

Gun Drill, 105 mm Howitzer, LG1 MK II

(ENGLISH)

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FOREWORD

1. B-GL-371-015/FP-001, *Artillery Field Manual, Volume 15, Gun Drill, 105 mm Howitzer, LG1 Mk II*, is issued on the authority of the Chief of the Defence Staff.
2. This publication is effective upon receipt.
3. Suggestions for amendments shall be forwarded through normal channels to: Commandant, School of Artillery, Combat Training Centre, CFB Gagetown.
4. Unless otherwise noted, masculine pronouns apply to both men and women.

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CHAPTER 1 GENERAL DUTIES

GENERAL

1. This manual is written primarily for detachment commanders and instructors. The duties of the gun position officer (GPO) are given in B-GL-306-004/FP-001 (Interim 3), *Artillery in Battle, Field Artillery, Volume 4, Duties Within the Regiment*, and are not described in this manual unless a description is necessary for the understanding of the duties of the detachment.
2. For general description of the howitzer and ammunition together with full details of routine maintenance and action of all working parts, reference shall be made to C-71-333-000/MB-000, *Operators Manual, 105mm LG1 Mk II*.
3. Throughout this manual, the term howitzer and gun are synonymous.
4. The following summary of principal duties is not a comprehensive list, but is intended as a guide to detachment commanders and instructors.

DUTIES OF NO 1

5. **General.** No 1 commands the detachment and is responsible for all aspects of serving the howitzer.
6. No 1 is responsible for the service ability of all assigned equipment. No 1 assigns detachment members responsibilities for completeness and serviceability of the parts and stores which they examine in preparation for action and examination of equipment. No 1 reports any defects in equipment or ammunition to the GPO or command post officer (CPO).
7. No 1 is responsible for ensuring the maximum protection is provided for his detachment, consistent with the efficient service of the gun. This includes arranging camouflage as ordered by the GPO.
8. No 1 acts directly on the orders of the GPO, except during tank engagements, when he is responsible for fire control once the GPO has ordered "ENGAGE". When gun programmes are in use, No 1 controls the

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fire of the gun in accordance with the written detail of the gun programme but acts immediately on any verbal orders from the GPO.

9. Before firing, No 1:

- a. lowers the firing platform;
- b. supervises the preparation and supply of ammunition and reports any unserviceable ammunition to the GPO;
- c. ensures that his gun is, at all times, laid at the correct bearing and elevation;
- d. verifies that the fuze and charge are correct before loading; and
- e. opens the breech.

10. During firing, No 1:

- a. orders the gun loaded and fired;
- b. watches the action of the recoil mechanism and corrects any faults as authorized;
- c. ensures that the spades dig in evenly and that they are evenly supported;
- d. ensures an accurate record is maintained of the details of the ammunition fired and of the amount of ammunition remaining;
- e. during pauses in firing, he supervises the maintenance of the equipment, and directs the clearing up of salvage; and
- f. arranges reliefs. No 1 may order any member to rest if the gun can be serviced without them.

11. After firing, No 1 closes the breech, raises the firing platform and supervises the destruction of unused propellant charges on the order of the GPO.

DUTIES OF NO 2

12. The duties of No 2 are to:

- a. assist the No 3 with the unclamping and clamping of the cradle;
- b. elevate, to insure the barrel can be freely rotated in the travelling position;
- c. rotate the barrel into the combat or road position;
- d. operate the right trail lock;
- e. operate the hydraulic pump located on the right trail; and
- f. remove the muzzle cover and attach or detach the traversing mechanism.

13. During a fire mission, No 2 will load alternately with Nos 4, 5 and 6 and assists in the preparation of ammunition.

14. During prolonged periods of firing, he cleans and lightly oils the breech and firing lock as opportunity offers.

DUTIES OF NO 3

15. The duties of No 3 are:

- a. assist No 2 with the unclamping and clamping of the cradle; and
- b. assist in the opening and closing of the trails;
- c. operate the left trail lock;
- d. direct No 4 in planting aiming posts and in setting up the collimator for bearing and elevation;
- e. set the sight at the bearing ordered;

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- f. set the elevation ordered;
- g. lay the gun on the ordered bearing and elevation; and
- h. fire the gun on order from No 1.

DUTIES OF NO 4

16. The duties of No 4 are:

- a. unlock and lock the trails;
- b. assist in opening and closing of the trails;
- c. assemble and set the collimator,
- d. assemble and plant the aiming posts, when ordered, and the centre of arc (C of A) marker; and
- e. affix and orient the aiming post lights.

17. During a fire mission, No 4 will load alternately with Nos 2, 5 and 6, and assist in the preparation of ammunition.

DUTIES OF NO 5

18. The duties of No 5 are:

- a. assist in the opening and closing of the trails; and
- b. lay the communication line to the command post (CP).

19. During a fire mission, No 5 will:

- a. load alternately with Nos 2, 4 and 6; and
- b. assist in the preparation of ammunition.

DUTIES OF NO 6

20 No 6 is the driver of the prime mover. During a fire mission, No 6 loads alternately with Nos 2, 4 and 5, and assist in the preparation of ammunition.

DUTIES OF NO 7

21 No 7 is the 2IC of the detachment. **The duties of No 7 are:**

- a. be prepared to replace No 1 at any time;
- b. assist in the opening and closing of the trails;
- c. operate the fuze setters;
- d. prepare the charge and set the fuze, if applicable, for all fire missions as soon as the ammunition has been ordered;
- e. ensure that the ammunition is kept clean and protected from dampness and extreme temperatures; and
- f. record accurate details of the ammunition fired and the amount.

CHAPTER 2 GUN DRILL

INTRODUCTION

1. **General.** For the convenience of instructors and detachment commanders, explanatory notes precede detailed gun drill in this and subsequent chapters. During training, the contents of these notes shall be explained indoors, or informally around the gun, before instruction in drill is given. The instructor shall also ensure that the members of the detachment are familiar with the names of the relevant parts of the equipment and understand how they are to be operated.
2. **Reduced Detachments.** Drill with reduced detachments shall be practised as soon as the detachments are proficient in the normal drill. In the later stages of training, drill with reduced detachments shall be regarded as normal rather than exceptional.
3. **Locational Terms:**

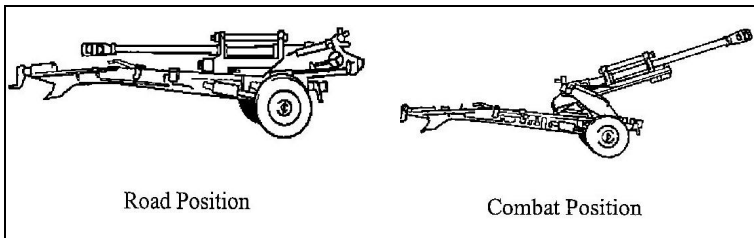


Figure 2-1: Gun Configurations

- a. When the gun is hooked into the vehicle the term “front” refers to the direction in which the vehicle is pointing.
- b. When the trail is unhooked, the term “front” refers to the direction in which the muzzle (in combat position) or the breech (in road position) is pointing depending on the gun configuration.
- c. The terms “right,” “left” and “rear” are always used in relation to “front”, as described in para 3.a. or 3.b.

- d. The terms “ACTION right,” “ACTION left” and “ACTION rear” are always used in relation to “front” as described in para 3.a.
- e. The terms “road position” and “combat position” are used to describe the gun configuration (see Figure 2-1).

FORMING DETACHMENT REAR (OR FRONT)

4. Drill:

- a. On the order “DETACHMENT REAR (FRONT)”, the detachment falls in two ranks: Nos 1, 3, 5, and 7 from right to left in the front rank and Nos 2, 4 and 6 in the rear rank covering Nos 3, 5, and 7 respectively, with one space between ranks. They dress by the right and stand at ease.
- b. With only six members, No 6 falls in the place normally occupied by No 7.
- c. At “DETACHMENT REAR”, when the gun is hooked to the vehicle, the front rank is three paces in rear of and facing the muzzle or the breech depending on which position the gun is in (combat or road), with No 1 covering the right gun wheel.
- d. At “DETACHMENT REAR”, when the trails are on the ground, the front rank is one pace in rear of the lunette, with No 1 covering the right gun wheel. They face the breech or muzzle.
- e. At “DETACHMENT FRONT”, when the gun is hooked to the vehicle, the front rank falls in three paces in front of the vehicle, with No 1 covering the right vehicle wheel. They face the direction the vehicle is pointing.
- f. At “DETACHMENT FRONT”, when the trails are on the ground, the front rank falls in three paces in front of the muzzle or the breech, with No 1 covering the right gun

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wheel. They face the direction the muzzle or the breech is pointing.

TELLING OFF

5. On the order “TELL OFF”, the Detachment Commander calls out “ONE” in a clear voice, the person on the right in the rear rank calls out “TWO”, the person in the front rank next to No 1, “THREE,” and so on.

CHANGING ROUND

6. Drill:

- a. On the order “CHANGE ROUND”, No 1 takes one pace left rear and one pace left. The person on the left in the rear rank takes two short paces to the front.
- b. At the same time, the remainder of the front rank takes two short paces to the right, and the remainder of the rear rank two short paces to the left.
- c. When the detachment consists of six, the person on the left in the rear rank takes one pace to left and one pace left front.

MOVING THE GUN

7. Notes:

- a. The drill described in para 8. is used for moving the gun on firm level ground, e.g., in gun sheds or on parade squares. On uneven ground the manhandling drill shall be employed (see Chapter 6).
- b. The order “FOR GUN DRILL, PREPARE TO ADVANCE (or RETIRE)” will normally be given when the detachments are in their positions at detachment rear.

- c. If, after the gun has been moved to the front (or rear), it is necessary to move it in the opposite direction, the order “HALT” and “PREPARE TO RETIRE (or ADVANCE)” is given.
- d. The order to move the gun is “WALK, MARCH”. The term “WALK, MARCH” is used to indicate that there is no attempt to keep in step. The gun is moved by Nos 2 and 3 pushing in front or in rear of the wheels with Nos 4, 5, 6, and 7 on the lifting handles.
- e. When the gun is to be moved without the vehicle, the order “RETIRE” will mean that the gun is to be moved trails first, i.e., in the direction in which the trail is pointing.
- f. On the order “ADVANCE”, the gun will be moved in the opposite direction of the trails at waist height.
- g. When moving the gun manually, the gun shall be moved in the combat position in order to reduce the weight on the trails.

8. Drill:

- a. On the order “FOR GUN DRILL, PREPARE TO ADVANCE”, the detachment doubles to their positions. Nos 1, 3, 5, and 7 go to the left of the equipment, Nos 2, 4, and 6 to the right as follows:
 - (1) Nos 2 and 3 take up their positions in rear of the wheels;
 - (2) No 1 positions himself where he can best supervise the movement of the gun;
 - (3) Nos 4, 5, 6, and 7 take up their position at the trails; the highest numbers nearest the lunette; and

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- (4) the detachment stands at attention facing the front, even numbers on the right and odd numbers on the left.
- b. On the order “WALK”, No 3 releases the brake, No 7 orders “LIFT”, and Nos 4, 5, 6 and 7 raise the trails off the ground.
- c. On the order “MARCH”, the detachment moves the gun as directed by No 1.
- d. On the order “HALT”, No 3 cautiously applies the brake, No 7 orders “LOWER”, and Nos 4, 5, 6, and 7 lower the trails gently to the ground.
- e. On the order “FOR GUN DRILL, PREPARE TO RETIRE”, the detachment acts as already detailed except that all of the numbers face the rear, with Nos 2 and 3 in front of the wheels.
- f. On the order “PREPARE TO RETIRE” when the detachment is facing the front, or “PREPARE TO ADVANCE” when the detachment is facing the rear, Nos 1, 4, 5, 6, and 7 turn inward about and Nos 2 and 3 move to their required positions at the wheels.

MOUNTING AND DISMOUNTING

9. Drill:

- a. On the order “MOUNT”, the detachment doubles to the vehicle, odd numbers proceeding along the right side of the gun, even numbers along the left. The detachment will mount and sit in the vehicle facing inwards, as follows:
 - (1) Nos 3 and 5 sit on the right, Nos 2, 4 and 7 on the left, lowest numbers nearest the tailgate; and
 - (2) No 1 will sit beside No 6, the driver.

- b. On the order “DISMOUNT”, the detachment will dismount and take up their positions at detachment rear.

CLAMPING AND UNCLAMPING THE CRADLE

10. **Notes.** In order to avoid damage to the elevating and traversing gears, the cradle must always be clamped before travelling.

11. Drill:

- a. **Clamping the Cradle.** No 3, pressing the ratchet, turns the hand crank until it is fully exposed. He then guides the cradle until the ball joint on the cradle is fully in contact with the clamp. No 2, using his ratchet, turns his hand crank until it too is in contact with the ball joint on the cradle. At times, the No 2 must inform No 3 in which direction he wishes the barrel moved, e.g., “TRAVERSE RIGHT (or LEFT)”, “ELEVATE (DEPRESS)”, “CLAMPED.”
- b. **Unclamping the Cradle.** No 2 and No 3, using their ratchets, turn their hand cranks until they are fully retracted.

OPENING AND CLOSING THE BREECH

12. Notes:

- a. When travelling, the breech block is held up by a safety latch located on the left side of the breech ring (ROAD position). Before opening the breech block, No 1 must insure that the safety latch is rotated free of the breech block (FIRE position).
- b. When a round is inserted, the rim of the casing pushes on the extractors causing the breech block to automatically move up and secure the breech block into the firing position.

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- c. The breech block is semi-automatic and will open automatically once a round has been fired; pushing the spent casing to the rear of the cradle.

13. **Drill:**

- a. **To Open the Breech.** No 1 places the safety latch in fire position and pulls the breech operating lever back, using his right hand causing the breech block to open. No 1 then replaces the breech operating lever back into the stowed position.
- b. **To Close the Breech.** No 1, gently pulling the breech operating lever handle back, relieves the left hand extractors' grip on the block. At the same time, using the clearing lever, the breech block can then go back up again accompanied by the breech operating lever in order to reduce the speed of the movement of the breech block moving upwards. When travelling, insure the safety latch is placed in the road position.

PREPARING FOR ACTION

14. **Notes:**

- a. **General:**
 - (1) The GPO will normally order "PREPARE FOR ACTION" to be carried out shortly before the guns move into action. The object is to ensure that the equipment is, in all respects, ready for action.
 - (2) If time permits and if the move into action is expected to be short, the GPO will normally order the quick sight test to be carried out at this time (see para 19. of Chapter 5).
 - (3) The drill described in para 15 reflects the gun being in the road position.

WARNING

With the LG1, walking backwards when opening the trails is a necessity. Caution shall be observed on uneven ground.

b. Definitions of covers:

- (1) The overall cover covers half way down the barrel group, recoil system, cradle, sight quadrant mount, and traversing and elevating mechanisms.
- (2) The breech cover covers the breech mechanism.
- (3) The sight cover covers the sight and mount when the howitzer is in action. It is to be used at night, in inclement weather, and when travelling (when overall cover is not being used).

15. Drill:**a. Preparation:**

- (1) On the order "PREPARE FOR ACTION", the detachment dismounts.
- (2) No 1 lowers the firing platform.
- (3) No 5 passes the sight box to No 3 who in turn places it by the left tire and applies the hand brake.
- (4) Nos 2 and 3 engage their trail locks then unclamp the cradle and slide the overall tarp to the No 4.
- (5) No 2 levels the barrel and, assisted by the No 4, rotates the barrel to the combat position then removes the muzzle cover.

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- (6) Nos 3, 4, 5, and 7 go to the trails, Nos 3 and 5 on the right, Nos 4 and 7 on the left, and Nos 5 and 7 nearest the lunette.
- (7) No 7 disconnects the electrical cable and secures it to the left trail. No 7 then removes the cotter pin from the towing hook and opens the towing hook.
- (8) No 5 disconnects the brake cable and secures it to the left trail.
- (9) No 2 installs the hydraulic pump handle, and with the lever in the CLOSE position, begins to pump until it becomes difficult. No 2 then rotates the lever pump to the OPEN position.
- (10) No 4 unlocks the trails.
- (11) No 7 orders "LIFT", when the towing eye is clear of the hook and reports "CLEAR" and then rotates the lunette to the firing position.
- (12) No 1 signals (or orders) "ADVANCE". The vehicle is advanced 5 metres and halted.
- (13) Once the vehicle is clear, No 1 orders "SPREAD".
- (14) No 2 begins to pump the trails open until he hears the two clicks from the trail locks being engaged. Once this occurs, he replaces the pump handle in the stowed position.
- (15) No 1 orders "LOWER".
- (16) No 2 attaches the traversing mechanism.
- (17) No 3 positions the dial sight into the sight mount and the direct fire telescope into its mount.
- (18) No 1 opens the breech.

b. **Examination:**

- (1) No 1 examines the bore and recoil system, ensuring that the detachment and equipment are, in all respects, ready for action.
- (2) No 2 visually checks the tires, removes the tail lights, if so ordered, and stows them in the vehicle.
- (3) No 3 checks the direct fire telescope, the traversing, and elevating mechanisms. No 3 also examines the dial sight and mount and sets the dial sight scales to zero.
- (4) No 4 examines the aiming posts, aiming post lights, and the collimator.
- (5) Nos 5, 6 and 7 check and examine the remainder of the stores.
- (6) The detachment then take up their positions at detachment rear. No 1 calls for reports, doubles to the GPO, and reports any deficiencies and ammunition state.

c. **Assembly.** On the order “HOOK IN”:

- (1) No 1 closes the breech.
- (2) Nos 2 and 3 unlock the trail locks.
- (3) No 2 replaces the muzzle cover.
- (4) No 3 removes the sight and direct fire telescope, places them into the sight box and places the sight mount cover on. No 3 then elevates the barrel so that it is ready to be clamped in.
- (5) No 2 places the pump handle into the pump and places the lever in the “CLOSE” position.

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- (6) No 1 orders "CLOSE".
- (7) Nos 3, 4, 5 and 7 take up there positions on the trails.
- (8) No 7 then orders "LIFT".
- (9) No 2 begins to pump until the trails are fully closed, then stows the pump handle.
- (10) No 4 locks the trails.
- (11) Nos 2 and 3 clamp the cradle.
- (12) No 1 raises the firing platform, ensures that it is locked, and then carries out a quick visual check of the gun.

d. **Hooking In:**

- (1) On completion of their tasks, the detachment will take up positions as follows:
 - (a) No 1 where the detachment can be seen and from where the vehicle can be directed into the required position,
 - (b) No 3 takes position by the hand brake facing the rear, and
 - (c) Nos 2, 4, 5, and 7 at the rear of the trails and facing the rear in line with the lunette. Odd numbers on the left, even numbers on the right, and the highest numbers nearest the lunette.
- (2) No 1 directs the vehicle into the required position, and orders "HOOK IN".
- (3) No 7 orders "LIFT". Nos 2, 3, 4, 5, and 7 lift the trails.

- (4) No 7 rotates the lunette to the travelling position.
- (5) No 7 will close the towing hook, fit the cotter pin, and hook up the safety cable.
- (6) If required, No 4 will hook up the electrical cable.
- (7) No 3 ensures that the hand brake is released once the gun is hooked in.

COMING INTO ACTION

16. Notes:

- a. When the guns are brought into action, the order or signal “ACTION” will be given as the guns approach the selected position. Each gun platform will normally be marked by a flag or marker, and No 1 is responsible for the gun being brought into action with the sight mount directly over the marker. When positions are not marked, the responsibility for the choice of the platform rests with No 1.
- b. If the position is to be occupied by the independent method, the guns will have been halted under cover close to the gun position. No 1 and possibly No 3 will have been taken to the gun position. No 1 will have been shown their platform and will have reconnoitred the route to it. No 1 will then lead the gun into action as ordered by the GPO.
- c. Although equipment is designed to withstand hard use under service conditions, the risk of damage can be greatly reduced without loss of efficiency, by the exercise of care by the driver and the detachment.
- d. If the ground is difficult, the GPO will order “NUMBER . DOUBLE-MAN NUMBER ___.

- e. The signals shown in the table at Figure 2-2 are used by No 1 for controlling the movement of vehicles when coming into and out of action. Voice control is the simplest method at night.

Ser	Order	Signal
1	“ACTION”	The hands are clenched and the arms extended straight to the front of the body facing the required bearing of fire.
2	“HALT”	Either arm is raised vertically above the head.
3	“ADVANCE”	No 1 faces the driver and extends the right arm to the front of the body bringing the hand upwards and towards the face and bending the arm at the elbow.
4	“REVERSE”	No 1 places both arms in front of the body with elbows bent and palms of the hands upright, towards the driver. He moves the forearms backward and forward as long as the reverse movement is required.
5	“CHANGE DIRECTION”	No 1 extends one arm with the fist clenched in line with the shoulder in the direction in which the vehicle is to move.

Figure 2-2: Signals for Controlling Vehicle Movements

17. Drill:

- a. **The approach:**
 - (1) Having received the order or signal “ACTION”, No 1 dismounts on approaching the gun platform and stands where the gun can be seen when it is in the required position.
 - (2) When the gun is in the required position, No 1 signals or orders “HALT” to the driver and orders “ACTION...”.
 - (3) The detachment dismounts.

b. **Unhooking:**

- (1) No 1 lowers the firing platform and insures it is locked into position.
- (2) No 5 passes the sight box to No 3, who in turn places it next to the left tire and applies the hand brake.
- (3) No 2 and No 3 engage their trail locks and unclamp the cradle.
- (4) Nos 2, 4, 5 and 7 go to the trails, Nos 5 and 7 on the right, Nos 2 and 4 on the left. Nos 4 and 7 are nearest the lunette.
- (5) No 4 disconnects the electrical cable and secures it to the left trail if necessary.
- (6) No 7 removes the safety cable and passes it to No 5 who in turn secures it to the trail. No 7 then removes the cotter pin from the towing hook and opens the towing hook.
- (7) No 2 installs the pump handle and with the lever in the CLOSE position, pumps until it becomes difficult, No 2 then rotates the lever to the OPEN position.
- (8) No 4 unlocks the trails.
- (9) No 7 orders "LIFT". When the towing eye is clear of the towing hook, No 7 will signal "CLEAR" and rotate the lunette into the firing position.
- (10) No 1 then orders "ADVANCE".
- (11) Once the vehicle is clear, No 1 orders "SPREAD".

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- (12) No 2 begins to pump until two distinctive clicks are heard from the trail locks. No 2 then replaces the pump handle in the stowing area.
- (13) No 1 orders "LOWER".
- (14) No 3 removes the sight mount cover and installs the sight. No 3 ensures all scales are set to zero mils and levels the barrel.
- (15) No 2 removes the muzzle cover.
- (16) No 1 opens the breech.

c. **Positioning Stores and Ammunition:**

- (1) Nos 4 and 5 remove the tool box from the vehicle and place it 5 metres in rear of the left trail.
- (2) Nos 6 and 7 unload the stores and ammunition from the vehicle and place them in a convenient position in rear of the left trail.
- (3) No 1 signals the vehicle to DRIVE ON, and the vehicle proceeds to the vehicle area under supervision of the TSM.
- (4) No 5 lays the communication line and takes the gun marker to the CP.
- (5) No 4 prepares the collimator and aiming posts.

ACTION POSITIONS

18. **DRILL:**

- a. No 1 stands where the work of the detachment can best be supervised, usually in rear of and close to the right trail.

- b. No 3 stands on the left of the gun, facing the front, and outside the trail.
- c. Nos 2, 4, 5, 6, and 7 stand 5 metres in rear of the left trail and to the right of the tool box, with No 7 positioned nearest the tool box.

PASSING ORDERS

19. Notes:

- a. The guns in action are numbered 1, 2, 3, etc., from right to left as viewed from the rear. In case of doubt due to dispersed siting, the GPO will allot numbers. In all cases, these numbers stand throughout the action regardless of the bearing in which the guns are laid.
- b. Orders will normally be passed and acknowledged through the communications system. If this fails, orders will be passed by voice and acknowledged as follows:
 - (1) when visible from the CP, No 1 shall raise one hand vertically above the head; or
 - (2) when not visible from the CP, No 1s shall report “NUMBER __ THROUGH __” in succession from the right.
- c. When orders are being passed by voice, each No 1 will look towards the next No 1 on the side away from the CP and will relay any orders which are not immediately acknowledged. If No 1 still fails to acknowledge, the order will be called out once more by the GPO.
- d. Confirmation of an order will be requested or attention will be called to omissions or obvious verbal errors by use of “VERIFY __”. For example, “VERIFY BEARING”.
- e. No 1 will relay orders affecting the detachment in a voice no louder than is necessary and only when the order has

not been heard by the detachment members concerned or when specially detailed in this manual.

- f. Reports from No 1 to the GPO will be acknowledged by the GPO by raising one hand vertically above the head or by ordering “DOWN __ (number of gun(s))”.
- g. Orders from the GPO always take precedence over reports from No 1.

DIRECTING THE MOVEMENT OF THE TRAILS

20. **Note.** The table at Figure 2-3 shows the signals used for directing the movement of the trails.

