



National  
Defence

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nationale

**B-GL-385-016/PT-001**

**WEAPONS**

**VOLUME 16**

**60 mm MORTAR M19 CDN**

**(ENGLISH)**

**(Supersedes B-GL-317-010/PT-001, 1976-02-23.)**

**WARNING**

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**Issued on the authority of the Chief of the Land Staff**

**Canada**





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**Issued on the authority of the Chief of the Land Staff**

**OPI: Infantry School  
Advanced Small Arms Cell**

**2000-04-30**

**Canada**



## FOREWORD

1. B-GL-385-016/PT-001, *Weapons, 60 mm Mortar M19 CDN* is issued on the authority of the Chief of the Land Staff.
2. It is effective upon receipt and supersedes B-GL-317-010/PT-001, *Weapons, 60 mm Mortar M19 CDN*.
3. Unless otherwise noted, masculine pronouns contained herein refer to both genders.
4. Suggestions for changes shall be forwarded through normal channels to The Infantry School, Attention: C Stds O.

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## **WEAPON SECURITY**

The security of small arms and small arms ammunition is your responsibility. Ensure your weapon(s) and ammunition are secured/protected in accordance with current orders and instructions.

### **WARNING: MISUSE OF WEAPONS, AMMUNITION, AND EXPLOSIVES**

#### **PURPOSE**

1. This order outlines Canadian Forces Policy governing the use or misuse of weapons, ammunition, and explosives.

#### **WEAPONS**

2. Firing or attempting to fire locally manufactured weapons, obsolete service or foreign weapons, or weapons used for display, ceremonial or trophy purposes in museums, messes, parade grounds, armouries or such like areas is prohibited except when specifically authorized by NDHQ.

3. Attention is also drawn to the following references, which concern offences connected with the use or misuse of weapons:

- a. National Defence Act, Section 117;
- b. Criminal Code of Canada, Sections 82 to 106; and
- c. QR & O 103.59.

## **AMMUNITION AND EXPLOSIVES**

4. Tampering with or use of service and commercial ammunition or explosives for other than their designated purpose is prohibited.

5. Except as prescribed in paragraph 6, the modification, breakdown or sectioning of live ammunition for experimental, instructional or any other purpose, or manufacture of explosives is forbidden. This prohibition includes:

- a. unauthorized interchange of fuzes or primers or both;
- b. experiments with blank ammunition to alter the powder charge or to introduce any other substance into the cartridge case or into the weapon with the approved cartridge;
- c. experiments involving the use of altered propelling charges or bursting charges with ammunition of any type;
- d. the use of any non-service or obsolete ammunition;
- e. the use of foreign ammunition other than that received through normal supply channels or supplied in accordance with NATO Standardization Agreements;
- f. the manufacture and use of locally fabricated explosive training devices, battle simulators, saluting charges, etc.;
- g. any alteration to the design of ammunition or explosive device;
- h. deviations from authorized drills for use of ammunition or explosive devices; and
- i. rendering live ammunition inert for use as museum or instructional items.



6. The prohibition stated in paragraph 5 does not apply to:
- a. authorized experiments, modifications, etc., carried out by experimental, research, proof or inspection establishments;
  - b. authorized breakdown, modification, repairs, proof-testing, etc., carried out as normal functions of a Canadian Forces ammunition depot or base ammunition facility;
  - c. personnel employed at the Canadian Forces School of Aerospace and Ordnance Engineering as instructors or trainees under supervision, when breaking down is carried out as part of a course training standard and in accordance with approved course training plan;
  - d. the use for its designed role of commercial pattern ammunition, which is obtained by local purchase as specified in CFP 137 or as authorized by NDHQ in accordance with CFAO 36-19;
  - e. the use for designed role of commercial pattern ammunition that is taken into service and catalogued;
  - f. hand-loading small arms ammunition in accordance with CFAO 50-18; or
  - g. other cases, when specifically authorized by NDHQ.



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## **CHAPTER 1 DESCRIPTION AND CHARACTERISTICS**

### **SECTION 1 AIM AND SCOPE**

#### **AIM**

1. The aim of this publication is to provide direction for the employment of the light 60 mm mortar as the primary means of indirect close support.

#### **SCOPE**

2. The 60 mm mortar M19 Cdn is a weapon that provides infantry units with intimate direct and indirect fire support. All infantrymen must be trained in the use of the 60 mm mortar in the handheld role. The weapon detachment personnel must know how to use it in the bipod role.

#### **FORMAT**

3. The information in Chapters 1, 2, 3 and 5 is presented in the form of lesson plans.

4. Chapter 4 contains information pertinent to the use of the 25 mm mortar training device.

## SECTION 2 LESSON PLANS

### LESSON 1—SAFETY PRECAUTIONS, CHARACTERISTICS AND DESCRIPTION, STRIPPING AND ASSEMBLING

#### INSTRUCTOR'S NOTES

5. **Aim.** To teach:
  - a. safety precautions;
  - b. characteristics;
  - c. general description;
  - d. stripping and assembling; and
  - e. care and cleaning.
6. **Time Required.** Three 40 minute periods.
7. **Method.** Lecture/Demonstration.
8. **Stores:**
  - a. 60 mm mortar (one per two students; one per instructor);
  - b. four tables; and
  - c. four blankets.
9. **Preparation.** Set up tables around the instructor's table with one mortar per table.
10. **Miscellaneous.** Explain and demonstrate the safety precautions.

**CONDUCT OF THE LESSON**

11. **Preliminaries.**

12. **Review.** Nil.

13. **Introduction.** The 60 mm mortar is an extremely simple weapon. It is loaded by inserting a complete round into the muzzle and allowing it to slide down to the base of the barrel. It is capable of either drop or lever fire. This weapon provides an integral fire support for the infantry platoon.

14. **Safety Precautions:**

- a. remove the muzzle cover;
- b. cup the left hand around the muzzle and carefully tip the mortar, so that the projectile or fouling will slide out into the left hand (if applicable);
- c. check down the barrel to ensure it is clear;
- d. replace the muzzle cover; and
- e. ensure that:
  - (1) no live projectiles are present during dry training; and
  - (2) no dummy projectiles are present during live practices.

15. **Confirm by Questions and Practice.**

16. **Characteristics.** The characteristics of the 60 mm mortar are:

- a. smooth bore, muzzle-loading, high trajectory weapon;
- b. a range from 100 to 2816 m with M1 mount;

60mm Mortar M19 Cdn

- c. can fire High Explosive (HE), Smoke (SMK) and Illuminating (ILLUM) rounds; and
- d. can be carried by one man.

17. **General Data:**

a. **Weight:**

- (1) mortar complete—7.7 kg,
- (2) barrel—5.8 kg, and
- (3) M1 baseplate—1.9 kg.

b. **Overall Length**—72.6 cm.

c. **Rate of Fire.** The rate of fire is dependent on the skill of the firer. The accepted rates are:

- (1) normal—8 rounds per mortar per minute (RP mor (P/M));
- (2) rapid—12 RP mor (P/M); and
- (3) maximum—30 RP mor (P/M).

**NOTE**

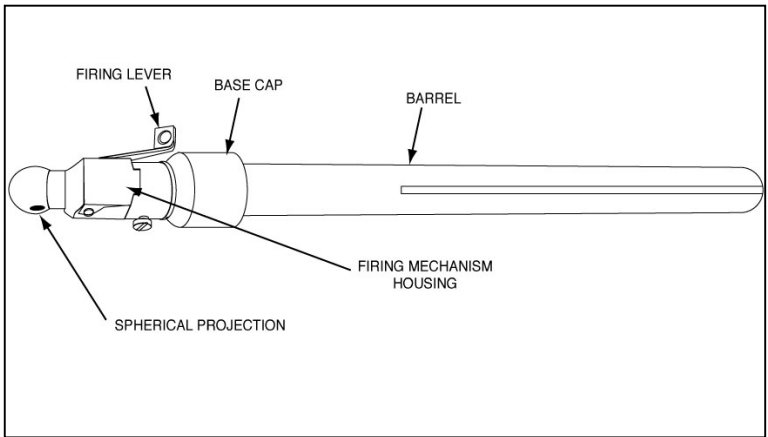
Firing at the maximum rate for longer than one minute will cause gas leakages around the base cap. This should be avoided.

18. **Confirm by Questions.**

19. **Description of the Mortar** (explain):

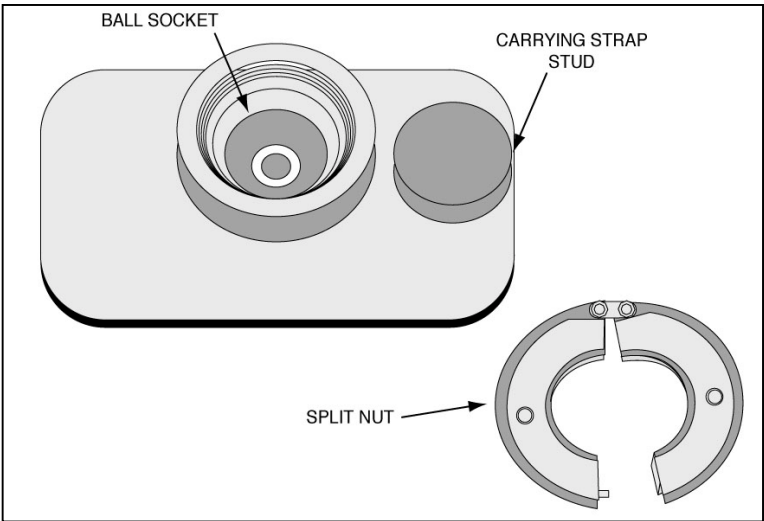
- a. **Barrel.** The barrel is smooth-bored and carefully finished in its interior dimensions and surfaces. The base cap is hollowed and threaded to screw on to the

barrel, thereby closing the breech end. The firing mechanism housing is attached to the base cap by a threaded adapter. The spherical projection which locks into the socket of the baseplate is a prolongation of the firing mechanism housing. The firing mechanism consists mainly of a firing pin, firing pin striker, firing spring, striker pawl, trigger, and firing lever. A firing selector, which acts as a cam on the rear end of the firing pin striker, permits the mortar to be drop fired or fired with the firing lever (Figure 1-1).



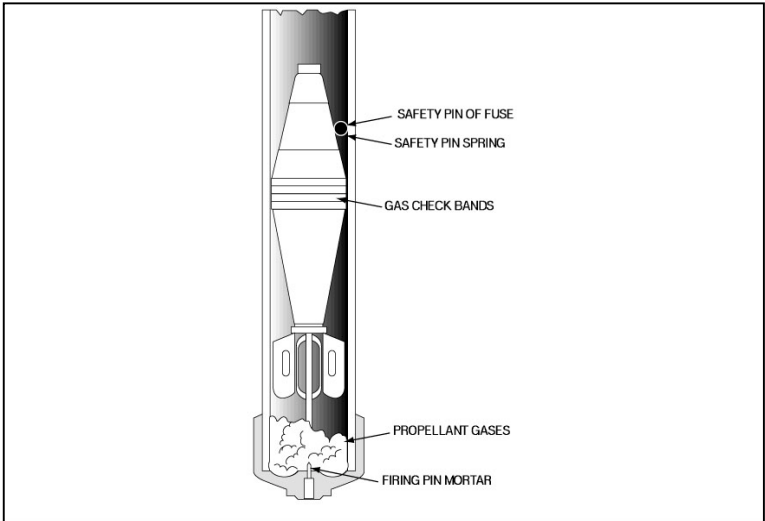
**Figure 1-1: Mortar Barrel Assembly**

- b. **M1 Baseplate.** The M1 baseplate is a curved metal base with a ball socket shaped to receive the spherical projection. Part of the ball socket consists of a split nut that fits around the spherical projection and then screws into the socket on the baseplate, to hold the spherical projection secure. One end of a carrying strap can be fastened to a stud located on the baseplate, and the other end of the strap is permanently attached to the muzzle cover (Figure 1-2).



**Figure 1-2: M1 Baseplate**

- c. **Principles of Operation.** The mortar is fired by inserting a complete round, fins first, into the muzzle. The elevation of the barrel allows the round to slide toward the base of the barrel. When the firing selector is set to **DROP FIRE**, the primer of the ignition cartridge strikes the firing pin located inside the base cap as the round reaches the base. The flame from the exploding cartridge ignites the propelling charge, and the gas pressure produced from the burning propellant drives the round up and out of the barrel, thus arming the fuze. When fired, the round carries the fired ignition cartridge case with it. The mortar is then ready for the next round. When the firing selector is set on **LEVER FIRE**, the lever is tripped to allow the firing pin to strike and to ignite the ignition cartridge after the round has come to rest against the base cap (Figure 1-3).



**Figure 1-3: Principles of Operation**

- d. **Function of the Firing Mechanism.** The moving parts of the firing mechanism are enclosed within, or attached to, the combination base cap and firing mechanism assembly. An exploded view of the parts is shown in Figure 1-4. The firing pin is contained in the firing mechanism adapter. When the firing selector is set to LEVER FIRE, it is held in a retracted position by the retracting spring at all times except when the striker exerts pressure on the rear end of the firing pin. This pressure causes it to protrude 1.3 mm beyond the surface of the firing pin bushing. As pressure is applied to the lever arm, the tripper forces the striker to the rear against the action of the firing spring until the cam surfaces become disengaged from the striker groove. The striker is released and shoots forward to strike the firing pin, which, in turn, strikes the primer, firing the round. When the firing selector is set at DROP FIRE, the cam surface of the selector acts directly on the rear of the striker, forcing it forward and holding it against the rear end of the firing pin. This causes the firing pin to remain extended 1.3 mm beyond the surface of the firing pin bushing, as shown in

Figure 1-3, causing the primer to be fired immediately upon reaching the base of the tube.

20. **Confirm by Questions.**

21. **Stripping and Assembling** (explain and demonstrate):

- a. Conduct normal safety precautions.
- b. Stripping the mortar (field stripping). To field strip the mortar with the M1 baseplate, the procedure is as follows:
  - (1) unscrew the split nut from the baseplate;
  - (2) remove the baseplate and split nut from spherical projection;
  - (3) remove the barrel from the baseplate;
  - (4) remove the locking screw from the firing mechanism housing; and
  - (5) unscrew the housing in a counter-clockwise direction.
- c. The mortar is assembled in the reverse order. Ensure that the baseplate is in the correct position, and that the split nut is securely screwed to the baseplate.
- d. **Stripping the Firing Mechanism** (Detail Stripping). To strip the firing mechanism (Figure 1-4), proceed as follows:
  - (1) remove the locking screw from the firing mechanism housing;
  - (2) unscrew the complete firing mechanism housing assembly from the base cap in a counter-clockwise direction;



- (3) remove the firing pin striker, firing spring, and firing spring stop;
- (4) rotate the firing selector so the back portion faces the pin;
- (5) remove the housing cover pin by pushing it out to the right;
- (6) push in the selector plunger and remove the housing cover, firing selector, selector plunger and spring, firing lever, trigger, and firing lever spring and sleeve;
- (7) take up the barrel at the base cap end, and remove the housing adapter from the base cap by screwing it in a clockwise direction and allowing it to slide out the muzzle end of the barrel;

### **CAUTION**

Do not unscrew the base cap from the tube.

- (8) remove the firing pin assembly from the housing adapter by turning the firing pin bushing in a counter-clockwise direction; and
- (9) remove the stop washer and retracting spring from the firing pin lock by pressing the firing pin lock against the action of the retraction spring until the lock slides out through the lock recess.

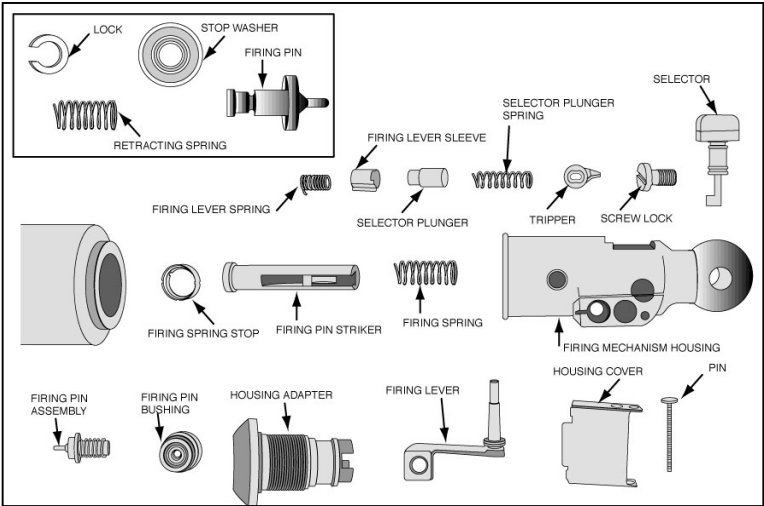
e. **Reassembling the Firing Mechanism:**

- (1) Place the stop washer and retracting spring on the rear shank of the firing pin and lock into place with the firing pin lock.
- (2) Place the firing pin assembly in the mushroom end of the housing adapter and secure the assembly by replacing the firing pin bushing. Set the bushing securely with the wrench provided for that purpose.
- (3) Replace the housing adapter in the base cap by sliding it down the barrel until the slotted collar protrudes from the base cap. Screw it firmly into place in a counter-clockwise direction.
- (4) Pick up the firing mechanism housing in the left hand with the raised square surface up and the spherical projection to the rear; replace the firing lever spring and sleeve in the upper forward hole in the right side of the housing.
- (5) Hold the trigger in the right hand with the point to the front and the flat cam surface up. Position it in the rectangular slot in the flat surface of the housing by placing the pointed cam in first. Keep it pointed toward the front of the firing lever in the hole on the left with the lever arm up and to the front. Set the firing lever spring sleeve flush with the surface of the housing.
- (6) Replace the selector plunger and spring in the rear upper hole and the firing selector in the lower hole on the right side of the housing.
- (7) Replace the housing cover and pin. The pin is drifted in from right to left. Press the

selector plunger in flush with the housing surface while replacing the housing cover.

- (8) Place the firing spring and spring stop on the striker. The spring stop sleeve must protrude beyond the face of the striker.
- (9) Place the striker in the housing with the groove in line with the trigger.
- (10) Set the firing selector to LEVER FIRE, and screw the complete mechanism housing assembly securely to the housing adapter in a clockwise direction.
- (11) Test the firing mechanism by tripping the firing lever. If it functions properly, replace the screw lock in the right side of the housing. If it does not function properly, the mortar must be stripped and reassembled properly.

22. **Confirm by Questions and Practice.**



**Figure 1-4: The Firing Mechanism**

23. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

24. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** It is very important that all mortar crews know how to handle the mortar safely and know how to strip and assemble the mortar in order to properly maintain it.
- c. The next lesson will be...

## LESSON 2—CARE AND CLEANING

### INSTRUCTOR'S NOTES

25. **Aim.** To teach:
- daily cleaning;
  - cleaning before firing;
  - care and cleaning in cold climate;
  - care and cleaning in tropical climate; and
  - care and cleaning in hot/dry climate.
26. **Time Required.** One 40 minute period.
27. **Method.** Lecture/Demonstration.
28. **Stores:**
- 60 mm mortar (one per two students; one per instructor);
  - table; and
  - cleaning materials.
29. **Preparation:**
- set up table;
  - field strip the mortar; and
  - arrange class so all students can see stripped weapon on table.
30. **Miscellaneous.**

## CONDUCT OF THE LESSON

31. **Preliminaries.**

32. **Stripping and Assembling.**

33. **Introduction.** Care and cleaning (explain and demonstrate). The 60 mm mortar is a reliable weapon which provides infantry units with intimate direct and indirect fire support. The care and cleaning of the mortar, its stores, and equipment is therefore a vital duty of the mortar crew. The mortar is more likely to become unserviceable through lack of maintenance than through prolonged use.

34. **Daily Cleaning.** Daily cleaning procedures are as follows:

- a. strip the mortar;
- b. clean the inside of the barrel thoroughly, ensuring that it is free from dust, dirt, and carbon;
- c. use hot water as a bore cleaner, if necessary;
- d. clean the firing pin bushing and ensure the vent is clean;
- e. clean the firing mechanism;
- f. remove all dirt from the baseplate;
- g. apply a light film of oil to all parts of the mortar in order to prevent rust; and
- h. assemble the mortar.

35. **Confirm by Practice.**

36. **Cleaning Before Firing** (explain). To clean before firing, clean the mortar as detailed for daily cleaning. Thoroughly dry the inside of the barrel, the firing mechanism, and the top portion of the base cap.

37. **Care and Cleaning in Cold Climates.** The following procedures must be adhered to when using the mortar in cold climates:

- a. Keep the moving parts of the weapon free of moisture. Lubricants or rust-preventative compounds used in temperate zones solidify in cold climates to the extent that they cause sluggish operation or complete failure.
- b. To winterize the mortar, strip it and remove all old lubricants and rust-preventative compounds. Use Varsol or other dry cleaning solvents to clean all parts. Wipe all parts clean.
- c. To lubricate, use lubricating oil 3CP-335A or graphite.
- d. Before firing a mortar that has been used in deep snow, carefully check the bore to ensure that it is not clogged with snow or other foreign material.
- e. After firing, clean the bore with a solution of rifle bore cleaner and alcohol.
- f. The colder the climate, the less lubricant that is needed to be used, as there is less moisture in the air. In extremely cold climates, the lack of moisture in the air decreases the possibility of the mortar rusting or corroding. However, care must be taken to prevent snow or ice from collecting on the working parts.
- g. Lubricants should not be applied to the bore before operating the mortar in extreme cold. All moving parts and machined surfaces other than the bore should be covered with a fine coating of lubricating oil. After firing, the mortar must be cleaned to make sure that ice and snow has not formed on any of the moving parts. The bore should be cleaned only with dry rags to remove any snow or ice from the bore, particularly around the firing pin.

- h. A heavy condensation forms on the mortar when it is taken from extreme cold into any type of heated shelter. When the mortar is brought indoors, allow at least one hour for the mortar to come to room temperature. Then strip it, wipe it dry of the condensed moisture, clean and oil it thoroughly.
- i. To avoid condensation, either keep the mortar outdoors or store it in a lean-to after firing. However, if the weather changes abruptly by thawing suddenly or raining, use the normal cleaning methods.

38. **Confirm by Questions.**

39. **Care and Cleaning in Tropical Climates.** Where temperature and humidity are high, where salt is present, and during rainy seasons, thoroughly inspect the weapon every day and keep it oiled when not in use. Keep unexposed parts and surfaces clean and oiled. Use temperate lubricating oil for lubrication and ensure that the oil is kept in waterproof containers.

40. **Care and Cleaning in Hot, Dry Climates:**

- a. In hot, dry climates, where sand and dust are likely to get into the mechanism and bore, wipe the weapon clean daily or more often if necessary.
- b. When using the weapon in sandy terrain, wipe off all lubricants. This prevents the sand from sticking to the lubricant and forming an abrasive compound that will ruin the mechanism. Immediately upon leaving sandy terrain, lubricate the weapon again with light preservative lubricating oil.
- c. Frequently wipe the metal parts dry, as sweat from the hands contain acid and causes rust. During sand storms or dust storms, keep the muzzle covered whenever possible.

41. **Confirm by Questions and Practice.**



42. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

43. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** It is very important to keep the mortar clean and operational at all times.
- c. The next lesson will be...



## CHAPTER 2

### MORTAR DRILLS AND TECHNIQUE OF FIRING

#### LESSON 1—MORTAR DRILLS

##### INSTRUCTOR'S NOTES

1. **Aim.** To teach:
  - a. fire positions;
  - b. laying the mortar;
  - c. loading, firing, and unloading the mortar; and
  - d. misfire drills.
2. **Time Required.** Two 40 minute periods.
3. **Method.** Practical.
4. **Stores:**
  - a. 60 mm mortar (one per two students); and
  - b. 60 mm dummy rounds (one per mortar).
5. **Preparation:**
  - a. obtain training aids and necessary equipment;
  - b. prepare classroom; and
  - c. execute normal safety precautions.

