined from the end-for-end test and the manufacturer's tolerance indicated on the breech ring.

* * * * *

67. Failure to Fire

If the weapon fails to fire—

* * * * *

e. (As superseded by C 1, 22 Aug 63) Secure a piece of wire and tie a loop in one end. Place the loop over the knob of the follower shaft on the block assembly. Stand clear of the breech-block, pull on the wire, and eject the primer. Secure the ejected primer.

* * * * *

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

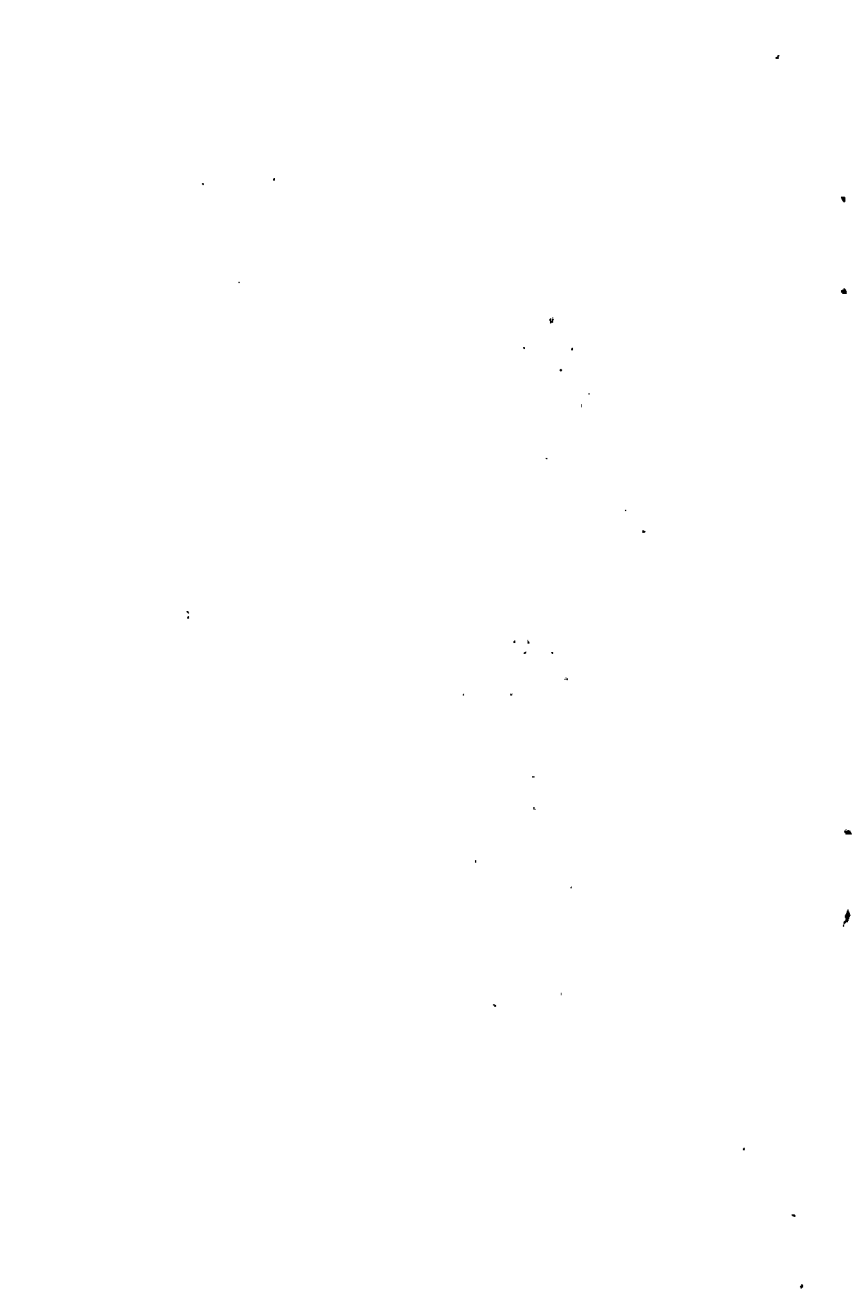
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ACSI (2)	Ft Riley (2)
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LOGCOMD (1)	TOE:
Armies (5)	6-325 (5)
Corps (3)	6-327 (5)
Div (2)	6-355 (5)
Div Arty (1)	6-357 (5)
Bde (1)	6-366 (5)
Regt/Gp/Bg (1)	6-367 (5)
CC (1)	6-376 (5)
Ft Carson (2)	6-425 (5)
Ft Devens (2)	6-427 (5)
Ft Hood (2)	

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

USAR: Units—same as Active Army except allowance is one copy to each unit. For explanation of abbreviations used, see AR 320-50.