Ser	Order	Signal	Action
1	“TRAILS RIGHT/ LEFT”	Arm extended toward the rear, palm of the hand turned in the direction required.	Nos 2, 4, 5 and 6 move the trails in the direction indicated until the “HALT” signal is given.
2	“HALT”	Fist clenched.	Nos 2, 4, 5 and 6 stop the movement and remain at the trails.
3	“TAKE POST”	Sharp tap on the buttock with the palm of the hand.	Nos 2, 4, 5 and 6 steady the trails then take up positions in action.

Figure 2-3: Signals for Directing Movement of the Trails

MOVING THE TRAILS

21. **Notes:**

- a. When the gun is first laid in the C of A, the traversing gear shall be approximately central. Thereafter, it shall not be necessary to move the trails unless the traverse has been expended.

- b. When it is considered absolutely necessary to move the trails, No 1 will order "TAKE POST TO LAY". If the trails are embedded, No 1 must first order "RUN UP."
- c. Due to uneven ground or the gun being on a slope, it may be necessary to bring up the towing vehicle (if the tactical situation allows) to move the gun. This will be further explained in the Run Up Drill.

22. Drill:

- a. On the order "TAKE POST TO LAY", No 3 centres the traverse if necessary.
- b. Nos 2, 4, 5 and 6 take up their respective positions on the trails.
- c. On the signal or order "TRAILS RIGHT/LEFT", Nos 2, 4, 5, and 6 move the trails in the required direction.
- d. On the signal or order "TAKE POST", the detachment takes up their positions in action.

RUNNING UP

23. Notes:

- a. The following drill is used for clearing the spades, either at coming out of action or when the limits of traverse have been exceeded and the equipment must be re-laid in a bearing beyond the limits of the traversing handwheel.
- b. If the gun is loaded, No 1 shall order "MAKE SAFE" or "UNLOAD" if a vehicle is to be used before ordering "RUN UP."
- c. If the ground is difficult, the GPO, TSM or No 1 may order "NUMBER __ , DOUBLE MAN NUMBER __."

Or they may have to order the towing vehicle up to pull the gun forward to clear the spades.

WARNING

When using a vehicle, do not exceed the amount of terrain covered to clear the spades, to ensure that no damage occurs to the firing platform.

24. Drill:

- a. On the order RUN UP, No 3 brings the traverse to centre.
- b. Nos 2, 4, 5 and 6 heave upwards on the trails. If required, Nos 1 and 7 will assist.
- c. No 1 co-ordinates their efforts by ordering “TOGETHER, HEAVE”.
- d. No 1 orders “TAKE POST TO LAY” or “CEASE FIRING”, as applicable, when the spades are clear.
- e. When the towing vehicle is being used, No 1 ensures the gun is empty, No 2 hooks the tow cable to the gun, and No 4 hooks the opposite end to the vehicle.
- f. Once Nos 2 and 4 are clear, the No 1 takes up position in front of the vehicle to direct the driver. No 7 takes up position to be able to see the No 1 and the spades. Once the spades are clear, No 7 signals this to No 1 who in turn halts the vehicle.

LAYING IN THE CENTRE OF ARC

25. Notes:

- a. During training but before detailing the drill of this and subsequent sections, the instructor will ensure that the detachment members who are to perform the duties of

Nos 1 and 3 are familiar with the drill for sight setting and laying as detailed in Chapter 4.

- b. The GPO is responsible for ensuring that the original bearing to all guns is in the direction ordered. This direction, from which all subsequent bearings are measured, is known as the C of A.
- c. When the individual angle method is to be used, and if the passage of orders by voice is likely to be difficult, the GPO will either:
 - (1) order runners to be sent from each detachment to the director (the drill as described in para 26 except that all orders and reports will be written and No 1 will not call back his angles to the GPO); or
 - (2) pass the angles to the guns through the communication system (the drill as described in para 26., No 1 calling angles back to the to the GPO through the communication system).
- d. When the individual angle method is being used, and if time permits, the GPO will redo the measurement of the angle to each sight after No 1 has reported “NUMBER FINISHED WITH DIRECTOR”. This procedure will eliminate errors due to the movement of the sight during laying. If the GPO finds that the original angle remains correct, he will order “NUMBER__RECORD AT__”. If a new angle is required, the GPO will order this angle and the drill as detailed in para 26 will be done again.

26. Drill:

- a. **Individual angle method:**
 - (1) On the order from the GPO “AIMING POINT DIRECTOR, NUMBER (angle in mils)”, No 1 calls back to the GPO the angle ordered. If the call back is incorrect, the

GPO orders the correct angle again. If the call back is correct, the GPO will acknowledge.

- (2) No 3 sets the angle ordered on the main scale of the sight.
- (3) No 1 checks the setting and orders "TAKE POST TO LAY", if necessary (see para 22).
- (4) No 3 directs the movement of the trails until the gun is roughly laid in its bearing.
- (5) On the signal or order "TAKE POST", the drill, as described in para 2-22, is carried out. No 3 lays on the director.
- (6) When laid, No 1 reports to the GPO "NUMBER , FINISHED WITH DIRECTOR".

b. **During a night occupation (when aiming posts are already planted):**

- (1) Having received the angle to the aiming posts from the GPO, No 3 sets the angle ordered on the main scale of the sight.
- (2) No 1 checks the setting and orders "TAKE POST TO LAY" (see para 22).
- (3) No 3 directs the movement of the trails until the gun is laid roughly in its bearing as described in para 22.
- (4) On the signal or order "TAKE POST", the detachment takes up their action positions.
- (5) No 3 lays on the aiming posts making due allowance for displacement, as described in para 10.c. in Chapter 4 and Figure 4-2.

- (6) When the gun is laid, No 1 immediately proceeds to record the C of A as described in paras 27 and 28.

c. **During a night occupation (when aiming posts have not been planted):**

- (1) Having received the first angle to the director from the GPO, No 3 sets it on the main scale of the sight.
- (2) No 1 checks the setting and orders "TAKE POST TO LAY" (see para 22).
- (3) No 3 directs the movement of the trails until the gun is roughly in its bearing.
- (4) On the signal or order "TAKE POST", the drill described in para 22 is carried out.
- (5) No 3 lays on the director.
- (6) When the gun is laid, No 1 reports to the GPO or CP through the communication system "NUMBER __, FINISHED WITH DIRECTOR".
- (7) No 3, on request from the GPO, will be ordered to illuminate his sight by shining the flashlight through the eyepiece to allow a second measurement.

d. **Aiming point method:**

- (1) On the order from the GPO, "AIMING POINT , (angle), RECORD AT __", for example, "AIMING POINT CHURCH STEEPLE, 4300 RECORD AT 1700", No 1 acknowledges the aiming point or doubles to the GPO for clarification.

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- (2) No 3 sets the angle on the main scale of the sight.
 - (3) No 1 ensures that No 3 knows the location of the aiming point.
 - (4) No 1 checks the setting and orders "TAKE POST TO LAY".
 - (5) No 3 directs the movement of the trails until the gun is laid roughly in its bearing.
 - (6) On the signal or order "TAKE POST", the drill described in para 22 is carried out.
 - (7) No 3 lays on the aiming point.
 - (8) Nos 1 and 3 complete the drill for recording the C of A.
- e. **Passing parallel line.** Passing and receiving parallel line from one gun to another is used when a gun cannot see the director or vice versa. The drill involves passing an angle from a gun that has been laid in the C of A to a gun which could not observe or be observed by the director.
- (1) The GPO will order "NUMBER ___ PASS PARALLEL LINE TO NUMBER ___".
 - (2) No 1 orders No 3 to turn the head of the sight onto the sight of the receiving gun.
 - (3) No 1 checks the lay, opens the blanking ring, notes the reading on the main scale, and orders No 3 to read.
 - (4) No 3 reads aloud the main scale reading and if they agree, No 1 adds or subtracts 3,200 from the reading and passes the resulting angle to the receiving gun. For example, "NUMBER FOUR LAY ON NUMBER ONE AT 3245".

- (5) No 1 of the receiving gun will call back the angle ordered and, following the drill in para 26., lay the gun in the C of A.

RECORDING CENTRE OF ARC

27. Notes:

- a. The GPO will order the original bearing to be recorded as the C of A. Three independent records will be made as follows on the recording plate (see Figure 4-4):
 - (1) a record of the main scale reading to gun aiming post (GAP) 1;
 - (2) a record of the main scale reading to GAP 2; and
 - (3) a record of the bearing of the C of A ordered by the GPO.

- b. No 1 will adhere to the following priorities when selecting the GAPS:
 - (1) **By day:**
 - (a) collimator;
 - (b) aiming posts;
 - (c) distant GAP; and
 - (d) close GAP.

 - (2) **By night:**
 - (a) collimator;
 - (b) aiming posts with FLASHLIGHT or TRI-LUX lights; and

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- (c) night picket.
- c. As soon as all three records have been completed, No 1 will report to the GPO “NUMBER RECORDED”.
- d. If fire orders are received before the C of A has been recorded, the GPO will normally order “DEFER SECOND METHOD”. No 1 will then report “NUMBER RECORDED” as soon as the following records have been completed and checked:
 - (1) a record of the main scale reading to GAP 1, and
 - (2) a record of the bearing of the C of A ordered by the GPO.No 1 will record GAP 2 at the earliest opportunity without further orders from the GPO.
- e. After the C of A has been recorded, No 1 will direct the planting of a marker in the C of A in front of his gun. This marker will be used as an aid in measuring bearings and as a means of checking that the gun is, at all times, laid at the correct bearing. No 1 will point out GAPS 1 and 2 and the C of A marker to all members of his detachment.
- f. The records of the C of A will stand until cancelled by a subsequent order from the GPO, e.g., “RECORD AT ___”.
- g. The original bearing in which the guns are laid may be altered by the GPO by ordering a fresh bearing, e.g., “BEARING __, RECORD AT ___.” On the latter order, No 3 will lay on his GAP at the bearing ordered. The C of A marker will be moved to correctly reflect the C of A bearing in which the gun is recorded, if the new C of A has been ordered for all guns.
- h. In both cases (paras 27.f. and g.), the No 1 will order **ALL** previous records to be erased and the drill, as

described in para 28, will be carried out with the gun laid in the new C of A.

- i. During the laying of the gun in the C of A and the recording of C of A, both the longitudinal and cross level bubbles of the sight mount must be central. The setting of the elevating knob of the dial sight and the elevation of the gun does not effect the accuracy of this drill.
- j. Under no circumstances will No 1 amend his C of A record without orders from the GPO. Should it be obvious that the C of A record is wrong, No 1 will report the fact to the GPO who will arrange for a check and order a new record made.

28. Drill for recording the Centre of Arc:

- a. On the order “RECORD AT __,” No 1 turns the sight onto the selected GAP 1.
- b. No 3 records the ordered bearing on the record plate.
- c. No 1 orders “LOOK, READ”.
- d. No 3 identifies GAP 1 by looking through and over the sight, reads the main scale, and records the reading on the record plate.
- e. While No 3 is recording this angle, No 1 slips the slipping scale to the bearing ordered and checks that the sight is still laid on GAP 1. He then reads the main scale, checks No 3’s record, and turns the sight onto his selected GAP 2.
- f. No 1 orders “LOOK, READ”.
- g. No 3 identifies GAP 2 by looking through and over the sight, reads the main scale, and records the reading on the record plate.
- h. No 1 reads the main scale and checks No 3’s record.

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- i. No 1 orders “GAP 1”.
- j. No 3 turns the sight onto GAP 1. No 3 reports the main scale reading, closes the blanking ring, and reports the bearing on the slipping scale. No 1 ensures these readings agree with the records on the recording plate. If they do not, No 1 takes the necessary steps to correct them. At this point, No 1 orders the C of A marker planted and then reports to the GPO “NUMBER __ RECORDED”.

RECORDING CENTRE OF ARC AT NIGHT

29. **Note.** The means of laying by night are given in para 27.

PLANTING AIMING POSTS

30. **Notes:**

- a. No 1 will order “AIMING POSTS LEFT FRONT” (or RIGHT REAR).
- b. To reduce confusion, aiming posts shall be planted alternately between guns and to the left front and right rear of each gun. For example, No 1 gun left front, No 2 gun right rear, etc. In addition, aiming posts cannot be located in the same sector between two guns.
- c. When aiming posts are to be planted, No 1 will indicate to No 4 where the near post is to be planted. The distance from the gun to the near post shall be approximately 50 metres; however, the distance from the gun to the near post will equal that from the near post to the far post regardless of distance.

31. **Signals.** The table at Figure 2-4 shows the signals used by No 3, their meanings, and the action to be taken by No 4.

Ser	Order and signal	Action by No 4
1	“MOVE IN THE DIRECTION INDICATED” The arm is extended upwards to the right, or the left arm extended upwards to the left, the palm of the hand in the direction required.	Hold the post upright, clear of his or her body, and move in the direction indicated; continuing until the “HALT”.
2	“HALT” Arm dropped.	Halt and allow the post to slip through the hand until the point rests on the ground.
3	“PLANT” Both arms dropped from above the head.	Press the point firmly into the ground. Ensure that the post is upright and then steps clear.
4	“MOVE TOP OF POST IN DIRECTION INDICATED” Both arms extended above the head and moved laterally in the direction required.	Move the top of the post in the direction indicated, continuing until the “HALT” signal is given. Ensure that the post is firmly planted and then steps clear.
5	“PICK UP” Both arms extended to the front and raised upwards.	Pull the post out of the ground and await further signals.
6	“COME IN” Body turned in the direction required, both arms extended above the head and lowered in the direction required.	When at the far post, double to the near post. When at the near post, double back to his or her position in action.

Figure 2-4: Signals used by No 3 for Planting Aiming Posts

32. Drill:

- a. On the order “RECORD AT __,” No 1 will order “AIMING POSTS LEFT FRONT” (or RIGHT REAR). No 4 obtains the aiming posts and doubles to a position about 50 metres in front (or rear) of the gun as indicated by No 1 and as closely as can be judged in the line

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indicated. No 4 plants the first aiming post then doubles a further equal distance with the second post and lines it up with the sight and near aiming post.

- b. No 4 faces the gun and awaits instructions from No 3. As soon as No 4 has planted the near aiming post, No 3 turns the sight accurately on it. No 3 then directs the planting of the far post exactly in line with the near one.
- c. No 3 signals No 4 to come in to the near post and to straighten it if necessary. No 3 then signals No 4 to come in.
- d. No 1 checks the alignment.
- e. No 3 and No 1 then complete the drill for recording C of A using the aiming posts as one of the GAPs.

PLANTING AIMING POSTS DURING A NIGHT OCCUPATION

33. Notes:

- a. During a night occupation, the C of A is recorded by:
 - (1) collimator;
 - (2) two aiming posts with flashlights or tri-lux; or
 - (3) night picket.
- b. The GPO shall order the C of A to be recorded by ordering “RECORD AT ___”.
- c. To reduce the possibility of confusion, guns shall alternate the arrangement of light colours on their posts.
- d. The light on the far post must be adjusted to appear above the light on the near post. To accomplish this, it may be necessary to remove the top section of the near post.

34. **Drill.** On the order “RECORD AT ___”.

- a. No 4 obtains the aiming posts and proceeds to a point 50 metres to the front/rear of the gun as directed by No 1.
- b. No 3 rotates the dial sight head towards the direction No 1 has indicated, and No 3 places a flashlight into the eyepiece.
- c. No 4 plants the first aiming post, fits the appropriate light, and turns the light so that it is facing the gun.
- d. No 3 lays the reticle of the sight on the light of the first post and as a signal to No 4, momentarily turns the flashlight at the eyepiece OFF.
- e. On this signal, No 4 turns the light through 3,200 mils and:
 - (1) proceeds a further distance equal to the first interval;
 - (2) lines up the second post with the light on the near post and the light in the sight;
 - (3) fits the other light, ensures that it is facing the gun; and
 - (4) returns to the near post and rotates the light on the near post so that it is facing the gun.
- f. No 3 removes the flashlight and aligns the reticle of the sight with the aiming post lights and checks for displacement if any.
- g. No 1 checks the alignment.
- h. Nos 1 and 3 then complete the drill for recording C of A, using the aiming posts as one of the GAP.

CHECKING THE BEARING

35. Notes:

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- a. The aim of the following drill is to ensure that the gun is parallel to the director.
- b. The drill is carried out:
 - (1) as soon as possible after the C of A has been recorded;
 - (2) as soon as possible after the spades are embedded by firing;
 - (3) before the beginning of a fire plan;
 - (4) at least once daily;
 - (5) at first light following a night occupation;
 - (6) when an error in bearing has occurred which cannot otherwise be detected; and
 - (7) anytime the GPO determines it is necessary to check the guns for line.
- c. The drill is accomplished by checking the guns at the nearest 100 mils to the current bearing. It is carried out by the GPO using the director.

36. **Drill:**

- a. On the order "CHECK BEARING, AIMING POINT DIRECTOR, BEARING __ (to the nearest 100 mils)", No 3 sets the bearing and lays on the GAP in use. No 1 checks and No 3 turns the sight onto the director.
- b. No 1 checks the lay and notes the reading on the main scale and micrometer.
- c. No 1 orders "READ". No 3 reads the main scale and micrometer and reports to No 1 as a check.

- d. On the order “NUMBER __”, No 1 reports the reading “NUMBER __ (angle read)”, and the GPO calls back the angle.
- e. If the call back is correct, No 1 acknowledges. If the call back is incorrect, No 1 says “WRONG” and reports the angle again.
- f. When the angle reported by No 1 is correct the GPO orders “NUMBER __ CORRECT”.
- g. No 1 will order to No 3 “GAP 1”.
- h. When the angle reported by No 1 is incorrect:
 - (1) The GPO orders “NUMBER __ (new angle)”. This new angle will cause the gun to be laid correctly in the current bearing of fire.
 - (2) No 1 calls back the angle to the GPO. If the call back is correct, the GPO orders “NUMBER __, RECORD AT __ (current bearing)”.
 - (3) No 3 ensures all previous records are erased. Nos 1 and 3 complete the recording drill.
 - (4) At the conclusion of the check, the GPO will give the necessary orders for relaying the guns on the last target or the final protective fire (FPF) task as applicable.
 - (5) The C of A marker will not be moved unless a new C of A has been ordered for all guns.

MEASURING THE ANGLE OF SIGHT TO A CREST

37. **Note.** Immediately after the guns are in action, the GPO may need to know vertical angle from each gun to any crest visible from the gun position. No 1 may initiate the following drill, depending on the circumstances.

38. **Drill:**

- a. On the order “MEASURE ANGLE TO CREST”, No 1 assisted by No 3 will lay on the crest indicated by sighting along the bottom of the bore.
- b. No 3 cross levels and, by means of the elevation knob, brings the longitudinal bubble into the centre of its run.
- c. No 1 reads the angle on the elevation scale and reports to the GPO “NUMBER __ ANGLE TO CREST__”.

LOADING

39. **Notes:**

- a. **General:**
 - (1) The gun will not be loaded without the order “LOAD” from No 1 except when engaging tanks (see Chapter 3).
 - (2) When a cartridge only is to be loaded, No 1 will order “CARTRIDGE ONLY, LOAD”.
- b. **Rules.** No 1 will observe the following rules of fire discipline in deciding when to give the order “LOAD”:
 - (1) **Applicable rules for impact fuzes:**
 - (a) A gun is loaded as soon as a method of adjustment or method of fire for effect (FFE) has been ordered for that gun.
 - (b) In adjustment, only the guns ordered to “ADJUST FIRE” are loaded.
 - (c) Throughout adjustment, the adjusting gun(s) will be reloaded on receipt of an elevation or the order “LOAD” from the GPO.

- (d) Guns will not be loaded sooner than necessary to maintain the rate of fire ordered. After an order for FFE has been carried out, guns will not be reloaded until the GPO orders a new method of adjustment or FFE.

(2) **Applicable rules for time or CVT fuzes:**

- (a) No gun will be loaded until a method of adjustment or orders for FFE together with a fuze setting have been ordered for that gun.
- (b) Once having loaded, guns will be reloaded as follows:
 - i. during adjustment the adjusting gun(s) will be reloaded immediately after the fuze setting and elevation for each succeeding round is ordered; and
 - ii. during FFE the guns will not be reloaded sooner than is necessary to maintain the rate of fire ordered.

(3) **Applicable rules for time or CVT fuzes ordered as impact:**

- (a) When the order “FUZE, M __, IMPACT” is received, the rules for impact fuzes are followed, fuzes being set to the appropriate setting according to the fuze in use. For example, if using M582, the setting would be > 98.
- (b) When the order “TIME” is given, the rules for time or VT fuzes are followed, fuzes being set to burst in the air.

c. **Ammunition:**

- (1) The preparation of ammunition is described in B-GL-306-015/MS-001 *Handbook of Equipment and Ammunition, 105mm Howitzer CI*, Chapter 2, also applicable to the LG1.
- (2) Throughout a fire mission, unless a specific number of rounds have been ordered, six ready rounds will be available.
- (3) When time fuzes are ordered, fuzes will be set only on those rounds which are included in the method of adjustment or method of FFE, as follows:
 - (a) fuzes are set by No 7; and
 - (b) No 1 will check the setting of every round before it is loaded. When ammunition has been prepared in advance, No 1 will ensure that the round is taken from the correct stack.
- (4) **Except when engaging tanks, the procedure is as follows:**
 - (a) No 1 will check every round before it is loaded by receiving the excluded charges from the loading number to ensure that the proper bags are enclosed.
 - (b) No 1 will periodically check the bore for residue and deposit on the chamber walls, and order it cleaned when necessary.
- (5) No 1 shall ensure that his gun is not left loaded while the gun is hot. If orders are received which will result in this, he will report "NUMBER __ LOADED, GUN HOT". A gun

is considered hot when it is painful to touch the barrel (see paras 49 to 53).

- (6) As soon as the ammunition is ordered, No 7 will prepare the rounds for loading.
- (7) Fuzes will not be set until the method of adjustment or FFE for that gun has been ordered.
- (8) No 7 will set CVT, time, and impact fuzes to the setting ordered.
- (9) No 7 will adjust the charge to the charge ordered.
- (10) Nos 2, 4, 5, and 6 will load the gun on the orders of No 1.
- (11) If difficulty is experienced in closing the breech after the round has been loaded, the loading number will obtain the ramming tool and endeavour to force the round home. Should this fail, No 1 will order "UNLOAD".
- (12) On no account shall an attempt be made to drive the round home without the proper tool.
- (13) If a gun is loaded with other than the type of ammunition ordered, No 1 will so report, e.g., "NUMBER __ LOADED SMOKE". The GPO will order "UNLOAD" or issue orders as to the disposal of the wrong ammunition.

40. Drill:

a. **Loading drill with impact fuzes:**

- (1) When the ammunition is ordered, No 7 will prepare rounds for the charge ordered.
- (2) No 2, alternating with Nos 4, 5 and 6, will carry a prepared round, excluding charges, to the gun to be loaded. The loading number will take up

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the loading position beside the left trail, halfway between the spade and breech, facing the breech, and clear of recoil.

- (3) At the appropriate moment No 1 will order "LOAD".
- (4) The loading number will hand the excluding charges to No 1 and call out "CHARGE ___". No 1 will check the fuze setting.
- (5) No 1 will order "CORRECT" if the round is correct. He will hold the excluded charge bags for that round until the round is fired and then will throw the bags over the right trail.
- (6) No 1 will order "WRONG, CHARGE ___", if the charge is incorrect and the next loading number will bring a correct round forward. The incorrect round will be returned to No 7 for correction.
- (7) The loading number, holding the round in the hollow of his left arm, will insert the nose of the projectile into the breech. With the right hand clenched and positioned at the base of the casing, he will push the round home.

b. **Loading drill with CVT or time fuzes:**

- (1) No 1 checks the fuze setting of the projectile and reports "CORRECT" or "WRONG, FUZE ___". If the fuze setting is not correct, the next loading number will bring a correct round forward and the incorrect round will be returned to No 7 for correction.
- (2) No 1 orders "LOAD" and the gun is loaded.

UNLOADING

41. **Notes:**

- a. When a change of charge or “END OF MISSION” is ordered after the gun has been loaded, No 1 will order “CARTRIDGE ONLY, UNLOAD”.
- b. In the case of a change of charge, No 1 will then order “CARTRIDGE ONLY, LOAD” unless the complete round has been extracted, then he will order “LOAD”.
- c. If on extraction, the projectile remains in the bore and “END OF MISSION” has been ordered, No 1 will order waste to be stuffed into the chamber and the breech closed.
- d. When “MISFIRE” is reported, the drill for misfires must be followed (see paras 54 to 57). A projectile shall not be left in the bore when the gun is hot.

42. Drill:

- a. **For unloading the cartridge only:**
 - (1) On the order from No 1 “CARTRIDGE ONLY, UNLOAD”, the loading number opens the breech taking care not to eject the cartridge violently.
 - (2) A loading number receives the round or cartridge, and returns it to No 7.
 - (3) If the cartridge only is ejected, No 1 checks that the complete cartridge has been removed and orders “CHARGE __, CARTRIDGE ONLY, LOAD”.
 - (4) In the case of “END OF MISSION” and the projectile remains in the bore, No 1 will order waste stuffed into the breech. A loading number will close the breech.
- b. **For unloading the complete round:**

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- (1) On the order from No 1 “UNLOAD”, a loading number will unload, taking care not to eject the cartridge violently. He then receives the round (or cartridge) and returns it to the rear. If the projectile remains in the bore, No 3 depresses the gun to the horizontal.
- (2) Waste is stuffed into the chamber and the breech is closed. No 5 assembles the rammer and staff, No 1 inserts the assembly into the barrel until it comes in contact with the projectile. No 1, assisted by No 5, pushes and, if necessary, taps the assembly lightly until the projectile is dislodged. A loading number receives the projectile and returns it to No 7.

