8-INCH HOWITZER M2, TOWED

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NOVEMBER 1962
CHANGE

HEADQUARTERS
DEPARTMENT OF THE ARMY
No. 1
WASHINGTON, D. C., 27 June 1967

8-INCH HOWITZER M115, TOWED

FM 6–90, 21 November 1962, is changed as follows:

Title of manual is changed to read “8-INCH HOWITZER M115, TOWED.”

Page 1, paragraph 1a. In line 3, “M2” is changed to read “M115.”


Page 5, paragraph 4. In line 2, “M2” is changed to read “M115.”

Page 6, paragraph 5b. In line 1 the following is added “for section drill”.

Page 13, paragraph 16b. Line 2 is changed to read as follows: “occupation is governed by time factors, personnel available, and unit”.

Page 17, paragraph 18. In lines 5 and 6 “(aiming posts or distant aiming point)” is changed to read “(infinity-aiming reference collimator aiming posts or distant aiming point).” At the end of line 10 “See figure 7.1” is added.

Page 18. Paragraph 20c is rescinded.
Figure 7.1 Infinity-aiming reference collimator and auxiliary equipment.
Page 22. Paragraph 24c(2) is superseded as follows:

(2) (The corresponding number(s) (graduations) on the panoramic telescope must be matched with the corresponding number(s) on the reticle of the infinity-aiming reference collimator, or the vertical reticle of the panoramic telescope must be aligned with the left edge of the aiming posts.

Page 22, paragraph 25a. In lines 2 and 3 “normally aiming posts and alternate” is changed to read “normally the infinity-aiming reference collimator, or the aiming posts, or alternate.”

Page 24. Paragraph 25c is added as follows:

c. The collimator may be positioned 4 to 17 meters to the left front of the panoramic telescope sight, at a deflection established by unit SOP. However, the best results are obtained from 5 to 12 meters depending on the weapon.

(1) While the howitzer is being laid, number 5 cannoneer aligns the optical system of the collimator on the center of the panoramic telescope rotating head and cross-levels the reticle pattern.

(2) After the howitzer is laid the gunner directs number 5 in aligning to 0 line of the reference collimator reticle with the vertical reticle of the panoramic telescope.

(3) To lay for direction during firing, the gunner sets the announced deflection on
Figure 8.1 Gunners sight picture of collimator when correcting for displacement.
the panoramic telescope and alines any number on the panoramic telescope reticle with the same number on the collimator reticle. This procedure for laying also compensates for weapon displacement during firing. See figure 8.1.

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

Page 24. Figure 8.1 is added as follows:

Page 29, paragraph 30a. In line 2, “M2” is changed to read “M115.”

Page 32, paragraph 32b. Line 3 is changed to read “limits of elevation.”

Page 35. Paragraph 35a(3) is rescinded.

Page 46, paragraph 43g. In line 1 “and” is changed to read “or.”

Page 55. Paragraph 50d is rescinded. Transfer the note to follow subparagraph e.

Page 60, paragraph 60d. In line 2, “M2” is changed to read “M115.”

Page 72, paragraph 77. In the subject column, lines 5 and 6 are changed to read “Infinity-aiming reference collimator, or aiming post displacement correction.”

Page 75, paragraph 78a. In line 3, “M2” is changed to read “M115.”

Page 75. Paragraph 79c is superseded as follows:

c. The corresponding number(s) on the panoramic telescope must be matched with the cor-
responding number(s) on the reticle of the
infinity-aiming reference collimator or the vertical
reticle in the panoramic telescope must be aligned
on the left edge of the aiming post or on the
same part of the aiming point or target each
time the howitzer is laid.

Page 79, paragraph 86b. In line 2, “600” is
changed to read “400.”

Page 80, paragraph 86c. In column 2, line 3,
“600” is changed to read “400.”

Page 81, paragraph 87b(1). In line 2, “600” is
changed to read “400.”

Page 83. Paragraph 88b(5) is superseded as
follows:

(5) The reference collimator or the aiming
posts will be set out at the deflection as deter-
mined by unit SOP.

Page 83, paragraph 88c. In column 3, lines 4
and 5, “until the vertical hairline of the” is
changed to read “until corresponding numbers
on the panoramic telescope coincide with those on
the reference collimator or the vertical reticle of
the”. Line 14, “Lays on aiming posts” is changed
to read “Lays on reference collimator or aiming
posts.” In column 2, line 9, “CEASE” is changed
to read “CHECK”. Delete “(No time considered
for this operation).”

Page 84, paragraph 88c. In column 3, line 11,
delete “hairline of the.”

Page 84. Paragraph 88d(1)(c) is superseded as
follows:
(c) The corresponding number(s) on the reticle of the panoramic telescope does not coincide exactly with the same number(s) on the reference collimator or the vertical reticle of the telescope is not on the aiming point or left edge of the aiming posts, as the case may be.

Page 88, paragraph 91b. Subparagraphs (1), (2), and (4) are superseded as follows:

(1) Infinity-aiming reference collimator or aiming posts will be set out at the prescribed distances.

(2) An assistant, selected by the candidate, will be stationed close to the reference collimator or the far aiming post.

(4) Then the azimuth adjustment screw on the reference collimator or the far aiming post will be moved so that a displacement of 5 to 10 mils occurs.

Page 89, paragraph 91c(1). In column 2, line 1, delete “Lays” and add the following: “The gunner sights on the collimator and matches the reticle of the panoramic telescope with the collimator reticle pattern or lays.”

Page 89, paragraph 91c(2). In column 1, “ALINE AIMING POSTS” is changed to read “ALINE REFERENCE COLLIMATOR OR AIMING POSTS.” In column 2, line 1, “alining aim-” is changed to read “alining the reference collimator or aim-”

Page 89. Paragraph 91d(1)(a) is superseded as follows:
(a) The corresponding number(s) on the reticle of the panoramic telescope does not coincide exactly with the same number(s) on the reference collimator or the far aiming post does not appear midway between the near post and the vertical reticle of the telescope.

Page 90, paragraph 91d(2). Subparagraphs (b) and (c) are superseded as follows:

(b) The reference collimator or the aiming posts are not properly aligned.

(c) The corresponding number(s) on the panoramic telescope is not matched with the corresponding number(s) on the reticle of the reference collimator or the vertical reticle of the telescope is not on the left edge of the aiming posts.

Page 92, paragraph 93b. Subparagraphs (1) and (2) are superseded as follows:

(1) The howitzer will be laid on the reference collimator or the aiming posts to the left front.

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

Table II, sequence 8. Chief of Section column, line 21, “until the aiming” is changed to read “until the reference collimator or aiming.” In the Gunner column the following is added before
the first sentence. “Districts alinement of the infinity-aiming reference collimator:

1. Sets the panoramic telescope at deflection 2600.
2. Illuminates reference collimator reticle and refers the panoramic telescope to the center of the reticle.
3. Assisted by number 5, alines the vertical of the panoramic telescope with the 0 lines on the reference collimator. (Minor adjustments may be made by both the gunner and number 5 to insure exact coincidence.)”

Sequence 8, number 5 column. In line 1 “Sets” is deleted and the following is added: “Assists the gunner to orient the infinity-aiming reference collimator. If required sets.”

Sequence 5, number 5 column. “Assembles aiming posts *** front of howitzer” is deleted and the following is added: “Prepares and emplaces the infinity-aiming reference collimator in a convienent location, to the left front of the direction of fire, from 17 to 35 feet from the weapon.

1. Orients collimator on the panoramic telescope and cross-levels the reticle.
2. Lays electrical cable from the collimator to the gunner’s position. (If required, assembles aiming posts and places these near left front of howitzer.)”

*Table III, Chief of Section column. In lines 46 and 62 “CEASE” is changed to read “CHECK”.

Gunner column. Line 2, item 3 is superseded as follows:
3. Traverses the piece until a number on the telescope reticle is matched with the same number on the reference collimator reticle, or until the vertical line of the telescope is on the left edge of the aiming point. After line 46 the following note is added:

*Note.* When using the reference collimator, matching the same number(s) on the telescope and collimator reticles in the direction of displacement compensates for any displacement.

Number 9 column. Lines 20 and 21 are changed to read "fuzes: M520, M562, M563, M564, and M565." In line 80, "M500" is changed to read "M20"

*Table IV is superseded as follows:*

*Table IV. Trajectory Characteristics, Shell HE, Charge 7*
*(Located in back of manual)*

*Table V. Chief of Section column, under *Ammunition and fuze selection*: item 2 is rescinded.

*Table VI, sequence 1. In number 5 column, lines 1 and 2 are deleted and the following is added: "Recovers, disassembles, and stows the reference collimator (aiming posts if required)."

By Order of the Secretary of the Army:

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

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

Distribution:
To be distributed in accordance with DA Form 12–11 requirements for 8-inch Howitzer, M115, Towed.
Table IV. Trajectory Characteristics, Shell HE, Charge 7

<table>
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<tr>
<th>Range (meters)</th>
<th>Elevation (mils)</th>
<th>Vertical displacement per 100-meter range change (feet)</th>
<th>Trajectory Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1</td>
<td>0.5</td>
<td>For ranges from 0 to 500 meters, the trajectory is flat enough to prevent an 8-foot tank from passing under it. 400 meters is the ideal range at which to open fire on a target.</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
<td>1.0</td>
<td>Start firing with the data for the estimated range at the closest 100-meter range.</td>
</tr>
<tr>
<td>300</td>
<td>4</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>7</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>9</td>
<td>2.5</td>
<td>For ranges between 600 and 1,400 meters, adjustment of fire on the target by bracketing is required.</td>
</tr>
<tr>
<td>700</td>
<td>10</td>
<td>3.0</td>
<td>1. Start firing with the estimated range at the closest 100 meter range line. 2. Bracket adjustment of the target (overs and shorts) is required.</td>
</tr>
<tr>
<td>800</td>
<td>12</td>
<td>3.5</td>
<td>3. Make 200 meter range changes until a bracket is obtained.</td>
</tr>
<tr>
<td>900</td>
<td>14</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>1,000</td>
<td>15</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>1,100</td>
<td>16</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>1,200</td>
<td>18</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>1,300</td>
<td>20</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>1,400</td>
<td>21</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>1,500</td>
<td>23</td>
<td>7.0</td>
<td>At ranges over 1,400 meters, bracket adjustment of the target is also required. 400 meter range changes should be made until a bracket is obtained.</td>
</tr>
<tr>
<td>1,600</td>
<td>24</td>
<td>8.0</td>
<td>1. Start firing with the estimated range at the closest 100 meter range line. 2. Bracket adjustment of the target (overs and shorts) is required.</td>
</tr>
<tr>
<td>1,700</td>
<td>26</td>
<td>8.5</td>
<td>3. Make 400 meter range changes until a bracket is obtained.</td>
</tr>
<tr>
<td>1,800</td>
<td>28</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>1,900</td>
<td>30</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>2,000</td>
<td>31</td>
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<tr>
<td>2,100</td>
<td>33</td>
<td>11.0</td>
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<tr>
<td>2,200</td>
<td>35</td>
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<td></td>
</tr>
<tr>
<td>2,300</td>
<td>36</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>2,400</td>
<td>38</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>2,500</td>
<td>40</td>
<td>13.5</td>
<td></td>
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# 8-INCH HOWITZER M2, TOWED

## FIELD MANUAL

**HEADQUARTERS, DEPARTMENT OF THE ARMY**  
No. 6-90  
**WASHINGTON 25, D.C., 21 November 1962**  

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*This manual supersedes FM 6-90, 9 January 1961.*
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CHAPTER 1
GENERAL

1. Purpose and Scope

a. This manual is a guide to assist commanders and chiefs of section in developing the towed 8-inch howitzer M2 sections into teams that will operate effectively in battle.

b. This manual prescribes duties of the section in —

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

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

d. To improve this manual, users are encouraged to submit changes and comments keyed to the specific page, paragraph, and line, with supporting reasons, direct to Commandant, U.S. Army Artillery and Missile School, Fort Sill, Okla.

2. Composition of the Howitzer Section
   (figs. 1 and 2)

   a. Chief of section (CS).
   b. Gunner (G).
   c. Assistant gunner (AG).
d. Cannoneers number 1 through 10.
e. Driver (D).

Figure 1. 8-inch howitzer M2, towed; howitzer section; and prime mover.