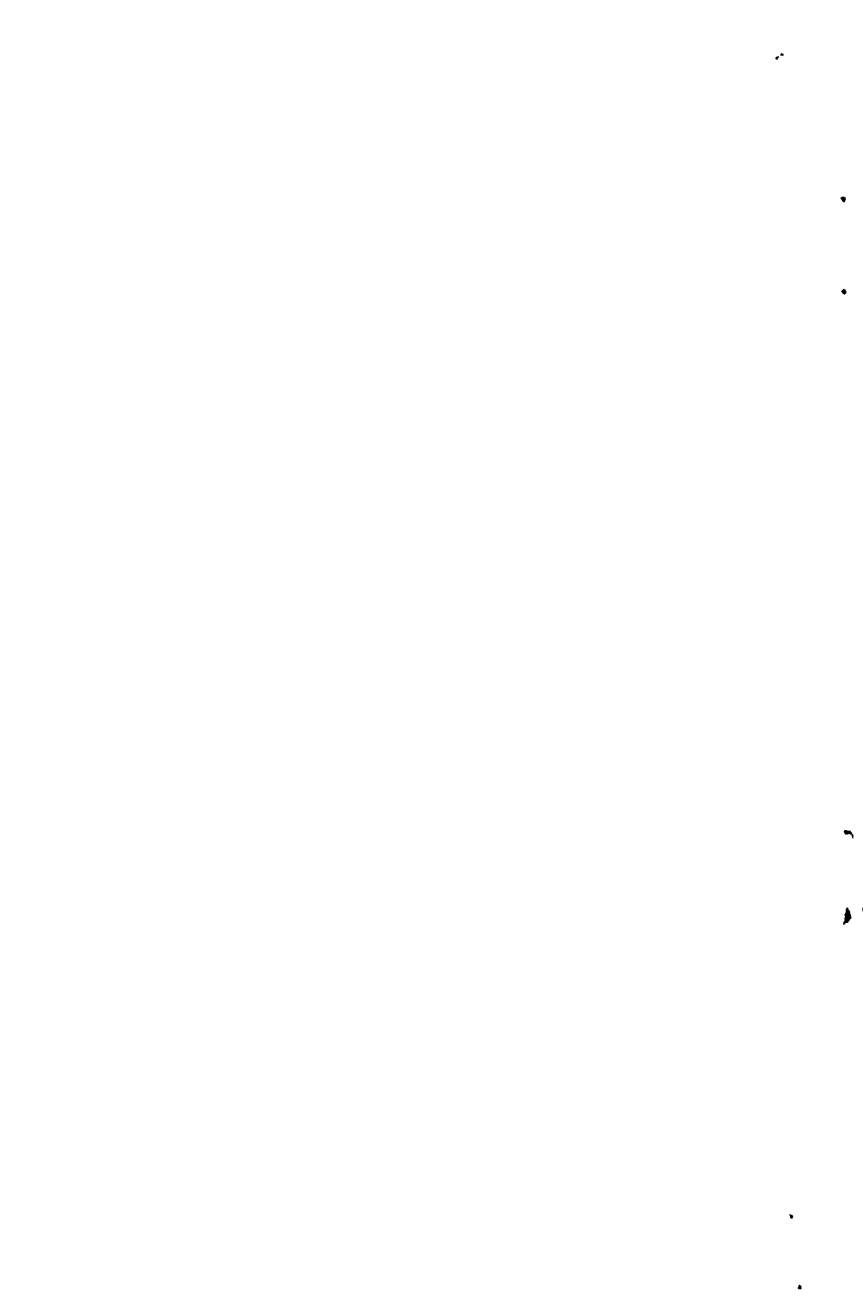


Table IV. (Superseded) Duties in Preparation for Traveling

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Commands MARCH ORDER. Inspects chamber to see that the howitzer is not loaded. Supervises the work of the section.	Sets azimuth counter to 3,200 mils and closes window. Sets gunner's aid counter to zero. Covers bubbles on the telescope mount.	Sets elevation counter to zero and sets correction counter to zero. Covers bubbles on the elevation quadrant.	Closes the breechblock after the chief of section has inspected the chamber. Secures the power rammer.	Replaces fuzes in containers and places them in howitzer compartment.	Checks that projectiles are ready for loading, all fuzes are removed, and lifting plugs are replaced.	Recovers and disassembles the aiming posts.		Secures communication equipment.	Replaces muzzle plug.
2		Removes the panoramic telescope from its mount and replaces it in its case.		Replaces unused primers in traveling compartments.	Returns fuze wrench and fuze setter to their traveling chest. Replace ammunition in the howitzer compartment.		Hands aiming posts to driver.	Assist in reloading ammunition and section equipment.		Disassembles and secures rammer staff sections. Secures aiming posts. Closes and secures telescope hatch cover.
3		Assists the driver in engaging howitzer travel lock. Places cab power switch to OFF. Locks cab traverse lock.		Secures, sponge, burlap, and cleaning materials.	Replaces vent and primer seat cleaning tools.					Lifts howitzer travel lock to the vertical position and, assisted by the gunner, locks tube in the traveling position. Closes direct fire telescope window.
4	Directs driver in extracting and stowing spades.	Steps on left and right release pedals, respectively, after driver has backed against the spades. pin. Closes left cab door. Verifies all section equipment is present and secure.	Makes sure pedal latch engages. Closes right cab door.	Assisted by Number 3, lifts the left spade into the travel position. <i>Warning: Check locking latches for complete engagement.</i> Replace left and right spade strut safety pins respectively. Secure left and right strut respectively. Close rear cab doors.	Assisted by Number 4, lifts the right spade into the travel position.	Assists Number 1 in lifting the left spade into the travel position. Assisted by Number 4 folds and stows paulin in right turret rack.	Assists Number 2 in lifting the right spade into the travel position. Assists Number 3 in folding and stowing paulin.			Starts engine and backs against spades as directed by the chief of section. Drives vehicle forward as directed by the chief of section to extract spades. Remains in driver's compartment unless otherwise directed.
5	Verifies that the howitzer is prepared for traveling. Takes post.		Takes post.	Takes post. Closes rear hull doors after the chief of section has taken his post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	
6	Reports to executive "Number () in order" or reports any defect that the section cannot remedy without delay.	Takes post.								



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FM 6-88
C 1

FIELD MANUAL

155-MM HOWITZER M109 SELF-PROPELLED

FM 6-88

CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 22 August 1963

FM 6-88, 20 December 1962, is changed as follows:

26. Aiming Points

After the howitzer * * * points) as required.

* * * *

c. The aiming posts * * * by the gunner.

* * * *

(5) (Superseded) Unit SOP will specify the deflection at which to place the aiming posts; however, weapon design permits placement of the aiming posts at any desired deflection.

* * * *

67. Failure To Fire

If the weapon fails to fire—

* * * *

e. (Superseded) Secure a piece of wire and tie a loop in one end. Place the loop over the knob of the follower shaft on the block assembly. Stand clear of the breechblock, pull on the wire, and eject the primer. Secure the ejected primer.

* * * *

The following tables are changed:

Table	Personnel	Sequence	Change
I	Gunner---	3	Delete: "Deflates eab race ring seal."
I	Assistant gunner.	3	Delete: "Deflates gun shield seal."
II	No. 1-----	2	(Superseded) Lowers rammer to operating position. Releases rammer cylinder latch. Loads the howitzer. 1. Places the projectile in the loading tray of the power rammer at the command QUADRANT (#). 2. Moves rammer cylinder to ram position. 3. Stows the rammer. 4. Places the propellant charge in the chamber so that the igniter pad is 3 inches inside the rear of the chamber (lashed end to the front). 2 5. Commands CLOSE. Closes the block assembly after the primer has been inserted.
II	No. 2-----	2	(Superseded) Rotates firing mechanism into desired firing position prior to loading. Closes the breech at the command CLOSE by lifting the eradle eam handle. Inserts the primer into the primer chamber. Attaches the lanyard to the eye-let on the firing mechanism lever.

Table	Personnel	Sequence	Change
II	No. 1----	4	Delete.
II	No. 2----	4	Added: At the command of the chief of section, fires the howitzer with a quick strong pull on the lanyard.
II	No. 3----	2	Change lines 35 and 36 as follows: with fuze setter M28, sets fuze VT M514-series:
II	No. 4----	2	<i>Note.</i> 6. (Superseded) When firing with charges 3 and 4, use of the M3 (green bag) propelling charge is preferred over the use of the M4A1 (white bag) propelling charge.
IV	Gunner---	3	Delete: "Inflates cab race ring seal."
IV	Assistant gunner.	3	Delete: "Inflates gun shield scal."

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DCSPER (2)	Ft Devens (2)
ACSI (2)	Ft Hood (2)
DCSLOG (2)	Ft Lewis (2)
DCSOPS (2)	Ft Riley (2)
Cb, Ofc Res Comp (2)	TJAGSA (1)
CRD (1)	PMGS (1)
COA (1)	MFSS (1)
CINFO (1)	USA Ord Sch (1)
TIG (1)	USAES (1)
CNGB (1)	USAQMS (1)
USACDC (1)	USATSCH (1)
USCONARC (5)	USASCS (1)
USAMC (5)	USACMLCSCH (1)
ARADCOM (2)	USACHS (1)
ARADCOM Rgn (1)	Centers (5)
LOGCOMD (1)	Units organized under following
Armies (5)	TOE's:
Corps (3)	6-325 (5)
Div (2)	6-327 (5)
Div Arty (1)	6-355 (5)
Bde (1)	6-357 (5)
Regt/Gp/BG (1)	6-425 (5)
Ft Carson (2)	6-427 (5)

NG: Statc AG (3).

USAR: Same as active Army, except allowance is one copy to each unit.
For explanation of abbreviations used, see AR 320-50.

Table IV. Duties in Preparation for Traveling

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Commands MARCH ORDER. Inspects chamber to see that the howitzer is not loaded. Supervises the work of the section.	Sets azimuth counter to 3,200 mils and closes window. Sets gunner's aid counter to zero. Covers bubbles on the telescope mount.	Sets elevation counter to zero and sets correction counter to zero. Covers bubbles on the elevation quadrant.	Disassembles the rammer staff and hands the sections to the driver.	Closes the breechblock after the chief of section has inspected the chamber. Secures the power rammer.	Replaces fuzes in containers and places them in howitzer compartment.	Recovers and disassembles the aiming posts.	Checks that projectiles are ready for loading, all fuzes are removed, and lifting plugs are replaced.	Secures communication equipment	Replaces muzzle cover.
2		Removes the panoramic telescope from its mount and replaces it in its case. Closes telescope cover.			Replaces unused primers in traveling compartments.	Returns fuze wrench and fuze setter to their traveling chest. Replace ammunition in the howitzer compartment.	Hands aiming posts to driver.	Assist in reloading ammunition and section equipment.		Secures rammer staff sections. Secures aiming posts.
3		Assists the driver in engaging howitzer travel lock. Places cab power switch to OFF. Locks cab traverse lock. Inflates cab race ring seal.	Inflates gunshield seal.	Secures sponge, burlap, and cleaning materials in the section chest.	Replaces vent and primer seat cleaning tools.					Lifts howitzer travel lock to the vertical position and, assisted by the gunner, locks tube in the traveling position. Closes direct fire telescope window.
4	Directs driver in extracting and stowing spades.	Steps on left and right release pedals, respectively, after driver has backed against the spades. Makes sure pedal latch engages pin. Closes left turret door. Verifies all section equipment is present and secure.	Closes right turret door.	Assisted by No. 3, lifts the left spade into the travel position. Warning: Check locking latches for complete engagement. Replace left and right spade strut strap safety pins respectively. Secure left and right strut strap respectively. Close rear turret doors.	Assisted by No. 4, lifts the right spade into the travel position.	Assists No. 1 in lifting the left spade into the travel position. Assisted by No. 4 folds and stows paulin in right turret rack.	Assists No. 2 in lifting the right spade into the travel position. Assists No. 3 in folding and stowing paulin.			Starts engine and backs against spades as directed by the chief of section. Drives vehicle forward as directed by the chief of section to extract spades. Remains in driver's compartment unless otherwise directed.
5	Verifies that the howitzer is prepared for traveling. Takes post.	Takes post.	Takes post.	Takes post. Closes rear hull doors after the chief of section has taken his post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	
6	Reports to executive "Number () in order" or reports any defect that the section cannot remedy without delay.									

Table IV

Table VIII. Duties in During Operations Service

Sequence	Chief of section	Gunner (left side)	Assistant gunner (right side)	No. 1 (left side)	No. 2 (right side)	Driver
1	Supervises the section during the service.	Check presence, security, and condition of sighting equipment. Check security of ammunition and all equipment inside the vehicle.		Check track tension and condition of track shoes, pads, and guides. Check for leaks and condition of the hydraulic track adjuster. Check for loose or damaged drive sprockets. Check for loose or damaged road wheels. Check for loose track pin bolts. Check for loose or damaged idler wheels. Check hubs for excessive heat.		Checks radiator water level. Checks engine oil level and adds oil if necessary. Refuels vehicle if required. Checks transmission oil level and adds oil if required. Checks batteries and cables.
2		Check condition and completeness of all exterior mounted equipment. Check for broken welds and missing parts.				Checks foot controls. Checks instruments and warning lights for normal indication. Checks vehicle steering action. Checks hand controls. Checks periscopes.
3		Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."
4	Reports "Sir, number () in order," or any defects the section cannot remedy without delay.					

