FM 23–85

WAR DEPARTMENT

BASIC FIELD MANUAL

60-MM MORTAR, M2

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FM 23-85

BASIC FIELD MANUAL

60-MM MORTAR, M2

Prepared under direction of the
Chief of Infantry

For sale by the Superintendent of Documents, Washington, D. C.
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WAR DEPARTMENT,

WASHINGTON, *July 19, 1940.*

FM 23–85, 60-mm Mortar, M2, is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

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TABLE OF CONTENTS

	Paragraphs	Page
CHAPTER 1. MECHANICAL TRAINING.		
Section I. Description	1– 3	1
II. Disassembling, assembling, care, and cleaning	4– 5	6
III. Sighting equipment	6– 8	8
IV. Spare parts and accessories	9	12
V. Instruments	10–11	13
VI. Safety precautions and misfires	12–15	21
VII. Ammunition	16–26	23
CHAPTER 2. TRAINING FOR PLACING MORTAR IN ACTION	27–37	27
CHAPTER 3. MARKSMANSHIP.		
Section I. Preparatory instruction	38–53	34
II. Examination	54–57	45
III. Qualification course, gunner's test	58–62	47
IV. Qualification course, expert's test	63–67	51
V. Targets, ranges, and range precautions	68–70	56
CHAPTER 4. TECHNIQUE OF FIRE.		
Section I. Conduct of fire	71–78	57
II. Defensive fire	79–80	67
III. Range table	81	68
CHAPTER 5. FIRING AT FIELD TARGETS.		
Section I. General	82–84	71
II. Preparatory exercises	85–88	71
III. Firing exercises	89–96	73
CHAPTER 6. ADVICE TO INSTRUCTORS.		
Section I. General	97–99	77
II. Mechanical training	100–102	77
III. Training for placing mortar in action	103	78
IV. Marksmanship	104–105	79
V. Firing at field targets	106–108	80
VI. Instruction on sand table	109	81

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CHAPTER 1

MECHANICAL TRAINING

		Paragraphs
SECTION I.	Description	1–3
II.	Disassembling, assembling, care, and cleaning	4–5
III.	Sighting equipment	6–8
IV.	Spare parts and accessories	9
V.	Instruments	10–11
VI.	Safety precautions and misfires	12–15
VII.	Ammunition	16–26

SECTION I

DESCRIPTION

■ 1. CHARACTERISTICS.—The 60-mm mortar is a smooth bore, muzzle loading, high angle fire weapon similar in design to the 81-mm described in FM 23–90. The mortar is assembled into a single unit while the mount consists of two units, the bipod and base plate. A detailed list of the parts and equipment and the essential data pertaining to the 60-mm mortar and mount may be found in SNL A–43. The mortar is attached to the bipod by means of a mortar clamp and is easily dismountable. It is fastened to the base plate by inserting the base cap into the base cap socket and then closing the base cap lever.

■ 2. GENERAL DATA.

Weights:		
Mortar	pounds	42
Mortar	do	12.8
Mount	do	29.2
Bipod	do	16.4
Baseplate	do	12.8
Overall length	inches	28.6
Elevations, approximate	degrees	40 to 85
Mortar clamp position A	do	40 to 65
Mortar clamp position B	do	45 to 70
Mortar clamp position C	do	50 to 85

Traverse, right or left, approximate	mils	70
One turn of handwheel, approximate	do	10
Rate of fire:		
Maximum rounds	per minute	30 to 35
Normal rounds	do	18
Range, approximate:		
Shell, HE, M49A1 / Shell, practice, M50A1	yards	100 to 1,935

■ 3. DESCRIPTION.—*a*. The mortar (fig. 1) consists of the barrel (tube), the base cap, and the firing pin.

(1) The barrel is bored smooth and carefully finished in interior dimensions and surfaces. Clamp position marks are painted on the barrel to indicate the position of the mortar clamp relative to elevation.

(2) The base cap is hollowed and threaded to screw on the barrel, thereby closing the breech end of the mortar. It terminates in a spherical projection which fits into and is locked in the socket of the base plate. The mortar serial number is in the base cap.

(3) The base cap is bored and threaded axially to receive the firing pin which to prevent gas leakage is screwed tightly into the base cap against a shoulder. When in place the firing pin is held stationary with its point protruding through the base cap into the tube.

b. The bipod (fig. 2) consists of the leg, elevating mechanism, and traversing mechanism assemblies.

(1) The leg assembly consists of two tubular steel legs connected by a clevis joint which is attached by two bearings (front and rear) to the elevating screw guide tube. The spread of the legs is limited by the clevis joint. Each half of the clevis joint is provided with a spring latch to lock the legs in the open position. The legs terminate in feet with spikes.

(*a*) The left leg is provided with a cross leveling mechanism which consists of a sliding bracket mounted on a sleeve and an adjusting nut. The sliding bracket is connected by a link to the elevating screw guide tube. A movement of the sliding bracket up or down on the sleeve is transmitted to the mortar through the connecting link, the elevating mechanism assembly, and the traversing mechanism assembly, causing

a corresponding movement of the mortar. A fluted locking nut attached to the sliding bracket locks it in any desired position on the sleeve. The leveling operation can be completed accurately by rotating the knurled adjusting nut on

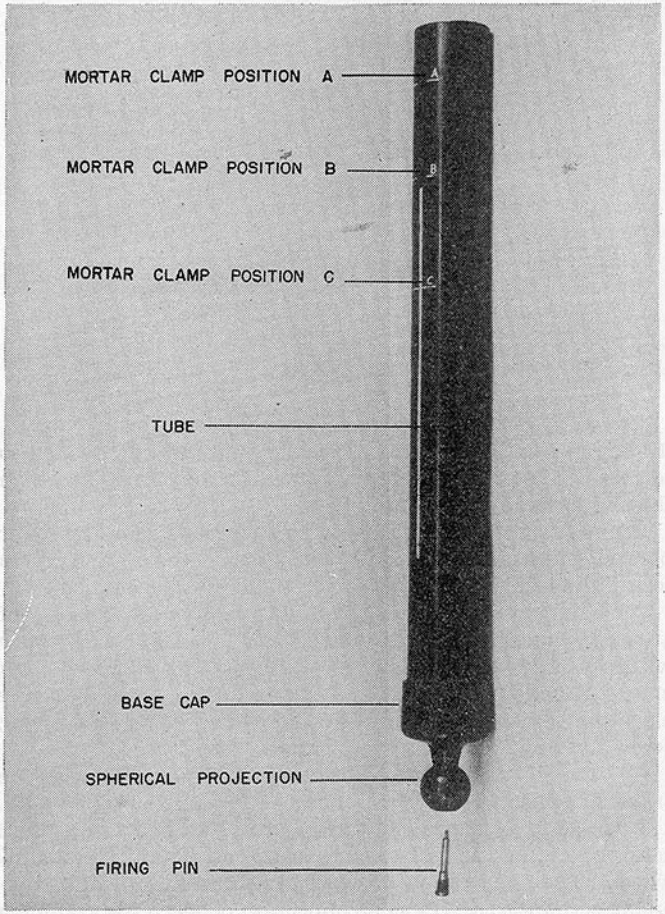


FIGURE 1.—60-mm mortar, M2.

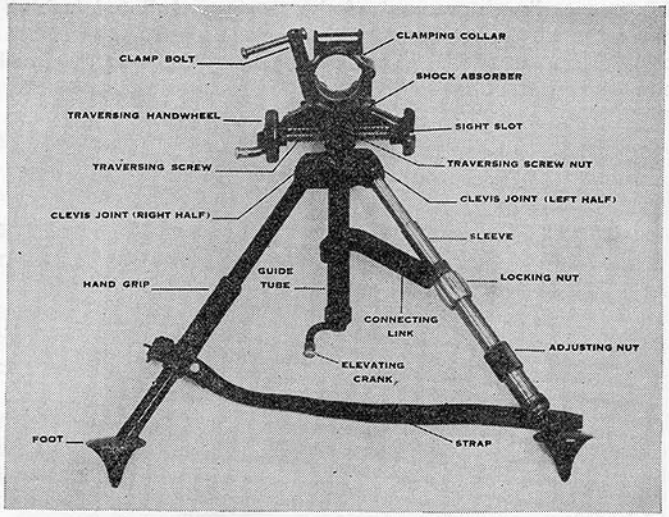


FIGURE 2.—Bipod, M2.

the lower part of the leg. The adjusting nut is threaded to screw on the left leg and is attached to the sleeve on which the sliding bracket is mounted.

(*b*) The right leg contains no moving parts. On the lower part of the right leg is a leather hand grip and a strap to secure the legs to the barrel when the mortar is carried.

(2) The elevating mechanism assembly consists mainly of an elevating screw nut which moves vertically on a screw within a guide tube. The elevating screw is actuated by a crank attached to its lower end. The upper end of the elevating screw nut fits into the lower end of the traversing screw nut and is locked to it by a pin.

(3) The traversing mechanism assembly consists of the traversing mechanism, shock absorbers, and clamping collar.

(*a*) The traversing mechanism consists of a horizontal screw operating in a yoke and actuated by a traversing handwheel. The yoke which provides the bearings for the traversing screw also serves as a connection between the clamping collar and the elevating mechanism. The yoke is provided

with a tapered dovetail slot to receive the bracket of the sight.

(*b*) The shock absorbers are designed to stabilize the mortar and mount during firing. They permit movement between the yoke and the collar which is countered by the resistance of two coil compression springs which are contained in the shock absorber retainers of the saddle.

(*c*) The clamping collar by means of which the barrel is clamped to the bipod is in two sections. The lower section of the clamping collar, called the saddle, consists of the lower half of the clamping collar and two shock absorber retainers with locking screws. The upper section consists of the upper half of the clamping collar. The two halves of the clamping collar are hinged and can be locked tightly together by the clamp bolt. When so secured about the barrel of the mortar they lock it firmly to the bipod.

c. The base plate (fig. 3) consists of a pressed steel body to 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.

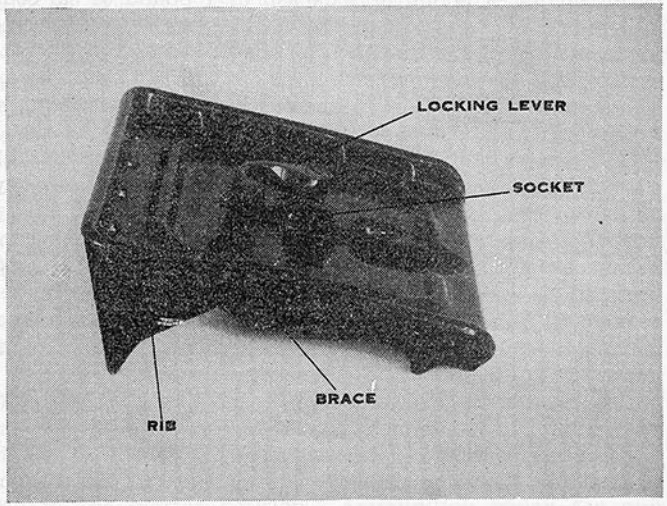


FIGURE 3.—Base plate.

reason has not been oiled must be cleaned and oiled. It is desirable to expend it as soon as possible.

(3) Any parts of the mortar, material, or equipment which have come in contact with mustard gas must be decontaminated thoroughly. The following measures should be taken:

(*a*) Free the objects of dirt, lumps of earth, and liquid with wooden spatulas and rags. After this operation the rags should be buried; they must not be burned.

(*b*) Sprinkle a layer of dry chloride of lime over the parts of the equipment that lend themselves to this treatment. After 2 hours wash off the chloride of lime and rinse thoroughly. All chloride of lime must be removed in order to prevent the deterioration resulting from its prolonged action. This precaution also applies to ammunition in order that no particles of chloride of lime be introduced into the bore of the mortar.

(*c*) Whitewash the parts which do not lend themselves to sprinkling with a thick paste made from three volumes of chloride of lime and one volume of water. After 2 hours wash off the parts.

(*d*) The delicate parts such as sighting apparatus and glasses which would be injured by chloride of lime should be cleaned by dry polishing with rags. After this operation the rags should be buried.

(*e*) When available, water may be used in place of chloride of lime except on greasy articles. The water should be warm but not boiling, and large quantities should be used.

(*f*) When it is not necessary to use immediately contaminated material or when the above means are not available, material may be considered safe to handle 6 days after exposure.

SECTION III

SIGHTING EQUIPMENT

■ 6. AIMING STAKES.—Stakes for use in aiming the 60-mm mortar are improvised as required.

■ 7. SIGHT, M4 (fig. 4).—The sight, M4, provided with the 60-mm mortar for aiming in direction and laying in elevation is likewise the standard sight for the 81-mm mortar.

a. General description.—The sight includes a collimator, elevating and lateral deflection mechanisms, and longitudinal and cross levels, all supported by a bracket with a dovetailed base which fits in a slot in the mortar yoke and latches in place. The levels when centered indicate the elevation and deflection angles, respectively, to be measured in true vertical and horizontal planes. The longitudinal level also provides a datum line for elevation settings. When the sight is level, the collimator establishes a vertical line in the field of view, the line of sight with a normal lateral deflection setting being parallel to the plane of fire. The collimator is pivoted so that it may be moved in elevation as required to bring the aiming point into the field of view; this motion has no effect on elevation indications. The sight is removed for traveling and a carrying case for it is provided.

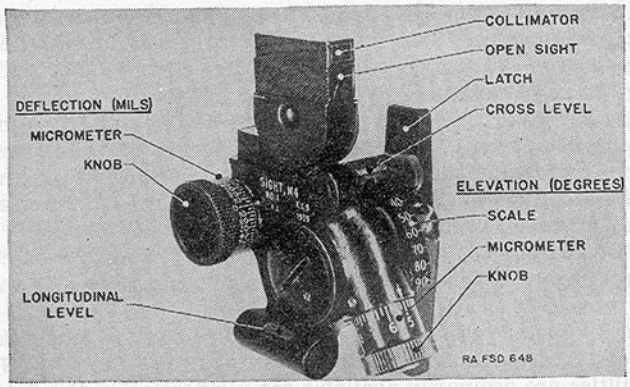


FIGURE 4.—Sight, M4.

b. Detailed description.—Elevation in degrees is indicated on the associated scale, graduated in 10° steps, supplemented by a micrometer graduated in ¼° steps. Deflection in mils is indicated on the associated micrometer which is graduated in 5-mil steps. Directions of motion for left and right deflections are indicated by the letters L and R and arrows near the index. Deflection is limited to ±150 mils and a zero indi-

cation corresponds to the normal setting (line of sight parallel to the plane of fire). The collimator and the open sight directly below it have vertical reference lines and may be placed as desired in elevation. With the collimator moved to the extreme rear and an elevation setting of 40°, the elevation of the overhead portion of the open sight is 2° below the axis of the mortar tube, a feature of service in determining the approximate minimum elevation for clearing nearby objects.

c. Operation.—(1) Remove the sight from the carrying case and insert the dovetailed base of the bracket in the slot of the mortar yoke. When the sight is fully inserted, the latch will snap into place, securing the sight in position. Check to see that the sight is firmly seated, latched, and free from lost motion.

(2) Set the elevation and lateral deflection to the desired values. Range elevation data are obtainable from the pertinent firing table. The angular units employed in elevation are given in degrees and the normal deflection (line of sight parallel to plane of fire) is in mils.

(3) Operate the elevating and cross leveling mechanisms of the mount until the levels are both centered, simultaneously traversing the mount until the vertical line of the collimator falls on the target or aiming point. The mortar is then properly aimed in direction and laid in elevation.

(4) To remove the sight for traveling, depress the latch to release the bracket, withdraw the sight, and place it in the carrying case provided.

d. Tests and adjustments.—Proper alinement of the levels, pivots, and collimator is accomplished at the factory. No facilities are ordinarily available for verification in the field, and no adjustment by the using arm is permitted.

e. Care and preservation.—(1) Each sight is rugged and suited for the purpose for which designed. It will not, however, stand abuse or rough handling, and inaccuracy or malfunctioning will result from such mistreatment. Exercise care to avoid striking or otherwise injuring any part of the sight, and particularly to avoid burring or denting the locating surface of the sight bracket and mortar yoke.