LAYING

43. Notes:

- a. The detailed drill for sight setting is given in Chapter 4. These paragraphs describe the duties of the detachment for each of the different methods of laying.
- b. Indirect laying with the range quadrant is the normal method and is used unless otherwise ordered.
- c. When the trails are embedded, they should not be moved if the target is within the scope of the traverse.
- d. No 1 is responsible for ensuring that his gun is always laid at the correct bearing and elevation. He will; therefore, measure all bearings from his C of A marker by extending the arm to its full length and, using the hand, measure angles (see Figure 2-5).
- e. No 3 will report the actual setting of the elevation scale, when-ever the setting is changed, by reporting “ELEVATION ___”.

- f. No 1 will examine the setting of the sight elevation scale whenever he considers it necessary.

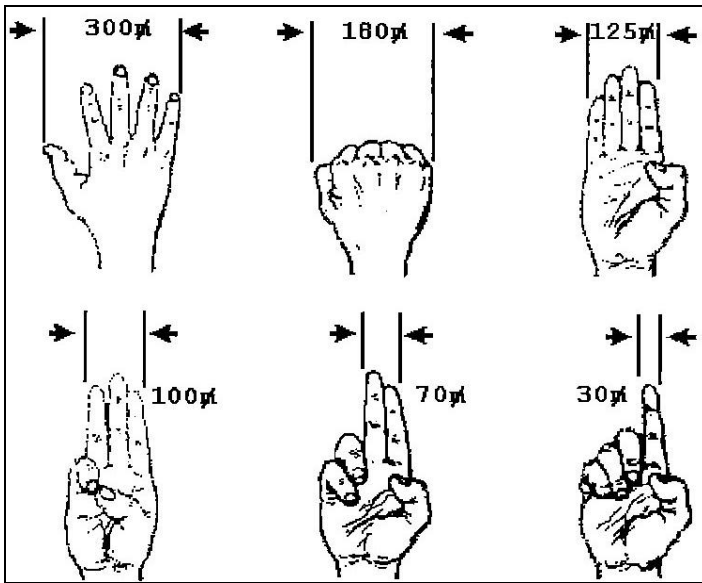


Figure 2-5: Approximate Angular Values for an Average Man's Hand

- g. No 1 is responsible for deducing the exact settings, or alterations to settings, to be applied to the sights in all cases when these settings are not ordered by the GPO, for example:

(1) **Elevations:**

- (a) When laying with the range quadrant, No 3 applies the elevation to the range quadrant scale.
- (b) When laying with the gunners quadrant, No 1 applies the correction for index error to the elevation ordered and sets the resulting elevation on the gunners quadrant.

- (2) **Fuze Setting.** No 1 applies the fuze correction to all subsequent fuze settings and orders the exact fuze setting to No 7.

44. **Drill:**

- a. **Normal indirect laying.** For normal indirect laying sequence see the table at Figure 2-6.

Ser	Order	Action
1	“BEARING”	No 3 sets the bearing ordered on the dial sight and lays for bearing. No 1 checks the bearing by measuring from the C of A.
2	“ELEVATION”	No 3 sets the elevation ordered on the elevation scale and reads the setting. “ELEVATION ____”. No 3 then lays for elevation and makes final adjustments and reports “READY”.

Figure 2-6: Normal Indirect Laying Sequence

- b. **Indirect laying using the gunner’s quadrant.** For indirect laying sequence using the gunner’s quadrant see the table at Figure 2-7.

- c.

Ser	Order	Action
1	“BEARING”	No 3 sets the bearing on the dial sight and lays for bearing. No 1 measures the bearing using the C of A marker.
2	“QUADRANT LAYING”	No 1 obtains the gunner’s quadrant, No 3 cleans the breech levelling plates.
3	“ELEVATION”	No 1 applies the correction for index error to the elevation ordered and sets it on the gunner’s quadrant. No 1 then hands the quadrant to No 3. No 3 reads the setting to No 1 and hands it back. No 1 holds the quadrant on the breech levelling plates with the words “line of fire” at the bottom and

Ser	Order	Action
		the arrow pointing towards the muzzle. No 3 lays for elevation. No 3 makes final adjustments and reports "READY". No 1 removes the quadrant from the breech.

Figure 2-7: Indirect Laying Sequence using the Gunner's Quadrant

- d. **Open action.** Same as normal indirect laying.
- e. **Anti-tank drill.** See Chapter 3.
- f. **To change from direct to indirect laying during a fire mission:**
 - (1) When engaging a target by direct fire, the need may arise to change to indirect fire.
 - (2) **Drill:**
 - (a) On the order "INDIRECT", No 1 turns the sight onto a GAP.
 - (b) No 3 identifies the GAP by looking through and over the sight.
 - (c) No 1 slips the slipping scale to zero.
 - (d) No 3 lays for indirect laying.

MEASURING THE QUADRANT ELEVATION

45. **Note.** During a fire mission, the need may arise to change to laying by the gunner's quadrant. The GPO will order "QUADRANT LAYING, REPORT QE". The angle measured will include the correction for index error. No 1 must therefore add/subtract the index error from the measured elevation.

46. **Drill:**

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- a. On the order “QUADRANT LAYING, REPORT QE”, No 3 lays at the last bearing and elevation ordered.
- b. No 1 places the gunner’s quadrant on the levelling plates of the breech ring and centres the bubble by moving the arm and micrometer. No 1 then reads the setting and passes the quadrant to No 3.
- c. No 3 reads the setting as a check.
- d. No 1 adds/subtracts the index error from the reading and reports the resulting angle as “NUMBER __, QE __”.

FIRING

47. Notes:

- a. The gun will not be fired without the order “NUMBER FIRE” from No 1, except when engaging tanks (after the first anti-tank round has been fired on the order from No 1), or when the sentry fires the gun on a FPF task.
- b. Before ordering the gun fired, No 1 must be satisfied that it is the detachment’s turn to fire, that the gun is ready, that the detachment is clear of recoil, and that the trajectory will clear any crest or obstacle (such as a tree or camouflage) close to the front of the gun. In cases of doubt, No 1 will ensure that the trajectory will clear such an object by looking along the top of the barrel for bearing and along the bottom of the bore for elevation.
- c. The opening round of a fire mission will not be fired until the GPO has ordered the method of adjustment or the order “FIRE FOR EFFECT.”
- d. When “AT MY COMMAND” is in force, the order to fire must come from the GPO.
- e. “AT MY COMMAND” remains in force until a new fire mission is ordered, or “CANCEL AT MY COMMAND” is given. When “AT MY COMMAND” is in force and

the order “FIRE FOR EFFECT” includes more than one round, the order “FIRE” authorizes all rounds specified to be fired without further orders.

- f. Whenever the executive order to fire must come from the GPO, No 1 will order “NUMBER ___” and will then report the gun ready by raising one arm, if visible from the command post, or by reporting “NUMBER READY” if not visible.

- g. After the opening round of a fire mission and when “AT MY COMMAND” is not in force, No 1 will order the gun fired as follows:
 - (1) During adjustment:
 - (a) Each elevation is the order for No 1 of the adjusting gun to fire as soon as the gun is ready.

 - (b) When “GUN NO 1, NO 2, etc. (NUMBER OF GUNS)” or “BATTERY RIGHT (LEFT) ADJUST FIRE” is ordered, guns fire one round in succession from the right (left) as ordered. If No interval is given, the standard five seconds will be used. This order should be coupled with “AT MY COMMAND” to ensure that all guns are ready.

 - (2) **At fire for effect (FFE).** Each gun independently fires the number of rounds ordered, No 1 ordering “FIRE” as soon as the gun is ready unless an interval is given.

- h. **Interval.** The interval is ordered in seconds, e.g., “ELEVATION 350, THREE ROUNDS FIRE FOR EFFECT, 60 SECONDS” or “ELEVATION 350, ___ GUNS RIGHT ADJUST FIRE, 10 SECONDS”.

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- (1) At fire for effect the interval is the time between the firing of individual rounds by any one gun.
 - (2) At battery right (left) adjust fire, the interval is the time between the firing of one gun and next gun.
- i. **Rate of fire.** The maximum is 12 rounds per minute. See Annex K to determine the number of authorized shots.

48. Drill:

- a. No 1 orders “NUMBER ___” shortly before it is that number’s turn to fire.
- b. That number faces inwards and grasps the handle of the firing lanyard with the right hand.
- c. The remainder of the detachment stand at their positions in action.
- d. At the appropriate moment No 1 orders “FIRE”.
- e. The number pulls the firing lanyard with the right hand.

TEMPERATURE MONITORING

49. The instructions which follow are defined to avoid risks which stem from pyrotechnical materials: “cook-off” and inadvertent operation of the explosive.

50. Two types of temperatures must be controlled at the tube level (see Figure 2-8):

- a. **T1.** The temperature at the level of the chamber, i.e., the part of the tube filled with propulsive charge (chamber).
- b. **T2.** The temperature of the tube at the level of the shell, i.e., part of the tube containing the projectile.

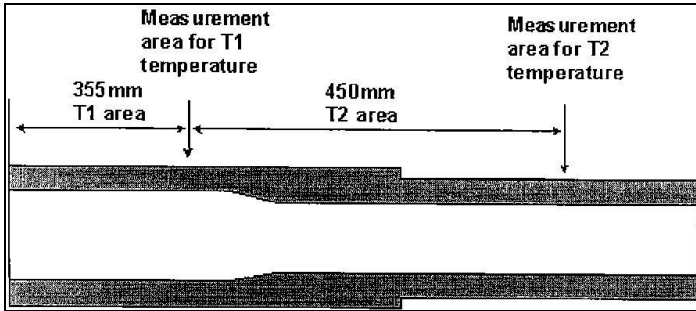


Figure 2-8: T1 and T2 Area

51. The temperature within the barrel may cause cook off (powder, shell and fuze) under prolonged fire. The following are the limits of use (see Annex K):

Level	Temperature limits at T1 and T2 (°C)	Safety precautions
Normal	T1 is less than 180EC and T2 is less than 260EC	No risks of cook-off
Hot	T1 is between 180EC and 200EC or T2 is between 260EC and 300EC	Risks of cook-off beyond a 10 minutes stay
Extremely Hot	T1 is greater than 200EC or T2 is greater 300EC	Loading is forbidden

Figure 2-9: Temperature Limits at T1 and T2 and Safety Precautions

52. High temperature at the zone T2 may cause inadvertent projectile operation at start of firing. The following are the limits not to exceed:

Temperature at T2 (EC)	Safety precautions
T2 is less than 100EC	No risks of inadvertent operation
T2 is between 100EC and 130EC	Firing must occur in less then 10 minutes
T2 is between 130EC and 180EC	Firing must occur in less then 5 minutes

Temperature at T2 (EC)	Safety precautions
T2 is between 180EC and 300EC	Firing must occur in less then 2 minutes

Figure 2-10: Temperature Limits at T2 and Safety Precautions

53. Barrel temperature may be measured using an electronic thermometer. If a thermometer is not available, the following can be used as a rough guide:

- a. The barrel will be considered “hot” when spit begins to bubble or when the area is painful to touch.
- b. The barrel will be considered “extremely hot” when paint begins to blister.

MISFIRES

54. Notes:

- a. This drill is designed to disclose the cause of failure to fire and to indicate the correct immediate remedy. When this remedy is of a temporary nature, No 1 will later carry out a full examination and ensure that the defect is corrected. In the case of defective ammunition, No 1 shall place the defective component at a safe distance from the gun and at the earliest opportunity, notify the GPO.
- b. Throughout the misfire drill, the detachment must remain clear of the path of recoil. The detachment and any rounds must also be clear of the line of possible flash when the breech opens.

55. During prolonged fire:

- a. At no time will the barrel be loaded when it is **EXTREMELY HOT**.

- b. If the barrel is loaded and a misfire occurs after a second attempt to fire, the following precautions will apply:
 - (1) If barrel temperature is hot, leave the gun position in less than 10 minutes to a distance of at least 500 M. Wait 3 hours.
 - (2) If barrel temperature is normal, wait at least **10 minutes**. The detachment may stay close to the gun.
- c. In both cases, and after having respected requested time limits, proceed as follows:
 - (1) open the breech;
 - (2) remove the cartridge or remove the entire round in the case of fixed ammunition;
 - (3) check that No propellant remains inside and if so, remove it;
 - (4) remove the projectile using the unloading head rammer; and
 - (5) in case it is impossible to remove the projectile smoothly, wait for a total cooling period of 5 hours before trying again.
- d. Causes of failure to fire may now be determined and rectified.
- e. If the T2 temperature was above 100EC at the time of loading, the ammunition must be returned to be destroyed.

56. Possible Causes:

- a. **Firing lock has not been tripped:**
 - (1) **The gun is set to “safe”**. No 1 orders “CANCEL MAKE SAFE”.

- (2) **The breech is not fully closed.** No 1 attempts to close the breech.
 - (3) **The firing gear is defective.** No 1 will fit the spare firing lock.
 - (4) **The gun has not fully counter-recoiled.** No 1 orders “UNLOAD” and it is reported to the GPO who then orders the gun to be taken out of action (the weapons technician must then be notified).
- b. **If the firing lock has been tripped.** The gun is said to have misfired when the firing lock has been tripped twice and the gun has failed to fire twice. Because of the danger of a “hangfire”, a pause of **10 minutes** (30 minutes for blank) is then made before the breech is opened to investigate the cause. The probable causes, the immediate remedies, and subsequent actions, when necessary are as follows:
- (1) **Primer not fairly struck.** This fault is due to a broken or worn firing pin. No 1 fits the spare firing lock. At the first opportunity No 1 will examine the firing lock and fit a new firing pin.
 - (2) **Primer fairly struck.** No 1 orders “LOAD” or “CARTRIDGE ONLY, LOAD” as applicable, and places the defective cartridge clear of all personnel. At the first opportunity, No 1 examines the round to determine:
 - (a) **If the primer has not fired.** This may be due to a defective primer or insufficient force of blow. If the fault recurs, insufficient force of blow is indicated and No 1 fits the spare firing lock. At the first opportunity, No 2 cleans the breech and firing mechanism and its recess, including the firing hole.
 - (b) **If the primer has fired.** The failure of the primer to ignite the charge indicates

either defective propellant or defective primer. No 1 shall place the defective component at a safe distance from the gun and at the earliest opportunity, notify the GPO.

- c. As soon as the gun is again ready, No 1 reports “READY” to the GPO or fires without further orders as follows:
 - (1) If gun programmes are in use, No 1 orders the correct bearing and elevation for the time at which he is ready, and continues the programme. Rounds detailed for the time that the gun is out of action will not be fired.
 - (2) At all other times No 1 reports “NUMBER READY” and awaits further orders.
- d. Figure 2-11 summarizes the causes of failure to fire.

57. Drill:

- a. If the gun fails to fire and the firing lock has not been tripped, No 1 ensures that the gun is not set to “safe”, the breech is fully closed, or the firing gear is not defective. If any of the above is found to be incorrect, action is taken to correct it and No 3 will again pull the lanyard.

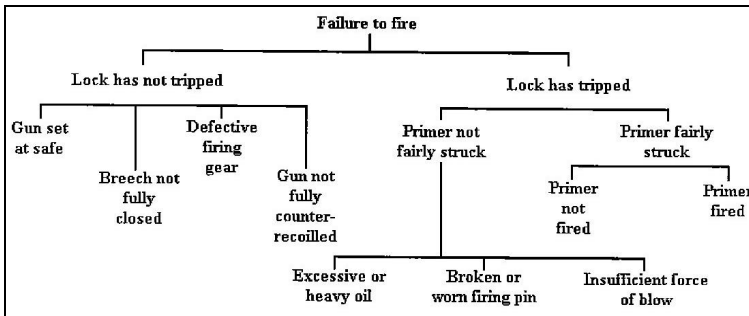


Figure 2-11: Summary of Causes of Misfires

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- b. If the gun fails to fire and the firing lock has been tripped, No 3 immediately pulls the firing lanyard a second time. If the gun again fails to fire, No 1 reports to the GPO “NUMBER __, MISFIRE”.

WARNING

In the case of a hot barrel, No 1 must inform the GPO as follows “NUMBER __ MISFIRE HOT BARREL”. The GPO must ensure that the appropriate action is taken as per para 55.c.

- c. After reporting “MISFIRE”, No 1 will observe the regulation pause of 10 minutes, or 30 minutes in the case of blank ammunition, and then order “CARTRIDGE ONLY, UNLOAD”.
- d. No 1 opens the breech carefully and accepts the cartridge (or round) and inspects the primer.
 - (1) If the primer has been fairly struck, No 1 orders “LOAD” or “CARTRIDGE ONLY, LOAD”, as applicable, and sets the offending cartridge aside for later examination.
 - (2) If the primer has not been fairly struck, No 1 returns the cartridge or round to a loading number and immediately orders the firing lock to be changed. He orders “LOAD” or “CARTRIDGE ONLY, LOAD” as applicable.

RECORDING A TARGET

58. Notes:

- a. A record may be required from each gun which has engaged the target, giving complete details of the final data. The GPO orders the target recorded and includes the letters and number, e.g., “RECORD AS TARGET ZP 1234”.

- b. No 1 records the actual settings on the sights, the fuze, and gunner's quadrant where applicable.
- c. A record is prepared by No 1 on a Target Record Form (the table at Figure 2-12).

TARGET RECORD (NO 1 TO GPO)		
1	Target letter and number	ZP 1234
2	Number in action	3
3	Shell	HE
4	Fuze	M557
5	Propellant	Dual Gran
6	Charge	5
7	Bearing (slipping scale)	3316
8	Converge	0
9	Gun correction	0
10	Fuze setting	Delay
11	Elevation	442
12	Index error correction	---

Figure 2-12: No 1's Target Record

59. Drill:

- a. On the order "RECORD AS TARGET__", No 1 of each gun that has fired during the fire mission inspects the ammunition and sights and completes a Target Record Form.
- b. No 1 then calls for reports of the relevant details from No 3 and No 7 and compares these with his own record. Having corrected all discrepancies, the target record is sent to the CP.

CHECK FIRING

60. On the order “CHECK FIRING”, all work on the gun is continued but the gun is not fired until “CANCEL CHECK FIRING” or a new fire mission is ordered.

STANDING FAST

61. “STAND FAST” is only used in connection with safety. All action on the gun position will cease immediately and detachment members will stand motionless. The order is cancelled by “CANCEL STAND FAST” given only by the originator of the order.

CEASE LOADING

62. After the order “CEASE LOADING” no gun will be loaded until “CANCEL CEASE LOADING” or orders for a new mission are received. The detachment continues their duties and any guns previously loaded will be fired at the appropriate moment.

MAKING SAFE

63. Notes:

- a. The order “MAKE SAFE” is normally given by No 1 but is also given by the GPO when guns are to be laid on their FPF task and left loaded.
- b. If the gun is loaded, No 1 must order “MAKE SAFE” under the following circumstances:
 - (1) when the order “REST” is given;
 - (2) when personnel are required to work in front of the gun or in the path of recoil;
 - (3) if it is necessary to move the trails; or

- (4) when ordered to “MAKE SAFE” by the GPO.
- c. “MAKE SAFE” is cancelled by orders for a new fire mission or “CANCEL MAKE SAFE”.

64. Drill:

- a. No 1 orders “MAKE SAFE”.
- b. A loading number lowers the breech block halfway and with the left hand, grasps the firing lanyard and applies a tension to it. Keeping the tension on the lanyard, the breech block is slowly released until it stops. As the breech block is closing, the firing mechanism of the breech ring will be engaged progressively in a groove on the left side of the breech block so it will not close properly. The opening lever is then returned to its initial position.
- c. No 1 ensures the breech block is not closed properly so no fire will occur if the lanyard is pulled.
- d. On the order “TAKE POST” or orders for a new mission, No 1 orders “CANCEL MAKE SAFE”.
- e. A loading number slightly lowers the breech block using the opening lever. The firing mechanism of the breech ring will return to its original position and the opening lever is then returned to its initial position.
- f. No 1 ensures the breech block is closed properly so fire will occur when the lanyard is pulled.

RESTING

65. Notes:

- a. When the order “REST” is given, the detachments remain at their guns ready to fire at short notice. No 1 of a gun ordered to rest does not acknowledge subsequent orders nor do the detachment follow up fire orders. “REST” is

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cancelled by “CANCEL REST” or by orders for a new fire mission.

- b. The guns must remain laid as last ordered.

66. **Drill:**

- a. On the order “REST”, No 1 orders “MAKE SAFE” if the gun is loaded.
- b. No 1 gives orders for any necessary work to be carried out around the gun and when the work is completed orders “NUMBER __, REST”. The detachment rest at their positions in action.

STAND EASY/END OF MISSION

67. **Notes:**

- a. When the order “STAND EASY” or “END OF MISSION” is given, the detachments concerned are withdrawn from their guns to a position previously ordered by the GPO. No 1 of the detachment(s) concerned does not acknowledge subsequent orders.
- b. At “STAND EASY”, No 1 will order any necessary work to be carried out. The gun must remain laid as last ordered.
- c. When laid on an FPF task, it may be necessary for the guns to remain loaded. In this case, the GPO must order “LOAD, MAKE SAFE” before ordering “STAND EASY”.
- d. “END OF MISSION” is cancelled by orders for a new fire mission.
- e. “STAND EASY” is cancelled by “TAKE POST” or orders for a new fire mission.

68. **Drill.** On the order “END OF MISSION” or “STAND EASY” No 1 orders “CARTRIDGE ONLY, UNLOAD” if the gun is loaded. No 1 orders any necessary work to be carried out around the gun. When completed, No 1 orders “DETACHMENT REAR”, marches the detachment to the stand easy position and orders “FALL OUT”.

TAKING POST

69. **Note.** “TAKE POST” may be used by the GPO or No 1 when the detachment is required to resume their positions in action. “TAKE POST” is cancelled by “STAND EASY” or “END OF MISSION”.

PREPARING TO ADVANCE (OR WITHDRAW)

70. The order “PREPARE TO ADVANCE (WITHDRAW)” is given as a warning that a move is anticipated. No 1 will order ammunition and stores not required for the immediate service of the gun to be repacked. Preparations for coming out of action will be made as far as possible. The guns must remain in action until “CEASE FIRING” is ordered.

EMPTYING THE GUN

71. **Notes:**

- a. On the order “EMPTY GUNS”, any guns already loaded will be laid at the last bearing and elevation ordered and will be fired. The order “EMPTY GUNS” is in itself an order to fire and no additional order is required if “AT MY COMMAND” is in force. Omission of this order need only be verified if the gun is loaded and “CEASE FIRING” has been ordered.
- b. As soon as the gun is empty, No 1 will report “NUMBER EMPTY”.

CEASE FIRING AND HOOKING IN

72. **Notes:**

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- a. The guns must be empty before “CEASE FIRING” is ordered. No 1 will normally be left to choose the most convenient direction for hooking in. At drill, the instructor may order the direction of hooking in.
- b. Ammunition which has been removed from its container will be examined and, if serviceable, will be dealt with as follows:
 - (1) **Time Fuzes.** Set to “SAFE” and reinsert pin if necessary. If applicable, remove from projectiles and place in containers.
 - (2) **Impact fuzes.** Set to “QUICK.”
 - (3) **VT fuzes.** Set to “SAFE”. If applicable, remove from projectiles and place in containers.
 - (4) **Cartridges.** Make up to full charge.
- c. Unserviceable ammunition will be set aside and its condition reported to the GPO.
- d. The following ammunition is unserviceable and will not be fired or replaced in the vehicle under circumstances:
 - (1) fuzes which cannot be set to “SAFE” or “QUICK”, and
 - (2) projectiles from which VT fuzes cannot be removed.
- e. At practice, defective ammunition will be set aside for examination by an ammunition technical officer.
- f. During operations, defective ammunition will be dumped and clearly marked.
- g. The signals which are used by No 1 to direct the movement of the vehicle are described in Figure 2-2.

- h. When detailing the drill for TRAILS “RIGHT (LEFT, FRONT) HOOK IN”, the instructor will give the complete detail, modifying the drill for “REAR HOOK IN” as follows: As soon as the trails are closed, No 1 orders “TRAILS RIGHT (LEFT)”. The trails are handled through 1600 or 3200 mils in the direction required under the orders of No 1.