Table IX. Duties in After Operation Service

Sequence	Chief of section	Gunner	Assistant gunner	No. 1 (left side)	No. 2 (right side)	No. 3 (left side)	No. 4 (right side)	No. 5	No. 6	Driver
1	Supervises the section during the service.	Checks panoramic telescope and mount for damage, operation, and cleanliness.	Checks direct fire telescope and mount for damage, operation, and cleanliness. Checks elevation quadrant for damage, operation, and cleanliness.	Check track tension and condition of track shoes, pads and guides. Check for leaks and condition of the hydraulic track adjuster. Check for loose and damaged road wheels. Check for loose track pin bolts. Check for loose or damaged idler wheel. Check for loose or damaged drive sprockets. Check hubs for excessive heat. Check for broken welds.		Check hydraulic shocks for leaks. Check oil level in road wheel hubs. Bubbles and yellow discoloration of the oil in the sight plugs indicate water contamination.		Checks all doors and hatches for proper operation and condition of seals. Checks spades for secure mounting.	Checks tow pintle for secure stowage. Checks trailer receptacle for damage.	Checks radiator water level and adds water if required. Checks engine oil level and adds oil if required. Refuels vehicle as required. Checks batteries and cables for corrosion.
2	Checks for proper supply of gasoline, water, and emergency rations. Verifies that the technical manual driver's accident report form, vehicle accident identification card, and lubrication order are present. Completes entries in the equipment log book.	Checks gunner's elevation and traversing controls for ease of operation. Checks cab traverse lock for proper operation. Checks intercommunication system for proper operation. Checks equilibrator system for adjustment. Checks recuperator for correct fluid content. Checks hydraulic connections on the recoil mechanism.	Checks number 1 man's elevation controls for proper operation. Checks elevation cylinder for proper operation. Checks variable recoil cylinders and replenishes for fluid content. Checks portable fire extinguisher. Checks cab hydraulic system power pack.	Check flotation device for damage.		Checks gun travel lock for secure mounting. Checks offset periscope for damage. Cleans and lubricates fuze setters.	Checks all exterior lights for proper operation. Checks air cleaner and cleans filter pac.	Checks machinegun and mount for operation. Cleans machinegun.	Checks condition and completeness of all exterior mounted equipment. Checks for broken welds and missing parts. Checks that the muzzle brake and evacuator are not damaged.	Checks foot controls. Checks instruments and warning lights for normal indication. Checks vehicle steering action. Checks hand controls. Checks periscopes.
3			Checks operation of the breechblock, cleans and oils as required. Checks operation of the firing mechanism and cleans as required. Checks operation of the power rammer and cleans as required.	Clean and lubricate the bore and chamber.		Clean the howitzer and the vehicle.				
4	Inspects the vehicle.	Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."	Reports "Ready."
5	Reports "Sir No () in order," or any defects the section cannot remedy.									



Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Commands PREPARE FOR ACTION. Supervises work of cannoneers during all activities.	Depresses left pedal latch. Opens left cab door.	Depresses right pedal latch. Opens right cab door.	Opens rear turret doors.	Opens real hull doors.					
2	Directs backing of carriage against spades. Directs driver to cut engine and set brakes.			Remove left and right spade strut safety pins. Release left and right locking latches, simultaneously, allowing spades to drop.	Remove paulin from turret storage rack and spread it on ground at left rear of motor carriage.			Unload and arrange equipment as directed by the chief of section.		When directed by the chief of section, backs carriage against the spades. Sets brakes and stops engine. Leaves master switch on.
3	Checks position of replenisher indicator and recuperator pressure. Checks recoil system for leaks. Directs servicing, as required.	Releases cab traverse lock. Places cab power switch to ON. Selects No. 1 gunner for power elevation. Checks equilibrator fluid level.	Checks cab hydraulic system powerpack pressure.		Procures fuze setter. Assisted by No. 3, unloads fuze boxes and opens and arranges fuzes as directed by the chief of section. <i>Note.</i> During firing, No. 2 will fuze projectiles and set fuzes from outside the howitzer. During initial phases of firing, it may be necessary to utilize ammunition from inside the howitzer. When ammunition from other vehicles is available, No. 2 assumes all duties of fuze preparation and the ammunition fired from the basic load of the howitzer will be replenished.	Assists No. 2 in unloading fuze boxes and opening and arranging fuzes.	Unloads and arranges projectiles as directed by the chief of section.	Assisted by No. 6, unloads and arranges propelling charges as directed by the chief of section.	Assists No. 4 & 5 in unloading and arranging ammunition.	Removes muzzle plug and tosses it in driver's hatch. Opens and locks direct fire telescope window.
4		Assists driver in disengaging howitzer traveling lock. Checks functioning of elevating mechanism (power) and traversing mechanism (power manual).	Checks functioning of elevating mechanism (power and manual).	Procures lanyard, and operates firing mechanism. Inspects, operates and cleans the breechblock, power rammer, chamber, bore and primer vent.	Assists No. 1 in inspecting and cleaning the breechblock chamber, bore, primer vent and power rammer and leaves the breechblock open.					Assisted by the gunner, lowers and secures howitzer traveling lock. Removes aiming posts, rammer staff sections and pioneer equipment as needed.
5		Installs panoramic telescope. Uncovers azimuth 6,400-mil counter. Sets azimuth counter to 3,200 mils and zeros the gunner's aid counter. Levels telescope mount.	Depresses tube to loading elevation on elevation quadrant and centers cross-level bubbles. Sets correction counter to zero.	Procures sponge, burlap, and a bucket of water and places them in a convenient location.	Places vent cleaning bit in a convenient location. <i>Note.</i> The breechblock must be opened for initial round. For subsequent rounds, the breechblock opens automatically.		Assembles aiming posts and places them near left front of motor carriage.		Lays communication cable from howitzer to MX-155/GT, prepares telephone for use and assures operation of communication equipment.	Raises and secures telescope hatch cover.
6	Verifies the adjustments of the sighting and fire control equipment.	Tests and alines (boresight) fire control equipment.		Procures primers and places them in a convenient location.			Emplaces and holds testing target, if required.			Assembles rammer staff and head and places to right side of howitzer.
7	*Measures site to the mask, assisted by the assistant gunner: 1. Sights along lowest element of bore. 2. Directs the assistant gunner to elevate or depress the tube until the lowest element of the bore just clears the highest crest in the field of fire. 3. Directs the assistant gunner to center the cross-level and elevation bubbles. 4. Reads elevation on elevation counter and reports to the executive "Sir, number () site ()." (Gunner's quadrant may be used.) 5. Records and announces minimum elevation for each charge to the gunner and Number 1.	*Lays the howitzer for direction: 1. When the command is given identifying the aiming point, identifies aiming point through telescope and announces "Number (), aiming point identified." 2. Executive commands NUMBER (), DEFLECTION (). 3. Sets announced deflection on the azimuth counter (top window). 4. Traverses cab until reticle pattern of telescope is centered on objective lens of aiming circle. 5. Checks that pitch- and cross-level bubbles are centered. 6. Reports to executive "Sir, number () ready for recheck." 7. Repeats steps in 3 through 6 above, until executive announces "Number () is laid." (Lay of tube will not be disturbed until an aiming point is established.)	Assists chief of section in measuring site to mask.				Sets out the far aiming post to the left front of the howitzer at a deflection between 2,400 and 2,600 mils and approximately 100 meters from the piece.			
8	*Indicates alternate aiming point to the gunner when one is designated by the executive. If an alternate aiming point is not designated, the chief of section should select a clearly defined point at a distance of at least 2,000 meters. This aiming point is to be used as directed by the executive or at such times when the aiming posts are rendered useless. Deflections read from the azimuth counter are recorded and reported to the executive and are used to maintain parallelism, until the aiming posts are reemplaced.	*Directs alinement of aiming posts: 1. Refers telescope to the far aiming post previously set out by Number 4. 2. Directs Number 4 by hand signals to aline near aiming post with the far aiming post and the vertical reticle. 3. Pushes in and turns reset knob and sets reset counter to 3,200. 4. Records reading in azimuth counter window and closes the window. <i>Note.</i> The azimuth counter is used to lay the howitzer. The reading in this window reflects the angle required to place the tube parallel to the direction of fire. The reset counter is then used to establish a common deflection of 3,200. Lays on alternate aiming point: 1. The piece has been laid. 2. The executive may command AIMING POINT, LEFT FRONT, LONE TREE, REFER. 3. Without moving the tube, refers the sight to the aiming point. 4. Reads the deflection from the azimuth counter and reports "Number (), deflection ()." <i>Note.</i> The executive may record the referred deflection for future use, or he may proceed as follows: 5. Commands COMMON DEFLECTION 3,200. 6. Pushes on reset knob and turns counterclockwise until 3,200 appears on the reset counter. 7. Verifies that the line of sight is on the aiming point. 8. Closes window over azimuth counter. 9. Reads and sets subsequent deflections from reset counter.	Sets the howitzer in the loading position. Checks direct fire telescope: 1. Adjusts eyepiece arm to a convenient viewing angle. 2. Adjusts light control knob for optimum reticle illumination. 3. Adjusts level-vial mirror for convenient viewing. 4. Centers cant correction bubble by turning the red cant correction knob. 5. Verifies that elevation and azimuth slip scales are set at 4.				Places the near aiming post midway between the piece and the far aiming post and sets it as directed by the gunner.			
9	Verifies that the howitzer is prepared for action. Reports to executive "Sir, Number () in order" or reports any defects that the section cannot remedy without delay.	<i>Note.</i> All cannoneers take posts after they have performed their specific duties.								