3. Duties of the Chief of Section

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

a. Training and efficiency of personnel.
b. Performance of duties in drill, firing, tests and adjustments, inspection, and maintenance.
c. Observance of safety precautions.
d. Preparation of field fortifications.
e. Camouflage discipline, local security, and chemical, biological, and radiological security discipline.
g. Police and improvement of the section area.
4. References

Publications applicable to the 8-inch howitzer M2, towed, are listed in the appendix.
CHAPTER 2
SECTION DRILL

Section I. GENERAL

5. Purpose
This chapter prescribes —
   a. Objectives and instructions for section drill.
   b. Commands and formations.

6. Objective
The objective of section drill is the attainment of efficiency and precision, coupled with high speed.

7. Instructions
Section drill will be—
   a. Conducted in silence except for commands and reports.
   b. Repeated until reactions are automatic, rapid, and efficient.
   c. Supervised so that mistakes will be discovered, reported, and corrected immediately.
   d. Supervised by battery officers to insure uniformity and efficiency.
   e. Conducted so that each member of the section can perform all duties within the section.
Section II. COMMANDS AND FORMATIONS

8. Forming the Section

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

a. To form the section, the chief of section commands FALL IN. The section —

(1) Moves at double time.

(2) Forms in a double rank at close interval, with the gunner and assistant gunner on the right in the first and second ranks, respectively; the cannoneers in numerical order; and the driver at the left of the second rank.

(3) Centers on the chief of section at a distance of 3 paces (fig. 3).

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

(1) Moves and forms as in a above.

(2) Faces the direction of fire.

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

(1) Moves and forms as in a above.

(2) Faces direction indicated in the command.

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

9. To Call Off

With the section in formation the command is CALL OFF.
Figure 3. Section in formation.

a. All personnel except the gunner and assistant gunner execute eyes right.


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

10. To Take Posts

The command is 1. CANNONEERS, 2. POSTS.

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

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

c. The section moves to posts as shown in—

(1) Figure 4, dismounted, howitzer coupled.
(2) Figure 5, howitzer section mounted.
(3) Figure 6, prepared for action.
(4) Figure 7, howitzer uncoupled, not prepared for action.
11. To Change Posts

To train all members of the section in all duties, posts should be changed frequently. With the section in formation (fig. 3), the commands are as follows:

a. 1. CHANGE POSTS, 2. MARCH.
   (1) Numbers 6 and 10 move at double time in the rear of their ranks to the posts of number 1 and the assistant gunner, respectively.
   (2) Numbers 1 through 5 and numbers 7 through 9 take two left steps taking the positions of the next higher numbered cannoneers, and the assistant gunner takes two left steps taking the position of number 7.

b. 1. SECTION CHANGE POSTS, 2. MARCH.
   (1) The leftmost men move at double time to the posts of gunner and assistant gunner, respectively.
   (2) All other men move as in a above.

12. To Mount

To mount, the following commands may be given:

a. 1. PREPARE TO MOUNT, 2. MOUNT.
   (1) At the preparatory command, the section moves at double time to position shown in figure 4.
   (2) At the command of execution, personnel mount and take positions as shown in figure 5.
Figure 4. Posts, dismounted.
Figure 5. Howitzer section mounted.
(3) If any member of the section is not to mount, he is designated and cautioned by "Stand fast." 1. PREPARE TO MOUNT, driver stand fast, 2. MOUNT.

b. MOUNT. The section moves directly to positions shown in figure 5.

13. To Dismount

To dismount, the following commands may be given:

a. 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

(1) At the preparatory command, the section assumes positions for rapid dismounting.

(2) At the command of execution, the personnel take positions as shown in figure 4.

b. DISMOUNT. The section moves without delay to positions shown in figure 4.

14. To Fall Out

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

a. During Drill.

(1) The command may be given at any time.

(2) Section remains in vicinity of drill area.

b. When Firing.

(1) The command is given when firing is temporarily suspended.

(2) Section remains in the vicinity but clear of the piece.

(3) Settings and layings are not disturbed.
CHAPTER 3

DUTIES OF THE HOWITZER SECTION

Section I. PREPARATIONS FOR FIRING

15. Purpose

This chapter prescribes duties for —

a. Uncoupling the howitzer (table I).

b. Preparing the howitzer for action (table II).

c. Firing by indirect laying (table III).

d. Firing by direct laying (table V).

e. Preparing the howitzer for march order (table VI).

f. Coupling the howitzer (table VII).

16. At the Position

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

b. Preparation of the firing position prior to occupation is governed by time factors and unit standing operating procedures (SOP). The following preparations will facilitate the occupation:

(1) Mark the position with a stake where the center of the carriage is to be placed.

(2) At a distance of 50 to 100 meters in the approximate direction of fire, place another stake toward which the driver can point the tube.

c. Hand signals are used for guiding the driver.
17. To Prepare for Action

a. The command is PREPARE FOR ACTION.
   (1) It may be given with the howitzer in position or approaching it.
   (2) To uncouple, the command is UNCOUPLE.
   (3) Duties of individuals are given in tables I and II.
   (4) Each man takes his post (fig. 6) when he has completed his duties.

   Table I. Duties in Uncoupling
   (Located in back of manual)

   Table II. Duties in Preparing for Action
   (Located in back of manual)

b. The howitzer normally is partially prepared for action prior to reaching the firing position.

c. All duties are conducted at double time.

d. If the howitzer is to be uncoupled but not prepared for action at the firing position, the caution “Do not prepare for action” must precede the command UNCOUPLE. When their duties are completed, the section moves to the posts shown in figure 7.
Figure 6. Posts, prepared for action.
Figure 7. Howitzer uncoupled, not prepared for action.
Section II. FIRING

18. Firing by Indirect Laying

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

19. Firing by Direct Laying

Some targets may be attacked by direct laying. This is a method of taking the target under fire by sighting directly on the target. Since such targets are usually capable of returning fire, the following factors must be emphasized:

a. Speed and accuracy in laying.

b. High standards of training.

c. Section operation as an independent unit.

20. Methods

a. Two-Man, Two-Sight System. The two-man, two-sight system is the principal sighting system used with the weapon.

(1) The gunner establishes lead (table V) with the panoramic telescope.

(2) The assistant gunner establishes range with the elbow telescope.

b. One-Man, One-Sight Systems. The one-man,
one-sight system, in which the gunner lays for both deflection and elevation may be used against stationary targets only. The two-man, two-sight system, however, provides faster laying, better accuracy, and a greater assurance of first round hits.

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

(1) The gunner sets the lead on the azimuth micrometer index and traverses the tube until the vertical hairline is on the center of the target.

(2) Subsequent changes in lead are made in 5-mil increments by sound (clicks) and feel when turning the azimuth micrometer knob.

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

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

Table III. Duties in Firing, Indirect Laying

(Located in back of manual)

21. Range Card

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

b. During reconnaissance of the position and shortly after occupation of position, the chief of section—
(1) Measures or estimates the ranges to prominent terrain features and likely avenues or approach.

(2) Establishes reference points as required.

(3) Prepares a range card (fig. 8).

(4) As time permits, replaces estimated ranges with more accurate ranges obtained by pacing, taping, speedometer, maps, or survey.

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

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

e. The section field of fire should, if possible, be cleared of obstruction that might—

   (1) Obstruct fields of fire.

   (2) Hinder observation.

f. Care must be taken not to expose the location of the position.

22. Trajectory Characteristics

Trajectory characteristics for different ranges must be considered prior to taking a target under fire. Table IV provides data and information covering the effective direct fire ranges of the weapon.
Figure 8. Range Card for direct laying.
23. Preparation for Traveling

a. The command is MARCH ORDER. Duties of individuals are given in table VI.

b. To couple, the command is COUPLE.

(1) Duties of individuals are given in table VII.

(2) Each man takes his post (fig. 4) when he has completed his duties.

Table IV. Trajectory Characteristics, Shell HE, Charge 7
(Located in back of manual)

Table V. Duties in Direct Laying
(Located in back of manual)

Table VI. Duties in March Order
(Located in back of manual)

Table VII. Duties in Coupling
(Located in back of manual)
CHAPTER 4

TECHNIQUES AND SITUATIONS THAT REQUIRE SPECIAL ATTENTION

24. Precision in Laying

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

b. The gunner and assistant gunner verify the laying after the breech is closed.

c. For uniformity and accuracy—

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

(2) The vertical hairline of the panoramic telescope should be aligned with the left edge of the aiming post.

25. Aiming Points and Aiming Posts

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

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

(2) Alternate aiming points (distant aiming points) must be at a distance of at least 3,000 meters. This distance prevents dis-
placement in firing or traverse from causing more than a ½-mil horizontal change with the same settings on the scales.

b. The aiming posts are placed in alinement with the vertical hairline of the panoramic telescope, as directed by the gunner.

(1) The far aiming post is placed at least 100 meters from the piece. This distance is the most desirable for accuracy, visibility, and control of the aiming post lights.

(2) The near aiming post is set up halfway between the far post and the piece. Equal spacing is accomplished either by pacing or by measuring with the panoramic telescope and using the aiming post as a stadia rod or by using a wire or cord with the appropriate distances marked in a convenient manner.

(3) When the aiming post is used as a stadia rod, the procedure is as follows:

(a) Number 5 stands at the far aiming post and holds the upper section of the aiming post parallel to the ground so that the long axis is perpendicular to the line of sight.

(b) The gunner measures the length of the aiming post in mils on the reticle of the panoramic telescope.

(c) The gunner directs number 5 to move toward the piece until the upper section of the aiming post measures twice the number of mils it measured
at the far aiming post and directs number 5 to emplace the near aiming post.

(4) For night use, the light on the far aiming post should be placed so that it appears to be several feet above the light on the near post. The lights placed in this manner establish a vertical line for laying the howitzer.

(5) Unit standing operating procedure will specify the deflection at which to place the aiming posts; however, a deflection of 2,600 mils reduces misalinement and allows for maximum visibility.

(6) Correction for displacement of the aiming posts from the vertical hairline of the panoramic telescope is discussed in table III.

26. Changes in Data During Firing

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

a. Piece Unloaded. If the piece is unloaded new data are set off and firing is resumed when the quadrant is announced.

b. Piece Loaded. If the piece is loaded—

(1) New data are set off and firing is resumed when the quadrant is announced, if the fuze, time setting, or charge is not changed.

(2) If the data requires a change in the fuze, time setting, or charge, the chief of section will suspend firing and report to the
executive "Number 2 (so-and-so) loaded, charge (such-and-such), fuze time (such-and-such)" stating the elements that are changed.

(3) Data changes during continuous fire are applied so as not to stop the fire or break its continuity.

27. To Unload the Howitzer

a. A complete round, once loaded, should be fired. However, if unloading is required, the command is UNLOAD.

b. If the howitzer has been fired sufficiently to heat the tube, fire the piece if at all possible, or, if required, remove the round as quickly as possible.

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

(1) The assistant gunner operates the elevating handwheel and number 2 operates the elevating mechanism clutch to lower the tube to zero elevation.

(2) Number 1 removes the firing mechanism, opens the breech, and receives the waste from number 3.

(3) Number 3 removes the powder charge and passes it to number 8. Number 1 fills the chamber with waste and closes the breech.

(4) The assistant gunner and number 2, assisted by numbers 4 and 5, insert the rammer head into the muzzle of the howitzer until the rammer head incloses the
fuze and contacts the projectile. Then, they apply steadily increasing pressure, tapping the end of the rammer staff if necessary, until the projectile is loosened.

(5) When the projectile is loosened, the ramming operation is suspended. Number 1 opens the breech, removes the waste, and passes it to number 3. Numbers 6 and 7 and numbers 8 and 9 place the loading tray in position in the breech recess. Number 7 holds a pickax handle (or extra rammer if available) firmly against the base of the projectile to steady it as it is removed.

(6) Rammer staff operators ((4) above) slowly push the projectile back onto the loading tray. After the projectile is unloaded ((5) above), it is disposed of as directed by the chief of section.

d. For further information on unloading, see TM 9–3004.

e. In case of a misfire, the instructions in TM 9–3004 will be followed.

28. Care of Ammunition

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

a. Instructions in TM 9–1900 applicable to field service should be followed.
b. Projectiles will be protected from damage by—
   (1) Removing the eyebolts only when the fuze is to be inserted.
   (2) Using tarpaulins and dunnage to protect ammunition against weather, dirt, and sun.
   (3) Stacking projectiles in the open and raising the stacks 6 inches off the ground. Drainage ditches should be dug around the stacks.
   (4) Using dunnage liberally between ammunition layers and providing a 6-inch air space between the top of the stack and the covering tarpaulin.

c. Propellant charges will be—
   (1) Protected from direct rays of the sun and moisture.
   (2) Left in containers until just prior to firing.