73. **Drill:**

- a. Initial action:
- (1) On the order “CEASE FIRING”, No 1 orders “RUN UP”. When the spades have been cleared (see para 24), No 1 orders “CEASE FIRING” and then disconnects the communication system.
 - (2) No 1 closes the breech with the assistance of the No 3 if necessary and insures the breech safety lever is rotated to the road position.
 - (3) No 3 removes the sight from the sight mount and replaces it into its box. No 3 then disengages the left trail lock and replaces the sight cover.
 - (4) No 2 replaces the muzzle cover and with the assistance of the No 3 replaces the overall cover or the breech cover if so ordered.
 - (5) No 3 then centres the barrel and, depending on the situation, either levels the barrel to be rotated in the road position or places the barrel at an elevation approximately 400 mils for the combat position.
 - (6) No 2 disengages the right trail lock and places the pump handle into the pump and places the lever to the CLOSE position.
 - (7) No 4 collects the aiming posts, if necessary, and secures them, packs up the collimator and the C of A marker and takes up his position on the

trails.

b. Preparing to hook in:

- (1) Nos 3 and 5 on the left, Nos 4 and 7 on the right side of the trails.
- (2) No 1 orders "CLOSE".
- (3) On the order "LIFT" from No 7, Nos 3, 4, 5, and 7 lift the trails.
- (4) No 2 begins to pump until the trails are closed and then replaces the pump handle in the stowed position.
- (5) No 4 locks the trails.
- (6) Once this is completed, No 7 orders "LOWER".
- (7) If in the combat position, Nos 2 and 3 clamp in the cradle (see para 11).
- (8) Nos 4, 5, and 7 place stores and ammunition in a convenient location for loading.
- (9) No 1 directs the vehicle into a convenient position for loading stores and ammunition and then places himself into the required position for hooking in.

c. Hooking in:

- (1) No 1 orders "HOOK IN".
- (2) Nos 2, 4, 5, and 7 stand beside the trails; Nos 5 and 7 on the left, Nos 2 and 4 on the right. The highest numbers are nearest the lunette, facing the rear. No 3 positions himself at the hand brake.

- (3) No 7 orders "LIFT". Nos 2, 3, 4, 5, and 7 lift the trails.
- (4) No 7 rotates the lunette into the travelling position and hooks up the electrical cable.
- (5) No 3 ensures that the hand brake is released once the gun is hooked in.
- (6) No 5 locks the catch on the towing hook of the vehicle, replaces the cotter pin, and connects the safety cable:
 - (a) **Combat Position.** The detachment will mount without further orders when travelling in the combat position.
 - (b) Road Position:
 - i. No 3 ensures that the barrel is level;
 - ii. No 2 disengages the traversing mechanism and stows the traversing arm on the travelling arm;
 - iii. No 2 rotates the barrel to the No 4 which in turn places it over the trails;
 - iv. Nos 2 and 3 clamp in the cradle (see para 11); and
 - v. at this point, the detachment mounts the vehicle without further orders.
- (7) No 1 raises the firing platform, ensures that it is locked into position, and does an overall check of the gun. No 1 then mounts and directs the driver to the position of assembly.

- (8) At drill, when no towing vehicle is available, the detachment forms detachment rear.

DRILL WITH REDUCED DETACHMENTS

74. **Notes.** In action, the detachments may be reduced by reliefs, casualties, or men employed on other details. With reduced detachments the drill is carried out as far as possible in the normal way; duties being combined as directed by No 1. The following allotment of duties can be taken as a guide:

- a. **With a crew of six.** One member performs the duties of Nos 6 and 7.
- b. **With a crew of five.** One member performs the duties of Nos 5, 6, and 7.
- c. **With a crew of four:**
 - (1) No 1 performs the duties of Nos 1 and 2, and
 - (2) One member performs the duties of Nos 5, 6, and 7.
- d. **With a crew of three:**
 - (1) No 1 performs the duties of Nos 1 and 2, and
 - (2) One member performs the duties of Nos 4, 5, 6, and 7.

DRILL WITH DAMAGED EQUIPMENT

75. **Notes.** (These notes cover variations of drill to be used in action when damaged equipment cannot be replaced or repaired.)

- a. **Damaged range quadrant.** The gun is laid by gunner's quadrant.

- b. **Damaged sight.** The GPO or Section Commander directs the gun onto the required bearing by compass.
- c. **Damaged cross level bubble.** No 3 follows the normal sequence of laying; cross levelling the sights as near as can be judged by eye.
- d. **Damaged firing gear.** No 1 orders damaged equipment replaced.
- e. **Damaged hydraulic suspension mechanism (Trail hydraulic).** If there is a break or dent in the trail hydraulic lines, it may be necessary to open and close the trails manually with a block and tackle which is included in the gun stores.

(1) **Opening the trails:**

- (a) No 1 lowers the firing platform.
- (b) Nos 4 and 5 attach the block and tackle to the appropriate hooks on each trail, No 4 on the right trail and No 5 on the left trail.
- (c) No 5 pulls on the hoist cords to make them tight.
- (d) No 2 uncouples the cylinder from the left hand trail.
- (e) No 1 orders “SPREAD” after the cylinder has been uncoupled.
- (f) Nos 2, 3, 4, and 7 take position at the trails, Nos 2 and 4 on the right trail, Nos 3 and 7 on the left trail, then No 4 unlocks the trails.
- (g) No 7 orders “LIFT”, Nos 2, 3, 4, and 7 lift the trails.

- (h) Gradually and cautiously No 5 loosens the block and tackle by lifting the brake with the help of the cord until the gun is firmly on the platform. Caution must be taken in order to prevent the trails from opening suddenly. Because of the weight of the gun, the trails will open on their own.
- (i) When there is no more tension on the block and tackle it is removed. Then Nos 2, 3, 4, and 7 spread the trails until the trail locks are engaged.

(2) **Closing the trails:**

- (a) Nos 4 and 5 attach the block and tackle to the appropriate hooks on each trail, No 4 on the right trail and No 5 on the left trail.
- (b) No 5 pulls on the hoist cords to make them tight.
- (c) Nos 2 and 3 disengage their trail locks.
- (d) No 2 turns the pump lever in the CLOSE position.
- (e) No 1 orders "CLOSE".
- (f) Nos 2, 3, 4, and 7 take position at the trails, Nos 2 and 4 on the right trail, Nos 3 and 7 on the left trail.
- (g) No 7 orders "LIFT", Nos 2, 3, 4, and 7 lift the trails.
- (h) No 5 pulls on the cord slowly until the trails are fully closed. Caution must be taken in order to prevent the trails from opening suddenly. Because of the

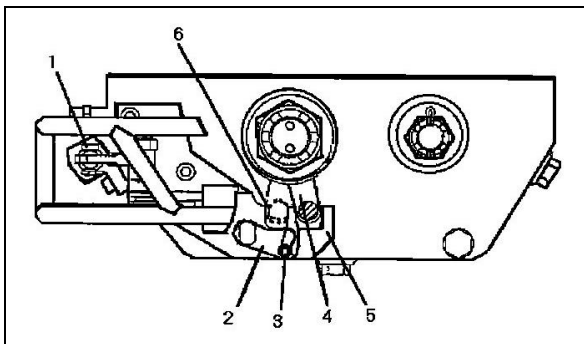
weight of the gun, the trails will open on their own.

- (i) Once the trails are closed, the No 4 engages the trail lock.
- (j) No 1 raises the platform.

f. **Damaged variable recoil mechanism control.** If there is a broken or damaged component, it may be necessary to adjust the variable recoil by manual means (see Figure 2-13).

(1) **Elevation angle below 622 mils (long recoil):**

- (a) Release the lock (2) using the nut (3), lower if necessary.
- (b) Disengage the variable recoil rod (located on the right side of the cradle) from the variable control mechanism (located on the front of the cradle) by removing the nut (1).
- (c) Position the buffer rod lever (4) in the right position of the support housing (5).
- (d) Raise the lock (2) and lock the nut (3).



1. Nut	4. Lever - position for long recoil
2. Lock	5. Support
3. Nut for lock	6. Lever - position for short recoil

Figure 2-13: Variable Recoil Mechanism Control

(2) **Elevation angle above 622 mils (short recoil):**

- (a) Release the lock (2) using the nut (3), lower if necessary.
- (b) Disengage the variable recoil rod (located on the right side of the cradle) from the variable control mechanism (located on the front of the cradle) by removing the nut (1).
- (c) Position the buffer rod lever (6) in the left position of the support housing (5).
- (d) Raise the lock (2) and lock the nut (3).

PRECAUTIONS TO BE OBSERVED WHEN FIRING BLANK AMMUNITION

76. Notes:

- a. No officer, NCO, or gunner who is not qualified in gun drill shall command a section or form part of a gun detachment firing blank ammunition at salutes or during training.
- b. When firing blank cartridges, no gun will be reloaded within 15 seconds of firing. Even after this interval, no gun will be reloaded until No 1 has examined the chamber and bore and removed any debris.
- c. In the event of a misfire, the normal misfire drill is carried out except that a pause of not less than 30 minutes must

be allowed to elapse before the breech is opened. No one will be in rear of the breech when it is opened.

CHAPTER 3 ANTI-TANK DRILL

PREPARATION FOR OPENING FIRE

1. Notes:

- a. In choosing the gun position, the GPO will have considered its suitability for anti-tank defence and will have sighted individual guns to achieve the best defence consistent with the need for concealment, ease of control, and the ability to carry out the normal field artillery tasks.
- b. In order to ensure an all-around watch for tanks and to provide a rapid means of indicating targets, the GPO will allot zones of observation to each gun.
- c. To provide a means of indicating difficult targets, the GPO will normally choose one or two reference points in each zone and will indicate these to No 1, together with the name of each reference point and the range to it.
- d. The GPO will normally order the maximum range at which fire is to be opened.
- e. The GPO is responsible, when necessary, for ordering the special states of preparedness (see para 3 of Chapter 2) and for the general control of the fire of the troop, including the allotment of targets to guns and giving the executive order to engage the targets.
- f. As soon as possible after coming into action, the No 1 ensures that the detachment knows the sector for which they are responsible, the ranges to reference points, and the range for opening fire as ordered by the GPO.
- g. No 1 orders cartridge cases for HESH or HEM1 to be chambered and then placed in a convenient position.

2. States of Preparedness:

- a. **General.** When a threat of tank attack is reported, the GPO will order “PREPARE FOR TANKS” or “TANK ALERT”. When the threat has passed, the normal state will be restored by ordering “CANCEL PREPARE FOR TANKS” or “CANCEL TANK ALERT”.
- b. **“PREPARE FOR TANKS”:**
- (1) The order “PREPARE FOR TANKS” means that a tank attack is considered likely but not necessarily imminent. The guns remain laid on their present task.
 - (2) Ten rounds of HESH or HEM1 per gun are prepared and placed in a convenient position.
 - (3) No 1 ensures that all preparations for normal state have been completed and that at least one of the detachment members is keeping a close watch on the zone allotted. Camouflage nets are removed if ordered.
 - (4) The direct fire telescope is fitted and the long lanyard brought up.
 - (5) “PREPARE FOR TANKS” is cancelled by “CANCEL PREPARE FOR TANKS” or “TANK ALERT”.
- c. **“TANK ALERT”:**
- (1) The order “TANK ALERT” means that a tank attack is considered imminent.
 - (2) Any other task on which the guns are engaged lapses. No 1 orders “RUN UP, TAKE POST TO LAY” and the gun is moved to face its zone.
 - (3) The guns are loaded.
 - (4) The direct fire telescope is zeroed.

(5) A close watch is kept on the zone allotted.

d. **Anti-tank action:**

- (1) When tanks are seen, the GPO indicates the direction to some or all guns by means of the pre-arranged zones and reference objects.
- (2) Until the GPO orders "ENGAGE", No 1 does not order "FIRE" but issues all other necessary orders and follows up the movement of the tanks with his gun.
- (3) When the tanks are identified as hostile and are within effective range, the GPO passes control of fire to all or some of No 1's by ordering "ENGAGE" or "NUMBER ___ ENGAGE" or "NUMBER __ AND NUMBER __ ENGAGE".
- (4) "ENGAGE" is cancelled by "CHECK FIRING".
- (5) "TANK ALERT" is cancelled only by "CANCEL TANK ALERT".

APPLICATION OF FIRE

3. **General.** The effective application of fire depends on:

- a. correct initial orders by No 1, including a clear indication of the target;
- b. correct choice of initial lead by No 1;
- c. accurate laying by No 3;
- d. immediate response by the loading number to the order "FIRE" from No 3;
- e. correct observation by No 1 and accurate corrections if required; and

- f. good drill by the rest of the detachment.

4. Fire control:

- a. **Initial orders.** To quicken the drill and to ensure that errors or omissions are more readily detected, the orders are given by No 1 in a standard sequence.
- (1) **Indication of target.** This indicates the beginning of a mission, e.g., “TARGET, HULL-DOWN TANK”. The term “HULL-DOWN” is used if the bulk of the target is not visible.
 - (2) **Range.** This assists No 3 in locating the target and tells him the sight reticle to be used (see para 4.b.).
 - (3) **Trails or Traverse Right or Left.** This order is used to direct the gun at the target, e.g., “TRAILS LEFT, TRAVERSE RIGHT”.
 - (4) **Description.** A description of the target may be necessary if No 3 does not recognize it (see para 4.c.).
 - (5) **“ON”.** This order tells the detachment that the gun is pointed at the target.
 - (6) **“LEAD”.** This tells No 3 the reticle to be used (see paras 4.e. and f.).
 - (7) **“FIRE”.** This tells No 3 to order fire as soon as the gun is laid.
- b. **Initial range.** No 1 orders the estimated range to the target. Ranges may be ordered in metres, e.g., “RANGE FOUR HUNDRED” or “RANGE SIX FIVE ZERO”. The range may also be ordered by the No 1 in mils, e.g., “RANGE 20 MILS”. No 3 will apply the range ordered by No 1 and lay the range line on the centre of the visible mass.

- c. **Description of target.** No description need be given when the target is obvious. When a description is required, it should be brief and the most obvious feature should be named first. For example:
- (1) by direction of movement, e.g., “MOVING RIGHT, HEAD ON”;
 - (2) by position or size of group, e.g., “CLOSE GROUP, SMALL GROUP”; or
 - (3) by position of tank in group, e.g., “FRONT TANK, LAST TANK,” or “SECOND TANK FROM LEFT”.
- d. **Indication by sectors or reference points.** When No 1 cannot return to the gun, he will indicate the direction of the target to No 3 by using sectors and, if necessary, use angles right or left of the reference points. For example:
- (1) “FRESH TARGET, HULL-DOWN, RANGE 600. RIGHT SECTOR, REFERENCE HOUSE, RIGHT 10”, or
 - (2) “FRESH TARGET, RANGE 400, RIGHT SECTOR, LARGE GROUP, FRONT TANK”.
- e. **Initial Lead.** The table at Figure 3-1 shows the initial leads for a crossing target.
- f. **The Form of Lead Orders.** All leads are ordered in units, e.g., “LEAD, RIGHT 5”, “LEAD, LEFT 10”. Each lead cancels the previous lead. No 3 lays the direct fire telescope using the reticle corresponding to the lead ordered. He repeats each lead back by No 1.

Lateral speed of target (km/h)	Leads (mils)
15	10
30	20

	50	30
Notes	<ol style="list-style-type: none"> 1. For a target crossing diagonally, half the lead is ordered. 2. For stationary or head on targets, the lead is zero. A small lead may sometimes be required to allow for wind. 	

Figure 3-1: Initial Leads for a Crossing Target

5. Observation and corrections:

- a. **Observation of fire.** Whenever possible, No 1 will observe the path of the projectile at the target and not the fall of shot. Wrong deductions may be made if the projectile is observed before or after passing the target.
- b. **Corrections:**
 - (1) The object is to hit with the first round. If the first round misses, either range or lead must be altered at once with the objective of hitting with the second round.
 - (2) Except for a short round, it will seldom be possible to judge the range of a round which is incorrect for line. No 1 shall therefore ensure that the line is correct before altering the range.
 - (3) If a round misses widely, a bold correction must be ordered. In all cases, the rules given in paras 5.c. and d. below will apply.
- c. **Corrections to lead:**
 - (1) If a round misses to the right or left, No 1 orders a fresh lead. The alteration required depends on the range and on the width presented at the target.
 - (2) The correct alterations in lead for targets between 400 and 600 metres are as follows:

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- (a) for targets moving across or diagonally 10 mils;
 - (b) head on targets 5 mils; and
 - (c) hull-down targets 5 mils;
- (3) These alterations to lead are doubled for targets at ranges under 400 metres and halved for targets at ranges over 600 metres.

d. **Correction to range:**

- (1) **Ranges from 0 to 300 metres using HESH, or from 0 to 500 metres using HE charge 7.**
Within these range limits, the trajectory will be flat enough to prevent a 2.5 metre tank from passing safely under it.
- (2) **Ranges from 300 to 600 metres using HESH or from 500 to 900 metres using HE charge 7.**
These range limits include the zone in which the trajectory is sufficiently flat to permit direct estimation for range without bracketing the target. If a hit is obtained at the bottom of a 2.5 metre tank firing at the upper range limit, e.g., 600 metres with HESH, the adding of a 100 metre change will result in a round which will just brush the top of the tank. During adjustment within this zone, range changes will seldom be more than 100 metres and frequently range changes of 50 metres will be sufficient.
- (3) **Ranges From 600 to 1200 Metres using HESH or 900 to 1600 metres using HE charge 7.**
This zone includes the ranges at which hits are only reasonably possible. Bracket methods are normally used to obtain adjustment in this zone. Fire should not be opened at these ranges.

e. **Vertical displacement table.** Vertical displacement is the change in the point of burst between two rounds fired

at an upright target at different ranges. The table at Figure 3-2 shows the vertical displacement for a 100 metre range change, at various ranges, firing HESH and HE charge 7.

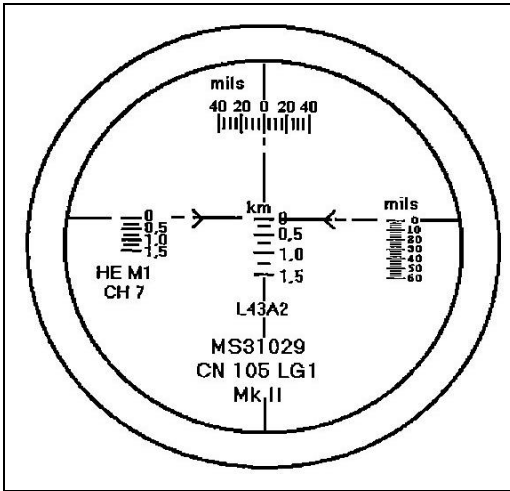
HESH shell		Remarks	HE Charge 7	
Range (m)	Displacement (feet)		Displacement (feet)	Range (m)
100	0.0	Start firing using 400 metres range setting	0.0	100
200	0.5		0.0	200
300	1.0		0.5	300
			1.0	400
			1.5	500
400	1.5	Start firing using estimated range. Increase or decrease by multiples of 50 or 100 metres. Bracketing is not necessary	2.0	600
500	2.0		2.5	700
600	2.5		3.0	800
			3.5	900
			4.0	
700	3.0	Bracket the target to obtain a hit	4.5	1000
800	4.0		5.0	1100
900	5.0		5.5	1200
1000	6.5		6.0	1300
1100	7.0		6.5	1400
1200	8.0		7.0	1500
			7.5	1600
1300	Firing at moving at this distance is too inaccurate			

Figure 3-2: Vertical Displacement in Feet Per 100 Metres Change in Range

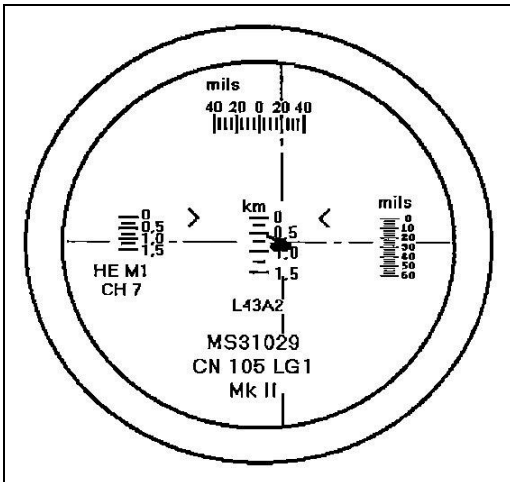
ANTI-TANK LAYING

6. Notes:

- a. **Point of Aim.** The point of aim is the centre of the visible mass of the target.



Direct Fire Telescope set to zero



Ammunition: HESH

Range: 750 metres

Lead: Left 20 mils

Figure 3-3: Direct Fire Laying

- b. **Ranges.** All ranges are set on the reticle of the direct fire telescope.
- c. **Lead.** The lead ordered is laid on the point of aim.
- d. **Movement of the trails.** After No 1 has initially directed the gun onto the target, No 3 will order “TRAILS, RIGHT (or LEFT)” when a movement of the trails is necessary and “HALT” when movement is sufficient.
- e. **Sequence of Laying.** No 3 applies the range and lead to the reticle of the direct fire telescope and lays onto the centre of the visible mass (see Figure 3-3).

ANTI-TANK DUTIES

7. Duties of No 1:

- a. No 1 controls the fire of the gun as follows:
 - (1) Selects the most dangerous target in the direction indicated by the GPO.
 - (2) Indicates this target to No 3 by directing the gun onto it.
 - (3) Gives the initial orders for the engagement.
 - (4) Takes up a position from which he can observe.
 - (5) Orders “FIRE” when:
 - (a) ready to observe;

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- (b) the target is within the range for opening fire; and
 - (c) the GPO has ordered “ENGAGE”;
- (6) Observes and, if necessary, corrects the fire of the gun. No 1 makes no correction on any round for which the No 3 has ordered “WRONG” unless a correction is necessary due to the movement of the target, but repeats back “WRONG”.
- (7) Orders “CHECK FIRING” when the target has been destroyed or has disappeared and then selects a fresh target if available and engages it. If it is in the same group as the last and requires the same lead and range No 1 orders “(description), CANCEL CHECK FIRING”. Otherwise No 1 gives a complete set of initial orders if it is not practicable to return to the gun to indicate the target to No 3, and describes its position by means of the sectors or reference points.

8. Duties of No 2:

- a. No 2, alternately with Nos 4 and 7, load and fire the gun.
- b. No 2 loads and grasps the long firing lanyard and reports “READY”. No 2 fires on the order “STAND BY, FIRE” from No 3. It is vital that there be no delay between No 3’s order to “FIRE” and the firing of the gun.

9. Duties of No 3:

- a. No 3 lays for line and range using the direct fire telescope.
- b. He lays ahead of the target for line making due allowance for loading when necessary. As the target approaches the correct line, he orders “STAND BY” and then “FIRE” at the appropriate moment.

- c. No 3 applies the range and lead to the appropriate scale on the direct fire telescope ordered by the No 1, then lays onto the centre of the visible mass and keeps the gun laid for line and range, as ordered, throughout the mission.
- d. No 3 ensures that the target indicated by No 1 has been acquired. If a doubt exists, No 3 reports “TARGET LOST”.
- e. No 3 calls back all leads and ranges ordered by No 1.
- f. When laid, No 1 orders “STAND BY, FIRE” provided that:
 - (1) No 1 has initially ordered “FIRE”; and
 - (2) the loading number has reported ready.
- g. No 3 reports “WRONG” whenever the gun has fired when laid incorrectly for line and range.
- h. No 3 reports “TARGET LOST” whenever the target cannot be seen.
- i. No 3 orders “TRAILS RIGHT (LEFT)” when a movement of trails is necessary.

10. Duties of No 4:

- a. No 4, alternately with Nos 2 and 7, load and fire the gun.
- b. No 4 loads and grasps the long firing lanyard and reports “READY”. No 4 fires on the order “FIRE” from No 3. It is vital that there be no delay between No 3’s order to fire and the firing of the gun.

11. Duties of No 5 and No 6:

- a. Nos 5 and 6 man the trails on the order “TAKE POST TO LAY” and remain on the trails until No 1 orders “TAKE POST”.

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- b. No 1 will not order “TAKE POST” before the GPO has ordered “CANCEL TANK ALERT”.

12. **Duties of No 7:**

- a. No 7, alternately with Nos 2 and 4, load and fire the gun.
- b. No 7 loads and grasps the long firing lanyard and reports “READY”. No 7 fires on the order “FIRE” from No 3. It is vital that there be no delay between No 3’s order to fire and the firing of the gun.

ANTI-TANK GUN DRILL

13. **Drill:**

- a. **Preparation.** On the order “TANK ALERT” from the GPO, the following drill is carried out:
 - (1) No 1 orders “TAKE POST TO LAY” and “RUN UP”, if necessary, and the gun is moved to face its zone.
 - (2) Nos 5 and 6 remain on the trails.
 - (3) No 3 depresses the gun to zero elevation.
 - (4) No 1 orders “HESH” or “HE CHARGE 7”, “LOAD”.
 - (5) No 2 loads then moves around to the left of the cradle. He grasps the long firing lanyard in the right hand and reports “READY”. (CAUTION: Stay out of the path of recoil and the breech.)
 - (6) Nos 4 and 7 take up their positions with a ready round.
- b. **Engagement.** On the order from the GPO, “TANKS SECTOR” or “TANKS __ REAR”, the following drill is carried out:

- (1) No 1 selects the target, estimates the range and orders "TARGET __ (RANGE)". No 3 repeats the range.
- (2) No 1 directs the gun at the target by ordering "TRAILS RIGHT (LEFT)" or "TRAVERSE RIGHT (LEFT)" at the same time ordering description of the target, if necessary, and the lead.
- (3) No 3 calls back the lead.
- (4) No 1 reports "ON" when the gun is directed at the target.
- (5) No 3 applies the range and lead on the direct fire telescope and centres it on the visible mass. When correctly laid for range and lead, he reports "ON".
- (6) No 1 takes up position for observation.
- (7) On the order from the GPO, "NUMBER ___ ENGAGE" or as soon after that order when ready, No 1 orders "FIRE".
- (8) No 3 orders "STAND BY, FIRE" and at the same time steps clear.
- (9) Nos 2, 4 or 7 fires on the order "FIRE" from No 3.
- (10) No 1 observes and orders any corrections necessary.
- (11) Nos 2, 4 or 7 reload as soon as the gun is fired and report "READY".
- (12) The gun is always reloaded without further orders and is fired on No 3's order "FIRE".