* These steps may be omitted during training when drill does not include laying of the piece.

Table II. (Superseded) Duties in Firing, Indirect Laying

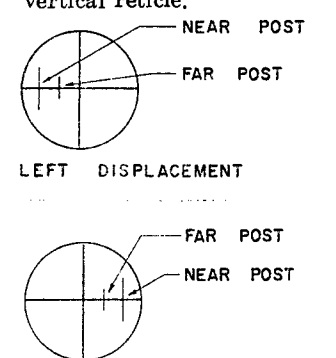
Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Commands the section during firing and insures an efficient and safe operation.									
2	Follows fire commands and repeats commands to the section as required to insure efficiency and safety.	Sets and Lays for Deflection: 1. The command is DEFLECTION (). 2. Sets announced deflection on the reset counter by turning the azimuth knob. <i>Note.</i> Final motion of traverse is from left to right. 3. Traverses the piece until the vertical reticle of telescope is on the left edge of the aiming point. <i>Note.</i> Final deflection are set in increasing direction on the reset counter. 4. Centers the pitch and cross-level bubbles.	Sets and Lays for Quadrant: 1. The command is QUADRANT (). 2. Sets the announced quadrant on the elevation counter with the elevation knob. 3. Closes the breach at the command CLOSE by lifting the cradle cam handle. 4. After the piece is loaded, elevates the tube until the elevation-level bubble is centered. 5. Centers the cross-level bubble with the cross-level knob.	Loads the Howitzer: 1. Lowers rammer to operating position. Releases rammer cylinder latch. 2. Places the projectile in the loading tray of the power rammer. 3. At the command QUADRANT (), moves rammer cylinder to ram position. 4. Returns rammer to stowed position. 5. Places the propellant charge in the chamber so that the igniter pad is 3 inches inside the rear of the chamber (lashed end to the front). 6. Commands CLOSE. 7. Inserts the primer into the primer chamber. 8. Closes the block assembly. Slides the block assembly to the left to position the firing mechanism over the primer. <i>Note.</i> The firing mechanism must be rotated into the desired firing position prior to loading.	Fuzes projectiles: 1. The command is FUZE (). 2. Removes lifting plug. 3. Inspects fuze socket for rust or dirt. 4. Removes or replaces supplementary charge as required. 5. Screws in designated fuze, using authorized fuze wrench. <i>Caution: Do not hammer on a fuze wrench or use an extension handle.</i> 6. Removes safety pull wire from time fuzes. With fuze setters M26, sets fuzes TSQ M54, TSQ M55, MT 67, T39 M500, TSQ M501, TSQ M520. 1. Seats upper lug of fuze setter in the upper recess of the fuze. 2. Loosens wingnut on fuze setter, sets announced time on the appropriate time band. 3. Locks wingnut, places handle to horizontal, turns counterclockwise until a stop is felt and a click is heard. 4. Raises handle, removes setter, verifies setting. With fuze setting M28, sets fuze VT M514 series: 1. Seats stationary lug of setter into top of recess of fuze. 2. Sets announced fuze setting on the fuze setter. 3. Turns setter clockwise until setter stops or a click is heard. 4. Removes setter and verifies setting. Sets selective superquick and delay fuzes: On fuze quick, verifies that letters S.Q. are aligned with the slot on the setting sleeve. On fuze delay, turns setting sleeve with screwdriver until the slot is aligned with word DELAY. Combination time and super-quick fuzes: For impact, the command is FUZE. M500 (or other fuze) QUICK. Verifies that the letter "S" on the setting ring is aligned with the index on the fixed ring.	Inspects and cleans projectiles: 1. Verifies that projectile is the type designated in the command. 2. Removes grommet and examines rotating band to see that it is free from all dirt and burrs. <i>Note.</i> Projectile with burred rotating band will be put aside until the burrs can be removed with a file. 3. Examines entire projectile for defects. 4. Stands projectile on end and cleans it thoroughly. <i>Note.</i> Any sand, dirt, oil, or grease on the projectile will cause wear, scratches, or gouges in the bore. Holds projectile upright for fuzeing and fuze setting: 1. Selects proper projectile as commanded. 2. Holds projectile firmly while Number 2 fuzes and sets the fuze. When directed, reads and announces the time set on the fuze.	Carries projectile to the howitzer: 1. Grasps the fuzed end of the projectile with his left hand and the base with his right hand. 2. Carries the projectile to the howitzer and sets it on its base inside the hull, where it will be convenient to Number 1. <i>Caution: Care must be exercised in placing the ammunition in the hull to prevent damage to the rotating band and fuze.</i>	Prepares propellant charge, assisted by driver: <i>Note.</i> Two types of charges are available for issue. 1. Type M3, green bag, consisting of five charges, 1 to 5. 2. Type M4A1, white bag, consisting of five charges, 3 to 7. The executive will designate the type of charge to be used: 1. The command is CHARGE 3, GREEN BAG. 2. Removes the complete charge from the container, placing base charge on bottom. 3. Unties the lashings. 4. Removes the bag marked "4" and "5". 5. Ties remaining bags together. 6. Removes igniter protector cap from base charge. 7. Discards bags 4 and 5, as directed. 8. Hands the charge to the driver and calls out "Charge prepared, green bag." 9. The same procedure is used to prepare white charge propellants. <i>Note.</i> Green bag and white bag increments must not be mixed in the same charge. When firing at night, the flash reducer M2 is tied beneath the strings next to the highest number increment used. <i>Note.</i> The M2 flash reducer is used with white bag propellants only. <i>Notes.</i> Care and proper handling of ammunition must be insured. It is imperative that— 1. There be no smoking in vicinity of ammunition. 2. Only flashlights be used in vicinity of powder charges. 3. Rough handling of projectiles, powder containers, fuzes, and primers be prevented. 4. Projectiles not strike together. 5. Ammunition not become dirty, wet, or overheated. 6. When firing with charges 3 and 4, use of the M3 (green bag) propelling charge is preferred over the use of the M4A1 (white bag) propelling charge.	Assists Number 3 and 4 in preparing ammunition.	Assists Number 5 in preparing the propellant charge. Hands the propellant charge to Number 1 so that he can grasp the base of the charge with his right hand.
3	Indicates that the howitzer is ready to fire, after the assistant gunner calls "Set" and the gunner calls "Ready," by extending his right arm vertically and reporting "Number (), Ready."	Calls "Ready," and raises right hand after the piece is laid for direction and the assistant gunner has called "Set."	Calls "Set."	Attaches the firing lanyard to the eyelet on the firing mechanism lever.						
4	Gives the command to fire by dropping his arm sharply to his side and commanding FIRE.				At the command of the chief of section, fires the howitzer with a quick strong pull on the lanyard.					
5	Observes and checks functioning of material during firing. Reports promptly to the executive any mistakes, unusual incidents, equipment malfunctions, and any reason the howitzer may not be fired.		Depresses howitzer to loading elevation after each round is fired. Cleans obturator vent and primer seat as required.	Swabs and inspects the powder chamber forcing cone, after each round is fired and calls "Bore clear." Calls out number and quadrant for each round in volley fire.	<i>Caution: A time fuze should be returned to ordnance after being set twice.</i> <i>Note.</i> The wrench-type fuze setter M27 may be used to set time fuzes. The setter is engaged in fuze notch and rotated in the direction of increasing readings, until the time setting is opposite the index mark on the fuze. This type of setter should be used only when mechanical setters are not available.					
6 (These duties are performed as required.)	Lays for quadrant with gunner's quadrant. 1. The command is USE GUNNER'S QUADRANT. 2. The announced quadrant is set on the gunner's quadrant. <i>Note.</i> Increments are of 10 mils, are set on the quadrant frame arc. Mil and 0.1 mil increments are set with the micrometer knob. The same side of the quadrant must be used for settings on the quadrant frame arc and micrometer. 3. After the howitzer is loaded and laid for direction— Stands squarely opposite quadrant seats. Places and holds gunner's quadrant firmly on the seats. Insures that the words <i>line-of-fire</i> are on the bottom of the quadrant and the line of fire arrow is pointed toward the muzzle and is on the same side of the quadrant as the scale used. 4. Directs the assistant gunner to elevate the tube until the bubble is centered. Cautions the assistant gunner when the bubble is approaching center so that the final centering may be expedited. <i>Note.</i> For subsequent settings, the chief of section will take the same position, hold the quadrant in the same manner, and view the quadrant bubble from the same angle to insure consistency in leveling. Measures the quadrant: 1. The command is MEASURE THE QUADRANT. 2. With the piece laid, directs the assistant gunner to center the cross-level bubble and turn the elevation knob until the bubble in the elevation-level vial is centered. 3. Reads the quadrant in the elevation counter window. 4. Reports to executive officer "Number () Quadrant ()." <i>Note.</i> The quadrant can also be measured by placing the gunner's quadrant on the breech quadrant seat and centering the bubble by moving the index arm and turning the micrometer knob.	Corrects for aiming post displacement when the vertical reticle in the panoramic telescope is displaced from the line formed by the aiming posts. He lays the howitzer so that the far aiming post appears exactly midway between the near aiming post and the vertical reticle.  <i>Figure 11. Correction for aiming post displacement.</i> <i>Note.</i> If displacement is caused by traversing, lay as described above. If displacement is caused by shifting of the carriage due to firing shock— 1. Lay as above until there is a hull in firing. 2. Notify chief of section for permission to realine the aiming posts. 3. Lay howitzer as described above. 4. Direct Number 4 to move the far post into alignment with the vertical reticle and then align the near aiming post. Lays for quadrant. When one-man, one-sight system is used— 1. Places the gunner's elevation control switch to GUNNER. 2. Places the announced quadrant on the elevation counter with the elevation handwheel. 3. Elevates the tube until the pitch-level bubble is centered. 4. Checks the cross-level bubble. 5. Calls "Ready" and raises his right hand when piece is laid for direction and quadrant. Refers the piece. 1. The executive commands AIMING POINT THIS INSTRUMENT (or other point), REFER. 2. Does not disturb the lay of the tube.	<i>Note.</i> During hulls in firing, the assistant gunner and Number 1, swab out the bore, wash powder residue from the mushroom head, the gas check seat, and the threaded section of the breech recess and breechblock.							
	Conducts prearranged fires in conformity with prescribed data (e.g., barrages, harassing, and interdiction fires). Commands "CEASE FIRING." 1. Command may be given by anyone. 2. All firing will stop immediately. 3. If the howitzer is loaded, reports that fact to the executive who will acknowledge with "Number () loaded." 4. The executive will then investigate the cause, correct it, and resume firing by announcing the quadrant. 5. If CEASE FIRE is commanded by the Fire Direction Center, fire is resumed by announcing the quadrant.	3. Checks centering of bubble. 4. Refers sight until the vertical reticle is on the designated point. 5. Opens the azimuth counter door. 6. Reads from the azimuth counter and reports to the executive "Sir Number (), deflection ()." <i>Notes.</i> 1. Each time the weapon is traversed, the gunner must center the pitch- and cross-level bubbles on the panoramic telescope mount, and the assistant gunner must insure that the elevation-level bubble and the cross-level bubble are centered each time the weapon is elevated or depressed. 2. If, during firing, power traverse or power elevation fails, use the manual options, until there is a hull in firing and the power systems are repaired. 3. Individual piece corrections will normally be added to the common deflection and quadrant, and the total deflection and quadrant are announced to each piece (e.g., deflection number 1, 2390; quadrant number 1, 887). The gunner's aid counter and correction counter windows should, therefore, normally read zero. However, it may be necessary for the assistant gunner to carry a correction on the correction counter of the elevation quadrant due to errors found while performing the end-for-end test. (See TM 9-2860-217-10).								