##### CONDUCT OF THE LESSON

6. **Preliminaries.** Inspect all weapons and dummy rounds.

7. **Review:**

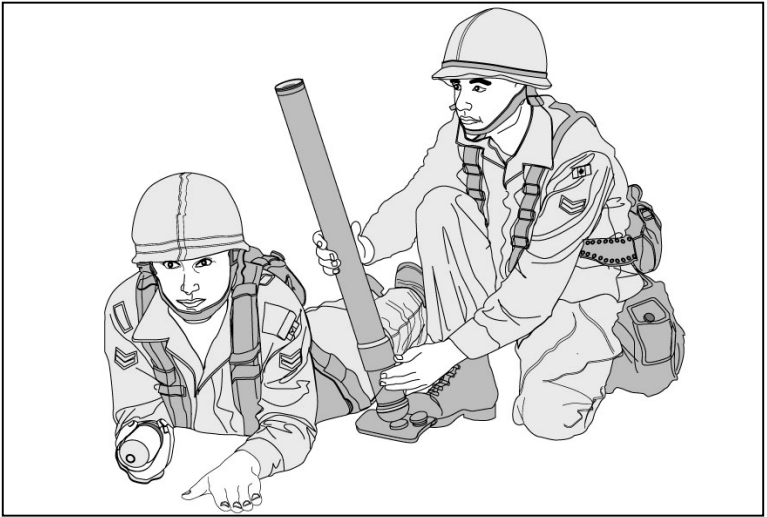
- a. care and cleaning; and
- b. characteristics.

8. **Introduction:**

- a. The 60 mm mortar is the platoon close support direct and indirect fire weapon. The design is simple, and it can be handled easily and fired by one or two men.
- b. A high rate of fire can be maintained when:
  - (1) a No. 2 acts as a loader under the direction of a No. 1; and
  - (2) the No. 1 receives his fire tasks from the platoon commander or the weapons detachment commander.

9. **Fire Positions.** The mortar can be fired from a kneeling, sitting or lying position:

- a. **Kneeling.** To adopt the kneeling position, place the right foot on the baseplate and support the mortar with the right hand approximately halfway up the barrel as shown in Figure 2-1. Ensure the firing lever is on the left and the firing selector is at LEVER FIRE.



**Figure 2-1: Kneeling Position**

- b. **Sitting.** The drill for bringing the mortar into action for the sitting position is the same as for the kneeling position, except that the mortar is placed between the legs as shown in Figure 2-2. Drop fire can be carried out from this position. Low angle fire must not be attempted when in the sitting position.



**Figure 2-2: Sitting Position**

- c. **Lying.** To adopt the lying position, lie directly behind and in line with the mortar barrel, keeping the baseplate clear of the chest as shown in Figure 2-3. Hold the mortar with the right hand approximately halfway up the barrel. Low angle fire must not be used when in the lying position.

**CAUTION**

Low angle fire must not be fired in the sitting and lying position, due to the risks of the baseplate sliding back and striking the firer.



**Figure 2-3: Lying Position**

10. From each of these positions, the firer must seat the baseplate into the ground several times to ensure that s/he has a firm base.
11. **Two Pers Crew.** No. 2 will be in the prone position on the right side of the No. 1. In all positions ammunition will be prepared to the right of No. 2.
12. **Confirm by Practice.**

## **LAYING, LOADING, FIRING, AND UNLOADING THE MORTAR**

13. **Laying the Mortar.** To lay the mortar:
  - a. adopt a firing position;
  - b. hold the mortar firmly with the right hand; and
  - c. with the head directly behind the barrel, align the axis of the barrel on a point of aim.

14. **Loading:**

- a. To load without a No. 2, the No. 1 will:
  - (1) set the firing selector to LEVER FIRE;
  - (2) remove the muzzle cover;
  - (3) remove the safety wire from the fuze;
  - (4) insert the round into the mortar barrel with a sharp thrust to ensure that the round reaches the bottom of the barrel;
  - (5) when the mortar is fired at low angle, the barrel must be raised before loading to ensure that the round will descend to the bottom of the barrel; and
  - (6) grasp the firing lever.
  
- b. To load with a No. 2:
  - (1) the No. 1 will tell the No. 2 how many rounds to prepare;
  - (2) the No. 1 will set the firing selector to the desired position and order **DROP FIRE LOAD** or **LEVER FIRE LOAD**;
  - (3) the No. 2 will:
    - (a) remove the muzzle cover;
    - (b) remove the safety wire from the fuze; and
    - (c) insert the round into the mortar barrel with a sharp thrust; and
  - (4) the No. 1 will order **LOAD** for each subsequent round.



- c. Rapid fire without the use of the bipod is not recommended except in an emergency because of the lack of accuracy. Rapid fire may only be used in the drop fire mode, and the No. 1 must still give the word of command **LOAD** before the insertion of each round.

15. **Firing the Mortar:**

- a. When the firing selector is set to LEVER FIRE, the mortar is fired by operating the firing lever with the left hand. The firer must not look down and he must be careful not to jerk the firing lever, as this will alter the alignment and elevation of the barrel.
- b. After each shot, the firer must re-lay the mortar. The baseplate will bed-in on firing, and it may be necessary to reposition it in order to operate the firing lever. On very soft ground, this repositioning may even be necessary after firing each round.
- c. When the firing selector is set to drop fire, firing occurs automatically as the mortar round reaches the bottom of the barrel.

16. **Unloading:**

- a. to unload the mortar, turn the mortar on its side and tip it so that the projectile slides out into the hands of the loader; and
- b. projectiles which have not been fired and which have been unloaded must have the safety wires and propellant increments replaced before being returned to containers or stores.

17. **Confirm by Practice.**

18. **Misfire Drills:**

- a. Some causes of misfires are:
  - (1) defective primer or ignition cartridge;
  - (2) defective or damaged firing pin or other part of the firing mechanism;
  - (3) loose firing pin bushing;
  - (4) firing pin fouled or obstructed by remnants of previously fired rounds; and
  - (5) fouled bore.
  
- b. The majority of these faults need never occur if the mortar is prepared and fired correctly.
  
- c. The action to be taken by the firer when a misfire occurs is as follows:
  - (1) Jar the barrel with the left hand—taking care not to change the angle or misalign the barrel—then operate the firing lever several times.
  
  - (2) If the shell does not fire, wait one minute, unload as taught, and examine the cap of the ignition cartridge. Then:
    - (a) If the cap has been well struck, replace the safety wire and set the round aside to be dealt with later. Then reload another round and fire.
  
    - (b) If the cap has not been struck, or only lightly struck, replace the safety wire and set the round aside. Remove the firing mechanism housing and clean all

fouling from the firing pin and spring to ensure the firing pin moves freely and protrudes beyond the firing pin bushing. Ensure base cap is fitted correctly. If the firing pin is broken, replace it, assemble, reload using the same round, and fire.

- d. To replace a broken firing pin:
- (1) remove the firing mechanism adapter from the base cap;
  - (2) remove the broken firing pin;
  - (3) replace the retracting spring, stop washer, and spring; and
  - (4) lock on a new firing pin and assemble.

19. **Confirm by Questions and Practice.**

20. **Conclusion:**

- a. questions to and from the class;
- b. test on lesson;
- c. safety precautions; and
- d. pack up.

21. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** It is important that you know and can carry out all mortar drills quickly and correctly to maximize your effectiveness.
- c. The next lesson will be...

## LESSON 2—ADJUSTING FIRE

### INSTRUCTOR'S NOTES

22. **Aim.** To teach:
- angle of fire;
  - correcting fire;
  - tactical employment of smoke; and
  - adjusting fire.
23. **Time Required.** One 40 minute period.
24. **Method.** Lecture.
25. **Stores:**
- chalkboard;
  - overhead projector and slides; and
  - 60 mm mortar (one per two students).
26. **Preparation:**
- obtain training aids; and
  - prepare overhead projector and classroom.

### CONDUCT OF THE LESSON

27. **Review.** Nil.
28. **Introduction.** The technique for firing the mortar and correcting fire is a simple procedure. Complicated procedures must be avoided. The mortar can be fired in either the direct role--where the

firer can observe the target--or in the indirect role--where the firer cannot observe the target.

29. **General—Siting.** In the direct fire role, the mortar should be sited in the open or preferably in a partially defiladed position that will allow the firer to see the target at the same time as giving him cover from view and, if possible, from fire.

30. **Angle of Fire:**

a. **Laying.** Laying is the simple technique of ensuring, prior to firing, that the barrel of the mortar is pointing in the correct direction and is at the correct angle to attain the required range. Because the mortar is handled and fired under conditions that affect the trajectory of the projectile (such as wind and temperature), it would be unrealistic to expect pin-point accuracy. However, with common sense and practice, it is possible for a firer to obtain a high degree of accuracy. Adjustment for line and range is made as follows:

(1) **Line:**

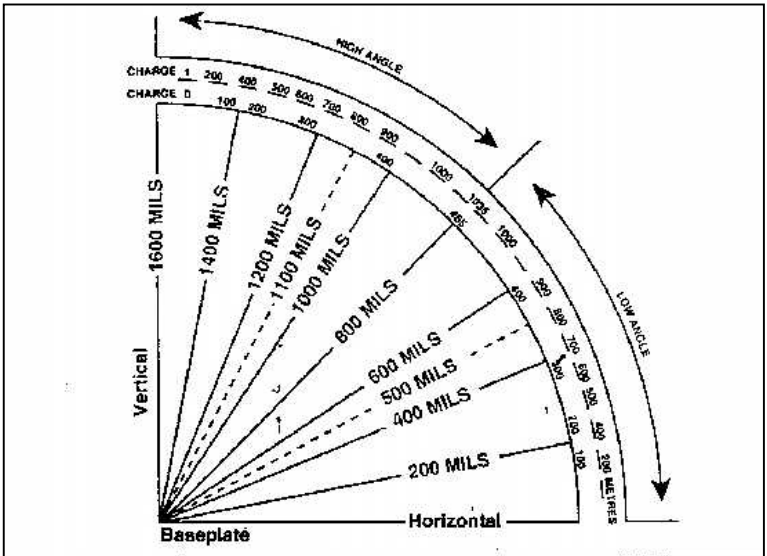
- (a) Lay the mortar on the ground with the muzzle pointing towards the target. Align the mortar, using the muzzle (centre top) as a foresight, so that it is directly in line with the target or point of aim. (Compensating for wind must be considered).
- (b) Check where the edge of the baseplate is in relation to the ground, grasp the mortar, and strike the edge of the baseplate into the ground so that it is bedded at right angles to the target or selected point of aim.

- (c) Adopt the position that is to be used; keeping the baseplate in the correct position, raise the barrel while ensuring that its axis is directly in line with the target or point of aim.

(2) **Range:**

- (a) The mortar can be fired at either high or low angle. Low angle is between the horizontal level and 800 mils (45°). High angle is between 800 mils and vertical. The angles are taken from level ground (this must be taken into consideration when the mortar is fired from sloping ground). With high angle firing, the projectile goes high into the air and descends almost vertically; with low angle firing, the trajectory of the projectile is much flatter:
  - i. low angle is used when possible because the round is less affected by wind and the time of flight is shorter; and
  - ii. high angle is used when there are obstructions such as buildings, trees, or high ground along the flight path, when the enemy is so protected by his position that only a shell falling at a steep angle can be effective, or when crest clearance becomes a problem if firing at low angle.

- (b) Ranges varying from approximately 100m to 1585m (C110) can be obtained by varying the angle of elevation of the mortar. It is not practical to make the fine adjustments of angle necessary to obtain the high degree of accuracy suggested by the firing tables when using the mortar in the handheld role. It is reasonable, however, for the firer to be able to judge the angles shown in Figure 2-4 in order to obtain the ranges indicated. These angles may be obtained by a process of halving: e.g., 800 mils is halfway between the vertical and the horizontal, 400 mils is halfway between 800 mils and the horizontal, and so on.



**Figure 2-4: Mortar Firing Angles (Approximate—for Handheld Role with C110 Ammunition)**

**NOTE**

Exact angles/ranges can be obtained from the firing tables.

- (c) The range will also be affected when the baseplate is on very soft ground or when there is a headwind. In both cases, the projectile will not travel as far for a given barrel angle of elevation. Conversely, the range will increase if there is a tail wind. The factors of wind and ground must be taken into consideration when laying for range.

31. **Confirm by Questions.**

32. **Correcting Fire.** Correction of fire can only be done when the burst of the round can be clearly observed. Normally, corrections for line are given first, followed by corrections for range, although on many occasions both corrections can be made at the same time. The procedure is as follows:

- a. **Line.** Corrections for line are made by simply laying the barrel to the left or right to bring the round onto the selected target or point of aim on the ground.
- b. **Range.** Corrections for range are made by altering the barrel angle. The only point that the firer must be aware of is the difference between high angle and low angle firing. To increase the range when using low angle, raise the barrel towards the 800 mil angle. To increase the range when using high angle fire, lower the barrel towards the 800 mil angle. Since the 800 mil angle represents maximum range, it is a convenient guide to remember that one increases the range by going towards the 800 mil



angle and decreases it by going away from the 800 mil angle.

33. **Unobserved Projectiles.** Projectiles that cannot be observed because they fall behind trees, buildings, or dead ground, etc., present difficult problems to the firer. Bold corrections, either for line or range or both, should be made so that the projectile will fall in an observed area from which corrections can be carried out. If a round fails to explode on impact (dud), another should be fired from the same lay.

34. **Confirm by Questions and Practice.**

35. **Tactical Employment of Smoke.** Smoke can be used effectively to:

- a. conceal the movement of our own troops from an exposed position to a better one or simply to cover movement from one position to another;
- b. screen the advance when no natural cover exists;
- c. thicken or fill gaps in existing screens; and
- d. deceive the enemy as to the direction of our movement, attack, etc.

36. **Use of Smoke.** It has already been mentioned that head or tail winds will affect the range of the projectile and that cross winds can also affect it considerably for line. When laying smoke, the firer must also consider the strength and direction of the wind so that s/he can achieve the best results with as few rounds as possible. When laying smoke on a target, the following should be kept in mind:

- a. **Cross Winds.** The projectiles should fall up-wind of the target and slightly in front of it. As soon as the firer has found his correct point of burst, he should fire sufficient rounds immediately to obtain the necessary density. Thereafter, he must observe the effects of wind changes on the screen and adjust his fire accordingly while feeding the screen. He must not allow the screen to become thin, nor must

the screen be laid in such a way that our own troops, while moving towards enemy positions, become silhouetted against the screen, providing the enemy with easy targets.

- b. **Head Winds and Tail Winds.** When it is necessary to lay a screen during a tail wind, the rounds should fall short of the target area and the screen be allowed to drift towards the position. The screen can be allowed to drift straight onto the position or to drift onto one of the flanks, as required. When dealing with a head wind, the rounds should fall beyond the target area and the screen be allowed to drift towards the position or to one of the flanks. Adjustment in fire may have to be made continuously, based on observed wind changes, in order to properly feed and maintain the screen.

37. **Limitations on the Use of Smoke.** The employment of smoke may be affected by any of the following factors:

- a. **Wind.** When high winds prevail, it will be most difficult to lay an effective smoke screen. When there is no wind whatsoever, a very large number of shells may be required to produce a screen.
- b. **Weight.** The weight of smoke shells will limit the number carried by assault troops. This limitation, in turn, will influence the number, size, and duration of screens that can be laid.
- c. **Supporting Fire.** Aimed or observed supporting fire may have to be discontinued when observation becomes obscured by the screen.

38. **Confirm by Questions.**

39. **Adjusting Fire and Fire For Effect:**

- a. The correction of the mortar for line and elevation to bring the point of burst onto the target is known as adjustment. The fewer the number of shells used for

adjustment, the better. Prolonged adjustment can be wasteful and reduces the effect of surprise. If the firer can land his first projectile on target, the time and ammunition saved can mean the difference between success and failure.

b. When the round strikes the right place on the ground for the first time, the firer must decide whether to continue lever fire or drop fire and how many rounds are to be used. The rate, accuracy, and duration of fire for effect will be further influenced by the following considerations: the amount of ammunition immediately available, the tactical situation, and whether the firer is working alone or has a loader to assist him. The following points should be kept in mind:

- (1) Accurately laid lever fire, with a loader assisting, normally produces the most effective fire.
- (2) If no loader is present, it may take longer to get the bombs on target.
- (3) Drop fire, with the help of a loader, can produce a greater number of bombs on target in a given time than lever fire. Drop fire at a rapid rate will, however, create greater dispersion in the target area, thereby covering a greater area than if lever fire is used.
- (4) Drop fire at a rapid rate without a loader can produce a dispersion of bursts greater than with a loader and in some cases becomes very inaccurate.
- (5) The rate of fire depends on the skill of the mortar team.
- (6) Rounds may have to be delivered during a short span of time or over a long span of

time. In either situation, economy must be exercised by firing the minimum number of rounds necessary to produce the required effect.

40. **Confirm by Questions.**

41. **Indirect Fire:**

- a. **Siting.** Although it is best for the mortar team to fire from a position where the firer can observe the burst of the rounds (direct role), there may be occasions when, because of ground features or the tactical situation, the mortar must be fired in a location from which the firer cannot observe the burst of the rounds. Such a situation is known as indirect fire. When the mortar team has no alternative but to fire in the indirect role, the firer takes up a suitable position and receives directions from an observer who indicates the direction of the target and gives an estimate of the range or the elevation required. The observer uses informal verbal commands or arm and hand signals. In adjusting fire, the observer directs the firer to move the barrel to the left or right and to increase or decrease the range. The firer should make bold movements of the barrel for the initial adjustments, in order to economize on the number of rounds used in ranging. For indirect role using the bipod and the sight unit C2A1 see Chapter 4 of this publication.
- b. **Subsidiary Aiming Marks.** It may be possible to select an object such as a bush, boulder, or chimney beyond the target and use it as an aid for obtaining direction. Such a point of aim is known as a subsidiary aiming mark. Due allowance must be made for wind, if necessary, when using subsidiary aiming marks.
- c. **Auxiliary Aiming Marks.** If subsidiary aiming marks cannot be selected, two or more auxiliary aiming marks can be used. Sticks, stones, or

bayonets are suitable for this purpose. The setting out of these aiming marks is done by crawling out and placing the first mark just below the top of the cover, than moving back towards the mortar and placing the second auxiliary in position so that the two marks line up on the target or the point of aim chosen for wind correction. The mortar can then be aimed at the target by aligning the axis of the bore with the two auxiliary aiming marks. The further apart the mortar and the two aiming marks can be placed, the greater will be the accuracy in laying. It may be possible to use some natural or other object already in place as one of the auxiliaries.

42. **Confirm by Questions and Practice.**

43. **Conclusion:**

- a. questions to and from the class;
- b. test on lesson;
- c. safety precautions; and
- d. pack up.

44. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** It is important that you keep the procedures simple for adjusting and firing so as not to waste time and to be effective in providing support.
- c. The next lesson will be...



## CHAPTER 3 AMMUNITION AND FUZES

### LESSON 1—AMMUNITION AND FUZES CURRENTLY IN USE

#### INSTRUCTOR'S NOTES

1. **Aim.** To teach:
  - a. current High Explosive (HE), Smoke (SMK) and Illuminating (ILLUM) rounds;
  - b. current fuzes; and
  - c. packaging.
2. **Time Required.** Two 40 minute periods.
3. **Method.** Lecture.
4. **Stores:**
  - a. overhead projector with slides;
  - b. dummy rounds (one of each type); and
  - c. one table for display.
5. **Preparation:**
  - a. set up overhead projector; and
  - b. set up table with dummy rounds.
6. **Miscellaneous.** Conduct normal safety precautions.

## CONDUCT OF THE LESSON

7. **Review.** Nil.

8. **Introduction.** Ammunition for the 60 mm mortar is classified as semi-fixed since the propelling charges are in increments that permit adjustment for zone fire. Except for the training sabots, all ammunition is issued in the form of complete fuzed rounds:

- a. Older HE and White Phosphorus (WP) rounds consist of a fuzed projectile with a fin assembly, propelling charge, ignition cartridge, and percussion primer. Newer HE, Red Phosphorus (RP), SMK and ILLUM rounds consist of a fuzed projectile with a tail unit, primary cartridge, and charge increments.
- b. The following cartridge types and model numbers are provided for use by the Canadian Forces (CF):
  - (1) Cartridge, 60 mm, HE, C110;
  - (2) Cartridge, 60 mm, RP-S, C111; and
  - (3) Cartridge, 60 mm, ILLUM, C112.

### WARNING

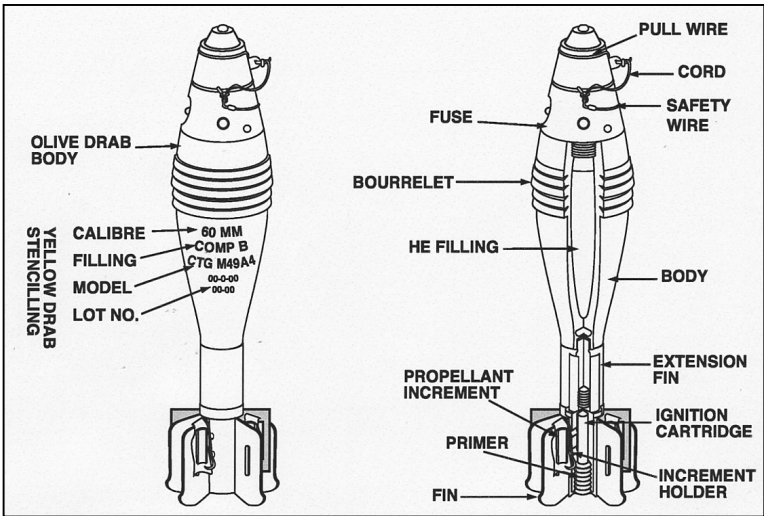
All ammunition mentioned in this publication shall not be fired above Charge 2 in the handheld role during training.

9. **Cartridge, 60 mm, High Explosive (HE), M49A4:**

- a. **General.** This cartridge is a US design provided for fragmentation and blast effect. It is used against light vehicles and personnel in the open and has a maximum range of 1795m, using Charge 4.



- b. **Description.** The complete round is 295 mm long, weighs 1.45 kg, and consists of the following main components (Figure 3-1):
- (1) fuze (PD, M525 or DM 111A2);
  - (2) projectile body and filler;
  - (3) fin extension; and
  - (4) fin assembly.
- c. **Projectile Body.** The projectile body consists of a hollow forged steel or iron casing filled with 190.5 grams of cast Composition B (RD/TNT):
- (1) The body is threaded internally at the nose end to receive the fuze and at the base end to receive the fin extension. A light coat of corrosion preventative compound is applied to both threaded areas.
  - (2) A bourrelet with four annular grooves is machined near the nose end of the body. This acts as the forward bearing surface and as a gas check.
  - (3) The body has the following details stamped into the metal approximately one inch below the bourrelet:
    - (a) lot number;
    - (b) year of manufacture; and
    - (c) calibre and designation of projectile.



**Figure 3-1: Cartridge, 60 mm, HE, M49A4 Fuzed PD, M525**

- d. **Fin Extension.** The fin extension is cylindrical in shape, made of aluminium alloy, and is 60 mm long and 24.6 mm in diameter. The forward end screws into the base of the projectile body. The rear (fin) end of the extension receives the M2 fin.
  
- e. **Fin Assembly.** The fin assembly consists of the following (Figure 3-1):
  - (1) fin, cartridge, 60 mm, M2;
  - (2) holder, propellant increment, M1A1;
  - (3) cartridge, ignition, M5A2;
  - (4) primer, percussion, M32; and
  - (5) charge, propellant increment, M181 (quantity four).
  