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- (13) If no orders or corrections are given by No 1, No 3 continues to fire at the current data.

CHAPTER 4 LAYING

THE DIAL SIGHT

1. **Description.** (See Figure 4-1)

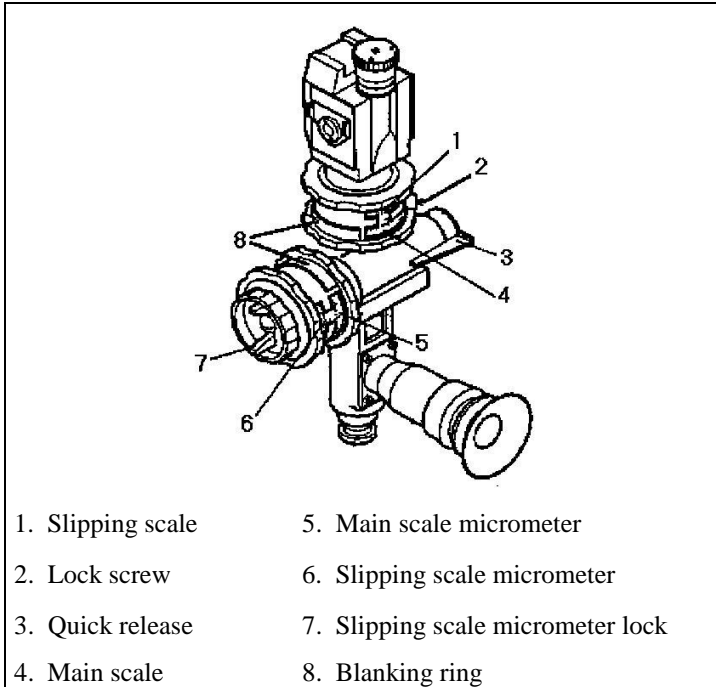


Figure 4-1: Dial Sight

2. **The scales.** The dial sight has two horizontal scales graduated in opposite directions as follows:

a. **Main scale:**

- (1) This scale is graduated anti-clockwise in hundreds of mils. The corresponding scale of units is on the left, inside micrometer. It measures the clockwise angle between the

bearing at which the gun is laid and the line at which the sight is laid.

- (2) This scale is used to lay in the original bearing to record the angles to aiming points, and to check the bearing at which the gun is currently laid.
- (3) To ensure that this scale measures true horizontal angles during these important operations, the cross level and longitudinal bubbles of the sight mount must be in the centre of its run.

b. Slipping scale

(1) This scale is graduated clockwise in hundreds of mils. The corresponding scale in mils is on the left, outside scale.

(2) This scale, when oriented on an aiming point, provides a means of laying the gun at any desired bearing. The scale may be “slipped” or “set”.

(3) **To slip the slipping scale:**

(a) This operation which is performed only by No 1. The object is to ensure that the slipping scale reads the bearing at which the gun is laid when the sight is laid on the aiming point in use.

(b) With the gun laid at the correct bearing and the sight laid on the aiming point, No 1 loosens the lock screw and slips the scale to the bearing ordered, and tightens it.

(c) No 1 loosens the slipping scale micrometer and slips the scale to the required number of units, and re-clamps it.

(4) **To set the slipping scale:**

(a) This is the operation by which all bearings are set on the sights during a

mission. When No 3 relays on the aiming point, the gun is laid at the bearing at which the sight is set.

- (b) No 3 moves the main and slipping scales, clamped together as one unit, and sets the slipping scale and left, outside micrometer scale at the bearing ordered.

3. For convenience during indirect laying, the rotating head is provided with an elevation knob for moving the image up or down until it appears in the centre of the field of view.

4. **The Reticle Pattern.** The reticle pattern of the dial sight is marked with horizontal and vertical crosshairs. Vertical intercepts are marked on the horizontal line every 5 mils and numbered every 10 mils up to 80 mils. These are used for displacement laying, see Figure 4-2.

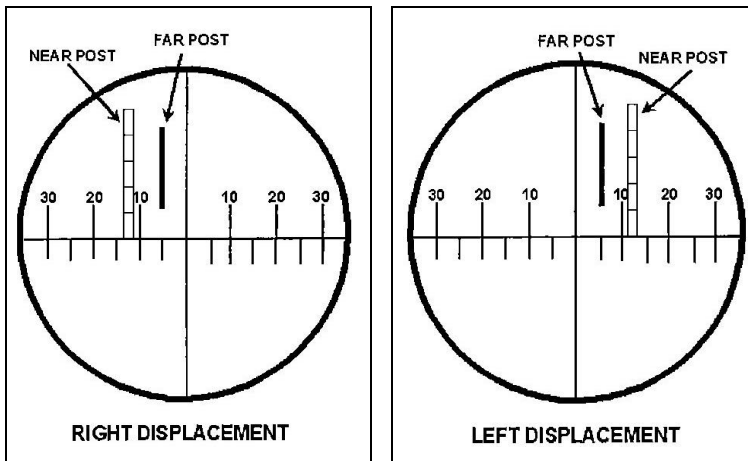


Figure 4-2: Displacement Laying

THE DIRECT FIRE TELESCOPE

5. The direct fire telescope is used for laying for lead and range in anti-tank laying. The optical and mechanical systems are designed to provide two times magnification and a field of view of 340 mils. The reticle pattern comprises two reticles, two control knobs, an elevation

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control knob, and a vertical zero alignment knob. The sight picture consists of two parts. The top part has vertical graduations every 5 mils on either side of the vertical zero alignment. The centre portion consists of three groups of horizontal graduations, left and centre marked 0, 0.5, 1.0 and 1.5 expressing 100 metres and an intermediate line between each value. Each group of graduations corresponds to a specific type of ammunition, HEM1 or L43A2 HESH. The right is marked in mils, 0 to 60, and is marked every 10 mils and graduated every 2 mils horizontally.

6. **Drill:** See Figure 4-3.

- a. No 3, using the knurled knob on the side (target correction control knob), moves the vertical zero alignment if necessary so that it passes through the target correction value (scale at the top of the reticle). If there is no target correction, check that the zero alignment is set on "0".
- b. No 3 then turns the knurled knob on the top (range control knob) so that the horizontal zero alignment passes through the distance corresponding to the ammunition being used.
- c. The intersection of the zero alignments will then be brought onto the specific target by the No 3 laying the gun .

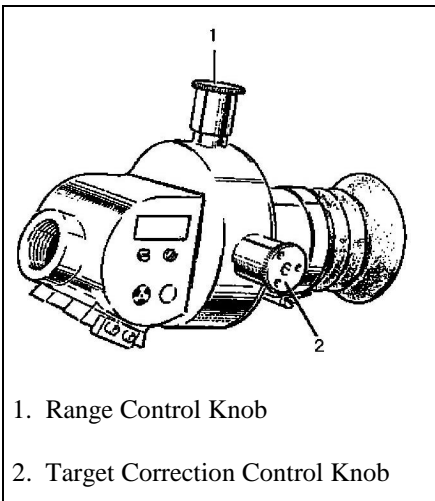


Figure 4-3: Direct Fire Telescope

SIGHT SETTING

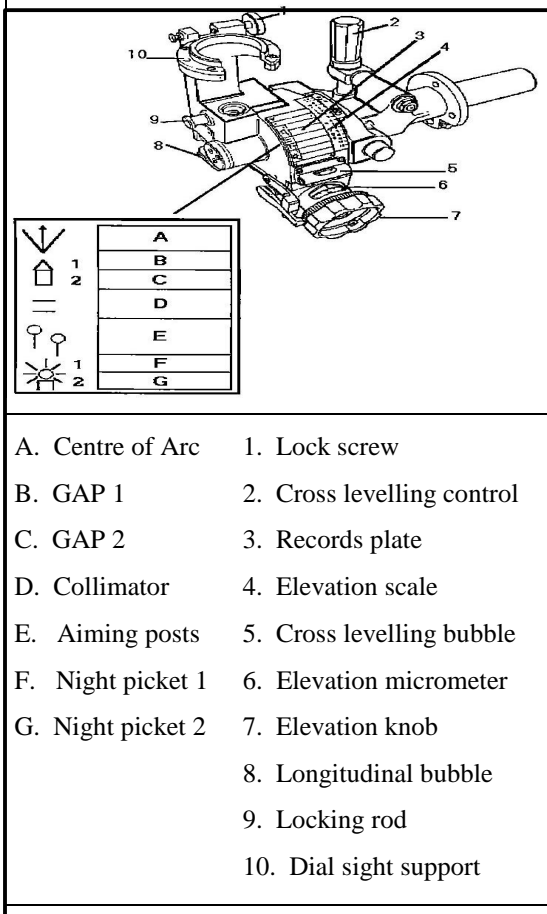
7. Notes:

- a. **The use of the quick release mechanism.** The quick release mechanism is used for moving the scales through angles greater than 200 mils. No attempt will be made to re-engage the gears at the exact setting ordered. The micrometer will be turned through at least one complete turn to ensure that the gears have re-engaged correctly.
- b. **Scale settings and final motions.** In order to avoid errors caused by backlash, the following restrictions must be strictly adhered to:
 - (1) **Bubbles.** The bubbles must be centred exactly.
 - (2) **Indices.** The indices must be aligned exactly with the proper graduation.
 - (3) **Traverse.** The last motion of the traversing handwheel must be such as to cause the vertical hair line of the dial sight to approach the GAP from left to right.
 - (4) **Elevation.** When elevating or depressing the barrel, the last motion of the handwheel must be in the direction that offers the greatest resistance.
 - (5) **Bearing.** The left hand will always be used in setting an angle on the sight.

8. Drill:

- a. **To set the angle to an aiming point.** On the order “AIMING POINT ___” or “AIMING POINT DIRECTOR, NUMBER __”, No 3 uses the quick release if required, and having re-engaged the gears, turns the micrometer knob until the main scale is set to the even hundred mils below the angle ordered and the main scale micrometer reads 0. He then turns the micrometer knob towards him until the main scale micrometer reads the required number of mils as illustrated in the following examples:

- (1) **Example 1.** The angle ordered is “3257”. The angle which No 3 sets on the main scale is 32 (3200) and 57 set on the main scale micrometer.
 - (2) **Example 2.** The angle ordered is “0698”. The angle which No 3 sets on the main scale is 6 (600) and 98 set on the main scale micrometer.
- b. **To set a bearing.** On the order “BEARING__”, No 3 uses the quick release if required, and having re-engaged the gears, sets the slipping scale by turning the micrometer knob until the slipping scale is set to the even hundred mils below the bearing ordered and the slipping scale micrometer reads 0. He then turns the micrometer knob away from him until the slipping scale micrometer reads the required number of mils.
- c. **To set an alteration to the current bearing.** On the order “BEARING RIGHT (LEFT)___”, No 3 turns the micrometer knob and counts the mils on the slipping scale micrometer, as follows:
- (1) When “RIGHT” is ordered, he turns the micrometer knob away from him. When “LEFT” is ordered, he turns the micrometer knob towards him.
 - (2) In each case he turns the knob with his left hand.
- d. **To set an elevation on the elevation scale.** See Figure 4-4.



- | | |
|-------------------|----------------------------|
| A. Centre of Arc | 1. Lock screw |
| B. GAP 1 | 2. Cross levelling control |
| C. GAP 2 | 3. Records plate |
| D. Collimator | 4. Elevation scale |
| E. Aiming posts | 5. Cross levelling bubble |
| F. Night picket 1 | 6. Elevation micrometer |
| G. Night picket 2 | 7. Elevation knob |
| | 8. Longitudinal bubble |
| | 9. Locking rod |
| | 10. Dial sight support |

Figure 4-4: Sight Mount

- (1) On the order "ELEVATION__", No 3 turns the elevation micrometer knob until the elevation coarse scale is set to the even hundred below the elevation ordered and the elevation micrometer reads zero.
- (2) No 3 then turns the elevation micrometer knob until the elevation micrometer reads the required number of mils.

- e. **To set an alteration to the elevation.** On the order “ELEVATION, ADD (DROP)___”, No 3 turns the elevation micrometer knob and counts the mils on the elevation scale in the appropriate direction. To add, turn the micrometer left; to drop, turn the micrometer right.

- f. **To set an elevation on the gunners quadrant.** When “QUADRANT LAYING” is ordered, No 1 applies the correction for index error to all elevations ordered and sets the quadrant by moving the index arm to the nearest 10 mils below the elevation ordered. He then sets the index micrometer to the nearest whole mil or, if necessary, to the nearest 0.1 mil.

CHOICE OF GAPS 1 AND 2

9. Notes:

- a. No 1 is responsible for choosing the GAPS. The priorities for GAPS are detailed in para 27.b. of Chapter 2.

- b. If a distant object is used as a GAP:
 - (1) it must be conspicuous and unmistakable;
 - (2) it must have a definite edge on which to lay; and
 - (3) its position must be such that it can be used for all targets within the zone of fire of the gun and that it is not likely to be obscured by the muzzle of the gun at high elevation, by the detachment, or by the other guns or their detachments.

- c. GAP 1 must satisfy the requirements of a good GAP. In addition, it must be as far as possible. Approximately 1500 metres may be used as a guide; the most suitable position is to the left front or the right rear.

- d. GAP 2 must satisfy the conditions of a good GAP. In addition, it must be near enough to ensure that it will not be obscured by changes in the weather conditions, but not

so near that inaccuracies in bearing will result as the gun is moved in traverse. Approximately 300 to 600 metres may be used as a guide. The most suitable position is to the left front or the right rear.

- e. GAP 1 and GAP 2 are to be located in different quadrants, e.g., GAP 1 left front and GAP 2 right rear. This is done to avoid confusion by the No 3 during the laying procedure.

POINT OF AIM

10. **Notes.** At indirect laying, No 3 using the traversing handwheel, lays the vertical cross hair of the telescope as follows:

- a. **When using an aiming point.** No 3 lays on the left edge of the aiming point unless otherwise ordered.
- b. **When using the collimator.** The vertical cross hair is laid as detailed in Annex G.
- c. **When using aiming posts.** No 3 lays on the left edge of the aiming posts provided they appear in line. Otherwise, No 3 lays in such a manner that the far aiming post appears exactly midway between the near aiming post and the vertical hair line. The horizontal hair line is laid at the ground level of the near aiming post (See Figure 4-2).
- d. **When direct laying.** The point of aim is the centre of the visible mass of the target.

SEQUENCE OF LAYING

11. **Notes:**

- a. The sequence of laying drill shall be rigidly followed. If an incorrect sequence is followed, one adjustment may upset a previous one and result in delay or an incorrect lay.

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- b. The gun is laid for elevation when the elevation scale is correctly set and the cross and longitudinal level bubbles are centred.
- c. The gun is laid for bearing when the slipping scale is correctly set, the vertical cross hair of the dial sight is laid on the correct point of aim, and the cross level and longitudinal level bubbles are centred.
- d. Unless the trunnions are accurately levelled, a small adjustment to either bearing or elevation will alter the other. However, a small adjustment for elevation will have less effect on the bearing than a small adjustment for bearing will have on the elevation. Thus, in indirect laying, it is desirable that final adjustments for bearing and elevation be carried out immediately one after the other. No 3 will report “READY” when all apparent motion of the gun has ceased.
- e. The following instructions describe the sequence of operations as they should be carried out. The sequence is designed for accurate and consistent laying with minimum delay.
 - (1) **To lay for bearing.** No 3 traverses rapidly until the vertical cross hair of the dial sight is laid on the aiming point. He then alternately levels the cross level bubble with the cross level knob and the longitudinal level bubble with the elevating handwheel and traverses back on the point of aim until the gun is laid for bearing.
 - (2) **To lay for elevation.** No 3 elevates or depresses rapidly until the longitudinal level is centred. He then centres both bubbles by operating the cross levelling knob and elevating handwheel.

12. Drill for indirect laying:

- a. **Normal indirect laying.** For normal indirect laying sequence, see the table at Figure 4-5.

Ser	Order	Action
1	“BEARING__”	No 3 sets the bearing ordered on the dial sight and lays for bearing. No 1 checks the bearing by measuring from the C of A marker.
2	“ELEVATION__”	No 3 sets the elevation ordered on the elevation scale and reads the setting, “ELEVATION__”. He lays for elevation and makes final adjustments and reports “READY”.

Figure 4-5: Normal Indirect Laying Sequence

- b. **Drill for quadrant laying.** For quadrant laying sequence, see the table at Figure 4-6.

Ser	Order	Action
1	“BEARING__”	No 3 sets the bearing on the dial sight and lays for bearing. No 1 measures the bearing using the C of A marker.
2	“QUADRANT LAYING”	No 1 obtains the gunner’s quadrant. No 3 cleans the breech levelling plates.
3	“ELEVATION_”	No 1 applies the correction for index error to the elevation ordered and sets it on the gunners quadrant. No 1 then hands the quadrant to No 3. No 3 reads the setting to No 1 and hands it back. No 1 holds the quadrant on the breech levelling plates with the words “line of fire” at the bottom and the arrow pointing towards the muzzle. No 3 lays for elevation, makes final adjustments, and reports “READY”. No 1 removes the quadrant from the breech.

Figure 4-6: Indirect Laying Sequence using the Gunner’s Quadrant

13. **Anti-tank laying.** For anti-tank laying see Chapter 3.

TO CHANGE FROM ONE AIMING POINT TO ANOTHER

14. Notes:

- a. It is sometimes necessary to change from one aiming point to another, e.g., from GAP 1 to GAP 2.
- b. If during a fire mission the current aiming point becomes unusable, No 3 will report this fact to No 1, "GAP 1 OBSCURED". No 1 will then order the change to an alternate aiming point.

15. Drill. On the report GAP OBSCURED by No 3:

- a. No 1 notes the reading on the slipping scale and micrometer and orders "REPORT";
- b. No 3 reports the reading on the slipping scale and micrometer;
- c. No 1 orders No 3 to set the dial sight at the recorded angle to the aiming point, e.g., GAP 2;
- d. No 3 sets the main scale and micrometer at the angle to the aiming point ordered;
- e. No 1 checks the setting and slips the slipping scale and micrometer to the bearing of the C of A;
- f. No 1 orders the current bearing as noted in para 15.a. above; and
- g. No 3 sets the slipping scale and micrometer as ordered, and re-lays on the new aiming point.

REPOSITIONING THE SLIPPING SCALE

16. Note. If the slipping scales are correctly clamped by No 1 they should not slip, but if they do slip they can be repositioned using the drill detailed in para 17.

17. Drill:

- a. No 1 orders No 3 to set the dial sight at the recorded angle to the current aiming point, e.g., “AIMING POSTS”.
- b. No 3 sets the main scale and micrometer at the angle for the aiming point ordered as recorded on the record plate.
- c. No 1 checks the setting and slips the slipping scale and micrometer to the reading for the C of A.
- d. No 1 obtains the correct bearing from the GPO or from the nearest gun.
- e. No 1 then orders the gun to be laid at the current bearing.
- f. No 3 sets the slipping scale and micrometer as ordered and re-lays on the aiming point.

COMPLETING A DEFERRED CENTRE OF ARC RECORD**18. Notes:**

- a. If “DEFER SECOND METHOD” is ordered or if fire orders are received during the recording of the C of A, No 1 will report “NUMBER RECORDED” as soon as the record to the first aiming point has been completed.
- b. The record of the main scale reading to GAP 2 must then be completed without further orders at the first opportunity, e.g., as soon as “END OF MISSION” is ordered.
- c. Before beginning this operation, No 1 must note the bearing at which the gun is laid in order that the gun be re-laid as last ordered after the operation is complete.

19. Drill:

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- a. No 1 notes the current reading of the slipping scale and micrometer and orders No 3 to “REPORT” the reading as a check.
- b. No 1 orders “CENTRE OF ARC”.
- c. No 3 sets the slipping scale and micrometer to the C of A and lays on GAP 1.
- d. No 1 checks that the main scale reading agrees with the reading to GAP 1 as recorded on the record plate.
- e. The drill for recording GAP 2 is then carried out in the normal manner.
- f. No 1 then orders the gun to be laid as last ordered.
- g. No 3 sets the scales and re-lays on GAP 1.

NIGHT LAYING

20. Notes:

- a. Illumination is required for the aiming posts, dial sight and sight mount.
- b. The dial sight has a built-in tritium lamp. Aiming post lights are used for the aiming posts and a built-in lighting system is incorporated in the range quadrant.
- c. The GPO is responsible for illumination of the troop GAP. No 1 is responsible for the illumination of the sights and aiming posts.
- d. The M1A1 Collimator has its own built-in light source (see Annex G)

CHAPTER 5 SIGHT TESTING

NOTES

1. **Aim.** Purpose of sight testing is to ensure that the sights are maintained in direct and precise relation to the bore of the gun.
2. **Checking.** After an adjustment has been made as the result of any test, the test will be repeated in order to ensure that the adjustment has been accurately made.
3. **Sequence.** Some of the tests are dependent on correct adjustments having already been made in some of the previous tests. The tests will, therefore, always be carried out in sequence.
4. **Training.** During training, the quick sight, boresight, and elevation tests will be carried out frequently in order that all ranks concerned are practised in both tests and adjustments.
5. **Droop.** Droop is disregarded in sight testing. The effect of droop, if any, is absorbed in the results of calibration.

TYPES OF TEST

6. **Periodic Tests.** The GPO is responsible for ordering these tests and No 1 is responsible for carrying them out. Adjustments will be carried out only by personnel qualified to make them. Accuracy tests will be conducted as follows:
 - a. immediately on receipt of a new weapon;
 - b. once every three months if the gun is being fired;
 - c. once a year if the weapon is being used for “dry” training only;
 - d. as soon as possible after extensive use, accidents, or after crossing extremely rough terrain; and

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- e. when the weapon fires inaccurately for no apparent reason.

7. **Quick sight tests.** The aim of these tests is to disclose any gross error in bearing and/or elevation. The GPO is responsible for ordering these tests and No 1 is responsible for doing the tests and ensuring that the appropriate adjustments are made. They are carried out:

- a. daily, when firing;
- b. on the order "PREPARE FOR ACTION";
- c. as soon as possible, after the C of A has been recorded;
- d. after each change of position;
- e. immediately before a deliberate fire plan;
- f. during any pause in prolonged firing;
- g. weekly, when not firing; and
- h. immediately, after a periodic test.

8. **Bore sight and elevation test.** The GPO is responsible for ordering this test conducted, and the No 1 is responsible for doing the test and ensuring that the appropriate adjustments are made. This test is used to check the scales against the bearing and elevation at which the gun is laid and is carried out:

- a. when the quick sight test indicates there is an error; and
- b. on receipt of a new sight.

PREPARATION FOR TESTS

9. **Note.** Before carrying out periodic, bore sight, or elevation tests, the carriage will be placed on a firm platform which is as level as possible. The trunnions will be levelled and the correction for index error in the gunner's quadrant will be ascertained.

10. **To level the trunnions.** The trunnions may be levelled by one of the following three methods:

- a. **The plumb bob method.** This is the most accurate and must be used for the periodic tests before adjustments are made or the reference lines scribed on the mount. The procedure is as follows:
 - (1) Suspend a plumb line, at least 10 metres long, 2 to 3 metres in front of the muzzle. Insert the bore sight ring in the chamber or remove the firing lock and insert the bore-sight muzzle disc.
 - (2) Align the cross-hairs with the plumb line by sighting through the bore, moving either the plumb line or by traversing, provided the piece remains approximately in the centre of traverse.
 - (3) Elevate and depress the piece, checking to see that the vertical cross-hair tracks the plumb line throughout its length. If it tracks, the trunnions are level. The maximum allowable error is 1 mil.
 - (4) If the vertical hair does not track the plumb line within limits, it will be made to do so by blocking the lower trail and repeating the process.
- b. **Gunner's quadrant method.** The gunner's quadrant is used to level the trunnions when the use of a plumb bob is not practical and reference lines have not been scribed on the sight mount.
 - (1) **Method 1.** The procedure is to place the gunner's quadrant at a right angle to the axis of the bore on the breech ring. Ensure the quadrant is set to zero, incorporating the index error (see para 11.) Level the bubble of the gunner's quadrant by blocking one of the trails. The trunnions should then be level.