Table VII. Duties in Before Operation Service

Sequence	Chief of section	Gunner	Assistant gunner	No. 1 (left side)	No. 2 (right side)	No. 3 (left side)	No. 4 (right side)	No. 5	No. 6	Driver
1	Supervises the section during the service.	Checks panoramic telescope and mount for damage, operation, and cleanliness.	Checks direct fire telescope and mount for damage, operation, and cleanliness. Checks elevation quadrant for damage, operation, and cleanliness.	Check track tension and condition of track shoes, pads, and guides. Check for leaks and condition of the hydraulic track adjuster. Check for loose or damaged drive sprockets. Check for loose or damaged road wheels. Check for loose track pin bolts. Check for loose or damaged idler wheel. Check for broken welds.		Check hydraulic shocks for leaks and support arms for water contamination. Check oil level in road wheel hubs. Bubbles and yellow discoloration of the oil in the sight plugs indicate water contamination.		Checks all doors and hatches for proper operation and condition of seals. Checks spades for secure mounting.	Checks tow pintle for secure stowage. Checks trailer receptacle for damage.	Checks radiator water level and adds water if required. Checks engine oil level and adds oil if required. Refuels vehicle as required. Checks transmission oil level and adds oil if required. Checks batteries and cables for corrosion.
2	Checks for proper supply of gasoline, water, and emergency rations. Verifies that the technical manual equipment log book, driver's accident report form, vehicle accident identification card, and lubrication order are present.	Checks gunner's elevation and traversing controls for ease of operation. Checks cab traverse lock for proper operation. Checks intercommunications system for proper operation. Checks equilibrator system for adjustment. Checks recuperator for correct fluid content.	Checks number 1 man's elevation controls for proper operation. Checks elevation cylinder for proper operation. Checks variable recoil cylinders and replenisher for fluid content. Checks gun shield seal and cab race ring seal inflation air pump, and air gage for proper operation. Checks portable fire extinguishers. Checks cab hydraulic system power pac.	Checks fixed fire extinguisher actuating handle for damage and corrosion. Check condition and security of the flotation device.	Checks cab hydraulic system power pack oil reservoir.	Checks gun travel lock for secure mounting. Checks off-set periscope for damage. Cleans and lubricates fuze setters.	Cleans all exterior lights and checks for proper operation.	Checks machinegun and mount for operation and cleanliness. Checks stowage of machinegun ammunition.	Checks condition and completeness of all exterior mounted equipment. Checks for broken welds and missing parts.	Checks foot controls. Checks instrument and warning lights for normal indication. Checks vehicle steering action. Checks hand controls. Checks periscopes.
3	Inspects ammunition for proper lot number, condition, and stowage.		Checks operation of the breechblock and cleans with a dry cloth. Checks operation of the firing mechanism and cleans as required. Checks operation of the power rammer.	Clean bore and chamber with clean dry cloth.		Load ammunition and equipment.				
4	Inspects loading of section equipment for completeness and security.	Reports "Ready," and takes post.	Reports "Ready," and takes post.	Reports "Ready," and takes post.	Reports "Ready," and takes post.	Reports "Ready," and takes post.	Reports "Ready," and takes post.	Reports "Ready," and takes post.	Reports "Ready," and takes post.	Reports "Ready," and takes post.
5	Reports "Sir, No. () in order," or any defects the section cannot remedy without delay.									

Table VII

Table VI. Duties in Amphibious Operations

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
Preparing the Vehicle for Amphibious Operation										
1	Commands PREPARE FOR AMPHIBIOUS OPERATION. Supervises the section during the operation. <i>Note.</i> The duties performed by numbers 3, 4, 5, and 6 will have to be accomplished by the remaining section members in the event the ammunition vehicle is not present.	Engages cab traverse lock. Elevates tube to allow installation of barriers. Removes air inlet cover. Installs front bag.	Assists gunner to install front bag.	Installs barriers.	Assists No. 1 to install barriers.	Releases side bag latches on the left side of the howitzer.	Releases side bag latches on the right side of the howitzer.	Assists No. 1 to install barriers.	Assists No. 1 to install barriers.	Lowers and secures howitzer traveling lock. Installs muzzle plug. Removes engine exhaust deflector. Verifies battery cell vent caps are tight.
2				Attaches bilge pump hose to hull outlet.	Removes window cover from barrier.	Verifies that bag supports on the left side are engaged.	Verifies that bag supports on the right side are engaged.			Opens and secures dipstick cover with spring retainer. Closes hull drain plugs. Closes personnel air duct.
3	Verifies that the howitzer is prepared for amphibious operation. Insures that all personnel are wearing life preservers.	Insures that cab and hull are securely closed.								Places inflation-deflation lever to the inflate position turns on blower switch and inflates the flotation bags. Shifts transmission lever to "2" range and starts bilge pump.
4	Commands the driver to enter the water.									At the command of the chief of section, enters the water slowly at right angles to the bank.
Stowing the Flotation Device										
1	Supervises the section during the operation.									Approaches bank slowly at a right angle and reduces track speed. Drives vehicle to level ground. Opens drain valve in the driver's compartment. Operates bilge pump until all water is drained from the engine compartment. Deflates flotation bags.
2		Removes front bag and replaces air inlet cover.	Assists gunner to remove front bag.	Removes bilge pump hose from hull outlet.	Replaces window cover on the barrier.					
3				Removes and secures barriers.	Assists No. 1 to remove barriers.	Assists No. 1 to remove and secure barriers.	Assists No. 1 to remove and secure barriers.	Assists No. 1 to remove and secure barriers.	Assists No. 1 to remove and secure barriers.	Closes dip stick cover. Replaces engine exhaust deflector.
4	Inspects the vehicle to insure that the flotation device is secure.	Depresses the tube.								Raises and secures howitzer travel lock. Checks transmission and final drive oil levels for water contamination.
5	Reports "Sir, No. () in order," or any defects the section cannot remedy without delay.									