(2) When not in use, keep the sight in the carrying case provided. It is essential that the sight be kept as dry as possible and never placed in the carrying case while wet.

(3) Any sight which fails to indicate or function correctly is to be turned in for repair by competent ordnance personnel.

(4) No painting of the sight by the using arm is permitted.

(5) Elevation mechanisms and deflection micrometers have stops limiting their motion. Do not attempt to turn the knobs beyond these limits.

(6) No disassembly of the sight by the using arm, other than its removal from the yoke to the carrying case, is permitted.

(7) Keep the optical parts of the collimator clean and dry. For wiping these parts, use only paper specially intended for cleaning optical glass (U. S. A. Spec. 19–40); use of cleaning cloths in the field is not permitted. Under no conditions will polishing liquids, pastes, or abrasives be used for polishing optical parts.

(8) Occasionally oil the exposed moving parts of the sight with a small quantity of neutral oil (U. S. A. Spec. 2–81). Keep the dovetailed surface of the bracket and the mating surface of the mortar yoke lightly coated with refined petrolatum (U. S. A. Spec. 2–67). Keep excess lubricant that seeps from the moving parts wiped off to prevent accumulation of dust and grit.

■ 8. FIRING TABLES.—*a.* Abridged firing tables FT 60–B–2 were formerly furnished with each 60-mm mortar, M2, but are now available only on requisition. This table gives elevation in degrees for the various ranges throughout the field of fire. Extract of these firing tables may be found in section III, chapter 4.

b. For ammunition of future manufacture, a firing table card will be included with each complete round container. This table gives elevations (degrees) corresponding to various ranges throughout the field of fire and also gives the change in deflection (mils) due to one turn of the traversing control of the mount. The latter feature permits direct introduction of deflection corrections in the event that the sight becomes lost or unserviceable.

SECTION IV

SPARE PARTS AND ACCESSORIES

■ 9. SPARE PARTS AND ACCESSORIES.—*a. Spare parts.*—The parts of any mortar in time will become unserviceable through breakage or wear resulting from continuous usage. For this reason spare parts are provided for replacement purposes. As far as possible, sets of spare parts should be kept complete at all times. Whenever a spare part is used to replace a defective part, the defective part should be repaired or a new part substituted in the spare parts set. Parts that are carried complete at all times should be assembled correctly and ready for immediate use. The allowance of spare parts is prescribed in SNL A–43.

b. Accessories.—(1) *General.*—Accessories include the tools and equipment required for disassembling and assembling, and for the cleaning and preservation of the equipment. They also include chests necessary for storage and protection when the equipment is not in use or when traveling. Accessories should not be used for purposes other than as prescribed. The names or general characteristics of certain accessories indicate their uses or application, therefore detailed description or methods of use are not outlined herein. However, accessories embodying special features or having special uses are described below.

(2) *Bag, ammunition, M1.*—The ammunition bag, M1, previously used for carrying ammunition but which has been superseded by ammunition bag M2, is made of canvas and has two straps which buckle together. The bag is used by the squad leader to carry spare parts.

(3) *Bag, ammunition, M2.*—This ammunition bag is a reinforced strip of canvas with a central opening which admits the head of the ammunition carrier. Pockets are provided in front and rear to carry ammunition.

(4) *Bag, base plate, M4.*—The base plate bag is made of canvas and has an attached leather strap to suspend it from the carrier's shoulder when the base plate is being transported.

(5) *Brush, bore, with staff.*—The bore brush staff consists of three separable tubular steel sections. A "Steelgript"

type of brush is attached to one end for cleaning and swabbing the bore of the mortar.

(6) *Cover, muzzle, with carrying strap, M308.*—The leather muzzle cover is used to protect the mortar from foreign matter and moisture. The attached strap is used as a sling when carrying the mortar.

(7) *Cover, traversing screw.*—The traversing screw cover is under development and will be used to cover the traversing mechanism during transport.

(8) *Pad, shoulder, M2.*—The shoulder pad consists of two pads, one for the left and one for the right shoulder. They are strapped together and provide protection for the shoulders of ammunition and matériel carriers.

(9) *Staff, cleaning, M3.*—The cleaning staff is under development. Data pertaining thereto will be added when available.

(10) *Tool, firing pin vent, cleaning.*—The firing pin vent tool is used to clean the firing pin vent of the mortar.

(11) *Accessories for pack transport.*—Pack transport accessories for the above matériel are under development. Data pertaining thereto will be added when available.

SECTION V

INSTRUMENTS

■ 10. LENSATIC COMPASS, MODIFIED PRISMATIC TYPE (fig. 5).—*a. Description.*—This compass is issued to units armed with the 60-mm mortar. It has a pivoted dial needle inclosed in a nonmagnetic metal case with a hinged cover and an eyepiece containing a small magnifying lens. The needle dial has inscribed on it two concentric azimuth circles. The outer circle is graduated in mils and the inner circle is graduated in degrees. The smallest graduation of the outer circle represents 20 mils and that of the inner circle 5°. The least reading of the compass is 20 mils. Owing to the sensitive character of the needle suspension, even this accuracy is difficult to obtain unless the compass rests on a solid support. One outside ring about the base of the compass is graduated into the cardinal points of the compass and another (graduated

in degrees) as an azimuth circle. The former is useful for taking bearings and the latter is useful on a map as a protractor and in setting off azimuths by means of the index on a movable ring about the top. Directions are laid off by means of the index (pointer) on this movable ring. The index on the movable ring, the zero point on the azimuth circle on the dial, and the north point of the needle are marked with radiolite for visibility in the dark. The eyepiece consists of a metal standard supporting a small lens through which azimuth may be read directly from the dial. Vertically above the aperture of the standard is a narrow slit. Vertically across the glass face of the compass cover is an etched line in the line of sight of the instrument.

b. Use.—(1) The chief use of the lensatic compass, modified prismatic type, with the mortar is the measurement of magnetic azimuths. It may also be used as a marching compass.

(2) If practicable, the compass should be rested on a level surface. However, it can be read accurately when held in the hands, the ring between the thumb and forefinger of one hand, the other fingers closed, with the thumb and forefinger of the other hand grasping the compass box and the other fingers clasping the other hand, elbows close to the body or resting on the knees, depending on the position of the observer.

(3) The instrument should be held as nearly level as possible to permit the dial to swing free, otherwise errors in the readings will result.

c. Operation.—(1) *To declinate the compass.*—(*a*) Select some point located on the map which may be accurately located on the ground and from which several points may be accurately located both on the map and on the ground. Measure the grid (Y) azimuths on the map to the selected points. Measure the magnetic azimuths to each of the points on the ground. Compute the differences between the magnetic azimuths, as measured by the compass and the grid azimuths, as measured on the map. The average of these differences will be the declination constant for that particular compass. Record the value of the constant for ready refer-

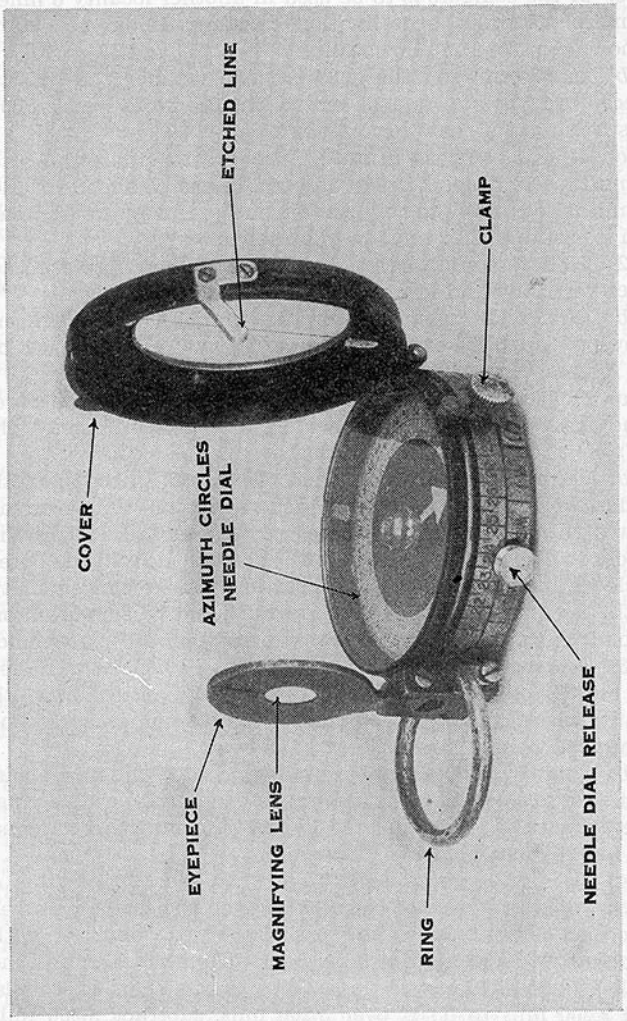


FIGURE 6.—Lensatic compass, modified prismatic type.

ence. If the compass is to be used in another locality 6 miles or more distant, the declination constant should be determined again for the new locality.

(*b*) In determining the declination constant, it is best to select three points, one of which should be at least 2,000 mils from one of the other points.

(*c*) If the compass azimuths are greater than the grid azimuths, the declination is west and must be added to grid azimuths to convert to compass azimuths; if less, the declination is east and they must be subtracted.

(2) *To measure an azimuth.*—(*a*) Raise the eyepiece and cover vertically and lower the needle dial.

(*b*) Grasp the ring between the thumb and forefinger, allowing the base of the compass to rest on the back of the fingers.

(*c*) Hold the compass horizontally in front of the face, hand against the chin, and aperture of eyepiece immediately in front of one eye with the other eye closed.

(*d*) Turn about carefully until the object whose azimuth is desired is bisected by the etched line on the cover as viewed through the slit of the eyepiece standard. Allow the needle to come to rest, then read the azimuth from the outer circle as viewed through the aperture. If greater stability of the needle is desired, the compass should be supported on a solid platform or used in a prone position on the ground.

(3) *To measure an azimuth at night.*—(*a*) Use the radiolite marker on the movable index ring to lay off the azimuth on the circle about the outside of the compass case. The clamp controls the movable ring.

(*b*) Hold the compass horizontally and carefully turn about until the needle points to the marker on the movable ring. The azimuth is now indicated by the radiolite marker along the line of sight of the instrument.

(4) *To determine azimuth of position of observer from a given point (target).*—Read azimuth of the given point as described above. Since the position of the observer with respect to the given point is on back azimuth, determine the back azimuth, that is, if the reading is less than 3,200 mils, add 3,200 mils to it; if over 3,200 mils, subtract 3,200 mils from it.

(5) *To lay off a line of a given azimuth from position of observer.*—Turn the compass until the dial index indicates the given azimuth. Direct placing of an aiming stake on the line of sighting.

(6) *Given an azimuth to a point, to find a position from which the point is on that azimuth.*—The observer places himself approximately on the required line, aims at the given point, and reads the dial. He then moves to the right or left while aiming at the point until the given azimuth is indicated on the dial. Moving to the right decreases the reading; to the left increases it.

(7) *Given the azimuth from a point, to find a position which is on that azimuth from the given point.*—Determine back azimuth. The result is the azimuth of the given point from the required position, then proceed as in (6) above to find that position.

(8) *To find horizontal angle between two points from position of observer.*—Read azimuth to each point and subtract the smaller reading from the larger. The difference is the required angle.

d. Care and preservation.—The instrument contains a delicately pointed pivot and jewel, and must be handled carefully. Care should be taken to prevent damaging the glass cover. No adjustments of the parts in the compass box are permitted within the organization.

■ 11. FIELD GLASS, TYPE EE (fig. 6).—The field glass, type EE, complete, consists of the field glass and its carrying case.

a. Description.—(1) The field glass, type EE is an observation instrument of 6 power with an 8° field of view. It contains a graduated mil scale for the measurement of small horizontal and vertical angles. In field glasses of older manufacture there is also provided an inverted sight leaf scale for the rapid computation of certain fire data. The field glass complete consists of the glass and its carrying case and neck strap.

(2) The field glass proper consists of two compact prismatic telescopes pivoted about a common hinge which permits adjustment for interpupillary distances. A scale graduated every 2 millimeters from 56 to 74 permits the observer

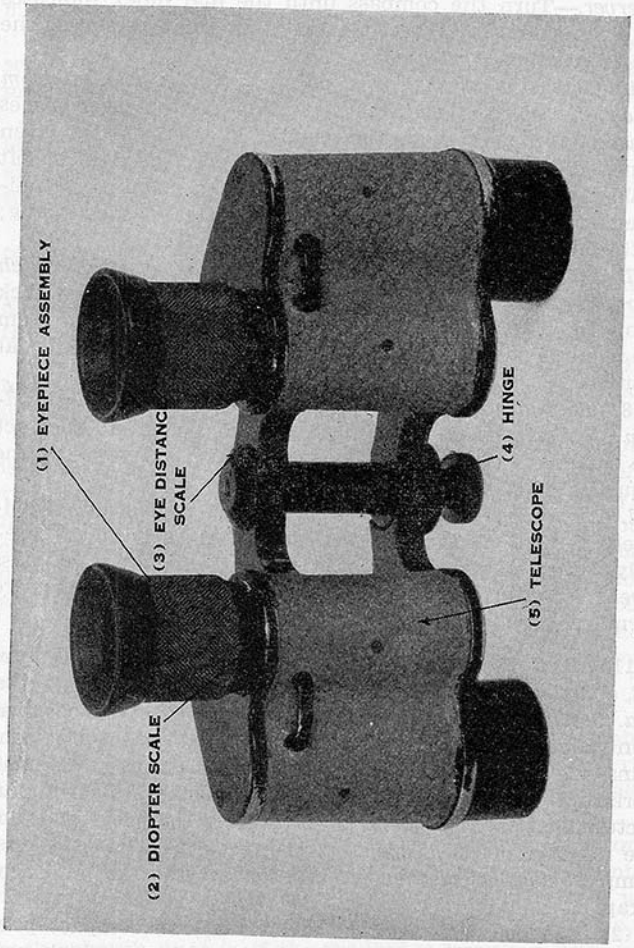
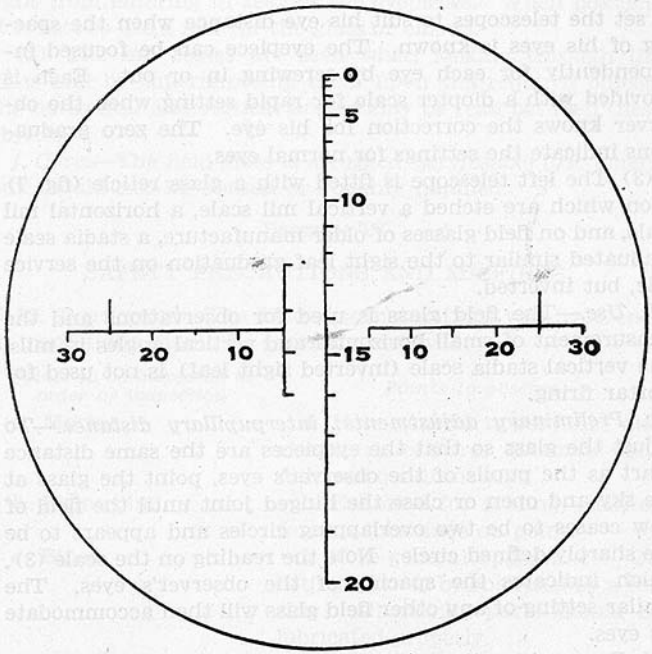
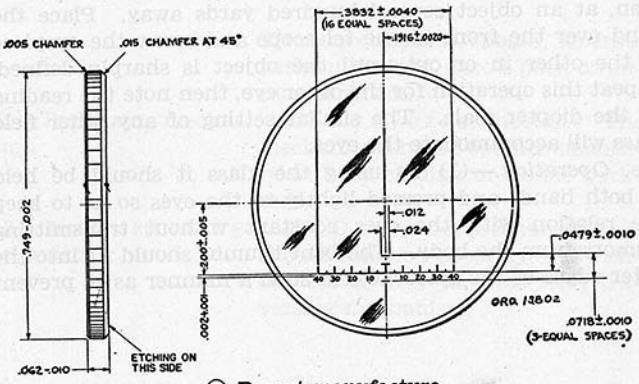


FIGURE 6.—Field glass, type EE.