- f. **Preparation for Firing.** The following actions are necessary to prepare the HE M49A4 cartridge for firing:

- (1) remove the fuze safety wire (and pull wire, if applicable);
- (2) if DM111A2 fuze is being used, ensure the selector switch on the fuze is aligned vertically with **OV** for super quick action, or horizontally with **MV** for delay action; and
- (3) leave fitted to the tail only those M181 charge increments needed to make up the charge ordered/required.

### CAUTION

If cartridges have been prepared but were not fired, they must be reconditioned to full service charge, and have fuse safety wires replaced before the ammunition is transported.

- g. **Identification.** The projectile body colour is olive drab, with the following details stencilled in yellow on the body:
- (1) calibre—60 mm;
  - (2) type of filling—COMP B;
  - (3) cartridge model number—CTG M49A4;
  - (4) ammunition lot number—MA-25-118; and
  - (5) month and year of filling—2/75.

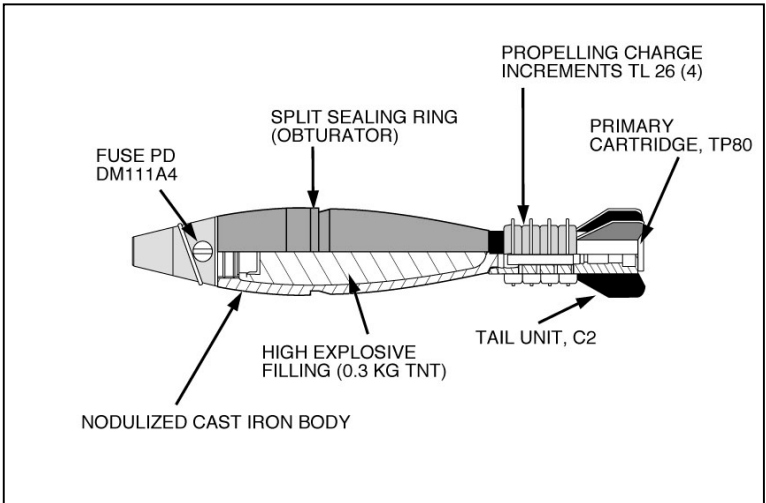
#### 10. **Confirm by Questions.**

#### 11. **Cartridge, 60 mm, High Explosive (HE), C110:**

- a. **General.** Cartridge, 60 mm, HE, C110 was produced for Canada by Hirtenberger AG of Austria and was type classified STANDARD in 1989 for use

against light material targets and personnel in the open. It has a maximum range of 2816 m on Charge 4.

- b. **Description.** The complete round consists of the following main components (Figure 3-2):
- (1) fuze, PD, DM111A4;
  - (2) projectile body and filler;
  - (3) tail unit C2;
  - (4) primary cartridge TP80; and
  - (5) propelling charge increments TLS 84 (quantity four).
- c. **Projectile Body.** The HE C110 projectile body is made of nodulized cast iron and filled with 0.3 kg of TNT. Immediately to the rear of the bourrelet, the body has an external groove to accept a split sealing ring (obturator) made of plastic. This obturator ensures that hot propellant gases are kept to the rear on firing, thereby contributing to ballistic consistency from round to round.



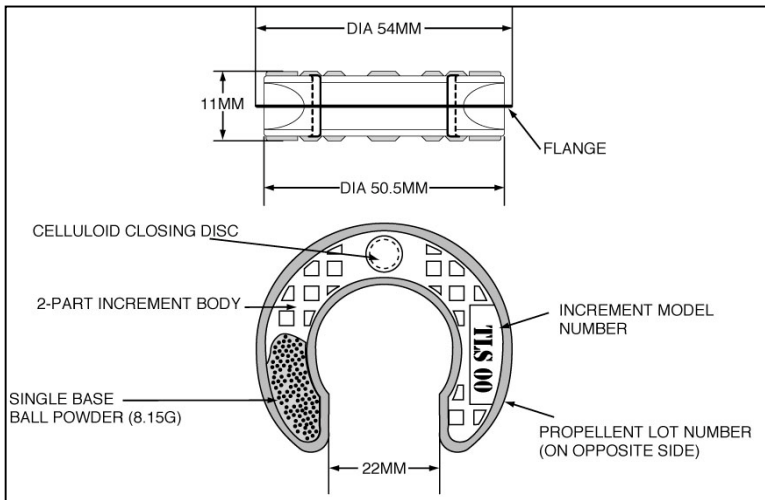
**Figure 3-2: Cartridge, 60 mm, HE, C110—Main Components**

- d. **Tail Unit, C2.** The complete tail unit is made of extruded profile aluminium and is 107 mm long. Both ends of the tail unit are threaded internally to accept the male threads of the projectile body and the primary cartridge TP80. The tail has eight fins for projectile stability.
- e. **Primary Cartridge, TP80.** The various components of this primary cartridge (primer) are made of aluminium alloys. The primary charge is initiated by a priming charge, which, in its turn, is initiated by an anvil-type percussion primer.
- f. **Charge Increment, TLS 84.** The complete round is issued with a full service charge of four equal size TLS 84 increments. Each increment consists of 8.15 grams of SB ball powder, which is housed in a horse-shoe shaped celluloid container (Figure 3-3).
- g. **Preparation for firing.** The following actions are required to prepare the HE C110 cartridge for firing:
- (1) remove the fuze safety wire;

- (2) ensure the selector on the fuze is aligned vertically with **OV** for super quick action or horizontally with **MV** for delay action; and
- (3) leave fitted to the tail only those charge increments needed to make up the charge ordered/required.

### CAUTION

If cartridges have been prepared but were not fired, they must be reconditioned to full service charge, and have the fuse safety wire replaced before the ammunition is transported.



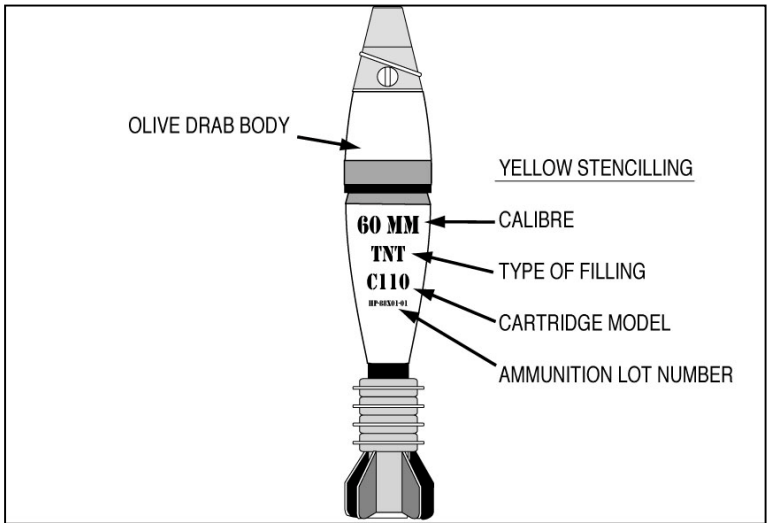
**Figure 3-3: Charge Increment, TLS 84/86**

- h. **Identification.** The basic body colour is olive drab, with the following information stencilled in yellow on the projectile body (Figure 3-4):

- (1) calibre—60 mm;

- (2) type of filling—TNT;
- (3) cartridge model number—C110; and
- (4) ammunition lot number—HP-89B01-01.

## 12. Confirm by Questions.



**Figure 3-4: Identification—Cartridge, 60 mm, HE, C110**

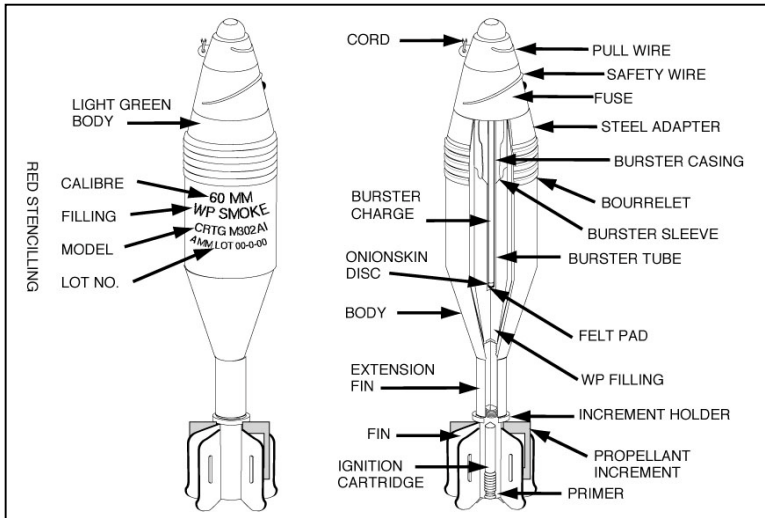
## 13. Cartridge, 60 mm, White Phosphorus (WP) M302A1:

- a. **General.** This cartridge is a US design provided for use as a spotting and screening smoke, with a secondary incendiary effect. It has a maximum range of 1472 m on Charge 4.
- b. **Description.** The complete round is 332 mm long, weighs 1.86 kg, and consists of the following main components (Figure 3-5):
  - (1) fuze, PD, M527B1 or NR 2168;
  - (2) projectile body;

- (3) burster assembly;
- (4) fin extension; and
- (5) fin assembly.

c. **Projectile Body.** The projectile body consists of a thin-walled steel casing with cylindrical side walls and a conical base filled with 300 grams of white phosphorus and 3.2 mm of water:

- (1) The nose of the body is fitted with a steel adapter, which is secured to the body with a 6400 mil braze. The adapter is internally threaded to receive the fuze and provides a tight seal for the filling and the forward end of the burster assembly.



**Figure 3-5: Cartridge, 60 mm, WP M302A1 Fuze, PD, M527B**

- (2) The base end of the body is threaded internally to receive the fin extension. A light coat of corrosion preventative compound is applied to both threaded areas.



- (3) A bourrelet with four annular grooves is machined near the nose end of the body. This acts as the forward bearing surface and as a gas check.
- d. **Burster Assembly.** The burster assembly consists of:
- (1) **M8 Burster Casing.** Constructed of seamless steel tubing 107 mm long and 14.4 mm in diameter. This tube is closed at the bottom and flanged at the top. A steel sleeve is secured by a 6400 mil silver braze to the forward end. An alternative M8 burster casing is constructed in one piece from a deep-drawn stamping of steel. The burster casing is press-fitted into the steel projectile body adapter.
  - (2) **M19 Burster Assembly.** Consists of a steel or aluminium tube 99 mm long and 10 mm in diameter containing 16 grains of pressed RDX pellets. The ends are closed by onion-skin discs secured with adhesive. This assembly fits into the M8 burster casing and rests on a felt pad.
- e. **Fin Extension.** Is the same as found on the HE round M49A4.
- f. **Fin Assembly.** The fin assembly consists of the following:
- (1) fin, cartridge, 60 mm, M2;
  - (2) holder, propellant increment, M1A1;
  - (3) cartridge, ignition, M5A2;
  - (4) primer, percussion, M32; and

- (5) charge, propellant increment, M181 (quantity four).
- g. **Preparation for Firing.** The following actions are necessary to prepare the WP M302A1 cartridge for firing:
- (1) remove the fuze safety wire and pull wire; and
  - (2) leave fitted to the tail only those M181 charge increments needed to make up the charge ordered/required.

### CAUTION

If cartridges have been prepared but were not fired, they must be reconditioned to full service charge, and have the fuze safety wires replaced before the ammunition is transported.

### WARNING

The following conditions may cause significant short ranging effects when firing HE M49A4 and WP M302A1 cartridges:

1. The use of wet ammunition and/or having water in the barrel of the mortar.
2. Firing at temperatures at -18°C or below.

## NOTES

1. Range loss may be especially pronounced when firing HE M49A4 and WP M302A1 cartridges at Charge 0 under the above conditions.
2. Higher than normal dud rates may be encountered with HE M49A4 and WP M302A1 cartridges, which range less than 50 percent of maximum due to insufficient setback forces for fuse arming.

h. **Identification.** The projectile body colour is light green and has a 9.5 mm wide yellow band encircling the body just below the bourrelet. The following details are stencilled in light red on the body:

- (1) calibre—60 mm;
- (2) type of filling—WP SMOKE;
- (3) cartridge model number—CTG M302A1;
- (4) ammunition lot number—PB-1-8 (example); and
- (5) month and year of filling—2/74 (example).

14. **Confirm by Questions.**

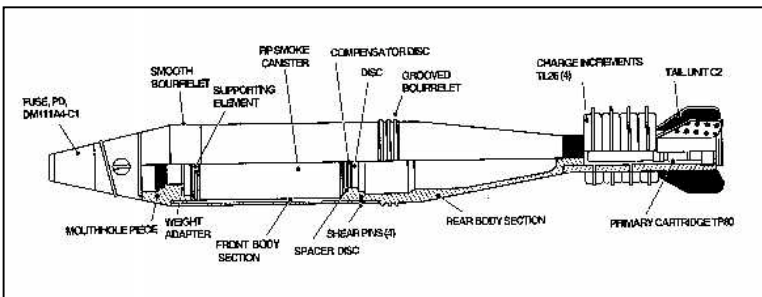
15. **Cartridge, 60 mm, Smoke, Red Phosphorus (RP-S) C111:**

- a. **General.** Cartridge, 60 mm, RP-S, C111 was produced for Canada by Hirtenberger AG of Austria, and was type classified STANDARD in 1989 for use as a spotting or screening smoke. It has a maximum range of 1994 m on Charge 4.
- b. **Description.** The complete round consists of the following main components (Figure 3-6):

- (1) fuze, PD, DM111A4-C1;

- (2) projectile body;
- (3) RP smoke canister;
- (4) tail unit C2;
- (5) primary cartridge TP80; and
- (6) propelling charge increments TLS 86 (quantity four).

c. **Projectile Body.** The RP-S C111 projectile body is made of aluminium alloy and consists of a front and rear section. The front body section has a threaded adapter to accept a 4 mm 12 UNF fuze, which houses the RP Smoke Canister and has a smooth bourrelet to act as the front bearing surface for the projectile. The conical rear body section is externally threaded to accept the tail unit and has a bourrelet of four annular grooves (behind the point where the two body sections are joined). This grooved bourrelet acts as a gas check (obturator) and is the rear bearing surface of the projectile. Both body sections are joined using four shear pins and a rubber sealing ring.



**Figure 3-6: Cartridge, 60 mm, RP-S, C111—Main Components**

d. **RP Smoke Canister.** This assembly consists of a canister filled with two cylindrical RP pellets weighting a total of 330 grams. The forward end of

the canister has a 0.1 second delay element, which is followed by the burster charge housed in a stamped aluminium tube and centrally located in the canister.

- e. **Tail Unit, C2.** The complete tail unit is the same as found on the HE round C110.
- f. **Primary Cartridge.** The RP-S C111 round utilises the same TP80 as the HE C110 round. The propelling charge is the TLS 86 (Figure 3-3).
- g. **Preparation for Firing.** The following actions are required to prepare the RP-S C111 Cartridge for firing:
  - (1) remove the fuze safety wire;
  - (2) ensure that the selector is aligned with **OV** for super quick action (do not use at **MV**); and
  - (3) leave fitted to the tail only those charge increments needed to make up the charge ordered/required.

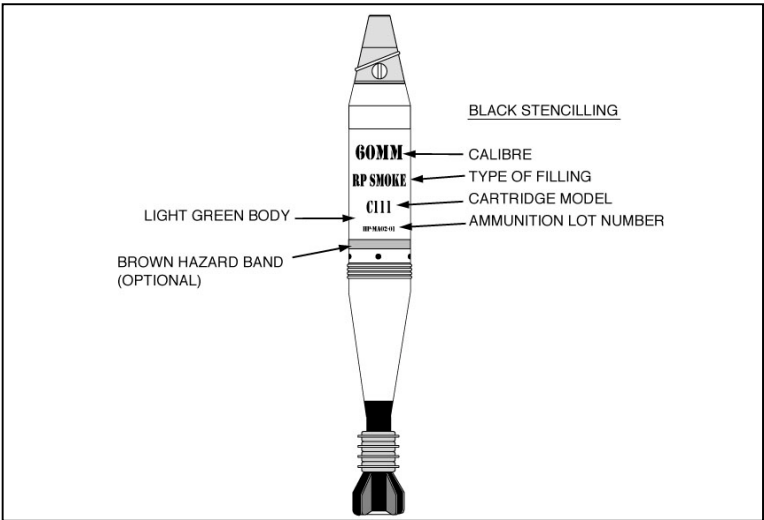
### CAUTION

If cartridges have been prepared but were not fired, they must be reconditioned to full service charge, and have the safety wire replaced before the ammunition is transported

- h. **Identification.** The projectile body colour is light green (a brown hazard band is optional) and the following information is stencilled in black on the body (Figure 3-7):
  - (1) calibre—60 mm;
  - (2) type of filling—RP SMOKE;

60mm Mortar M19 Cdn

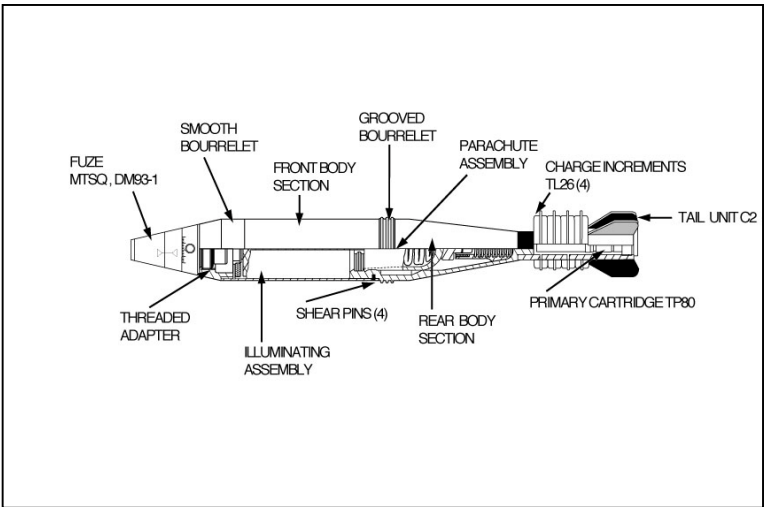
- (3) cartridge model number—C111; and
- (4) ammunition Lot Number—HP-89A01-01.



**Figure 3-7: Identification—Cartridge, 60 mm, RP-S, C111**

- 16. **Confirm by Questions.**
- 17. **Cartridge, 60 mm, Illuminating (ILLUM) C112:**
  - a. **General.** Cartridge, 60 mm, ILLUM, C112 was produced for Canada by Hirtenberger AG of Austria, and type classified in 1989 for use in area illumination. It has a maximum range of 1758 m on Charge 4 and burns at 400 000 candle power.
  - b. **Description.** The complete round consists of the following main components (Figure 3-8):
    - (1) fuze, mechanical time super quick (MTSQ), DM93-1;
    - (2) projectile body;

- (3) illuminating assembly;
  - (4) parachute assembly;
  - (5) tail unit C2;
  - (6) primary cartridge TP80; and
  - (7) propelling charge increments TLS 84 (quantity four).
- c. **Projectile Body.** The Illumination C112 projectile body is made of aluminium alloy and consists of a front and rear section. The front body section has a threaded adapter to accept a 4 mm 12 UNF fuze, which houses the illuminating assembly, and has a smooth bourrelet to act as the front bearing surface. The conical rear body section is externally threaded to accept the tail unit, houses the parachute assembly, and has four annual grooves behind the point where the two body sections are joined. This grooved bourrelet acts as the rear bearing surface and as a gas check (obturator). Both body sections are joined using four shear pins and a rubber sealing ring.
- d. **Illuminating Assembly.** The illuminating assembly consists of a thin-walled aluminium flare canister filled with 300 grams of magnesium/halogen composition, with a priming composition at the forward end. The front of the flare canister also houses a delay element holder with two 0.4 second delay pellets. Three Belleville (plate) springs are used in front of the canister to compensate for dimensional differences and hold the payload to the rear. The bottom of the flare canister rests against two aluminium half-collars (spacers).



**Figure 3-8: Cartridge, 60 mm, ILLUM, C112—Main Components**

- e. **Parachute Assembly.** The parachute assembly consists of the bell-shaped spring guide, spring and spring holder, parachute housing, white nylon parachute, and ten steel shroud lines. A square eye bolt is used to connect the shroud lines to the flare canister, while a screw-bolt attaches the spring holder to the rear body section of the projectile.
- f. **Tail Unit, C2.** The complete tail unit is the same as found on the HE round C110.
- g. **The C112 Illumination Round** utilizes the same primary cartridge—TP80—as the C110 HE round. The propelling charge is the TLS 86 (Figure 3-3).
- h. **Preparation for Firing.** The following actions are required to prepare the ILLUM C112 cartridge for firing:
  - (1) remove the fuze safety wire;
  - (2) set the fuze (by hand or with a fuze wrench) to the desired time—5-54 sec—of function

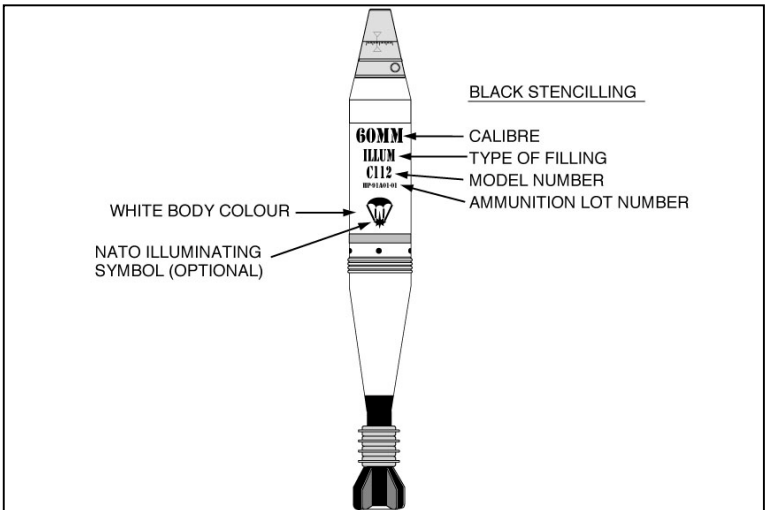


commensurate with the range, elevation, and charge. Should the fuze fail to function at the set time, SQ action will automatically occur at target impact; and

- (3) leave fitted to the tail only those charge increments needed to make up the charge ordered/required.

### CAUTION

1. ILLUM C112 was designed for optimum performance at Charges 1 to 4 only (Charge 0 is not authorized).
2. If cartridges have been prepared but were not fired, they must be reconditioned to full service charge and have the fuse reset to safe with the safety wire replaced before the ammunition is transported.



**Figure 3-9: Identification—Cartridge, 60 mm, ILLUM, C112**

- i. **Identification.** The projectile body colour is white, a brown Low Explosive hazard band and an illuminating symbol are optional, and the following information is stencilled in black on the projectile body (Figure 3-9):
  - (1) calibre—60 mm;
  - (2) type of filling—ILLUM;
  - (3) cartridge model number—C112; and
  - (4) ammunition lot number—HP-89C01-01.

18. **Confirm by Questions.**

19. **Current Fuzes:**

- a. **Fuze, PD M525.** The M525 fuze is a single action, super quick impact fuze. It has a safety wire and pull wire which must be removed before firing. It will not arm before a minimum of 91 m of round travel. A bore-riding safety pin is ejected from the body of the fuze when the round leaves the tube.
- b. **Fuze, PD DM111A2.** This fuze is a super quick or delay action impact fuze. It has a safety wire to be removed before firing. It does not arm before a 40 m flight. A slotted selector switch permits the user to select OV (super quick ) or MV (0.05 second delay) action.
- c. **Fuze, PD M527B1.** This fuze is a single action super quick impact fuze. It has a safety wire and pull wire which must be removed before firing. It is not armed until after a minimum of 91 m of round travel. A bore riding safety pin is ejected from the body of the fuze after the round leaves the tube.
- d. **Fuze, PD NR2168.** This fuze is identical to the M527B1 in all aspects except that the steel projectile

adapter was lengthened by 2 mm to accommodate the longer threads on the NR2168 fuze.