Table VI

Table III. Duties in Direct Laying

Sequence	Chief of section	Gunner	Assistant gunner	Nos. 1 through 6	Driver																													
1	Conducts fire of howitzer. 1. Takes control of his section and fires the howitzer when the executive commands TARGET, TANK RIGHT (LEFT) FRONT, FIRE AT WILL or simply FIRE AT WILL. 2. Alerts section to prepare for direct fire.	Prepares panoramic telescope for direct laying. 1. Uncovers window on azimuth counter. 2. Sets azimuth counter to 3200. 3. Verifies gunner's aid counter is zero. 4. Actuates click sight mechanism. 5. Centers pitch and cross-level bubbles.	Prepares direct fire telescope: 1. Checks reticle for optimum illumination. 2. Checks level-vial mirror for convenient viewing.	Performs the same duties as in indirect laying.	Performs same duties as in indirect laying.																													
2	Identifies or selects target: 1. Identifies target designated by executive. 2. If target is a group of vehicles, selects the target that is the greatest threat to his position or the supported position based on this priority. a. Tanks at short range threatening to overrun the position. b. Hull down stationary tanks covering the advance of other tanks. c. Area containing personnel threatening to overrun the position. 3. Repeats target designation to the section "Lead tank," "MOVING TANK." Takes post to the flank and slightly to the rear of the piece where his observation will not be obscured by muzzle blast and smoke. Estimates range to target: 1. A range card (fig. 8) with accurate measurements to key points provides the most accurate ranges. 2. Estimated ranges are used if accurate measurements are not available. Determines lead in mils: Lead is based on target speed, range, direction of travel, and ammunition used. Approximate initial leads are as follows: <table><tr><td colspan="4">Lead (mils)</td></tr><tr><td></td><td colspan="2">Target traveling perpendicular to line of fire</td><td>Target traveling 45° to line of fire</td></tr><tr><td rowspan="2">Speed (MPH)</td><td>5</td><td>5</td><td>5</td></tr><tr><td>10</td><td>10</td><td>5</td></tr><tr><td rowspan="2">Slow</td><td>15</td><td>15</td><td>10</td></tr><tr><td>20</td><td>20</td><td>15</td></tr><tr><td rowspan="2">Medium</td><td>25</td><td>20</td><td>15</td></tr><tr><td>30</td><td>30</td><td>20</td></tr></table>	Lead (mils)					Target traveling perpendicular to line of fire		Target traveling 45° to line of fire	Speed (MPH)	5	5	5	10	10	5	Slow	15	15	10	20	20	15	Medium	25	20	15	30	30	20				
Lead (mils)																																		
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3	Gives initial commands: <table><tr><td>Sequence</td><td>Element</td><td>Example</td></tr><tr><td>1.</td><td>Target designation</td><td>TARGET (tank, etc.)</td></tr><tr><td>2.</td><td>*Projectile, charge, and fuze</td><td>SHELL HE, CHARGE 7, FUZE QUICK or SHELL HE, CHARGE 7, FUZE DELAY.</td></tr><tr><td>3.</td><td>Lead</td><td>LEAD, RIGHT (LEFT) 10.</td></tr><tr><td>4.</td><td>Method of fire</td><td>Fire is continuous unless otherwise commanded.</td></tr><tr><td>5.</td><td>Range</td><td>RANGE 600.</td></tr></table>	Sequence	Element	Example	1.	Target designation	TARGET (tank, etc.)	2.	*Projectile, charge, and fuze	SHELL HE, CHARGE 7, FUZE QUICK or SHELL HE, CHARGE 7, FUZE DELAY.	3.	Lead	LEAD, RIGHT (LEFT) 10.	4.	Method of fire	Fire is continuous unless otherwise commanded.	5.	Range	RANGE 600.	Sets initial lead on the azimuth counter. Traverses howitzer until the vertical reticle is centered on the target and maintains this sight picture by continuous tracking of the target. Commands FIRE, after the assistant gunner calls "Set." <i>Note.</i> The gunner and assistant gunner track the target in deflection and elevation, as a team, while adjusting for the correct sight picture. They will continue tracking after the round is fired and make corrections as directed by the chief of section.	Elevates or depresses the piece, until the target is on the appropriate range line in the reticle. Checks the level-vial mirror and adjusts for <i>cant</i> , as required, to center the bubble. Maintains target on appropriate range line by continuous tracking. Calls "Set." <i>Note.</i> A canted reticle in the direct fire telescope introduces an unacceptable range error and prevents satisfactory direct fire on moving targets.													
Sequence	Element	Example																																
1.	Target designation	TARGET (tank, etc.)																																
2.	*Projectile, charge, and fuze	SHELL HE, CHARGE 7, FUZE QUICK or SHELL HE, CHARGE 7, FUZE DELAY.																																
3.	Lead	LEAD, RIGHT (LEFT) 10.																																
4.	Method of fire	Fire is continuous unless otherwise commanded.																																
5.	Range	RANGE 600.																																
4	Gives subsequent commands based on observed effect: 1. Change in lead (given in 5-mil increments) RIGHT (LEFT) 5. 2. Change in range ADD (DROP) 100.	Actions taken for subsequent commands. While the gunner and assistant gunner continue to track the target, the chief of section gives commands based on observed effects. When the chief of section commands RIGHT (LEFT) ()— 1. Turns azimuth knob in 5-mil increments to set the lead change as directed. <i>Note.</i> With the click sights, the gunner can determine by sound and feel the appropriate change has been made without moving his eye from the telescope eyepiece. 2. Traverses the piece until the vertical reticle is again centered on the mass of the target. 3. Checks that the pitch- and cross-level bubbles are centered. 4. Commands FIRE, after the assistant gunner has called Set.	When the chief of section commands ADD (DROP) ()— 1. Elevates or depresses the piece until the appropriate range line is centered on the mass of the target. 2. Checks the level-vial mirror and adjusts for cant as required. 3. Calls "Set." <i>Note.</i> During the laying sequence, checks the direction of the lead as set by the gunner.																															
5	Commands END OF MISSION when target is destroyed or neutralized. New targets will be selected and taken under fire as outlined above. *Ammunition and fuze selection. Ammunition and fuze combinations are as follows: 1. Shell HE, charge 7, fuze quick is normally the most effective combination for indirect fire due to the following: a. Speed and ease of adjustment. b. Highest forward motion to projectile and fragments. c. Most effective fuze action against armor and personnel at close ranges. 2. Shell, white phosphorous, may be used to set stalled tanks and other vehicles afire and produce casualties. 3. Fuze delay may be used for ricochet effect. The point of impact is adjusted 10 to 30 meters in front of the target. If less than 50 percent of the bursts ricochet, change to fuze quick. 4. Fuze time is the least desirable and should be used at ranges of 1,000 meters or greater. Areas effectively covered by air and ricochet bursts are similar.																																	
6	ONE-MAN, ONE SIGHT SYSTEM 1. Fire commands are the same as above except range will be given in the form of a quadrant QUADRANT (). 2. Elevations are listed in table IV for gun-target ranges of approximately the same altitudes. If altitude differences are apparent, it will be necessary to compute the angle value by the mil relation formula and apply it to the elevation. 3. Subsequent commands for range changes are converted to quadrant and expressed as ADD (DROP) ().	Lays for both deflection and range: 1. Deflection is layed the same as the two-man, two-sight system. 2. Range is announced as "Quadrant ()" and is set on the elevation quadrant. 3. Elevates howitzer until the bubble in the pitch-level vial is centered. 4. Checks centering of cross-level bubble. 5. Tracks the target and places the vertical reticle on the center of the mass of the target. 6. Commands FIRE.																																