① Older manufacture.



② Recent manufacture.

FIGURE 7.—Reticle on field glasses.

to set the telescopes to suit his eye distance when the spacing of his eyes is known. The eyepiece can be focused independently for each eye by screwing in or out. Each is provided with a diopter scale for rapid setting when the observer knows the correction for his eye. The zero graduations indicate the settings for normal eyes.

(3) The left telescope is fitted with a glass reticle (fig. 7) upon which are etched a vertical mil scale, a horizontal mil scale, and on field glasses of older manufacture, a stadia scale graduated similar to the sight leaf graduation on the service rifle, but inverted.

b. Use.—The field glass is used for observations and the measurement of small horizontal and vertical angles in mils. The vertical stadia scale (inverted sight leaf) is not used for mortar firing.

c. Preliminary adjustments; interpupillary distance.—To adjust the glass so that the eyepieces are the same distance apart as the pupils of the observer's eyes, point the glass at the sky and open or close the hinged joint until the field of view ceases to be two overlapping circles and appears to be one sharply defined circle. Note the reading on the scale (3), which indicates the spacing of the observer's eyes. The similar setting of any other field glass will then accommodate his eyes.

d. Focus of eyepiece.—Look through the glasses, both eyes open, at an object several hundred yards away. Place the hand over the front of one telescope and screw the eyepiece of the other in or out until the object is sharply defined. Repeat this operation for the other eye, then note the reading on the diopter scale. The similar setting of any other field glass will accommodate the eyes.

e. Operation.—(1) In using the glass it should be held in both hands and pressed lightly to the eyes so as to keep the relation with the eyes constant without transmitting tremors from the body. The bent thumbs should fit into the outer edges of the eyesockets in such a manner as to prevent

light from entering in rear of the eyepieces. When possible, it is best to use a rest for the glass or elbows.

(2) The mil scales are seen when looking through the glass and by superimposing them upon the required objects the horizontal and vertical angles may be read between these objects.

f. Care.—The field glass is a rugged, serviceable instrument but should not be abused or roughly handled.

SECTION VI

SAFETY PRECAUTIONS AND MISFIRES

■ 12. INSPECTION.—The following instructions with reference to inspections should be carefully observed:

Points to be inspected in order of inspection	*Points to observe*
a. Mortar.	*a.* Note general appearance and cleanliness of bore. Examine condition of quadrant seat.
b. Firing pin.	*b.* Examine for fouling, rust, or foreign substance on point.
c. Bipod.	*c.* Note general appearance. Oil fittings should be encircled by a red ring. All moving parts should be lubricated properly.
(1) Elevating mechanism.	(1) Elevate and depress mortar. The mechanism should operate without binding, excess play, or undue backlash.
(2) Traversing mechanism.	(2) Traverse mortar. The mechanism should operate smoothly without binding or undue backlash.
(3) Cross leveling mechanism.	(3) Operate mechanism. It should function properly and without excess play to cross level traversing mechanism.

d. Sight and its mounting.	*d.* Note whether operating condition of sight or rigidity of its mounting has been impaired.

■ 13. PRECAUTIONS BEFORE FIRING.—*a.* Mortar must be locked to base plate.

b. Clamp bolt must be secure.

c. Mortar must be cross leveled and locking nut secure.

d. Bore must be swabbed out before firing.

e. Each shell must be clean, particularly the bourrelet.

■ 14. PRECAUTIONS DURING FIRING.—*a.* From time to time check to be sure that the clamp bolt and locking nut are tight.

b. Swab the bore after *every ten rounds.*

c. Check frequently to see that base plate and bipod positions are safe for firing.

■ 15. MISFIRES.—*a. General.*—A misfire occurs when a round is loaded into the barrel of the mortar but fails to fire because the propelling charge did not function. The round therefore remains in the mortar until it is removed by hand.

b. Removal of round after misfire.—(1) When a misfire occurs, the mortar crew must wait at least 1 minute before removing the round in order to avoid accident caused by possible delayed fire. Then the gunner (No. 1) unlocks the mortar from the base cap, places his left hand on and braces the right leg of the bipod, and his right hand around the base cap. The assistant gunner (No. 2) places his right hand, palm up, under the barrel near the muzzle, and his left hand, palm down, on top of the barrel. Care is taken that no part of either hand is in front of the muzzle.

(2) The gunner (No. 1) lifts the base of the mortar until the round slides slowly forward. As soon as the round has started forward, *and not before,* the assistant gunner (No. 2) places the thumb of each hand over the muzzle and stops the round as the point of the fuze reaches the muzzle. No. 2 then locates the safety pin and places a finger over the head of the safety pin and inserts the cotter pin. He then passes the round to ammunition handler No. 3 who inspects the round to determine the cause of the misfire. The gunner (No. 1) inspects the firing pin to see that it is clean and

tightly screwed into the base cap and replaces the base cap in the socket. The assistant gunner swabs out the bore. Firing is then resumed. A round which has been misfired should be placed to one side. Another round should be placed in the mortar. If it does not misfire the preceding round was defective and should be destroyed.

c. Causes of misfire.

(1) Defective primer or ignition cartridge.

(2) Bent or crooked cartridge container.

(3) Defective, damaged, or loose firing pin.

(4) Firing pin fouled or obstructed by fragments from previous rounds.

(5) Lack of percussion due to—

(*a*) Fouled bore.

(*b*) Excess oil in bore.

(*c*) Cartridge not fully inserted in container.

SECTION VII

AMMUNITION

■ 16. GENERAL.—The information in this section pertaining to the complete rounds of semifixed ammunition authorized for use in the 60-mm mortar, M2, includes a description of the round, means of identification, care, use, and ballistic data.

■ 17. CLASSIFICATIONS.—Based upon use, the principal classifications of ammunition for this mortar are—

a. High explosive (HE), for use against personnel and light matériel targets.

b. Practice, for use in target practice.

■ 18. AMMUNITION LOT NUMBER.—When ammunition is manufactured, an ammunition lot number, which becomes an essential part of the marking, is assigned in accordance with with pertinent specifications. This ammunition lot number is stamped or marked on every loaded complete round, on packing containers, and on the accompanying ammunition data card. It is required for all purposes of record, including reports on condition, functioning, and accidents in which the ammunition might be involved.

■ 19. IDENTIFICATION.—*a. Marking on fiber containers and packing boxes.*—The contents of original packing boxes and fiber containers are identified readily by the markings on the box. Additional data pertaining to the round contained therein are included on the ammunition data card packed with the round in the fiber container or packing box.

b. Color of projectiles.—All projectiles are painted to prevent rust and, by means of the color, to provide a ready means for identification as to type. The color scheme is as follows:

(1) High explosive projectiles, yellow.
(2) Practice, blue.

c. Markings on round.—The complete round when removed from its fiber container is identified by the following information stenciled thereon:

(1) Caliber of mortar in which fired.
(2) Kind of filler.
(3) Model of shell.
(4) Ammunition lot number.

■ 20. CARE, HANDLING, AND PRESERVATION.—*a.* Ammunition is made and packed to withstand all conditions ordinarily encountered in the field. Nevertheless, since explosives are adversely affected by moisture and high temperature, due consideration should be given to its protection from such conditions.

b. Complete rounds, being fuzed, must be handled with due care at all times. The explosive elements in primers and fuzes are particularly sensitive to undue shock and high temperature.

c. Do not break moisture-resistant seal until ammunition is to be used.

d. Do not attempt to disassemble any fuze.

e. Protect the ammunition carefully from mud, sand, dirt, and water. The round should be free of such foreign matter before firing. If it gets wet or dirty, wipe it off at once.

f. Do not allow the ammunition to be exposed to direct rays of the sun for any length of time. More uniform firing is obtained if the rounds are at the same temperature.

g. Just before firing, but at no other time, remove the safety pin (cotter pin) from the fuze.

h. When firing, enter the round into the mortar, cartridge end first. When the projectile is released to slide down the bore, promptly remove the hand from the muzzle.

i. Rounds prepared for firing but not used will be returned to their original packing and appropriately marked. Such rounds will be used first in subsequent firing in order that stocks once opened may be kept at minimum.

j. Do not handle duds. After firing, fuzes are extremely dangerous. Duds are disposed of in accordance with TM 9–1900 (now published as TR 1370–A).

■ 21. STORAGE.—Whenever practicable, ammunition should be stored under cover. Should it be necessary to leave the ammunition in the open, it should be raised on dunnage at least 6 inches from the ground and the pile covered with a double thickness of paulin. Suitable trenches should be dug to prevent water from flowing under the pile.

■ 22. AUTHORIZED ROUNDS.—Ammunition authorized for use in this mortar is shown in the following table:

Nomenclature	Prescribed fuzes		Approximate weight as fired (pounds)
	Model	Action	
Shell, HE, M49A1, w/PDF M52, 60-mm mortar	M52	SQ	2.96
Shell, practice, M50A1, w/PDF M52, 60-mm mortar	M52	SQ	2.96

PDF=point detonating fuze. SQ=superquick.

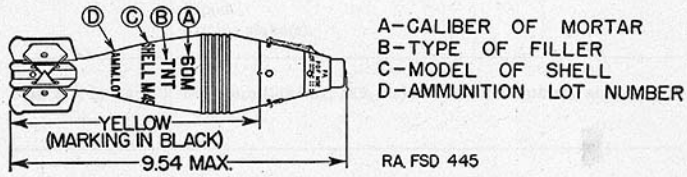


FIGURE 8.—Shell, HE, M49A1, with PDF M52.

■ 23. PREPARATION FOR FIRING.—Ammunition, issued as assembled, complete rounds, is prepared for firing as follows:

a. Adjust propelling charge for zone to be fired (see par. 24).

b. Remove cotter pin from fuze (see par. 25).

■ 24. PROPELLING CHARGES.—*a.* Propelling charges for mortar ammunition are divided into parts to provide for zone firing.

b. The full (outer zone) charge consists of an ignition cartridge and four equal propellent increments (bundles of sheet powder) assembled to the base of the round as issued. The increments are fitted between the blades of the fin. To prepare the charge for firing inner zones it is only necessary to remove those increments not required.

■ 25. FUZE, PD, M52.—This standard fuze, a superquick type, is identified by "PDF, M52" stamped on the body. For use in the field, it is issued assembled to the shell as a component of the complete round. To prepare for firing it is only necessary to remove the cotter pin. This is readily done by removing the strip of adhesive tape which holds the ring against the side of the fuze, then a pull of the ring withdraws the cotter pin.

■ 26. FIRING TABLES.—The firing tables applicable are, FT 60–B–2, abridged, pertaining to the 60-mm mortar, M1 and M2, firing shell, HE, M49A1, and shell, practice, M50A1.

CHAPTER 2

TRAINING FOR PLACING MORTAR IN ACTION

■ 27. OBJECT AND SCOPE.—*a.* The primary purpose of this training is to teach all members of the mortar squad the duties of each member in carrying mortar and equipment, in placing mortar in action, and in serving the mortar during firing.

b. The most important consideration is development of accuracy. When accuracy has been obtained, emphasis is then placed on development of speed.

■ 28. TO SECURE EQUIPMENT TO PUT MORTAR INTO ACTION.—The command is: SECURE EQUIPMENT. At this command, the men fall out and secure equipment as follows:

Personnel	Equipment
Corporal	Base plate in bag, base plate, M4. Spare part in bag, ammunition, M1. Sight. Field glasses. Compass. Bore cleaning brush with staff.
No. 1	Mortar. Bipod. Aiming stake(s).
Nos. 2, 3, and 4	1 ammunition bag, M2, and 12 rounds of dummy ammunition each.

As soon as the equipment listed above has been secured, the men re-form in line and all members of the squad (except the corporal) ground their equipment.

■ 29. To GROUND EQUIPMENT (fig. 9).—At the original assembly with equipment and at all halts, loads (except the corporal's) are grounded without command as follows:



FIGURE 9.—60-mm mortar squad with equipment laid out.

a. No. 1 places the mortar, bipod attached, so that mortar is up and muzzle is to the right. He places the aiming stake(s), point(s) to the left, on the ground in front of the mortar and parallel to it.

b. Nos. 2, 3, and 4 place their ammunition bags on the ground with shoulder straps to the left.

c. All equipment will be parallel to the front and touching the toes of the man by whom it is carried.

■ 30. To TAKE EQUIPMENT (fig. 10).—At all preparatory commands for movement, loads are taken as follows:



FIGURE 10.—60-mm mortar squad with loads.

a. No. 1 removes muzzle cover, places aiming stake(s) inside the barrel of the mortar, replaces muzzle cover, and slings the mortar as prescribed in paragraph 39, FM 22–5 (see also fig. 10).

b. Nos. 2, 3, and 4 put on their ammunition bags.

■ 31. FORMATION AND MOVEMENTS.—Formations and movements of the 60-mm mortar squad are prescribed in FM 22–5, and in FM 2–5.

■ 32. To CHANGE NUMBERS AND DUTIES IN THE SQUAD.—At any time during drill the squad leader may command FALL OUT ONE. At this command, No. 1 takes the position of No. 4. No. 2 takes the position of No. 1, and all other numbered members of the squad move up one number. This rotation is made during drill in order to train all members of the squad in the duties of the other members.

33. ACTION (see figs. 11 and 12).—The squad being in any formation to prepare the mortar to fire on a target, the command is: ACTION.

a. No. 1 removes carrying strap and muzzle cover from the mortar and passes the aiming stake(s) to No. 2. He then receives the base plate from the squad leader and attaches it to the spherical projection of the mortar. He unstraps the legs of the bipod, loosens the locking nut, and spreads the legs to their full extent.

b. The squad leader places the sight and bore cleaning brush on the ground at the point where the mortar is to be mounted and indicates the direction of fire. He then moves to a position nearby where he can observe and control the fire by oral fire orders to the mortar crew.

c. No. 1 moves to the indicated position, places the mortar on the ground so that the front edge of the base plate is approximately perpendicular to the direction of fire and the legs of the bipod are in a plane parallel to the front edge of the base plate. He then mounts the sight.



FIGURE 11.—60-mm mortar squad going into action.



FIGURE 12.—Posts.

d. No. 2 moves to the indicated position, removes his load of ammunition from the ammunition bag, and places it on the ground convenient to his firing position. He then places the aiming stake to mark the direction of fire as directed by the squad leader.

e. No. 1 sets the elevation scale at 65° and the deflection scale at zero. With the elevation screw nut one-half exposed and the traversing screw nut centered, he moves the legs of the bipod until the aiming line of the sight is laid on the stake and the longitudinal bubble is approximately centered. He completes the laying by cross-leveling the mortar.

NOTE.—The conditions set forth in *e* above enable the gunner to make shifts in elevation and deflection with the minimum movement of the bipod during fire for adjustment.

f. All numbered members of the squad then take post as follows:

(1) *Gunner, No. 1.*—Prone on left side of the mortar in a position convenient to elevating and traversing mechanisms.

(2) *Assistant gunner, No. 2.*—Prone on right side of the mortar in a position from which he can load.

(3) *Nos. 3 and 4.*—Echeloned to right and left rear where they can supply ammunition to No. 2.

■ 34. TO FIRE MORTAR.—*a. Squad leader.*—Gives an initial fire order as described in paragraph 73.

b. Gunner.—(1) Consults firing table.

(2) Announces charge to be used, as CHARGE 1.

(3) Sets sight (par. 7) in accordance with data contained in the fire order.

(4) Lays for elevation (par. 45).

(5) Lays for deflection (par. 44).

(6) Cross levels.

(7) Commands: FIRE.

c. Assistant gunner, No. 2.—(1) Repeats announcement of charge.

(2) Removes necessary number of increments to leave announced charge in place.

(3) Withdraws cotter pin.

(4) At gunner's command FIRE, he grasps the round with his left hand around the bourrelet and inserts the shell, fuze end up, in muzzle of the mortar. Upon releasing the shell, he immediately withdraws his hand to the rear.

d. Nos. 3 and 4.—Supply ammunition to No. 2 as directed by him.

■ 35. TRAINING IN REMOVING MISFIRES.—Frequently during mortar drill when the squad has simulated firing the mortar using a dummy round, the corporal will announce MISFIRE and require the mortar crew to remove the misfire as prescribed in paragraph 15.