- e. **Fuze, PD DM111A4.** The DM111A4 is a point detonating (PD) fuze, with a setting screw to permit the selection of super quick or delay functioning at target impact. A fuze safety wire, which supplements safety during handling and transportation, must be removed before firing.

#### NOTE

Crew safety is provided by a delayed-arming feature that ensures the fuse cannot be armed before a minimum of 40 m of round travel.

- f. **Fuze, PD DM111 A4-C1.** The basic DM111A4, which is a PD fuze capable of super quick or delay action on impact, became the DM111A4-C1 when it was modified by replacing the booster charge and cup with a perforated aluminium cup containing a five gram BP expelling charge. The RP-S C111 cartridge was designed for use at the OV (super quick) setting only, and duds or lost rounds may occur if the delay setting (MV) is used. The fuze safety wire, which supplements safety during handling and transportation, must be removed before firing.

#### NOTE

Crew safety is provided by a delayed-arming feature that ensure the fuse cannot be armed before a minimum of 40 m of round travel.

- g. **Fuze, MTSQ DM93-1.** The basic DM 93, which is a mechanical time and super quick (MTSQ) fuze capable of being set to function anytime from five to 54 seconds, or set at AZ (super quick only), became the DM93-1 when it was modified by having a

perforated aluminium cup with a five gram BP expelling charge screwed onto the bottom of the fuze. The safety wire, which supplements safety during handling and transportation, must be removed before firing.

#### NOTE

Crew safety is provided by a delayed-arming feature that ensures the fuse cannot be armed before one second after firing (a minimum of 40 m of round travel).

- h. The modified MTSQ fuze functions at the set time, or at target impact, and ignites the BP expelling charge. Gas pressure generated by the expelling charge forces the flare canister (and two aluminium half-collars) to the rear, cutting the shear pins and separating the two body sections. Simultaneous with separation, the delay pellets at the top of the flare canister are ignited by the expelling charge. The compressed spring in the rear body section reasserts itself, assisting in deployment of the parachute and illuminating payload. Following burn-through of at least one delay pellet, the priming composition is ignited for flare initiation (illumination).

#### WARNING

If a buzzing sound is heard when the pull wire and safety wire are removed from the fuse, or the wire cannot be removed by hand, **DO NOT FIRE THE CARTRIDGE**. Such rounds are only safe to handle and transport providing the safety wire can be reinserted and the bore-riding pin is in position.

20. **Confirm by Question.**

21. **Packaging:**

- a. **Cartridge, HE M49A4.** The rounds are packed in a fibre tube container. Twelve containers packed in a wooden box marked with:

- (1) stock number;
- (2) number of cartridges, type, model;
- (3) type of fuze;
- (4) weight and volume;
- (5) date loaded; and
- (6) lot number.

- b. **Cartridge, HE C110, RP-S C111 and III C112.** All three of the new rounds are packed in the same type of container (Figure 3-10):

- (1) Four complete rounds are packed in each quadruple polyethylene C124 container. This container is dark green in colour, and each round fits nose first into a loose plastic sleeve/spacer assembly, which rests on a black elastomer (hard rubber) spring inside the container body. Each round is held securely in place by another elastomer (sponge like) spring and load distribution plate, both of which are glued to the inside of the container cap, compressing when the cap is screwed onto the container.
- (2) The packed C124 container is 519.2 mm long, 364.2 mm wide, 97.0 mm high, and weighs approximately 10.1 kg (C110) or 12.0 kg (C111 and C112).
- (3) **Embossed Container Markings.** During the production process, each C124

container is permanently embossed with the following information:

- (a) manufacturer's date plug. In accordance with the production specification, this symbol identifies the shift, month, day, and year of the container manufacture;
- (b) container model number (C124);
- (c) manufacturer's part number for C124 body (9851011214); and
- (d) shipment approval markings. In accordance with UN and Transport Canada regulations, the following markings indicate that packed C124 containers are approved for commercial shipments as follows:
  - i. United Nations (UN) marking signifying approval for international shipment: U  
4H2/Y13/S/89/CAN/DN  
D/2-N 18; and
  - ii. Canadian Government Specifications Board (CGSB) marking signifying approval for domestic shipment: CGSB-43-GP-151.

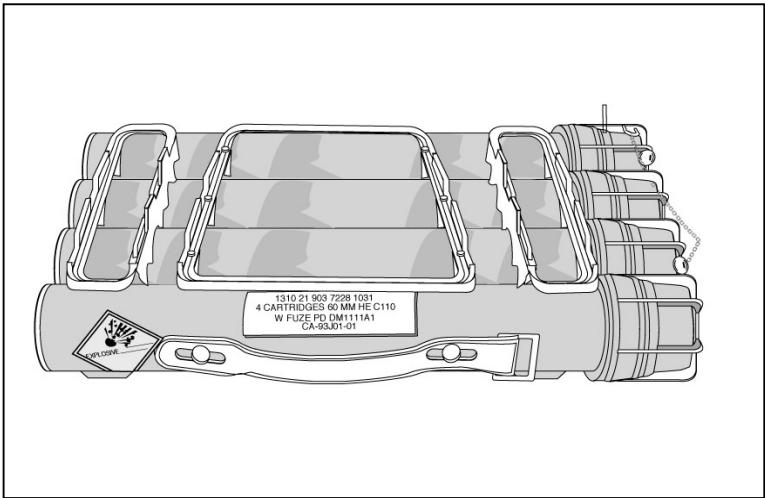
**NOTE**

The year of manufacture (89) in the UN making changes annually.

- (4) **Container Labels.** Three labels are applied to each packed C124 container, with the following information printed in black on a yellow background:
- (a) explosive hazard label—1.2 E;
  - (b) nomenclature label:
    - i. NSN and AIC—1310 21 903 7228-1031;
    - ii. nomenclature/quantity—four Cartridges 60 mm;
    - iii. lot number (underlined)—HP-89B01-01; and
  - (c) shipping detail label:
    - i. shipping name—Cartridges for Weapons (HE, SMK, ILLUM);
    - ii. United Nations number—UN 0321; and
    - iii. weight and cube size—WT 10.5 kg CU 0.018 M3.
- c. **Cartridge, WP M302A1.** The rounds are packed in a fibre tube container. Nine containers packed in a wooden box marked with: (Figure 3-11 and 3-12):

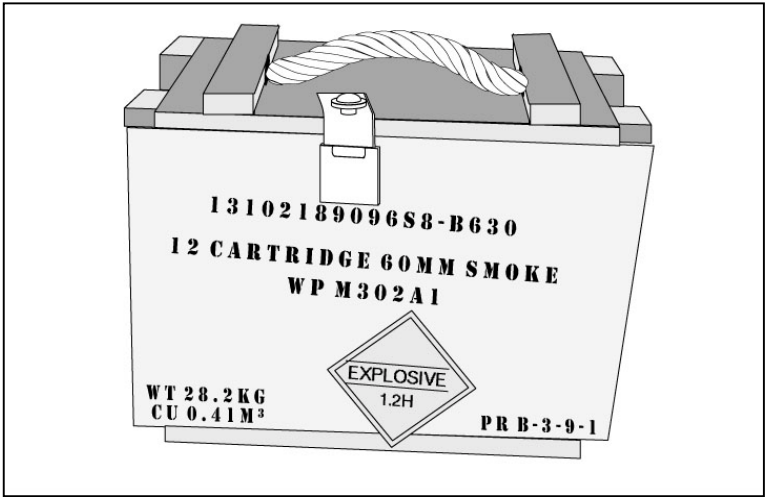
60mm Mortar M19 Cdn

- (1) stock number;
- (2) number of cartridges, type, model;
- (3) type of fuze;
- (4) weight and volume;
- (5) date loaded; and
- (6) lot number.

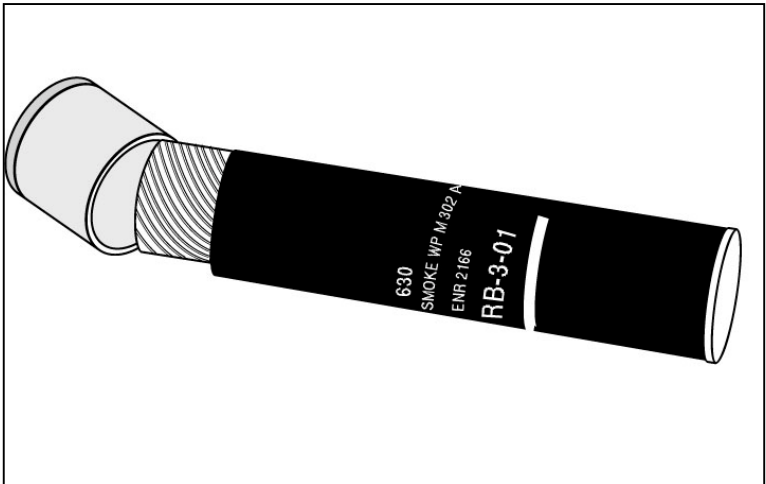


**Figure 3-10: Cartridge, 60 mm, HE, M49A4 Fuzed PD, M525—  
Packaging**





**Figure 3-11: Cartridge, 60 mm, WP M302A1—Packaging**



**Figure 3-12: Cartridge Container, 60 mm, WP, M302 Individual Round Packaging**

22. **Confirm by Questions.**
23. **Conclusion:**

60mm Mortar M19 Cdn

- a. questions to and from the class;
- b. test on lesson;
- c. safety precautions; and
- d. pack up.

24. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** Thorough knowledge of present ammunition will ensure the crew properly identifies the round that is ordered for use.
- c. The next lesson will be...

## CHAPTER 4

### 25 mm MORTAR TRAINING DEVICE

#### LESSON 1—DESCRIPTION AND IDENTIFICATION

##### INSTRUCTOR'S NOTES

1. **Aim.** To teach:
  - a. description and identification;
  - b. operation and firing; and
  - c. maintenance and storage.
2. **Time Required.** One 40 minute period.
3. **Method.** Lecture (Explain).
4. **Stores:**
  - a. overhead projector with slides;
  - b. five 60 mm SABOT C2;
  - c. transport and storage case; and
  - d. table for display.
5. **Preparation:**
  - a. set up overhead projector;
  - b. set up table; and
  - c. check training aids.
6. **Miscellaneous.** Conduct normal safety precautions.

## CONDUCT OF THE LESSON

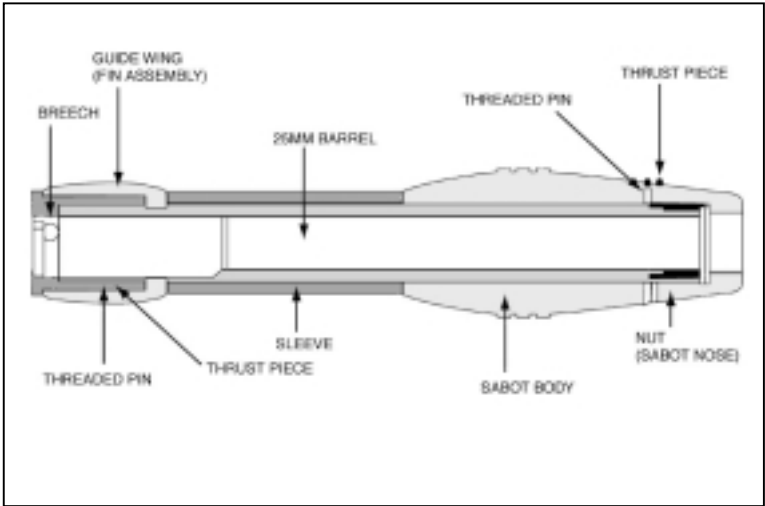
7. **Review.** Nil.

8. **Introduction.** The 25 mm Mortar Training Device (MTD), which consists of a miniature range, mortar training sabots, and sub-calibre 25 mm practice training cartridges, allows the realistic training of 60 mm mortar crews in a limited space and at a low cost.

9. The mortar training sabot corresponds in weight and shape to the service round for the 60 mm mortar. These sabot rounds may be fired, recovered, and reused an unlimited number of times. The same firing tables may be used with all calibres of mortar training sabots (81 mm and 60 mm).

10. **Description:**

- a. **Sabot Mortar Cartridge 60 mm C2.** As shown in Figure 4-1, the 60 mm sabot consists of a robust aluminium body, sleeve, and fin assembly similar in shape and weight to a service round, and an inside sub-calibre 25 mm barrel with a locking system (breech) on the rear end. The forward internal diameter of each sabot nose is 27 mm, which permits safe exit of the 25 mm cartridge from the sabot even if the lip of the sabot nose has been slightly bent or damaged.



**Figure 4-1: Sabot, Mortar Cartridge, 60 mm C2**

- b. **25 mm Practice Training Cartridge.** The 25 mm practice training cartridge is a sub-calibre device for use with the 25 mm MTD. The cartridge as shown in Figure 4-3a consists of a case (A) complete with primer (B), sabot ejection charge (C), and a projectile (D). There are four propelling charge weights, muzzle velocities, applicable ranges, and markings for the training cartridges. (Figure 4-2).

CHARGE	COLOUR OF PROJ HEAD	CTG CASE GROOVES	MUZZLE VELOCITY	RANGES
0	Green	None	51 m/s	70-240m
1	Yellow	One	61 m/s	150-320m
2	Blue	Two	70 m/s	200-410m
3	Red	Three	77 m/s	250-480m

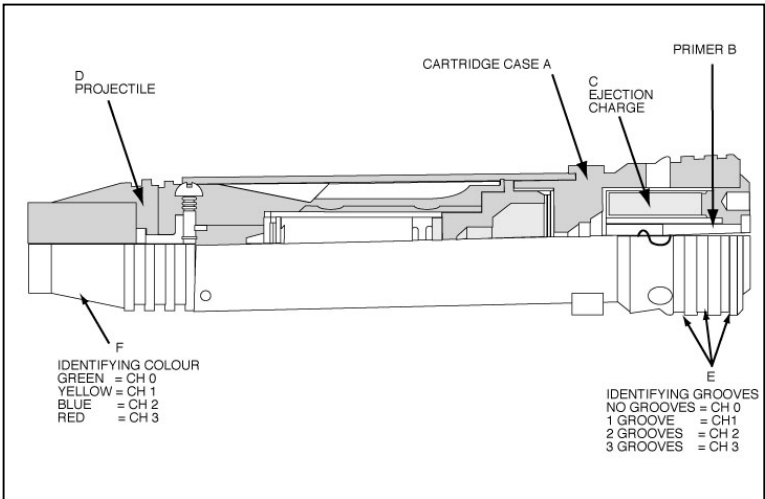
**Figure 4-2: Information on the Training Cartridge**

11. **Confirm by Questions.**
12. **Identification:**

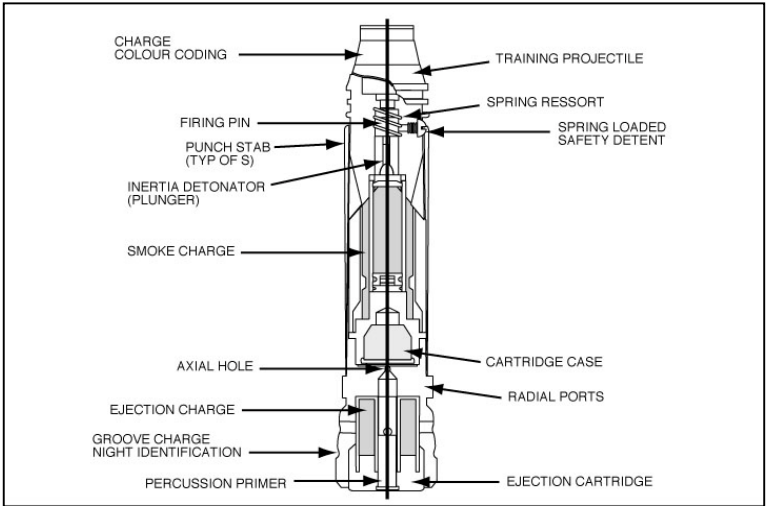
**NOTE**

Velocities (VO) are measured in at a point 2.5m in front of the mortar muzzle.

- a. **60 mm Sabot C2** is 330 mm long and weighs 2.5 kg. The following information is stamped into the metal of the sabot body underneath the lowest bourrelet ring:
  - (1) nomenclature and lot number—SABOT 60 mm C2;
  - (2) manufacturer's code—DN—AG; and
  - (3) item serial number and month/year of manufacture—7753 9/89.



**Figure 4-3a: Cartridge 25 mm Practice Training Markings**



**Figure 4-3b: Cartridge 25 mm Practice Training Markings**

- b. **25 mm Practice Training Cartridge.** As shown in Figure 4-3a, the four different cartridges are identified by means of grooves in the serrated portion of the case (E), by the colour of the projectile head (F) and by stock numbers (Figure 4-4):

CHARGE	STOCK NUMBER
0	1305-21-885-7712
1	1305-21-885-7713
2	1305-21-885-7714
3	1305-21-885-7715

**Figure 4-4: Identification by Stock Number**

13. **Confirm by Questions.**

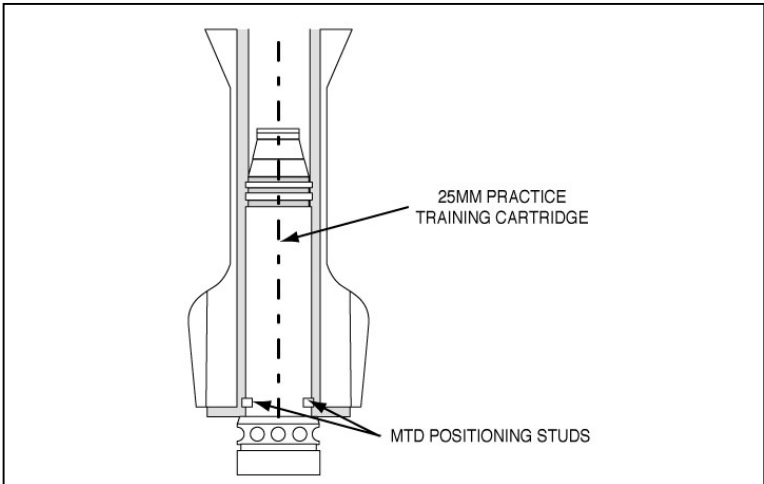
14. **Principle of Operation.** The mortar training sabot is fitted with a 25 mm practice training cartridge, then loaded into the mortar tube and fired in accordance with Chapter 2 of this publication. The sabot falls to the ground 10-15 m in front of the mortar area while the

25 mm training cartridge flies to the target area and functions on impact by producing a sound and a puff of smoke. The sabot is recovered and cleaned and the spent casing is removed, allowing reuse of the sabot.

15. **Preparation for firing.** The 25 mm practice training cartridge is fully inserted in the breech of the 25 mm barrel of the MTD and is locked by turning it 60 degrees clockwise until contact is made between the case projections and the MTD positioning studs (Figure 4-5).

**CAUTION**

Ensure the sabot barrel is clean and free of obstructions before loading the 25 mm practice training cartridge.



**Figure 4-5: MTD with 25 mm Cartridge Installed**

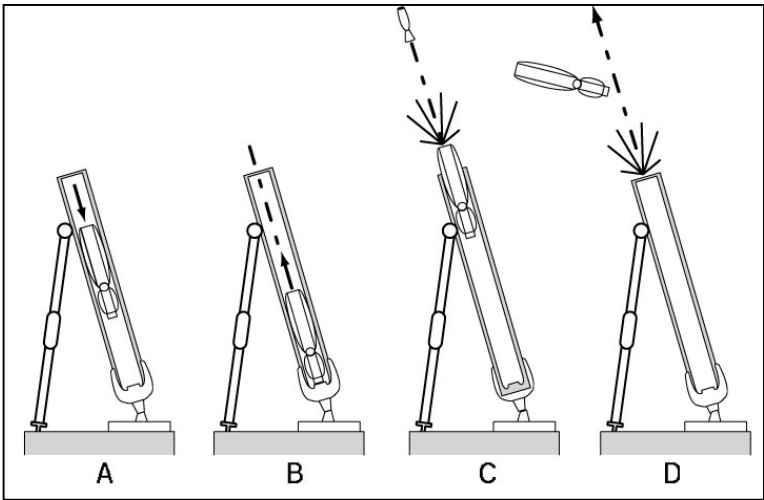


16. **Firing.** The MTD, with cartridge fitted, is fired in the normal manner for service projectiles in accordance with Chapter 2 of this publication and functions as follows (Figure 4-6):

- a. The sabot, with 25 mm cartridge fitted, is loaded into the mortar and slides down the barrel.
- b. When the primer strikes the mortar firing pin, the resulting flash ignites propellant in 25 mm projectile, and gases force projectile out of sabot.
- c. The primer flash also ignites the ejection charge in the cartridge case. The resulting gases are forced out through holes in side of case, pushing on the base of sabot.
- d. The 25 mm projectile continues on path to target while the sabot is ejected and lands 10-15 m in front of the mortar.
- e. After recovery of the sabot, the empty 25 mm cartridge case is removed by turning it counter-clockwise and pulling slightly.

### CAUTION

Recovery of the fired sabots must only take place when firing has been suspended at the baseplate position.



**Figure 4-6: Sequence of Firing**

17. **Firing Tables:**

- a. the firing tables for the 60 mm sabot with 25 mm cartridge can be found in C-71-192-000/DF-021 dated 1991-01-01; and
- b. the danger area template for the 60 mm mortar, firing the 25 mm practice training cartridges, is provided in B-GL-381-001/TS-000 *Operational Training, Volume 3, Part 1, Training Safety*. These weapons can be fired from any pretemplated firing point provided the sabot template remains inside the approved danger area trace.

18. **Training.** The 25 mm MTD has significant training value. Its full potential as a training device can best be exploited if local miniature training ranges are constructed. The scale of range for the 25 mm MTD in relation to conventional 60 mm ammunition is approximately 1:10. Accordingly, if miniature ranges are constructed, they should be at a scale of 1:10, consisting of portable miniature buildings, vehicles, and Figure 11 targets or other representative enemy targets.

19. **Confirm by Questions.**20. **Care and Cleaning:**

- a. Responsibility for maintenance of the training sabots and the accessories lies solely with the mortar crew. Maintenance consists of:
- (1) continuous surveillance of each item's condition;
  - (2) proper storage and handling;
  - (3) verification of correct operation;
  - (4) sabot cleaning;
  - (5) determination of damage; and
  - (6) damage repair arrangements.
- b. After every firing practice, the sabots must be carefully cleaned, checked for damage, repaired if necessary, and all steel components should be lightly lubricated. Prior to storage, or returning these items to units, each transport and storage case must be checked to ensure sabots and accessories are present.
- c. Each sabot should be cleaned again approximately three days after any firing practice.
- d. After any long period of storage and/or non-use, the sabots should be cleaned and given a light coat of oil. All other parts can be wiped with a wet rag and then dried.
- e. Should any training sabots become damaged from striking hard objects or surfaces in the sabot landing area, they **MUST** be repaired or have components exchanged. Operator repairs are only possible on the outer surface of the sabot, and those components which come in contact with the mortar tube (body

and fin assembly) must not be heavily damaged. Light damages may be treated using a metal file, and afterwards polished (smoothed) with an abrasive cloth if necessary.