Table 11. Duties in Firing, Indirect Laying

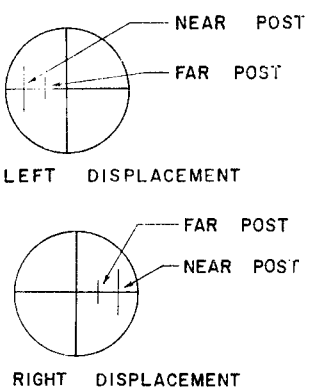
Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Commands the section during firing and insures an efficient and safe operation.									
2	Follows fire commands and repeats commands to the section as required to insure efficiency and safety.	Sets and Lays for Deflection: 1. The command is DEFLECTION (). 2. Sets announced deflection on the reset counter by turning the azimuth knob. <i>Note.</i> Final motion of traverse is from left to right. 3. Traverses the piece until the vertical reticle of telescope is on the left edge of the aiming point. <i>Note.</i> Final deflections are set in increasing direction on the reset counter. 4. Centers the pitch and cross-level bubbles.	Sets and Lays for Quadrant: 1. The command is QUADRANT (). 2. Sets the announced quadrant on the elevation counter with the elevation knob. 3. After the piece is loaded, elevates the tube until the elevation-level bubble is centered. 4. Centers the cross-level bubble with the cross-level knob.	Loads the Howitzer: 1. Places the projectile in the loading tray of the power rammer at the command QUADRANT (). Commands RAM. 2. Places the propellant charge in the chamber so that the igniter pad is 3 inches inside the rear of the chamber (lashed end to the front). 3. Commands CLOSE. Closes the block assembly. Slides the block assembly to the left to position the firing mechanism over the primer. Attaches the firing lanyard to the eyelet on the firing mechanism lever.	Rotates firing mechanism lever into desired firing position prior to loading. Lowers rammer to operating position. Releases rammer cylinder latch. Moves rammer cylinder to ram position at the command RAM. Returns rammer to stowed position. Closes the breech at the command CLOSE by lifting the cradle cam handle. Inserts the primer into the primer chamber.	Fuzes projectiles: 1. The command is FUZE (). 2. Removes lifting plug. 3. Inspects fuze socket for rust or dirt. 4. Removes or replaces supplementary charge as required. 5. Screws in designated fuze, using authorized fuze wrench. <i>Caution: Do not hammer on a fuze wrench or use an extension handle.</i> 6. Removes safety pull wire from time fuzes. With fuze setters M26, sets fuzes TSQ M54, TSQ M55, MT 67, T39 M500, TSQ M501, TSQ M520: 1. Seats upper lug of fuze setter in the upper recess of the fuze. 2. Loosens wingnut on fuze setter, sets announced time on the appropriate time band. 3. Locks wingnut, places handle to horizontal, turns counterclockwise until a stop is felt and a click is heard. 4. Raises handle, removes setter, verifies setting. With fuze setting M28, sets fuze VT M513-series: 1. Seats stationary lug of setter into top of recess of fuze. 2. Sets announced fuze setting on the fuze setter. 3. Turns setter clockwise until setter stops or a click is heard. 4. Removes setter and verifies setting. Sets selective superquick and delay fuzes: On fuze quick, verifies that letters S.Q. are aligned with the slot on the setting sleeve. On fuze delay, turns setting sleeve with screwdriver until the slot is aligned with word DELAY. Combination time and super-quick fuzes: For impact, the command is FUZE, M500 (or other fuze) QUICK. Verifies that the letter "S" on the setting ring is aligned with the index on the fixed ring.	Prepares propellant charge, assisted by driver: <i>Note.</i> Two types of charges are available for issue. 1. Type M3, green bag, consisting of five charges, 1 to 5. 2. Type M4A1, white bag, consisting of five charges, 3 to 7. The executive will designate the type of charge to be used: 1. The command is CHARGE 3, GREEN BAG. 2. Removes the complete charge from the container, placing base charge on bottom. 3. Unties the lashings. 4. Removes the bag marked "4" and "5." 5. Ties remaining bags together. 6. Removes igniter protector cap from base charge. 7. Discards bags 4 and 5, as directed. 8. Hands the charge to the driver and calls out "Charge prepared, green bag." 9. The same procedure is used to prepare white charge propellants. <i>Note.</i> Green bag and white bag increments must not be mixed in the same charge. When firing at night, the flash reducer M2 is tied beneath the strings next to the highest number increment used. <i>Note.</i> The M2 flash reducer is used with white bag propellants only. <i>Note.</i> Care and proper handling of ammunition must be insured. It is imperative that— 1. There be no smoking in vicinity of ammunition. 2. Only flashlights be used in vicinity of powder charges. 3. Rough handling of projectiles, powder containers, fuzes, and primers be prevented. 4. Projectiles not strike together. 5. Ammunition not become dirty, wet, or overheated. 6. Use M3 charges for registrations and calibrations. The M3 charges closely approximate firing table velocities, and produce less dispersion than the M4A1 charges.	Carries projectile to the howitzer: 1. Grasps the fuze end of end of the projectile with his left hand and the base with his right hand. 2. Carries the projectile to the howitzer and sets it on its base inside the hull, where it will be convenient to Number 1. <i>Caution: Care must be exercised in placing the ammunition in the hull to prevent damage to the rotating hand and fuze.</i>	Inspects and cleans projectiles: 1. Verifies that projectile is the type designated in the command. 2. Removes grommet and examines rotating band to see that it is free from all dirt and burrs. <i>Note.</i> Projectile with burred rotating band will be put aside until the burrs can be removed with a file. 3. Examines entire projectile for defects. 4. Stands projectile on end and cleans it thoroughly. <i>Note.</i> Any sand, dirt, oil, or grease on the projectile will cause wear, scratches, or gouges in the bore. Holds projectile upright for fuzing and fuze setting: 1. Selects proper projectile as commanded. 2. Holds projectile firmly while Number 3 fuzes and sets the fuze. When directed, reads and announces the time set on the fuze.	Assists Number 4 in preparing the propellant charge. Hands the propellant charge to Number 1 so that he can grasp the base of the charge with his right hand.
3	Indicates that the howitzer is ready to fire, after the assistant gunner calls "Set" and the gunner calls "Ready," by extending his right arm vertically and reporting "Number (), Ready."	Calls "Ready," and raises right hand after the piece is laid for direction and the assistant gunner has called "Set."	Calls "Set."							
4	Gives the command to fire by dropping his arm sharply to his side and commanding FIRE.			At the command of the chief of section, fires the howitzer with a quick strong pull on the lanyard.						
5	Observes and checks functioning of materiel during firing. Reports promptly to the executive any mistakes, unusual incidents, equipment malfunctions, and any reason the howitzer may not be fired.		Depresses howitzer to loading position after each round is fired.	Swabs and inspects the powder chamber forcing cone, after each round is fired and calls "Bore clear." Calls out number and quadrant for each round in volley fire. <i>Notes.</i> 1. During lulls in firing Nos. 1 and 2 swab out the bore, wash powder residue from the mushroom head, the gas check seat, and the threaded section of the breech recess and breechblock. 2. Nos. 1 and 2 may be required to change duties as the howitzer is traversed.	Cleans obturator vent, as required.	<i>Caution: A time fuze should be returned to ordnance after being set twice.</i> <i>Note.</i> The wrench-type fuze setter M27 may be used to set time fuzes. The setter is engaged in fuze knoth and rotated in the direction of increasing readings, until the time setting is opposite the index mark on the fuze. This type of setter should be used only when mechanical setters are not available.				
6 (These duties are performed as required.)	Lays for quadrant with gunner's quadrant. 1. The command is USE GUNNER'S QUADRANT. 2. The announced quadrant is set on the gunner's quadrant. <i>Note.</i> Increments are of 10 mils set on the quadrant frame arc. Mil and 0.1 mil increments are set with the micrometer knob. The same side of the quadrant must be used for settings on the quadrant frame arc and micrometer. 3. After the howitzer is loaded and laid for direction— Stands squarely opposite quadrant seats. Places and hold gunner's quadrant firmly on the seats. Insures that the words <i>line-of-fire</i> are on the bottom of the quadrant and the line of fire arrow is pointed toward the muzzle and is on the same side of the quadrant as the scale used. 4. Directs the assistant gunner to elevate the tube until the bubble is centered. Cautions the assistant gunner when the bubble is approaching center so that the final centering may be expedited. <i>Note.</i> For subsequent settings, the chief of section will take the same position, hold the quadrant in the same manner, and view the quadrant bubble from the same angle to insure consistency in leveling. Measures the quadrant: 1. The command is MEASURE THE QUADRANT. 2. With the piece laid, directs the assistant gunner to center the cross-level bubble and turn the elevation knob until the bubble in the elevation-level vial is centered. 3. Reads the quadrant in the elevation counter window. 4. Reports to executive officer "Number () Quadrant ()." <i>Note.</i> The quadrant can also be measured by placing the gunner's quadrant on the breech quadrant seat and centering the bubble by moving the index arm and turning the micrometer knob. Conducts prearranged fires in conformity with prescribed data (e.g., barrages, harassing, and interdiction fires). Commands "CEASE FIRING." 1. Command may be given by anyone. 2. All firing will stop immediately. 3. If the howitzer is loaded, reports that fact to the executive who will acknowledge with "Number () loaded." 4. The executive will then investigate the cause, correct it, and resume firing by announcing the quadrant. 5. If CEASE FIRE is commanded by the Fire Direction Center, fire is resumed by announcing the quadrant.	Corrects for aiming post displacement when the vertical reticle in the panoramic telescope is displaced from the line formed by the aiming posts. He lays the howitzer so that the far aiming post appears exactly midway between the near aiming post and the vertical reticle.  <i>Figure 11. Correction for aiming post displacement.</i> <i>Note.</i> If displacement is caused by traversing, lay as described above. If displacement is caused by shifting of the carriage due to firing shock— 1. Lay as above until there is a lull in firing. 2. Notify chief of section for permission to realign the aiming posts. 3. Lay howitzer as described above. 4. Direct Number 5 to move the far post into alignment with the vertical reticle and then align the near aiming post. Lays for quadrant. When one-man, one-sight system is used— 1. Places the gunner's elevation control switch to GUNNER. 2. Places the announced quadrant on the elevation counter with the elevation handwheel. 3. Elevates the tube until the pitch-level bubble is centered. 4. Checks the cross-level bubble. 5. Calls "Ready" and raises his right hand when piece is laid for direction and quadrant. Refers the piece. 1. The executive commands AIMING POINT THIS INSTRUMENT (or other point), REFER. 2. Does not disturb the lay of the tube. 3. Checks centering of bubble. 4. Refers sight until the vertical reticle is on the designated point. 5. Opens the azimuth counter door. 6. Reads from the azimuth counter and reports to the executive "Sir Number (), deflection ()." <i>Notes.</i> 1. Each time the weapon is traversed, the gunner must center the pitch- and cross-level bubbles on the panoramic telescope mount, and the assistant gunner must insure that the elevation-level bubble and the cross-level bubble are centered each time the weapon is elevated or depressed. 2. If, during firing, power traverse or power elevation fails, use the manual options, until there is a lull in firing and the power systems are repaired. 3. Individual piece corrections will normally be added to the common deflection and quadrant, and the total deflection and quadrant are announced to each piece (e.g., deflection number 1, 2390; quadrant number 1,367.) The gunner's aid counter and correction counter windows should, therefore, normally read zero. However, it may be necessary for the assistant gunner to carry a correction on the correction counter of the elevation quadrant due to errors found while performing the end-for-end test. (See TM 9-2360-217-10.)								