■ 36. OUT OF ACTION.—At the squad leader's command OUT OF ACTION—

a. No. 1 removes the sight and replaces it in its case. He then unlocks the mortar from the base plate and prepares the mortar and bipod for carrying, reversing operation of going into action.

b. All members of the squad secure equipment and form as directed by the squad leader.

■ 37. PREPARATION OF FIRING POSITION ON STEEP SLOPE.—The 60-mm mortar is normally placed in a firing position with the

base plate on top of the ground. The base plate will be seated by the recoil of the first two or three rounds. When the mortar is to be mounted on a steep slope or uneven ground it may be necessary to dig a pit to provide the proper slope. Such a pit (fig. 13) may be hastily constructed, its only requirement being that the rear wall or bearing surface incline at an angle of about 30° (534 mils) from the horizontal.

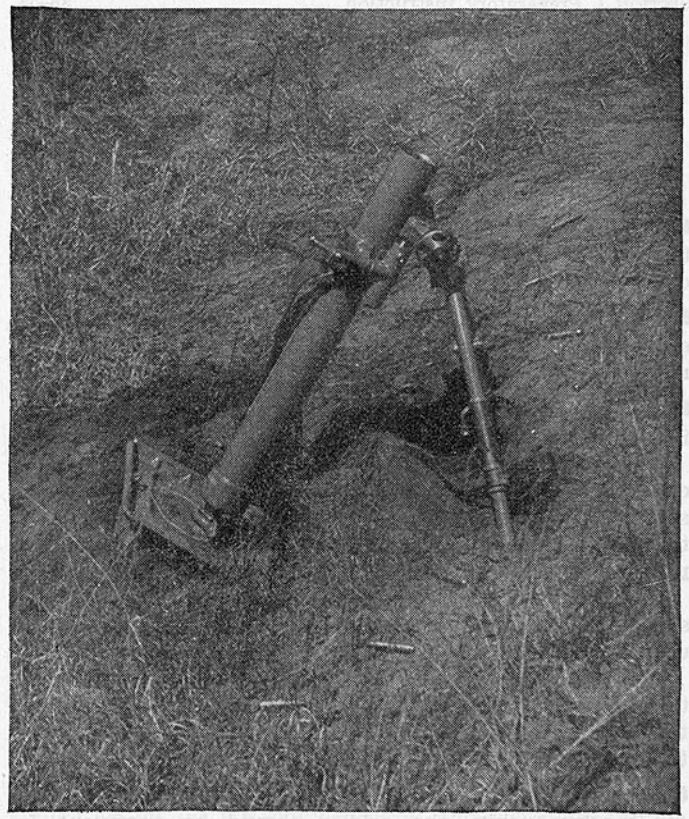


FIGURE 13.—60-mm mortar emplacement.

CHAPTER 3

MARKSMANSHIP

	Paragraphs
SECTION I. Preparatory instruction	38–53
II. Examination	54–57
III. Qualification course, gunner's test	58–62
IV. Qualification course, expert's test	63–67
V. Targets, ranges, and range precautions	68–70

SECTION I

PREPARATORY INSTRUCTION

■ 38. PURPOSE.—The purpose of preparatory training is to teach the individual soldier to perform accurately the duties of gunner and squad leader while delivering fire.

■ 39. SCOPE.—Preparatory instruction consists of a series of exercises which require the soldier to perform in a prescribed manner each of the duties of gunner and squad leader.

■ 40. METHOD OF INSTRUCTION.—The applicatory method of instruction is used throughout.

a. Each exercise is first explained and demonstrated to all of the men undergoing instruction. The demonstration should be performed by a group which has been previously trained to perform the exercise. Each man is then given practical work in the exercise.

b. The officer in charge of the instruction should detail such assistants as he may require. The squad leaders will usually act as group instructors.

c. Upon completion of the explanation and demonstration of each of the instruction exercises, the groups return to their squad equipment where the assigned squad instructors conduct the practical work.

■ 41. PRIOR TRAINING.—Before receiving instruction in mortar marksmanship, the soldier should be proficient in mechanical training and mortar drill.

■ 42. GUNNER'S POSITION AT MORTAR.—In all exercises the gunner takes a prone position on the left side of the mortar convenient to the elevating crank and traversing handwheel. In laying the mortar, he grasps the traversing handwheel with his right hand, his right arm above the mortar barrel. This is the normal position (fig. 14) as it offers the maximum protection to the gunner. The sight is mounted in the bracket on the yoke.



FIGURE 14.—Firing position of gunner.

■ 43. EXERCISE NO. 1—DUTIES OF GUNNER NO. 1—SIGHT SETTING EXERCISE.—*a.* The purpose of this exercise is to teach the gunner to operate the sight.

b. (1) Holding the sight in his hand, the instructor names the principal parts of the sight and describes their function to the assembled groups. He explains how to determine and set off deflections as described in paragraph 7.

(2) He then explains how to set off elevation as described in paragraph 7, illustrating this by several examples. He further explains how to mount the sight on the mortar.

(3) To demonstrate the group method of conducting this exercise, the instructor uses two trained men, one to act as gunner and the other as group instructor. He requires the gunner to set off a given deflection and elevation and to

explain the operation as he performs it. The group instructor checks each detail and points out any errors made.

■ 44. EXERCISE NO. 2—DUTIES OF GUNNER NO. 1—EXERCISE IN LAYING FOR DIRECTION.—*a.* The purpose of this exercise is to teach the gunner to aim accurately for direction.

b. The instructor explains to the assembled groups as follows: Accurate shooting is possible only when the vertical line in either the collimator or the open sight is laid exactly the same for each round fired at the same target and the mortar is accurately cross leveled. When aiming with the collimator, the eye should be held at a distance of 3 to 10 inches from the lens of the collimator and in such a position that both the aiming point and the vertical line of the collimator are visible. The gunner must select a clearly defined edge of the target or aiming point, and by manipulating the traversing handwheel bring the vertical aiming line of either the open sight or the collimator into coincidence with the selected edge of the stake. To complete each laying, the mortar is cross leveled by operating the cross leveling mechanism on the left leg of the mount until the bubble in the horizontal level on the sight is centered.

c. To demonstrate the method of conducting this exercise, the instructor has two trained men act as gunner and group instructor, respectively. The group instructor lays the mortar, repeats the explanation described above, and requires the gunner to observe the aim. He then requires the gunner to re-lay on the same aiming point several times. After each laying, the instructor checks the gunner's aim and the cross leveling of the mortar. He then traverses the mortar to the right or left to disturb the aim.

■ 45. EXERCISE NO. 3—DUTIES OF GUNNER NO. 1—EXERCISE IN LAYING FOR ELEVATION.—*a.* The purpose of this exercise is to teach the gunner to determine the angle of elevation and charge for any given range and to lay the mortar in elevation.

b. The instructor first explains the use of the range table to find the correct angle of elevation and charge to be used for the desired range. He then explains the method of laying for elevation as follows: The gunner upon determining the charge to be used must announce it to No. 2, for example,

CHARGE 2, so that the latter can prepare the round to be fired. The setting of an angle of elevation on the sight does not move the axis of the bore. The actual laying for elevation is accomplished by manipulating the elevating crank until the bubble in the longitudinal level is centered.

c. To demonstrate the method of conducting the exercise, the instructor has two trained men act as gunner and group instructor, respectively. The group instructor announces a range and requires the gunner to determine the correct angle of elevation, announce the charge, and lay the mortar for elevation. The group instructor checks each operation and explains any errors made. The groups return to their equipment where the group instructors conduct the exercise as demonstrated.

■ 46. EXERCISE NO. 4—DUTIES OF SQUAD LEADER—ESTABLISHING DIRECTION OF FIRE.—*a.* The purpose of this exercise is to teach the squad leader the methods of establishing the direction of fire of the mortar.

b. The instructor explains that when the mortar is in complete defilade, the direction of fire is marked by a stake or other aiming point placed a short distance in front of the mortar. Using previously instructed men to act as squad leader, gunner, and No. 2, he demonstrates each of the following methods of establishing the direction of fire:

(1) The squad leader moves to a position where he can see the target (or reference point) and directs No. 2 in placing the aiming stake or other marker on the line mortar–target (reference point).

(2) The squad leader reads the azimuth of the line mortar–target (reference point) as described in paragraph 10 and announces it to the gunner. Using the compass, the gunner directs No. 2 in placing the aiming point on the line of the given azimuth.

(3) When the sector to be covered by a single mortar is wider than 300 mils (the total amount of deflection which can be set off on the sight), the gunner directs No. 2 in placing additional aiming stakes 200 mils to the right and left of the initial or *base* stake. The gunner uses the sight as a measuring instrument to lay off the 200-mil angle. The base stake is the origin for all shifts; the right and left stakes

supplement the deflection scale of the sight. For example, the squad leader (observer) using the mil scale in his field glass measures the angle between the reference point (in prolongation of the line mortar–base stake) and the target as right 175 mils. As this angle is greater than the maximum deflection which can be set off on the sight, the squad leader computes the direction of the target in relation to the right stake. The right stake is 200 mils to the right of the base stake. The desired direction is 175 mils right of the base stake. The desired direction is 200 minus 175 or 25 mils to the left of the right stake. The deflection elements of the initial fire order to engage this target are: LEFT 25 and RIGHT STAKE.

c. After the instructor has explained and demonstrated each of the methods described in *b* above, the groups return to their equipment where the group instructors require each man to perform the method demonstrated.

■ 47. EXERCISE NO. 5—DUTIES OF ASSISTANT GUNNER NO. 2—LOADING EXERCISE.—*a.* The purpose of this exercise is to teach the assistant gunner the correct method of loading.

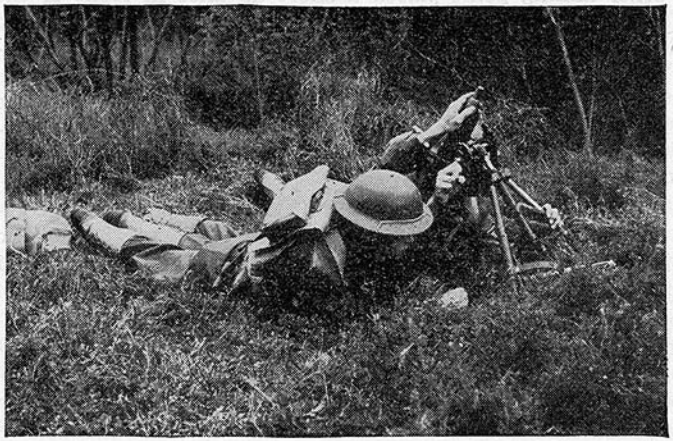


FIGURE 15.—Firing position of assistant gunner.

b. The instructor explains the method of loading as follows: During firing, the assistant gunner No. 2 takes a prone position on the right of the mortar as illustrated in figure 15. To load, he grasps the round in his left hand with one finger over the head of the safety pin. He removes the adhesive tape from the wire ring on the side of the fuze and with his right hand withdraws the cotter pin from the fuze. He inserts the round, fuze end up, in the muzzle of the mortar. Upon releasing the shell, he withdraws his left hand immediately to the rear. He loads at the command FIRE given by the gunner.

c. The exercise is demonstrated and the groups return to their equipment where each man is required to perform the exercise as demonstrated.

■ 48. DUTIES OF OBSERVER.—Duties of the observer are to—

a. Obtain data for firing the first round at the target.

b. Transmit these data to the mortar crew by oral fire orders.

c. Observe each burst, sense errors, and give the corrections by subsequent oral fire orders until the fire mission is accomplished.

■ 49. EXERCISE NO. 6—DUTIES OF OBSERVER—EXERCISES IN RANGE ESTIMATION.—*a.* The purpose of this exercise is to teach the observer to estimate ranges by eye with the minimum amount of error.

b. Methods of determining ranges.—The usual method of range determination by the observer is estimation by eye. Difficult ranges may be secured from other troops or from a map but this will not usually be practicable. Estimation of range by a well-trained observer is sufficiently accurate when the bracketing method of adjusting fire (par. 75) is used.

c. Necessity for training.—(1) As estimation by eye must be depended upon in combat, all men should be trained in this method. Stress should be laid on estimating ranges between 200 and 1,500 yards.

(2) Estimation by eye of untrained men is little better than a guess, and the average error of such men will be at least 12 percent of the range. A definite system of range estimation

frequently practiced is the only way to make estimation by eye sufficiently reliable.

d. Method of estimation by eye.—(1) Estimation by eye consists in measuring the range by applying to it a unit of measure 100 yards long. The method is the same as that employed in measuring the length of a board with a ruler. The only difference is that the soldier's unit of measure is applied mentally. Thorough familiarity with the 100-yard unit and its appearance on different kinds of ground and at different distances will enable the estimator to apply it with a fair degree of accuracy.

(2) Knowledge of terrain, life in the open, and training in scouting and patrolling are helpful in range estimation.

(3) Application of the unit of measure beyond 500 yards is difficult. For this reason in ranges over 500 yards it is better to select a point halfway to the target, apply the 100-yard unit up to this halfway point, and multiply the estimated distance by two.

(4) The average of a number of estimates by different men is generally more accurate than a single estimate. However, in combat the squad leader must usually rely on his own estimation.

e. Conditions affecting appearance of objects.—(1) Conditions of light and terrain have considerable effect upon the appearance of objects, making them seem sometimes much nearer and at other times much more distant than they really are. The effect of these conditions on the appearance of the 100-yard unit of measure is negligible.

(2) In some cases much of the ground between the observer and the target will be hidden from view and the application of the unit of measure to the hidden portion of the ground will be impossible. In such cases the appearance of objects is the only guide.

(3) If there is a considerable stretch of visible ground extending from the far edge of the depression to the target, it is best to estimate the distance to the far edge of the depression, judging by the appearance of objects, and then to apply the unit of measure over the remaining distance to the target.

(4) Whenever the appearance of objects is used as a basis for range estimation, the observer must make allowance for the effects noted below:

(*a*) Objects seem nearer when—

1. Object is in a bright light.
2. Color of the object contrasts sharply with the color of the background.
3. Looking over water, snow, or uniform surface like a wheat field.
4. Looking from a height downward.
5. In the clear atmosphere of high altitudes.
6. Looking over a depression most of which is hidden.

(*b*) Objects seem more distant when—

1. Looking over a depression all of which is visible.
2. There is a poor light or fog.
3. Only a small part of the object can be seen.
4. Looking from low ground toward higher ground.

f. Exercises.—(1) *No. 1.*—(*a*) *Purpose.*—To familiarize the student with the unit of measure, 100 yards.

(*b*) *Method.*—The unit of measure, 100 yards, is previously staked out over varied ground, using markers that will be visible up to 500 yards. The men are required to become thoroughly familiar with the appearance of the unit of measure at various ranges. They do this by moving away from and in prolongation of the lines staked out and studying the appearance of the unit from distances of 100, 200, 300, and 400 yards.

(2) *No. 2.*—(*a*) *Purpose.*—To illustrate the application of the unit of measure.

(*b*) *Method.*—Ranges up to 900 yards are measured accurately and marked at every 100 yards by large markers or target frames, each bearing a number to indicate its range. Men undergoing instruction are then placed about 25 yards to one side of the prolonged line of markers and directed to place a card, hat, or some other object before their eyes so as to cover from view all of the markers. They are then directed to apply the unit of measure five times along a straight line in the general direction but slightly to one side of the markers. When they have selected the final point reached by mentally applying the unit to the ground five times, the

eyecover is removed and the estimations of the successive 100-yard points and the final point are checked against the markers. Accuracy is gained by repeating the exercise. Ranges greater than 500 yards are then considered. With the markers concealed from view in the same manner as explained above, men estimate the ranges to points which are obviously over 500 yards distant and a little to one side of the line of markers. As soon as they have announced each range, they remove their eyecovers and check the range to the target and to the halfway point by means of the markers.

(3) *No. 3.*—(*a*) *Purpose.*—To give practice in range estimation.

(*b*) *Method.*—From a suitable point, ranges are previously measured to objects within 1,000 yards. The instructor conducts the class to the point where the men are required to estimate the ranges to the various objects that are pointed out by the instructor, writing their estimates upon paper previously issued. Thirty seconds are allowed for each estimate. When all ranges have been estimated, the papers are collected and the true ranges announced to the class. Individual estimates and squad averages are posted on bulletin boards accessible to all members of the class.