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

d. Explosive elements in primers and fuzes are particularly sensitive to shock and high temperatures. Handling is as follows:
   (1) Protect from weather, direct sunlight, and rough handling.
   (2) Protection and safety devices are removed from fuzes just prior to their use.
   (3) No attempt will be made to disassemble a fuze.
e. Protection against enemy fire may be provided by—

(1) Dispersing ammunition in small stacks. Each stack should contain not more than 25 rounds and should be only one layer high, and the stacks should be placed at least 10 meters apart.

(2) Storing ammunition in trenches and dugouts.

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

g. For further information on care of ammunition, see FM 6-40, FM 6-140, TM 9-1300-203, TM 9-1900, and the appropriate operator’s manual.

h. For care and handling of nuclear ammunition, see (S) TM 39-B33-9, (S) TM 9-1100-218-20P, (S) TM 39-N-7, and (S) TM 39-N-13.
CHAPTER 5
BORESIGHTING

Section I. GENERAL

29. Description

Boresighting is —

a. The process used to verify and align, if required, the optical axes of the panoramic telescope and the elbow telescope so that they are parallel to the axis of the tube in deflection and elevation.

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

c. A method to insure accuracy in laying for elevation and direction.

30. Methods of Boresighting

a. The four methods for boresighting the 8-inch howitzer M2, towed, are—

(1) Testing target method (pars. 33–35).
(2) Distant aiming point method (pars. 36–38).
(3) Aiming circle method (pars. 39–41).

b. The method of boresighting will be determined by unit standing operating procedure and time available.

31. Equipment

The following equipment is needed to boresight the weapon using the testing target method:
a. Front and Rear Boresights.

(1) The front and rear boresights provide a means for aligning the tube on the testing target or distant aiming point.

(2) If boresights are not available, crosshairs are fastened to the muzzle, and the obturator spindle vent is used as a rear sighting guide by removing the firing mechanism from the closed breechblock.

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

(1) Mount a flat piece of material on a stand to provide stability (fig. 9).

(2) Inscribe a mil scale for use in leveling or canting the target (fig. 9).

(3) Draw vertical reference lines for use when the trunnions are not level (fig. 9).

(4) Bore a 1/16-inch hole through the center of each aiming diagram and cover each hole with a piece of heavy cloth. For nighttime use the aiming diagram may be illuminated by placing a flashlight against the hole. The resulting dot of light is used as the aiming point.

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

*Note.* Use the proper tools to prevent damage to fire control equipment.

d. Plumb Line. The plumb line is used to level the trunnions for testing, and for boresighting if
Figure 9. Testing target.
time is not a factor. The plumb line is prepared as follows:

(1) Suspend the line from any convenient location so that the muzzle of the howitzer can be placed at a distance approximately 5 feet from the line.

(2) For the most accurate test, insure that the line is long enough to allow sighting down the tube at the highest elevation possible.

(3) Attach a weight to the end of the line to maintain tautness and place the weight in a liquid-filled container to prevent the line from swinging.

32. Requirements for On-Carriage Fire Control Alinement

Correct alinement exists when—

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

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

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

d. All scales and indexes are at zero.

e. All bubbles are centered.
33. General

The testing target method consists of aligning the lines of sight of the tube, the panoramic telescope, and the elbow telescope with the appropriate aiming diagrams on the testing target.

34. Preparations for Boresighting

a. Emplace the howitzer on level ground.

b. Place the tube in the center of traverse.

c. Install the front and rear boresights (par. 31a).

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

   1. Prepare a plumb line (par. 31d).
   2. Manually traverse the piece until the plumb line is aligned with the front and rear boresights.
   3. Elevate and depress the tube throughout its limits. The vertical hairline of the front boresight should remain in coincidence with the plumb line.
   4. If coincidence is not maintained, raise the appropriate trail.
   5. Perform procedures in (3) and (4) above until coincidence is maintained throughout the elevation limits of the tube.

e. The gunner’s quadrant normally will be used to level the trunnions under field conditions when time is critical. The procedure is as follows:
(1) Use gunner's quadrant that has been checked by the end-for-end test (par. 49).

(2) Set the index arm and the micrometer scale on the quadrant at zero.

(3) Place the gunner's quadrant across the machined lower rim of the top carriage hold down clip.

(4) Raise the low trail until the bubble on the gunner's quadrant is centered.

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

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

35. Boresighting Procedures

With the weapon prepared as in paragraph 34, boresight with the testing target as follows:

a. Testing Target Alinement. Place the testing target at least 50 to 100 meters in front of the howitzer. Without moving the tube, aline the center aiming diagram on the testing target with the line of sight through the tube. The testing target then must be made secure.

(1) If the trunnions are level, the aiming diagrams on the testing target must be vertical to insure that the horizontal center lines on the testing target are level. This can be determined by using a plumb line on the testing target.
(2) If the trunnions are not level, the testing target must be canted in the same direction as the piece.

(3) If the tube is not level longitudinally, the face of the target must be tilted accordingly, either forward or backward.

(4) In all instances the target must be positioned so that it is at right angles with line of sight through the tube and the horizontal centerlines of the aiming diagrams are parallel to the axis of the trunnions.

b. Panoramic Telescope Alinement.

(1) Set the azimuth scale and micrometer to zero.

(2) Turn the elevation knob to aline the horizontal line of the reticle with the horizontal line of the left aiming diagram.

(3) If the vertical line of the reticle does not line up with the vertical line of the aiming diagram, loosen the locking screws on the telescope socket and adjust the tangent screws until the vertical line of the reticle is properly alined. Tighten the locking screws and verify the adjustment.

(4) Check that—

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

   (b) The telescope mount is level.
c. Elbow Telescope Alineent.

(1) Rotate the azimuth and elevation knobs to lay the reticle precisely on the right aiming diagram. If the reticle pattern appears tilted in relationship to the target, loosen the leveling clamping screw on the telescope mount and turn the leveling worm until the range lines are parallel to the horizontal center line of the aiming point. Tighten clamping screws and verify adjustment.

(2) If the boresight cross on the reticle of the telescope is not aligned with the aiming diagram, loosen the vertical and lateral clamping screws.

(3) Sight through the eyepiece.

(4) Turn the vertical and leveling adjusting worms until the boresight cross is aligned with the aiming diagram.

(5) Tighten the clamping screws and verify the adjustment.
Section III. DISTANT AIMING POINT METHOD

36. General

The distant aiming point method consists of aligning the lines of sight of the tube, the panoramic telescope, and the elbow telescope on an aiming point at a distance of at least 3,000 meters.

37. Preparations for Boresighting

a. Select a well-defined point at a distance of not less than 3,000 meters.

b. Preparations prescribed for the testing target method apply, except accurate leveling of the trunnions is not required.

38. Boresighting Procedure

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

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

c. Adjust the telescopes as required (par. 35b and c).
Section IV.  AIMING CIRCLE METHOD

39. General

The aiming circle method of boresighting may be used when weather or terrain prohibits the use of the testing target method or the distant aiming point method. The aiming circle method corrects only deflection errors. It does not include a test for determining elevation errors. When this method is used, any adjustments should be verified at the first opportunity by boresighting on a testing target or a distant aiming point. Before boresighting with the aiming circle, certain preliminary operations (par. 40) must be performed, preferably after a basic periodic test (pars. 45-47) when the panoramic telescope mount is in correct adjustment.

40. Preparations for Boresighting

a. The aiming circle is set up 30 to 50 meters in the rear of the weapon, and a parallax shield (par. 126, TM 9-3004) is fastened to the eyepiece.

b. The trunnions of the weapon are leveled.

c. A common straight pin is fastened in the top witness mark on the muzzle with a piece of adhesive tape so that the pin projects above the muzzle. Threads are then fastened in the witness marks.

d. The breech boresight is placed in the bore so that two of the fingerholes are in a vertical plane.

e. A straightedge is placed in a vertical position on the rear face of the breech, and the left side of the straightedge is aligned with the center of
the center hole of the breech boresight and the vertical thread on the muzzle.

f. By sighting through the aiming circle and traversing the tube, the pin mounted on the muzzle and the left side of the straightedge are aligned with the right edge of the vertical hairline of the aiming circle. A pencil line is drawn on the breech along the left side of the straightedge.

g. The straightedge is laid on the top of the tube at the muzzle end along the line of sight, and another pencil line is drawn.

h. White stripes are then painted on the top of the tube and on the breech (fig. 10) so that the left edge of the stripes coincides with the pencil lines.

i. During the actual boresighting with the aiming circle, the leveling of the trunnions is not necessary. Therefore, a corresponding boresight mark (radius mark) must be placed on the rear face of the breech. This radius mark is painted on the breech along a line that intersects the vertical line at exactly the same distance from the axis of the bore. The distance is determined by measuring the distance from the center of the crosshairs on the muzzle to the top edge of the muzzle. Then, the same distance is measured from the center of the obturator spindle vent up the vertical line on the breech. Owing to the rounded surface of the breech-block, the horizontal radius mark must be established in the following manner:

(1) The breech is opened and the tube is depressed until the crosshairs of the aim-
Figure 10. Boresight stripes on muzzle and breech with radius point indicated.
ing circle reticle are centered directly on the muzzle boresight. When breech is closed, the crosshairs of the aiming circle reticle should be centered on the obturator spindle vent.

(2) The end of the straightedge is placed over the obturator spindle vent with the edge along the vertical line.

(3) The distance measured at the muzzle is marked on the straightedge.

(4) The crosshairs of the aiming circle reticle are aligned with the distance measured on the straightedge.

(5) The straightedge is placed in a horizontal position on the breechblock so that the lower edge coincides with the upper edge of the horizontal crosshair of the aiming circle reticle. A pencil line is drawn along the lower edge of the straightedge. The radius mark is painted along the pencil line so that it intersects the vertical boresight mark (fig. 11).

41. Boresighting Procedure

a. The aiming circle is set up 30 to 50 meters in the rear of the weapon.

b. A parallax shield is placed over the eyepiece of the panoramic telescope and the eyepiece of the aiming circle.

c. The scales of the aiming circle are set at zero.

d. By traversing the weapon and using the lower motion of the aiming circle, the right edge of the
Figure 11. Establishing the radius point.
vertical hair in the reticle is aligned on the intersection of the radius mark with the vertical boresight mark on the breech and aligned on the top left edge of the boresight mark (fig. 12) on the muzzle. The line of sight must be exactly on these two points when the trunnions are not level so that sighting is on a horizontal plane.

e. The azimuth micrometer knob is used to sight on the objective lens of the panoramic telescope. The amount of the angle measured is called to the operator of the panoramic telescope.

f. The operator of the panoramic telescope places this angle on the scales of the telescope and, by means of the tangent screws, aligns the line of sight of the telescope on the objective lens of the aiming circle.
Figure 12. Measuring the boresighting angle with the aiming circle and panoramic telescope.
Section V. STANDARD ANGLE METHOD

42. General

The standard angle method of boresighting consists of referring the line of sight of the panoramic telescope to a selected point on the muzzle, using standard angles in azimuth and elevation. This method of boresighting normally will be used when it is not practical to use the methods previously discussed. Misalignment corrections determined from this test should be verified as soon as possible by a more accurate means of boresighting.

43. Preparations for Boresighting

The ideal time to determine standard angles is immediately after the basic periodic tests have been performed. The procedure is as follows:

a. Verify that the trunnions are level.

b. Verify that the panoramic telescope mount is level.

c. Verify that the recoiling parts are in the correct position with respect to the nonrecoiling parts by checking that the breech ring is snug against the cradle housing.

d. Boresight the weapon by using the testing target method (pars. 34 and 35).

e. Fasten a small pin, approximately $\frac{3}{32}$-inch diameter, in the left horizontal witness mark of the muzzle. The pin must extend past the muzzle and be visible through the panoramic telescope.

f. Fasten a parallax shield over the eyepiece of the panoramic telescope.
g. Elevate and depress the tube until the horizontal hairline of the panoramic telescope is alined with the pin in the witness mark.

h. Turn the azimuth micrometer knob until the vertical hairline of the panoramic telescope is alined at the junction of the pin and the muzzle (fig. 13).

i. With a sharp instrument scribe a line in the paint on the body of the telescope mount and fill the scribed line with red paint.

j. Read and record the deflection from the panoramic telescope to the nearest $\frac{1}{4}$-mil. This deflection is the standard azimuth angle (fig. 14).

k. Using the gunner’s quadrant, read and record the elevation angle to the nearest $\frac{1}{4}$ mil. This angle is the standard angle (fig. 15).

l. If the tube or carriage is changed, the standard angles must be reestablished.