Table I. Duties in Prepare for Action

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Commands PREPARE FOR ACTION. Supervises work of cannoneers during all activities.	Depresses left pedal latch. Opens left turret door.	Depresses right pedal latch. Opens right turret door.	Opens rear turret doors. Unbuckles left spade strut strap.	Opens real hull doors. Unbuckles right spade strut strap.	Remove paulin from turret storage rack and spread it on ground at left rear of motor carriage.		Unload and arrange equipment as directed by the chief of section.		
2	Directs backing of carriage against spades. Directs driver to cut engine and set brakes.			Remove left and right spade strut safety pins. Release left and right locking latches, simultaneously, allowing spades to drop.						When directed by the chief of section, backs carriage against the spades. Sets brakes and stops engine. Leaves master switch on.
3	Checks position of replenisher indicator and replenisher pressure. Checks recoil system for leaks. Directs servicing, as required.	Deflates cab race ring seal. Releases cab traverse lock. Places cab power switch to ON. Selects No. 1 gunner for power elevation. Checks equilibrator fluid level.	Deflates gun shield seal. Checks cab hydraulic system powerpack pressure.		Procures fuze setter. Assisted by No. 3, unloads fuze boxes and opens and arranges fuzes as directed by the chief of section. <i>Note.</i> During firing, No. 3 will fuze projectiles and set fuzes from outside the howitzer. During initial phases of firing, it may be necessary to utilize ammunition from inside the howitzer. When ammunition from other vehicles is available, No. 3 assumes all duties of fuze preparation and the ammunition fired from the basic load of the howitzer will be replenished.	Assists No. 2 in unloading fuze boxes and opening and arranging fuzes.	Unloads and arranges propellant charges as directed by the chief of section.	Assisted by No. 6, unloads and arranges ammunition as directed by the chief of section.	Assists No. 5 in unloading and arranging ammunition.	Removes muzzle cover and tosses it in driver's hatch. Opens and locks direct fire telescope window.
4		Assists driver in disengaging howitzer traveling lock. Checks functioning of elevating mechanism (power) and traversing mechanism (power manual).	Checks functioning of elevating mechanism (power and manual).	Procures lanyard. Operates firing mechanism. Assisted by No. 2, inspects and cleans, as required, the breechblock chamber, bore, and primer vent.	Assists No. 1 in inspecting and cleaning the breechblock chamber, bore, and primer vent. Checks functioning of the breechblock and power rammer and leaves the breechblock open.					Assisted by the gunner lowers and secures howitzer traveling lock. Removes aiming posts and rammer staff sections.
5		Opens telescope cover and secures visor cord in catch. Installs panoramic telescope. Uncovers azimuth 6,400-mil counter. Sets azimuth counter to 3,200 mils and zeros the gunner's aid counter. Levels telescope mount.	Sets elevation counter on elevation quadrant to 300 and centers cross-level and elevation bubbles. Sets correction counter to zero.	Procures sponge, bur-lap, and a bucket of water and places them in a convenient location.	Places vent cleaning bit in a convenient location. <i>Note.</i> The breech-block must be opened for initial round. For subsequent rounds, the breechblock opens automatically.		Assembles aiming posts and places them near left front of motor carriage.		Lays communication cable from howitzer to MX-155/GT, prepares telephone for use and assures operation of communication equipment.	
6	Verifies the adjustments of the sighting and fire control equipment.	Tests and alines (boresight) fire control equipment.		Assembles rammer staff and head.	Procures primers and places them in a convenient location.		Emplaces and holds testing target, if required.			
7	*Measures site to the mask, assisted by the assistant gunner: 1. Sights along lowest elevation of bore. 2. Directs the assistant gunner to elevate or depress the tube until the lowest element of the bore just clears the highest crest in the field of fire. 3. Directs the assistant gunner to center the cross-level and elevation bubbles. 4. Reads elevation on elevation counter and reports to the executive "Sir, number () site ()." (Gunner's quadrant may be used.) 5. Records and announces minimum elevation for each charge to the gunner and Number 1.	*Lays the howitzer for direction: 1. When the command is given identifying the aiming point, identifies aiming point through telescope and announces "Number (), aiming point identified." 2. Executive commands NUMBER (), DEFLECTION (). 3. Sets announced deflection on the azimuth counter (top window). 4. Traverses cab until reticle pattern of telescope is centered on objective lens of aiming circle. 5. Checks that pitch- and cross-level bubbles are centered. 6. Reports to executive "Sir, number () ready for recheck." 7. Repeats steps in 3 through 6 above, until executive announces "Number () is laid." (Lay of tube will not be disturbed until an aiming point is established.)	Assists chief of section in measuring site to mask.				Sets out the far aiming post to the left front of the howitzer at a deflection between 2,400 and 2,600 mils and approximately 100 meters from the piece.			
8	*Indicates alternate aiming point to the gunner when one is designated by the executive. If an alternate aiming point is not designated, the chief of section should select a clearly defined point at a distance of at least 2,000 meters. This aiming point is to be used as directed by the executive or at such times when the aiming posts are rendered useless. Deflections read from the azimuth counter are recorded and reported to the executive and are used to maintain parallelism, until the aiming posts are reemplaced.	*Directs alinement of aiming posts: 1. Refers telescope to the far aiming post previously set out by Number 4. 2. Directs Number 4 by hand signals to aline near aiming post with the far aiming post and the vertical reticle. 3. Pushes in and turns reset knob and sets reset counter to 3,200. 4. Records reading in azimuth counter window and closes the window. <i>Note.</i> The azimuth counter is used to lay the howitzer. The reading in this window reflects the angle required to place the tube parallel to the direction of fire. The reset counter is then used to establish a common deflection of 3,200. Lays on alternate aiming point: 1. The piece has been laid. 2. The executive may command AIMING POINT, LEFT FRONT, LONE TREE, REFER. 3. Without moving the tube, refers the sight to the aiming point. 4. Reads the deflection from the azimuth counter and reports "Number (), deflection ()." <i>Note.</i> The executive may record the referred deflection for future use, or he may proceed as follows: 5. Commands COMMON DEFLECTION 3,200. 6. Pushes on reset knob and turns counterclockwise until 3,200 appears on the reset counter. 7. Verifies that the line of sight is on the aiming point. 8. Closes window over azimuth counter. 9. Reads and sets subsequent deflections from reset counter.	Sets the howitzer in the loading position. Checks direct fire telescope: 1. Adjusts eyepiece arm to a convenient viewing angle. 2. Adjusts light control knob for optimum reticle illumination. 3. Adjusts level-vial mirror for convenient viewing. 4. Centers cant correction bubble by turning the red cant correction knob. 5. Verifies that elevation and azimuth slip scales are set at 4.				Places the near aiming post midway between the piece and the far aiming post and sets it as directed by the gunner.			
9	Verifies that the howitzer is prepared for action. Reports to executive "Sir, Number () in order" or reports any defects that the section cannot remedy without delay.	<i>Note.</i> All cannoneers take posts after they have performed their specific duties.								

* These steps may be omitted during training when drill does not include laying of the piece.

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