■ 50. EXERCISE NO. 7—DUTIES OF SQUAD LEADER—EXERCISE IN FIRE ORDERS.—*a.* The purpose of this exercise is to teach the squad leader to give rapid, accurate, and complete fire orders.

b. The instructor assembles the men who are to receive this instruction. He explains that the squad leader controls the fire of his mortar by fire orders which contain the firing data to be used. He also explains that such orders must be brief and accurate and must include all the essential data shown in paragraph 73. He further explains that there are two classes of fire orders. These are—

(1) Initial fire orders, which contain the data for firing the first round on each target.

(2) Subsequent fire orders, which continue the fire on the target, and which contain only the data to be changed in correcting errors in range and deflection of the preceding round. He illustrates this explanation by various examples

of fire orders. He then requires one or more members of the group to give a fire order, calling on others to point out any errors made. The group is then divided into smaller groups and the exercise continued under group instructors.

■ 51. EXERCISE NO. 8.—DUTIES OF OBSERVER—EXERCISE IN CONDUCT OF FIRE.—*a.* The best and most direct method of teaching the observer to conduct fire is by practice firing. However, ammunition allowances restrict the use of this method and it will be necessary for the instructor to devise other means. A suitable method of teaching this subject is described in *b* below.

b. Training in adjustment of fire can be taught in the classroom with the following equipment:

Blackboard.
Sand table.
Burst pointer.

The burst pointer is a classroom pointer split at one end with a small ball of cotton about ½ inch in diameter placed securely in the split end to represent the "burst."

(1) The instructor first explains the method of sensing described in paragraph 74 and the method of correcting the errors thus sensed by means of fire commands. To illustrate this explanation, he uses a blackboard to show a sketch of the line mortar–target, and a second line perpendicular to it through the target. He plots the bursts and explains their deviation from these lines as described in paragraph 74. The group to be instructed is then assembled at the sand table where exercises similar to the one described below are conducted.

(2) The equipment is set up with the mortar placed approximately 1,000 inches from the general area of the targets. The observation point may be at the gun position or to the flank, depending on the exercise. The observer uses the mil scale in the field glass, type EE, to measure deflection errors on the miniature terrain. Ranges are indicated by placing markers in depth along an edge of the sand table. Cards about 3 by 4 inches numbered to indicate ranges in hundreds of yards (10, 11, 12, etc.) are suitable markers.

(3) *Example.*—The instructor designates a target. The observer computes the initial firing data for engaging the target and gives the fire order. During the early stages of instruction, the observer may pattern his fire order after a model on a blackboard near his position. When the observer has given his order, the instructor (standing alongside the sand table) says "On the way," and momentarily places the tip of the burst pointer at a point on the range approximately where the fire order would cause the shot to strike. The observer estimates the errors in deflection and range, and issues a fire order to correct them. This procedure is continued until the required final bracket is obtained. For example, the instructor designates a target on the sand table at a range of 1,000; the observer gives the fire order "High explosive, 1,100, zero, that stake, one round." The instructor places his pointer beyond the target; the observer sees that the burst is an "over" and issues the fire order "900, one round." The instructor places his pointer before and to the right of the target (to bring out a deflection change); the observer estimates the error in deflection with his field glass, sees that the burst is a "short," and issues the fire order "1,000, left ten, one round." The instructor places his pointer in front or in rear of the target or hits the target, depending on the point he desires to bring out. Should the observer give an incorrect fire order such as right deflection instead of left deflection, the instructor places the "burst" as called for, in order to emphasize the error by demonstration.

■ 52. EXERCISE NO. 9—DUTIES OF OBSERVER—EXERCISE IN PREPARATION OF RANGE CARDS.—*a.* The purpose of this exercise is to teach the observer the correct method of preparing range cards.

b. The instructor assembles the groups on suitable terrain where he explains the method of preparing range cards as described in paragraph 80. He requires the men to perform each step of the work as he explains it. Group instructors supervise the work of their groups, pointing out any mistakes and requiring their immediate correction. The men are then required to make a range card without help of the instructor. The instructor collects these cards, points out any mistakes

made, and requires the men to correct them. This exercise is repeated until the men are considered proficient.

■ 53. TRAINING IN EXAMINATION SUBJECTS.—In order to train the soldier to develop the speed and accuracy required in the various subjects of the gunner's test listed in paragraph 56*a*, he is first required to perform each test without regard to time. Once the habit of exactness is formed, he is required to take each test in the time prescribed. The progress of each man is noted by the instructor on the progress chart shown below.

PROGRESS CHART, 60-MM MORTAR MARKSMANSHIP

Names	Mounting mortar and laying with initial fire data	Laying on aiming points	Re-laying for changes in fire data	Preparation of range cards

Fair	Good	Very good	Excellent
X	X X	X X X	X X X X

SECTION II

EXAMINATION

■ 54. GRADES AND BASIS OF QUALIFICATION.—The proficiency of individual soldiers with the mortar will be indicated by grading them as expert gunner, first-class gunner, second-class gunner, and unqualified. The unqualified class includes those men of an organization who have been examined and have failed to qualify as second-class gunner or better, and all others who for any reason have not been examined. Examinations will be held once each year to determine the proficiency and qualification of personnel undergoing instruction.

■ 55. EXAMINING BOARDS; APPOINTMENT AND CONSTITUTION.—The examination will be conducted by a board of three or more officers, not more than one of whom is a member of the same company as the man being tested. Boards will be appointed by the commanders having authority to issue qualification orders as provided in AR 35–2380.

■ 56. SUBJECTS OF EXAMINATION.—*a. Gunner's test.*

Subjects	*Value*
(1) Mounting mortar and laying with initial fire data	40
(2) Laying on aiming points	30
(3) Re-laying for changes in fire data	30

b. Expert's test.

Subjects	*Value*
(1) Preparation of range cards	100
(2) Individual field firing	100

■ 57. GENERAL RULES GOVERNING EXAMINING BOARDS.—The following rules will govern examining boards:

a. The conditions of the examination will be made as nearly equal as possible for all candidates. The board is responsible that no data obtained by a candidate during a particular test are transmitted to any other candidate who is to take that test under identical conditions; also that no candidate will receive the benefit of any sight setting or laying of the mortar as left by a previously tested candidate.

b. Only ranges that are listed in the range table available to the candidate will be ordered.

c. At no time during a trial will any range be ordered which requires a sight setting beyond the limits of the elevation scale.

d. Should any candidate fail in any trial through the fault of an examiner or an assistant, or because of the failure or malfunction of the sight or other instrument used, that trial will be disregarded and the candidate immediately will be given another trial of the same nature.

e. The candidate may select the assistants authorized from any members of his squad or section.

f. Each candidate will be given the tests in the order in which they are described herein.

g. In any test requiring the candidate to lay for elevation or to cross level the mortar, the board will consider the position of the bubble in either the longitudinal or horizontal level vial to be correct if the bubble is more than half inside the two center lines on the glass tube.

SECTION III

QUALIFICATION COURSE, GUNNER'S TEST

■ 58. SCOPE.—This section prescribes the requirements of the gunner's test. The gunner's test is divided into three subjects as listed in paragraph 55.

■ 59. MOUNTING MORTAR AND LAYING WITH INITIAL FIRE DATA.—*a. Equipment required.*—(1) *For candidate.*—Mortar, complete.

(2) *For board.*—Stop watch and score card.

b. Conditions.—(1) The mortar will be laid out on the ground at the spot where it is to be mounted. The base plate will be attached to the spherical projection and the legs will be strapped to the barrel. The sight in its case will be placed near the mortar. The candidate will be in a prone position to the left of and on line with the mortar.

(2) An aiming stake will be placed about 15 yards from the mortar position to indicate the direction of fire.

(3) Each candidate will be given two trials.

c. Procedure.—(1) When the candidate is ready, a member of the board will give the order for mounting the mortar, for example, TO YOUR FRONT THAT STAKE, ACTION.

(2) At the above order, the mortar will be mounted and laid on the left edge of the aiming point.

(3) The sight will be mounted.

(4) As soon as the mortar is mounted and laid, the candidate will call "Ready."

(5) Time will be taken from the announcement of the last element of the command by the board to the announcement of "Ready" by the candidate.

d. Scoring.—(1) No credit will be given if the—

(*a*) Sight is not set correctly for deflection (zero) and elevation (65 degrees).

(*b*) Mortar is not laid correctly for elevation.
(*c*) Mortar is not cross leveled.
(*d*) Vertical line in the collimator is more than 5 mils off the left edge of the aiming stake.
(*e*) Traversing screw is more than two turns to the right or left of the center position.
(*f*) Elevation screw nut is more than three turns from the center position.
(*g*) Time is more than 80 seconds.

(2) If the mortar is found to be laid correctly within the limits prescribed, credit will be given as follows:

Time in seconds exactly or less than	50–60–70–80
Credit	20–15–10– 5
Total score possible (2 trials)	40

■ 60. LAYING MORTAR ON AIMING STAKES.—*a. Equipment required.*—(1) *For candidate.*—Mortar, complete, and three aiming stakes.

(2) *For board.*—Stop watch and score card.

b. Conditions.—(1) Three aiming stakes will be set out in such a manner that the angular distance between stakes measured at the mortar position is 200 mils.

(2) The mortar will be mounted with the elevation scale set at 65°, the longitudinal and horizontal bubbles centered, and the elevating screw nut one-half exposed. The sight will be mounted on the yoke with the deflection scale set at zero, and the traversing screw will be centered. The mortar will be laid on one of the stakes as described above and checked by the candidate before each trial is begun.

(3) Each candidate will have three trials in laying the mortar on an aiming stake.

c. Procedure.—(1) With the candidate in the gunner's position on the left of the mortar, a member of the board will give the order for laying the mortar on either of the other two stakes, for example:

500.
ZERO.
RIGHT STAKE.

(2) The candidate will repeat the command, consult the range table, announce the charge to be used, lay the mortar on the left edge of the designated stake with the announced deflection and elevation, and cross level the mortar. As soon as the mortar is laid, he will call "Ready."

(3) Time will be taken from the announcement of the first element of the fire order by the board to the announcement of "ready" by the candidate.

(4) At each trial, a different range and aiming stake will be ordered.

d. Scoring.—(1) No credit will be given if the—
(*a*) Sight is set incorrectly for deflection or elevation.
(*b*) Mortar is not laid correctly for elevation.
(*c*) Mortar is not cross leveled.
(*d*) Vertical line in the collimator is more than 5 mils off the left edge of the proper aiming stake.
(*e*) Charge announced is incorrect.
(*f*) Time is more than 35 seconds.

(2) If the mortar is found to be laid correctly within the limits prescribed, credit will be given as follows:

Time in seconds exactly or less than	20–25–30–35
Credits	10 –7 –4 –1
Total score possible (3 trials)	30

■ 61. RE-LAYING MORTAR FOR CHANGE IN FIRE DATA.—*a. Equipment required.*—(1) *For candidate.*—Mortar complete, and one aiming stake.

(2) *For board.*—Stop watch and score card.

b. Conditions.—(1) A mortar will be mounted as described below with an aiming stake placed at a convenient distance. The sight will be mounted. The mortar will be laid on the stake with a deflection set off on the sight and the traversing screw centered. The elevation scale will be set at 65°, the bubbles in the longitudinal and horizontal levels centered, and the elevation screw nut one-half exposed. The conditions set forth above will be checked by the candidate before his first trial is begun. The second and third trials may begin with the mortar as laid by the candidate at the end of the preceding trial.

(2) The amount of deflection given will not exceed 50 mils and the range will not be more than 1,700 yards nor less than 200 yards.

(3) Each candidate will have three trials in this subject.

(4) The candidate will take the gunner's position on the left of the mortar and note the elevation and deflection recorded on the sight. He may start this test with his hands on the deflection and elevation knobs of the sight if he so desires.

c. Procedure.—(1) When ready to receive orders, a deflection change and a new range will be announced, for example, 700, RIGHT 50.

(2) The candidate will repeat the order, announce the correct charge, set the sight with the data as ordered, re-lay on the left edge of the aiming stake, and cross level. When the mortar is laid he will announce "Ready."

(3) Time will be taken from the announcement of the first element of the fire order by the board to the announcement of "Ready" by the candidate.

d. Scoring.—(1) No credit will be given if the—

(*a*) Sight is set incorrectly for elevation or deflection.

(*b*) Mortar is not laid correctly for elevation.

(*c*) Mortar is not cross leveled.

(*d*) Vertical line in the collimator is more than 5 mils off the left edge of the aiming stake.

(*e*) Charge announced is incorrect.

(*f*) Time is more than 35 seconds.

(2) If the mortar is found to be laid correctly within the limits prescribed above, credit will be given as follows:

Time in seconds exactly or less than	20–25–30–35
Credits	10– 7– 4– 1
Total score possible (3 trials)	30

■ 62. MAXIMUM CREDITS FOR GUNNER'S TEST.

Mounting mortar and laying with initial fire data	40
Laying on aiming point	30
Re-laying for changes in fire data	30
Total possible score for gunner's test	100

SECTION IV

QUALIFICATION COURSE, EXPERT'S TEST

■ 63. SCOPE.—This test is divided into two subjects as follows:

a. Subject No. 1.—Preparation of range cards.

b. Subject No. 2.—Individual field firing.

■ 64. SELECTION OF TERRAIN.—The examining board will select the terrain upon which the test in Subject No. 1, Preparation of Range Cards, is to be conducted so that the various ranges used are not familiar to the candidate.

■ 65. PREPARATION OF RANGE CARDS.—*a. Equipment required.*—(1) *For candidate.*—Range table, pencil, paper, and field glass.

(2) *For board.*—Stop watch and range table.

b. Conditions.—(1) The test will include the preparation of a range card for a defensive position as described in paragraph 80.

(2) The position and sector will be selected by the examining board. The sector will include five target positions. Target positions will be between 300 and 1,000 yards from the mortar position.

(3) The board will indicate the assumed mortar position and the candidate will be required to remain in the immediate vicinity of the position while making the range card.

(4) One of the five targets will be designated as the reference point.

(5) All targets should be clearly visible to the candidate from his position.

(6) The same positions and sector will be used for all candidates examined on any one day.

c. Procedure.—(1) A member of the board will furnish the candidate with a sheet of paper and point out to him the location of the targets and the reference point. When the candidate states that he identifies all targets, the board will call, "Time."

(2) The candidate will prepare the range card as described in paragraph 80. He will estimate all ranges. He will measure deflections with the field glass.

(3) Time will be taken from the announcement of "Time" by a member of the board. The board will require the candidate to submit his range card within 15 minutes.

d. Scoring.—(1) No credit will be given if the range card is not submitted within 15 minutes.

(2) If the candidate's range card is submitted within the prescribed time limit, credit will be given as follows:

(*a*) Percentage of error in range, each target,

exactly or less than	15–20–30
Credits	10– 8– 6
Total score possible (5 targets)	50

(*b*) Error in deflection (mils) for each target,

exactly or less than	5–10–15
Credits	5– 4– 3
Total possible score	25

(*c*) For recording, computation, and legibility of each of the following on the range card:

	Each	*Total*
1. Designation of squad, platoon	---	1.0
2. Numbering of targets	1.0	5.0
3. Correct elevations and charges (based on the ranges as actually estimated by the candidate)	3.0	15.0
4. Description of targets	.8	4.0
Total possible	---	25.0

(*d*) Total possible for range card --- 100.0

■ 66. INDIVIDUAL FIELD FIRING.—*a. Personnel and equipment.*—(1) *For candidate.*—Mortar crew; mortar, complete for firing; field glass, type EE; and individual ammunition allowance as prescribed in AR 775–10.

(2) *For board.*—Recording sheet (shown below); field glass, type EE; and score card.

b. Conditions.—Individual field firing will be conducted by the bracketing method on a point target as described in paragraph 75 and under the following conditions for each problem:

(1) The candidate will compute the initial firing data and give the gunner the necessary order (par. 73) to enable him to lay the mortar and open fire upon the target.

(2) After firing has commenced, the candidate will sense orally all bursts and order the proper corrections until fire is adjusted upon the target or his ammunition allowance is expended. If adjustment is completed, fire for effect will be ordered by the candidate but the fire will not be delivered.