- (2) **Method 2.** The procedure is to place the gunner's quadrant at a right angle to the axis of the bore on the breech ring. Ensure the quadrant is set to zero incorporating the index error (see para 11) Level the bubble of the gunner's quadrant by using the quadrant micrometer; note this reading. Transfer the gunner's quadrant to the target testing board, facing in the same direction, and set to the same reading obtained at the breech. Tilt the target testing board until the board is level with the gunner's quadrant bubble. The board is now level in relation to the trunnions.

11. To find the correction for index error. The object of finding the correction for index error of the gunner's quadrant is to ensure that it accurately indicates the angle at which the gun is laid for elevation.

a. **Procedure:**

- (1) Set both the index arm and micrometer scale of the gunner's quadrant to zero.
- (2) Place the quadrant on the levelling plates of the breech ring; the "line of fire" arrow pointing toward the muzzle. Centre the bubble by means of the elevating handwheel.
- (3) Turn the quadrant end for end and replace it on the levelling plates. The bubble should again be central.
- (4) If it is not, centre the bubble by means of the quadrant micrometer knob, setting the index arm to read -10 mils, if necessary, and read the setting.

- (5) Half of this reading (subtracted from 10 if the index arm is set to -10 mils) is the correction for index error. It is plus if the index arm is set to zero and minus if set to -10 mils.

Note: Care shall be taken in determining that the correction for index error is minus. With the index arm set to -10 mils and the micrometer reading set to 6, the index error will be -4. The correction for index error will be -2. Set the index arm to -10 and the micrometer to 8. Set the correction on the gunner's quadrant and repeat 11.a.(2) and (3). If the bubble does not remain central, repeat the process from para 11.a.(1).

- (6) The correction for index error will be recorded and must be applied with its correct sign to all elevations when laying by gunner's quadrant.
- (7) At the first opportunity, the quadrant will be forwarded to a fire control systems technician for adjustment.

b. **Examples.** The following examples show the application of the correction found:

(1) **Example 1:** (elevation below 800 mils)

- (a) Correction for index error
+0.2 mils
- (b) Elevation ordered
458.0 mils
- (c) Angle set on gunner's quadrant
458.2 mils

(2) **Example 2:** (elevation above 800 mils)

- (a) Correction for index error
+0.3 mils

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- (b) Elevation ordered
956.0 mils

- (c) Angle set on gunner's quadrant
955.7 mils

For angles greater than 800 mils the quadrant is reversed and so a plus correction must be subtracted.

PERIODIC TESTS

12. Notes:

- a. The tests specified in paras 14 to 18 inclusive will be performed using this manual and need not be memorized (see Figures 5-1 and 5-2 for reference).
- b. If the maximum allowable error is exceeded during any of the tests, the equipment will be adjusted by the weapons technician (land).
- c. The tests will be performed in the sequence shown.

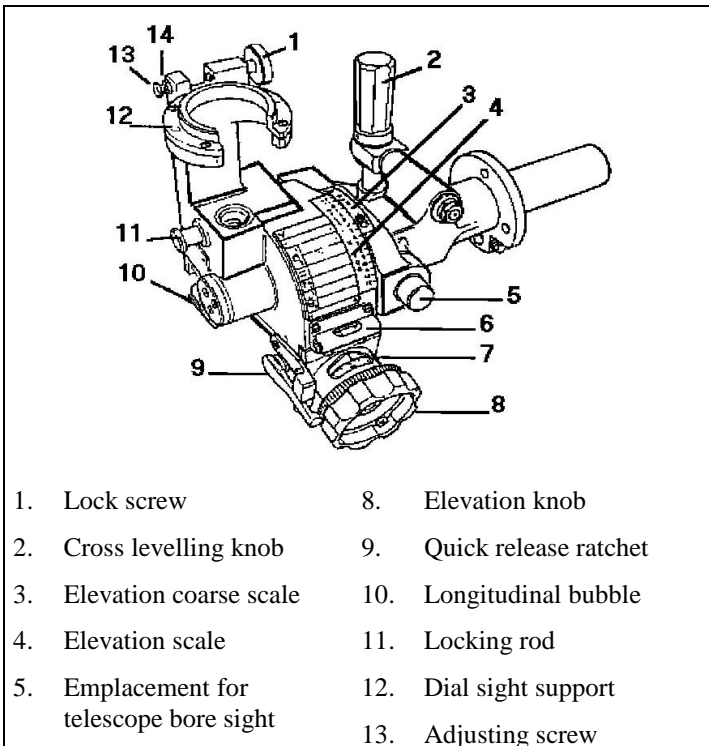
13. Preparation:

- a. Level the trunnions as described in para 10.
- b. Do not disturb this setting and check it frequently since the accuracy of the following tests is dependent upon the trunnions being exactly level.
- c. In addition to the preparations shown in paras 10 and 11, obtain a machined steel plate or piece of plate glass, preferably square in shape and at least 15 cm long.

14. To test the elevation indices on the mount:

- a. Lay the gun accurately at zero elevation with the gunner's quadrant (corrected for index error) and centre the cross and longitudinal level bubbles.

- b. The fine indices on the elevation micrometer and the indices on the elevation course scale should read 0 mils, if not:
- (1) Slacken the two securing screws of the coarse scale zero index mark. Slide the index block until the scale reads zero. Carefully tighten the securing screws.
 - (2) Slacken the four fine scale securing screws in the quadrant elevation micrometer, push in on the quick release ratchet, slip the micrometer's scale to read zero and tighten the securing screws.
 - (3) Ensure the longitudinal bubble has remained level and both scales read zero. Recheck the elevation with the gunner's quadrant.



6. Cross levelling bubble	14. Nut
7. Elevation micrometer	

Figure 5-1: Sight Mount

15. To test the sight mount:

- a. Lay the gun accurately at zero elevation by means of the gunner's quadrant (corrected for index error).
- b. Centre the cross and longitudinal level bubbles. Turn the cross-level knob throughout its limits of motion.
- c. The longitudinal level bubble should remain central. Maximum allowable error is one-half a graduation of the bubble vial.
- d. Centre the cross and longitudinal level bubbles.
- e. Elevate the barrel to the maximum elevation in steps of 100 mils. Level the longitudinal level bubble after each 100 mil step. The cross-level bubble should be central after each step. Maximum allowable error is one-half a graduation of the bubble vial.

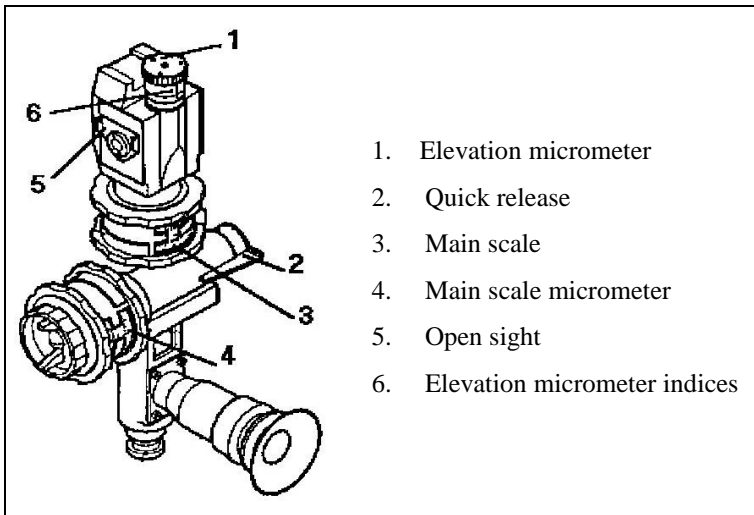
16. To test the cross and longitudinal level bubbles on the mount:

- a. Centre the cross and longitudinal level bubbles.
- b. Place the machined plate (or glass plate) on top of the dial sight mount.
- c. Set the gunner's quadrant at zero (corrected for index error). Place the quadrant on the machined plate, parallel to the axis of the bore. The quadrant bubble should be central. If it is not, centre it by means of the quadrant micrometer knob. Maximum allowable error is 0.2 mils.
- d. Set the quadrant back to zero and place it on the machined plate at right angles to the axis of the bore.

- e. The quadrant bubble should be central. If it is not, centre it by means of the quadrant micrometer knob. Maximum allowable error is 0.2 mils.

17. To test the sights for parallax:

- a. Parallax is the apparent movement of the reticle with respect to the target as the eye is moved from side to side or up and down when viewing.



- 1. Elevation micrometer
- 2. Quick release
- 3. Main scale
- 4. Main scale micrometer
- 5. Open sight
- 6. Elevation micrometer indices

Figure 5-2: Dial Sight

- b. Install the dial sight and indirect fire telescopes in their mounts.
- c. Lay each in turn on a reference object at least 400 metres distance, shifting the eye from side to side and up and down while observing the reference object.
- d. If the reticle appears to move with respect to the target, the sight is out of adjustment.

18. To test the dial sight for backlash:

- a. Turn the main scale micrometer through at least 200 mils to lay onto a suitable aiming point.

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- b. Note the reading on the main scale.
- c. Continue turning the main scale micrometer in the same direction for at least a further 200 mils.
- d. Reverse the direction of the rotation until the sight reticle is again laid on the aiming point.
- e. Note the reading on the main scale. The difference between the two readings indicates the amount of backlash present, tolerance 1 mil.

THE QUICK SIGHT TESTS

19. **Note:**

- a. The quick sight tests consist of the alignment test using the recorded standard angle which the weapons technicians will obtain after they have performed their sight testing on receipt of a new gun.
- b. The Detachment Commander must ensure that the serial numbers of the sights and the CFR of the gun match the standard angle recorded by the weapons technicians in the gun history book.
- c. If the sight does not match, a bore sight and elevation test must be carried out and a new standard angle must be obtained.
- d. On completion of the quick sight test, if the readings do not match the standard recorded angle within a tolerance of 2 mils, a bore sight test is carried out. A quick sight test is again carried out. If the tolerance of 2 mils exceeds the standard angle, a weapons technician must check to ensure that the sight mount is properly aligned.

20. **Preparation.** On the order “QUICK SIGHT TEST”, proceed as follows:

- a. Verify that the parts that move in recoil are in the same position in respect to the non-moving parts as they were when the standard angle was determined. If they are not in the same position, the amount of recoil oil in the recoil mechanism must be modified until the distance is the same.
- b. The barrel is elevated to 300 mils.

21. Alignment test

- a. Using the cross level knob, match the scribe lines located on the left trunnion and the sight mount and ensure the elevation micrometer is set to 300 mils.
- b. Turn the head of the sight until the sight reticle is laid on the left edge of the muzzle brake (see Figure 5-3).
- c. The main scale of the dial sight shall read the “standard angle” (2 mils).
- d. If there is an error greater than 2 mils, a bore sight test shall be carried out. If however, time does not permit a bore sight test, the main scale can be set to read the “standard angle” and the sight socket adjusted until the lay for line is correct.
- e. A bore sight test is to be carried out at the first opportunity after such an adjustment has been made.

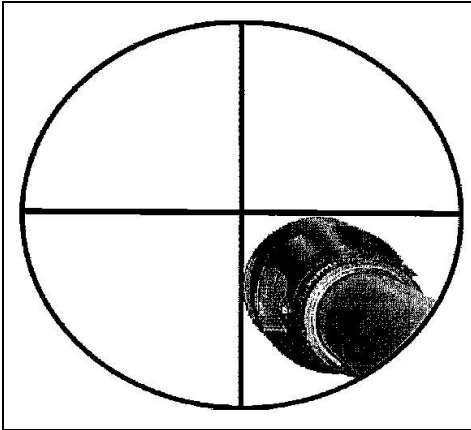


Figure 5-3: Quick Sight Lay

22. Elevation test:

- a. Set the quadrant elevation scale to 300 mils.
- b. Set the gunner's quadrant to 300 mils tested for index error and place it on the breech.
- c. Using the elevating handwheel, bring the gunner's quadrant bubble centre.
- d. The elevation bubble should be centre. If not, level the longitudinal and cross-level bubbles by means of the elevation micrometer and cross-levelling knob.
- e. The elevation coarse scale should read 300 and the micrometer should read zero. If the resultant reading differs by 1 mil or less, the elevation scale is accepted as correct for elevation.
- f. If the reading differs by more than 1 mil, the scales will be adjusted as follows:

- (1) Slacken the two securing screws of the coarse scale zero index mark. Slide the index block until the scale reads zero. Carefully tighten the securing screws.
- (2) Slacken the four fine scale securing screws in the quadrant elevation knob, push in on the quick release ratchet, slip the micrometer's scale to read zero and tighten the securing screws.
- (3) Ensure the longitudinal bubble has remained level and both scales read zero. Recheck the elevation with the gunner's quadrant.

BORE SIGHT AND ELEVATION TESTS

23. Notes:

- a. These tests consist of a bore sight (alignment) test and an elevation test.
- b. The bore sight and elevation tests can be carried out separately. If there is an error in the alignment and/or elevation of a gun found as a result of the quick sight test, that gun will be withdrawn from action, the bore sight and/or elevation test performed, any adjustment made, and the gun returned to action.
- c. Adjustments made as a result of alignment tests do not affect either the angle passed from the director or the recorded angles to GAPS, etc.
- d. Once this test is complete, a quick sight test must once again be conducted to ensure that the standard angle is within the tolerance of 2 mils. If this second test exceeds the tolerance, a weapons technician must check the alignment of the sight mount.
- e. On receipt of a new sight, after completion of the bore sight test, a quick sight test is carried out to determine the new standard angle.

24. Bore sight test

- a. **Aim.** The purpose of this test is to ensure that the main scale of the dial sight correctly records the clockwise horizontal angle between the bearing in which the gun is laid and the line of sight through the dial sight. This is an accurate method of bore sighting and will be carried out as indicated in para 8.

- b. **Preparation:**
 - (1) Fix the dial sight and direct fire telescope in their mounts and check the sights for slackness in the locking clamps.
 - (2) Insert the bore sighting disc at the breech end or remove the firing lock and insert the muzzle sighting disc.
 - (3) Level the barrel using the gunner's quadrant and centre the cross-level and longitudinal level bubbles of the sight mount.
 - (4) Level the trunnions by means of one of the methods described in para 10.
 - (5) Set up the target testing board (see Figure 5-4) 50 metres in front of the gun and at right angles to the axis of the bore. Select as a laying mark the centre of the right cross-hairs by looking through the bore. Align the target testing board by using hand signals. Or, select as a laying mark a well defined object at least 2000 metres distant.

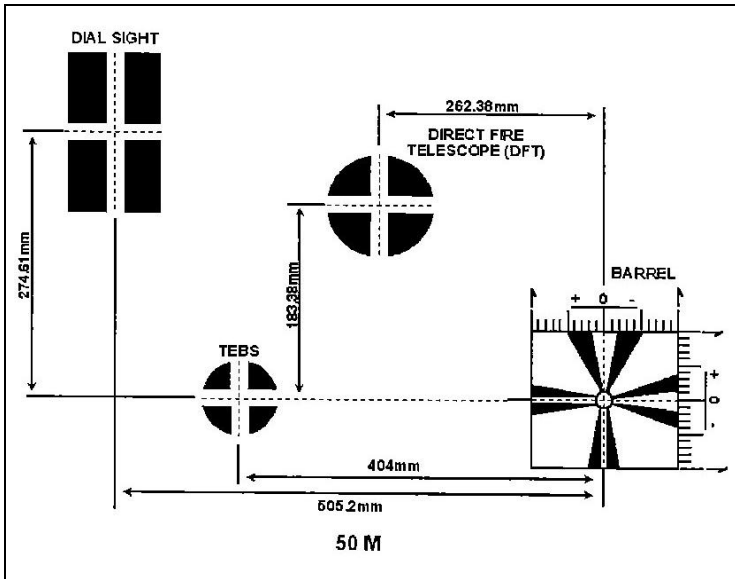


Figure 5-4: Target Testing Board

c. **Dial sight - Test and adjustments:**

- (1) To test the dial sight for alignment, lay it on the distant laying mark or on the centre of the left cross-hairs of the target testing board, by means of the left micrometer and the elevation micrometer on the dial sight.
- (2) The main scale and left micrometer should read zero mils and the elevation micrometer index and the index on the rotating head should coincide.
- (3) If the test shows that the dial sight is not in alignment for line and/or elevation, the sight is adjusted as follows:
 - (a) **For line.** Using a 10mm open end wrench, loosen the nut of the dial sight adapter adjusting screw. Adjust the adjusting screw and the lock screw until the dial sight is laid for line. Tighten

the nut of the adjusting screw and recheck the lay (see Figure 5-1).

- (b) **For elevation.** Turn the elevation micrometer until the sight is laid for elevation. Loosen the three screws on the elevation micrometer. Move the elevation micrometer until the index coincides with the index on the rotating head. Tighten the three screws and recheck the lay (see Figure 5-2).

- (4) To check that all adjustments are correct, remove and replace the dial sight. Relay on the distant object or sight testing board and ensure that the main scale micrometer reads zero and the indices on the elevation micrometer coincide.

d. **The direct fire telescope - Test and adjustment:**

- (1) The following test must be carried out to establish the accuracy of the direct fire telescope using the target testing board.
- (2) Ensure all preparations are made, para 24.b.
- (3) Set the reticles in the direct fire telescope range and the lead mark to zero using the target control knobs.
- (4) The direct fire telescope cross-hairs should now be laid on the centre of the aiming point for the telescope on the target testing board.
- (5) If the test shows that the direct fire telescope is not in alignment for line and/or range, the sight is adjusted as follows:
 - (a) **For line.** Slacken the four mounting bracket screws using a 5mm Allen key. Rotate the bracket to adjust for line and

retighten the screws on the bracket.
Recheck the alignment.

- (b) **For range.** Using a screw driver, slacken the four elevation clamping screws and adjust the opposing setscrews for range using a 2.5mm Allen key. Retighten the clamping screws. Recheck the alignment.

25. Elevation Test:

- a. **Aim.** The purpose of this test is to ensure that the elevation scale correctly indicates the elevation applied to the gun.
- b. **Procedure:**
 - (1) Level the trunnions if they are not already levelled.
 - (2) Determine the correction for index error of the gunner's quadrant.
 - (3) Set the elevation coarse scale and micrometer to zero.
 - (4) Level the barrel by means of the gunner's quadrant.
 - (5) Level the longitudinal and cross-levelling bubbles by means of the elevation micrometer and cross-levelling knob.
 - (6) The elevation coarse scale and micrometer should read zero.
- c. **Adjustment of indices.** If the tests show that the elevation indices do not match, they will be adjusted as follows:

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- (1) Slacken the two securing screws of the coarse scale zero index mark (Figure 5-1). Slide the index block until the scale reads zero. Carefully tighten the securing screws.
 - (2) Slacken the four fine scale securing screws in the quadrant elevation knob, push in on the quick release ratchet, slip the micrometer's scale to read zero and tighten the securing screws.
 - (3) Ensure the longitudinal bubble has remained level and both scales read zero. Recheck the elevation with the gunner's quadrant.
- d. **Consistency test.** The object of this test is to disclose inconsistency in the range quadrant. The procedure is as follows:
- (1) Lay the gun accurately at 300 mils and 700 mils respectively by means of the gunner's quadrant.
 - (2) Centre the cross and longitudinal bubbles after each operation. The elevation scales should read 300 and 700 mils respectively. Maximum allowable error is 1 mil. If a discrepancy of more than 1 mil occurs, adjustment must be carried out by a maintenance technician.

ZEROING

26. Notes:

- a. The object of zeroing is to ensure that the point of impact for range coincides with the point of aim at the range which zeroing is carried out.
- b. Zeroing should be carried out at least every quarter life of the gun, or after any adjustment to the elevation quadrant due to a periodic test.

- c. The ammunition to be used for zeroing can be either HESH, Squash Head practice or HE.

27. Preparation:

- a. Bring the gun into action on a level platform and carry out the bore sight and elevation tests.
- b. At 500 metres from the gun and as nearly as possible at the same level, set up a zeroing target. (A black canvas screen 9 feet square, divided centrally by horizontal and vertical white bands. Ensure the bottom of the screen is clear of the ground.)
- c. Set up a confirmation target at 1000 metres from the gun, to the left or right of the first target, using the same criteria as in para 27.b in Chapter 2.

28. Test and adjustments:

- a. **The gun will be zeroed as follows:**
 - (1) Using the range control knob, set the 500 metre reticle of the corresponding ammunition being used. Using the target correction control knob, set the vertical reticle at zero on the direct fire telescope.
 - (2) Lay the gun on the intersection of the white bands.
 - (3) Fire the gun.
 - (4) If the round misses the target, alter the lead or range used, re-lay, and fire. Continue to correct until a hit is obtained.
 - (5) Fire a total of three rounds at the range which gives a hit; re-laying accurately on the centre of the target for each round.
 - (6) Re-lay after the last round of the group.

- (7) If the firing shows that the direct fire telescope is not in alignment for line and/or range, the sight is adjusted as follows:
- (a) Without disturbing the alignment of the bore, repeat step (1).
 - (b) **For line.** Slacken the four mounting bracket screws using a 5 mm Allen key. Rotate the bracket to adjust for line on the centre of the grouping and retighten the screws on the bracket. Recheck the alignment.
 - (c) **For range.** Using a screw driver, slacken the four elevation clamping screws. Using a 2.5 mm Allen key, adjust the opposing setscrews for range on the centre of the grouping and retighten the clamping screws. Recheck the alignment.

29. **Confirmation:**

- a. Confirmation will be done as follows:
 - (1) Using the range control knob set the 1000 metre reticle of the corresponding ammunition being used. Using the target correction control knob, set the vertical reticle at zero on the direct fire telescope.
 - (2) Lay on the 1000 metre target at the intersection of the white bands and fire a confirmation round.
- b. The result of the zeroing is accepted as correct if the confirmation round strikes the target.

CHAPTER 6 MANHANDLING AND WINCHING

INTRODUCTION

1. It may be necessary to use chains, winches, planks, and improvised aids to assist in moving the gun over difficult country.
2. Detailed instructions for driving and winching are given in the appropriate manuals. These notes are intended only as a guide.
3. Guns will often have to be manhandled into position. As far as possible, each detachment is to be capable of moving the gun without outside assistance. The correct methods of lifting and pulling must be applied. Manhandling is not a drill and personnel are to be detailed to tasks in accordance with their physique.
4. When the gun is in the travelling position, the weight of the trails is increased by the barrel. Therefore, manhandling in the combat position is preferred.

MANHANDLING

5. **Lifts and pulls:**

- a. **Positions.** In lifting heavy objects, the best position is with the feet parallel and approximately 30 cm apart, the knees bent, and the back as straight as possible. Full use is then made of the strong muscles of the buttocks and legs, thus conserving energy and reducing the chance of injury, especially to the back.
- b. **The Colliers' Lift.** The back is turned towards the object to be lifted, which is then grasped with arms straight, knees bent, and back as straight as possible. The lift is then performed by straightening the legs, using the leg and buttock muscles. This lift can be applied from the muzzle side of the wheels when the gun is to be taken trails first over an obstacle.

c. **The rope pull:**

- (1) This is a pull as in a tug-of-war. The rope is held under the right armpit and grasped with both hands close together; left hand in front, palm upward, arm straight. The feet placed at right angles to the rope, both pointing to the right and about 30 cm apart from the rear. The left leg is straight to provide leverage and the right leg bent to provide driving power.
- (2) If personnel are placed on the right of the rope, their positions are as described above but with “left” and “right” interchanged.
- (3) In order to avoid waste of effort when two or more members are to pull on a rope, the rope must be straight, i.e., personnel must be aligned in the direction of the pull. If the rope is attached low down, members must be sized with the shortest in front.
- (4) On the level, the pull is divided into two phases: “taking strain” and “heaving”. While on a slope there is a third phase, “holding”. The pull is controlled as follows:
 - (a) On the order “TAKE STRAIN”, each member allows the body to fall back to an angle of about forty-five degrees, keeping the body straight from the sole of the leading foot to the crown of the head. The sides of the feet are dug well into the ground and the rope made taut.
 - (b) On the order “HEAVE”, the strain is maintained on the rope and each member lowers the angle of the body and heaves by a powerful stretch of the legs and body. As soon as possible, both feet are moved in the direction of the pull.

- (c) On the order “HOLD”, each member holds the rope taut until the brake has been engaged or until chocks have been placed under the wheels. The order “REST” is then given.
 - d. **Towing on the flat.** When the gun is on fairly level ground and can be kept on the move, ropes can be used for towing. The ropes are attached to the front ring on the bottom carriage, each man faces the direction of the tow, and pulls on the rope with one or both hands beside the body; the leading man on each rope passing the rope round his body.
- 6. **Aids to manhandling.** To avoid waste of energy, full use should be made of the following aids:
 - a. **Spades.** When going uphill, it is generally best to manhandle the gun muzzle first. The spades can then be used to prevent the gun running back when “HOLD” is ordered.
 - b. **Brake.** This should be applied at once on the order “HOLD” and released on “TAKE STRAIN”.
 - c. **Chocks.** These are stones, wooden blocks, or the like, which are placed close against a wheel to prevent the gun from running down hill, or placed against a vertical obstacle to form a small ramp or step.
 - d. **Ramps and planks.** These may be used for crossing a ditch or for making a sloping path over a vertical obstacle.