44. Boresighting Procedure

After the standard angles have been determined, the procedure for boresighting is as follows:

a. Verify that the breech ring is snug against the cradle housing.

b. Fasten a pin in the left horizontal witness mark.

c. Place a parallax shield on telescope eyepiece.

d. Set off the standard azimuth and elevation angles.

e. Verify that the red scribed line is in coincidence.
Figure 13. Sight picture, standard angle.
Figure 14. Standard angle (azimuth)
Figure 15. Standard angle (elevation).
f. If the vertical line of the reticle is not in exact alinement, adjust the tangent screws until the vertical line of the reticle is properly alined.

g. If the horizontal line of the reticle is not in exact alinement, turn the elevation knob of the panoramic telescope until the reticle is properly alined to match the fine elevation indexes (par. 35b).
CHAPTER 6

BASIC PERIODIC TESTS

Section I. GENERAL

45. Purpose

Basic periodic tests are performed—

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

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

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

(1) Once each year if the howitzer is used for nonfiring training.
(2) Every 3 months if the howitzer is fired.
(3) As soon as possible after intensive use, accidents, or travel in extremely rough terrain.
(4) When fire is inaccurate for no apparent reason.

46. Preparations for Basic Periodic Tests

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

a. Place the howitzer on a site that is as nearly level as possible.

b. Suspend a plumb line (par. 31d).

c. Level the trunnions.
d. Boresight the howitzer using the testing target method.

e. Prepare a parallax shield for the panoramic telescope to eliminate parallax when the plumb line is viewed at close range.

47. Conditions

Care must be taken to insure that the following conditions exist:

a. The line of sight of the panoramic telescope remains in a plane parallel to the vertical plane passing through the axis of the bore as the weapon is elevated throughout its limits of elevation.

b. With the sight mount longitudinal-level bubble centered, the cross-level bubble remains centered throughout the limits of elevation of the tube.

c. With the tube level, the sight mount longitudinal-level bubble remains centered when the movable cross-level segment is operated throughout its limits.

d. With the gunner’s quadrant set at zero and allowable corrections applied, the quadrant bubble centers when the tube is level.
Section II. TESTS OF GUNNER’S QUADRANT AND MOUNT

48. General

The gunner’s quadrant must be in proper adjustment prior to conducting tests and adjustments on other sighting and fire control equipment.

49. End-for-End Test

a. Inspect the shoes on the gunner’s quadrant for dirt, nicks, and burs.

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

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

d. Place the quadrant on the quadrant seats, and depress or elevate the tube until the bubble in the gunner’s quadrant is centered.

e. Reverse the quadrant on the seats and check the bubble; if the bubble recenters, the quadrant is in adjustment, and the test is completed.

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

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

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

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

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

(1) Turn the micrometer knob until the bubble centers.

(2) Take the reading on the micrometer scale, add 10 to it, and divide the sum by 2. Place the value of the quotient on the micrometer scale.

(3) With the quadrant arm set at minus 10 and the value obtained in (2) above set on the micrometer scale, place the quadrant on the quadrant seats and level the tube.

(4) Reverse the quadrant. The bubbles should center.

(5) Subtract the reading on the micrometer scale from 10 to obtain the error.

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

50. Micrometer Test

a. Set the radial arm to a reading of 10 mils on the elevation scale and set the micrometer at zero.

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

c. Set the radial arm at zero and set the micrometer at 10 mils.
d. Reverse the quadrant; the bubbles should center.

Note. Do not disturb the lay of the tube.

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

51. Comparison Test

The comparison test is conducted in the following manner:

a. Compare the readings taken at low, medium, and high elevations with each gunner's quadrant in the battery on the leveling plates of a single piece.

b. Compute the average reading at each elevation.

c. Compare each quadrant reading with the average reading.

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

e. When a gunner's quadrant requires a correction as determined by the end-for-end test, this correction is not carried during firing but is recorded and applied only when sight tests and adjustments are made.
Section III. TESTS OF ON-CARRIAGE
FIRE CONTROL EQUIPMENT

52. Telescope Mounts

For tests and adjustments of the panoramic telescope mount and the elbow telescope mount see TM 9-3004, operator's manual.

53. Quadrant Mount

For tests and adjustments of the quadrant mount, see TM 9-3004, operator's manual.
Section IV. TEST OF FUZE SETTERS

54. General

a. Examine for burred or dented edges—
   (1) The stop that fits into the slot of the movable time ring.
   (2) The adjusting pawl which engages the notch in the fixed fuze ring.

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

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

55. Time Scale Test

a. Set the corrector to 30.

b. Set any convenient time on the time scale.

c. Test the time scale on the fuze setter by setting several fuzes.
   (1) The time set on the fuze should agree with the time setting on the fuze setter within one-fourth of the smallest graduation on the fuze time ring.

   Caution: Before setting a fuze, make sure that the T and C screws (of the fuze setter) are tight so that the scale indexes will not slip when the handle is rotated.

   (2) Tolerances:
      (a) 0.05 second for fuzes with 0.2-second graduations.
(b) 0.125 second for fuzes with 0.5-second graduations.

(3) If the fuzes do not agree with the time set on the fuze setter—
   (a) Repeat the test as a check with a different setting.
   (b) If the fuzes and the fuze setter still do not agree refer the instrument to ordnance.

(4) Do not set a live fuze more than twice.
(5) Never use a fuze from a dud.
(6) When tests are complete, reset all fuzes to SAFE and replace the safety wire or cotter pin.
CHAPTER 7

MAINTENANCE AND INSPECTIONS

56. General

Systematic maintenance and inspection are essential to insure that—

a. The howitzer section is prepared to perform its mission immediately.

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

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

57. Disassembly, Adjustment, and Assembly

Authorized adjustments and disassemblies to be performed by battery personnel are prescribed in TM 9–3004, operator’s manual, and appropriate Department of the Army supply manuals. Deviation from these procedures is not authorized, except as permitted by the responsible ordnance officer.

58. Records

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

59. Maintenance

Detailed instructions for maintaining the howitz-
er and the carriage are contained in TM 9–3004, operator’s manual, and LO 9–335.

60. Inspections, General

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

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

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

d. Detailed instructions for inspecting the howitzer M2 are contained in TM 9–3004, operator’s manual.

e. For detailed instructions for inspecting the prime mover being used, see the appropriate technical manual for that vehicle.

61. Operational Services

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

a. Before-Operation Service is a brief service to determine whether the vehicle and howitzer are ready for operation. At this time the chief of section will verify that sufficient ammunition, tools, and equipment are available and secure.

b. During-Operation Service consists of detecting any unsatisfactory performance of the vehicle.
c. *After-Operation Service* prepares the vehicle to operate again on a moment's notice. This is the basic daily service for the vehicle, and it is particularly important to detect deficiencies that developed during operation. All defects that the driver and crew cannot remedy must be reported at this time. The chief of section will resupply ammunition as required and verify that all equipment is present. Procedures for daily preventive maintenance services are contained in TM 9-3004, operator's manual, and the appropriate technical manual for the prime mover.
CHAPTER 8
DECONTAMINATION OF EQUIPMENT

62. General

a. Equipment that has been contaminated with chemical, biological, or radiological agents constitutes a hazard to personnel and must be removed or neutralized.

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

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

63. Decontamination of Toxic Chemical Agents

Table VIII prescribes the actions and the decontaminants to be used for toxic chemical agents.

64. Decontamination of Biological Agents

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

65. Decontamination of Radiological Agents

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

b. Decontamination is the process of reducing the hazard by removing or shielding against radiation. Methods are contained in table IX.
**Table VIII. Decontamination for Toxic Chemical Agents**

<table>
<thead>
<tr>
<th>Contaminated object</th>
<th>Preferred decontamination methods</th>
<th>Alternate decontamination methods</th>
<th>Field expedient methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canvas ...........</td>
<td>Boil in soapy water for 1 hour. Use 5 percent solution of household bleach for V-agents. Use 5 percent solution of washing soda for G-agents.</td>
<td>Immerse in boiling water for 1 hour. Launder by standard methods. Use DANC' solution or DS2'. Use slurry.</td>
<td>Aerate (except for V-agents).</td>
</tr>
<tr>
<td>Clothing .......</td>
<td>Immerse in boiling water for 1 hour, stir, add 1 pound of soap to each 10 gallons of water. 5 percent solution of bleach for V-agents. 5 percent solution of washing soda for G-agents.</td>
<td>Launder by standard methods. Dryclean. Use DS2 for cotton items only.</td>
<td>Rub M5 ointment on small contaminated areas. Aerate except for V-agents.</td>
</tr>
</tbody>
</table>

1 DANC and DS2 are injurious to plastic and hard rubber and should not be used in the bore.
2 Equal weights of water and chloride of lime.
Table VIII. Decontamination for Toxic Chemical Agents—Continued

<table>
<thead>
<tr>
<th>Contaminated object</th>
<th>Preferred decontamination methods</th>
<th>Alternate decontamination methods</th>
<th>Field expedient methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpainted metals.</td>
<td>Use DS2 or DANC; then rinse or wipe with organic solvent$^3$ and dry.</td>
<td>Wash with cool soapy water$^4$ and rinse.</td>
<td>Aerate.</td>
</tr>
<tr>
<td>Painted metals.</td>
<td>Spray with DS2 or DANC solution.</td>
<td>Wash with hot, soapy water and rinse. (Slurry may be used if it is removed within 1 hour and the surface is oiled.)</td>
<td>Aerate. Weather.</td>
</tr>
<tr>
<td>Instruments.</td>
<td>Clean with alcohol (or gasoline) and apply a thin coat of oil.</td>
<td>Wipe with rag dampened with DANC or DS2, dry with clean rag, and oil.</td>
<td>Weather.</td>
</tr>
</tbody>
</table>

$^3$ Organic solvents (petroleum products) and water do not neutralize contaminants. Precautions must be taken to dispose of the solvents as contaminated material.
<table>
<thead>
<tr>
<th>Method</th>
<th>Contaminated object</th>
<th>Technique</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water washing scrubbing.</td>
<td>All nonporous surfaces (metal, paint, plastics).</td>
<td>Work from top to bottom and up wind.</td>
<td>Drainage must be controlled — water is contaminated.</td>
</tr>
<tr>
<td>Detergent (soap) solution.</td>
<td>All nonporous surfaces.</td>
<td>Heat water if possible. Rub surface and wipe dry. (Moist application is all that is desired; do not let drip.)</td>
<td>Rags and runoff require disposal.</td>
</tr>
<tr>
<td>Organic solvents. (Petroleum products.)</td>
<td>All nonporous surfaces.</td>
<td>Immerse or wash with solvent, then wash in hot, soapy water and rinse with clear water.</td>
<td>Vapors are toxic; fire precautions are required.</td>
</tr>
<tr>
<td>Brushing</td>
<td>Porous and non-porous surfaces.</td>
<td>Brush or sweep dust from equipment or clothing.</td>
<td>Limited control of contaminated dust. Wear protective mask.</td>
</tr>
</tbody>
</table>

Sanding, filing, or grinding may be used to reduce hot spots. These methods are not practicable for large areas. Protective mask and gloves are required.

<table>
<thead>
<tr>
<th>Laundry</th>
<th>Clothing</th>
<th>Use hot, soapy water and rinse with clear water.</th>
<th>Water requires disposal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathing and</td>
<td>Personnel</td>
<td>Use brushes, running water, and soap.</td>
<td>Continue scrubbing until contamination level is safe.</td>
</tr>
<tr>
<td>scrubbing.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

with clear water.
CHAPTER 9

DESTRUCTION OF EQUIPMENT

66. General

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

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

67. Plans

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

a. Plans must be adequate, uniform, and easily executed.

b. Essential parts must be destroyed first.

c. Destruction must be as complete as possible.

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

68. Methods

a. The most generally applicable methods of destruction are:

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

   (2) Burning—Requires gasoline, oil, or other flammables.
(3) Demolition—Requires ammunition or explosives.

(4) Gunfire—Requires artillery, rocket launchers, rifle grenades, or hand grenades.