(3) The actual range to the target will be not less than 300 yards nor greater than 1,500 yards.

(4) The authorized individual ammunition allowance will not be exceeded.

(5) The target will be clearly designated to the candidate but will not be visible from the mortar position.

(6) The observation post will be not more than 25 yards from the mortar position.

(7) If practicable, all members of the 60-mm mortar section except those who are yet to take this test will be permitted to witness the firing.

(8) No person will correct or coach the candidate at any time during firing, and no one, except an official conducting the examination, will communicate or in any way interfere with any person connected with the firing.

c. Procedure.—When the target has been clearly designated to the candidate by a member of the board, he will give his initial fire order to the mortar crew. He will thereafter sense each burst orally and give the necessary fire orders to correct the errors sensed. When he believes the fire is effectively adjusted on the target, he will order FIVE ROUNDS, whereupon the board will terminate the problem.

d. Scoring.—If the problem is fired without error, the candidate will receive a credit of 100 points. If errors are made, his score will be the difference between 100 points and the number of points deducted by reason of the following errors:

(1) *Initial fire order.*

Error	*Deduction points*
Range, failure to give	1.0
Range, error in range for each 100 yards greater than 200 yards	5.0
Deflection, failure to give	.5
Deflection, incorrect (error greater than 10 mils)	2.0
Number of rounds, incorrect or failure to give	1.0

(2) *Sensing.*

Each failure to give sensing for range	1.0
Each failure to give sensing for deflection, if required	1.0
Each incorrect range sensing	5.0
Each incorrect deflection sensing	1.0

(3) *Correction.*

Each correction ordered more than 1 minute following a burst	2.0
Each deflection correction ordered which is in error more than 10 mils	2.0
Each failure to order correct range	10.0

■ 67. MAXIMUM CREDITS FOR EXPERT'S TEST.

Preparation of range cards	100
Individual field firing	100
Total possible for expert's test	200

EXPERT GUNNER'S TEST, FIELD FIRING PROBLEM, 60-MM MORTAR

Problem No. ____ Date _____ Candidate _____

Organization _____

Initial fire order

Elements	*Candidate's order*	*Deductions*
Range		
Deflection		
Aiming point		
Number of rounds		

Deductions, initial fire order _____

Round No.	Candidate's fire order			Candidate's sensing		Board's sensing		Deductions
	Range	Deflection	Number of rounds	Range	Deflection	Range	Deflection	
1	See above							
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Deductions, subsequent orders	
Deductions, initial fire order	
Initial credit	100
Total deductions	
Credit	

_____, *President.*

_____, *Recorder.*

SECTION V

TARGETS, RANGES, AND RANGE PRECAUTIONS

■ 68. TARGETS.—Targets for 60-mm mortar firing are natural features of terrain. Artificial targets such as panels and silhouettes should be used only when the terrain available for firing is not varied enough to furnish reference points or targets.

■ 69. RANGES AND RANGE PRECAUTIONS.—Range areas and safety precautions for 60-mm mortar firing must conform to the instructions set forth in AR 750–10.

■ 70. ADDITIONAL SAFETY PRECAUTIONS.—Individual safety precautions to be observed by the mortar crew are described in section VI, chapter 1.

CHAPTER 4

TECHNIQUE OF FIRE

	Paragraphs
SECTION I. Conduct of fire	71–78
II. Defensive fire	79–80
III. Range table	81

SECTION I

CONDUCT OF FIRE

■ 71. GENERAL.—*a.* The squad leader conducts the fire of the squad from a position near the mortar where he can observe the target area and control the fire by oral fire orders. The mortar usually will be placed in sufficient defilade to protect the mortar crew, and the gunner will be unable to see the target through the sight. It usually will be necessary therefore to use an aiming point other than the target to establish the initial direction of fire and to aim accurately each succeeding round.

b. The principal elements in the conduct of fire are—

(1) Preparation of initial data.
(2) Fire orders.
(3) Sensing.
(4) Fire for adjustment.
(5) Fire for effect.

■ 72. PREPARATION OF INITIAL DATA.—*a. Determination of range.*—Range is usually estimated by eye. It may be determined from a map or aerial photograph, if available. The accuracy obtained by the more elaborate methods of range determination is not essential where the bracketing method of adjusting for range is used.

b. Determination of direction of fire.—(1) As the gunner usually will not be able to aim directly on the target, the line of aim must be established or marked on the ground at a convenient distance from the mortar. To do this, the squad leader directs No. 2 in alining some suitable marker

(aiming stake, sight case, etc.) with the aiming line. It frequently will be desirable to establish the line of aim to some well-defined reference point centrally located in the sector of fire or target area of the individual mortar. A basic direction thus established and marked by an aiming point a few yards from the mortar will serve as an origin of shift for all targets within the deflection limits of the sight. To shift the fire of the mortar to any target, the squad leader measures the angle between the reference point and target and announces it in his initial fire order for that target.

(2) When going into action to engage immediately a target, it may be necessary to establish an aiming point on the line mortar–target. The method is the same as that described in (1) above except that there is no deflection correction applied.

(3) The first method is more flexible where a number of targets are expected. It obviates establishing a new aiming point for each target, a procedure which would require considerable movement by the mortar crew and increase the likelihood of exposure to enemy observation. It also affords the observer a well-defined reference point from which to measure angles of shift to indistinct targets such as are usually designated as mortar targets.

■ 73. FIRE ORDERS.—*a. General.*—(1) The squad leader directs the fire of his squad by fire orders. These orders contain the data necessary to enable the squad to lay correctly the mortar and to fire with the correct ammunition. The elements of a fire order are given in a definite sequence in order to accustom the squad to execute them in a definite routine. Whenever practicable, fire orders are given orally. When oral orders are not practicable, arm-and-hand signals may be used. The elements of the fire order are repeated by the gunner.

(2) Fire is begun at the gunner's command FIRE, after he has received the last element of the squad leader's fire order. If the squad leader desires the mortar to be fired at his command, he includes the words UPON COMMAND as the next to the last element of his fire order. Fire is

stopped by the squad leader's command CEASE FIRING, but in an emergency anyone present may give the command CEASE FIRING.

(3) Fire orders are classed as initial fire orders and subsequent fire orders.

b. Initial fire orders.—(1) The initial fire order which contains the data necessary to lay the mortar and fire the first round includes the elements listed below in their correct sequence.

(*a*) Range.
(*b*) Deflection.
(*c*) Aiming point.
(*d*) Number of rounds.

(2) The initial range to the target is announced as a number of yards ending with a multiple of 25 and without the words "range" and "yards," as for example, 800. The gunner reads the corresponding angle of elevation in the range table, sets the sight, and announces the charge which is repeated by the assistant gunner (loader).

(3) The deflection setting is announced as RIGHT (LEFT) (SO MUCH) or ZERO, depending on the relation between the aiming point and the line mortar–target.

(4) The aiming point is described briefly as BASE STAKE.

(5) The number of rounds is the last element of the fire order and is the squad leader's command to the gunner to fire the mortar when laid.

(6) The following is an example of an initial order:

800.
ZERO.
BASE STAKE.
ONE ROUND.

c. Subsequent fire orders.—(1) Subsequent fire orders contain only the data which are to be changed and the number of rounds to be fired. The elements listed in their correct sequence are as follows:

(*a*) Range (if changed).
(*b*) Deflection correction (if any).
(*c*) Number of rounds.

(2) In subsequent fire orders, the number of rounds is always announced as this element is the squad leader's command of execution.

(3) The elements of a subsequent fire order may be expressed as follows:

(*a*) *Completion of fire for adjustment.*

825.
RIGHT 10.
ONE ROUND.

(*b*) *Fire for effect.*

FIVE ROUNDS.

d. Arm-and-hand signals.—(1) It is not contemplated that the observer will be at such a distance from the mortar position as to necessitate the use of arm-and-hand signals. There may be situations, however, when it is not practicable to move the mortar position close enough to the observer to enable him to give his orders orally. In such a situation, arm-and-hand signals may be used to transmit such simple changes in fire data as are contained in subsequent fire orders. Since the elements of initial fire orders are not easily transmissible by arm-and-hand signals, they must be transmitted by voice or message. Arm-and-hand signals are given by the observer while facing toward the mortar position. Deflection signals are given in the direction toward which the correction is to be taken regardless of which arm is used. The order to fire is understood to be the completion of a series of signals.

(2) The general arm-and-hand signals used are as prescribed in chapter 11, FM 22–5, and in FM 2–5. Minor changes essential for use in mortar firing are given below:

(*a*) *Are you ready?*—The first signal in any series is, "Are you ready?"

(*b*) *Deflection right (left).*—Extend one arm toward the gunner(s) concerned; swing the hand and arm horizontally in the direction in which the fire is to be shifted, palm turned in that direction; with the palm of the hand toward the gunner(s), expose one finger for each mil the fire is to be shifted. If more than 5 mils change in deflection is necessary, repeat the signal until the desired number of mils has been given.

(*c*) *Range; or, change in elevation.*—Extend the arm fully toward the leader or men for whom the signal is intended, with the fist closed. Open the fist, exposing one finger for each 100 yards of range. For each 25-yard increase the fist is thrust upward vertically from the shoulder to the full extent of the arm and returned. For each 25-yard decrease in range the fist is thrust downward vertically from the shoulder and returned.

(*d*) *Fire for effect (or five rounds).*—Extend one arm above the head, hand open; flex the wrist, making a quick, choppy, lateral movement with the hand. If necessary, the signal for change in range should precede the signal for fire for effect.

■ 74. SENSING.—*a. General.*—(1) Sensing is the ability of the observer to determine from observation of the burst of a projectile whether the point of strike is right or left, over or short of the target. If the strike of the projectile is visible but its location is not sufficiently definite for the observer to be sure that it is over or short, the round is sensed as *doubtful* for range. If the observer sees no indication of the strike of the projectile, the round is sensed as *lost.* Unless the observer can sense accurately he cannot make prompt and effective adjustment of fire. He should not announce that a burst is over or short, or right or left of the target unless he is sure of that fact. If he is not sure, he should sense the round as *doubtful.*

(2) A sensing should be made promptly except when a short delay is advisable in order to take advantage of drifting smoke after a burst. The squad leader should base his sensing on what he sees while it is before his eyes and not on his recollections.

(3) Positive sensings for range and deflection usually are made on bursts in line with the target. They may be made when the bursts are not in line with the target if the terrain is such as to leave no doubt as to the location of the burst with respect to the target; for example, when the target is on a positive slope or when the observation post is above the target area. Also, under some conditions drifting smoke from the burst may permit a positive sensing. When an observer senses a burst from a round fired, he determines

the deflection error; that is, the number of mils to the right or left of the target, and whether it is an *over* or a *short*, that is, whether the burst is beyond or nearer than the target. He may be able to sense the round for deflection but not for range, in which case the round is sensed as *doubtful* and another round is fired with the deflection correction applied and with the same range as the preceding round.

(4) Ability to sense rapidly may be developed by accustoming the observer to announce his sensing of each round as promptly as observation will permit.

(5) The observer must study the terrain in the vicinity of the target to locate ravines or hollows which may hide bursts. He must note particularly the direction of the wind. Smoke from hidden bursts may appear later and may cause erroneous sensings.

b. Deflection.—The position of the observer (corporal) is in the immediate vicinity of the mortar. For this reason, he senses all errors in deflection by measuring their deviation from the line motrar–target in mils, using the mil scale in the field glass, type EE. The angle thus measured may be set off directly on the sight to correct the deflection of the succeeding round. For example, the burst is to the left of the line mortar–target and the observer reads the angle between the burst and the target as 20 mils. His sensing is 20 left. The correction to be set off on the sight for the next round is right 20.

c. Range.—The method of sensing for range is that used in the bracketing method of adjustment. In this method the observer does not attempt to measure the errors in range but simply senses each burst as over, short, doubtful, or lost, as described in *a*, above.

■ 75. FIRE FOR ADJUSTMENT.—*a. General.*—Fire for adjustment precedes fire for effect and has for its purpose the determination from the observed relation of the bursts and the target of the data necessary to place fire on the target. In fire for adjustment, range is usually adjusted by bracketing. The target is kept between two ranges, one increasing and the other decreasing until the center of impact is on or near

the target. A target is said to be bracketed for range when one short and one over have been obtained. The actual distance from the target of the short or over is immaterial and need not be estimated or considered by the observer.

b. Procedure.—(1) *Adjustment of range.*—(*a*) *Bracketing method.*—The range to the target is estimated as accurately as possible and a round is fired with this setting. If the burst is observed to be an over, the range setting is decreased 100 yards and another round fired with this new setting. If this round is a short, the third round is fired with a range setting which is the mean or average of the two previous range settings. Subsequent rounds are fired with range settings which are the mean of the last short and the last over. If the first burst is a short, the range setting is increased 100 yards and another round is fired. Subsequent rounds are fired with range settings which are the mean of the last short and the last over. After the bracket is obtained, the range is increased or decreased in steps of 50 and 25 yards according to the desired size of the final bracket. The following example illustrates this procedure.

Example.—The range to the target is estimated to be 700 yards and the first round is fired with this setting. The burst is observed to be a short. The range setting is increased 100 yards and the next round is fired with a setting of 800. The burst is observed to be an over. The bracket is now established. The range setting for the third round is the mean of the short (700) and the over (800) and is fired with a setting of 750. The third round is observed to be an over. The fourth round is fired with a range setting of 725 which is the mean of the last short (700) and the last over (750). The fourth round bursts on the target. This may be verified by one additional round at the same setting and fire for effect opened or fire for effect may be opened without a verifying round. The extent to which adjustment of range is carried or the size of the final bracket depends on the nature of the target and time available. Usually, it will be sufficient to establish a 25-yard bracket. The effective bursting radius of the shell and the dispersion of the rounds fired for effect will cover the target. If, however, greater precision

is deemed necessary, adjustment is continued until the 25-yard bracket is split. For ranges less than 1,000 yards the size of the initial bracket is 100 yards. For ranges greater than 1,000 yards a 200-yard initial bracket is used.

(b) *Creeping method.*—In a situation requiring fire close to friendly troops, the bracketing method cannot be used. The method employed is called the *creeping method.* The procedure is as follows: The observer estimates the range to the target, adds 100 yards for safety, and the first round is fired at this increased range. The observer estimates the distance of the burst from the target and deducts one-half of this error in range from the previous range setting for the next round. This procedure is followed until the burst is brought within effective distance of the target. This method may be illustrated as follows: The observer estimates the range to the target to be 700 yards and the first round is fired with a range of 800 yards. If his estimation is correct, the burst is 100 yards over. The next round is fired at 750 yards and so on until the burst strikes the target or the target is included within the effective radius of the burst.

(2) *Adjustment of deflection.*—During fire for adjustment of range, it is necessary to adjust deflection as closely as possible in order to be able to sense accurately for range. Therefore for each round which does not burst on the line mortar–target, the deflection to the right or left of this line is measured and a corresponding correction applied for the succeeding round. For example, in the illustrative problem in b(1)(a) above, if the initial round which is fired at a range of 700 yards bursts 30 mils to the right of the line mortar–target, it may be impossible to determine whether it is short or over. The next round is fired with a deflection setting of left 30 mils so that the observer can sense for range.

c. *General safety rule.*—60-mm mortar fire should be at least 100 yards from friendly troops.

■ 76. FIRE FOR EFFECT.—The purpose of fire for effect is to keep fire on the target until the desired result is accomplished. As it is contemplated that this mortar will be used against definitely located targets, fire for effect usually will be fixed

fire. The range at which fire for effect is opened is that limit of the final bracket which appears nearer to the target. It is fired in groups of rounds. A group is usually a volley of five rounds fired at one range and deflection setting. Each round is fired as rapidly as accuracy in laying the mortar permits. If more than five rounds are necessary to accomplish the mission, a second group of five rounds is fired. The purpose in firing in groups of five rounds is to permit the observer to make slight adjustments and prevent wild shooting. He observes each group and corrects the succeeding group accordingly. Since it will seldom be practicable to distribute the fire of this mortar to cover an area, there is no fixed method for this type of fire. If it becomes necessary in the judgment of the corporal to traverse or search a target, he can readily estimate the number of turns of the elevating crank or traversing handwheel (see par. 78) to distribute the fire in the desired direction.