- f. Damages such as scrapes and gouges on those areas that do not come into contact with the mortar barrel will not effect the safety or operation of the sabot. However, should a sabot become heavily damaged to a point where safe operation cannot be assured, then the complete sabot must be sent for repair.

21. **Transport and Storage Case:**

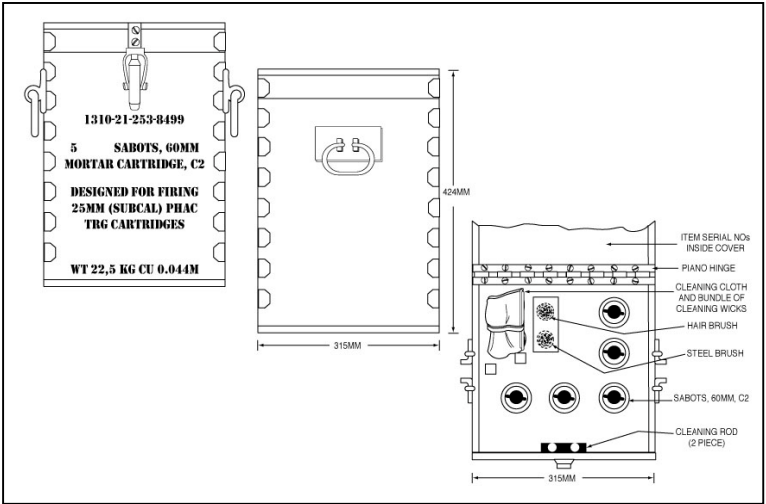
- a. The transport and storage case for the Sabot, 60 mm, C2 (Figure 4-7) is 315 mm long, 315 mm wide, and 424 mm high. The wooden case is packed with five sabots and accessories, which consist of the following:

- (1) cleaning rod (two pieces);
- (2) steel brush;
- (3) hair brush;
- (4) cleaning cloth; and
- (5) bundle of cleaning wicks.

- b. The total packed weight is approximately 22.5 kg. The sabot serial numbers are stencilled inside the lid of each case and the following information is stencilled on the outside front of the case:

- (1) NATO stock number (NSN) 1315-21-253-8498;
- (2) quantity and nomenclature—Five  
SABOTS, 60 mm MORTAR  
CARTRIDGE, C2;

- (3) intended usage—DESIGNED FOR FIRING 25 mm (SUBCAL) PRAC TRG CARTRIDGES;
- (4) weight and cube size—WT 22.5 kg  
CU 0.044 m<sup>3</sup>.



**Figure 4-7: Sabot, 60 mm, C2—Transport and Storage Case**

- 22. **Confirm by Questions.**
- 23. **Conclusion:**
  - a. questions to and from the class;
  - b. test on lesson;
  - c. safety precautions; and
  - d. pack up.
- 24. **Summary:**
  - a. Restate the aim.

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- b. **Final Statement.** Thorough knowledge of the 25 mm mortar training device will allow the crew to train effectively at a reduced cost.
  
- c. The next lesson will be ...

## CHAPTER 5

### 60 mm MORTAR WITH M5 MOUNT

#### LESSON 1—MOUNT M5

#### INSTRUCTOR'S NOTES

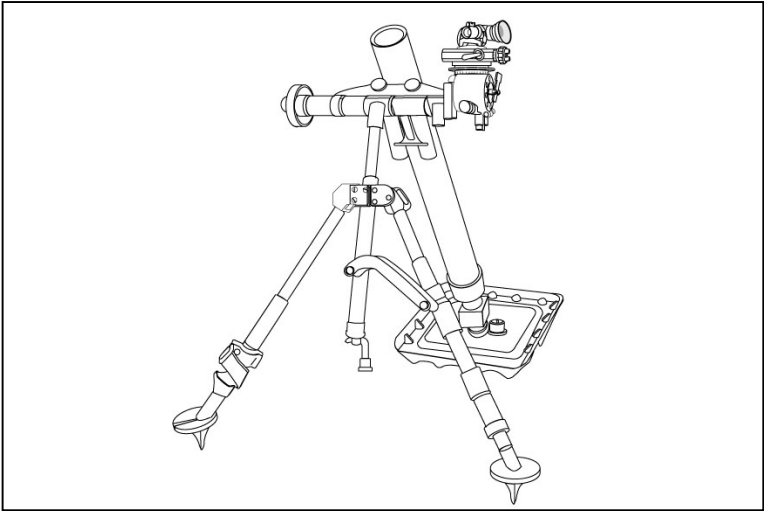
1. **Aim:** To teach:
  - a. description of the M5 baseplate;
  - b. description of the M5 bipod; and
  - c. stripping and assembling (mortar with M5 mount).
2. **Time Required.** Two 40 minute lessons.
3. **Method.** Lecture/Practice.
4. **Stores:**
  - a. 60 mm mortar with M5 mount (one per two students; one per instructor); and
  - b. one six foot table.
5. **Preparation:**
  - a. set up table, place assembled mortar on the table; and
  - b. arrange class so all students can see the weapon on the table.

#### CONDUCT OF THE LESSON

6. **Review.** Nil.

## 60mm Mortar M19 Cdn

7. **Introduction.** The 60 mm mortar can be used with the M5 mount and the C2A1 sight unit, which allows for better accuracy, stability, a higher rate of fire, the ability to engage targets at longer ranges and an enhanced ability to record targets. The M5 mount will also allow the weapon to be used in both direct and indirect fire roles.



**Figure 5-1: 60 mm Mortar M19 with M5 Mount**

### 8. **General Data:**

#### a. **Weights:**

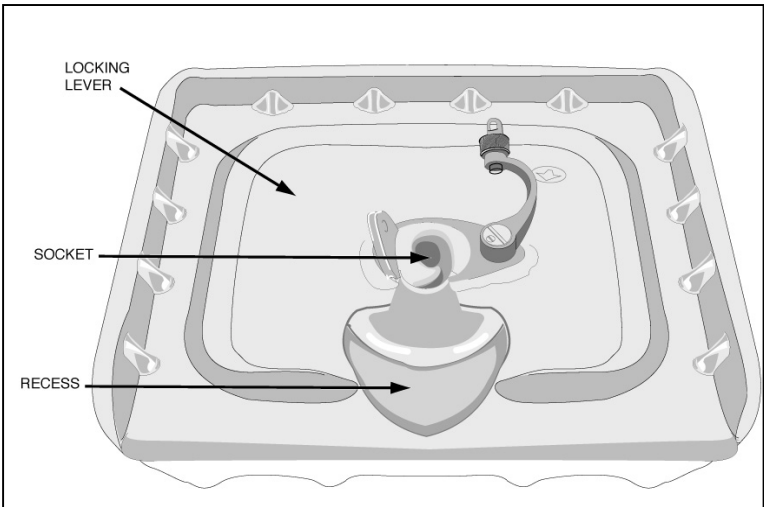
- (1) mortar complete with M5 mount—9 kg;
- (2) bipod—7.4 kg;
- (3) baseplate M5—5.8 kg; and
- (4) sight unit C2A1—1.2 kg.

#### b. **Elevation:** 800 to 1515 mils.

#### c. **Traverse Left or Right of Centre:** 125 mils One turn of handwheel: 15 mils.



9. **Description of the Mount M5 Baseplate.** The baseplate is a pressed metal body onto which are welded a series of ribs and braces, a front flange, and the socket. A locking lever is mounted on a pivot on the left of the socket to lock the spherical projection of the mortar in the socket. The base cap fits into the recess in the forward part of the baseplate when the entire mortar is carried as one unit (Figure 5-2).



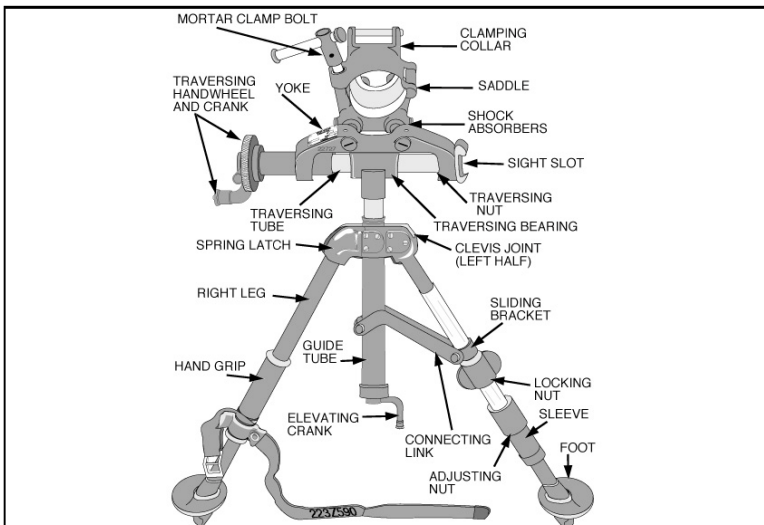
**Figure 5-2: Mount M5 (Baseplate)**

10. **Description of the Mount M5 Bipod - General.** The bipod consists of a leg assembly, an elevating mechanism assembly, and a traversing mechanism assembly. The leg assembly consists of two tubular steel legs connected by a clevis joint that is attached by two bearings (front and rear) to the elevating screw guide tube. The clevis joint limits the spread of the legs. Each half of the clevis joint is provided with a spring latch to lock the legs in the open position. The legs terminate with spiked feet (Figure 5-3). A further description follows:

- a. The left leg has a cross-levelling mechanism that provides the gunner with a means of keeping the bubble in the cross-level of the sight centred.
- b. The cross-levelling mechanism consists of a sliding bracket, a sleeve, a locking nut, an adjusting nut, and

a connecting link. Turning the adjusting nut centres the cross-levelling bubble of the sight unit.

- c. The right leg contains no moving parts. On the lower part of the right leg are a leather hand grip and a strap to secure the legs to the barrel when the mortar is carried.
- d. The elevating mechanism assembly consists of an elevating screw nut that moves vertically on a screw within the guide tube. The elevating screw is turned by the crank attached to its lower end. The upper end of the elevating screw nut fits into the lower end of the traversing bearing and is locked to it by a pin. The elevating screw remains within the guide tube when the elevating crank is turned. The elevating screw nut appears above the guide tube when the mortar is elevated.



**Figure 5-3: Mount M5 (Bipod)**

- e. The traversing mechanism consists of a worm screw and handwheel. It is mounted in the yoke. Turning the handwheel causes the yoke and the barrel to

traverse left or right. The sight dovetail bracket fits into the sight slot in the yoke.

- f. The shock absorbers stabilize the mortar and mount during firing.
- g. The clamp is in two sections and clamps the barrel to the bipod. The lower half is called the saddle and includes the two shock absorbers. The upper half of the clamp is called the clamping collar. The clamping collar is placed around the barrel so that eight inches of the barrel extends in front of the collar.

11. **Confirm by Questions.**

12. **Assembling Mortar with M5 Mount.** Explain and demonstrate the method of assembling the mortar:

- a. Remove all mortar equipment from transient box.
- b. Remove M1 baseplate from mortar tube by unscrewing split nut.
- c. Replace split nut on M1 baseplate and return to transient box.
- d. Unscrew mortar clamp bolt counter-clockwise until collar becomes loose.
- e. Slide mortar tube, muzzle end first, into bottom of clamping collar until horizontal line is visible above clamping collar.
- f. Tighten mortar clamp bolt clockwise until it is tight.
- g. Open locking lever on M5 baseplate, seating spherical projection into socket of the M5 baseplate and close locking lever (ensure firing lever is on left side of mortar).

- h. Undo strap on bipod legs, separate legs, and loosen locking nut. Slide the locking nut upward until it is in the middle of the inner tube and tighten it (guide tube vertical).
- i. Centralize traversing and elevation mechanism.
- j. Mount C2A1 sight unit into sight slot with elevation reading 1100.
- k. Level elevation bubble by moving bipod leg toward or away from M5 baseplate until bubble is centralized.

13. **Stripping Mortar with M5 Mount.** The mortar is stripped in reverse order to the assembly. When stripping the mortar, ensure that the firing lever is in the proper position for storage:

- a. set firing selector to LEVER FIRE;
- b. depress elevation mechanism until only 5 cm of inner tube is showing;
- c. dismount C2A1 sight unit (ensure elevation scale reads 800 and all bearing indexes are zeroed)—return to case;
- d. traversing mechanism must be moved completely to the right beside the handwheel with the crank folded down;
- e. loosen locking nut and lower it until it contacts the cross-level adjusting nut;
- f. close bipod legs and secure with strap;
- g. undo mortar baseplate locking lever, remove spherical projection from socket, and close locking lever;
- h. unlock mortar clamp bolt, remove mortar tube from bottom of collar, and secure mortar clamp bolt;

- i. replace M1 baseplate onto mortar tube; and
  - j. replace all mortar equipment into transient box.
14. **Confirm by Questions and Practice.**
15. **Conclusion:**
- a. questions to and from the class; and
  - b. test on lesson.
16. **Summary:**
- a. Restate the aim.
  - b. **Final Statement.** It is important that you know all parts of the M5 mount and their purpose in order to efficiently operate the 60 mm mortar in this configuration.
  - c. The next lesson will be...

## LESSON 2—C2A1 SIGHT UNIT

### INSTRUCTOR'S NOTES

17. **Aim.** To teach:
- a. technical specification;
  - b. sight unit description and setting;
  - c. safety; and
  - d. case and periscope extension.
18. **Time Required.** Three 40 minute lessons.
19. **Method.** Basic instructional periods.

20. **Stores:**

- a. sight units (one per detachment);
- b. periscope extension (one per detachment); and
- c. overhead projector and slides or charts of sight unit.

21. **Preparation:**

- a. set out sight units (all units zeroed and facing the same way); and
- b. set up overhead projector or charts.

**CONDUCT OF THE LESSON**

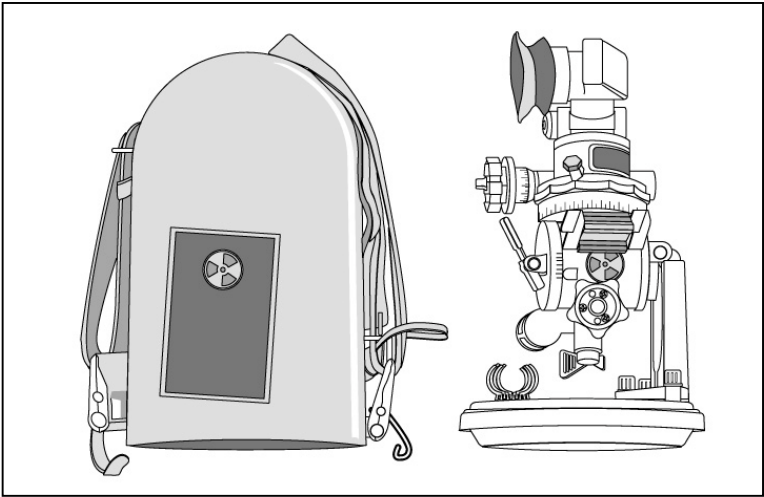
22. **Review.** Description of the 60 mm mortar.

23. **Introduction.** The C2A1 Sight unit is the standard sighting device used with the 81 mm mortar. It is used primarily with the mortar to fire in the indirect role, however, it can be used during direct fire should the need arise. This sight unit is also used with the GPMG (C6) in the sustained fire (SF) role and the 60 mm while mounted on the M5 mount.

24. **Sight Characteristics.** The C2A1 sight unit was developed as a sight instrument for indirect fire weapons. It is designed to withstand rough treatment under field conditions and operate efficiently at climatic extremes. All scales and bubbles are illuminated with radioactive material. It is relatively light (1.3 kg) and is issued in a case. It can be tested and adjusted by the mortar crew and can operate as a modified compass for recording aiming points.

**WARNING**

The light sources which are used to provide illumination for the level dials, reticle, bearing and elevation scales and micrometer drums, together with their indices, contain radioactive tritium gas which is sealed in glass capsules. There is no significant external radiation hazard. The only hazard is when the capsules are broken. Tritium is a gaseous substance, which emits low energy beta radiation. When released into the air it rapidly oxidizes or combines with water and in such form is rapidly absorbed by the body through contact with the skin, inhalation or ingestion. If such absorption occurs, the tritium will rapidly be distributed throughout the body fluids and deliver a significant dose of harmful radiation to the body. The C2A1 sight unit contains a total of 2972 millicuries in its various components. The need for careful handling is obvious. If breakage of one of the capsules occurs in a confined or poorly ventilated space, the following action shall be taken: **ALL PERSONNEL EVACUATE THE ROOM, VEHICLE OR IMMEDIATE VICINITY FOR 30 MINUTES LEAVING DOORS, ACCESSES AND WINDOWS OPEN WHEN APPLICABLE**



**Figure 5-4: Sight Unit and Case**

25. **The C2A1 sight unit consists of four main components:**

- a. telescope;
- b. bearing mechanism and scales;
- c. elevation mechanism and scales; and
- d. sight unit mount.

26. **Telescope.** The sight consists of a fixed focus, ninety degree elbow telescope fitted with a rubber eyepiece. It incorporates a fixed reticle consisting of both a horizontal and vertical crosshair, allowing a field of view of 180 mils at a magnification of 1.8. The horizontal crosshair is split by four graduations of five mils each, left and right of centre, to facilitate the alignment on the aiming point. It is mounted to the top of the sight unit by a trunnion and clamp. It can be adjusted vertically to assist in locating the aiming point. The housing is located on the top right of the telescope, to receive the periscope assembly. The eyepiece can be rotated through an arc of 3200 mils to facilitate:



- a. use of the open sight, which is part of the telescope housing; and
- b. alignment on the aiming points.

27. **Confirm by Questions.**

28. **Bearing Mechanism and Scales** (explain and demonstrate):

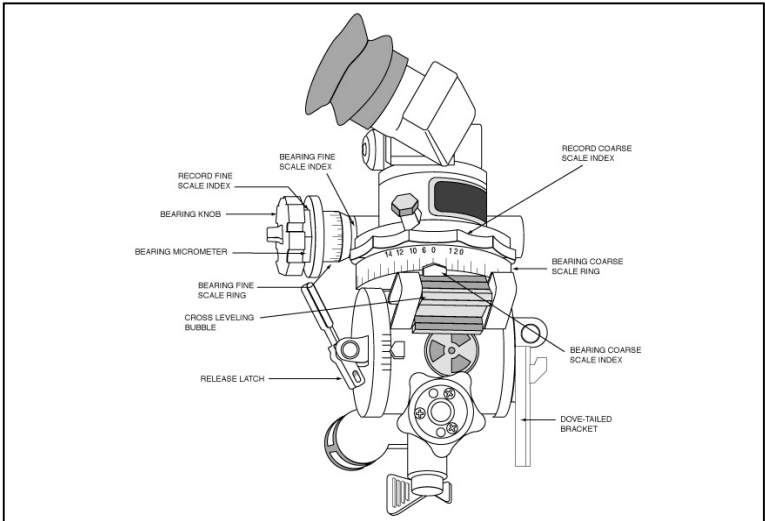
- a. **Bearing Scales.** The bearing coarse scale ring is a rountable ring graduated from 0 to 6400 mils marked each 100 and numbered every 200 mils. The zeroes designating hundreds have been omitted. A coarse scale clamp is provided to lock the coarse scale ring in any desired position. The coarse scale ring may be read against three separate indices, which are as follows:
  - (1) the bearing coarse scale index is located below the coarse scale ring against which all bearings in hundreds of mils will be read;
  - (2) the record coarse scale index is located above the coarse scale ring against which all records in hundreds of mils will be read; and
  - (3) the back bearing index is located below the coarse scale ring, 3200 mils from the bearing index.
- b. **Bearing Fine Scale Ring.** This is a rountable ring located on the bearing knob. It is graduated from 0 to 100 mils, marked each mil and numbered every 10 mils, and is used to supplement the bearing coarse scale ring. A butterfly nut is provided, which allows the fine scale ring to be locked in any desired position. Two indices are provided against which these scales are read:

- (1) The bearing fine scale index is located to the right of the fine scale ring next to the body of the sight unit against which all bearings in mil units will be read.
- (2) The record fine scale index is located on the left side of the fine scale ring against which all records in mil units will be read. This record index can be adjusted during sight unit adjustment.

c. **Bearing Mechanism:**

- (1) A quick release gear is provided to allow rapid horizontal rotation of the telescope. By turning the bearing locking device counter-clockwise and moving the bearing knob forward, the gear is disengaged and allows the upper part of the sight unit to be rotated freely until the desired arc has been covered.
- (2) The bearing locking device must be reapplied to prevent changes in bearing during firing.
- (3) The cross-levelling bubble is located directly below the bearing coarse scale ring. When this bubble is centralized and the reticule of the sight unit is laid on the point of aim, it ensures that the barrel is laid on the bearing indicated on the bearing scales.

29. **Confirm by Questions.**

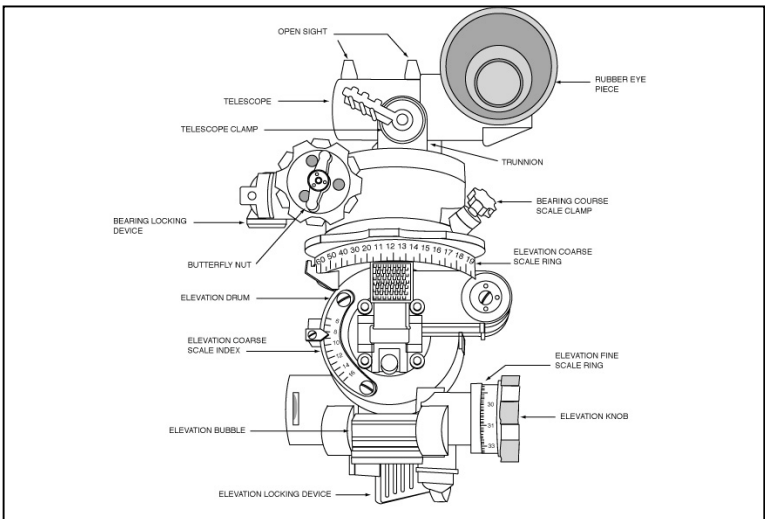


**Figure 5-5: Sight Unit C2A1—Rear View**

30. **Elevation Mechanism and Scales** (explain and demonstrate):

- a. **Elevation Coarse Scale.** Though the sight unit has two elevation coarse scales on the elevation drum, only the forward one is used with mortars; the one in rear is designed for use with other weapons. The elevation coarse scale for mortars is graduated from 600 to 1600 mils, marked each 100 mils and numbered every 200 mils. The last zero of each graduation has been omitted. An elevation coarse scale index is provided in front of the drum against which all elevation in hundreds of mils will be read.
- b. **Elevation Fine Scale Ring.** This ring is located on the elevation knob and is provided to supplement the elevation coarse scale. It is graduated from 0 to 100 mils, marked each mil and numbered every 10 mils. An elevation fine scale index is located next to the body of the sight unit against which all elevation in mil units will be read. The elevation fine scale ring can be adjusted during sight unit testing.

- c. **Elevation Bubble.** This bubble is located below the elevation drum. When this bubble is centred, it indicates that the angle of elevation read on the sight unit has been applied to the barrel.
- d. **Elevation Locking Device.** This is provided to prevent changes in the elevation setting during firing. A wing nut located under and in front of the elevation knob must be turned and relocked after the elevation has been set on the sight unit.
- e. **Sight Unit Mount.** This is provided to lock the sight unit securely into the sight slot on the bipod and consists of a dovetailed bracket and latch. The latch must be depressed when placing the dovetailed bracket into the sight slot to prevent binding and facilitate removal when required.