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

69. References

Detailed information on destruction of the howitzer is contained in TM 9-3004, operator's manual; for ammunition, see TM 9-1901, technical manuals listed in paragraph 28h, and the appropriate technical manual for the prime mover.
70. General

Safety precautions to be observed in training are prescribed in AR 385–63. Additional information is found in FM 6-40, FM 6-140, TM 9-3004, and TM 9-1900. The more important safety precautions are summarized in paragraphs 71 through 73.

71. Ammunition

The following precautions must be observed when handling ammunition:

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

b. Keep fire and flammables out of the area.

c. Protect ammunition from direct rays of the sun.

d. Do not disassemble fuzes.

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

(1) Powder increments are in proper order, in good condition, of the proper lot number, and placed in containers marked with corresponding lot number.

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

If the weapon fails to fire —
   a. Make two additional attempts to fire the weapon.
   b. Keep the weapon trained on the target.
   c. Clear unnecessary personnel from the vicinity of the howitzer.
   d. Wait 2 minutes after the last attempt to fire.
   e. Remove primer, staying out of the path of recoil.
   f. Inspect primer. If the primer has not been indented by the firing pin, inspect the firing pin.
   g. If the primer is indented, replace with a new primer and fire the weapon.
   h. If the primer did fire, wait an additional 8 minutes from the last attempt before opening the breech (a total of 10 minutes).

73. Drill and Firing

   a. The weapon is loaded only when firing is imminent.
   b. Personnel should move in rear of the piece when going from side to side.
   c. Personnel must stay clear of recoil path.
   d. Crew members should use ear plugs or cotton to protect ear drums.
   e. A safety officer will be present during all firing in training exercises. Specific duties for the safety officer are listed in FM 6–40.
CHAPTER 11
TRAINING

Section I. GENERAL

74. Purpose

The purpose of this chapter is to present the minimum requirements for training the howitzer section. Included are —
   a. Information for conduct of training.
   b. Minimum training schedule.
   c. Gunner's qualification tests.

75. Conduct of Training

Section training is conducted by the section chief. Battery officers are responsible for preparing training plans and supervising their execution. The chief of section will —
   a. Train each member of his section to function smoothly and efficiently in all duties within the section.
   b. Weld the section into an effective, coordinated team, capable of functioning efficiently in combat.
   c. Emphasize the application of prior instruction to current training.
   d. Maintain a progress card on each man to show —
      (1) Instruction attended.
      (2) Tests taken.
      (3) Remarks pertaining to progress.
   e. References: AR 611–201, ATP 6–100, FM 21–5, and FM 6–125.
Section II. MINIMUM TRAINING SCHEDULE

76. Training Periods

The following principles should be followed in scheduling and preparing training periods:

a. Periods in service of the piece drill should be arranged along with other battery training to provide a balanced training program.

b. Section drill should not exceed 1 hour and should be conducted in a vigorous manner.

c. Howitzer drill should be preceded and followed with logically related subjects. For example, precede the drill period with tests and adjustments and follow the period with inspection and maintenance.

d. Army Subject Schedule 6–3 provides uniform guidance for cannoneer training.

e. Operational and maintenance characteristics of the weapon are referenced in TM 9–3004.

f. The training schedule outlined in paragraph 77 is a guide to meet the minimum training requirements.
<table>
<thead>
<tr>
<th>Method</th>
<th>Hours</th>
<th>Subject</th>
<th>Text references</th>
<th>Training aids and equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>C, D, PW.....</td>
<td>1</td>
<td>Organization and composition of howitzer section, general duties of individuals, and formation of howitzer section.</td>
<td>Pars. 2, 3, 8, and 15.</td>
<td>Howitzer and vehicle.</td>
</tr>
<tr>
<td>C, D, PW.....</td>
<td>1</td>
<td>Posts and posting, changing posts, and mounting and dismounting.</td>
<td>Pars. 8-14</td>
<td>Do.</td>
</tr>
<tr>
<td>C, D, PW.....</td>
<td>2</td>
<td>Prepare for action. March order .........</td>
<td>Pars. 17, 23..</td>
<td>Do.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1-hour periods.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C, D, PW.....</td>
<td>24</td>
<td>Howitzer drill, duties in firing by indirect laying.</td>
<td>Par. 18 .......</td>
<td>TOE equipment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(½-hour periods.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C, D, PW.....</td>
<td>9</td>
<td>Howitzer drill, duties in firing by direct laying.</td>
<td>Pars. 19-22....</td>
<td>Do.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(½-hour periods.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Time</td>
<td>Reference</td>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------------</td>
<td>-------</td>
<td>-----------------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>Tests and adjustments of sighting and fire control equipment.</td>
<td>6</td>
<td>Pars. 29–55...</td>
<td>Decontamination and TOE equipment.</td>
<td></td>
</tr>
<tr>
<td>Aiming post displacement correction</td>
<td>2</td>
<td>Table III......</td>
<td>TOE equipment, blackboard and chalk.</td>
<td></td>
</tr>
<tr>
<td>Inspection and maintenance drills</td>
<td>4</td>
<td>Pars. 56–61...</td>
<td>TOE equipment.</td>
<td></td>
</tr>
<tr>
<td>Decontamination of equipment</td>
<td>1</td>
<td>Pars. 62–65...</td>
<td>Demolition and TOE equipment.</td>
<td></td>
</tr>
<tr>
<td>Destruction of equipment to prevent use by the enemy</td>
<td>1</td>
<td>Pars. 66–69...</td>
<td>TOE equipment.</td>
<td></td>
</tr>
<tr>
<td>Safety precautions</td>
<td>1</td>
<td>Pars. 70–73...</td>
<td>TOE equipment.</td>
<td></td>
</tr>
<tr>
<td>Method</td>
<td>Hours</td>
<td>Subject</td>
<td>Text references</td>
<td>Training aids and equipment</td>
</tr>
<tr>
<td>------------</td>
<td>-----------</td>
<td>---------------------------------------------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>PW</td>
<td>16</td>
<td>Service practice, firing by indirect laying.</td>
<td>Par. 18.........</td>
<td>Do.</td>
</tr>
<tr>
<td></td>
<td>(4-hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>periods.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PW</td>
<td>4</td>
<td>Service practice, firing by direct laying.</td>
<td>Pars. 19-22.....</td>
<td>Do.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C, PW</td>
<td>6</td>
<td>Review and tests of subjects previously covered.</td>
<td>All previous references.</td>
<td>Do.</td>
</tr>
<tr>
<td></td>
<td>(1-hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>periods.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C—conference, D—demonstration, PW—practical work.
Section III. GUNNER’S QUALIFICATION TESTS

78. Purpose and Scope

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

a. Determine the relative proficiency of the artillery soldier while performing the duties of gunner, 8-inch howitzer M2, towed. The tests are not a basis for determining the relative proficiency of batteries or higher units.

b. Serve as an adjunct to training.

79. General Instructions, Standards of Precision

The following standards are required for the candidate:

a. Scale settings must be exact.

b. Leveling bubbles must be centered exactly.

c. The vertical hairline in the panoramic telescope must be aligned on the left edge of the aiming post or on the same part of the aiming point or target each time the howitzer is laid.

d. Final motions must be made in the appropriate directions.

(1) The scales are set from lower to higher numbers.

(2) The tube is elevated in the direction of more difficult movement.

(3) The tube is traversed from left to right.

(4) The vertical hairline of the panoramic telescope is aligned on the aiming point from left to right.
80. Assistance

   a. The candidate will receive no unauthorized assistance.

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

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

81. Time

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

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

82. Scoring

   a. Scoring will be in accordance with the subparagraphs entitled “Penalties” and “Credit.”

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

83. Preparation for Tests

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

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

   c. The candidate will report “I am ready” before each test.
84. Qualification Scores

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

<table>
<thead>
<tr>
<th>Individual classification</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert gunner</td>
<td>90</td>
</tr>
<tr>
<td>First-class gunner</td>
<td>80</td>
</tr>
<tr>
<td>Second-class gunner</td>
<td>70</td>
</tr>
</tbody>
</table>
## 85. Outline of Tests.

<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Subject</th>
<th>Number of tests</th>
<th>Points each</th>
<th>Maximum credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>86</td>
<td>Direct laying, panoramic telescope</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>87</td>
<td>Direct laying, elbow telescope</td>
<td>4</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>88</td>
<td>Indirect laying, deflection only</td>
<td>16</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>89</td>
<td>Laying for elevation with gunner's quadrant</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>90</td>
<td>Cross-leveling the quadrant mount and operating the elevation mechanism clutch lever</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>91</td>
<td>Displacement correction</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Part I</td>
<td></td>
<td>4</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td>Part II</td>
<td></td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>92</td>
<td>Measuring site to the mask</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>93</td>
<td>Referring the howitzer</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>94</td>
<td>Tests and adjustments of sighting and fire control equipment.</td>
<td>6</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Test 1</td>
<td>(1)</td>
<td>2</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>Tests 2, 3, 5, and 6</td>
<td>(4)</td>
<td>1</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td>Test 4</td>
<td>(1)</td>
<td>4</td>
<td>(4)</td>
</tr>
<tr>
<td>95</td>
<td>Materiel</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credit</td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>
86. Direct Laying, Panoramic Telescope

a. Scope of Tests.

(1) Four tests (two groups of two tests each) will be conducted in which the candidate will be required to execute commands similar to those in c below.

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

(3) The candidate will be tested in the duties of the gunner.

b. Special Instructions.

(1) A stationary target will be placed approximately 600 meters from the howitzer.

(2) The fixed azimuth scale and the azimuth micrometer scale will be set at zero.

(3) The candidate will be posted as the gunner.

(4) The howitzer will be pointed so that —

(a) A shift of approximately 100 mils will be required for tests 1 and 3.

(b) It will not be necessary to shift the trails for any of the four tests.

(5) The laying of the piece will not be disturbed after tests 1 and 3.

(6) The examiner will announce the assumed direction of the movement of the target at the beginning of tests 1 and 3. The assumed direction of the movement of the target in test 3 will be opposite that in test 1.
### c. Outline of Tests.

<table>
<thead>
<tr>
<th>Test number</th>
<th>Examiner commands (for example)</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 3.</td>
<td>TARGET, THAT TANK: LEAD 5, RANGE 600.</td>
<td>Centers cross-level bubble. Traverses howitzer until proper lead has been set. (The horizontal crosshair of the reticle should be placed on the target in order to insure accuracy of lead.)</td>
</tr>
<tr>
<td>2 and 4.</td>
<td>RIGHT (LEFT) (10), ADD (DROP) 200.</td>
<td>When ready, steps clear and commands FIRE. Same as test 1 above.</td>
</tr>
</tbody>
</table>

### d. Penalties.

No credit will be allowed if, after each test —

1. The azimuth scale has been moved from zero.
2. The indexes on the azimuth micrometer have been moved from zero.
3. The lead in mils is not set properly.
4. The cross-level bubble was not centered prior to traversing the howitzer.

### e. Credit.

Time in seconds, exactly or less than .. 7 8 9

Credit (points for each test)... 3.0 2.0 1.0

---

### 87. Direct Laying, Elbow Telescope

#### a. Scope of Tests.

1. Four tests (two groups of two tests each) will be conducted in which the
candidate will be required to execute commands similar to those in c below.

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

(3) The candidate will be tested in the duties of the assistant gunner, laying for range by using the elbow telescope.

b. Special Instructions.

(1) A stationary target will be placed approximately 600 meters from the howitzer.

(2) For tests 1 and 3, the field of view of the telescope will be placed on the target with the correct range line more than 100 meters off the target.

(3) An assistant selected by the candidate will be posted as number 2 cannoneer to release and lock the elevating mechanism by operating the clutch lever.

(4) The laying of the howitzer will not be disturbed after tests 1 and 3.

c. Outline of Tests.

<table>
<thead>
<tr>
<th>Test number</th>
<th>Examiner commands (for example)</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 3.</td>
<td>TARGET, THAT TANK: RANGE 500.</td>
<td>Places proper reticle line for announced range on the center of the visible mass of the target. Calls “Set” and steps clear. Same as test 1 above.</td>
</tr>
<tr>
<td>2 and 4.</td>
<td>ADD (DROP) 100.</td>
<td></td>
</tr>
</tbody>
</table>

d. Penalties. No credit will be allowed if, after each test, the correct range line is not on the center of the visible mass of the target.
e. Credit.