■ 77. NIGHT FIRING.—a. *Laying.*—It may be necessary to fire the 60-mm mortar at night or at other times when visibility is limited. In such cases an aiming stake with a night-firing device attached is set up and used as an aiming point for all laying. If the position has been occupied during hours of good visibility, data are determined (preferably by firing) to the various probable targets. These data are recorded on a range card similar to the one described in paragraph 80. The deflections recorded on the range card indicate the direction and amount (in mils) of shift from the aiming point to any desired target. If the mortar position is occupied at night and no daylight reconnaissance has been made, any night firing that is done must be based on computed data from an aerial photograph or map. Such data are only as accurate as the aerial photograph or map available.

b. *Night-firing device.*—Any luminous marker that gives a light which is sufficiently diffused as not to disclose the position is satisfactory as a night-firing device. For example, a night-firing device can be improvised as follows: In the end of a tin can cut a cross-shaped slit and cover it with a thin white cloth, or remove the lid of the can,

mark a heavy black cross on a sheet of paper, and fasten it over the open end. Punch several holes in the other end of the can. In one side of the can cut a rough, cross-shaped slit and bend its edges inward to admit and hold a candle. Punch several nail holes above and on each side of the point where the flame of the candle will be. Insert a lighted candle in the can and attach the latter to the aiming stake. A flashlight may be used instead of a candle for illumination.

■ 78. FIRING WITHOUT SIGHTS.—The mortar is not rendered useless because of loss or destruction of the sight or the sight bracket.

a. Direction.—The mortar may be laid in direction on a vertical aiming line such as the left edge of an aiming stake by alining either the right or left edge of the barrel on the aiming line in a manner similar to laying with the vertical line in the collimator. Subsequent changes in deflection can be made with the traversing handwheel. With the clamping collar clamped so that its top edge lies between the upper barrel mark "A" and the lower barrel mark "C" one turn of the traversing handwheel moves the barrel 10 mils.

b. Elevation.—To lay the mortar in elevation without the sight, the angle of the barrel with the horizontal must be made to correspond with the angle of elevation designated in the range table opposite the desired range. The correct angle of the barrel must be judged by eye for the initial shot. It will greatly assist the gunner in estimating this angle if his assistant holds a plumb bob (may be improvised) directly over the center of the base cap of the mortar. The desired angle of the barrel with the vertical, or string of the plumb bob, will be 90° minus the angle of elevation given in the range table for the desired range. For example, assume the range to the target to be 700 yards. The corresponding angle of elevation found in the range table is 62°. Therefore the barrel of the mortar when laid for elevation should make an angle of 28° with the string of the plumb bob. Subsequent changes in elevation may be made by using the elevating crank. One turn of the elevating crank is approximately equal to two-thirds of a degree.

SECTION II

DEFENSIVE FIRE

■ 79. GENERAL.—In defense each 60-mm mortar usually is assigned a sector of fire. In order to be prepared to deliver fire promptly on likely targets, data which will facilitate the laying of the mortar during hours of both good and limited visibility are determined to important terrain features within the sector at or near which targets may be expected, such as woods, ravines, and important defiladed areas. One or more planned fires may be assigned by the company commander to be fired on call or upon a prearranged signal. The data must be recorded in a form which will serve as a guide to the mortar crew. A range card for each mortar position is used for this purpose. On it are listed the probable locations of targets and the data as to direction and range necessary to place fire on them. Duplicates of the original range cards prepared during the occupation and consolidation of a newly occupied position are collected by the section leader who consolidates them for his unit.

■ 80. PREPARATION OF RANGE CARDS.—Figure 16 illustrates this type of range card. It is prepared as follows:

a. A code designation may be given the squad and company, followed by the accurate location of the mortar position and the date of occupation.

b. The range to each target is listed in column 1.

c. All targets are numbered from left to right and listed in the order of their numerical designation in column 2.

d. Column 3 contains a brief description of each target and, in case it is to be fired on call or signal, a designation such as shown for target No. 1.

e. As the mortar is usually laid on an aiming stake, deflections must be measured from the line established by the aiming stake to the various targets. These deflections are listed in column 6. The reference point in the target area upon which the aiming stake is alined being in prolongation of the base direction is listed as zero.

f. Columns 4 and 5 list the corresponding elevation and charge for each range.

RANGE CARD

1st Mortar Squad
Company ——, —— Infantry
7th Infantry Woods
October 19, 19——

1 Range	2 No.	3 Description	4 Elevation	5 Charge	6 Deflection
500	1	Clump of woods (Signal.)	70	1	Left 85
650	2	Stream junction	61°30′	1	Left 75
725	3	Ravine	69°30′	2	Left 50
550	4	Lone pine on ridge (Reference point.)	67°30′	1	0

FIGURE 16.—Range card.

SECTION III

RANGE TABLE

■ **81. RANGE TABLE AND ITS USE.**—*a.* To determine the angle of elevation and charge which correspond to any desired range proceed as follows: In column 1 find the desired range. Reading horizontally from left to right, find the corresponding angle of elevation in column 2 and the corresponding charge in column 3. For example, if the range to the target is estimated to be 725 yards, the angle of elevation at which the mortar should be laid is 71¾° and the correct charge or the number of increments to be used is two.

b. Column 3 shows only the number of powder increments to be used. As the cartridge must always be used, its use is understood and not included in the listed charge. For example, *charge 0,* listed for ranges from 100 to 400 yards, consists of the cartridge alone; *charge 1,* the cartridge and one increment; etc.

NOTE.—A range table will be placed in the fiber container with each round of 60-mm mortar shell.

RANGE TABLE FOR 60-MM SHELL

1 Range (yards)	2 Elevation (degrees)	3 Charge (increments)	1 Range (yards)	2 Elevation (degrees)	3 Charge (increments)
100	84¼	0	1,025	61½	2
125	82¾	0	1,050	60¼	2
150	81¼	0	1,075	59	2
175	79¾	0	1,100	67¾	3
200	78¼	0	1,125	67	3
225	76½	0	1,150	66¼	3
250	74¾	0	1,175	65¾	3
275	73	0	1,200	65	3
300	71¼	0	1,225	64¼	3
325	69	0	1,250	63½	3
350	66¾	0	1,275	62¾	3
375	64½	0	1,300	62	3
400	62¼	0	1,325	68	4
425	74¾	1	1,350	67½	4
450	73¾	1	1,375	67	4
475	72¾	1	1,400	66½	4
500	71¾	1	1,425	66	4
525	70¾	1	1,450	65½	4
550	69½	1	1,475	64¾	4
575	68½	1	1,500	64¼	4
600	67¼	1	1,525	63½	4
625	66	1	1,550	63	4
650	64¾	1	1,575	62¼	4
675	63¼	1	1,600	61¾	4
700	62	1	1,625	61	4
725	71¾	2	1,650	60¼	4
750	71	2	1,675	59½	4
775	70¼	2	1,700	58¾	4
800	69½	2	1,725	58	4
825	68¾	2	1,750	57	4
850	67¾	2	1,775	56	4
875	67	2	1,800	55	4
900	66¼	2	1,825	53½	4
925	65¼	2	1,850	52¼	4
950	64¼	2	1,875	51	4
975	63½	2	1,900	49½	4
1,000	62½	2	1,925	49	4

c. Firing Table 60–B–2, Abridged.—The firing table applicable to the 60-mm mortar, M1 and M2, firing shell, HE, M49A1, and shell, practice, M50A1 (fuze PD, M52; weight of fuzed projectile, 2.96 pounds), is as follows:

Range (yards)	Elevation (degrees)				
	Cartridge	Cartridge plus			
		One increment	Two increments	Three increments	Four increments
	Charge				
	0	1	2	3	4
1,935					45.00
1,900					49.50
1,800					55.00
1,700					58.75
1,600					61.75
1,585				45.00	62.00
1,500				53.50	64.25
1,400				58.50	66.50
1,300				62.00	68.50
1,245			45.00	63.50	69.50
1,200			51.50	65.00	70.50
1,100			58.00	67.75	72.50
1,000			62.50	70.25	74.25
900			66.25	72.50	76.00
875		45.00	67.25	73.00	76.25
800		55.25	69.50	74.75	77.50
700		62.00	72.50	76.75	79.25
600		67.25	75.25	78.75	80.75
500		71.75	78.00	80.75	-------
480	45.00	72.50	78.50	-------	-------
400	62.25	75.75	80.50	-------	-------
300	71.25	79.50	-------	-------	-------
200	78.25	83.25	-------	-------	-------
100	84.25	-------	-------	-------	-------
Deflection for one turn of traversing screw					
For all clamp positions				10 mils.	

CHAPTER 5

FIRING AT FIELD TARGETS

	Paragraphs
SECTION I. General	82–84
II. Preparatory exercises	85–88
III. Firing exercises	89–96

SECTION I

GENERAL

■ 82. PURPOSE.—The purpose of this phase of training is to instruct leaders in the control of their units under simulated battle conditions, and the individual soldier in the performance of his duties as a member of a fighting team so as to secure the maximum fire efficiency.

■ 83. PLACE IN TRAINING.—Before a unit receives training in firing at field targets—

a. All men should be given instruction in mechanical training, mortar drill, marksmanship, and the technique of fire.

b. All noncommissioned officers and a few selected privates should be given instruction in the care and operation of fire-control instruments.

■ 84. SCOPE.—Training in firing at field targets will include instruction in the selection and occupation of observation posts and mortar positions, range estimation, the use of cover and concealment, communications between observation post and mortar positions, technique of fire, and firing exercises.

SECTION II

PREPARATORY EXERCISES

■ 85. GENERAL.—*a.* Before a unit is presented a field firing exercise it should receive preparatory instruction by means of conferences, demonstrations, and practical work, using nonfiring exercises. These exercises are valuable because

they eliminate to a great degree the question of safety and allow the troops to give undivided attention to the instruction.

b. Officers conducting preparatory exercises receive valuable experience. They learn quickly to present and conduct exercises, to judge solutions, and to conduct critiques. They may give their entire attention to these important points by the elimination of the distraction caused by enforcing necessary safety precautions when live ammunition is used.

■ 86. RANGE ESTIMATION.—In firing exercises economy of time and ammunition is greatly enhanced by correct range determination. It is therefore advisable during this phase of instruction to review the methods of range estimation described in paragraph 49.

■ 87. SELECTION OF POSITIONS.—*a. Mortar position.*—The position selected must permit accomplishment of the assigned mission, afford a suitable observation post near the mortar, as much cover from ground and aerial observation as is possible, and a good route of approach from the rear for ammunition supply. Wherever practicable mortars fire from fully defiladed positions. The low relief of the piece permits it to utilize the cover afforded by minor terrain features such as shell holes, ditches, hillocks, and small rises. Alternate and supplementary positions should also be selected.

(1) These factors are pointed out in a demonstration showing several different positions. The favorable and unfavorable points of each position are discussed.

(2) This should be followed by exercises in which the men are required to select a number of possible mortar positions and to state the reasons for their selection. The advantages and disadvantages of each position are discussed to insure that all of the important factors governing the selection of a mortar position enumerated in *a* above have been considered.

b. Observation posts.—The squad leader acts as observer for the mortar squad and selects an observation post where he can see the target area well enough to observe the accuracy and effect of his fire, and in addition control the fire of his mortar. The observation post should be located in

the immediate vicinity of the mortar position and approximately on the line mortar-target.

c. Communication.—In order to control fire of the mortar, the squad leader must be able to control fire of the mortar by oral fire orders and arm-and-hand signals.

■ 88. USE OF NATURAL COVER AND CONCEALMENT.—*a.* When a mortar can be definitely located by the enemy either from the ground or air it is soon put out of action. It is necessary therefore that the crew take advantage of all natural cover and concealment available both in approaching and occupying the mortar position.

b. During training in the use of cover and concealment when the section is working as a unit, one squad selects the observation post and moves the mortar into position while the other squad acts as observers. On completion of the exercises the observers discuss the actions of the men of the squad that occupied the positions and point out the errors that were made.

c. When an exercise is finished, the squads change places and another exercise is solved.

d. In training men in the use of cover and concealment the following points are stressed:

(1) Positions should be concealed or camouflaged.

(2) Shiny articles or sharply contrasting colors will not be worn.

(3) Steel helmets will be camouflaged so as to break the regular curved outline of the helmet.

(4) When crawling into a position in sight of the enemy, move straight toward him. Do not move sideways or zigzag.

(5) When crawling keep the body well down. Do not let the arms and legs wave around.

(6) Avoid quick or jerky movements.

SECTION III

FIRING EXERCISES

■ 89. UNITS TO FIRE.—Each mortar squad and section will engage in field firing exercises when local facilities permit.

■ 90. TERRAIN.—*a.* The availability of ground and consideration for safety determine the selection of terrain for field firing. Where possible, varied ground suitable for the employment of mortar fire should be selected. It is a great advantage from the instructional standpoint to use ground that is unfamiliar to the unit to be trained.

b. In the absence of other facilities a known-distance range may be used by arranging the exercises so that they begin off the range and require the delivery of fire on the range and in a safe direction.

■ 91. TARGETS.—*a.* Targets for mortar firing are natural features of the terrain. The high trajectory of mortar fire makes it especially useful for covering areas in defilade from flat trajectory weapons. Ravines, stream lines, heavily wooded areas, fieldworks, and reverse slopes may be reached by mortar fire. The bursting radius of the mortar shell makes the weapon suitable for searching small areas in which the targets are so well concealed by natural cover that they cannot be definitely located. It is particularly effective against personnel.

b. Artificial targets such as panels and silhouettes should be used only when the terrain suitable for firing is not varied enough to furnish reference points or targets.

■ 92. SAFETY.—*a.* AR 750–10 states the general safety measures to be observed when firing live ammunition in peacetime.

b. The officer in charge of a firing exercise is responsible for the safe conduct thereof. He insures that the mortars are not loaded or firing begun before the range is clear. He will also see that the direction of fire conforms to local requirements, and that throughout the exercises all safety precautions are strictly complied with.

■ 93. FIRING EXERCISE No. 1.—*a. Purpose.*—(1) *For the leaders.*—Practice in control of fire of their units by fire orders in order to engage properly the various types of mortar targets.

(2) *For the men.*—The application of the fundamentals of selection of positions, use of individual cover and concealment, technique of fire, and ammunition supply.

b. Unit.—One mortar squad.

c. Situation.—The squad is deployed under cover. A target area is indicated to the squad leader and he is directed to place his mortar in a suitable position to fire on any targets that appear in that area.

d. Method.—(1) After the target area is pointed out to the squad leader, he selects his observation post and issues the necessary orders for placing the mortar in position. After the mortar is in position a target is indicated. The squad leader issues his fire order, opens fire on the target, and adjusts his fire. Fire for effect is not a part of these exercises. As soon as fire for adjustment has been accomplished, the positions of the crew are changed, a new target selected, and the exercise repeated.

(2) Initially each type of target is presented in a separate exercise. When the men have completed a simple exercise engaging each type of target, exercises are conducted of a similar type in which one or more surprise targets appear so that it is necessary to shift a part or all of the fire of the squad to engage them.

■ 94. FIRING EXERCISE No. 2.—*a. Purpose.*—(1) *For the leaders.*—Practice in the selection of firing positions, conducting the unit forward by covered routes, issuing orders for the occupation of the initial firing positions, fire orders, and fire control.

(2) *For the men.*—Movement into the initial firing position and its occupation with the minimum of exposure, application of the fundamentals of fire technique.

b. Unit.—One 60-mm mortar section.

c. Situation.—The section is in approach march formation, halted under cover.

d. Method.—The general positions of the mortar section and target areas are indicated to the section leader. The section leader sends for the squad leaders and directs that the section move forward to a location nearby. Upon arrival of the squad leaders, the section leader issues his order assigning target areas and general locations for the squads. The squad leaders reconnoiter for definite positions, conduct their units forward under cover, and issue their orders for occu-

pation of firing positions. The mortars are placed in position under supervision of the section leader and the squad leaders. From this point on the problem is conducted in a manner similar to that described in paragraph 94.