**Figure 5-6: Sight Unit C2A1—Side View**

**31. Confirm by Questions.**

32. **Sight Unit Setting for Bearing:**

- a. **Small Bearing.** If the ordered bearing does not exceed plus or minus 100 mils from the original bearing, the following actions are carried out:
- (1) unlock the bearing locking device;
  - (2) turn the bearing knob until the desired bearing, in hundreds of mils, is read against the bearing coarse scale index;
  - (3) continue to turn the bearing knob until the desired bearing in mil units is read against the bearing fine scale index; and
  - (4) check the reading opposite both indices and, if correct, relock the bearing locking device.
- b. **Large Bearings.** Should the ordered bearing exceed plus or minus 100 mils from the original bearing, the following actions are carried out:
- (1) Unlock the bearing locking device.
  - (2) With the forefinger on the front of the quick release gear housing and the thumb on the bearing knob, force the knob forward and disengage the quick release gear.
  - (3) Rotate the upper portion of the sight unit until the desired bearing in hundreds of mils is read against the bearing coarse scale index. Release the pressure and allow the quick release gear to re-engage.
  - (4) Turn the bearing knob until the desired bearing in mil units is read against the bearing fine scale index.

- (5) Check the reading against both and, if correct, relock the bearing locking device. Ensure that the quick release gear is fully engaged or errors in bearing will result.

33. **Sight unit Setting for Elevation.** To set an elevation on the sight unit, the following actions are carried out:

- a. unlock the elevation locking device;
- b. turn the elevation knob until the desired elevation in hundreds of mils is read against the elevation coarse scale index;
- c. continue to turn the elevation knob until the desired elevation in mil units is read against the elevation fine scale index; and
- d. check the reading opposite both indices and, if correct, relock the elevation locking device.

#### **NOTE**

When setting the sight unit for either bearing and/or elevation, care must be taken to ensure an error of 100 mils is not made. Double check all settings.

34. **Zeroing the Sight Unit.** Before the sight unit is placed in the case, the bearing and record scales must be set to zero. The elevation scales must read 800 mils. Explain and demonstrate how to zero the sight unit:

- a. Ensure that the zero graduation of both the coarse and fine scale rings are locked against their respective record indices.
- b. Unlock the bearing locking device and, by disengaging the quick release gear, rotate the upper portion of the sight unit until the zero graduation of

the coarse scale ring is read against the bearing coarse scale index. Notice that the record coarse scale index is in alignment with the bearing coarse scale index.

- c. Turn the bearing knob until the zero graduation of the fine scale ring is opposite the bearing fine scale index. Notice that the record fine scale index is now directly opposite the bearing fine scale index.
- d. Turn the elevation knob until 800 is read against the coarse scale index and zero is read against the fine scale index. Zeroing is now complete.

35. **Confirm by Questions and Practice.**

36. **Case Sight Unit C2A1 and Carriage:**

- a. **Case.** The sight unit has a metal protective immersion proof carrying case (Figure 5-4). The case includes secure storage space for accessories.
- b. **Carriage.** To fit the sight into the case:
  - (1) align the indices;
  - (2) place the sight unit in the dovetail bracket on the base of the case; and
  - (3) place the top over the sight and ensure the fasteners are closed.

37. **Periscope Extension C2A1 Sight unit** (explain and demonstrate):

- a. The periscope extension is used to overcome a barrel obstruction when the field of view of the sight unit telescope is obscured by the barrel. It consists of the following parts:
  - (1) periscope extension; and

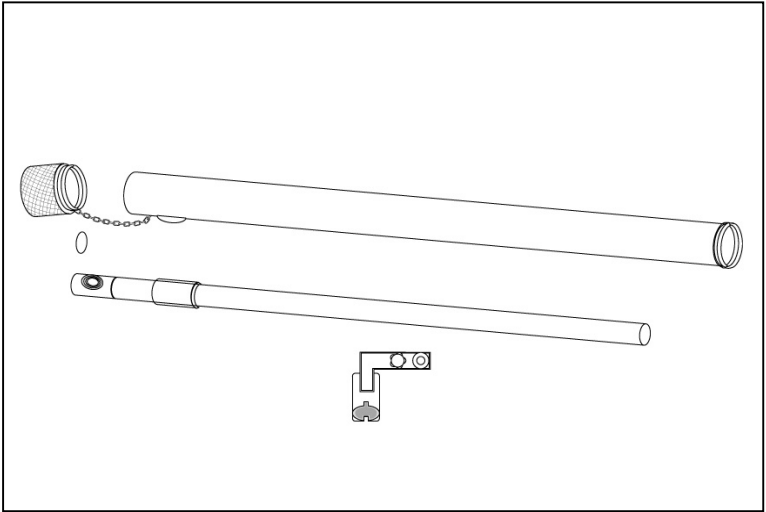
- (2) mounting bracket assembly.

b. **Description:**

- (1) The periscope is contained in a metal tubular case that has a threaded cap on one end secured by a chain. The periscope is 40 cm long with prisms at each end. The lower portion consists of a collar with two metal projections used for positioning and locking the periscope into position.
- (2) The mounting bracket assembly will be carried with the periscope in the accessory spare parts chest. It is used to position the periscope for use with the sight unit. It consists of a bracket, a ring, and a securing screw.

c. **Installation.** The mounting bracket assembly slides over the lamp housing on the telescope. Ensure that the ring is positioned in front of the telescope. Tighten the securing screw. The periscope with the end containing the collar is inserted into the ring ensuring that the window is in line with the telescope and that the projections on the collar are engaged in the slots of the ring.





**Figure 5-7: Periscope**

38. **Setting the Record on the Sight unit.** The No. 1 will set the record on the sight unit for the desired aiming point using the procedures below:

- a. unlock the butterfly nut and rotate the bearing fine scale ring until the last two figures of the record are read against the bearing fine scale index (i.e., 75 of an ordered record 3275), and lock the butterfly nut;
- b. rotate the bearing fine scale back to zero;
- c. unlock the bearing coarse scale clamp, rotate the bearing coarse scale ring until the even hundreds are read against the bearing coarse scale index, lock the coarse scale, and rotate the bearing knob back to line up the record index with the bearing fine scale index;
- d. the record is now set on the sight and is left in this position while laying the mortar using the particular aiming point;

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- e. if it becomes necessary to use one of the other aiming points, the same procedure is followed when setting the record on the sight; and
- f. records can be set on the sight by the No. 1 when the sight is on the mortar or before placing it on the mortar.

### NOTE

To avoid errors, the bearing scales should be zeroed before placing a record on the sight unit, and detachment commander verifies the scales reading.

#### 39. **Confirm by Questions.**

#### 40. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

#### 41. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** It is important to know and remember the parts of the C2A1 sight unit and how to set a record with it to assist you in the efficient operation of the mortar when using the M5 mount.
- c. The next lesson will be...

## LESSON 3—ACTION AND CEASE FIRING

### INSTRUCTOR'S NOTES

#### 42. **Aim.** To teach:

- a. action; and
  - b. cease firing.
43. **Time Required.** One 40 min period.
44. **Method.** A practical explanation/demonstration and practice period.
45. **Stores:**
- a. mortar with M5 mount (one per two students); and
  - b. sight unit.
46. **Preparation:**
- a. have a suitable area; and
  - b. have mortars assembled and laying on the ground.

## CONDUCT OF THE LESSON

47. **Review.** Stripping and assembling the mortar.
48. **Introduction.** When on the move, the No. 1 carries the mortar slung on his right side and the sight unit slung on his left side. The order to put the mortar in action is initiated by the support weapon detachment commander.
49. The following procedures may be used, however, the bipod and baseplate might not always be employed depending on the type of operation you are conducting. When on the advance, the mortar is likely to be used in the light role. During the defensive, deliberate attack and even raids the mortars may be used with bipod and baseplates.
50. Upon contact with the enemy, the platoon commander will indicate targets to the weapon detachment commander. The mortar crew will then bring the mortar into action as quickly as possible in

order to suppress the enemy fire. In this case, the mortar crew will use the mortar in a direct fire role.

51. In order for the mortar crew to properly engage the target, the weapon detachment commander (or the No. 1, in the weapon detachment commander's absence) must give out the initial fire control order, which consist of:

- a. warning order;
- b. number of rounds to be prepared and fired, with fuze setting and number of increments (charges) to be employed;
- c. No. 1 will read back all information;
- d. bearing (given if applicable);
- e. elevation (given if applicable);
- f. type of fire method (lever fire load or drop fire load);
- g. command to fire (**ADJUST FIRE, FIRE FOR EFFECT, AT MY COMMAND ADJUST FIRE, AT MY COMMAND IN FIRE FOR EFFECT** or **AT MY COMMAND FIRE FOR EFFECT**); and
- h. once again, No. 1 will read back.

52. Complete example:

- a. Fire Control Orders (FCO)—
  - (1) **MORTAR DETACHMENT;**
  - (2) **1500;**
  - (3) **REFERENCE BRIDGE, 3 O'CLOCK;**
  - (4) **MG POSITION;**

- (5) **NEUTRALIZE;**
- b. Warning Order—
  - (1) **FIRE MISSION (FM);**
  - (2) **10 ROUNDS DELAY;**
  - (3) **CHARGE 2;**
  - (4) **BEARING 3200 mils** (if applicable);
  - (5) **ELEVATION 1050 mils** (if applicable);
  - (6) **ADJUST FIRE.**
53. **Action.** On the order ...**ROUNDS ACTION** the No. 1 will:
  - a. Lay the mortar on the ground pointing in the direction of the target.
  - b. Unbuckle the leather strap.
  - c. Grasp the mortar midway on the barrel. Raise the barrel until the mount can swing clear of the baseplate.
  - d. Pull the legs apart until the spring catch engages.
  - e. Loosen the locking nut and slide up the sliding bracket until the elevating guide tube is vertical.
  - f. Screw up the adjusting nut until approximately 2.5 cm of unpainted leg is visible.
  - g. Tighten the locking nut.
  - h. Position legs approximately 45 cm in front of baseplate.
  - i. Centre elevating screw nut.

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- j. Centre traversing screw.
- k. Mount the sight on the mortar, ensuring that the four indexes are aligned.
- l. Set the elevation at 1100 mils.
- m. Level all bubbles.

54. The No. 2 will prepare the amount of ammunition given in the order **...ROUNDS ACTION**, place it handy at the right rear of the baseplate, and position himself on the right side of the mortar.

55. **Cease firing.** On receiving the order **CEASE FIRING**, the No. 1 will:

- a. remove the sight and replace it in the case;
- b. centre the traversing unit;
- c. put the traversing crank to the non-operating position;
- d. depress the elevating screw into the guide tube;
- e. loosen the locking nut and move the guide tube to the left leg;
- f. close the legs; and
- g. fold the mount until the legs are under the baseplate and rebuckle the strap.

56. The No. 2 will recondition the unused rounds and repack them.

57. **Confirmation.** Practice the class.

58. **Conclusion:**

- a. questions to and from class; and

- b. test on lesson.

59. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** It is important that you know and carry out all mortar drills quickly and correctly to maximize your effectiveness.
- c. The next lesson will be...

## LESSON 4—AIMING AND AIMING POINTS

### INSTRUCTOR'S NOTES

60. **Aim.** To teach aiming, including:

- a. aiming points;
- b. aiming; and
- c. the rules of aiming.

61. **Time Required.** Two 40 minute periods.

62. **Method.** An explanation and a practical explanation/demonstration period.

63. **Stores:**

- a. mortar, sight unit, and baseplate flag (one per detachment);
- b. overhead projector with slides; and
- c. chalkboard.

64. **Preparation:**

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- a. prepare overhead projector and chalkboard for the first period, which will include theory, selection of aiming points, and method of laying and aiming;
- b. for the outdoor period, mortars should be mounted and aiming points established; and
- c. the instructor will carry out safety precautions.

## CONDUCT OF THE LESSON

65. **Review.** Sight unit C2 naming parts.

66. **Introduction.** The 60 mm mortar can also be used as an indirect fire weapon. In this situation, the target will not be seen from the mortar position. Accurate fire can only be brought to bear through the use of an aiming point and through the mortar crew's ability to lay a correct aim on that aiming point.

67. **Aiming Points** (explain and demonstrate):

- a. there are three types of aiming points (AP):
  - (1) distant aiming point (DAP);
  - (2) close aiming point (CAP); and
  - (3) auxiliary aiming point (AAP).

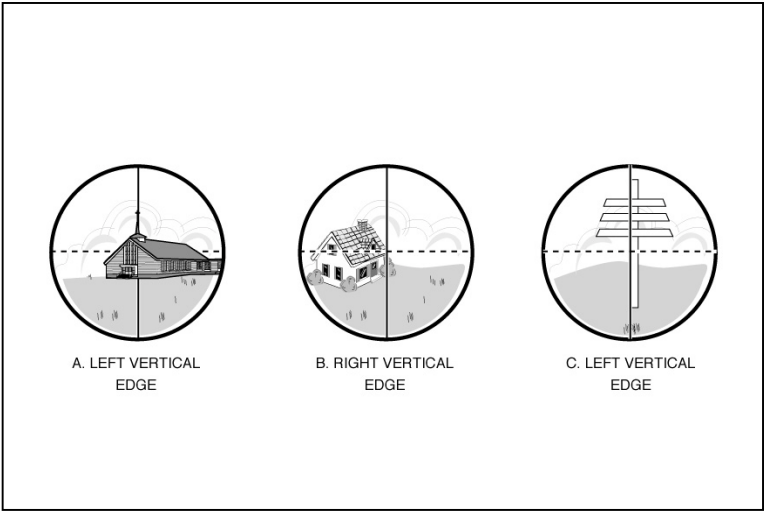
68. **Distant Aiming Point.** When speed is essential, a DAP should be used. Light conditions permitting, it should be a clearly defined, easily recognizable object (a building, a tree, a telephone pole, a clearly defined hilltop, etc.) at a minimum distance of 1000 m from the mortar position. The chosen DAP should be to the left of the mortars in order to minimize the chance of a barrel obstruction. A distant aiming point may be selected at night if light conditions are good or if a distant light is visible.



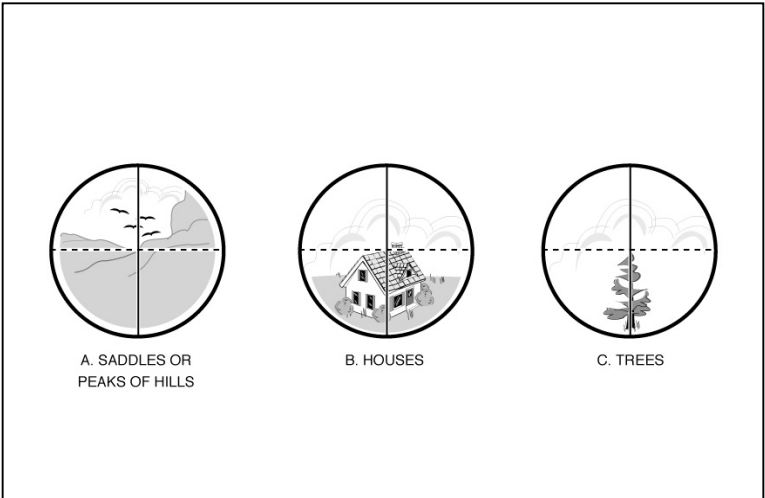
### NOTE

In order to obtain the record, the support weapon detachment commander will stand in the centre of the mortar line and shoot a grid bearing with his compass through the DAP. He will give it to all mortars as a record. If recording one mortar only, he will shoot a bearing through the sight unit to the DAP.

69. **Close Aiming Point.** A CAP can be established by a compass. It should use two stakes planted in line with the near stake a minimum of 10 m and the far stake a minimum of 20 m (minimum of 10 m from each mortar) from the mortar position, depending upon prevailing conditions. It should be to the left front of the mortar to reduce the chance of a barrel obstruction.
70. **Auxiliary Aiming Points.** When a CAP or a DAP is in use, it should be supplemented by an AAP that can be used should a barrel obstruction or poor visibility obscure the field of view between the telescope and the aiming point in use. An AAP is represented by two stakes to the left rear not less than 800 mils from the AP in use.
71. **Confirm by Questions.**
72. **Aiming.** Because of the variable types of objects that may be used as aiming points, a point of aim must be selected to avoid errors in laying the mortar. Points of aim will normally be either a vertical edge or an apex. When laying the mortar on a point of aim, the following rules will apply:
- a. **Vertical Edges.** The vertical lines of the reticle will be placed on the vertical edge (Figure 5-8).
  - b. **Apex.** The vertical lines of the reticle will be placed on top of the apex (Figure 5-9).



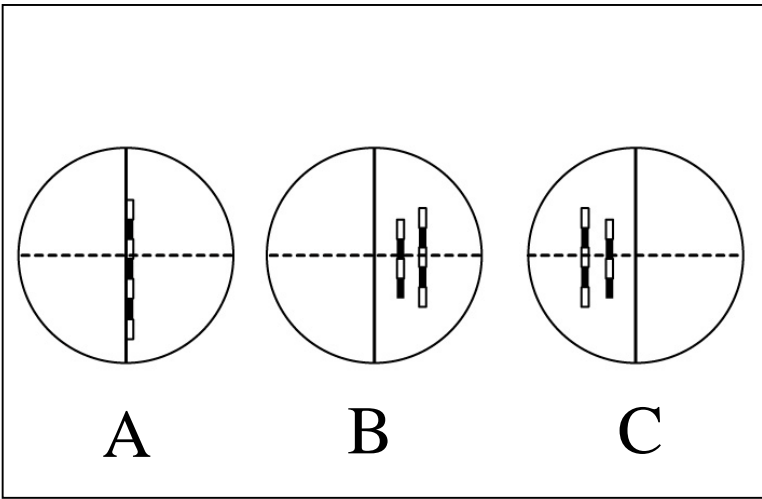
**Figure 5-8: Use of Vertical Edges as Aiming Points**



**Figure 5-9: Use of Apexes as Aiming Points**

73. **Stakes** (explain and demonstrate):

- a. When using one stake, the vertical line of the reticle will be laid on the lower left edge.
- b. When two stakes are used and they appear as one, the reticle will be laid on the lower left edge (Figure 5-10 A).
- c. When two stakes are used and both appear in the sight picture, a compensated point of aim must be established. To establish a compensated point of aim:
  - (1) lay the vertical line of the reticle on the left edge of the far stake;
  - (2) note the point on the horizontal line that touches the left edge of the near stake;
  - (3) place this point on the left edge of the far stake; and
  - (4) ensure the distance between the vertical line of the reticle and the left edge of the far stake is equal to the far stake and the left edge of the near stake, thus compensating for the error in sight unit displacement (Figure 5-10 B and C).



**Figure 5-10: Use of Aiming Stakes as Aiming Points**

74. **Confirm by Questions.**

75. Aiming is the process of applying direction to the barrel through the use of the sight unit and point of aim. To carry out this process, a set of rules for aiming must be followed. Explain:

a. **The Rules of Aiming:**

- (1) look through the telescope using the eyepiece;
- (2) adjust the telescope vertically to bring the AP into the field of view required;
- (3) lay the vertical line of the reticle correctly on the selected point of aim; and
- (4) when using the open sight, aim as with the rifle.

- b. **To Lay a Correct Aim:**
- (1) look through the telescope bearing in mind the rules of aiming; and
  - (2) turn the traversing handwheel and crank until the vertical line of the reticle in the telescope is correctly aligned on the selected point of aim.

76. **Confirm by Questions.**

77. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

78. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** Without proper aiming mortar fire will not be accurate; and
- c. Your next lesson will be ...

## **LESSON 5—RECORDING AND ESTABLISHING AIMING POINTS**

### **INSTRUCTOR'S NOTES**

79. **Aim.** To teach:

- a. recording aiming points; and
- b. establishing aiming points.

80. **Time Required.** Two 40 minute periods.

81. **Method.** A practical explanation/demonstration period.

82. **Stores:**

- a. one mortar and sight unit;
- b. aiming post and intermediate aiming post;
- c. baseplate flag (one per detachment); and
- d. compass.

83. **Preparation:**

- a. mortars should be mounted and aiming points selected; and
- b. instructor will carry out safety precautions.

## CONDUCT OF THE LESSON

84. **Review.** Mortars in and out of action.

85. **Introduction.** The 60 mm mortar, when used as an indirect fire weapon, must establish an artificial or natural aiming point which is not the target. A compass is used to orient the mortar so that bearings placed on the sight unit will be the grid bearing of the mortar barrel, once properly laid on the aiming point.

86. **Recording Aiming Points:**

- a. Action of the detachment commander:
  - (1) when the mortar/group is ordered into action, it will be the detachment commander's responsibility to establish an aiming point and ensure each mortar is recorded for its respective aiming point; and
  - (2) when the No. 1s are ordered to record this aiming point, the order will contain the following information:

- (a) type of aiming point;
  - (b) description of the aiming point, including the selected point of aim; and
  - (c) the RECORD in mils GRID.
- b. **Action of the No. 1s.** On receipt of the detachment commander's indication of the aiming point, the No. 1s shall:
- (1) acknowledge the order and identify the aiming point;
  - (2) write on the Record of Aiming Points Card, the information indicated at Figure 5-11;

<b>RECORD OF AIMING POINTS</b>		
<b>TYPE</b>	<b>DESCRIPTION</b>	<b>RECORD</b>
DAP	Left, brown house left edge.	2175
CAP	Left, near and far stake, left edge.	1600
AAP	Right, rear stake, left edge.	0945

**Figure 5-11: Record of Aiming Points Card**

- (3) refer to this Record of Aiming Points card when using a particular aiming point to set the record on his sight unit; and
  - (4) erase this record when **CEASE FIRING** is ordered.
87. **Subsequent Action by the No. 1** (explain):
- a. As long as the No. 1 has the record of the particular aiming point he is using set on his sight unit, the mortar when laid will point in the direction of the ordered bearing. It will be necessary on occasion to

change aiming points and therefore the record on the sight unit must be changed.

- b. If for any reason the bearing coarse scale clamp or butterfly nut becomes loose and the scales slip, the record can be reset on the sight unit by the No. 1. He refers to his Record of Aiming Points card and follows the procedure outlined above.

88. **Safe Distance Table** (explain):

- a. certain metals and electricity have a very real effect on the accuracy of bearings taken using a compass;
- b. as a guide, the following distances from the objects listed should be respected when taking a bearing to ensure accuracy:
  - (1) radio set Type B—1 m;
  - (2) flashlight—30 cm;
  - (3) rifles and steel helmets—1 m;
  - (4) vehicles—14 m; and
  - (5) mortars—2 m.

89. **Confirm by Questions and Practice.**

90. **Establishing and Recording an AAP from a Prerecorded DAP or CAP.** On command **ESTABLISH AAP** or when time permits, the No. 1 shall:

- a. select an area that provides an unobstructed field of view for a minimum distance of 20 m, and at a minimum angle of 700-800 mils on the left of the aiming point;
- b. check the lay of his mortar on the initial aiming point and write down his barrel bearing, e.g., 6300 mils;



- c. using the quick release gear, rotate the telescope until the selected area can be viewed;
- d. order **STAKE 2** and plant two stakes in the selected area by carrying out the proper procedure for planting stakes;
- e. check his mortar to ensure that no movement has taken place, unlock and slip both the bearing coarse and fine scale rings (using the same procedure as for putting on a record) until the noted bearing (6300) is read against the bearing indices—lock the scales;
- f. note the reading now against both the coarse and fine scale record indices (this reading is the **RECORD** of the AAP);
- g. record the AAP on the Record of Aiming Point card as previously taught;
- h. unlock and slip the coarse and fine scale rings until the record of the initial aiming point is read against the record indices; lock the scales; and
- i. rotate the telescope back to his initial aiming point (the reading opposite the bearing indices will be 6300 mils).

#### **NOTE**

If two stakes are not available, then only one can be used.