WINCHING

7. General:

- a. An attempt to tow the gun after wheel spin has begun is almost certain to result in bogging the vehicle. The gun shall be unhooked at once and the vehicle driven forward to the extent of the winch cable. The vehicle is then

Gun Drill, 105 mm Howitzer, LG1 MK II

turned about, halted, the brakes applied, and the winch cable pulled out and attached to the lunette by means of a shackle. The gun is then winched to the vehicle.

- b. If the vehicle is now on moderately firm ground but further bad patches are anticipated, the gun may be left attached to the winch cable, the winch brake applied, and the vehicle driven backward until wheel spin begins again. The winch brake can then be released and the vehicle driven slowly backwards, paying out the winch cable. Before the end of the cable is reached, the vehicle is halted, braked, and the gun again winched forward.

8. **Considerations.** The following considerations are important:

- a. The vehicle should be pointed as closely as possible along the line of pull so that the pull is direct.
- b. The shackle must be used for attaching the cable to the lunette.
- c. The cable must be under tension during paying out and winding in.
- d. The cable must be kept clean and must not be allowed to drag on the ground.
- e. The cable must not be completely unwound from the winch drum. There should be three or four turns of the cable around the drum before winching begins.
- f. Care should be taken to ensure that all personnel stand clear of the cable. A whip action will occur if the cable breaks.

CHAPTER 7
INSPECTION AND PREVENTIVE MAINTENANCE

GENERAL

1. **Note**
 - a. Inspection and preventive full explanation of all inspection and maintenance may be defined as the care exercised and the work performed to keep the equipment in good operating condition. Procedures can be found in the gun supplement C-71-333-000/MB-000, *Operator's Manual, Gun, 105mm LG1 MKII*, which remains the primary reference for the howitzer.
 - b. At Annex J, a maintenance checklist is provided as a guide.

ANNEX A
DENIAL OF MILITARY EQUIPMENT AND
SUPPLIES TO AN ENEMY

DEFINITIONS

1. **Denial.** Removal from a threatened area, rendering unusable by removal of parts, contamination (other than by NBC means), immobilization or partial or total destruction of military equipment or supplies.
2. **Military equipment and supplies.** This includes civilian equipment and supplies used by allied forces.

GENERAL

3. The enemy must be denied the use of military equipment and supplies of allied forces other than medical equipment and supplies.
4. Denial to the enemy shall, if possible, not preclude their later use by allied forces.
5. Destruction of military equipment and supplies will only be ordered when their falling into enemy hands cannot be prevented by other forms of denial.
6. Denial of military equipment and supplies to prevent their use by an enemy is the responsibility of the user.
7. Provision of instructions, means for, and training in the denial of military equipment and supplies is a national responsibility.
8. **Priorities.** The priorities and extent of the denial of military equipment and supplies must be decided by the commander ordering it, taking into account their potential value to the enemy. Some examples could be:
 - a. **As a high priority.**

- (1) Classified equipment, material and documents.
 - (2) Petroleum, oils and lubricants.
 - (3) Sophisticated weapons systems or electronic equipment.
 - (4) Heavy weapons and associated ammunition.
 - (5) Communications equipment.
 - (6) Ferrying and bridging equipment.
 - (7) Air, sea and land transport.
- b. **As a second priority.** Any other stores, equipment or facilities that may be of use to an enemy.
- c. **Extent of denial.** This will depend on the time available and the probability of recapture. In denial of equipment, all detachments must follow the same procedure so that if several pieces of equipment are captured they will all be deficient in the same essential part.

TEMPORARY DISABLEMENT

9. To disable the 105mm Howitzer so that it can be brought into action immediately after recapture; remove the dial sight, direct fire telescope, gunner's quadrant and the firing lock.

10. To disable the gun so that it can be brought into action after repair, remove the items in para 9. In addition, remove the oil from the recuperator and the trail tank.

DESTRUCTION

11. The authority for ordering the destruction of equipment and supplies is vested in divisional and higher commanders who may delegate it to subordinate commanders.

REPORTING

12. Reporting of the destruction of equipment and supplies will be through command channels.

PROCEDURE

13. **Ammunition.** If time permits, fire all ammunition at Charge 7, saving two rounds of HE. If time does not permit, lay out the charge bags in a straight line and ignite them from an upwind position. Ensure that all personnel are safe from flames.

14. **The gun.** To destroy the gun, place an HE projectile in the muzzle and load with HE. Fire the gun from behind cover by means of a long length of rope or wire attached to the firing lever. If time permits, drain the oil prior to firing. This will increase the damage done when the gun is fired.

ANNEX B CONSTRUCTION OF GUN PITS

REFERENCE

1. This annex is to be read in conjunction with the applicable engineer pamphlet on demolitions.

BASIC DIMENSIONS

2. The basic dimensions of a gun pit, giving arcs of fire for the top traverse are shown at Figure B-1. To increase the arc of fire by a further 200 mils on either side, the rear wall of the pit can be widened a further 4 feet on either side. For a 6400 mil traverse, the gun pit has a 17 foot radius.

METHOD OF CONSTRUCTION

3. The procedure may be varied and certain items omitted, depending on the nature of the ground and time available. The recommended sequence is as follows:

- a. **Marking.** Mark the perimeter of the pit on the ground. For night digging it shall be marked with white tape.
- b. **Removing the sod.** Remove the sod from the area inside the perimeter, leaving a strip around the edge of the pit approximately 2 feet wide. This strip acts as a guide during excavation and in the construction of the sandbag wall. Stack the sod grass to grass, earth to earth outside the perimeter. Remove top soil and pile it against the sod.
- c. **Preparations for Revetment.** Insert short pickets approximately 4 feet outside the perimeter, and attach eight strands of revetment wire to each picket. Lay the wire on the ground and allow a 1 foot overlap at the pit wall. One short picket and wire are required for each 2 feet of revetment. This distance may be increased to 3

feet if firm revetment material, such as corrugated iron sheeting or planks, is to be used.

d. **Digging and sandbagging:**

(1) Digging and sandbagging is to proceed concurrently. During digging, keep all soil within the perimeter. Lay the first, third, fifth, etc., courses of sandbags as leaders with the neck away from the centre of the pit. Lay the second, fourth, sixth, etc., courses of sandbags as stretchers, i.e., lengthways along the wall, with the side seam away from the centre of the pit.

(2) Sandbags are filled three-quarters full. The corners are tucked in when laid and the sandbag beaten flat with a shovel or pick handle. Do not break the bond when laying stretchers. On completion of digging and sandbagging, spread the soil evenly against the sandbags as shown in Figure B-1.

e. **Sodding.** Spread the soil over the banks and the tops of the sandbag walls and cover with sod.

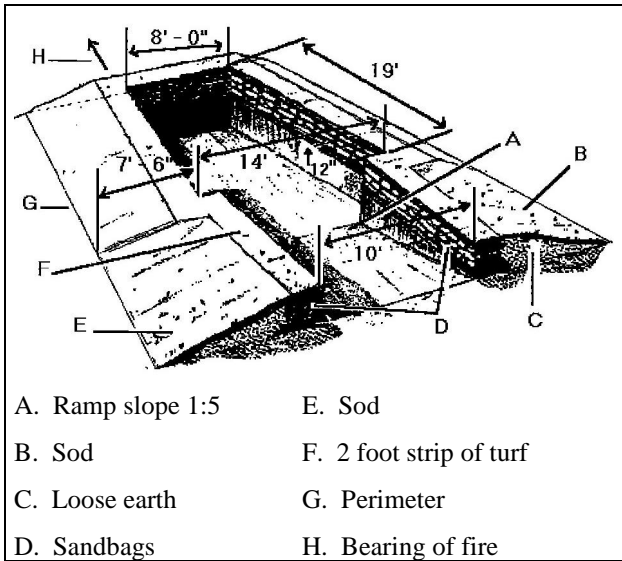


Figure B-1: Gun Pit Construction

- f. **Revetment.** Before starting revetment check the measurements of the pit then proceed as follows:
- (1) **Preliminary Revetment.** Carry out revetting which cannot be done once the pit is occupied.
 - (2) **Final Revetment.** Providing the ground is not unduly soft, final revetment may be carried out after occupation of the pit.
 - (3) **Windlassing.** Attach the revetment wires to the retaining pickets. Windlass the wires at the perimeter by inserting and twisting a stick or 6 inch nail between the wires. Drive the short pickets below ground and bury the revetment wires.
- g. **Drainage.** Drainage must be considered during the reconnaissance and construction of a gun pit and It shall be completed as early as possible.

Annex B

Construction of Gun Pits

- h. **Shelters.** Shelters for ammunition and for the detachment shall be dug close to the gun pit and connected to the pit by slit trenches.

ANNEX C
THE GPO'S INITIAL SEQUENCE OF ORDERS

1. The table at Figure C-1 shows the orders in a GPO's initial sequence of orders. The underlined orders must always be included. It is the duty of No 1 to call attention to any omission by using the word "VERIFY" coupled with the order concerned. For example, "VERIFY BEARING".

Ser	GPO's Orders
1	<u>WARNING ORDER</u>
2	TYPE OF ENGAGEMENT
3	TRAJECTORY
4	<u>AMMUNITION</u>
5	LOAD (Note a.)
6	CONVERGE (Note b.)
7	<u>BEARING</u>
8	QUADRANT LAYING
9	GUN CORRECTION (Note b.)
10	FUSE CORRECTION (Note b.)
11	FUSE SETTING (Note b.)
12	AT MY COMMAND
13	<u>ELEVATION</u>
14	<u>METHOD OF ADJUSTMENT or ORDER FOR FIRE FOR EFFECT</u>
15	DESCRIPTION OF TARGET

Figure C-1: The GPO's Initial Sequence of Orders

2. **Notes:**

Annex C

The GPO's Initial Sequence of Orders

- a. The order "LOAD" may be given at any time after a complete ammunition order has been sent.

- b. When the manual system is in use at the CP, a converge or a gun correction may be issued to the guns. Convergence or gun correction cannot be applied on the sighting system. No 1 will have to mathematically apply this data unless the CP has done the calculation. In this case, it would not be sent.

ANNEX D FIRE PLANS

GENERAL

1. This annex contains information about fire plans for the guidance of No 1.
2. A fire plan is one or more fire missions conducted on a timed programme.

PREPARATION OF AMMUNITION

3. All ammunition to be used shall, if possible, be prepared before the fire plan starts as there will be little time for preparing charges or setting fuzes during the plan.
4. Ammunition shall be stacked in groups by serials and charges shall be prepared, checked, and marked. Mixed lots shall be fired whenever possible on predicted serials of a fire plan.

SIGHT TESTING

5. **Sight tests are carried out as follows:**
 - a. bore sight and elevation tests if possible, otherwise the quick sight test before the fire plan begins; and
 - b. quick sight test during rest periods when firing a long fire plan.

TIMINGS

6. **General.** The first round of any serial is fired at the time given for the beginning of the serial. The last round is fired not later than the time given

for the end of the serial. Any rounds which have not been fired by the time ordered for the end of the serial must lapse.

7. Control of timings:

- a. The order “FIRE” will normally be given by the GPO for the opening round.
- b. Timings are best controlled by the GPO rather than by No 1. This is done by voice, the GPO ordering “LAY ON SERIAL__” and “SERIAL __, FIRE” at the appropriate time.
- c. If it is necessary to remain on a serial for longer than the time shown, the GPO will order “SERIAL __, ROUNDS FIRE FOR EFFECT, __ SECONDS”. The guns continue to engage the serial named until further orders.
- d. Timings may be controlled by No 1, taking his timings from the initial order “FIRE” by the GPO.
- e. The GPO will always brief No 1s on the method of control.

DUTIES OF NO 1

8. After the last round fired in any serial, No 1 orders the bearing (if altered), fuze setting (if necessary), and elevation for the next serial.
9. No 1 orders his detachment to rest and to resume at the times ordered.
10. No 1 ensures that the gun is laid at the current bearing and elevation while resting except when carrying out the quick sight test.
11. No 1 ensures that maintenance is carried out as detailed in C-71-333-000/MB-000, *Operator’s Manual, Gun, 105mm LG1 Mk II*.

GUN PROGRAMME

12. A specimen No 1's Gun Programme is shown at Figure D-1. Bearing and gun corrections may be incorporated in the bearing and elevation as shown in the specimen. Total ammunition required for any one fire plan may be shown in a convenient space on the form.

Annex D
Fire Plans

a	b	c	d	e	f	g	h	j	k	m	n	p
Ser	Time		Type of engagement	Ammo	Charge	Bearing	Site	AMC	Fuze	Elevation	Method of fire	Remarks
	from	to										
1	H	+8		HE M 582	5	2684	0		22.2	378	8 rds FFE 60	
2	+10	+14		HE M 739	5	2521	0		---	394	4 rds FFE 60	
3	+15	+18		HE M739	5	2535	0		---	412	3 rds FFE 60	
4	On call			HE M739	5	2617	0	YES	---	317	4 rds FFE	
5	On call			HE M739	5	2728	0	YES	---	360	4 rds FFE	

Figure D-1: Specimen No 1's Gun Programme

ANNEX E ARTILLERY SALUTES

GENERAL

1. The authorization for the firing of artillery salutes is detailed in orders issued by NDHQ. This annex deals only with the preparation and conduct of the mission.

PRECAUTIONS

2. When firing blank ammunition, the following precautions must be observed:

- a. No officer, NCO, or gunner who has not been trained in gun drill may command a section or form part of a gun detachment.
- b. No gun will be reloaded within 15 seconds after firing.
- c. No 1 will examine the chamber and ensure that any debris is removed before ordering load. A wet rag shall be available at each gun for this purpose.

PREPARATIONS

3. When the firing of an artillery salute has been ordered, the GPO shall ensure that the following preparations are completed 30 minutes before saluting time:

- a. The guns are ready on the saluting base.
- b. The ammunition, including spare rounds, has been examined and issued to the guns.
- c. All ammunition has been chambered and oversize rounds withdrawn from the guns.

Annex E
Artillery Salutes

- d. All members of the detachment are familiar with the drill for a misfire when firing blank ammunition.

4. The GPO shall appoint the following assistants and ensure that each is familiar with his duties:

- a. A deputy to supervise any action required at a gun owing to a misfire or a jammed cartridge. The deputy will note the time of a misfire and indicate to the GPO and No 1 when the breech may be opened. The deputy will order the redistribution of ammunition when required.
- b. A timer to time the interval between rounds and to indicate to GPO each time a round should be fired.
- c. A counter to check off each round as it is fired and to inform the GPO when the last round of the salute has been fired.

MISFIRES

5. When a misfire occurs with blank ammunition, the breech shall not be opened until 30 minutes have elapsed. Therefore, the gun will be out of action for the remainder of the salute. The remaining ammunition must be redistributed to the other guns on the orders of the GPO or the deputy.

6. The timer will make no attempt to make up for lost time but will start the interval from the time the next gun actually fires.

DRILL FOR MISFIRES

7. If the gun fails to fire on the first attempt, the firing number will immediately fire again.

8. If the gun fails to fire on the second attempt, No 1 will report “NUMBER __ MISFIRE”.

9. The GPO will immediately order that gun to check firing and the next gun to fire. For example, “NUMBER 2, CHECK FIRING, NUMBER 3 FIRE”.

10. The detachment of the gun concerned will remain at their positions in action until the salute has been completed, except to redistribute ammunition as ordered by the GPO or the deputy.

11. After 30 minutes have elapsed, and on order from the GPO or the deputy, No 1 of the gun concerned will order “UNLOAD” and accept the round from the breech.

12. The round will be examined by the GPO or the deputy. If the primer has been struck, the round will be placed in a container clearly labelled “MISFIRE” for return to the issuing unit. No attempt will be made to destroy the contents of the cartridge case.

13. If the primer has not been struck, the round will be returned to the issuing unit along with spare ammunition.

DRILL FOR JAMMED CARTRIDGES

14. When a cartridge becomes jammed during loading, the following drill will be carried out:

- a. No 1 will immediately report “NUMBER __ OUT OF ACTION”;
- b. the GPO will then order that gun to check firing and the next in turn to fire;
- c. No 1 will make every effort to remove the jammed cartridge, remedy the cause of jamming, and load;
- d. when the gun is loaded, No 1 will report “NUMBER __ READY” to the GPO or the deputy; and
- e. on the report of “READY”, the GPO may either order that gun to cancel check firing and include it in the orders to

fire, or have the remaining ammunition redistributed among the other guns.

FIRE DISCIPLINE

15. Due to the nature of the fire mission and the number of rounds to be fired, a slight departure from the recognized fire discipline is required. A sequence of orders is shown in the table at Figure E-1.

16. The interval between rounds is normally 10 to 15 seconds but shall be the same throughout the mission.

17. Two guns must be ready to fire as each round is ordered, thus No 1 of each gun must ensure that the gun is loaded and ready when the preceding gun is ordered to fire.

Ser	Orders	Remarks
(1)	(2)	(3)
1	FIRE MISSION FOUR GUNS	----
2	ROYAL SALUTE	----
3	21 ROUNDS BLANK	----
4	BEARING	----
5	GUN CORRECTION	----
6	ELEVATION	----
7	LOAD	----
8	REST	----
9	CANCEL REST	Just before dignitaries arrive.
10	AT MY COMMAND	----
11	NUMBER 1, FIRE NUMBER 2, FIRE	Given at the appropriate time. The GPO retains control until the salute is complete.

Ser	Orders	Remarks
	NUMBER 3, FIRE NUMBER 4, FIRE	
12	UNLOAD	After last round fired
13	END OF MISSION	-----

Figure E-1: The GPO's Sequence of Orders for a Royal Salute

ANNEX F OPEN ACTIONS AND SNIPING GUNS

OPEN ACTION

1. Open actions are used to engage targets which are visible from the gun position, or targets that the battery may encounter while on the move. The GPO may order direct or indirect fire and will select the highest possible charge to be used.
2. Since speed is essential, the guns are not laid in their C of A by the normal method. If indirect fire is to be used, the GPO may:
 - a. Select an unmistakable reference point from which he will measure the angle to the target using the hand method (see Figure 2-5) or, if time permits, a compass or director (see methods of orientation below). The GPO is not restricted to any method of orientation but the method used shall be understood by all No 1s.
 - b. Convert the range to the target in an elevation and give his initial sequence of orders (see the table at Figure F-1).
3. If No 1 has any difficulty in identifying the reference point, No 1 will double to the GPO who will indicate the reference point and order the bearing to the reference point.
4. Alterations to bearings may be ordered as “RIGHT” or “LEFT” provided no confusion can arise.

DRILL

5. On the order “FIRE MISSION __ GUNS (number of guns to engage) OPEN ACTION”, guns are brought into action in the normal manner.
 - a. On the order “REFERENCE POINT (Description), BEARING__”, for example, “REFERENCE POINT

CHURCH TOWER, BEARING 0123”, No 1 will ensure the main scale and slipping scale are set to zero.

- b. No 3 sets the bearing ordered on the slipping scale of the dial sight.
- c. No 1 checks the setting and orders “TAKE POST TO LAY” if necessary.
- d. No 3 directs the movement of the trails until the gun is roughly laid on the reference point, then signals “TAKE POST”.
- e. No 3 will lay the gun accurately using the reference point as a GAP.
- f. Subsequent bearings may be ordered as “BEARING RIGHT (or LEFT)” or as a new bearing.

Ser	GPO's Orders	Action
1	FIRE MISSION FOUR GUNS (or NUMBER), OPEN ACTION, HE QUICK, CHARGE 7	Guns are brought into action as indicated.
2	REFERENCE POINT, CHURCH TOWER, BEARING	On the order “REFERENCE POINT”, No 1 will ensure that the main and slipping scales are set to zero. The bearing ordered is then set on the slipping scale and the guns are laid using the reference point as a GAP. C of A is not recorded.
3	ELEVATION __, NUMBER __ ADJUST FIRE	Guns are laid in the normal manner.
4	BEARING __, BEARING RIGHT __, or BEARING LEFT	Alterations to bearing may be ordered as right or left provided no confusion can arise.

Figure F-1: The GPO's Initial Sequence of Orders for an Open Action Sniping Gun

6. Introduction. A special procedure using a single gun is sometimes used to destroy small targets by direct or close indirect fire, e.g., pillboxes, road blocks, fortified observation posts (OPs), or anti-tank guns.

7. Great accuracy is required. This implies that:

- a. a large calibre gun firing at a high charge is preferable;
- b. the gun, preferably self-propelled, shall be deployed as close to the target as possible since the vertical probable error increases rapidly with increase in range, thereby decreasing accuracy; and
- c. very accurate laying is required and may be achieved by the gunner's quadrant, thus permitting corrections of one tenth of a mil for elevation.

8. Deliberate preparations are required for the occupation of the position, the engagement of the target, and the withdrawal of the gun.

9. The fire mission is conducted by normal indirect fire methods due to the danger of the target becoming obscured. The detachment may be accompanied by an officer or NCO for observation of fire or an OP party may be tasked for this role. No 1 must be prepared to carry out the observation of fire task in the event that an observer is not available.

10. **Procedure (preparations for the task).** When ordered by the artillery commander authorized to order the movement of guns, the GPO/observer and detachment commander shall ensure that they:

- a. know the task, route and rendez-vous;
- b. know the originator of the task;
- c. know with whom to effect liaison on arrival;
- d. have the necessary stores for the completion of the task, i.e., binoculars, prismatic compass, graphic firing tables,

or firing tables, the correct type and amount of ammunition, radios or telephones, map, protractor, etc.;

- e. have instructions on where to report or whom to contact on completion of the task;
- f. brief the detachment on all aspects of the operation;
- g. deploy and orient the gun;
- h. order the initial sequence of orders to the gun, excluding “ADJUST FIRE”; and
- i. occupy an OP if required.

11. During the mission:

- a. corrections to bearing and elevations will be ordered by the observer in mils, following the normal rules for adjustment of fire, i.e., correct for line, then bracket for range (see B-GL-306-003/FP-001, *Duties of the Battery Commander and the Observer*);
- b. adjustment is carried out until a target round is attained;
- c. fire for effect is ordered with any necessary corrections; and
- d. confirmation is obtained from the originator of the task that the mission has been completed to his satisfaction and then the mission is ended.

12. On completion of the task, No 1 shall:

- a. withdraw by the selected route;
- b. return to the selected rendez-vous; and
- c. carry out any further orders received.

13. Detailed duties of No 1. On arrival at the rendez-vous, No 1 will:

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Open Actions and Sniping Guns

- a. order No 7 to “PREPARE FOR ACTION” (No 3 will set the main and slipping scales to 0 mils);
- b. report to the originator of the task to determine;
 - (1) the target location and description;
 - (2) the gun area; and
 - (3) restrictions, if any;
- c. conduct a detailed reconnaissance of the area allotted and select:
 - (1) a suitable gun platform and mark it;
 - (2) the route IN and OUT;
 - (3) a suitable GAP (care must be taken to ensure that the GAP will not become obscured by the gun or by smoke during firing);
 - (4) the method of orienting the gun (see methods of orientation below);
 - (5) the bearing and range to the target; and
 - (6) a position from which to observe the target (the position should be forward and upwind of the gun);
- d. on completion of the reconnaissance, return to the rendezvous and brief the detachment on the operation;
- e. accompanied by the driver and No 3, return to gun platform and show the driver the IN and OUT route and the gun platform;
- f. show No 3 the target, GAP, and brief on the method of orientation. No 1 will leave No 3 at the gun platform to

observe the target and return with the driver to the rendezvous;

- g. deploy and orient the gun;
- h. order the initial sequence of orders to the detachment, excluding the order “ADJUST FIRE” (see the table at Figure F-1). Charge 7 is the normal charge used in the sniping role;
- i. if no observer is available, occupy the OP and when ready to observe, order “ADJUST FIRE” (see para 10); and
- j. complete the task.

ORIENTATION METHODS

14. No 1 is not restricted to any method of orientation. Many options are available, two of which are:

- a. the reference point method; and
- b. the aiming point method.

15. **The reference point method.** When using this method the following must be considered:

- a. prior, the slipping scale, the main scale and the micrometer must have been zeroed;
- b. the angle to the reference point will be applied on the slipping scale and micrometer;
- c. the gun will not be recorded; and
- d. alterations to bearings may be ordered as RIGHT or LEFT provided no confusion can arise.

16. **To determine the angle to a reference point.** No 1 takes up a position at or near the gun marker and using a compass or the hand method

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Open Actions and Sniping Guns

(see Figure 2-5) determines the angle between the target and the reference point.

- a. **If the reference point is to the left of the target.** To calculate: target - reference point = the angle; which is the bearing ordered to the gun.

(1) **Example 1:**

Bearing to target 5850 mils
Bearing to the Reference Point 3640 mils
Determine the angle: $5850 - 3640 = 2210$
The bearing ordered to the gun is
2210 mils.

(2) **Example 2:**

Bearing to target 0750 mils
Bearing to the Reference Point 5900 mils
Determine the angle:
 $0750 + 6400 - 5900 = 1250$
The bearing ordered to the gun is
1250 mils.

- b. **If the reference point is to the right of the target.** To calculate: $6400 - (\text{Reference Point} - \text{Target}) = \text{angle}$ which is the bearing ordered to the gun.