Time in seconds, exactly or less than .......... 1 2/5 1 4/5 2
Credit (points for each test) ............. 1.0 0.7 0.5

88. Indirect Laying, Deflection Only

a. Scope of Tests. Sixteen tests will be conducted in which the candidate will be required to execute commands similar to those in c below. Tests 1 through 8 (and tests 9-16) will be executed as one series of commands.

b. Special Instructions.

(1) Commands will not necessitate shifting trails.

(2) The examiner will select a suitable aiming point and identify it to the candidate.

(3) The commands for new deflections for the following tests will be within the limits prescribed below:

<table>
<thead>
<tr>
<th>Test number</th>
<th>Maximum change (mils)</th>
<th>Minimum change (mils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 and 10</td>
<td>180</td>
<td>140</td>
</tr>
<tr>
<td>3 and 11</td>
<td>90</td>
<td>70</td>
</tr>
<tr>
<td>7 and 15</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>8 and 16</td>
<td>50</td>
<td>30</td>
</tr>
</tbody>
</table>

(4) The howitzer will be laid with correct settings at the conclusion of each test before the examining proceeds with the next test.
(5) Aiming posts will be set out at the prescribed deflection and distance for these tests.

(6) The examiner will designate the section number of the howitzer to be used.

c. Outline of Tests.

<table>
<thead>
<tr>
<th>Test number</th>
<th>Examiner commands (for example)</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 9.</td>
<td>DEFLECTION 2690.</td>
<td>Sets deflection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Centers the cross- and longitudinal-level bubbles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traverses the tube until the vertical hairline of the panoramic telescope reticle is on the left edge of the aiming posts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Checks centering of bubbles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Re-lays if necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calls &quot;Ready&quot; and steps clear.</td>
</tr>
<tr>
<td>2 and 10.</td>
<td>DEFLECTION 2550.</td>
<td>Sets deflection.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lays on aiming posts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Checks centering of bubbles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Re-lays if necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Calls &quot;Ready&quot; and steps clear.</td>
</tr>
<tr>
<td>3 and 11.</td>
<td>DEFLECTION 2620.</td>
<td>Same as test 2 above.</td>
</tr>
<tr>
<td></td>
<td>At conclusion of tests 3 and 11, give CEASE FIRE, END OF MISSION. (No time considered for this operation.)</td>
<td></td>
</tr>
<tr>
<td>Test number</td>
<td>Examiner commands (for example)</td>
<td>Action of candidate</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>4 and 12.</td>
<td>AIMING POINT, CHURCH STEEPLE, REFER.</td>
<td>Refers telescope to church steeple. Reads deflection and calls &quot;Number 1, deflection (so much).&quot;</td>
</tr>
<tr>
<td>5 and 13.</td>
<td>DEFLECTION 2600, REFER.</td>
<td>Slips the slipping micrometer scale to zero. Slips the slipping azimuth scale to 2600. Verifies that the vertical hairline of the reticle is on the church steeple. Calls &quot;Number 1, deflection 2600.&quot; Steps clear.</td>
</tr>
<tr>
<td>6 and 14.</td>
<td>DEFLECTION 2680.</td>
<td>Same as test 1 above.</td>
</tr>
<tr>
<td>7 and 15.</td>
<td>DEFLECTION 2730.</td>
<td>Same as test 2 above.</td>
</tr>
<tr>
<td>8 and 16.</td>
<td>DEFLECTION 2750.</td>
<td>Same as test 2 above.</td>
</tr>
</tbody>
</table>

d. Penalties.

(1) No credit will be allowed if, after each test—

(a) The deflection is set incorrectly.

(b) The cross-level or longitudinal-level bubble is not centered.

(c) The vertical hairline of the telescope is not on the aiming point or left
edge of the aiming posts, as the case may be.

(2) The last motion of the traverse was not made to the right.

e. Credit.

Time in seconds:

For tests 1 and 9 and tests 5 and 13, each...... 14 15\(\frac{1}{2}\) 16

For other tests, each exactly or less than..... 11 12 13

Credit (points for each test) ............. 2.0 1.5 1.0

89. Laying for Elevation with Gunner’s Quadrant

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those in c below.

b. Special Instructions.

(1) Each test will require a change of quadrant elevation setting within the limits of 30 to 60 mils.

(2) An assistant selected by the candidate will be posted as number 2 cannoneer to release and lock the elevating mechanism by operating the clutch lever and to cross-level the quadrant mount, when necessary.

(3) Before beginning the first test, the gunner’s quadrant will be set at zero and the cross-level bubble of the quadrant mount will be centered.

(4) The candidate will be posted as the assistant gunner.
c. Outline of Tests.

<table>
<thead>
<tr>
<th>Test number</th>
<th>Examiner commands (for example)</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>QUADRANT 180..</td>
<td>Sets gunner's quadrant at 180, seats gunner's quadrant, elevates or depresses the tube until the quadrant bubble is centered. Verifies centering of cross-level bubble. Calls “Ready” and waits for examiner to verify laying.</td>
</tr>
<tr>
<td>2</td>
<td>QUADRANT 240..</td>
<td>Same as test 1 above.</td>
</tr>
<tr>
<td>3</td>
<td>QUADRANT 205..</td>
<td>Same as test 1 above.</td>
</tr>
</tbody>
</table>

d. Penalties.

(1) No credit will be allowed if, after each test—

(a) The quadrant elevation is set incorrectly.

(b) The quadrant is not properly seated.

(c) The quadrant bubble is not properly centered.

(2) No credit will be allowed if the last movement of the tube was not in the direction in which the elevating handwheel is more difficult to turn.

e. Credit.

Time in seconds, exactly or less than ............ 9 10 11

Credit (points for each test) ............ 2.0 1.5 1.0
90. Cross-Leveling Quadrant Mount and Operating Elevation Mechanism Clutch Lever

a. Scope of Tests. Three tests will be conducted in which the candidates will be required to execute commands similar to those in c below.

b. Special Instructions.
(1) The quadrant mount cross-level bubble will not be level for the first test.
(2) Each succeeding test will require a change of quadrant elevation setting within the limits of 50 to 75 mils. An assistant selected by the candidate will be posted as the assistant gunner to operate the elevating handwheel and to set and level the gunner's quadrant.
(3) The candidate will take the post of number 2 cannoneer.

c. Outline of Tests.

<table>
<thead>
<tr>
<th>Test number</th>
<th>Examiner commands (for example)</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>QUADRANT 180..</td>
<td>Centers quadrant mount cross-level bubble. Releases elevation mechanism clutch lever. Sets elevation mechanism clutch lever when directed by the assistant gunner. Rechecks the cross-level bubble.</td>
</tr>
<tr>
<td>2</td>
<td>QUADRANT 240..</td>
<td>Same as test 1 above.</td>
</tr>
<tr>
<td>3</td>
<td>QUADRANT 187..</td>
<td>Same as test 1 above.</td>
</tr>
</tbody>
</table>
d. **Penalties.** No credit will be allowed if, after each test —

(1) The quadrant mount cross-level bubble is not centered.

(2) The elevating mechanism clutch lever is not applied promptly and smoothly.

(3) The candidate fails to center the cross-level bubble before changing elevation and fails to check the cross-level bubble after changing elevation.

e. **Credit.**

Time in seconds, exactly

<table>
<thead>
<tr>
<th></th>
<th>5</th>
<th>5 3/5</th>
<th>6</th>
</tr>
</thead>
</table>

Credit (points for each test)

<table>
<thead>
<tr>
<th></th>
<th>2.0</th>
<th>1.5</th>
<th>1.0</th>
</tr>
</thead>
</table>

91. **Displacement Correction**

**a. Scope of Test.** One test, consisting of two parts, will be conducted in which the candidate will be required to execute the commands in c below.

**b. Special Instructions.**

(1) Aiming posts will be set out at the prescribed distances.

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

(3) The examiner will require the candidate to lay the howitzer on an announced deflection and report "I am ready."

(4) Then the far post will be moved so that a displacement of 5 to 10 mils occurs.
(5) The laying of the howitzer at the termination of part I will not be disturbed for part II.

c. Outline of Tests.

(1) Part I.

<table>
<thead>
<tr>
<th>Examiner commands</th>
<th>Action for candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORRECT FOR DISPLACEMENT.</td>
<td>Lays the howitzer so that the far aiming post appears midway between the near post and the vertical hairline of the telescope. Checks centering of level bubbles. Re-lays if necessary. Calls &quot;Ready&quot; and steps clear.</td>
</tr>
</tbody>
</table>

(2) Part II.

<table>
<thead>
<tr>
<th>Examiner commands</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALINE AIMING POSTS.</td>
<td>Directs assistant in alining aiming posts. Calls &quot;Ready&quot; and steps clear.</td>
</tr>
</tbody>
</table>

d. Penalties.

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

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

(b) The cross-level or the longitudinal-level bubble is not centered.

(c) The last motion of traverse was not made to the right.
(2) *Part II.* No credit will be allowed if—

(a) The deflection is other than the announced deflection.
(b) The aiming posts are not properly aligned.
(c) The vertical line of the telescope is not on the left edge of the aiming posts.

e. *Credit.*

Part I, time in seconds, exactly or less than. 7 8 9 10
Credit ................. 4.0 3.0 2.0 1.0
Part II, no time limit. — — — —
Credit ................. 1.0 — — —

92. Measuring Site to Mask

a. *Scope of Test.* One test will be conducted in which the candidate will be posted as chief of section and will execute the command in c below.

b. *Special Instructions.*

(1) The howitzer, prepared for action, will be placed 200 to 400 meters from a mask of reasonable height.
(2) The tube will be pointed so that it is 100 to 150 mils above the crest and 100 to 150 mils to the right or left of the highest point of the crest.
(3) The candidate will be posted at the right rear of the breech.
(4) Three assistants, selected by the candidate, will be posted to perform the duties of the gunner, assistant gunner, and number 2.
c. Outline of Test.

<table>
<thead>
<tr>
<th>Examiner commands</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEASURE SITE TO MASK.</td>
<td>Sights along lowest element of bore and directs the gunner, assistant gunner, and number 2 in operation of the elevating and traversing mechanisms until the line of sight just clears the crest. Directs the assistant gunner and number 2 to measure the elevation. Verifies the reading on the gunner's quadrant and reports “Number (so-and-so), site to mask (so much).”</td>
</tr>
</tbody>
</table>

d. Penalties. No credit will be allowed if—
(1) The line of sight along the lowest element of the bore does not just clear crest.
(2) The quadrant cross-level bubble is not properly centered.
(3) The quadrant bubble is not centered when the quadrant is seated properly.
(4) The site is announced incorrectly.

e. Credit.
Time in seconds, exactly or less than. 17 18 19 20
Credit ................. 5.0 4.0 3.0 2.5

93. Referring the Howitzer

a. Scope of Test. One test will be conducted in which the candidate will be posted as the gunner
and will measure and report a deflection in accordance with the command in c below.

b. Special Instructions.
   (1) The howitzer will be laid on aiming posts to the left front.
   (2) An aiming point within 200 mils to the left or right of the aiming posts will be designated by the examiner and identified by the candidate.

c. Outline of Test.

<table>
<thead>
<tr>
<th>Examiner commands</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER (so-and-so), AIMING POINT THAT (so-and-so), REFER</td>
<td>Centers cross-level and longitudinal-level bubbles.</td>
</tr>
<tr>
<td></td>
<td>Refers to aiming point.</td>
</tr>
<tr>
<td></td>
<td>Check centering of bubbles and re-lays telescope if necessary.</td>
</tr>
<tr>
<td></td>
<td>Reads the deflection and reports &quot;Number (so-and-so), deflection (so much)&quot; and steps clear.</td>
</tr>
</tbody>
</table>

d. Penalties. No credit will be allowed if —
   (1) The cross-level or the longitudinal-level bubble is not centered properly.
   (2) The vertical line of the telescope reticle is not on the aiming point.
   (3) The deflection is announced incorrectly.
   (4) The traversing handwheel is turned.

e. Credit.

Time in seconds, exactly
   or less than. 5 5\(\frac{3}{5}\) 6 6\%

Credit .................. 5.0 4.0 3.0 2.5
94. Tests and Adjustments of Sighting and Fire Control Equipment

a. Scope of Tests. Six tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the prescribed tests and authorized adjustments or describe the action taken (i.e., send to the ordnance maintenance company) if adjustment is not authorized by using personnel.

b. Special Instructions.

(1) The howitzer will be prepared for the tests as indicated for the testing target method of boresighting in paragraph 34. Trunnions will be level.