91. **Establishing and Recording CAPs From a Prerecorded DAP.** To establish and record the CAPs, the same basic procedures as outlined above will apply. However, in addition, the following actions shall be carried out by the No. 1:

- a. select an area that provides an unobstructed field of view for a minimum distance of 20 m;

- b. using the quick release gear, rotate the head of the telescope until the selected area can be viewed through the telescope;
- c. order **STAKE 2**. The No. 2 moves to the selected area and at approximately 20 m plants his far stake. The No. 1 will rotate the sight unit, using the fine scale knob, onto the left edge of the stake;
- d. direct the No. 2 to advance 10m towards the mortar and plant the near stake in such a manner so that its left edge is in line with the vertical line of the telescope and the left edge of the far stake;
- e. order **IN 2**;
- f. unlock and slip the bearing coarse and fine scale rings until the noted reading is read against both bearing indices and lock both scales (the reading now opposite the coarse and fine scale record indices is the record for the CAP); and
- g. carry out the procedures outlined above for establishing and recording an AAP.

92. **Confirm by Questions and Practice.**

93. **Conclusion:**

- a. questions to and from the class; and
- b. test students on lesson.

94. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** A thorough knowledge of these drills will assist in the quick and efficient recording of targets.
- c. The next lesson will be ...

**LESSON 6—LAYING THE MORTAR****INSTRUCTOR'S NOTES**

95. **Aim.** To teach:
- a. laying for a small correction; and
  - b. laying for a large correction.
96. **Time Required.** Two 40 min periods.
97. **Method.** A practical explanation/demonstration period.
98. **Stores:**
- a. complete mortar and sight unit (one per detachment); and
  - b. one demonstration detachment.
99. **Preparation:**
- a. mortars should be dismounted;
  - b. target and aiming points are selected; and
  - c. the suggested method for teaching is demonstration, talk through, and practice.

**CONDUCT OF THE LESSON**

100. **Review.** Action and cease firing.
101. **Introduction.** At any time during operations, the mortar numbers may be called upon to lay the mortar. The laying is done by the No. 1, occasionally assisted by the No. 2. The procedure for laying must become instinctive to all, and speed coupled with accuracy is essential, otherwise the resulting fire will not be effective.

102. **Laying the Mortar for Small Corrections:**

- a. the traversing mechanism on the bipod allows lateral movement of the mortar approximately 125 mils either side of its central position; therefore, small corrections for direction and elevation will be applied as taught in this lesson;
- b. during the laying of the mortar, the elevating bubble is to be centralized first and the cross-levelling bubble must be maintained in a central position; and
- c. on receiving a fire order, the No. 1 will:
  - (1) place the ordered data on the sight unit;
  - (2) acknowledge the order (read from sight unit);
  - (3) centralize the elevating bubble using the elevating crank;
  - (4) look through the telescope and note the position of the aiming point in the field of view;
  - (5) if the aiming point is in the field of view, rapidly turn the traversing handwheel and crank until the vertical line of the reticle is halfway to the selected point of aim;
  - (6) centralize the cross-levelling bubble;
  - (7) carry out the procedure of traversing and adjusting the cross-levelling bubble until the vertical line of the reticle is on the selected point of aim and the cross-levelling bubble is central;
  - (8) any movement of the cross-levelling bubble will necessitate a check on the point of aim

and vice versa until both are correct and no further corrections are required; and

- (9) recheck all bubbles and the selected point of aim, report **ON**, and order **FIRE** to your No. 2 if so ordered;
- d. if the point of aim is not seen through the telescope but is not far away, the No. 1 moves the bipod until he sees the point of aim in the telescope and carries on with the procedures as previously taught.

### NOTE

When moving the bipod, care must be taken with the baseplate and socket as it will allow small movement only.

#### 103. **Confirm by Questions and Practice.**

104. **Laying the Mortar for Large Corrections.** Frequently, bearings or targets will be ordered that will require movement of the baseplate because of the limited traverse permitted by the traversing mechanism and the socket. In such cases, the No. 1 will:

- a. place the ordered data on the sight unit;
- b. acknowledge order;
- c. look through the telescope and note the position of the point of aim in the field of view; and
- d. if, when the No. 1 looks through the telescope, the aiming point is not in the field of view and is far from line of sight, he must carry out the following additional procedures:
  - (1) Centralize the carrier and expose approximately 18 cm of the elevating screw.

- (2) Order **BASEPLATE 2**.
- (3) The No. 1 grasps the bipod legs and the No. 2 raises the baseplate.
- (4) The No. 1 moves the bipod until he observes that he is almost on the selected point of aim. At the same time, the No. 2 pivots the baseplate to follow the movement of the barrel, taking care that the socket stays over the same point. No. 1 then orders **STEADY**.
- (5) On this command, the movement of the bipod and baseplate cease, and the No. 2 presses the baseplate on the ground. No. 1 orders **STAMP IN**.
- (6) On this command, the No. 2 stamps in the baseplate and resumes his normal duty.
- (7) The No. 1 moves the bipod in or out until the elevating bubble starts to move and the cross-levelling bubble is roughly centred.
- (8) The No. 1 adjusts the elevating bubble using the elevating crank and lays the mortar as previously taught.

105. **Confirm by Questions and Practice.**

106. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

107. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** Continual practice is required until these drills become automatic and laying the mortar is quick and accurate.
- c. The next lesson will be ...

## LESSON 7—DIRECT FIRE

### INSTRUCTOR'S NOTES

108. **Aim.** To teach:

- a. firing the first round; and
- b. method of adjustment.

109. **Time Required.** One 40 minute period.

110. **Method.** A practical explanation/demonstration period.

111. **Stores.** One mortar, sight unit, and baseplate flag per detachment.

112. **Preparation:**

- a. have a suitable area;
- b. have mortars mounted; and
- c. safety precautions will be carried out by the instructor.

### CONDUCT OF THE LESSON

113. **Review.** Action and cease firing.

114. **Introduction.** This procedure is normally used to engage targets. The procedure for direct fire must be understood by all mortar crews in order to effectively engage a target. An enemy coming in direct line of sight with the mortar can be engaged with speed and accuracy using the direct fire method of engagement.

115. **Firing the First Round.** When direct fire is to be used, the detachment commander will estimate the range to target and, using the proper firing table, choose the appropriate charge and elevation. Give this data to the mortar. No. 1s, with this data, will:

- a. align all bearing indices together;
- b. apply the elevation to the sight unit;
- c. looking through the telescope, lay the mortar on the target ensuring that the levels are on;
- d. fire the first round; and
- e. re-lay the mortar as fast as he can and wait for the fall of shot.

116. **Method of Adjustment.** When the round explodes in the target area, the No. 1 will:

- a. using the bearing knob, rotate the sight unit to have the reticle on the point of explosion; and
- b. re-lay the mortar on the target (this will correct the round for line).

117. Depending on whether the first round was plus or minus of target, he will:

- a. crank up the elevating handwheel to decrease, or crank down to increase, the range of the next round, as many times as deemed necessary to hit the target or bracket it;
- b. level the elevating bubble using the elevating knob;



- c. check his lay in direction and the cross-levelling bubble; and
- d. fire another round.

118. All other corrections will be for range only, until the target is hit.

119. When the target has been hit, the specified amount of rounds will be fired for effect.

### NOTE

If more than one mortar is used all the mortars can use the same round to make their line correction and the elevation from the adjusting mortar for their fire for effect.

120. **Confirm by Questions.** All practice as No. 1s.

121. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

122. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** This drill is a quick and efficient method of engaging the enemy with direct fire.
- c. The next lesson will be ...

## LESSON 8—CRANK METHOD

### INSTRUCTOR'S NOTES

123. **Aim.** To teach:
- crank corrections; and
  - actions of the No. 1.
124. **Time Required.** One 40 minute period.
125. **Method.** A practical explanation/demonstration period.
126. **Stores:**
- mortar;
  - sight unit; and
  - baseplate flag (one per detachment).
127. **Preparation:**
- have a suitable area with DAP;
  - have mortars mounted; and
  - safety precautions will be carried out by the instructor.

### CONDUCT OF THE LESSON

128. **Review.** Engage a target with direct fire.
129. **Introduction.** In some instances, crank corrections can be given to the mortar. These types of corrections are quick and very effective.

130. **Crank Corrections.** Explain that one crank is a complete turn of the traversing or the elevating handwheel and crank. The No. 1 may receive a correction in direction or elevation. He may also receive a combined correction for direction and elevation. The support weapon detachment commander can order one crank or several cranks as follows:

- a. **RIGHT ONE CRANK;**
- b. **LEFT [number] CRANK(s);**
- c. **UP [number] CRANK(s);**
- d. **DOWN [number] CRANK(s);**
- e. **RIGHT [number] CRANK(s); or**
- f. **DOWN [number] CRANK(s).**

131. **Actions of the No. 1:**

- a. **Right or Left Correction:**
  - (1) turn the traversing handwheel and crank the specified amount of turns in the direction ordered;
  - (2) level the cross-levelling bubble;
  - (3) turn his telescope on the point of aim; and
  - (4) resume firing if so ordered.
- b. **Up or Down Correction:**
  - (1) turn the elevating handwheel and crank the specified amount of turns to elevate or depress the mortar as ordered;
  - (2) using the elevating knob, level the elevating bubble; and

- (3) resume firing if so ordered.

c. **Double Correction:**

- (1) turn the traversing handwheel and crank the specified amount of turns in the direction ordered;
- (2) turn the elevating handwheel and crank the specified amount of turns to elevate or depress the mortar as ordered;
- (3) using the elevating knob, level the elevating bubble;
- (4) level the cross-levelling bubble;
- (5) turn the telescope on the point of aim; and
- (6) resume firing if so ordered.

d. **When the Crank Corrections are Used to Adjust Onto a Target:**

- (1) do the procedure previously taught;
- (2) fire an adjusting round; and
- (3) re-lay the mortar.

e. On the command **FIRE FOR EFFECT**, all mortars (if more than one is used) will use the same data as the adjusting mortar.

f. Crank corrections may be given during a fire for effect to adjust the mean point of impact (MPI). The same procedure will then be applied.

132. **Confirm by Questions.** All practice as No. 1s.

133. **Conclusion:**
- a. questions to and from the class; and
  - b. test on lesson.

134. **Summary:**
- a. main points - restate the aim;
  - b. final statement; and
  - c. the next lesson will be ...

## **LESSON 9—MISFIRE DRILL**

### **INSTRUCTOR'S NOTES**

135. **Aim.** To teach:
- a. misfire drill; and
  - b. causes of misfires.
136. **Time Required.** One 40 minute period.
137. **Method.** A practical explanation/demonstration period.
138. **Stores.** One complete mortar and sight unit per two persons.
139. **Preparation:**
- a. mortars should be mounted and laid on a target; and
  - b. prepared fire orders.

### **CONDUCT OF THE LESSON**

140. **Review.** Reacting to fire orders.

141. **Introduction.** A misfire occurs when a round is loaded into the barrel of the mortar but fails to fire. Usually, the round strikes the firing pin and fails to function. In rare cases, the round may hang in the barrel without striking the firing pin. In any case, it is up to the crew to remove the unfired round and get the mortar back into action as soon as possible.



**Figure 5-12: Misfire Positions**

142. **Misfire Drill.** When a misfire occurs, the No. 1 will:
- a. Shout **MISFIRE** and tap the barrel with his hand. This may dislodge a round that had stuck in the barrel.
  - b. If the round is not fired, the No. 2 sets the firing selector on **LEVER FIRE** and trips the lever three times.
  - c. If the mortar still fails to fire, the crew will wait at least one minute before attempting to remove the round because of a possible delay action of the propelling charge.

- d. During this time the No. 1 tests the barrel for heat. If the barrel is cool at the end of one minute, the round is removed as described below.
- e. The No. 1 rises to a kneeling position and unlocks the barrel from the baseplate. He braces the bipod by grasping the guide tube with his left hand, just below the clevis joint. He places his right hand around the base cap and is careful to keep his head and shoulders from in front of the muzzle (Figure 5-12).
- f. The No. 2, from a kneeling position, places his right hand, palm up, under the barrel, and his left hand, palm down, on top of the barrel. He places his thumbs alongside the forefingers. He is careful to keep every part of each hand from in front of the muzzle. The No. 1 lifts the base of the barrel until the barrel is horizontal.
- g. **Under no circumstances does he again lower the base of the barrel below the horizontal until the round has been removed from the barrel.**
- h. As soon as the barrel reaches the horizontal, the No. 2 places his thumbs over the muzzle and as the base of the barrel moves above the horizontal position, he stops the round as the point of the fuze reaches the muzzle. He then removes the round from the barrel, replaces the safety wire, and inspects the round to determine the cause of misfire.
- i. If the primer of the ignition cartridge is dented, the round is placed aside for destruction. If the primer is not dented, the round may be fired after the mortar is remounted.
- j. The No. 1 raises the base of the barrel well above the horizontal and shakes it to dislodge any remnants from the last round fired. He then lowers the mortar and locks the spherical projection in the socket, sets the selector at drop fire, and resumes firing.

- k. If another misfire occurs, the No. 1 inspects the firing pin to see that it is clear and protruding beyond the surface of the firing pin bushing. If the firing pin is faulty, the firing mechanism is stripped and the defect corrected.

143. **Confirm by Questions and Practice.**

144. **Causes of Misfires:** (Explain)

- a. defective primer or ignition cartridge;
- b. defective or damaged firing pin or other parts of firing mechanism;
- c. loose firing pin bushing;
- d. firing pin fouled or obstructed by remnants from previous rounds;
- e. fouled bore;
- f. excess oil or water in bore;
- g. cartridge not fully inserted in container;
- h. misaligned stabilizing fin; and
- i. foreign matter or excess paint on bourrelet or fouled obturating ring.

145. **Confirm by Questions and Practice.**

146. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

147. **Summary:**

- a. Restate the aim.



- b. **Final Statement.** It is important that you know the causes of a misfire and carry out the misfire drill correctly to resume firing as fast as possible.
- c. The next lesson will be ...

## LESSON 10—ADJUSTING AND RECORDING TARGETS

### INSTRUCTOR'S NOTES

148. **Aim.** To teach using the weapon in the indirect fire role by means of:
- a. adjusting a target; and
  - b. recording targets.
149. **Time Required.** One 40 minute period.
150. **Method.** Explanation and practice on range.
151. **Stores.** Binoculars, compass, firing tables and target record sheet.
152. **Preparation.** Examples of bearing and ranges should be prepared in advance.

### CONDUCT OF THE LESSON

153. **Review.** Use of a compass and reticle pattern of the binocular.
154. **Introduction.** The 60 mm mortar can be employed in the indirect fire role by two methods:
- a. **Method 1.** The first but least common method is by means of employing an Advanced Mortar qualified mortar fire controller (MFC) to call and adjust fire from a displaced observation post (OP) and an Advanced Mortar qualified control post operator

(CPO) to calculate the fire data to be applied on the mortars. Procedures for their employment are found in B-GL-317-009/PT-001 *Weapons, Volume 9, 81 mm Mortar*.

#### NOTE

All other weapons handling drills and procedures for employment of the 60 mm mortar must be in accordance with the 60 mm mortar PAM. The 81 mm handling drills such as hanging the bomb will not be employed. The lever fire feature on the 60 mm precludes this.

- b. **Method 2.** The second and more common method involves the detachment commander acting as both MFC and CPO using procedures not requiring Advance Mortar qualification.

155. The detachment commander should position himself in close proximity to the front or rear of the mortar position and, if possible, in line with the mortar and the target area. Mortars can be controlled this way as an individual weapon within each platoon or as a group within the company. Orders can be given verbally, by field phone or radio.

156. **Adjusting a Target.** When a target has been identified and engagement ordered, the detachment commander will:

- a. shoot a bearing to the target (grid);
- b. compensate for the distance from his position to the mortar if necessary;
- c. pass this bearing to the mortar(s);
- d. estimate the range (by map, laser or any other means);
- e. with the firing tables, convert this range into charge and elevation;

- f. pass this elevation, the amount of rounds to be fired, and charge to the mortar(s); and
- g. order the mortar to **ADJUST FIRE** or **FIRE FOR EFFECT**.

157. Example of a fire mission:

- a. **FIVE ROUNDS CHARGE 2;**
- b. **BEARING 4425;**
- c. **ELEVATION 1158;** and
- d. **ADJUST FIRE.**

#### NOTE

Normally ranging should be done before firing for effect. The type of ammunition to be fired has to be specified if other than High Explosive (HE).

158. On receiving a fire order, the No. 1 will:

- a. read back the amount of rounds and charge (Note: No. 2 reads back the charge and prepares the ammunition);
- b. read back the bearing and elevation after setting it on his sight unit;
- c. lay the mortar and give the order **LEVER FIRE LOAD** or **DROP FIRE LOAD** when the mortar is on.

159. When the round explodes in the target area, the detachment commander will:

- a. with his binoculars, measure the right or left correction to be applied in mils and pass it on to the

mortar as a plus correction (right) or a minus correction (left); and

- b. estimate the error in range, verify with the firing table for the new elevation and pass it to the mortar with the command to fire. Example: **PLUS 30 MILS, ELEVATION 1135, FIRE.**

160. The No. 1 will apply the corrections as follows:

- a. apply the ordered elevation and add or subtract the ordered bearing correction to the C2 dial sight; and
- b. re-lay the mortar and order his No. 2 to load.

161. This process is repeated until the target is effectively engaged, then the detachment commander gives the order **FIRE FOR EFFECT**, at which time the No. 1 controls the loading of each round.

#### **NOTE**

The amount of rounds given in the fire order are fired for effect and does not include the number of adjusting rounds.

162. **Confirm by Questions.**

163. **Recording a Target:**

- a. **By Fire.** After a target has been engaged and has to be recorded, the detachment commander gives the order to record and gives a number to the target. Example: **RECORD AS TARGET 0005.**

- b. **Silent Registration:**

- (1) this is the method used when target security, conservation of ammunition, and the maintenance of surprise is of the utmost importance, and when authority is not granted to register by fire;

- (2) it must be understood that this method does not guarantee immediate effective fire on a target, but all targets can be identified and all data calculated in preparation of an engagement; and
  - (3) the detachment commander has to take a bearing and estimate the range to each target as well as give the mortar all this data and a number for each target.
- c. If the mortars are located in their individual platoon's position, coordination has to be done at company level.
164. When not otherwise engaged, all mortars in a company have to be laid on the final protective fire (FPF).
165. **Confirm by Questions and Practice.**
166. **Conclusion:**
- a. questions to and from class; and
  - b. test students on lesson.
167. **Summary:**
- a. Restate the aim.
  - b. **Final Statement.** Mastering these drills will ensure accurate fire on targets and ensure that they can be engaged later.
  - c. The next lesson will be ...

## LESSON 11—SIGHT UNIT TESTING

### INSTRUCTOR'S NOTES

168. **Aim.** To teach:

60mm Mortar M19 Cdn

- a. description of the M45 boresight;
- b. verification of boresight accuracy;
- c. test for elevation; and
- d. test for bearing.

169. **Time Required.** Four 40 minute periods.

170. **Method.** An explanation and practical period.

171. **Stores:**

- a. mortar, sight unit and baseplate flag (one per detachment); and
- b. M45 boresight (one per detachment).

172. **Preparation:**

- a. have suitable area with DAP;
- b. have mortars mounted; and
- c. safety precautions will be carried out by the instructor.

## CONDUCT OF THE LESSON

173. **Review.** Laying the Mortar.

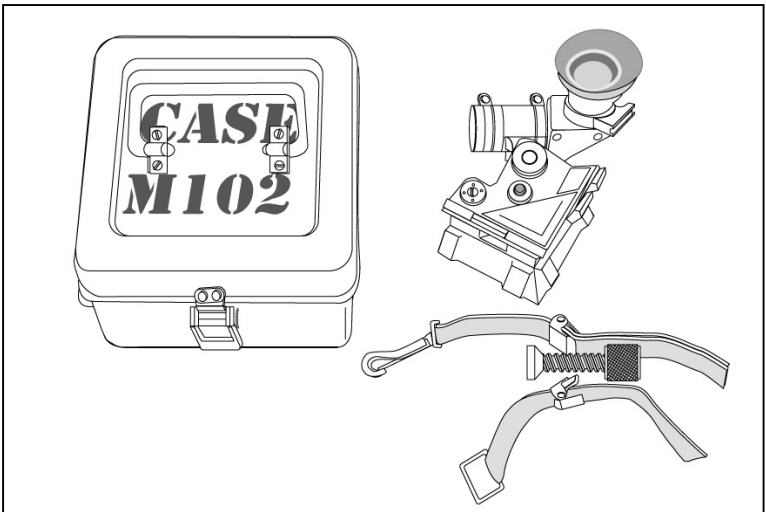
174. **Introduction.** The sight unit occasionally will be jarred out of adjustment for elevation and bearing due to firing or unnecessary rough handling. These errors can be determined and corrected by using the M45 boresight.

175. **Explain.** All mortar sights in a unit must be tested occasionally, particularly before firing. Precautions must be made to ensure that the sight unit being tested stays with the mortar it was

tested on; also, all sight units within a company must be tested with the same M45 boresight.

176. **The M45 Boresight:**

- a. **General Description.** The boresight has an elbow telescope with a rubber eyepiece at one end. The telescope has a fixed focus and a magnification of 3 power. It is attached to the body by a pivot shaft and clamp to allow the telescope to pivot either way. Included on the body are elevation and cross-level bubbles. Attached to the base of the body are two web straps designed to attach the boresight to the barrel of the mortar. After initial use, these straps may be cut at the desired length without danger of fraying. The boresight has a field of view of 215 mils and weighs 1.3 kg. It is carried in a metal case with a strap and a metal handle for carrying. The case weighs 1.5 kg (Figure 5-13).



**Figure 5-13: M45 Boresight**

177. **Maintenance.** The boresight should not be subjected to rough handling or abuse; if it is, inaccuracy will result. The instrument must be kept clean and dry. It must be cleaned periodically

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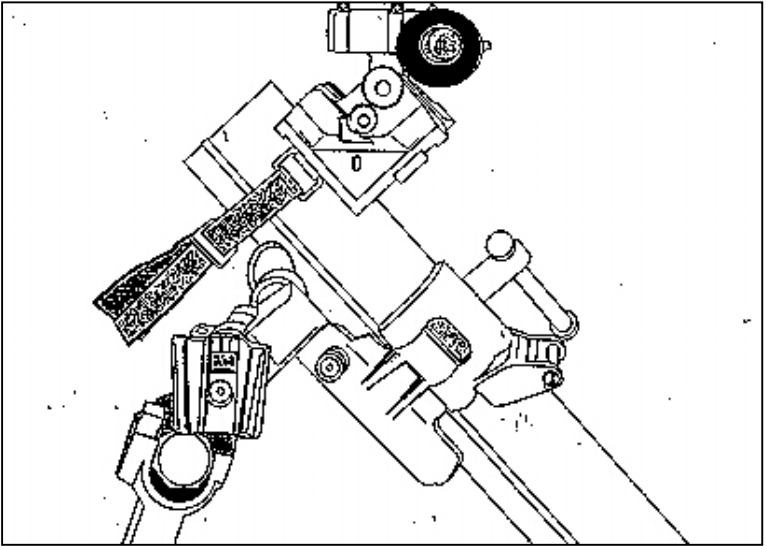
by removing all foreign matter with a soft cloth or brush. The glass surfaces should be cleaned with tissue using a detergent sparingly if the glass is oily or greasy. To prevent rust, a light film of instrument oil should be applied to all but the glass surface.