■ 95. CRITIQUE.—At the completion of all exercises the instructor should conduct a critique covering the following points:

a. Reconnaissance by section leader and squad leaders.
b. Actions of section leader and squad leaders in getting their units on the ground without delay.
c. Suitability of observation post.
d. Suitability of firing positions.
e. Suitability of alternate positions.
f. Use of cover and concealment.
g. Orders of—
(1) Section leader.
(2) Squad leader.
h. Fire action of unit (all elements of technique used in delivering fire).

■ 96. AMMUNITION.—Ammunition for this firing will be taken from the combat allowance.

CHAPTER 6

ADVICE TO INSTRUCTORS

	Paragraphs
SECTION I. General	97–99
II. Mechnical training	100–102
III. Training for placing mortar in action	103
IV. Marksmanship	104–105
V. Firing at field targets	106–108
VI. Instruction on sand table	109

SECTION I

GENERAL

■ 97. PURPOSE.—The provisions of this chapter are to be accepted as a guide and will not be considered as having the force of regulations. They are particularly applicable to emergency conditions when large bodies of troops are being trained under officers and noncommissioned officers who are not thoroughly familiar with approved training methods.

■ 98. ASSISTANT INSTRUCTORS.—A sufficient number of noncommissioned officers and selected privates should be trained in advance for use as assistant instructions during training of the remainder of the organization.

■ 99. DEMONSTRATION GROUPS.—A small group of men, usually two to six, should be trained in advance to demonstrate exercises while the instructor is making the explanation. They should be rehearsed carefully in the duties they are to perform so that when they present a demonstration it is correct in every detail and gives a clear picture of the work under discussion.

SECTION II

MECHANICAL TRAINING

■ 100. GENERAL.—*a.* The unit to be instructed should be divided into groups of from six to eight men each, depending on the size of the unit and the equipment available. Each

group under direct supervision of an assistant instructor and with its proper equipment is assembled at the place of instruction.

b. Instruction is centralized under the unit instructor. Explanation and demonstration are concurrent, each assistant demonstrating the elements of the particular phase of instruction as the instructor explains it from the platform. For short periods of practical work instruction is decentralized under assistant instructors.

■ 101. DESCRIPTION.—*a. Equipment for each group.*—Mortar, bipod, base plate.

b. Procedure.—(1) To teach the nomenclature of the various parts of the mortar, the assistant instructors point out each part as the instructor names it. The men are then required to point out and name each part until they become thoroughly familiar with it.

(2) To teach the functioning of the various parts of the mortar, the assistant instructors point out and manipulate each part while the instructor explains it. The men are then required to repeat the explanation. Instruction in functioning is greatly facilitated by the use of charts.

■ 102. CARE AND CLEANING.—A demonstration of the proper method of cleaning the mortar and points to be observed before, during, and after firing should be given early in the training schedule so as to insure that all equipment receives proper care.

SECTION III

TRAINING FOR PLACING MORTAR IN ACTION

■ 103. MORTAR DRILL.—*a.* In presentation of instruction in drill, demonstrations should be freely used. A demonstration unit of selected previously trained men is formed. Individuals or units to be instructed are arranged so that the demonstration unit can be plainly seen. The instructor explains that the demonstration unit, accompanying his description of the movements, will go through the movements step by step. He cautions individuals undergoing instruction to watch the demonstration unit and be prepared to imitate the movements as demonstrated.

b. Units (usually squads) are then formed with their equipment by the assistant instructors who require them to perform the movements demonstrated. Each movement is first executed step by step until the assistant instructor is satisfied with the performance of each man. Men are frequently rotated in the various squad positions.

c. The equipment necessary for each group is described in chapter 2.

SECTION IV

MARKSMANSHIP

■ 104. GENERAL.—Instruction in marksmanship should follow mechanical training and mortar drill. In marksmanship the element of speed has been added to exactness in performance of duties of various members of the mortar crew covered in the instruction exercises. The instructor must assure himself that each assistant thoroughly understands each exercise, is accurate in his explanations, and is insistent upon the exact performance of each sequence. The importance of exactness must be impressed upon the men at all times. For example, men in setting the sight in the sight-setting exercise are apt to say, "That is about right." There is no such thing as a sight that is about right; it is right or it is wrong. Once the habit of exactness is formed, speed follows as a matter of course. The various set-ups and equipment necessary for each test are described in chapter 3. The instructor divides the unit to be tested into groups of from four to eight men, depending on the size of the unit and the equipment available. When practicable, squad leaders act as assistant instructors in charge of each group. The groups contain the members of the squad leader's own squad plus a proportionate number of the unit overhead. In case it becomes necessary to use as assistant instructors noncommissioned officers or selected privates who are required to take the tests, they should be tested with the first group in order that they may be free to conduct the instruction.

■ 105. PROCEDURE.—*a.* Assistant instructors require each individual of their group to perform each of the tests described in chapter 3.

b. They check each performance in the same manner as described for the board conducting the tests.

c. They mark the progress of each man on the progress chart shown in chapter 3.

d. They report to the senior instructor when members of their group are ready to qualify.

e. The senior instructor supervises group instruction, notes progress of individuals on the group charts, and calls for the board to meet when a sufficient number of men are ready to be tested.

SECTION V

FIRING AT FIELD TARGETS

■ 106. GENERAL.—*a.* Field firing exercises should be prepared carefully and thoroughly. Requirements should be simple and the instruction it is desired stressed clearly brought out by the exercise. Complicated exercises confuse the participants and do more harm than good.

b. Before preparing a field firing exercise the instructor should make a personal reconnaissance of the terrain to be used for the exercise. In all demonstrations and exercises emphasis should be placed on terrain.

■ 107. SEQUENCE OF TRAINING.—*a.* A minimum of 20 hours of instruction should be devoted to this phase of training. The schedule of instruction should be divided into training periods of from 3 to 4 hours in length.

b. The following is a suggested course:

First period.—Preparatory exercise. Target designation and range estimation.

Second period.—Preparatory exercise (nonfiring). Selection of observation posts and mortar positions.

Third period.—Preparatory exercise (nonfiring). Occupation of positions, use of cover and concealment, preparation of fire data, and means of communication.

Fourth period.—Field firing exercise similar to that mentioned in paragraph 93.

Fifth period.—Exercise similar to that outlined in paragraph 94.

c. Additional periods.—Additional time available should be devoted to exercises involving selection and occupation of initial firing positions and fire problems.

■ 108. CRITIQUE.—*a.* The basis of good instruction in field firing is intelligent, tactful, and constructive criticism. In his critique conducted after each exercise, the instructor discusses the solution offered and makes a comparison with other possible solutions. The critique should be given on the ground used for the exercise.

b. The instructor should commend that which was done well and call attention to that which was done poorly or incorrectly. Where errors have been committed a correct solution should be indicated. In making corrections the instructor should avoid ridicule, sarcasm, or any remarks which might be harmful to morale or initiative or which might lead to a dread of assuming responsibility in the minds of the men.

c. The critique should not convey the impression that there is but one correct method of solving the exercise. Such a misconception is apt to lead to the adoption of fixed forms, an attempt to guess what the instructor wants, and a resulting destruction of initiative and independent thought.

SECTION VI

INSTRUCTION ON SAND TABLE

■ 109. PLACE IN TRAINING.—The sand table offers an effective means of teaching certain phases of technique and combat fundamentals. Exercises in conduct of fire, selection of gun positions, and use of cover can be adapted readily to the terrain of the sand table. This type of instruction is particularly valuable during inclement weather or when facilities do not permit use of adequate terrain. It engenders an appreciation for terrain by presenting terrain features and dispositions so that the pupil may view them perspectively. The various kinds of sand tables used in teaching military subjects may be compared mainly according to simplicity of construction. It is not necessary in teaching small units to use elaborate models nor is it desirable. Simple reproductions can be changed easily and frequently to present a variety of situations.

INDEX

	Paragraphs	Pages
Accessories	9	12
Action	33	30
Adjustment, fire for	75	62
Advice to instructors, purpose	97	77
Aiming stakes	6	8
Laying mortar on	60	48
Ammunition	16, 96	23, 76
Authorized rounds	22	25
Care, handling, and preservation	20	24
Classification	17	23
Fuze, PD, M52	25	26
Identification	19	24
Lot number	18	23
Propelling charges	24	26
Preparation for firing	23	26
Storage	21	25
Appointment of examining boards	55	46
Assembling	4	6
Assistant gunner, duties	47	38
Assistant instructors	98	77
Authorized rounds of ammunition	22	25
Basis of qualification	54	45
Care and cleaning of mortar	5, 102	6, 78
Care of ammunition	20	24
Change numbers and duties in squad	32	29
Characteristics of mortar	1	1
Classification of ammunition	17	23
Compass, lensatic, prismatic type	10	13
Conduct of fire	71	57
(Exercise No. 8)	51	43
Constitution of examining boards	55	46
Critique	95, 108	76, 81
Cover and concealment, use of natural	88	73
Data, initial, preparation	72	57
Data on mortar	2	1
Defensive firing	79	67
Demonstration groups	99	77
Description:		
Mechanical training	101	78
Mortar	3	2
Disassembling	4	6
Drill, mortar	103	78
Duties:		
Assistant gunner No. 2	47	38
Gunner No. 1	43–45	35
Observer	48, 49, 51, 52	39, 43, 44
Squad leader	46, 50	37, 42

	Paragraphs	Pages
Effect, fire for	76	64
Equipment:		
To ground	29	28
To secure to put mortar into action	28	27
To take	30	29
Establishing direction of fire (exercise No. 4)	46	37
Estimation, range	86	72
Examination subjects	56	46
Training in	53	45
Examining boards:		
Appointment and constitution	55	46
Rules governing	57	46
Exercises	43–52	35
Firing	93, 94	74, 75
Preparatory	85	71
Expert's test:		
Maximum credits for	67	54
Scope	63	51
Field glass, type EE	11	17
Field targets, firing at	106	80
Place in training	83	71
Purpose	82	71
Scope of training	84	71
Fire:		
Conduct	71	57
Data, re-laying mortar for change in	61	49
Defensive	79	67
For adjustment	75	62
For effect	76	64
Mortar	34	32
Orders	73	58
(Exercise No. 7)	50	42
Firing:		
At field targets	106	80
Exercises	93, 94	74, 75
Individual field	66	52
Night	77	65
Position, preparation on steep slope	37	32
Precautions:		
Before	13	22
During	14	22
Tables	8, 26	11, 26
Without sights	78	66
Formation	31	29
Fuze, PD, M52	25	26
Grades and basis of qualification	54	45
Ground equipment	29	28
Groups, demonstration	99	77
Gunner No. 1, duties	43–45	35
Gunner's position at mortar	42	35
Gunner's test:		
Maximum credits for	62	50
Scope	58	47

	Paragraphs	Pages
Handling of ammunition	20	24
Identification of ammunition	19	24
Individual field firing	66	52
Initial data, preparation	72	57
Inspection	12	21
Instruction in marksmanship	104	79
Instruction on sand table	109	81
Instructors:		
Assistant	98	77
Purpose of advice to	97	77
Laying for:		
Direction (exercise No. 2)	44	36
Elevation (exercise No. 3)	45	36
Laying mortar:		
On aiming stakes	60	48
With initial fire data	59	47
Lensatic compass, prismatic type	10	13
Loading (exercise No. 5)	47	38
Lot number of ammunition	18	23
Marksmanship:		
Instruction in	104	79
Procedure	105	79
Maximum credits:		
Expert's test	67	54
Gunner's test	62	50
Mechanical training	100	77
Description	101	78
Method of preparatory instruction	40	34
Misfires	15	22
Removing	35	32
Mortar, to fire	34	32
Mortar drill	103	78
Mounting mortar	59	47
Movements	31	29
Natural cover and concealment, use	88	73
Night firing	77	65
Object of training	27	27
Observer, duties	48, 49, 51, 52	39, 43, 44
Out of action	36	32
Positions, selection	87	72
Precautions:		
Before firing	13	22
During firing	14	22
Range	69	56
Safety	70	56
Preparation:		
Ammunition for firing	23	26
Firing position on steep slope	37	32
Initial data	72	57
Range cards	65, 80	51, 67
(Exercise No. 9)	52	44
Preparatory exercises	85	71

	Paragraphs	Pages
Preparatory instruction:		
Method	40	34
Purpose	38	34
Scope	39	34
Preservation of ammunition	20	24
Prior training	41	34
Procedure in marksmanship	105	79
Propelling charges	24	26
Purpose of firing at field targets	83	71
Qualification, grades and basis	54	45
Range—		
Cards, preparation	65, 80	51, 67
(Exercise No. 9)	52	44
Estimation	86	72
(Exercise No. 6)	49	39
Precautions	69	56
Table and its use	81	68
Ranges	69	56
Re-laying mortar	61	49
Rules governing examining boards	57	46
Safety measures	92	74
Safety precautions	70	56
Sand table, instruction on	109	81
Scope of—		
Expert's test	63	51
Gunner's test	58	47
Preparatory instruction	39	34
Training	27	27
Firing at field targets	84	71
Secure equipment to put mortar into action	28	27
Selection of positions	87	72
Sensing	74	61
Sequence of training	107	80
Sight, M4	7	8
Sight setting (exercise No. 1)	43	35
Spare parts	9	12
Squad, to change numbers and duties in	32	29
Squad leader, duties	46, 50	37, 42
Storage of ammunition	21	25
Subjects of examination	56	46
Tables, firing	8, 26	11, 26
Take equipment	30	29
Targets	68, 91	56, 74
Terrain	90	74
Selection	64	51
Training:		
Examination subjects	53	45
Mechanical	100	77
Description	101	78
Object and scope	27	27

	Paragraphs	Pages
Training—Continued.		
Removing misfires	35	32
Sequence	107	80
Units to fire	89	73
Use:		
Natural cover and concealment	88	73
Range table	81	68

BASIC FIELD MANUAL
60-MM MORTAR, M2

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON, March 24, 1942.

FM 23–85, July 19, 1940, is changed as follows:

■ 15. MISFIRES.—*a. General.*—A misfire occurs when a round is loaded into the barrel of the mortar but fails to fire. The round may hang in the barrel without striking the firing pin or it may strike the firing pin and fail to function.

b. Removal of round after misfire.—(1) When any misfire occurs, No. 3 will immediately strike the barrel several times with a heavy nonmetallic instrument such as a 2- by 4-inch timber or, if such a piece *of wood is not available, with the cleaning staff or* with the heel. The mortar crew must then wait at least 1 minute before removing the round in order to avoid accident caused by possible delayed fire. Then the gunner (No. 1) unlocks the mortar from the base plate, places his left hand on and braces the right leg of the bipod, and his right hand around the base cap. The assistant gunner (No. 2) places his right hand, palm up, under the barrel near the muzzle, and his left hand, palm down, on top of the barrel. Care is taken that no part of either hand is in front of the muzzle.

(2) The gunner (No. 1) lifts the base of the mortar until the round slides slowly forward. Under no circumstances will the base of the mortar be again lowered below the horizontal position until the shell has been removed from the barrel. If the round does not slide forward, the barrel may be struck gently to dislodge the round. If the round still remains stuck, the barrel should be laid on the ground in a horizontal position and reported to a commissioned officer, who will turn the barrel over to the proper ordnance authorities for disposal. As soon as the round has started forward, *and not before,* the assistant gunner (No. 2) places the thumb of each hand over the muzzle and stops the round as the point of the

*These changes supersede so much of section II, Training Circular No. 24, War Department, 1941, as pertains to paragraph 35, FM 23–85, and section I, Training Circular No. 61, War Department, 1941.

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fuze reaches the muzzle. No. 2 then * * * and should be destroyed.

c. Causes of misfire.

* * * * * * *

(5) Lack of percussion due to—

* * * * * * *

(d) **Misalined stabilizing fin.**

(e) **Foreign matter or excess paint on bourrelet.**

[A. G. 062.11 (7–25–41).] (C 1, March 24, 1942.)

So much of section II, Training Circular No. 24, War Department, 1941, as pertains to paragraph 35 is rescinded. The provisions of this paragraph are restored.

[A. G. 062.11 (2–11–42).] (C 1, March 24, 1942.)

■ 35. MISFIRES.—Frequently during mortar drill when the squad has simulated firing the mortar using training shell with cartridge removed, the squad leader will announce MISFIRE and require the mortar crew to remove the misfire as prescribed in pararaph 15.

[A. G. 062.11 (2–11–42).] (C 1, March 24, 1942.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

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