(2) The equipment for the tests includes boresight, plumb bob, testing target, plumb line, and other section equipment.

(3) The candidate will select assistants who will operate the elevating mechanism at his direction during tests 1, 2, 3, and 6 and who will adjust and aline the testing target at his direction prior to test 4.

(4) The tests will be conducted in the sequence indicated in c below. After completion of test 1, the gunner's quadrant used in that test will be used for tests 2, 3, 4, and 6, with the proper correction (determined in test 1) carried on the quadrant, provided the correction does not exceed 0.4 mil.
(5) Adjustments which the candidate may be required to accomplish fall within the following limits:

(a) Rotating head coarse elevation index — none.
(b) Rotating head fine elevation index—not to exceed one-fourth turn.
(c) Panoramic telescope slipping azimuth scale—not to exceed one 100-mil graduation.
(d) Panoramic telescope slipping micrometer scale — not to exceed ten 1-mil graduations.
(e) Elbow telescope range lines — not to exceed 200 meters.

**c. Outline of Tests.**

<table>
<thead>
<tr>
<th>Test number</th>
<th>Examiner commands</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT.</td>
<td>Performs test prescribed in paragraph 49. Calls “Correction (so many) mils, quadrant serviceable (unserviceable)” and hands quadrant to examiner for verification.</td>
</tr>
<tr>
<td>2</td>
<td>PERFORM MICROMETER TEST ON GUNNER'S QUADRANT.</td>
<td>Performs test prescribed in paragraph 50. Calls “Quadrant micrometer is (is not) in error” and states any further action which should be taken.</td>
</tr>
<tr>
<td>3</td>
<td>TEST PANORAMIC TELESCOPE MOUNT.</td>
<td>a. Performs test of telescope mount. Levels the telescope mount and traverses the tube so</td>
</tr>
<tr>
<td>Test number</td>
<td>Examiner commands</td>
<td>Action of candidate</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>TEST PANORAMIC TELESCOPE MOUNT — Continued.</td>
<td>that the line of sight is on the plumb line.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Directs the assistant gunner and number 2 in elevating the tube and in traversing the tube, if necessary to keep the vertical hairline of the reticle on the plumb line.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reports deviation to examiner and states action necessary.</td>
</tr>
<tr>
<td></td>
<td>b. Performs telescope mount cross-level test.</td>
<td>Levels the tube longitudinally, using gunner's quadrant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Centers the cross-level bubble.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Causes the tube to be elevated to maximum elevation, keeping the cross-level vial level.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reports any deviation of the cross-level vial and any action necessary.</td>
</tr>
<tr>
<td></td>
<td>c. Performs telescope mount longitudinal level test.</td>
<td>Levels the tube longitudinally, using gunner's quadrant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Centers the longitudinal-level bubble.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operates the cross-leveling knob throughout its limits.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reports any deviation of the longitudinal-level bubble and any action necessary.</td>
</tr>
<tr>
<td>Test number</td>
<td>Examiner commands</td>
<td>Action of candidate</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>3</td>
<td>TEST PANORAMIC TELESCOPE MOUNT — Continued.</td>
<td>d. Performs telescope socket alignment test. Zeros the azimuth and micrometer scales on the panoramic telescope. Traverses the tube and places the vertical line of the panoramic telescope reticle on the plumb line. Rotates the elevation knob throughout its extent of travel. Reports any deviation of vertical line of reticle and any action necessary. <em>Note. Prior to test 4, the cross- and longitudinal-leveling of the tube will be verified by the examiner, and the testing target will be alined (par. 35) by the candidate with the help of his selected assistants.</em></td>
</tr>
<tr>
<td>4</td>
<td>TEST ADJUSTMENT OF PANORAMIC TELESCOPE.</td>
<td>Performs tests and makes adjustments described in paragraph 35c. Calls “Ready” and steps clear.</td>
</tr>
<tr>
<td>5</td>
<td>TEST ADJUSTMENT OF ELBOW TELESCOPE.</td>
<td>Performs test and makes adjustments described in paragraph 35d. Calls “Ready” and steps clear. <em>Note. Prior to test 6, the cross-level bubble of the quadrant mount will be moved off center, and the gunner’s quadrant will be set at a reading other than zero.</em></td>
</tr>
<tr>
<td>Test number</td>
<td>Examiner commands</td>
<td>Action of candidate</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>6</td>
<td>TEST QUADRANT MOUNT.</td>
<td>Performs cross-level and longitudinal tests of quadrant mount. Calls “Quadrant mount is (is not) in adjustment” and states any further action necessary.</td>
</tr>
</tbody>
</table>

d. **Penalties.** The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that the candidate can perform the operation without wasted effort.

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

(a) The bubble of the gunner’s quadrant does not center when verified by the examiner.

(b) The correction (one-half of the amount of the angle which was indicated when the quadrant first was reversed and the bubble was centered by moving the index arm and micrometer) is announced incorrectly by the candidate.

(c) The candidate fails to declare the quadrant unserviceable if the error (necessary correction) exceeds 0.4 mil or fails to declare the quadrant serviceable if the error (necessary correction) is 0.4 mil or less.

(d) The time to complete the test exceeds 2 minutes.
(2) **Test 2.** No credit will be allowed if —

(a) The procedure is not followed correctly.

(b) The time to complete the test exceeds 1 minute.

(c) The candidate fails to report necessary action to be taken.

(3) **Test 3.** No credit will be allowed if —

(a) The candidate does not announce correctly in regard to the status of either the cross-level or the longitudinal-level bubble.

(b) The candidate does not correctly measure deviations.

(c) The candidate fails to report proper action to be taken.

(d) The time to complete the test is more than 2 minutes.

(4) **Test 4.** No credit will be allowed if —

(a) The candidate fails to make the adjustment indicated.

(b) The rotating head elevation indexes are not in coincidence.

(c) The zero line of either the azimuth scale or azimuth micrometer scale is not in coincidence with its index.

(d) The center line of the bore, as viewed through the boresights, or the line
of sight of the telescope does not fall on its aiming point on the testing target when all scales are set at zero.

(e) The time to complete the test and adjustments exceeds 4 minutes and 30 seconds.

(5) Test 5. No credit will be allowed if —

(a) The range lines of the reticle are not horizontal.

(b) The cross on the reticle does not fall on the aiming point.

(c) The time to complete the test and adjustments exceed 1 minute.

(6) Test 6. No credit will be allowed if —

(a) The candidate fails to center the cross-level bubble prior to elevating and depressing the tube.

(b) The candidate neglects zeroing the gunner’s quadrant prior to performing the longitudinal-level test.

(c) The time to complete the two tests exceeds 2 minutes.

c. Credit.

(1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.

(2) If the tests and adjustments are performed correctly within the prescribed time
limit, maximum credit will be given as follows:

<table>
<thead>
<tr>
<th>Test</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>2</td>
</tr>
<tr>
<td>Test 2</td>
<td>1</td>
</tr>
<tr>
<td>Test 3</td>
<td>1</td>
</tr>
<tr>
<td>Test 4</td>
<td>4</td>
</tr>
<tr>
<td>Test 5</td>
<td>1</td>
</tr>
<tr>
<td>Test 6</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

95. **Materiel**

a. **Scope of Tests.** The candidate will be required to perform three tests as outlined in c below.

b. **Special Instructions.**

(1) **Tests 1 and 2.** For tests 1 and 2, a tarpaulin will be placed on the ground for the convenience of the candidate in laying out the disassembled parts. The candidate will be allowed to select the tools and accessories necessary for the performance of the tests prior to the start of the tests. The candidate may select assistants to aid him in lowering and lifting the breechblock.

(2) **Test 3.**

(a) A complete set of lubrication equipment authorized for use of battery personnel will be placed on a tarpaulin near the howitzer.

(b) Every type of lubricant used on the howitzer will be available in plainly labeled containers.
c. Outline of Tests.

<table>
<thead>
<tr>
<th>Test number</th>
<th>Examiner commands</th>
<th>Action of candidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DISASSEMBLE BREECH MECHANISM AND FIRING MECHANISM.</td>
<td>Performs the operation as described in TM 9–3004, laying the parts on the tarpaulin. After disassembly, identifies all parts to examiner.</td>
</tr>
<tr>
<td>2</td>
<td>ASSEMBLE BREECH MECHANISM AND FIRING MECHANISM.</td>
<td>Performs the operation as described in TM 9–3004.</td>
</tr>
<tr>
<td>3</td>
<td>PERFORM DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.</td>
<td>Selects proper lubricating equipment and lubricant and tells how, when, and with which lubricant each lubrication point is serviced. (Actual lubrication is not performed.)</td>
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d. Penalties.

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

(2) No credit will be given if the following time limits are exceeded:

Test 1 ................ 12 minutes
Test 2 ................ 16 minutes
Test 3 ............... 5 minutes
(3) A penalty of one-half point will be assessed for each part not correctly identified or omitted in test 1. There is no time limit imposed on the identification of parts. However, the examiner may reduce the grade if it becomes obvious that the candidate is not familiar with the nomenclature.

(4) A penalty of one-half point will be assessed for each lubrication point missed and for each lubricating device and each lubricant improperly selected.

e. Credit.

(1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.

(2) A maximum credit of 5 points will be given for each test which is performed correctly within the prescribed time limit.
**APPENDIX**

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**LIBM** — Located in back of manual.
By Order of the Secretary of the Army:

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

Official

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

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NG: Units org under fol TOE: 6-100 (2); 6-300 (2); 6-401 (2); 6-415 (2); 6-416 (2); 6-417 (3); 6-501 (2).

USAR: Same as active Army except allowance is one copy each unit except Centers (none).

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

☆ U. S. GOVERNMENT PRINTING OFFICE. 664140—1962—(10031C)
<table>
<thead>
<tr>
<th>Number</th>
<th>Duties in Uncoupling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Chief of section</strong> Directs work of personnel performing uncoupling operations.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Gunner</strong> Directs work of personnel performing uncoupling operations. Directs driver to move prime mover forward.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Number 1</strong> Detaches blackout lighting system from prime mover. Closes service output cock on prime mover. Uncouples service line and connects dummy coupling. Passes end of service line to number 4.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Number 2</strong> Closes emergency output line from trail coupling dummy coupling. Receives other end of emergency line from number 3.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Number 3</strong> Closes emergency output line from prime mover. Uncouples emergency line from trail coupling dummy coupling. Connects emergency line to the right end of service line.</td>
</tr>
<tr>
<td>6</td>
<td><strong>Number 4</strong> Checks bogie wheels. Uncouples service line from trail; connects dummy coupling. Receives service line from number 4.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Number 5</strong> Releases chain hoist from traveling position. When trails are to be lowered and blocked, secures blocks and arranges them under the trails. Assists number 3 in removing right front spade and placing it in position.</td>
</tr>
<tr>
<td>8</td>
<td><strong>Number 6</strong> Assists number 4 in removing left front spade and placing it in position.</td>
</tr>
<tr>
<td>9</td>
<td><strong>Remainder of section</strong> Unloads section equipment under supervision of assistant gunner.</td>
</tr>
</tbody>
</table>
Table IV. Trajectory Characteristics, Shell HE, Charge 7

<table>
<thead>
<tr>
<th>Range (meters)</th>
<th>Elevation</th>
<th>Vertical displacement per 100-meter range change (feet)</th>
<th>Trajectory characteristics</th>
<th>Firing data</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1</td>
<td>0.5</td>
<td>For ranges from 0 to 500 meters, the trajectory is flat enough to prevent an 8-foot tank from passing under it. Five hundred meters is the ideal range at which to open fire, because fire can be conducted for the maximum time without misses if deflection is correct.</td>
<td>Start firing with the data for the estimated range at the closest 100-meter range.</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>4</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>6</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>7</td>
<td>2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>9</td>
<td>2.5</td>
<td>For ranges from 500 to 1,800 meters, the trajectory is sufficiently flat to permit direct range estimation without having to bracket the target. If a hit is obtained at the bottom of an 8-foot tank, firing at the upper range limit, the addition of a 100-meter range change will result in a round that will just brush the top of the tank. Range changes will seldom be more than 100 meters, and frequently 50-meter changes will be sufficient. 1,800 meters is the maximum range at which a tank should be fired on unless tactical condition requires otherwise.</td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>10</td>
<td>3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>12</td>
<td>3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>14</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,000</td>
<td>15</td>
<td>4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,100</td>
<td>16</td>
<td>5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,200</td>
<td>18</td>
<td>5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,300</td>
<td>20</td>
<td>6.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,400</td>
<td>21</td>
<td>6.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,500</td>
<td>23</td>
<td>7.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,600</td>
<td>24</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,700</td>
<td>26</td>
<td>8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,800</td>
<td>28</td>
<td>9.0</td>
<td>For ranges from 1,800 to 3,000 meters, hits are only reasonably possible. Adjustment of fire on the target by bracketing normally is required.</td>
<td></td>
</tr>
<tr>
<td>1,900</td>
<td>30</td>
<td>9.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,000</td>
<td>31</td>
<td>10.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,100</td>
<td>33</td>
<td>11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,200</td>
<td>35</td>
<td>12.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,300</td>
<td>36</td>
<td>12.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,400</td>
<td>38</td>
<td>13.0</td>
<td>At ranges over 2,300 meters, direct laying is too inaccurate for use against moving targets.</td>
<td></td>
</tr>
<tr>
<td>2,500</td>
<td>40</td>
<td>13.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The values shown in the elevation column are for targets at the same altitude as the weapon. The chief of section should correct the elevation for difference in altitude between the weapon and the target as shown in the firing tables.