178. **Confirm by Questions.**

179. **Verification of Boresight Accuracy.** The M45 boresight is adjusted at the manufacturing plant and it should not require readjustments as a result of normal field handling. The accuracy of the boresight will be verified by an Advanced Small Arms qualified NCM prior to the boresight being used. The following method will be used:

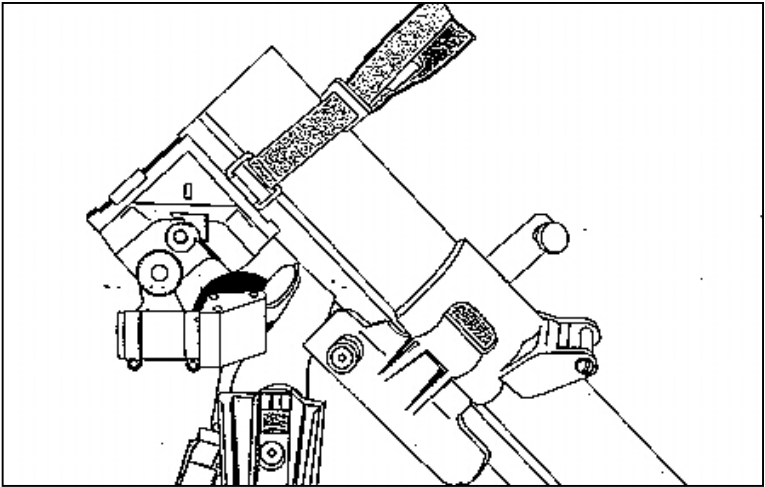
- a. Mount the mortar on level ground and sandbag it for stability if not bedded-in.
- b. Lay on a DAP, ensuring that the mortar and sight unit are cross-levelled.
- c. Adjust the boresight on top of the mortar barrel with the telescope pointed to the front, leaving the straps loose enough to allow slight movement. Cross-level the boresight by rotating it on the barrel circumference and tighten the clamp assembly (Figure 5-14).





**Figure 5-14: Boresight Mounted on Top of the Barrel**

- d. Align the vertical line in the boresight telescope on the DAP by traversing the mortar and, at the same time, keeping the boresight cross-level bubble central by slightly rotating the cross-leveiling mechanism on the bipod. This ensures that all bubbles remain central.
- e. Note the point of aim on the DAP.
- f. Without moving the barrel of the mortar, remove the boresight and adjust it beneath the mortar barrel, ensuring that the telescope is pointing to the front and it's cross-level bubble is central (Figure 5-15).



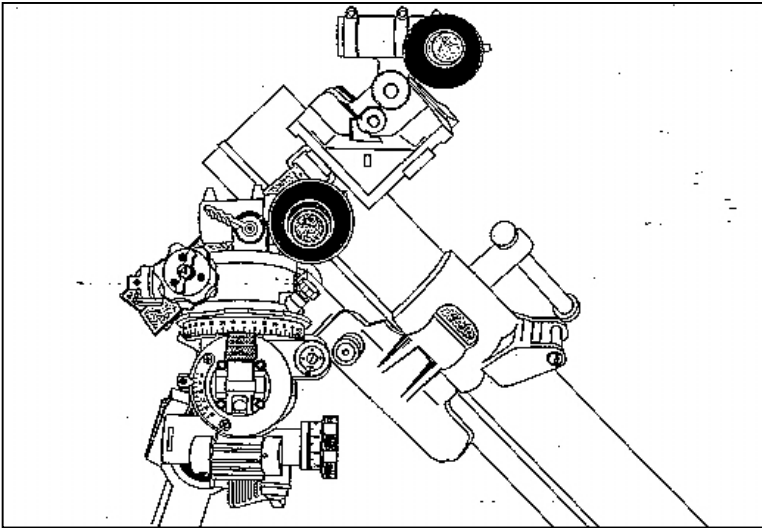
**Figure 5-15: Boresight Mounted on Bottom of the Barrel**

- g. Recheck the cross-level and elevation bubble and ensure that the lay of the mortar has not been disturbed.
- h. Note the point of aim on the DAP.
- i. Misalignment of the points of aim (sub-paragraphs e. to h.) indicates a bearing error in the boresight.
- j. If an error is revealed, the boresight will be turned in for repair.

**NOTE**

If absolutely required, the boresight can still be used for boresighting. The true bearing of the mortar tube lies midway between the two lines of sight of the boresight when installed on top of and below the barrel of the mortar tube (Figures 5-14 and 5-15). Note the deviation, set the sight unit crosshair on the midpoint, and zero the sight unit scales and indices in the manner indicated above. This deviation must then be added (or subtracted) from all other sight units.

180. **Confirm by Questions.** All to practice as No. 1.
181. **Sight unit Testing for Elevation.** When it is necessary to adjust the sight unit for elevation the procedures below are followed:
- a. Ensure the sight unit is tested on its proper mortar.
  - b. Mount the mortar on level ground and sandbag it for stability if not bedded-in.
  - c. Cross-level the mortar and sight unit.
  - d. Adjust the boresight on top of the mortar barrel with the telescope pointed to the front, leaving the straps loose enough to allow slight movement. Cross-level the boresight by rotating it on the barrel circumference and tighten the clamp assembly (Figure 5-16).



**Figure 5-16: Position of Boresight for Testing Elevation and Bearing**

- e. Elevate the mortar until the elevation bubble on the boresight is central. The barrel will now be at an angle of 800 mils.
- f. Cross-level the sight unit.
- g. Centre the sight unit elevation bubble by turning the elevation knob.
- h. Recheck all bubbles.
- i. The elevation scales should now read 800 mils. If not, adjust as follows:
  - (1) loosen the three screws in the end of the elevation knob with the small screwdriver provided with the sight unit;
  - (2) hold the knob in place and slide the elevation fine scale ring until it reads zero opposite the elevation fine scale ring index; and

(3) tighten the three screws.

- j. Finally, recheck all bubbles on both instruments, ensuring they are level and the sight unit elevation scales read exactly 800 mils. If not, repeat the above procedures.

182. **Confirm by Questions.** All to practice as the No. 1.

183. **Sight Unit Testing for Bearing.** The sight unit occasionally will be jarred out of adjustment for bearing by firing or abuse. The resulting error can be determined and corrected by using the boresight. All mortar sight units in a company should be tested occasionally during lulls in firing. This testing will only be done on the order and under supervision of a qualified Small Arms Instructor:

- a. When testing the sight unit for bearing, ensure that:
- (1) the mortar is mounted on level ground and sandbagged for stability if not bedded-in;
  - (2) the sight unit is tested on its proper mortar;
  - (3) the mortar is laid on a DAP with the bearing scales reading zero against both bearing and record indices and 800 mils on the elevation scales; and
  - (4) ensure that boresight accuracy test has been completed.
- b. **Boresighting.** Once the No. 1 is satisfied that the points mentioned above are correct, the mortar will be boresighted using the following procedures:
- (1) Adjust the boresight on the top of the barrel with the telescope pointing to the front and ensure its cross-level bubble is central (Figure 5-16).
  - (2) Align the vertical line in the telescope on the DAP by traversing the mortar and at the

same time, keeping the boresight cross-level bubble central by slightly rotating the cross-levelling mechanism on the bipod. This ensures all bubbles remain central.

- (3) Note the point of aim on the DAP.

184. **Testing and Adjusting the Sight unit for Bearing.** Once the point of aim for adjustment has been selected, the sight unit will be tested and adjusted using the following procedures:

- a. **Testing the Sight Unit.** To test the sight unit, the No. 1 will:
  - (1) look through the sight unit telescope and note the position of the vertical line of the reticle in relation to the point of aim for adjustment;
  - (2) if the vertical line is laid on the point of aim, the sight unit is in adjustment; and
  - (3) if the vertical line is off the point of aim, the sight unit is in error and must be adjusted.
- b. **Adjusting the Sight Unit.** To adjust the sight unit, the No. 1 will proceed as follows:
  - (1) Turn the bearing knob and align the vertical line of the reticle onto the point of aim. The resulting reading on the bearing fine scale index is the sight unit error.
  - (2) Loosen the butterfly nut and, keeping the bearing knob from rotating, move the bearing fine scale ring until the zero graduation read opposite the bearing index.
  - (3) Rotate the butterfly nut until the holes in the flange are opposite the three small screws and loosen each screw with the

small screwdriver provided with the sight unit.

- (4) Ensuring that no movement of the bearing knob is allowed, rotate the record index until it is aligned with the zero graduation of the bearing fine scale ring and the bearing fine scale index.
- (5) Tighten the three screws and the butterfly nut.
- (6) Recheck all bubbles and telescope vertical lines ensuring they are in alignment with the point of aim. If not, repeat the above procedures until all bubbles are central and all vertical lines are on the point of aim with zero on the bearing scales.

#### NOTES

1. If the sight unit is out of adjustment in excess of 10 mils in bearing or elevation, it should be taken to the weapons technician for checking.
2. Ensure that the same boresight is used for testing all the sight units in the company.

185. **Confirm by Questions and Practice.** All to practice as the No. 1.

186. **Conclusion:**

- a. questions to and from the class; and
- b. test on lesson.

187. **Summary:**

- a. Restate the aim.
- b. **Final Statement.** As part of the mortar crew, you must be able to carry out adjustment to the C2A1 sight unit under supervision to ensure that the equipment is as accurate as possible.
- c. The next lesson will be ...



## **CHAPTER 6**

### **60 mm MORTAR WEAPONS HANDLING TESTS**

#### **INTRODUCTION**

1. This chapter details the weapon handling tests and standards to be achieved with the 60 mm mortar when used in either the handheld role or as a weapons detachment member in the indirect fire role using the M5 mount and C2 sight unit.

#### **PURPOSE**

2. These tests provide a means for instructors to monitor progress during training and for commanders to assess the standard of training of their troops.

3. Standards should be measured:

- a. at appropriate stages during training; and
- b. annually in all units.

#### **CONDUCT**

4. The tests are to be done consecutively. They may be conducted in barracks using dummy ammunition. For the handheld role, a No. 2 may be employed but it is the No. 1 who is being tested. For the indirect role with a two man crew both the No. 1 and 2 are being assessed for some tests.

#### **DRESS**

5. Fighting order with helmet will be worn for all tests.

## STANDARDS

6. The following standards will apply:
  - a. **Skilled:** skilled standard in all tests.
  - b. **Average:** minimum of average in one or more tests.
  - c. **Fail:** fail in one or more tests.

**ANNEX A**  
**60 mm MORTAR, HANDHELD ROLE**

**APPENDIX 1**  
**SAFETY PRECAUTIONS**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>CARRY OUT SAFETY PRECAUTIONS</b>		
1	Remove the muzzle cover.		
2	Cup the left hand around the muzzle and carefully tip the mortar so that the projectile or fouling will slide out into the left hand (if applicable).		
3	Check down the barrel to ensure it is clear.		
4	Replace the muzzle cover.		
5	Inspect dummy rounds.		



**APPENDIX 2**  
**STRIPPING AND ASSEMBLING, CARE AND CLEANING**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>FIELD STRIP THE MORTAR</b>		
1	Conduct normal safety precautions.		
2	Unscrew the split nut from the baseplate.		
3	Remove the baseplate and split nut from the spherical projection.		
4	Remove the locking screw from the firing mechanism housing.		
5	Unscrew the housing in a counter-clockwise direction.		
	<b>CARE AND CLEANING.</b> Question trainee on cleaning procedures for:		
6	Daily cleaning.		
7	Cleaning before firing.		
8	Cleaning in cold climates.		
9	Cleaning in tropical climates.		
10	Cleaning in hot dry climates.		
	<b>ASSEMBLE THE MORTAR</b>		
11	Screw the housing in a clockwise		

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<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	direction.		
12	Insert the locking screw into the firing mechanism housing.		
13	Place the barrel back onto the baseplate.		
14	Place the baseplate and split nut back onto the spherical projection.		
15	Screw the split nut back onto the baseplate.		

**APPENDIX 3**  
**LAYING, LOADING, FIRING AND UNLOADING**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>ADOPT KNEELING/ SITTING/LYING FIRE POSITION, LEVER FIRE LOAD</b>		
1	KNEELING: Adopts kneeling position with right foot on baseplate and right hand on barrel (approximately halfway up), with firing selector set at LEVER FIRE and left hand on lever. SITTING: As per kneeling with mortar between legs. LYING: Lie directly behind and in one with the mortar barrel keeping the baseplate clear of the chest.		
2	Align the axis of the barrel with the point of aim.		
3	Remove the muzzle cover.		
4	Insert the round with a sharp thrust.		
	<b>FIRE</b>		
5	Fire the mortar using the lever.		
	<b>UNLOAD</b>		
6	Turn the mortar onto its side.		
7	Place left hand over the muzzle.		
8	Tip the mortar to allow projectile to		

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<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	slide out into the left hand.		
9	Recondition round by replacing the safety wire and unused increments.		



**APPENDIX 4  
MISFIRE DRILLS**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>ADOPT KNEELING/SITTING/LYING FIRE POSITION, LEVER FIRE LOAD, FIRE</b>		
1	All drills correctly carried out in accordance with ANNEX A APPENDIX 3.		
	<b>MISFIRE</b>		
2	Jar the barrel with the left hand.		
4	Operate the firing lever a minimum of three times.		
	<b>WEAPON STILL FAILS TO FIRE</b>		
5	Wait one minute.		
6	Unload, inspect the cap of the ignition cartridge.		
7	Identify problem for cap struck / cap not struck.		



**ANNEX B**  
**60 mm MORTAR, MOUNT M5 AND C2A1 SIGHT UNIT**  
**INDIRECT FIRE ROLE**

**APPENDIX 1**  
**ASSEMBLING, STRIPPING, CARE AND CLEANING**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>ASSEMBLE THE MORTAR</b>		
1	Remove all mortar equipment from transient box.		
2	Remove M1 baseplate from mortar tube by unscrewing the split nut.		
3	Replace split nut on M1 baseplate and return to transient box.		
4	Unscrew mortar clamp bolt counter-clockwise until collar becomes loose.		
5	Slide mortar tube, muzzle end first, into bottom of clamping collar until horizontal line is visible above clamping collar.		
6	Tighten mortar clamp bolt clockwise until it is tight.		
7	Open locking lever on M5 baseplate, seating spherical projection into socket; close locking lever (ensure firing lever is on left side).		

SER	SKILL TO BE PERFORMED	PASS/ FAIL	REMARKS
8	Undo strap on bipod legs, separate legs, loosen locking nut, slide it upward until it is in the middle of the inner tube, then tighten locking nut.		
9	Centralize traversing and elevating mechanism.		
10	Mount C2A1 sight unit, with elevation set at 1100 mils and all indices aligned.		
11	Level elevation bubbles.		
<b>STRIP THE MORTAR</b>			
12	Set firing selector to Lever.		
13	Depress elevation mechanism until only 3 cm of inner tube is showing.		
14	Dismount C2A1 sight unit; set elevation to 800 mils; return to case.		
15	Move traverse mechanism completely to the right beside handwheel with crank folded down.		
16	Loosen locking nut and lower until it contacts cross-levelling nut.		
17	Close bipod legs, securing with strap.		
18	Undo mortar baseplate locking lever; remove spherical projection from socket; close locking lever.		
19	Unlock mortar clamp bolt and remove mortar tube from bottom of collar; secure mortar clamp bolt.		

SER	SKILL TO BE PERFORMED	PASS/ FAIL	REMARKS
20	Replace M1 baseplate onto mortar tube.		
	<b>CARE AND CLEANING.</b> Question trainee on cleaning procedures for:		
21	Daily cleaning.		
22	Cleaning before firing.		
23	Cleaning in cold climates.		
24	Cleaning in tropical wet climates.		
25	Cleaning in hot dry climates.		



**APPENDIX 2**  
**ACTION AND CEASE FIRING DRILLS**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>10 ROUNDS ACTION</b>		
1	Lay the mortar on the ground in the direction of the target.		
2	Unbuckle leather straps, raise the barrel until the mount can swing clear of the baseplate, and pull the legs apart until the spring catch engages.		
3	Loosen the locking nut and slide up the sliding bracket until the elevating guide tube is vertical.		
4	Screw up the adjusting nut until approximately 2 cm of unpainted leg is visible; tighten the locking nut.		
5	Position legs approximately 45 cm in front of the baseplate.		
6	Centre elevating and traversing screws.		
7	Mount sight, ensuring all indices are aligned.		
8	Set elevation at 1100 mils.		
9	Level all bubbles.		
	<b>CEASE FIRE</b>		

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<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
10	Remove the sight; replace it in the case.		
11	Centre traversing unit.		
12	Place traversing crank to non-operating position.		
13	Depress the elevating screw into the guide tube.		
14	Loosen the locking nut, and move the guide tube to the left leg.		
15	Close the legs.		
16	Fold the mount until the legs are under the baseplate, and rebuckle the strap.		



**APPENDIX 3**  
**RECORDING AND ESTABLISHING AIMING POINTS**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>LEFT FRONT, CAP, RECORD AT _____ MILS</b>		
1	Acknowledge order, identify the aiming post.		
2	Zero all indices.		
3	Unlock the butterfly nut, and rotate bearing fine scale ring applying last two digits of ordered record to fine scale record index (e.g. 25 of 4325 mils).		
4	Tighten butterfly nut on fine scale index, continuing to turn bearing fine scale knob back to zero.		
5	Unlock bearing coarse scale clamp, and rotate the coarse scale ring until the even hundreds are read against the bearing coarse scale index (e.g. 43 of 4325 mils).		
6	Rotate the sight back onto the CAP, note the barrel bearing, and order STAKE 2 aligning the intermediate with the CAP.		
	<b>ESTABLISH AAP</b>		
7	Check lay of mortar on initial aiming point, recording the barrel bearing (e.g. 6300 mils).		

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<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
8	Select an area 20m and 700-800 mils to the left of the CAP.		
9	Use quick release gear, rotate the telescope onto the selected area ordering STAKES 2, and carry out the proper procedure for planting stakes.		
10	Unlock and slip both the bearing coarse and fine scales, applying the noted barrel bearing against the bearing indices.		
11	Note the reading against both the fine and coarse scale record indices, and report the new record.		

**APPENDIX 4**  
**LAYING THE MORTAR FOR LARGE AND SMALL**  
**CORRECTIONS**

SER	SKILL TO BE PERFORMED	PASS/ FAIL	REMARKS
	COMMAND		
	<b>NEW BEARING AND ELEVATION LAY (to be within 125 mils) LAYING FOR A SMALL CORRECTION</b>		
1	Place ordered data on the sight unit.		
2	Acknowledge order read from the sight unit.		
3	Centralize elevation bubble.		
4	Look through telescope; carry out procedure for traversing and cross-levelling until correct aim is achieved and all bubbles level.		
5	Report ON.		
	<b>NEW BEARING AND ELEVATION LAY (to be over 250 mils) LAYING FOR LARGE CORRECTIONS</b>		
6	Place the ordered data on the sight unit.		
7	Acknowledge order, read from the sight unit.		
8	Centralize the carrier and expose 18 cm of elevating screw.		

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<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
9	Order baseplate 2; No. 1 grasps the bipod; No. 2 grasps the baseplate, pivoting mortar until almost on the selected point of aim. No. 1 orders <b>STEADY</b> ; No. 2 presses the baseplate on the ground. No. 1 orders <b>STAMP IN</b> and No. 2 stamps baseplate in.		
10	No. 1 moves bipod legs in and out to roughly centre elevation and cross-levelling bubbles.		
11	Adjust as per laying for small correction.		
12	Report <b>ON</b> .		

**APPENDIX 5**  
**DIRECT FIRE AND CRANK METHOD**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>ORDER DIRECT FIRE AND ELEVATION (i.e. 1150 mils) FIRE</b>		
1	Align all bearing indices.		
2	Apply elevation to the sight unit.		
3	Look through the telescope and lay the crosshair on the target ensuring all bubbles are level.		
4	Fire the first round and re-lay the mortar as fast as possible, watching for the fall of shot.		
5	When the impact is indicated, rotate the sight unit onto the impact using the bearing knob.		
6	Re-lay the mortar (for bearing).		
7	Crank up (decrease range) or down (increase range) on the elevating handwheel to adjust for range.		
8	Level the elevation bubble using the elevating knob.		
9	Recheck lay for direction and cross-leveling bubbles.		
	<b>CRANK METHOD ORDER</b> <b>_____ CRANKS LEFT OR RIGHT</b>		

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SER	SKILL TO BE PERFORMED	PASS/ FAIL	REMARKS
10	Turn traversing handwheel the ordered number of cranks, level the cross-levelling bubble, and turn telescope onto the point of aim.		
	CRANK METHOD ORDER _____ <b>CRANKS LEFT OR RIGHT</b>		
11	Turn elevation handwheel the ordered number of cranks and level the elevation bubble using the elevating knob.		
	CRANK METHOD (double correction) ORDER _____ <b>CRANKS LEFT OR RIGHT AND _____ CRANKS UP OR DOWN</b>		
12	Turn traversing handwheel the ordered number of cranks.		
13	Turn elevation handwheel the ordered number of cranks.		
14	Level the elevation bubble using the elevation knob.		
15	Level the cross-levelling bubble.		
16	Turn the telescope onto the point of aim.		

## APPENDIX 6 MISFIRE DRILLS

SER	SKILL TO BE PERFORMED	PASS/ FAIL	REMARKS
	COMMAND		
	____ <b>ROUNDS DROP FIRE</b> <b>LOAD, FIRE</b>		
1	All drills correctly carried out in accordance with Annex B Appendices 2 and 3.		
	MISFIRE		
2	Shout <b>MISFIRE</b> and tap the barrel with the left hand.		
	WEAPON STILL FAILS TO FIRE		
3	No. 2 sets the selector to <b>LEVER FIRE</b> and trips the lever a minimum of three times.		
	WEAPON STILL FAILS TO FIRE		
4	Wait one minute. During this time No. 1 tests the barrel for heat; if it is cool at the end of one minute, carry on to the next step.		
6	No. 1 rises to kneeling position, unlocks barrel from baseplate, braces bipod (by grasping guide tube with left hand), and places right hand around base cap.		
7	No. 2 (from kneeling position) places right hand palm up under barrel and left hand palm down over barrel.		

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<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
8	Under no circumstances is the barrel to be again lowered until after the round is removed.		
9	As barrel reaches horizontal, the No. 2 places thumbs over the muzzle and stops the round as the point of the fuze reaches the muzzle.		
10	No. 2 removes round and inspects reporting <b>PRIMER STRUCK</b> or <b>PRIMER NOT STRUCK</b> .		
11	No. 1 raises barrel well over horizontal to shake out any remnants from the last round fired.		



**APPENDIX 7**  
**SIGHT UNIT TESTING AND ADJUSTING (BORESIGHTING)**

<b>SER</b>	<b>SKILL TO BE PERFORMED</b>	<b>PASS/ FAIL</b>	<b>REMARKS</b>
	COMMAND		
	<b>TEST SIGHT UNIT FOR ELEVATION</b>		
1	Mount mortar on level ground and sandbag for stability.		
2	Cross-level mortar and sight unit.		
3	Attach and cross-level boresight to the top of the mortar barrel.		
4	Elevate mortar until elevation bubble on boresight is central.		
5	Cross-level sight unit.		
6	Centre sight unit elevation bubble by turning knob.		
7	Elevation scales should now read 800 mils; if not, adjust the elevation fine scale ring.		
	<b>TEST SIGHT UNIT FOR BEARING</b>		
8	Mount mortar on level ground and sandbag for stability.		
9	Align all bearing indices and, with elevation set at 800 mils, lay the mortar on a DAP.		

SER	SKILL TO BE PERFORMED	PASS/ FAIL	REMARKS
10	Attach and cross-level boresight to the top of the mortar barrel.		
11	Align the vertical of the boresight onto the DAP, and keep the cross-levelling bubble on the sight unit and boresight level.		
12	Note the point of aim of the sight unit onto the DAP; if it is on, the sight unit it is in adjustment; if not, adjust the sight unit.		
	<b>ADJUSTING SIGHT UNIT FOR BEARING</b>		
13	Turn the bearing knob aligning the reticle onto the DAP.		
14	Loosen butterfly nut and three screws, rotate and align the zero mark on the bearing fine scale ring, and record index with the bearing fine scale index.		