(1) **Example 1:**

Bearing to target 5850 mils
Bearing to the Reference Point 1250 mils
Determine the angle:
 $1250 + 6400 - 5850 = 1800$
Subtract the angle from
 $6400 - 1800 = 4600$
The bearing ordered to the gun is
4600 mils.

(2) **Example 2:**

Bearing to target 0740 mils
Bearing to the Reference Point 3300 mils
Determine the angle: $3300 - 0740 = 2560$

Subtract the angle from
 $6400 - 2560 = 3750$
The bearing ordered to the gun is
3750 mils.

17. **The aiming point method.** When using this method the following must be considered:

- a. No requirement to zero the scales.
- b. The order to the gun is “AIMING POINT (description), (angle), RECORDED AT ___”.
- c. The angle to the aiming point will be applied on the main scale then the gun is recorded at the bearing ordered (see para 26.d in Chapter 2).

18. **To determine the angle to an aiming point.** No 1 takes up a position at or near the gun marker and, using a compass, determines the bearing to the target and the bearing to the aiming point, or the angle between the target and the aiming point using the hands method (Figure 2-5).

- a. **Using bearings.** To calculate the angle to the aiming point: BEARING OF THE AIMING POINT (+ 6400 if necessary) - BEARING OF THE TARGET = ANGLE TO THE AIMING POINT.

(1) **Example.** (see Figure F-2). With the prismatic compass No 1 has determined the following:

Bearing to target 2400 mils

Bearing to the Aiming Point 6260 mils

Determine the angle: $6260 - 2400 = 3860$

The angle ordered to the gun is 3860 mils.

- b. **With an angle.** Using hands or protractor, determine the angle between the target and the aiming point. If the aiming point is on the left of the target, the angle found is subtracted from 6400. If the aiming point is on the right

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of the target, the angle found is the angle to the aiming point.

- (1) **Example.** (see Figure F-3). Using the hand (Figure 2-5), No 1 has determined an angle of 2400 mils between the target and the aiming point. In this example, the aiming point is on the left of the target.

No 1 will then subtract the angle found from 6400 mils: $6400 - 2400 = 4000$. The angle ordered to the gun is 4000 mils.

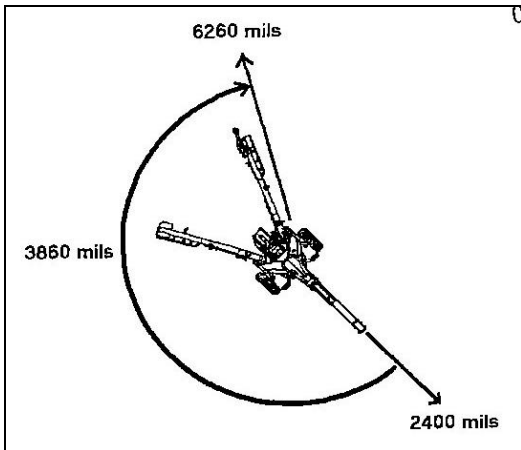


Figure F-2: Aiming Point Method from Bearings

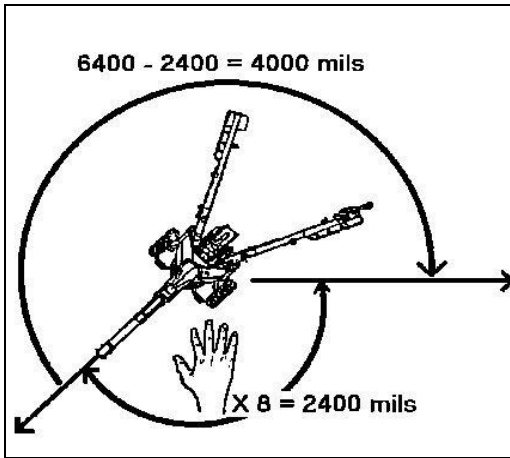


Figure F-3: Aiming Point Method from an Angle

GENERAL

19. For both methods, reference point and aiming point, if the bearing to the target is determined from the map, then the compass bearing to the reference point or aiming point must be converted to a grid bearing before proceeding to find the angle between the target and the reference point/aiming point.

20. The range to the target will be determined from the map and verified by estimation, then converted to an elevation using the appropriate firing table (see table at Figure F-4).

21. No 1 is not restricted to the reference point method of orientation.

Bearing (/,m)	Range (M)	Elevation (/,m)	
	200	4	
	400	9	
	600	13	
	800	18	
	1000	23	

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Open Actions and Sniping Guns

Bearing (/m)	Range (M)	Elevation (/m)	
	1200	28	
	1400	33	
	1600	38	
	1800	44	
	2000	50	
	2200	56	
	2400	63	
	2600	69	
	2800	76	
	3000	84	
	3200	91	
	3400	99	
	3600	107	
	3800	116	
	4000	124	

Figure F-4: Range/Elevation Table for Charge 7

ANNEX G INFINITY AIMING REFERENCE

COLLIMATOR M1A1

1. The collimator is an optical instrument used for indirect laying of artillery equipment by establishing an optical reference from which bearings can be measured. It consists of a tripod with telescoping hinged legs, a mount base, and a yoke sub-assembly which houses the bearing and elevation controls. The bearing clamping knob is at the top of the yoke. The elevation yoke allows the collimator to be adjusted plus or minus 853 mils in the vertical plane (see Figure G-1)

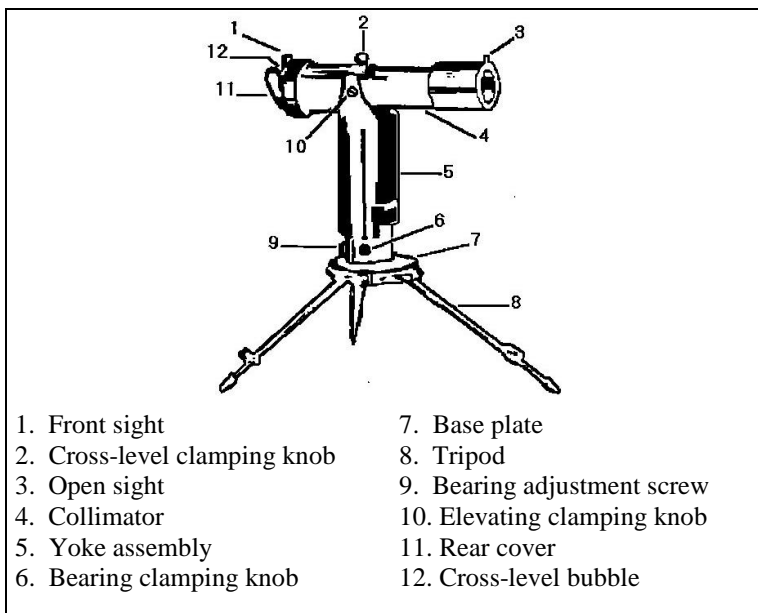


Figure G-1: Collimator M1A1

2. The collimator assembly consists of an optical system, a mechanical housing, and a built-in self-luminous tritium light source. The reticle pattern is a bearing reference scale repeated at vertical intervals, forming a grid in the field of view. The reticle pattern is cross-levelled using the cross-levelling bubble and the collimator is locked in the level position by

means of the clamping knob. Open sights on the collimator permit alignment between the collimator and the dial sight.

3. When not in use, the optical system is protected by a fibreglass reinforced plastic cover. The cover is attached to the collimator by three snap locks. A strap restrains the tripod legs when folded.
4. When the gun has been laid in the C of A, the collimator is placed from 10 to 15 metres to the left front or left rear of the dial sight at an angle approximately 5900 mils for left front and 3700 mils for left rear from the left tire (see Figure G-2).

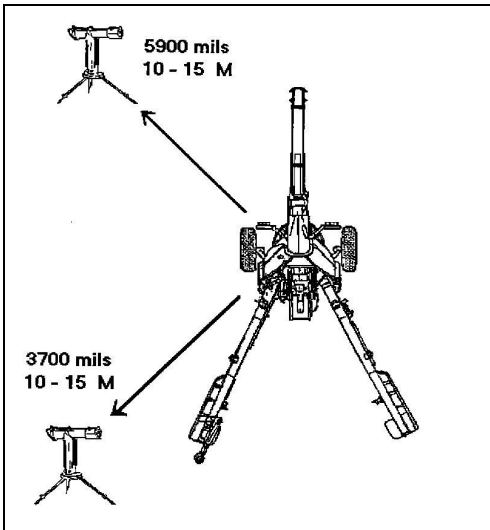


Figure G-2: Collimator Placement

SETTING UP THE COLLIMATOR

5. **Drill:**
 - a. Unfasten the strap on the instrument cover. Fold down the legs, extend as required, and plant them firmly in the ground. Unfasten the latches between the cover and collimator base and remove the cover.

- b. The collimator shall be as level as possible, approximately 1 metre high.
- c. Centre the bearing adjustment screw, loosen the elevation and bearing clamps. Sight through the front and rear sights until the optical system is lined on the dial sight.
- d. Release the collimator clamping knob and level the cross-level bubble; tighten the clamping knob. The reticle pattern is now cross-levelled.
- e. The MIA1 collimator is fitted with a rear cover which must be opened for daylight operation. The cover can be rotated to reflect maximum light through the rear of the collimator. For night operation, the cover is left in the closed position.

RECORDING CENTRE OF ARC

6. Drill:

- a. On the order “RECORD AT__”, No 1 orders “COLLIMATOR LEFT FRONT (REAR)”. No 4 sets up the collimator.
- b. No 4 centres the bearing adjustment screw and roughly levels the collimator and by means of the front and rear sight, aligns it on the dial sight.
- c. No 3, with his hand extended, signals No 4 to move the collimator left or right as indicated by the direction of his palm.
- d. No 4, using the bearing adjustment screw, slowly moves the collimator in the direction indicated. When the zero line of the V pattern appears in the centre of the dial sight (Figure G-3), No 3 signals clamp by making a fist.

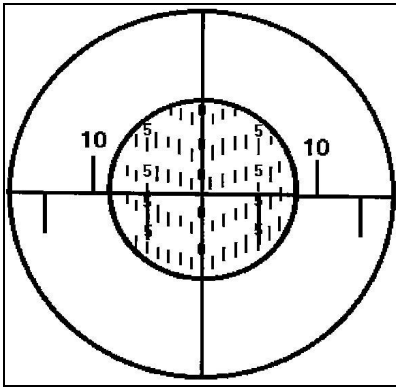


Figure G-3: Initial Alignment

- e. No 4 clamps the collimator and returns to the gun. No 1 checks the lay and proceeds with the recording drill.

LAYING

7. The numbers shown in the reticle pattern are in increments of 5 mils. Individual mils are marked by short vertical lines in the “V” pattern. This “V” pattern indicates left or right displacement of the weapon. To correct for displacement, No 3 sights on the collimator and matches the reticle of the dial sight with the reticle of the collimator.

8. For example, if No 3 sees 10 to 15 in the collimator and the reticle slopes upward from right to left, which indicates a right displacement, he matches the left portion of the dial sight reticle with the collimator reticle pattern as shown in Figure G-4.

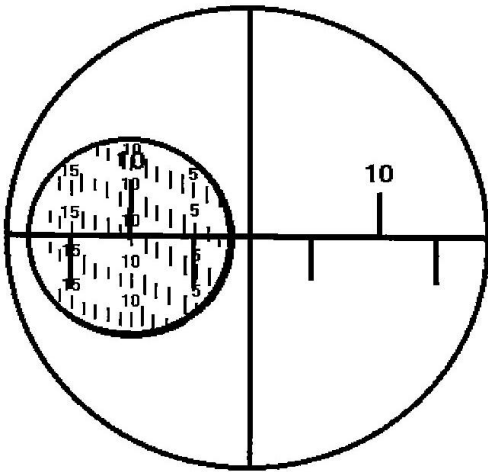


Figure G-4: Right Displacement

**ANNEX H
FIRST AID TREATMENT FOR WHITE
PHOSPHORUS BURNS**

GENERAL

1. White phosphorus coming in contact with the skin will cause severe and painful burns. Every person handling or storing white phosphorus ammunition shall be familiar with the emergency first aid treatment of white phosphorus burns.
2. Wherever there is a possibility of white phosphorus burns, the unit shall be equipped with the following first aid supplies:
 - a. buckets/jerry cans of water;
 - b. suitable eye wash bottles or fountains;
 - c. asbestos gloves (mittens, cloth, asbestos NSN 8415-21-104-2107); and
 - d. gauze pads, etc.

FIRST AID TREATMENT

3. The first aid treatment for white phosphorus burns is as follows:
 - a. Move the patient from immediate area and remove contaminated clothing and footwear.

WARNING

Do not use oils, grease dressings, tannic acid, or other preparations. White phosphorus is soluble in oils and could be absorbed more readily and cause serious systemic phosphore poisoning.

- b. White phosphorus burning on the skin shall be extinguished by immediate submergence of the affected part in water and by covering the involved area with a dressing kept completely and continuously wet.
 - c. If white phosphorus is splashed into the eyes, wash the eyes with copious quantities of water for at least 15 minutes and apply a wet pad. This pad must be kept wet or burning will resume.
 - d. After neutralization and/or removal of all loose particles of white phosphorus, the treatment is the same as for a thermal burn. General principles of patient management apply, especially for any extensive burns.
4. Embedded visible pieces of phosphorus shall be removed surgically and it is important that any person burnt by phosphorus be taken to the nearest medical facility immediately upon completion of this first aid.

Note: As long as unoxidized phosphorus remains embedded in the skin, the contaminated area must be kept submerged in water.

ANNEX I
RADIATION AND POISONING HAZARDS OF INSTRUMENTS
USING RADIOACTIVE LIGHT SOURCES

GENERAL

1. Certain types of instrument lights contain a radioactive gas. The gas is sealed in a zinc-coated glass container which, if broken, presents two potential hazards:

- a. radiation from the released gas; and
- b. poisoning from the coated glass splinters.

2. Gun detachment and mortar crews shall be particularly alert to these hazards.

3. Instruments using radioactive light sources include:

NATO Stock Number	Nomenclature
1290-99-960-84-8743	Light, Aiming Post, Tri-Lux Orange L2A1
1290-99-960-84-8742	Light, Aiming Post, Tri-Lux Green L1A1
1290-21-851-8522	Set of one each of the above
1290-21-857-1743	Aiming Circle C2
1240-00-332-1870	M1A1 Collimator
1240-99-254-7946	Dial Sight
1240-99-915-4048	Carrier Sight Lightweight MK2
1240-99-840-2140	Direct Fire Telescope

Figure I-1: Instruments using radioactive light sources
(Note: this list is incomplete)

SAFETY PRECAUTIONS

4. The radiation hazard from one broken glass container is negligible unless the released gas, which disperses quickly, is inhaled. If a container is broken in a confined space, such as vehicle, the space should immediately be evacuated by all personnel and thoroughly aired.

5. Glass fragments from the broken container shall be disposed of in the following manner:

- a. The contaminated area shall be wiped with a damp cloth to collect the glass fragments. Gloves must be worn to protect the hands.
- b. The cloth and fragments shall be placed in a suitable container, such as a metal can or plastic bag, and disposed of as normal waste.
- c. Hands shall then be thoroughly washed with soap and water.

6. Any cuts or abrasions caused by the glass fragments must be washed with soap under running water to wash out any foreign matter. The casualty shall then be referred immediately to the nearest medical officer even though the injury might normally be regarded as trivial.

ANNEX J
105 MM LG1 MK II - INSPECTIONS
AND PREVENTIVE MAINTENANCE

INSPECTION CHECKLIST

CFR: _____

BF = Before firing DF = During firing AF = After firing

Assembly	Checks/ Operation	Frequencies				Remarks
		BF	DF	AF	200 hrs	
Recoiling mass	Oil firing mechanism slightly, together with breech block housing and the percussion block	X	X	X		
	Check tightness of barrel/sleigh coupling nuts and locking washer	X		X		Every 300 Rds
	Check condition sleigh/cradle coupling linings	X		X		Every 100 Rds
	Check recuperator oil level	X	X	X		Every 300 rds
	Check buffer oil level	X	X	X		Every 300 rds
	Visually check oil leakage at the recuperator for piston buffer and replenisher	X	X	X		Every 300 rds

Assembly	Checks/ Operation	Frequencies				Remarks
		BF	DF	AF	200 hrs	
Recoiling mass (cont'd)	Check cradle for correct coupling	X		X		
	Clean and grease lightly the cradle slide	X	X	X		
	Check cleanliness of barrel, chamber and bore	X	X	X		
	Check operation of firing mechanism	X	X	X		
	Manually check opening and closing of the breech	X	X	X		
	Check condition of the breech block stop	X	X	X		
	Check locking in "ROAD" state of the breech block	X		X		
	Lightly oil the bore and chamber	X	X	X		
	If to be stored for long period, grease bore and chamber			X		

Annex J
 105 MM LG1 MK II-Inspections
 and Preventive Maintenance

Assembly	Checks/ Operation	Frequencies				Remarks
		BF	DF	AF	200 hrs	
Recoiling mass (cont'd)	Check that there are no traces of oxidation or any damage to barrel and chamber	X		X		
	Visually inspect firing pin	X		X		
	Check tightness of muzzle brake and muzzle brake key	X		X		Every 100 rds
Running components	Check tire pressure (26 to 28 PSI)	X		X		
	Check parking brake	X		X		
	Check safety cable	X		X	X	
Lights	Check light attachments and operation	X		X		
Non-running chassis	Check that there is no leakage from the trail opening and closing system, check oil level trail closed	X		X		
	Check trail lock	X		X		
	Check and oil (if necessary) handbrake mechanism and trail lock	X		X	X	

Assembly	Checks/ Operation	Frequencies				Remarks
		BF	DF	AF	200 hrs	
Non-running chassis (cont'd)	Check cleanliness of trail open lock	X		X		
	Check platform coupling	X		X		
Sights	Check sight alignment	X		X		

Figure J-2: Inspection Checklist

OIL CHANGE AND LUBRICATION FREQUENCIES

Items	What to do	Frequency	Products	Remarks
Trail hydraulic opening & closing system	Level and top up if necessary	Weekly or prior to use	C-635 MIL-H-6083	
	Change oil and change seals	5 years		
Barrel bore/ Chamber	Clean bore and chamber	After firing, after cleaning	Break-Free MIL-L-63460	
	Grease if gun is to be stored for long periods	During and after firing, after cleaning	G-403 (GAA)	
Cradle	Grease lightly	Before and after firing, monthly	G-403 (GAA)	Grease more heavily if gun to be stored for long periods

Annex J
 105 MM LG1 MK II-Inspections
 and Preventive Maintenance

Items	What to do	Frequency	Products	Remarks
Firing mechanism	Oil lightly	Before, during, after firing and monthly	Break Free MIL-L-63460	
Handbrake	Oil lightly	Every 50 hrs	Break Free MIL-L-63460	
Close-trail lock	Grease	Every 50 hrs	G-403 (GAA)	

Figure J-3: Oil Change and Lubrication Schedule

GREASING POINTS

Components	No of points	Frequency
Tow bar	2	Grease with G-403 every six months or after three months of active use or after an intensive firing period. PRECAUTION: Operate the RH and LH clamps and RH and LH trail open latch to eliminate excess grease. Clean with clean rags.
Top/bottom carriage link	2	
Left-hand/right-hand trunnions	2	
Traversing control unit	3	
Elevating control	2	
Left/right hand clamping device	2	
Suspension cylinder attaching ball joint/suspension cylinder	6	
Left/right trail latch	2	
Platform latch	2	
Trail hinges	2	
Brake cable	1	
Recoil cam	1	
Trail lock	1	
Breech opening cam	1	

FigureJ-4: Greasing Points

Annex J
105 MM LG1 MK II-Inspections
and Preventive Maintenance

<u>Remarks:</u>		

Name

Date

ANNEX K NUMBER OF AUTHORIZED ROUNDS ACCORDING TO BARREL TEMPERATURE

GENERAL

1. The temperature of the barrel will increase during firing and will dictate the number of authorized rounds.
2. Two types of temperature must be controlled at the tube level (see Figure K-1):
 - a. **T1.** The temperature at the level of the chamber, i.e., the part of the tube filled with propulsive charge (chamber).
 - b. **T2.** The temperature of the tube at the level of the shell, i.e., part of the tube containing the projectile.

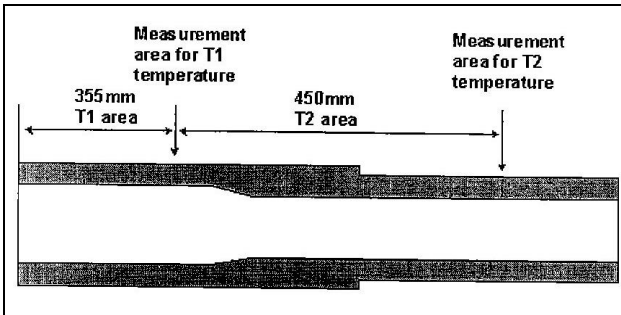


Figure K-1: T1 and T2 Areas

PROCEDURE

3. Take T1 and T2 temperatures in the zones described in Figure K-1 at least 5 minutes after the last round has been fired.
4. In Figure K-2, using the temperature at T1, note the corresponding value in the appropriate column (peace or war) according to the ammunition in use.

Annex K
 Number of Authorized Rounds
 According to Barrel Temperature

5. In Figure K-3, using the temperature at T2, note the corresponding value in the appropriate column (peace or war) according to the ammunition in use.

Temperature T1 EC	Danger of cook-off - charge Number of authorized rounds			
	105 HE M1 Ch7		HE 105 LP G1	
	Peace	War	Peace	War
-40	122	133	88	96
-30	117	128	84	92
-20	111	122	80	88
-10	106	117	76	84
0	100	111	72	80
10	94	106	68	76
20	89	100	64	72
30	83	94	60	68
40	78	89	56	64
50	72	83	52	60
60	67	78	48	56
70	61	72	44	52
80	56	67	40	48
90	50	61	36	44
100	44	56	32	40
110	39	50	28	36
120	33	44	24	32
130	28	39	20	28
140	22	33	16	24
150	17	28	12	20
160	11	22	8	16
170	6	17	4	12
180	0	11	0	8
190		6		4
200		0		0

Annex K
 Number of Authorized Rounds
 According to Barrel Temperature

Figure K-2: Number of authorized rounds according to T1

Temperature T2 EC	Danger of cook-off - round Number of authorized rounds			
	105 HE M1 Ch 7		HE 105 LP G1	
	Peace	War	Peace	War
-40	86	97	56	63
-30	83	94	54	61
-20	80	91	52	59
-10	77	89	50	57
0	74	86	48	56
10	71	83	46	54
20	69	80	44	52
30	66	77	43	50
40	63	74	41	48
50	60	71	39	46
60	57	69	37	44
70	54	66	35	43
80	51	63	33	41
90	49	60	31	39
100	46	57	30	37
110	43	54	28	35
120	40	51	26	33
130	37	49	24	31
140	34	46	22	30
150	31	43	20	28
160	29	40	19	26
170	26	37	17	24
180	23	34	15	22
190	20	31	13	20
200	17	29	11	19
210	14	26	9	17
220	11	23	7	15
230	9	20	6	13
240	6	17	4	11
250	3	14	2	9
260	0	11	0	7
270	0	9	0	6
280	0	6	0	4
290	0	3	0	2
300	0	0	0	0

Figure K-3: Number of authorized rounds according to T2

6. The lowest value found between the tables is the one to use for the number of authorized rounds.
7. The number of authorized rounds is valid whatever the rate of fire (up to a maximum of 12 rounds per minute) and with a maximum delay of 2 minutes between the loading and firing of each round.
8. **Example 1:**

Ammunition HE M1: T1 = 90EC

Peace Time: T2 = 110EC

Using Figure K-2, go to 90EC (T1), find 50 rounds. Using Figure K-3, go to 110EC (T2), find 43 rounds. The lowest value is 43, the number of authorized rounds is 43. In this example the gun is authorized to fire 43 rounds in 4 minutes, i.e., 12 rounds per minute for 3 minutes (36 rounds) then 7 rounds in the next minute: $36 + 7 = 43$.

9. **Example 2:**

Ammunition HE M1: T1 = 105EC

Peace Time: T2 = 123EC

Using Figure K-2, go to 110EC (T1), find 39 rounds. Using Figure K-3, go to 130EC (T2), find 37 rounds. The lowest value is 37. The number of authorized rounds is thus 37. In this example the gun is authorized to fire 37 rounds in 4 minutes, i.e., 12 rounds per minute for 3 minutes (36 rounds), then one round in the next minute: $36 + 1 = 37$.

10. **Example 3:**

Ammunition HE M1: T1 = 180EC

Peace Time: T2 = 220EC

Using Figure K-2, go to 180EC (T1), find 0 rounds. Using Figure K-3, go at 220EC (T2), find 11 rounds. The lowest value is 0. The number of authorized rounds is thus 0. In this example the gun is “hot”, there is risk of

Annex K
Number of Authorized Rounds
According to Barrel Temperature

cook-off from the charge if the projectile remains more than 10 minutes in the tube.

11. If the firing must continue after having reached the number of authorized rounds, repeat steps 3 to 7 above.

12. If the delay between rounds fired exceeds 2 minutes, re-do steps 3 to 7 above.