Table IV.
<table>
<thead>
<tr>
<th>Number</th>
<th>Duties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Chief of section</strong> Derives work of personal performing coupling operation.</td>
</tr>
<tr>
<td></td>
<td><strong>Commands COUPLE.</strong> Supervises the operation.</td>
</tr>
<tr>
<td>2</td>
<td>Attaches hooks of chain block to trail clamping bracket and operates hoist to raise trails to coupling position.</td>
</tr>
<tr>
<td></td>
<td>Removes trail coupling hitch pin.</td>
</tr>
<tr>
<td></td>
<td>Removes trail coupling pin key.</td>
</tr>
<tr>
<td>3</td>
<td>Removes right front spade key in bracket.</td>
</tr>
<tr>
<td></td>
<td>Removes left front spade key in bracket.</td>
</tr>
<tr>
<td>4</td>
<td>Detaches chain block from trail clamping bracket.</td>
</tr>
<tr>
<td></td>
<td>Passes service line to number 2.</td>
</tr>
<tr>
<td>5</td>
<td>Receives end of service line from number 4.</td>
</tr>
<tr>
<td></td>
<td>Removes chocks from bogie wheels.</td>
</tr>
<tr>
<td>6</td>
<td>Disconnects dummy coupling on prime mover.</td>
</tr>
<tr>
<td></td>
<td>Couples service line and opens service output cock.</td>
</tr>
<tr>
<td>7</td>
<td>Connects blackout lighting system to prime mover.</td>
</tr>
<tr>
<td>8</td>
<td>Receives end of emergency line from number 2.</td>
</tr>
<tr>
<td></td>
<td>Removes emergency output cock.</td>
</tr>
<tr>
<td>9</td>
<td>Receives end of emergency line from number 1.</td>
</tr>
<tr>
<td></td>
<td>Removes chocks from trails.</td>
</tr>
</tbody>
</table>

**Table VII. Duties in Coupling**

- **Number 1**: Removes trail coupling hitch pin.
- **Number 2**: Removes trail coupling pin key.
- **Number 3**: Removes right front spade key in bracket.
- **Number 4**: Removes left front spade key in bracket.
- **Number 5**: Attaches hooks of chain block to trail clamping bracket and operates hoist to raise trails to coupling position.
- **Number 6**: Receives end of service line from number 4.
- **Number 7**: Connects blackout lighting system to prime mover.
### Table II. Duties in Preparing for Action

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Chief of section</th>
<th>Assistant gunner</th>
<th>Number 1</th>
<th>Number 2</th>
<th>Number 3</th>
<th>Number 4</th>
<th>Number 5</th>
<th>Number 6</th>
<th>Number 7</th>
<th>Number 8</th>
<th>Number 9</th>
<th>Number 10</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shoots the drive in position throughout all sequences.</td>
<td>Assembles numbers 6, 8, and 7 in sequences 1 and 2. Primes the load chamber.</td>
<td>Remover leads tray and places it to the right of the howitzer.</td>
<td>Remover blanket lighting system and reflects on with section equipment.</td>
<td>Sign front spade pit.</td>
<td>Remove overall cover as prescribed in sequences 1 through 5.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>Removes the drive in position throughout all sequences.</td>
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<tr>
<td>3</td>
<td>Remover and blanket lighting system and reflects on with section equipment.</td>
<td></td>
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</tr>
</tbody>
</table>

**Notes:**
- All operators who are off duty have been positioned for service duties.
- Shooting tasks may occur even when all operators are positioned for service duties.

---

**Table II:**

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Chief of section</th>
<th>Assistant gunner</th>
<th>Number 1</th>
<th>Number 2</th>
<th>Number 3</th>
<th>Number 4</th>
<th>Number 5</th>
<th>Number 6</th>
<th>Number 7</th>
<th>Number 8</th>
<th>Number 9</th>
<th>Number 10</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shoots the drive in position throughout all sequences.</td>
<td>Assembles numbers 6, 8, and 7 in sequences 1 and 2. Primes the load chamber.</td>
<td>Remover leads tray and places it to the right of the howitzer.</td>
<td>Remover blanket lighting system and reflects on with section equipment.</td>
<td>Sign front spade pit.</td>
<td>Remove overall cover as prescribed in sequences 1 through 5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Removes the drive in position throughout all sequences.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>Remover and blanket lighting system and reflects on with section equipment.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- All operators who are off duty have been positioned for service duties.
- Shooting tasks may occur even when all operators are positioned for service duties.
Table III. Duties in Firing, Indirect Laying

<table>
<thead>
<tr>
<th>Number</th>
<th>Duties in Firing, Indirect Laying</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Removes firing mechanisms and oil breech.</td>
</tr>
<tr>
<td>2.</td>
<td>Releases the breech and lowers the lock to the horizontal position.</td>
</tr>
<tr>
<td>3.</td>
<td>After number 3 has completed the firing mechanism and oil breech, number 4 passes the projectile to number 5.</td>
</tr>
<tr>
<td>4.</td>
<td>Passes the projectile to number 5.</td>
</tr>
<tr>
<td>5.</td>
<td>Boards the projectile to the breech.</td>
</tr>
<tr>
<td>6.</td>
<td>After the projectile has been placed in the breech, number 6 positions the projectile.</td>
</tr>
<tr>
<td>7.</td>
<td>Number 7 positions the projectile.</td>
</tr>
<tr>
<td>8.</td>
<td>Number 8 positions the projectile.</td>
</tr>
<tr>
<td>9.</td>
<td>Number 9 positions the projectile.</td>
</tr>
<tr>
<td>10.</td>
<td>Number 10 positions the projectile.</td>
</tr>
</tbody>
</table>

Notes:
1. One and two pound charges must be used in order to avoid breakage of the projectile. |
2. Two pound charges must be used in order to avoid breakage of the projectile.
<table>
<thead>
<tr>
<th>Sequence</th>
<th>Chief of section</th>
<th>Number 1</th>
<th>Number 2</th>
<th>Number 3</th>
<th>Number 4</th>
<th>Number 5</th>
<th>Number 6</th>
<th>Number 7</th>
<th>Number 8</th>
<th>Number 9</th>
<th>Number 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Commands March Order.</td>
<td>Supervises operation throughout all sequences.</td>
<td>Inspects bore and powder chamber.</td>
<td>Directs work of howitzer section throughout all sequences.</td>
<td>traverses howitzer to approximate center and centers crosslevel bubbles on telescope mount.</td>
<td>Returns panoramic telescope to sight case, receives elbow telescope from assistant gunner and places it in sight case.</td>
<td>Removes left spade key.</td>
<td>Closes breech block and firing mechanism.</td>
<td>Closes breech.</td>
<td>Returns lanyard, vent cleaning tool, oiler, and spare firing mechanism to tool chest.</td>
<td>Passes gun cover to numbers 9 and 10.</td>
</tr>
<tr>
<td>2</td>
<td>Assistant Gunner</td>
<td>Sets gunner's quadrant at 150 mils and places it on quadrant mount seat.</td>
<td>Assists in leveling gunner's quadrant by operating the elevating handwheel.</td>
<td>Returns gunner's quadrant to tool chest.</td>
<td>Passes elbow telescope to gunner.</td>
<td>Removes right spade key.</td>
<td>Cleans and oils breech-block and firing mechanism.</td>
<td>Closes breech.</td>
<td>Returns ammunition, equipment, and accessories in prime mover in any sequence where not otherwise engaged.</td>
<td>Assisted by number 2, assisted by number 3, closes right trail.</td>
<td>Assisted by number 4, assists in preparing equipment for loading when not otherwise engaged.</td>
</tr>
<tr>
<td>3</td>
<td>Number 1</td>
<td>Assisted by number 2, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 3, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 4, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 5 and 6, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 6, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 7 and 8, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 8 and 9, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by numbers 8 and 10, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 9, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 10, assists in preparing equipment for loading when not otherwise engaged.</td>
</tr>
<tr>
<td>4</td>
<td>Number 2</td>
<td>Assisted by number 4, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 5, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 6, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 7 and 8, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 8 and 9, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 9, assists in preparing equipment for loading when not otherwise engaged.</td>
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<td>Assisted by number 10, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 10, assists in preparing equipment for loading when not otherwise engaged.</td>
</tr>
<tr>
<td>5</td>
<td>Number 3</td>
<td>Assisted by number 4, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 5, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 6, assists in preparing equipment for loading when not otherwise engaged.</td>
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</tr>
<tr>
<td>6</td>
<td>Number 4</td>
<td>Assisted by number 5, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 6, assists in preparing equipment for loading when not otherwise engaged.</td>
<td>Assisted by number 7 and 8, assists in preparing equipment for loading when not otherwise engaged.</td>
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</tr>
</tbody>
</table>
### Table V. Duties in Direct Laying

<table>
<thead>
<tr>
<th>Chief of Section</th>
<th>Gunner</th>
<th>Assistant Gunner</th>
<th>Numbers 1 through 6</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prepares panoramic telescope for direct laying:</td>
<td></td>
<td>Perform the same duties as in indirect laying.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sets initial lead announced by Chief of Section on the horizontal reticle scale.</td>
<td></td>
<td>Performs same duties as in indirect laying.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elevates or depresses the piece until the target is on the appropriate range line in the reticle.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintains target on appropriate range line by continuous tracking.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calls &quot;Set.&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: A canted reticle in the elbow telescope introduces an unacceptable range error and prevents satisfactory direct fire on moving targets.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Element</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Target designation</td>
<td>TARGET (Tank, etc.)</td>
</tr>
<tr>
<td>2</td>
<td>*Projectile, charge, and fuze</td>
<td>SHELL HE*, CHARGE 7, FUZE QUICK, or SHELL HE, CHARGE 7, FUZE DELAY</td>
</tr>
<tr>
<td>3</td>
<td>Lead</td>
<td>LEAD, RIGHT (left) 10</td>
</tr>
<tr>
<td>4</td>
<td>Method of fire</td>
<td>Fire is continuous unless otherwise commanded</td>
</tr>
<tr>
<td>5</td>
<td>Range</td>
<td>RANGE 600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Element</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Change in lead</td>
<td>RIGHT (left) 5</td>
</tr>
<tr>
<td>7</td>
<td>Change in range</td>
<td>ADD (drop) 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>*Ammunition and fuze selection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Shell HE, charge 7, fuze quick, is normally the most effective combination for direct fire because of the following:</td>
</tr>
<tr>
<td>a. Speed and ease of adjustment.</td>
</tr>
<tr>
<td>b. Highest forward motion to projectile and fragments.</td>
</tr>
<tr>
<td>c. Most effective fuse action against armor and personnel at close ranges.</td>
</tr>
<tr>
<td>2. Shell, white phosphorous, may be used to stall stalled tanks and other vehicles and produce casualties.</td>
</tr>
<tr>
<td>3. Fuze delay may be used for ricochet effect. The point of impact is adjusted 10 to 20 meters in front of the target. If less than 50 percent of the bursts ricochet, change to fuze quick.</td>
</tr>
<tr>
<td>4. Fuze time is the least desirable and should be used at ranges of 1,000 meters or greater. Areas effectively covered by air and ricochet bursts are similar.</td>
</tr>
</tbody>
</table>

**Commands END OF MISSION when target is destroyed or neutralized.**

New targets are selected and taken under fire as outlined above.